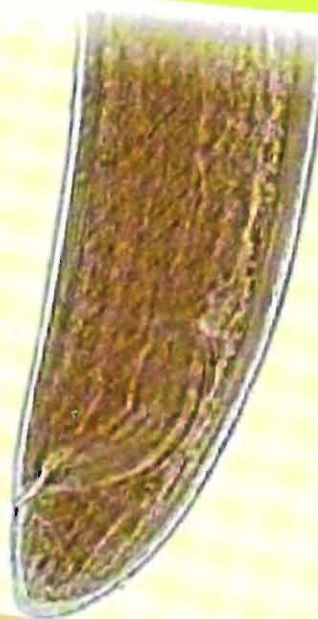


Pictorial Handbook on Plant and Soil Nematodes of Rajasthan

PADMA BOHRA



ZOOLOGICAL SURVEY OF INDIA

Pictorial Handbook on Plant and Soil Nematodes of Rajasthan

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**Zoological Survey of India
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PREFACE

Nematodes are found in almost all habitats, but are often overlooked because most of them are microscopic in size. For instance, a square yard of wood land or agricultural habitat may contain several million nematodes. Many species are highly specialized parasites of vertebrates, including humans, or of insects and other invertebrates. Other kinds are plant parasites, some of which can cause economic damage to cultivated plants. Nematodes are particularly abundant in marine, freshwater and soil habitats.

Soil is an excellent habitat for nematodes. Because of their importance to agriculture, much more is known about plant-parasitic nematodes than other kinds of nematodes which are present in soil. Most kinds of soil nematodes do not parasitize plants, but are beneficial in decomposition of organic matter. These nematodes are referred as free-living nematodes.

PADMA BOHRA

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INTRODUCTION

The nematodes are placed at a very low level of hierarchical classification of Invertebrata among Rotifers, Gastrotricha, Kinorhyncha, Nematomorpha, Acanthocephala etc. The number of known species of nematodes is only 50,000 but it may increase ten times when all habitats and areas are explored. Due to absence of 'chitin' in body walls of nematodes, they are not able to come in open atmosphere. As soon as they come into contact of open environment, their body starts dehydrating. This is the reason that nematodes are hideous in nature. In view of this reason they also remain hidden and unseen, be these in the bodies of animals or plants, in the aquatic or soil environments, the oceans, rivers or lakes, deserts, grasslands or mountains. The nematodes are found practically in all conceivable habitats where any other form could barely exist. This is the reason that they are world wide in distribution and found in all kinds of habitats which have led to acquisition of highly diversified shapes, sizes, structures and the ways of life by these animals.

The number of species present in any habitat is usually of an order of magnitude, which is greater than other major taxon (Platt & Warwick, 1980). Jairajpuri (2001) discussed in detail their numerical strength and the species diversity. The nematodes inhabit all biotopes; marine, fresh-water, soil and parasitize species of all groups of animals above the level of metazoa. They occupy a key position in food web as they feed on most organisms and are food for many others.

Nematode diversity is such an exhaustive topic which is not within the scope of present book. So keeping this point in view, the present book deals with phytophagous Nematode Diversity in Rajasthan State. Nematology deals with all forms of nematodes, phytonematology deals with plant nematodes feeding on living plants, not only their structure and life cycle but also their pathological aspects, including host-parasite relationship, methods of their control etc.

Nematodes are worm-like, the length of adult nematodes range from 0.5mm (*Bunonema*) to 10mm (*Paralongidorus maximus*). The greatest morphological diversity of nematodes can be seen in their lip region, stoma, pharynx, i.e. the structures which are closely associated with its feeding activity as also its reproductive structures. Yeats (1993) made a comprehensive review of the nematode feeding habits and categorized soil nematodes into eight feeding types-

- (i) Plant feeding
- (ii) Fungal (Lymphal) feeding
- (iii) Bacterial feeding

- (iv) Substrate ingestion (especially the ingestion of the substrate on which bacteria are growing)
- (v) Predation on protozoa and soil animals (rotifer, enchytracids, other nematodes)
- (vi) Unicellular eukaryote feeding (diatoms and other algae)
- (vii) Dispersal stages of animal parasites, of both invertebrates and vertebrates (some may actually have a bacterial or fungal feeding reproductive cycle in the soil)

The feeding apparatus i.e., the alimentary canal in nematode is divisible into three regions : the stomodeum the mesentron and the proctodeum. The stomodeum begins at the oral opening and includes the mouth cavity/stoma and oesophagus/pharynx. The mesentron, formed by the embryonic endoderm, is the midgut or intestine proper which leads to proctodeum or rectum that ends at the anal or cloacal opening. The stomodeum is mainly responsible for feeding and its structure is highly diversified because of the varied habit of nematodes. The mouth and the lips are also associated with the feeding activity. Though the stoma is the chief organ of feeding, the pharynx also contributes significantly in this activity.

As we have seen that nematodes exhibit great diversity in feeding apparatus. Similarly this diversity continues in reproductive organs and reproductive behaviour of nematodes also. In soil-inhabiting forms, the males and females are vermiform and usually of the same size. Sexual dimorphism in body length is not very distinct generally. Males are smaller than females. Extreme sexual dimorphism occurs in shape of the body in the sedentary endo and semi-endo parasites. In these forms, females swell and become saccate (root-knot and cyst nematodes), kidney shaped (reniform nematode) or may be irregularly obese (citrus and false root-knot nematodes). The secondary adaptation of body shape appears to be a parasitic adaptation enabling the nematodes to produce a very large number of eggs and in the cyst nematodes of also protecting them. Sexual dimorphism of the feeding apparatus is an example in Criconematoidea where males lack a spear and the pharynx is very poorly developed.

The female reproductive system may be single (monodelphic) or paired (didelphic). A monodelphic reproductive system may be directed anteriorly from the vulva (prodelphic) or posteriorly (opisthodelphic). In former cases the vulval opening will be situated in the posterior half of the body while in latter it would be in the anterior half. In monodelphic species, the anterior or posterior uterine sac is present. The female reproductive system generally consists of one or two ovaries, an oviduct, a spermatheca, uterus and vagina leading to the exterior via the vulva.

The males are monorchic (with one testis) or diorchic (with two testes). Monorchic males are characteristic of secerentians except in *Meloidogyne* spp., which have two testes instead of one and both are directed anteriorly and diorchic of adenophoreans. In the secerentians the testis may be outstretched (Tylenchida) or reflexed (Rhabditida). Males reproductive system consists of spicules, lateral guiding pieces, gubernaculum, bursa, ventromedian supplements, telamon; titiale, caudal papillae, subventral papillae. The

shape, size and number of these organs are taxonomic importance in identification of species.

Tail or post anal extension of body is also very important character in identification of species. As in other parts of body of nematodes, tail also exhibits great diversity in shape, size and in curvature (dorsal or ventral).

REVIEW OF LITERATURE

In 1743, Needham recorded the first phytophagous nematode (*Anguina tritici* Scopoli 1777) from England. The economic importance of plant parasitic nematode was first realized in 1859 by Schacht in Germany when he discovered a species of cyst nematode, later named *Heterodera schachtii* by Schmidt in 1871. This species was later found to be responsible for decline in sugar beet production in West Europe. Thereafter, the discovery of root-knot nematodes (*Meloidogyne* spp.) and the golden nematode (*Heterodera rostochiensis* now *Globodera rostochiensis*) accelerated the development in research on nematodes in Europe. Meanwhile, helminthologists like Kuhn Miller, Bory, Dujardin, Carter, etc. initiated the work on the identification of free living terrestrial nematodes. Bastian (1865), Butschli (1873), de Man (1876), Orley (1880) identified and described a large number of plant and soil nematode species. In view of the economic importance of plant and soil nematodes, N.A. Cobb, a legendary nematologist from U.S.A. proposed in early 20th century that the study of these nematodes be removed from Helminthology and be assigned to a new branch of science to be known as Nematology.

However, Rajasthan state could not feature in nematology literature till Arya (1957) reported a root-knot species (*Meloidogyne* sp.) from district Jodhpur. Prasad, Mathur and Seghal (1959) identified a serious nematode pest *H. avenae*, which causes "Molya" disease in wheat. The taxonomical studies in Rajasthan could only be initiated in a systematic manner after Dr. S. Khera joined Department of Zoology, Jodhpur University, in 1965. Khera and his co-workers (1966-72) reported a large number of species from Jodhpur, Pali, Ajmer, Bikaner, Jaisalmer and Sirohi districts.

Meanwhile Prof. B.S. Yadav and B.N. Mathur also established nematology laboratories at Udaipur and Jaipur respectively. They (1966-80) have made significant contribution on the identification of phytophagous nematodes especially, root-knot and cyst nematodes, and the problems caused by them in the State. The Udaipur centre in present time is also active in the able guidance of Prof. A.U. Siddiqi. Prof. Siddiqi and his co-workers have made significant contribution in the field of Plant Parasitic Nematodes (PPN) and Entomopathogenic Nematodes (EPN) from the state.

The other important reference on survey and identification of nematodes from Rajasthan include Swarup and Sethi (1968-77); Koshy, Swarup and Sethi (1971), Sethi and Swarup (1971-88); Mulk and Jairajpuri (1986); Lal, Mathur and Rajan (1990); Sharma and Trivedi (1993) and few others. Trivedi (1996) has provided useful information about the host and localities of phytophagous nematodes from Rajasthan. Baqri (1994, 1998, 2000), Bohra

and Baqri (2000-2005) described many new species to science and new records of phytophagous nematodes from the state. Bohra (2006-2008) has published papers on the taxonomy, ecology and distribution of plant and soil-free-living nematodes from Rajasthan.

While providing the historical review of Indian Nematology, Baqri (1991) and Baqri and Jairajpuri (1992) have observed that commendable work has been done in India on Survey and identification of plant and soil nematodes after 1959. In all, about 1600 species belonging to about 320 genera, 80 families and 10 orders have been reported from India. Baqri (2000) has reported 142 species of plant and soil nematodes from Rajasthan. However, it is difficult to state the exact number of species of plant and soil nematodes described from country till date.

OBJECTIVE

This is an established fact that the correct identification of the nematode species is the prerequisite to initiate the work on applied aspects. The objective of this book is to provide a base for identification and to create interest towards working on microorganisms like 'Nematodes' (Plant & soil) amongst the Scholars/researchers. To facilitate identification, the diagnosis of higher taxa i.e. Orders, Superfamilies, Families, subfamilies, Genera and Keys along with photographs of the specie have been provided in details. In some cases, the quality of photographs are defeated so, in order to avoid inconvenience, the line diagrams have also been given wherever necessary.

In present days, it has been noticed that the number of taxonomists are declining due to some reason or the other and this is high time for every taxonomist to provide information to coming generation by way of publishing Pictorial Hand Book/Guide etc. in order to develop interest in them for taxonomic study. The diagnostic characters i.e. shape of lip region, oesophagus, tail shape are clearly visible in photographs.

NEMATODE DIVERSITY IN RAJASTHAN STATE

Rajasthan has an area of 3,42,293,62 sq. km. being a largest state of India. The state is conglomeration of hostile, harsh climatic conditions and the diversity in geological formation imbedded in the Aravalli ranges and lakes that is reflected in the distinctive flora and fauna. On the western side of the Aravallis, there is the great Thar Desert with extreme high temperature during summer with dust storms and erratic rainfall, while on the eastern side, a good forest cover is seen in the Aravalli hill range running parallel to each other from Udaipur to Gujarat state. The desert area of Rajasthan is among the few tropical deserts of the world which have the highest population density. The Indian desert, generally known as the Thar Desert, is one of the important ecosystem in India. The Thar dessert is unique because of its location at the crossing where Palaearctic, Oriental and Saharan elements of biodiversity are found.

In present time it is felt that time has come to gather stock of our knowledge not only for better planning of research work in future but also for the preparation of distribution

maps and computerized database in each natural zone of state. The establishment of such databank has now become important in each zone / state with the aim to provide advisory service to the farmers on the distribution of key-potential nematode pests and their friends and enemies, soil amendments, improved agronomical practices, resistant varieties of crops, crop rotation, etc. If these databank could become effective then the use of nematicides will certainly come down (Baqri, 1994).

Baqri (2000) reported 142 species of plant and soil nematodes from the State. Baqri and Bohra (2002) while compiling the distribution of plant and soil nematodes of entire Thar Desert, a fragile ecosystem (Rajasthan, Gujarat Punjab and Haryana) reported 197 species. Subsequently Bohra & Baqri (2000) reported six species of plant and soil nematodes as new record from the country. Bohra & Baqri (2003) reported 17 species of plant and soil nematodes as new records from Rajasthan. Baqri & Bohra (2001-2003) described ten species and one new genus to science from Rajasthan and Gujarat. Bohra & Baqri (2005) described two new species as new to science.

Similarly survey, distribution and identification of plant and soil nematode fauna in Gujarat worked out by Bohra & Baqri (2004) reported 85 species which include 78 species as new records from the Gujarat State.

Bohra (2008) had carried out Quantitative and Qualitative studies of plant and soil nematode fauna, associated with crops of economic importance of Alwar, Bharatpur, Dholpur, Sawaimadhopur, Dausa, Karauli and Jaipur districts and fauna were worked out. Out of 84 species identified during the study, 29 species have been recorded for the first time from the State while 14 species have been recorded for the first time from India.

The result of quantitative estimation from all the eight districts surveyed during the study concludes that key/potential pests of economically important crops in Rajasthan State follow pattern in the districts surveyed. *Hoplolaimus indicus*; *Helicotylenchus dihystra*; *Helicotylenchus erytherinae*; *Helicotylenchus multicinctus*; *Rotylenchulus reniformis*; *Pratylenchus thornei*; *Pratylenchus zae*; *Hirschmanniella oryzae*; *Meloidogyne* spp.; *Heterodera avenae*; *Tylenchorhynchus mashhoodi*; *Tylenchorhynchus devitatus*; *Bitylenchus goffartii*; *Hemicriconemoides mangiferae*; *Paratrachodorus porosus*; *Paralongidorus* spp; *Xiphinema* spp. and so on.

Simultaneously plant and soil nematode fauna of Protected Areas were also worked out i.e. Bohra & Baqri (2004). Bohra & Sharma (2009); Bohra & Baqri (2010) published Fauna of Desert National Park; Faunal Exploration of Tal Chhapar Wild Life Sanctuary and Fauna of Ranthambhore National Park respectively. Bohra & Sultana (2008-2009) described and illustrated ten species new to science.

As stated above a significant contribution have been made during the period about survey, distribution and identification of plant and soil nematodes of Rajasthan.

The Rajasthan State has been represented by 316 species belonging to 11 Orders of Plant and Soil Nematodes (Table I).

Table I. Known diversity of plant and soil nematodes in Rajasthan State

Order's	Families	Genera	Species
Tylenchida	13	31	109
Aphelenchida	02	03	09
Dorylaimida	13	39	111
Triplonchida	01	01	02
Mononchida	05	09	19
Rhabditida	04	21	43
Araeolaimida	04	04	10
Monhysterida	01	01	01
Enoplida	03	04	11
Isolaimida	01	01	01
Total	47	114	316

Table II. Diversity of plant and soil nematode species dealt with

Orders	Families	Genera	Species
Tylenchida	11	26	62
Aphelenchida	01	01	01
Dorylaimida	13	33	89
Triplonchida	01	01	02
Mononchida	04	08	15
Rhabditida	03	09	11
Araeolaimida	03	03	04
Chromodorida	01	01	01
Enoplida	01	01	02
Isolaimida	01	01	01
Total	39	84	188

In all, 188 species belonging to 84 genera of 39 families of 10 Orders : Tylenchida (62 spp.); Aphelenchida (01 sp.); Dorylaimida (89 spp.);Triplonchida (02 spp.); Mononchida (15 spp.); Isolaimida (01 sp.); Chromodorida (01 sp.); Araeolaimida (04 spp.); Enoplida (02 spp.); and Rhabditida (11 spp.); have been dealt in the present book. Information about their host and localities (Table II) have also been furnished.

About 60% fauna from the State have been dealt in the Pictorial Handbook. The list of remaining 128 species have also been furnished in Table III.

Line drawings of some species have also been provided in addition to micro-photographs to facilitate the identification of genera/species.

The information regarding morphology and diagnostic characters of Orders Tylenchida, Aphelenchida, Dorylaimida, Mononchida, Triplonchida, Isolaimida, Rhabditida, Araeolaimida, Chromadorida, Monhysterida and Enoplida have been discussed under respective chapters.

Table III. List of species not included

Order TYLENCHIDA Thorne, 1949

Family TYLENCHIDAE Orley, 1880

Tylenchus arcuatus Siddiqi, 1963

Basiria varianus (Khan & Khan, 1976) Bajaj & Bhatti, 1979

Neopsilenchus loofi Bajaj & Bhatti, 1981

Neopsilenchus similis Khan & Khan, 1976

Neothada tatra (Thorne & Malek, 1968) Khan, 1973

Malenchus (Malenchus) subtilis Lal & Khan, 1988

Infraorder ANGUINATA Siddiqi, 2000

ANGUINIDAE Nicoll, 1935 (1926)

Ditylenchus clarus Thorne & Malek, 1968

Ditylenchus myceliophagus Goodey, 1958

Safinema anchilosposoma (Tarjan, 1958), Siddiqi, 1980

Nothotylenchus acris Thorne, 1941

Nothotylenchus bhatnagari Tikyani & Khera, 1969

HOPLOLAIMIDAE Filipjev, 1934 (Wieser, 1953)

Hoplolaimus pararobustus (Schh. Stekh. & Teunissen, 1938) Sher in Coomans, 1963

Hoplolaimus cephalus Mulk & Jairajpuri, 1976

Hoplolaimus dimorphicus Mulk & Jairajpuri, 1976

Hoplolaimus seshadrii Mulk & Jairajpuri, 1976

Helicotylenchus arachisi Mulk & Jairajpuri, 1975

Helicotylenchus diagonicus Perry in Perry, Darling & Thorne, 1959

Helicotylenchus rotundicauda Sher, 1966

Helicotylenchus imperialis Rashid & Khan, 1974

Helicotylenchus indenticaudatus Mulk & Jairajpuri, 1975

Helicotylenchus pseudorobustus (Steiner, 1914) Golden, 1956

Helicotylenchus retusus Siddiqi & Brown, 1964

Helicotylenchus truncatus Roman, 1965

Family PRATYLENCHIDAE Thorne, 1949 (Siddiqi, 1963)

Pratylenchus coffeae (Zimmerman, 1898) Filipjev & Stekhoven, 1941*Pratylenchus crenatus* Loof, 1960*Pratylenchus delattrei* Luc, 1958*Pratylenchus mulchandi* Nand Kumar & Khera, 1970*Pratylenchus penetrans* (Cobb, 1917) Filipjev & S. Stekh; 1941*Pratylenchus scribneri* Steiner, 1943*Hirschmanniella gracilis* (de Man, 1880) Luc & Goodey, 1964*Radopholus similis* (Cobb, 1893) Thorne, 1949

Family MELOIDOGYNIDAE Skarbilovich, 1959

Meloidogyne arenaria (Neal, 1998) Chitwood, 1949*Meloidogyne javanica* (Treub, 1885) Chitwood, 1949

Family HETERODERIDAE Filipjev & S. Stekhoven, 1941

Heterodera cajani Koshi, 1967*Heterodera sacchari* Luc & Merry, 1963*Heterodera zae* Koshy, Swarup & Sethi, 1971

Family TELOTYLENCHIDAE Siddiqi, 1960

Telotylenchus paaloofi Tikyani & Khera, 1970*Telotylenchus tonkiensis* Mulk & Jairajpuri, 1975*Tylenchorhynchus hordei* Khan, 1972*Tylenchorhynchus zae* Sethi & Swarup, 1968*Tylenchorhynchus brevidens* Allen, 1955*Tylenchorhynchus madarpurensis* Sultana, Singh & Sakhiya, 1991*Tylenchorhynchus nordiensis* Khan & Wanjappa, 1974*Tylenchorhynchus nudus* Allen, 1955*Neodolichorhynchus* (*Prodolichorhynchus*) *elegans* (Germani & Luc, 1984) Siddiqi, 2000*Qunisulcius capitatus* (Allen, 1955) Siddiqi, 1971

Family PARATYLENCHIDAE Thorne, 1949

Paratylenchus curvatus Van der Linde, 1938*Paratylenchus nainianus* Edward & Misra, 1963*Pratylenchus verucaudatus* Wu, 1962

Family PAURODONTIDAE Thorne, 1934

Paurodontella asymmetricus (Tikyani & Khera, 1968) Somekova, 1975*Paurodontella aberrans* (Nand Kumar & Khera, 1969) Somekova, 1975

Order APHELENCHIDA Siddiqi, 1980

Family PARAPHELENCHIDAE T. Goodey, 1951 (J.B. Goodey, 1960)

Paraphelenchus myceliophthorus J.B. Goodey, 1958

Family APHELENCHOIDIDAE Skarbilovich, 1947

Aphelenchoides asterocaudatus Das, 1960*Aphelenchoides besseyi* Christie, 1942*Aphelenchoides bicaudatus* (Imamura, 1931) Filipjev & Stekh., 1941)*Aphelenchoides delhiensis* Chawla, Bhambukar, Khan & Prasad, 1968*Aphelenchoides jodhpurensis* Tikyani, Khera & Bhatnagar, 1968*Aphelenchoides longiurus* Das, 1960*Aphelenchoides subtenuis* (Cobb, 1926) Steiner & Buhrer, 1932

Order DORYLAIMIDA Pears, 1942

Family DORYLAIMIDAE de Man, 1876

Calodorylaimus andrassyi Baqri & Jana, 1982

Family APORCELAIMIDAE Heyns, 1965

Aporcelaimellus obtusicaudatus (Bastian, 1865) Altherr, 1968

Family QUDSIANEMATIDAE Jairajpuri, 1965

Labronema virgo Monteiro, 1970*Eudorylaimus centrocerus* (De Man, 1880) Andrassy, 1959*Eudorylaimus odhneri* (Allgen, 1950) Andrassy, 1959*Eudorylaimus longicardius*, Thorne, 1974*Allodorylaimus irritans* (Cobb in Thorne & Swanger, 1936) Andrassy, 1982*Allodorylaimus kosabamensis* Ahmad*Discolaimus similis* Thorne, 1939*Discolaimus agricola* Sauer & Annels, 1986*Discolaimus perplexans* Siddiqi, 1961*Discolaimus silvicollis* Sauer & Annels, 1986*Discolaimus paramajor* Coomans, 1966*Discolaimus texanus* Cobb, 1913*Discolaimus rotundicaudatus*, Khan & Laha, 1982*Discolaimium upum* Baqri & Jairajpuri, 1968*Moshajia cultristyla* Siddiqi, 1982*Moshajia idiofora* Siddiqi, 1982

Family NORDIIDAE Jairajpuri & Siddiqi, 1964

Kochinema sectum Siddiqi, 1966

Family ACTINOLAIMIDAE Thorne, 1939

Neoactinolaimus oomercooperi (Filipjev, 1931) Baqri, Coomans & Van der Heiden, 1975*Neoactinolaimus thornei* Chaturvedi & Khera, 1979

Family CARCHAROLAIMIDAE Thorne, 1967

Carcharolaimus discus Thorne, 1967

Family LONGIDORIDAE Thorne, 1935

Longidoroides bikanerensis, Lal & Mathur, 1986*Longidorus proximus* Sturhan & Agro, 1983*Longidours minrus* Khan *et al.*, 1972*Paralongidorus citri* (Siddiqi, 1959) Siddiqi, Hooper & Khan, 1963*Paralongidorus rosundatus* Khan, 1987*Longidoroides beryllus* (Siddiqi & Hussain, 1965) Luc & Doucet, 1984

Family XIPHINEMATIDAE

Xiphinema luci Bajaj & Jairajpuri, 1979

Family BELONDIRIDAE Thorne, 1939

Belondira tenuidens Thorne, 1964*Belondira porta* Thorne, 1964*Dorylaimellus (D.) indicus* Siddiqi, 1964*Dorylaimellus (D.) andrassyi*, Heyns, 1963

Family TYLENCHOLAIMIDAE Filipjev, 1934

Tylencholaimus pusillus Loof & Jairajpuri, 1968

Family LEPTONCHIDAE Thorne, 1935

Bertzuckermannia salina, Khera, 1970*Oostenbrinkella oostenbrinkella* Jaiajpuri, 1965*Metadorylaimus pachylaimus* Jairajpuri & Goodey, 1966

Family MYDONOMIDAE Thorne, 1964

Dorylaimoides (Dorylaimoides) indicus Jairajpuri, 1965*Dorylaimoides (Dorylaimoides) thecolaimus* Heyns, 1965

Order TRIPLONCHIDA Cobb, 1920

Family TRICHODORIDAE Thorne, 1935

Paratrachodorus mirzai (Siddiqi, 1960) Siddiqi, 1974

Order MONONCHIDA Jairajpuri, 1969

Family MONONCHIDAE Chitwood, 1937

Coomansus indicus Jairajpuri & Khan, 1977

Family MYLONCHULIDAE Jairajpuri, 1969

Mylonchulus mulveyi Jairajpuri, 1970*Sporonchulus vagabundus* Jairajpuri, 1971

Family ANTONCHIDAE Jairajpuri, 1969

Miconchus aquaticus Khan, Ahmad & Jairajpuri, 1978

Family IOTONCHIDAE Jairajpuri, 1969

Iotonchus jairi (Lordello, 1958) Clark, 1960*Iotonchus trichuris* (Cobb, 1917) Mulvey, 1963

Family BATHYDONTIDAE Clark, 1961

Oionchus paraobtusus Jairajpuri, 1982

Family RHABDITIDAE Örley, 1880

Operculorhabditis longespiculosa Khera, 1969*Saprorhabditis adentifera* Khera, 1969*Pelodera* (*Cruznema*) *sambharensis* Khera, 1971*Mesorhabditis mitoki* (Sudhaus, 1978) Andrassy, 1983

Family DIPLOGASTRIDAE Micoletzky, 1922

Mesodiplogasteroides longipyge Khera, 1969*Rhabditoides contiminata* Khera, 1971

Family CEPHALOBIDAE Filipjev, 1934

Chiloplacus jodhpurensis Rathore & Nama, 1992*Chiloplacus saccatus* Loof, 1971*Acrobeloides enoplus* Steiner, 1938*Acrobeloides sativus* Nama & Soni, 1979*Zeldia acuta* Allen & Noffsinger, 1972

Family PANAGROLAIMIDAE Thorne, 1937

Tricephalobus steineri (Andrassy, 1952) Rühm, 1956

Family PLECTIDAE Orley, 1880

Plectus indicus Khera, 1973

Family PRISMATOLAIMIDAE Micoletzky, 1922

Prismatolaimus parvus Milne, 1963*Prismatolaimus leptolaimus* Andrassy, 1969

Family TRIPYLIDAE Orley, 1880

Tobrilus confuses Khera, 1975

Tobrilus kherai Soni & Nama, 1981

Neotobrilus asea Rathore & Nama, 1991

Family CEPHALOBIDAE Filipjev, 1934

Chiloplacus jodhpurensis Rathore & Nama, 1992

Chiloplacus magnus Rashid & Heyns, 1990

Family LEPTOLAIMIDAE Orley, 1880

Chronogaster brasiliensis Meyl, 1957

Family Ironidae de Man, 1876

Ironus longicaudatus de Man, 1884

ABBREVIATIONS USED

$$a = \frac{\text{body length}}{\text{maximum body width}}$$

$$b = \frac{\text{body length}}{\text{oesophageal length}}$$

$$c = \frac{\text{body length}}{\text{tail length}}$$

$$V = \frac{\text{distance from head end to vulva}}{\text{body length}} \times 100$$

$$T = \frac{\text{distance from cloacal aperture to anterior end of testis}}{\text{body length}}$$

$$c' = \frac{\text{tail length}}{\text{body width at anus}}$$

KWLS : Kumbhalgarh Wildlife Sanctuary

METHODOLOGY

SOIL SAMPLING

Soil samples were collected from around roots of host plants with the help of shovel from the depth of 5-15 cms in moist soil fields. If the field was arid or semi-arid, the depth is increased. For making a bulk soil sample, 4-5 sub-samples were collected from the fields. The soil is collected in a polythene bag and brought to laboratory. A label bearing information regarding host, locality, district, date, etc. is tied at the neck of polythene bag with the help of rubber band. In order to avoid evaporation of moisture from soil sample they are stored in a refrigerator at 10-15°C temperature and processed as soon as possible.

PROCESSING

Soil/sediment samples were processed in laboratory by Cobb's (1918) sieving and decantation technique (350 mesh sieve or 53 μm pore size). Soil samples were placed in a bucket (A) of 15 ltrs. Capacity and filled to 1/3rd of its volume with water. The soil and water were thoroughly mixed by hand to make a homogenous suspension. The bucket was left undisturbed for 20-30 seconds so as to allow the heavy particles of soil to settle down at the bottom. This suspension was then filtered through a 25-mesh sieve to get rid of debris and was collected in a bucket (B). The same process was repeated with 300-mesh sieve. The aliquot from 300 mesh sieve was collected in a beaker and was poured gently on moist double tissue paper placed on a small supporting coarse sieve with 2 mm pores. The air bubbles should not be allowed between the tissue paper because they will check the filtration of nematodes. The supporting sieve is placed into a shallow Petri dish filled with water touching the bottom of coarse sieve and left undisturbed for 24 hours. After 24 hours the nematodes were collected in a test tube with the help of the dropper.

KILLING AND FIXATION

The suspension containing the nematodes was placed in a test tube for 20-30 minutes so that nematodes may settle down at the bottom. Most of the water was discarded carefully from the test tube with the help of dropper. The nematodes were fixed in hot 4% formalin.

PERMANENT SLIDES

The nematodes were transferred from fixative to a solution of 5 parts of glycerin and 95 parts of alcohol in a cavity block. The cavity block having the nematodes was placed in desiccators for slow dehydration of nematodes at room temperature for 2-3 weeks. The nematodes were finally mounted in a glass/metal slide in pure anhydrous glycerin. Ordinary nail polish was used as a sealing material. All measurements were made on specimens mounted in anhydrous glycerin with the help of ocular micrometer. De Man's (1884) formula for denoting body dimensions of nematodes was used.

CHAPTER-1

SYSTEMATIC LIST OF SPECIES OF ORDER TYLENCHIDA

Order TYLENCHIDA Thorne, 1949

Suborder TYLENCHINA Chitwood in Chitwood & Chitwood, 1950

Infraorder TYLENCHATA Siddiqi, 2000

Family TYLENCHIDAE Orley, 1880

Subfamily TYLENCHINAE Orley, 1880

Genus **Tylenchus** Bastian, 1865

Tylenchus ritae Siddiqi, 1963

Tylenchus magnus Khurana & Gupta, 1988

Genus **Filenchus** Andrassy, 1954 (Meyl, 1961)

Filenchus filiformis (Butschli, 1873) Meyl, 1961

Genus **Sakia** Khan, 1964

Sakia alii Suryawanshi, 1971

Genus **Aglenchus** Andrassy, 1954 (Meyl, 1961)

Aglenchus agricola (de Man, 1884) Meyl, 1961

Subfamily BOLEODOIRNAE Khan, 1964

Genus **Boleodorus** Thorne, 1941

Boleodorus thylactus Thorne, 1941

Boleodorus brevistylus Khera, 1970

Genus **Basiria** Siddiqi, 1959

Basiria graminophila Siddiqi, 1959

Subfamily DUOSULCIINAE Siddiqi, 1979

Genus **Malenchus** Andrassy, 1968

Malenchus (M.) holochmatus (Singh, 1971) Siddiqi, 1986

Genus **Ottolenchu** Husain & Khan, 1967 (Golden, 1971)

Ottolenchus equisetus (Hussain & Khan, 1967 (Wu, 1970)

Infraorder ANGUINATA Siddiqi, 2000

Family ANGUNIDAE Nicoll, 1935 (1926)

Subfamily ANGUININAE Nicoll, 1935 (1926)

Genus **Anguina** Scopoli, 1777

Anguina tritici (Steinbuch, 1799) Filipjev, 1936

Family HOPLOLAIMIDAE Filipjev, 1934 (Wieser, 1953)

Subfamily HOPLOLAIMINAE Filipjev, 1934

Genus **Hoplolaimus** Daday, 1905

Hoplolaimus indicus Sher, 1963

Subfamily ROTYLENCHOIDINAE Whitehead, 1958

Genus **Helicotylenchus** Steiner, 1945

Helicotylenchus multicinctus (Cobb, 1893) Golden, 1956

Helicotylenchus conicephalus Siddiqi, 1972

Helicotylenchus crenacauda Sher, 1966

Helicotylenchus dihystra (Cobb, 1893) Sher, 1961

Helicotylenchus erytherinae (Zimmermann, 1904) Golden, 1956

Helicotylenchus exallus Sher, 1966

Helicotylenchus goodi Tikyani, Khera & Bhatnagar, 1969

Helicotylenchus labiatus Roman, 1965

Helicotylenchus labiodiscinus Sher, 1966

Helicotylenchus leiocephalus Sher, 1966

Helicotylenchus glissus Thorne & Malek, 1968

Helicotylenchus tropicus Roman, 1965

Helicotylenchus microdorus Prasad et al., 1965

Helicotylenchus pisi Swarup & Sethi, 1968

Family ROTYLENCHULIDAE Husain & Khan, 1967 (Husain, 1976)

Subfamily ROTYLENCHULINAE Husan & Khan, 1967

Genus **Rotylenchulus** Linford & Oliveira, 1940

Rotylenchulus reniformis Linford & Oliveira, 1940

Family PRATYLENCHIDAE Thorne, 1949 (Siddiqi, 1963)

Subfamily PRATYLENCHINAE Thorne, 1949

Genus **Pratylenchus** Filipjev, 1936

Pratylenchus loosi Loof, 1960

Pratylenchus neglectus (Rensch, 1924) Filipjev & Schh. Stekh; 1941

Pratylenchus uralensis (Komaniko, 1966) Loof, 1991

Pratylenchus brachyurus (Godfrey, 1929) Filipjev & Schh. Stekh. 1941

Pratylenchus zaeae Graham, 1951

Pratylenchus goodeyi Sher & Allen, 1958

Pratylenchus thornei Sher & Allen, 1963

Pratylenchus macrostylus Wu, 1971

Subfamily HIRSCHMANNIELLINAE Fotedar & Handoo, 1978

Genus *Hirschmanniella* Luc & Goodey, 1964

Hirschmanniella oryzae (Van Breda de Haan, 1902) Luc & Goodey, 1964

Hirschmanniella caudacrena Sher, 1968

Family MELOIDOGYNIDAE Skarbilovich, 1959 (Wouts, 1974)

Subfamily MELOIDOGYNINAE Skarbilovich, 1959

Genus *Meloidogyne* Goeldi, 1892

Meloidogyne incognita (Kofoid & White, 1919) Chitwood, 1949

Family HETERODERIDAE Filipjev & S. Stekhoven, 1941

Subfamily HETERODERINAE Filipjev & S. Stekhoven, 1941

Genus *Heterodera* Schmidt, 1871

Heterodera avenae Wollenweber, 1924

Family TELOTYLENCHIDAE Siddiqi, 1960

Subfamily TELOTYLENCHINAE Siddiqi, 1960

Genus *Telotylenchus* Siddiqi, 1960

Telotylenchus indicus Siddiqi, 1960

Telotylenchus aerolatus Baqri & Jairajpuri, 1969

Genus *Tylenchorhynchus* Cobb, 1913

Tylenchorhynchus clarus Allen, 1955

Tylenchorhynchus mashhoodi Siddiqi and Basir, 1959

Tylenchorhynchus robustus Thorne & Malek, 1968

Tylenchorhynchus triglyphus Seinhorst, 1963

Tylenchorhynchus brassicae Siddiqi, 1961

Tylenchorhynchus latus Allen, 1955

Tylenchorhynchus marudharensis Lal, Mathur & Rajan, 1990

Tylenchorhynchus delhiensis Chawla, Bhamburkar, Khan & Prasad, 1968

Genus *Bitylenchus* Filipjev, 1934 (Jairajpuri, 1982)

Bitylenchus goffarti (Sturhan, 1966), Jairajpuri, 1982

Bitylenchus brevilineatus Williams, 1960

Bitylenchus dubius (Butschli, 1873) Filipjev, 1934

Genus *Neodolichorhynchus* Jairajpuri & Hunt, 1984

Neodolichorhynchus (*Mulkorhynchus*) *phaseoli* (Sethi & Swarup, 1968) Talavera & Tobar, 1997

Genus *Uliginotylenchus* Siddiqi, 1971

Uliginotylenchus rhopalocerus (Seinhorst, 1963) Siddiqi, 1971

Genus **Quinisulcius** Siddiqi, 1971

Quinisulcius curvus (Williams, 1960) Siddiqi, 1971

Subfamily MERLINIINAE Siddiqi, 1971

Genus **Merlinius** Siddiqi, 1970

Merlinius brevidens (Allen, 1955) Siddiqi, 1970

Merlinius nanus (Allen, 1955) Siddiqi, 1970

Family PSILENCHIDAE Paramonov, 1967 (Khan, 1969)

Subfamily PSILENCHINAE Paramonov, 1967

Genus **Psilenchus** de Man, 1921

Psilenchus hilarulus de Man, 1921

Suborder CRICONEMATINA Siddiqi, 1980

Family CRICONEMATIDAE Taylor, 1936

Subfamily HEMICRICONEMOIDINAE Andrassy, 1979

Genus **Hemicriconemoides** Chitwood & Birtchfield, 1957

Hemicriconemoides coccophilus (Loos, 1949) Chitwood & Birchfield, 1957

Hemicriconemoides mangiferae Siddiqi, 1961

Hemicriconemoides brachyurus (Loos, 1949) Chitwood & Birchfield, 1957

Family TYLENCHULIDAE Skarbilovich, 1947 (Kirjanova, 1955)

Subfamily TYLENCHULINAE Skarbilovich, 1947

Genus **Tylenchulus** Cobb, 1913

Tylenchus semipenetrans Cobb, 1913

Order TYLENCHIDA

The Tylenchid species are the largest and economically the most important group of plant-parasitic nematodes. The Order also includes large group Hexatyline which includes parasites, insects and mite haemocoels. As plant parasites, they attack all plant organs including flowers and seeds but mostly they attack roots.

Several tylenchids, particularly the members of families Pratylenchidae, Meloidogynidae and Heteroderidae are of great economic importance as parasites of agricultural crops and forest trees. They cause substantial crop losses in many countries, for example in our country in Rajasthan, it has been estimated that 60 million rupees are lost in wheat production due to a single nematode species, *Heterodera avenae*. Sasser (1929) estimated that crop losses due to *Meloidogyne* spp. in tropical countries show average losses of 15% yield losses in vegetable, cereals and fruit crops.

Tylenchids occur in all possible habitats in soil, water and plants. Their greatest diversity of form occurs amongst parasites of roots. A grain of galled wheat might contain up to 30,000 nematodes. One gram of coconut roots could yield about 4000 *Radopholus similis* (including eggs) (Koshy *et al.*, 1976).

Most of the Tylenchids are ectoparasites that live in soil and feed on roots, often changing feeding sites. Some are migratory or sedentary endo parasites. Only Anguinoidea and some free living generations of insect parasites enter shoots, where they generally incite galls.

The members of order Tylenchida have longitudinal muscles for locomotion, a terminal oral opening surrounded by bilaterally or radially arranged sensilla, protrusible stomatal stylet, a substylet orifice of the dorsal oesophageal gland, a circum-oesophageal or circum-intestinal nerve ring, an excretory system with a single duct and renette cell, a pore like anus directed onward, a true tail (post anal continuation of the body), and they lack circulatory system and motile cilia. They are phasmidians but the suborders Tylenchina, Hexatylinea and Criconematina do not have detectable phasmids.

As in other nematodes, sexes are separate and reproduction is by 'amphimixis'. Regeneration or sexual reproduction does not occur in nematodes. The gonads are tubular and outstretched. The male genital structures include a pair of cuticularised spicules, a gubernaculum with or without telamon and titillatae, a non-papillary (non-ribbed) bursa and genital papillae, 1-4 being grouped around the cloacal aperture; the male tail is devoid of caudal papillae. The eggs are typically oval without sperms. Most tylenchids are oviparous except entomoparasitic nematodes which are ovoviviparous.

Some members of Tylenchida show a great ability to withstand desiccation and extreme adverse environmental conditions. The phenomenon of 'anabiosis' is well illustrated by members of Anguinoidea. Fielding (1951) found that dormant *Ditylenchus dipsaci* and *Anguina tritici* could be revived after 20 to 28 years respectively.

Since tylenchids maintain a somewhat balanced community structure in the rhizosphere in non-agricultural lands, grasslands and aquatic habitats are affected by changes in environmental conditions. They serve as useful tools in ecological studies and can be used as models in environmental research for monitoring pollution.

In present book, classification of Order Tylenchida is followed as proposed by Siddiqi (2000). The Order Tylenchida comprises four suborders i.e. Tylenchina, Hoplolaimina, Criconematina and Hexatylinea besides two Infra Order Anguinata and Tylenchata.

In all 62 species of Order Tylenchida belonging to 25 genera of 10 families have been dealt in the present publication. Information about their diagnostic characters, habitats and localities and their distribution have been provided.

Key to Infra orders of Tylenchida (after Siddiqi, 2000 (amended))

1. Amphidial apertures minute oblique slits on raised areas on labial plate; cardia absent; fungal feeders and/or parasites of above-ground plant parts **Anguinata**
- Amphidial apertures not minute oblique slits on raised areas on labial plate but variously modified from pore to large sinuate slits; cardia present; algal and root feeders, not fungal feeders or parasites of above-ground plant parts **Tylenchata**

Key to suborders of TYLENCHIDA Thorne, 1949

1. Median pharyngeal bulb absent **Hexatylinea**
- Median pharyngeal bulb present 2
2. Female reproductive system monodelphic with no postvulval uterine sac; phasmids or prophasms absent; spermatheca ventral to gonad axis, hypopygma single; male pharynx degenerate **Criconematina**
- Female reproductive system didelphic, if monodelphic then usually with a postvulval uterine sac; phasmids or prophasms present; spermatheca not ventral to gonad axis, hypopygma double; male pharynx rarely degenerate 3
3. Female reproductive system didelphic; phasmids present **Hoplolaimina**
- Female reproductive system monodelphic; phasmids absent **Tylenchina**

A. Infraorder TYLENCHATA**Suborder TYLENCHINA Chitwood in Chitwood and Chitwood, 1950**

Diagnosis : Stoma armed with a protrusible knobbed axial stylet. Annulations never retorse. Cuticle without distinct outer and inner layers. Female monodelphic with a post uterine sac. Phasmids absent. Tail similar in both sexes.

Type and only superfamily : Tylenchoidea Örley, 1880 (Chitwood in Chitwood, 1937)

Superfamily TYLENCHOIDEA Örley, 1880 (Chitwood in Chitwood, 1937)

Diagnosis : Sexual dimorphism in the anterior region very rare. Deirids present or absent. Phasmids present. Cuticular annules never retorse or with scales or spines. Stylet variable in length. Pharyngeal glands forming a basal bulb or extending over intestine. Females vermiform may become spherical kidney or lemon shaped in some sedentary forms. Gonad monodelphic or amphidelphic.

Type family : Tylenchidae Örley, 1880

**Key to families of TYLENCHOIDEA Örley, 1880
(Chitwood in Chitwood, 1937)**

1. Cephalic setae present **ATYLENCHIDAE**
- Cephalic setae absent 2
2. Stylet over 24 μm long, if shorter then about as long as precorpus, with tubular protractors **TYLODORIDAE**
- Stylet under 24 μm (generally 8-16 μm) long, not as long as precorpus, generally with divergent protractors 3

3. Body extremely attenuated (a = 50-150), appearing glass fibre-like, bursa often lobed ECPHYADOPHORIDAE
- Body not extremely attenuated, not appearing glass fibre-like, bursa not lobed TYLENCHIDAE

Family TYLENCHIDAE Orley, 1880

Algal, Lichen, moss feeders and root surface feeders

Members of this family are cosmopolitan. They are found in large numbers in extraction of soils rich in algae and mosses. Members of Tylenchidae can be characterized in having small to moderately large body length (0.3-1.3 mm). Lateral field each with two, three or four incisures. Dierids present. Labial disc inconspicuous or absent; a disc like structure present in *Discotylenchus* and *Cucullitylenchus*. Amphidial aperture labial or post labial. Stylet usually weak and slender, small (6-12 μ m); conus usually less than half of total stylet length, rarely with distinct lumen, basal knobs or swellings small, rounded or absent. Orifice of dorsal gland close to or at same distance. Precorpus cylindrical. Post corpus or median bulb fusiform or oval, not filling body width. Isthmus slender. Basal bulb with glands, usually pyriform, abutting intestine, with a cardia at base. Vulva transverse slit. Postvulval uterine sac one body width or less long. Spermatheca offset or elongated and lobe directed anteriorly. Ovaries anteriorly out stretched. Testis out stretched. Cloacal lips variable in shape; hypopygium present or absent. Spicules small, slender, arcuate. Gubernaculum linear or trough shaped, fixed. Tails generally filiform, similar in both sexes. Bursa adanal, simple, not lobed, rarely absent. Species of the following genera have been recorded from Rajasthan : *Tylenchus* (2 spp.); *Aglenchus* (1 sp.); *Filenchus* (1 sp.); *Sakia* (1 sp.); *Boleodorus* (2 spp.); *Basiria* (1 sp.); *Malenchus* (1 sp.); and *Ottolenchus* (1 sp.) are described hereunder.

Type subfamily : Tylenchinae Örley, 1880

Key to subfamily of TYLENCHIDAE Örley, 1880

1. Corpus short and broad, about as long as basal bulb TANZANIINAE
- Corpus elongate-slender, longer than basal bulb 2
2. Amphidial apertures prominent, posterior to level of cephalic papillae, partially covered by a cuticular flap BOLEODORINAE
- Amphidial apertures rarely prominent, anterior to cephalic papillae, not covered by a cuticular flap 3
3. Lateral field narrow, with a single ridge DUOSULCIINAE
- Lateral field broad, with two or three ridges 4

4. Spermatheca axial, tails short conoid to subcylindroid..... THADINAE
 – Spermatheca offset; tail elongate, usually filiform.....TYLENCHINAE

Other subfamilies : *BOLEODORINAE Khan, 1964; DUSULCIINAE Siddiqi, 1979; THADINAE Siddiqi, 1986; TANZANIINAE Siddiqi, 2000

Subfamily TYLENCHINAE Orley 1880
 (Marcinowsky, 1909)

Diagnosis : Body generally 0.3-1.3 mm long. Cuticle finely striated or coarsely annulated, rarely smooth (*Polenchus*). Lateral fields marked by 3-4 incisures. Amphidial apertures generally longitudinal slits, may be ventrally curved or pore-like. Lip region generally continuous or set off. Stylet 6-21 μ m, conus shorter than or rarely as long as shaft with distinct basal knobs. Orifice of dorsal oesophageal gland opens at about quarter or less of stylet length posterior to its base. Muscular median oesophageal bulb present. Spermatheca often set off. Ovary outstretched. Testis outstretched. Spicules and gubernaculum typical of the family. Bursa adanal, simple. Tails generally filiform.

Type genus : **Tylenchus* Bastian, 1865

Other genera : **Aglenchus* Andrassy, 1954; *Cervoannulatus* Bajaj, 1997; *Coslenchus* Siddiqi, 1978; *Cucullitylenchus* Siddiqi, 1978; *Discotylenchus* Siddiqi, 1980; **Filenchus* Andrassy, 1954; *Fraglenchus* Siddiqi, 2000; *Irantylenchus* Kheiri, 1972; *Polenchus* Andrassy, 1980; **Sakia* Khan, 1964

Key to genera of Tylenchinae

1. Median oesophageal bulb absent or represented by a non-muscular swelling without cuticular thickenings ***Sakia***
 Median oesophageal bulb present, muscular, with cuticular thickenings 2
2. Subventral knobs of stylet absent ***Irantylenchus***
 Subventral knobs of stylet present 3
3. Cephalic region with a distinct disc-like structure 4
 Cephalic region without a disc-like structure 5
4. Cephalic disc extending laterally as a hood ***Cucullitylenchus***
 Cephalic disc not extending laterally as a hood ***Discotylenchus***
5. Cuticle non-annulated on most of body 6
 Cuticle annulated on most of body 7
6. Head inflated, offset; spicules almost straight; bursa prominent
 ***Cervoannulatus***

- Head continuous with body; spicules arcuate; bursa not prominent **Polenchus**
7. Longitudinal ridges outside lateral field present **Coslenchus**
 Longitudinal ridges outside lateral field absent 8
8. Lateral vulval membranes present; postvulval uterine sac absent 9
 Lateral vulval membranes absent; postvulval uterine sac present 10
9. Head and body finely annulated; cloacal lips not tubular **Fraglenchus**
 Head and body coarsely annulated; cloacal lips tubular **Aglenchus**
10. Amphidial apertures straight slits extending along cephalic region; stylet conus shorter than half stylet length **Filenchus**
 Amphidial apertures pore-like, not extending along cephalic region; stylet conus about half stylet length **Tylenchus**

Genus **Tylenchus** Bastian, 1865

Diagnosis : Small to medium sized (0.4-1.3 mm), ventrally curved upon fixation. Cuticle moderately thick (1.2 μm), distinctly annulated. Lateral fields each with four incisures. Cephalic region continuous, annulated, labial framework with light or without sclerotization. Stylet 8-12 μm long, with conus about half of stylet length; knobs round or posteriorly, sloping. Median oesophageal bulb oval. Basal bulb pyriform. Cardia distinct, Excretory pore opposite to basal bulb. Vulva a transverse slit, usually at 60-70% of body. Female reproductive system prodelphic, posterior uterine branch about one body width long. Spermatheca round or oval, off set. Ovary outstretched. Tail ventrally arcuate, often hooked, regularly tapering to a pointed or minutely rounded terminus. Bursa adanal, margins crenate. Spicules cephalated, arcuate, 13-25 μm long. Gubernaculum simple, fixed.

Type species : *Tylenchus davainei*, 1865

About 50 species have so far been described under the genus *Tylenchus* Bastian, 1865. *Tylenchus ritai* Siddiqi, 1983 and *Tylenchus magnus* Khurana & Gupta, 1988 are being described hereunder

1. ***Tylenchus ritai*** Siddiqi, 1963

(Plate No. 1, Fig. 1)

Measurements : Females : L = 0.68-0.84 mm; a = 29-36; b = 5.8-7.2; c = 5.0-6.3; c' = 9-10; V = 59-64; stylet = 14-15 μm

Males : L = 0.68-0.84 mm; a = 29-36; b = 5.8-7.2; c = 5.0-6.3; c' = 9-10; spicules = 22-24 μm ; gubernaculum = 6-7 μm .

Description : Female : Body ventrally arcuate. Lip region continuous with body. Lateral

fields marked by four incisures. Stylet 14-15 μm long. Oesophagus tylenchid. Female reproductive system monodelphic-prodelphic. Tail 112-146 μm long, strongly ventrally arcuate.

Male : Spicules 22-24 μm long arcuate, cephalated. Gubernaculum 6-7 μm long. Bursa 42-50 μm long.

Habitat and localities : Soil around roots of various plants at Desuri ki Naal district Pali; Nadbai district Bharatpur.

Distribution : Rajasthan, Uttar Pradesh, Himachal Pradesh.

2. *Tylenchus magnus* Khurana & Gupta, 1988

(Plate No. 1, Fig. 2)

Measurements : Females : L = 0.73-0.92 mm; a = 25-29; b = 5.6-6.5; c = 7.4-8.7; c' = 5.0-7.0; V = 69-71. VAD/TL = 1.3-1.6.

Male : L = 0.73 mm; a = 25; b = 5.6; c = 7.4

Description : Female : Body strongly ventrally curved. lateral fields each with four incisures, outer ones weakly crenate. Lip region continuous with four distinct striae. Excretory pore at level of basal bulb. Post-uterine sac 17-22 μm , vulva anus distance 1.4-1.6 of tail length. Tail 88-105 μm long, strongly ventrally curved, ending in a hook.

Male : Males comparatively slender and less curved. Bursa weak, 26 μm long. Spicules 23 μm long. Gubernaculum 6 μm long. Tail 82 μm long.

Habitat and locality : Collected from soil around grasses at Kelwada, Udaipur.

Distribution : India : Rajasthan, Uttar Pradesh, West Bengal.

Genus *Aglenchus* Andrassy, 1954 (Meyl, 1969)

Diagnosis : Body small (0.35-0.77 mm); usually straight to slightly arcuate. Cuticle coarsely annulated. Lateral fields marked by two prominently raised ridges. Cephalic region with distinct striations. Stylet less than 15 μm long; conus about half total length; knobs rounded. Median bulb round to oval, basal bulb pyriform. Cardia discoid. Vulva sunken in body, with larger membrane at 53-60% of body length. Vagina directed forward. Post vulval uterine sac absent. Spermatheca off set; round to oval, usually with sperms. Tail elongate filiform, longer than vulva-anus distance. Males usually present, with distinct adanal bursa, 11-16 μm long spicules and elevated-pointed cloacal lips forming a tubus.

Type species : *Aglenchus agricola* (de Man, 1884) Meyl, 1961

Under the genus *Aglenchus* about 10 species are being described till date. *Aglenchus agricola* is being described below :

3. *Agelenchus agricola* (de Man, 1884) Meyl, 1961
(Plate No. 1, Fig. 3)

Measurements : Females : L = 0.46-0.69 mm a = 25-35; b = 4.7-7.8; c = 3-5; c' = 13-19; V = 54-63; stylet = 10-13 μ m.

Males : L = 0.47-0.63 mm; a=30-40; b = 5.5-6.7; c = 3-4; c' = 14-15; stylet = 11-13 μ m.

Description : Female : Body curved posteriorly. Lateral fields marked by three separated bands. Lip region continuous, smooth. Oesophagus tylenchid. Vulva conspicuous, sunk in body contour. Reproductive system monodelphic-prodelphic. Posterior-uterine branch absent. Vulval flaps distinct. Females tail very long, needle like, 134-139 μ m 1-2.3 times vulva-anus distance.

Male : Spicules 13-15 μ m, hook-like, bent distally. Gubernaculum 4-5 μ m. Male tail 140-155 μ m long.

Habitat and localities : Soil around roots of various plants at Kumher, district Bharatpur, Thandi Beri, district Udaipur.

Distribution : Rajasthan, Andman and Nicobar.

Genus *Filenchus* Andr ssy, 1954 (Meyl, 1961)

Diagnosis : Body small to moderately large, straight to arcuate upon fixation. Cuticle finely or coarsely striated. Lateral fields marked by four incisures. Amphidial apertures straight, longitudinal slits or clefts. Deirids present. Lip region rounded or conoid, rarely truncated, continuous or slightly set off. Labial framework light to moderately sclerotized. Stylet moderately developed. Basal knobs distinct. Orifice or dorsal oesophageal gland close to base of stylet. Median bulb oval to rounded, muscular valvet. Cardia distinct. Vulva at 55-70% of body. Spermatheca set off. Vagina directed forward. Ovary outstretched. Post vulval uteine sac present. Tail generally filiform and straight, may be elongate conoid. Bursa adanal. Spicules tylenchoid. Gubernaculum strongly cupped.

Type species : *Filenchus filiformis* (Butschli, 1873) Meyl, 1961

4. *Filenchus filiformis* (Butschli, 1873) Meyl, 1961
(Plate No. 1, Fig. 4 & 1, A-B)

Measurements : Females : L = 0.56-0.61 mm; a = 35; b = 5.6-5.8; c = 5.0-6.1; c = 9.1-10.0; V = 9-10 59-65

Description : Female : Body slightly arcuate upon fixation. Cuticle transversely striated, about 0.5 μ m apart. Lateral fields marked by four incisures. Lip region continuous striated. Stylet 10-11 μ m long, with small knobs. Oesophageal median bulb at 41-42% from anterior end. Basal bulb pyriform. Excretory pore at 92-95 μ m from anterior end. Posterior uterine sac about 0.6-0.7 vulval body-width long. Tail filiform, 91-121 μ m or 1.0-1.5 times the vulva anus distance.

Male : Not found.

Habitat and localities : Soil around roots of various plants at Mathania, district Jodhpur.

Distribution : Rajasthan, Gujarat, West Bengal.

Genus *Sakia* Khan, 1964

Diagnosis : Body slender, about 1mm long straight to arcuate upon fixation. Cuticle finely striated. Lateral fields each with four incisures. Cephalic region continuous, rounded or conoid; labial framework lightly sclerotized. Stylet about 10µm long, consus shorter than shaft. Knobs present. Orifice of dorsal gland orifice close to base of stylet. Median bulb fusiform, non-muscular, non valvate. Isthmus elongate slender. Basal bulb round, pearshaped or cylindroid off set from intestine. Cardia present. Vulva prominent transverse slit. Post-vulval uterine sac one body width long. Tail elongate-filiform. Spicules and gubernaculum typical of the subfamily.

Type species : *Sakia typica* Khan, 1964

About 8 species have so far been described under genus *Sakia*. *Sakia alii* Suryawanshi, 1971 is being dealt under.

5. *Sakia alii* Suryawanshi, 1971
(Plate No. 1, Fig. 5)

Measurements : Females : L = 0.54-0.58 mm; a = 46.2-47.1; b = 5.3-5.4; c = 17.9-18.4; V = 70-73.

Males : L = 0.56-0.59; a = 47.2-47.8; b = 5.5-5.6; c = 18.4-18.9.

Description : Female : Body almost straight upon fixation. Cuticle finely striated. Lateral fields marked by four incisures. Lip region rounded, continuous with adjacent body contour. Stylet 5-8 µm long, knobs weakly developed. Excretory pore in isthmus region, duct slightly sclerotized. Female reproductive system monodelphic-prodelphic. Postvulval uterine sac less than one body width long. Tail elongate.

Male : Similar to Female in general morphology except reproductive system. Spicules 17-20 µm long and gubernaculum 5-8 µm long.

Habitat and localities : Soil around roots of various plants at Kelwada, district Udaipur.

Distribution : Rajasthan, Maharashtra.

Subfamily BOLEODORINAE Khan, 1964

Diagnosis : Body generally less than 1 mm long. Cuticle finely striated. Lateral fields marked by four incisures. Phasmids obscure. Deirids present. Lip region conoid rounded. Generally elevated or smooth. Amphidial apertures prominent, oblique or longitudinal slits or V-shaped, partially covered by a cuticular flap, post labial. Stylet delicate, conus

shorter than shaft; its knobs weakly developed, round, flanged or absent (*Neopsilenchus*). Orifice of dorsal oesophageal gland generally at a quarter or more of stylet length posterior to stylet base. Postcorpus muscular or non muscular with or without valve-plates. Basal bulb set off from intestine. Post uterine sac present. Spermatheca lobed, usually set off. Ovaries and testis outstretched. Spicules and gubernaculum typical of the family. Bursa adanal, simple. Tails generally filiform may be elongate-conoid, terminus finely pointed, rounded, clavate or notched.

Type genus : **Boleodorus* Thorne, 1941

Key to genera of Boleodorinae

1. Median oesophageal bulb non-muscular, non-valvate ***Boleodorus***
 Median oesophageal bulb muscular, valvate ***Basiria***

Genus *Boleodorus* Thorne, 1941

Diagnosis : Body less than 1mm. Cuticle finely striated. Lateral fields marked with four incisures, not aeolated. Lip region elevated, conoid-rounded, smooth, with or without a depression. Amphidial apertures oval or crescentic slit, obliquely placed on labial disc. Stylet 8-10 μm long, with rounded or rarely flanged basal knobs. Dorsal oesophageal gland opens 1-4 μm posterior to stylet base. Median bulb cylindroids, devoid of musculature and valve plates. Basal bulb pyriform. Ovary single. Post vulval uterine sac less than a body-width. Tail ventrally arcuate or straight, usually with clavate terminus. Bursa adanal.

Type species : *Boleodorus thylactoius* Thorne, 1941

6. *Boleodorus brevistylus* Khera, 1970

(Plate No. 1, Fig. 6 & 1 C-D)

Measurements : Female : L = 0.75mm; a = 35; b = 6.34; c = 11.61; c' = 4; V = 77¹⁴

Description : Female : Body slender. Cuticle thin, with fine transverse striations, striae 0.7 μm apart. Lateral fields marked by four incisures. Lip region rounded, flattened anteriorly, 7 μm wide and 4 μm high. Stylet 8 μm with rounded basal knobs. Orifice of dorsal oesophageal gland 1.5 μm from base of stylet. Median oesophageal bulb at 54% from anterior end. Basal bulb set off and pyriform. Excretory pore at 95 μm from anterior end. Vulva a transverse slit. Female reproductive system monodelphic-prodelphic, vagina 10 μm or $\frac{1}{2}$ body with long ovary outstretched. Post vulval uterine sac 30 μm or 1.4 body-width long. Tail 65 μm long, conoid-elongate with rounded terminus.

Male : Not found.

Habitat and localities : Soil around roots of various plants around Jodhpur, Pali, Dausa and other districts in the State.

Distribution : India; Rajasthan, Uttar Pradesh, West Bengal.

7. ***Boleodorus thylactus*** Thorne, 1941
(Plate No. 2, Fig. 7)

Measurement : Females : L = 0.38-0.57 mm; a = 20-38; b = 4.1-6.4; c = 5.4-10.9; V = 74-76; stylet = 8.5-12 μ m long..

Description : Female : Body arcuate upon fixation. Lateral fields each with 4 incisures. Lip region smooth. Labial framework moderately sclerotized. Post-vulval uterine sac about 50% vulval body width long. Vulva-anus distance about twice tail length. Female tail ventrally hooked.

Male : Not found.

Habitat and locality : Found around roots of various plants and forest trees at KWLS, Chittorgarh.

Distribution : Uttar Pradesh, Rajasthan.

Genus ***Basiria*** Siddiqi, 1959

Diagnosis : Body about 1mm or less straight to arcuate ventrally upon fixation. Cuticle distinctly striated. Lateral fields marked by four incisures. Amphidial apertures distinct, slit-like or V-shaped. Lip region elevated, rounded, smooth. Labial sclerotization weak. Stylet slender, 9-13 μ m long, with small rounded knobs. Dorsal oesophageal gland opens about one stylet length posterior to base of stylet. Median bulb generally weakly developed. Basal bulb set off from intestine. Cardia distinct. Vulva at 60-70% of body length. Ovary single, outstretched. Posterior uterine sac shorter than body width. Tail elongate-filiform; with clavate, round, indented or pointed terminus. Bursa adanal. Spicules 14-24 μ m long. Gubernaculum simple fixed.

Type species : *Basiria graminophila* Siddiqi, 1959

8. ***Basiria graminophila*** Siddiqi, 1959
(Plate No. 2, Fig. 8 & 1, E-G)

Measurements : Females : L = 0.68-0.76 mm; a = 30-40; b = 5-6; c = 5.9-6.0; c' = 9.0-9.5; V = 12-1363-64.

Males : L = 0.65-0.67 mm; a = 39-40; b = 5.9-6.0; c = 5-6; T = 55-60; spicules = 16-18 μ m; gubernaculum = 4.5 μ m.

Description : Female : Body more or less straight upon fixation. Cuticle striated, striae about 1 μ m apart. Lip region marked by slight depression, with flat apex, narrower than body. Lateral fields marked by four incisures. Stylet 11-12 μ m long, with rounded basal knobs. Dorsal oesophageal gland opening at 9-10 μ m posterior to stylet base. Median oesophageal bulb poorly developed, 45-55% of oesophageal length from anterior end. Basal bulb set off from intestine. Cardia distinct. Female reproductive system monodelphic. Ovary outstretched. Spematheca lobed. Post vulval-uterine sac about half vulval

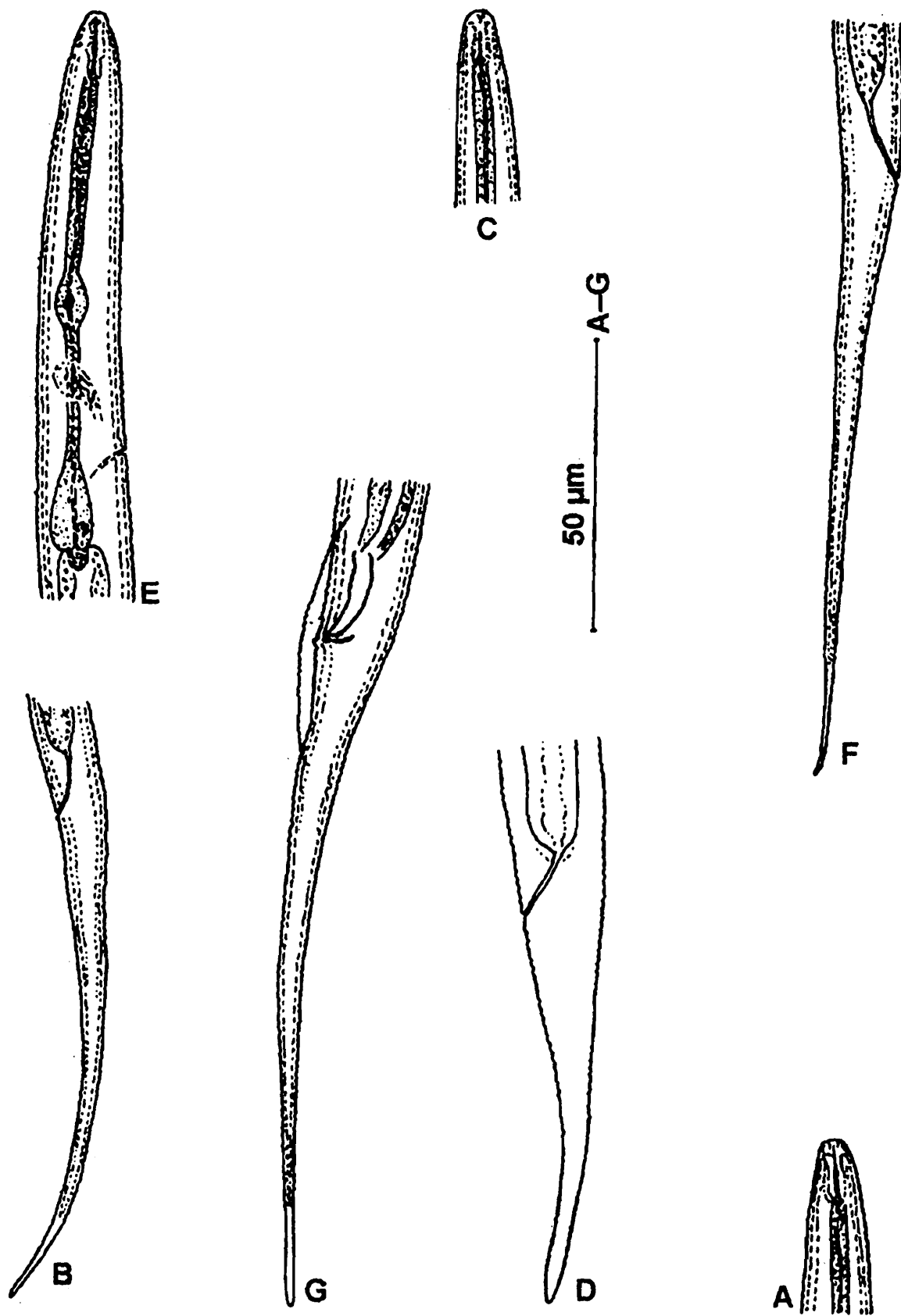


Fig. 1. A-B : *Filenchus filiformis* (Butschli, 1873) Meyl, 1961; A-Female anterior end; B-F emale tail ; C-D: *Boleodorus brevistylus* Khera, 1970; C- Female anterior end; D-Female tail; E-G : *Basiria graminophila* Siddiqi; 1959; E-Oesophageal region; F-Female tail; G-Male tail.

body-width long. Vulva-anus distance more than one tail length. Tail elongate filiform, 112-128 μm long, with fine rounded terminus.

Male : Similar to Female in general shape and morphology except in tail shape and reproductive system. Bursa adanal. Spicules 16-18 μm long. Gubernaculum simple fixed.

Habitat and localities : Soil around roots of various plants at Peeh, district Nagaur.

Distribution : India : Rajasthan, Haryana, Punjab, Uttar Pradesh.

Subfamily DUOSULCIINAE Siddiqi, 1979

Diagnosis : Body small (under 1 mm), straight to arcuate upon fixation, not extremely slender ($a < 60$). Cuticle deeply annulated; annules distinct, rounded or pointed, may be sculptured; longitudinally and transverse grooves may be present. Lateral field narrow with a single prominent ridge showing two incisures in lateral view. Stylet small (less than 15 μm), with distinct rounded basal knobs. Median bulb present or absent. Vulval lips not modified, lacking lateral membranes. Spermatheca off set, round or elongate sac directed forward. Post vulval uterine sac present or absent. Tail elongate conoid to filiform, with pointed, finely rounded or hooked terminus. Bursa present except in *Miculenchus*, adanal, simple.

Type genus : *Duosulcius* Siddiqi, 1984

Other genera : *Allotylenchus* Andrassy, 1984; **Malenchus* Andrassy, 1968; *Miculenchus* Andrassy, 1959; *Mukazia* Siddiqi, 1986; **Ottolenchus* Husain & Khan, 1967; *Ridgellus* Siddiqi, 2000; *Zanenchus* Siddiqi, 1979

Key to genera of Duosulciinae

1. Cuticle with longitudinal ridges outside lateral fields ***Ridgellus***
Cuticle without longitudinal ridges outside lateral fields 2
2. Cephalic region dorsoventrally flattened ***Malenchus***
Cephalic region circular 3
3. Cuticle not annulated or striated ***Allotylenchus***
Cuticle annulated 4
4. Annules well separated from each other by grooves body 0.7 mm or long
..... ***Mukazia***
Annules contiguous; body under 0.7 mm long 5
5. Body annules prominent, generally sculptured; cephalic region distinctly annulated, with four or more annules 6
Body annules not prominent or sculptured; cephalic region distinctly annulated, with less than four annules ***Ottolenchus***

6. Postcorpus non-muscular, without refractive thickenings **Duosulcius**
 Postcorpus muscular, with refractive thickenings 7
7. Post-vulval uterine sac present; bursa absent **Miculenchus**
 Post-vulval uterine sac absent, bursa present **Zanenchus**

Genus **Malenchus** Andrassy, 1968

Diagnosis : Body elongate-fusiform, with strong and regular tapering behind vulva so that width at anus becomes about half that at vulva. Annules prominent. Lateral field with two incisures. Cephalic region elevated, flattend dorso-ventrally. Stylet 7-14 μ m long, with distinct knobs. Basal bulb pyriform with flat to indented base. Vulva located in a body cavity. Spermatheca elongate-oval, or bilobed, off set, directed forward. Uterus with quadricolumella. Post-uterine sac present. Tail elongate conoid to a pointed or hooked tip. Bursa adanal. Spicules tylenchoid, Gubernaculum fixed.

Malenchus is further divided into subgenera.

Type subgenera : *Malenchus* (Andrassy, 1968) Siddiqi, 2000

Other subgenera : *Neomalenchus* Siddiqi, 1970; *Telomalenchus* Siddiqi, 2000

Under the genus *Malenchus* (*Malenchus*) about 30 known species have been described. *Malenchus* (*Malenchus*) *holochmatus* is described below :

9. **Malenchus (M.) holochmatus** (Singh, 1971) Siddiqi, 1986 (Plate No. 2, Fig. 9)

Measurements : Females : L = 0.37-0.39 mm; a = 36.5-39.5; b = 3.7-4.5; c = 27.5-28.2; V = 61-62.

Description : Female : Body strong, tapering regularly more posterior to vulva. Lateral fields marked with two incisures. Lip region elevated, with four to six fine annules. Stylet 12 μ m long with distinct basal knobs. Female reproductive system amphidelphic. Spermatheca elongate. Vulva located in a depression. Tail elongate-conoid, 12-14 μ m long. Phasmids located at 1-3 annules anterior to anus.

Male : Not found.

Habitat and localities : Collected from soil around roots of grasses at Desuri ki Naal, district Pali.

Distribution : Rajasthan.

Genus **Ottolenchus** Husain & Khan, 1967 Meyl, (1970)

Diagnosis : Cuticle with plain, fine or coarse annules. Lateral fields with two incisures, cephalic region low, less than three adjacent body annules high. Stylet slender about

11 μm or less long, knobs minute, rounded. Basal bulb pyriform. Vulva flush with body contour or depressed but not forming cavity. Post vulval uterine sac present. Tail elongate-filiform. Bursa adanal. Spicules slender, slightly arcuate. Gubernaculum slender, linear not strongly cupped.

Type species : *Ottolenchus equisetus* (Husain & Khan, 1967) Wu, 1970

The genus *Ottolenchus* is represented by about 35 known species.

10. ***Ottolenchus equisetus*** (Hussain and Khan, 1967) (Wu, 1970)
(Plate No. 2, Fig. 10)

Measurements : Females : L = 0.37-0.52 mm; a = 26-27; b = 5.4-6.7; c = 3.7-4.5; V = 57-65.

Description : Female : Body slightly curved ventrally upon fixation. Lip region, rounded, smooth, continuous with adjacent body. Lateral fields represented by a single band. Stylet 6-7 μm long. Female reproductive system monodelphic-prodelphic. Post-vulval uterine sac about one vulval body width long. Tail elongate filiform with a finely rounded tip.

Male : Not found.

Habitat and localities : Soil inhabiting, collected from around roots of various host plants at Thandi Beri Kumbhalgarh Wild Life Sanctuary, Udaipur.

Distribution : Rajasthan.

B. Infraorder ANGUINATA

Diagnosis : Cuticle smooth or finely striated. Cephalic region, low, cap-like. Stylet small with small rounded knobs. Cardia absent; two anteriormost intestinal cells often acting as a valve. Female gonad single, outstretched, spermatheca axial, elongated, sac-like. Phasmids absent. Male with robust spicules, anteriorly expanded. Tail similar in sexes.

Superfamily ANGUINOIDEA Nicoll, 1935 (1926)

Diagnosis : Traditionally *Anguina* and *Ditylenchus* have been classified in the Tylenchidae, but they differ from the members of this family in their different origin and evolution from fungal-feeding forms and in having two anterior most cells of the intestine modified to act as a valve (a tricellular cardia is absent in this group), a prominent cristaformia and large-sized sperm with a prominent cytoplasmic vesicle.

Type family : Anguinidae Nicoll, 1935 (1926)

Key to families of ANGUINOIDEA Nicoll, 1935 (1926)

1. Female tail cylindroids or subcylindroid, dissimilar to that of male; bursa enveloping tail terminus; associates of insects SYCHNOTYLENCHIDAE

2. Female tail conoid to filiform, rarely subcylindroid, similar to that of male; bursa not enveloping tail terminus; very rarely associates of insects.....
 SYCHNOTYLENCHIDAE

Family ANGUINIDAE Nicoll, 1935 (1926)

Diagnosis : Adults slender or obese. Cephalic region low, smooth. Median bulb present or absent. Basal pharyngeal bulb offset from intestine. Dorsal gland may become enlarged and extend over intestine as a lobe. Post vulval sac present or rarely absent. Tail similar between sexes. Bursa never enclosing tail tip.

Type subfamily : Anguininae Nicoll, 1935 (1926)

Key to subfamilies of ANGUINIDAE Nicoll, 1935 (1926)

1. Excretory duct widened, sclerotized; exclusively marine, parasitic on sea algae forming galls HALENCHINAE
- Excretory duct not widened or sclerotized; not marine, not parasitic on sea algae ...
 ANGUININAE

Subfamily ANGUININAE, Nicoll (1935) (1926)

Diagnosis : Adults slender or obese, straight, arcuate or strongly curved when relaxed. Procorpus cylindroid. Postcorpus muscular, with distinct valve plates. Basal bulb enclosing oesophageal glands, dorsal gland may form a lobe extending over intestine dorsally or laterally. Vulva lacking lateral membrane. Post vulval uterine sac well developed (absent in *Diptenchus*). Ovary outstretched or with tip reflexed once or twice. Gubernaculum present.

Type genus : *Anguina* Scopoli, 1777

Other genera : *Cynipanguina* Maggenti, Hart & Paxman, 1974; *Diptenchus* Khan, Chawla & Seshadri, 1969; *Ditylenchus* Filipjev, 1936

Genus *Anguina* Scopoli, 1777

Diagnosis : Medium to large sized (1.0-2.7 mm), obese; mature female curved generally in one to one and a half spiral. Median oesophageal bulb muscular. Basal bulb in adults enlarged, continuous or set off from isthmus by a constriction, usually extending over intestine. Ovary with one or two flexures anteriorly due to excessive growth. Oocytes in multiple rows, arranged about a radius. Crustaformeria a long tube formed by a large number of cells in multiple irregular rows. Spermatogonia in multiple rows. Bursa subterminal. Second stage juvenile generally resistant and is the infective stage. Obligate plant parasites, inciting galls in seeds of cereals and grasses stems, leaves and inflorescence of various monocotyledonous plants. Type species cause wheat seed galls (ear cockles).

Type species : *Anguina tritici* (Steinbuch, 1799) Chitwood, 1935

11. *Anguina tritici* (Steinbuch, 1799) Chitwood, 1935
(Fig. 2, A-C)

Measurements : Adult females : L = 2.64-4.36 mm; a = 13.22; b = 9.8-19.4; c = 24-63; V = 70-90.

Adult males : L = 2.04-2.40 mm; a = 21-30; b = 6.3-11.0; c = 17-24; T = 67-81; Stylet = 9-11 μ m.

IIInd stage juveniles : L = 0.74-0.78 mm; a = 46-57; b = 4.5-6.0; c = 22-26; Stylet = 9-10 μ m.

Description : Female : Adult Female body obese, spirally coiled ventrally upon fixation. Lateral fields with 4 or more incisures. Lip region low and flattened, slightly set off. Oesophagus in procorpus region swollen but constricted at junction with median bulb. Oesophageal glands forming a roughly pyriform bulb, not overlapping intestine. Cardia small. Anterior branch of genital tract greatly developed, ovary usually with two or more flexure. Posterior branch represented by a sac. Vulval lips prominent. Several eggs may be present in uterus at one time.

Male : Males with paired stout, arcuate spicules; head of spicules folded ventrally. Gubernaculum simple, trough-shaped. Bursa subterminal.

Habitat and localities : Cockles were collected from infected wheat plants at Udaipur.

Distribution : Rajasthan, Punjab, Haryana.

Suborder HOPLOLAIMINA Chizhov and Berezina, 1988

Diagnosis : Cuticle with distinct outer and inner layers. Cephalic framework usually with high arches. Stylet well develop, basal knobs prominent. Females amphidelphic. Phasmids present in or near tail region. Prophasms absent.

Type superfamily : Hoplolaimoidea Filipjev, 1934 (Paramonov, 1967)

Key to superfamilies of HOPLOLAIMINA Chizhov & Berezina, 1988

1. Subventral pharyngeal glands enlarged, usually extending past the dorsal gland; sexual dimorphism in anterior region manifested HOPLOLAIMOIDEA
- Subventral pharyngeal glands not enlarged, not extending past the dorsal gland; sexual dimorphism in anterior region not manifested DOLICHODOROIDEA

Superfamily HOPLOLAIMOIDEA Filipjev, 1934 (Paramonov, 1967)

Diagnosis : Cephalic sensilla not on surface. First cephalic annule generally divided into six sectors which may be modified. Pharyngeal glands lobed, overlapping intestine. Subventral glands enlarged, equal to or usually larger than dorsal gland; nuclei of one or both subventral glands lying posterior to that of the dorsal gland. Cellular cardia absent. Male tail with a distinct hyaline terminal portion.

Type family : HOPLOLAIMIDAE Filipjev, 1934 (Wieser, 1953)

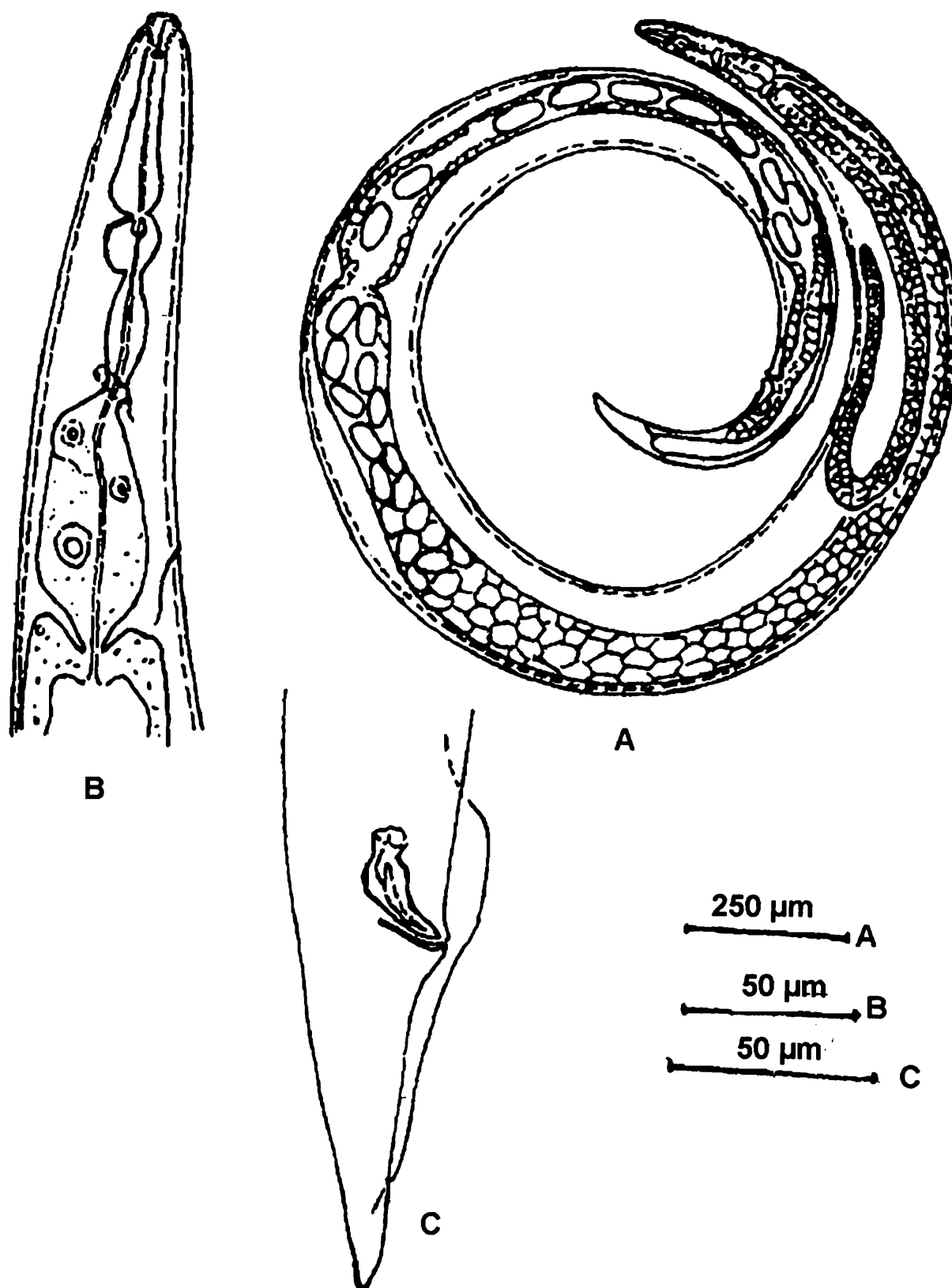


Fig. 2. *Anguina tritici* (Steinbuch, 1799) Chitwood, 1935. A-Entire female; B-Oesophageal region; C-Male tail.

Key to families of HOPLOLAIMOIDEA Filipjev, 1934 (Paramonov, 1967)

1. Mature Female round, lemon-shape behind neck, with anus terminal or near so; male with stylet larger than that of female and tail very short or absent 2
 - Mature Female not round or lemon-shape, with anus not terminal; male with stylet equal to or smaller than that of Female and tail not very short 3
2. Excretory pore in mature female opposite or anterior to median bulb; female labial disc dorsventrally elongated; male with large lip cap and large transverse slit-like amphidial apertures; gall-inciting MELOIDOGYNIDAE
 - Excretory pore in mature Female behind median bulb; Female labial disc rounded; male with small lip cap and small oval to round amphidial apertures; not gall-inciting HETERODERIDAE
3. Juveniles and females with low arched cephalic framework, generally endoparasites of roots PRATYLENCHIDAE
4. Juveniles and Females with high arched cephalic framework, generally ectoparasites of roots 4
5. Mature Female swollen, sedentary ROTYLENCHULIDAE
 - Mature Female not swollen, migratory HOPLOLAIMIDAE

Family HOPLOLAIMIDAE Filipjev, 1934 (Wieser, 1953)**Migratory ecotoparasite**

Diagnosis : This is a large family of economically important Tylenchida. It comprises three subfamilies Hoplolaiminae, Aphasmatylenchinae and Rotylenchoidinae, which have slender Females which are migratory ectoparasites of roots., but some have a tendency to burry themselves in roots. Small to moderately large (0.6-1.5 mm); generally vermiform. Sexual dimorphism manifest in anterior region. Lateral fields each with four incisures. Dierids absent. Phasmids either small, with pore-like apertures near or a little anterior to anus or large scutellum-like, near anus or much anterior to it anywhere on body behind oesophageal region; absent in *Aphasmatylenchus*. Cephalic region elevated, high arched, framework strongly sclerotized, labial disc usually distinct; labial sensilla not on surface. Oesophageal glands over-lapping intestine. Ovaries paired rarely single. Female tail short, rounded. Male tail short. Spicules robust or slender, straight to arcuate, with distal flanges which may be reduced. Bursa large, enveloping tail; flaps crenate, sometimes indented at tip, usually lacking phasmidial pseudo-ribs. Gubernaculum large, protrusible or fixed; telamon present or absent. Some of the common species are *Hoplolaimus indicus* (lance nematode); *Helicotylenchus* sp. (Spiral nematodes).

Key to subfamilies of HOPLOLAIMIDAE Filipjev, 1934 (Wieser, 1953)

1. Phasmids present 2
- Phasmids absent *Aphasmatylenchinae*
2. Phasmids large, scutellum-like *Hoplolaiminae*
- Phasmids small, pore-like *Rotylenchoidinae*

Subfamily HOPLOAIMINAE Filipjev, 1934

Diagnosis : Lip region usually set off, first and basal striae marked with longitudinal indentation. Labial framework strongly sclerotized. Lateral fields generally marked with four incisures. Stylet strong, with well developed tulip shaped basal knobs. Orifice of dorsal oesophageal gland one fourth from stylet base. Oesophageal glands either of the same length and not overlapping intestine or enlarged and overlapping the intestine. Female reproductive system amphidelphic; posterior branch may reduce to form post vulval uterine sac. Female tail short, rounded. Males with spicules which may be distally flanged. Gubernaculum protrusible. Bursa large, enveloping tail.

Type genus : *Hoplolaimus* Daday, 1905

Other genera : *Aorolaimus* Sher, 1963; *Peltamigratus* Sher, 1964; *Scutellonema* Andrassy, 1958

Key to genera of Hoplolaiminae

1. Stylet knobs tulip-shaped, each with one to three anteriorly directed tooth-like projections *Hoplolaimus*
 Stylet knobs not tulip-shaped, without tooth-like projections 2
2. Scutella in or near anal region, close to or opposite each other *Scutellonema*
 Scutella much anterior to anus, separated from each other 3
3. One scutellum prevulval, another postvulval *Aorolaimus*
 Both scutella postvulval *Peltamigratus*

Genus *Hoplolaimus* Daday, 1905

Diagnosis : Body 1-2 mm long, almost straight or slightly ventrally curved upon fixation. Lateral fields with four incisures, may be reduced to one or two, generally aerolated at level of phasmids (scutella) and anterior region, sometimes with stria irregularly scattered over entire field, rarely not aerolated. Lip region set off from body, wider than body, anteriorly flattened, with clearly marked annuli and longitudinal stria, basal annule divided into small squares. Cephalic framework heavily sclerotized, lateral sectors smaller than submedian. Stylet massive, with tulip-shaped knobs. Dorsal oesophageal gland orifice

close to stylet base. Oesophageal glands overlap intestine dorsally and laterally; sometimes gland nuclei duplicated to a total of six nuclei; intestine symmetrically arranged between the subventral glands. Epiptygma present. Female reproductive system amphidelphic, ovaries outstretched, equally developed. Tail short rounded.

12. *Hoplolaimus indicus* Sher, 1963

(Plate No. 2, Fig. 12 & 3, A-H)

Measurement : Females : L = 1.02-1.40 mm; a = 22-36; b = 7.5-9.7; c = 42-65; c' = 0.60-0.68; V¹⁰⁻¹¹ = 52-57¹⁰⁻¹¹

Males : L = 0.94-1.30 mm; a = 26-36; b = 7.9-10.1; c = 31-38; T = 50-55.

Description : Female : Lip region hemispheroid, marked by 3-4 annules. Stylet robust, 30-34 µm long; basal knobs tulip-shaped. Female reproductive system amphidelphic. Epiptygma single or double. Spermatheca filled with sperms. Tail with 8-13 annules. Male : Similar to Female in general morphology. Spicules arcuate and cephalated, 37-48 µm long. Gubernaculum 12-20 µm long. Tail conoid. Bursa terminal.

Habitat and localities : Rhizosphere of various crops and plants. Plant Parasitic.

Distribution : Rajasthan, West Bengal, Delhi, Himachal Pradesh, Bihar, Punjab, Haryana, U.P., Sikkim, etc.

Remark : It is a widely distributed species in the State

Subfamily ROTYLENCHODINAE Whitehead, 1958

Diagnosis : small to medium sized, (0.37-1.2 mm), often spirally curved upon fixation. Cuticle distinctly striated. Lip region small, conoid-rounded, and continuous with body. Labial disc flattened, inconspicuous. Orifice of dorsal oesophageal gland one fourth of stylet length posterior to stylet base. Oesophageal glands generally forming a wrap around anterior end of intestine. Female reproductive system amphidelphic, posterior branch may be reduced to form posterior uterine sac. Female tail short, rounded or dorsally convex-conoid with or without terminal projection (mucro). Bursa moderately developed, enclosing tail tip or rarely subterminal. Spicules slender, arcuate, pointed with indistinct terminal flanges. Gubernaculum slender, fixed. Hypoptygma present or absent.

Type genera : *Antarctylus* Sher, 1973; *Helicotylenchus* Steiner, 1945; *Orientylus* Jairajpuri & Siddiqi, 1977; *Varotylus* Siddiqi, 1986

Key to genera of Rotylenchoidinae

1. Oesophageal glands extending over intestine mostly ventrally and ventrolaterally 2
 Oesophageal glands extending over intestine mostly dorsally and dorsolaterally 3
2. Posterior ovary non-functional or absent ***Rotylenchoides***

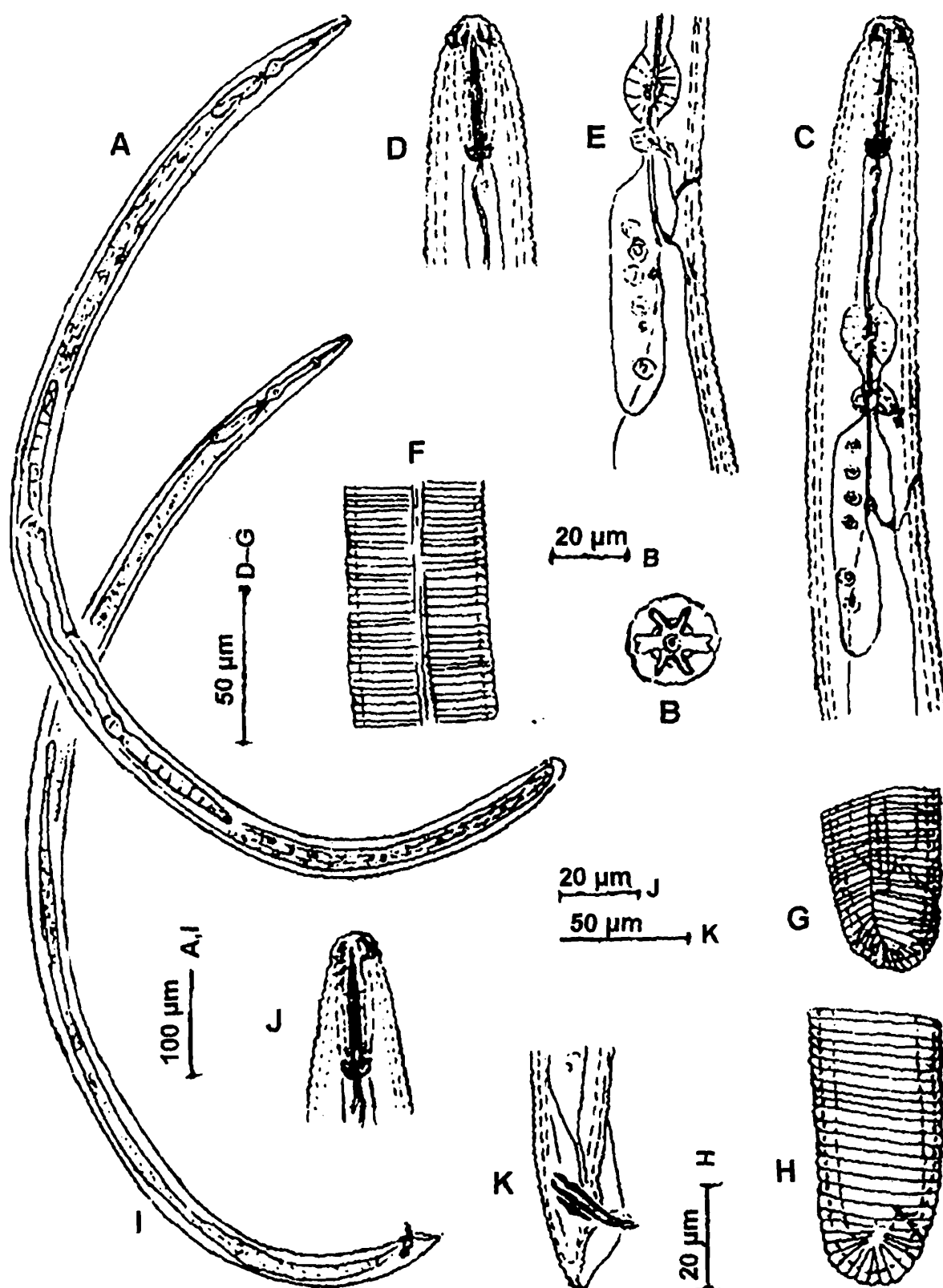


Fig. 3. *Hoplolaimus indicus* Sher, 1963. A-H : Female : A-Entire female B-En face view; C-Oesophageal region; D-Anterior end; E-Posterior oesophageal region; F-Surface view showing irregularly broken incisures at mid-body; G-Female tail; H-Female tail; I-K : Male : I-Entire male, J-Anterior end; K-Tail.

- Posterior ovary functional **Helicotylenchus**
3. Posterior ovary non-functional or absent **Orientylus**
- Posterior ovary functional 4
4. Female tail regularly tapering to a small tip, two to three anal body width long; subventral oesophageal glands a symmetrical..... **Antarctylus**
- Female tailnot regularly taperingto a small tip, less than two anal body width long; subventral oesophageal glands symmetrical 5
5. Orifice of dorsal oesophageal gland about half stylet length behind stylet base; gubernaculum fixed **Varotylus**
- Orifice of dorsal osophageal gland less than half stylet length behind stylet base; gubernaculum protrusible **Rotylenchus**

Genus **Helicotylenchus** Steiner, 1945

Diagnosis : Small to medium sized (0.4-1.2 mm long). Females spirally coiled, rarely arcuate. Lateral fields with four incisures. Lip region low or elevated, continuous or rarely set off, with or without striations. Stylet robust, about 3-4 times the lip region-width. Orifice of dorsal oesophageal gland one-fourth or more of stylet length posterior to basal knobs. Oesophageal glands overlap intestine ventrally. Intestine not overlapping rectum. Female reproductive system amphidelphic. Spermatheca functional or non functional. Female tail short, hemispherical, dorsally convex-conoid, with or without ventral terminal projection. Male tail short, conical, with a distinct terminal hyaline portion. Bursa enveloping entire tail tip, rarely subterminal. Gubernaculum trough or rod-shaped, fixed. About more than thirty species of genus *Helicotylenchus* are known to occur in the State. The present book dealt with 14 species of genus *Helicotylenchus*.

13. **Helicotylenchus multicinctus** (Cobb, 1893) Golden, 1956 (Plate No. 2, Fig. 13 & 4, A-B)

Measurements : Females : L = 0.73-0.87 mm; a = 30-36; b = 6.1-6.6; c = 44-50; c' = 0.60-1.00; V = ⁸960-668-9

Description : Female : Body spirally curved. Lip region hemispherical, marked by 3-5 striae. Stylet 25-29 µm long, with anteriorly indented basal knobs. Tail dorsally curved with hemispherical terminus, 16-18 µm long marked by 7-9 striae ventrally. Phasmids slightly anterior to anus.

Male : Not found.

Habitat and localities : Soil around roots of various plants. Plant parasitic. Bari district, Udaipur; Keladevi road, district Karauli, Jhakam range, district Pratapgarh.

Distribution : Rajasthan, Gujarat, West Bengal, Orissa, North Andaman.

14. ***Helicotylenchus conicephalus*** Siddiqi, 1972.

(Plate No. 3, Fig. 14)

Measurements : Females : L = 0.46-0.64 mm; a = 28-32; b = 4.5-6.5; c = 36-47; c' = 0.7-1.4; V = 60-63.

Description : Female : Lip region conical, anteriorly truncate, with a distinct terminal disc and lacking annules; labial framework heavily sclerotized. Labial annules very fine. Stylet 21-24µm long with flattened basal knobs. Reproductive system amphidelphic. Spermatheca axial, empty. Tail rounded the terminal annules finner than the rest, usually with a distinct ventral projection and with 7-9 annules ventrally. Phasmids anterior to anal level. Inner incisures on tail fusing distally.

Male : Not found

Habitat and localities : Soil inhabiting. Phytophagous. Parisal-Nadbai, district Bharatpur.

Distribution : Rajasthan.

15. ***Helicotylenchus crenacauda*** Sher, 1966

(Plate No. 3, Fig. 15 & 4,G-H)

Measurements : Females : L = 0.57-0.77 mm; a = 24-29; b = 4.7-6.2; c = 3.9-5.0; c' = 1.0-1.3; V = 59-64.

Description : Female : Body spiral in shape upon fixation. Lip region hemispherical with four distinct labial annules. Stylet 24-28 µm long with flattened anterior surface. Excretory pore anterior to level of oesophago-intestinal junction. Spermatheca inconspicuous, empty. Phasmids 4-6 annules anterior to anus. Tail indented terminally, pronounced ventral projection, 8 annules. Inner incisures fusing in posterior third of tail.

Male : Not found.

Habitat and localities : Soil around roots of various plants. Plant parasitic. Moria, district Udaipur. Parisal-Nadbai, district Bharatpur.

Distribution : Rajasthan, West Bengal, Andaman and Nicobar Islands

16. ***Helicotylenchus dihystra*** (Cobb, 1893) Sher, 1961

(Plate No. 3, Fig. 16 & 4,E-F)

Measurement : Females : L = 0.54-0.83mm; a = 20-32; b = 4.5-6.4; c = 44-46; c' = 1.0-1.3; V = 12-1560-66¹¹⁻¹³

Description : Female : Lip region continuous with body, hemispherical, marked by 4-5 striae. Stylet 24-27 µm long, with concave or anteriorly indented basal knobs. Spermatheca rounded, filled with sperms. Tail 13-18 µm long, dorsally convex-conoid, with slight ventral projection. Phasmids 6-8 striae anterior to anus.

Male : Not found.

Habitat and localities : Soil around roots of various plants. Plant parasitic. Mathania, district Jodhpur; Peeh, district Nagaur; Bari, district Udaipur.

Distribution : Gujarat, Himachal Pradesh, West Bengal, Karnataka, Orissa, Sikkim, Haryana, Madhya Pradesh, Maharashtra and Andaman & Nicobar Islands.

Remarks : Widely distributed species.

17. *Helicotylenchus erythrinae* (Zimmermann, 1904) Golden, 1956
(Plate No. 3, Fig. 17 & 4, C-D)

Measurements : Females : L = 0.73-0.88 mm; a = 23-26; b = 6.6-7.5; c = 29-32; c' = 1.3-1.5; V = $14 \cdot 2658 \cdot 63^{15-17}$

Description : Female : Body spirally curved. Lip region hemispherical, marked by 4-5 striae. Stylet 30-32 μ m long, basal knobs slightly anteriorly directed. Spermatheca functional. Tail 25-26 μ m long, tapering into a pronounced ventral projection. Phasmids 1-3 annules anterior to anus.

Male : Not found.

Habitats and localities : Soil around roots of various plants. Plant parasitic. Darrah, district Kota. This species is found to be most abundant in Udaipur district.

Distribution : India : West Bengal, Rajasthan, Tamil Nadu and Gujarat.

18. *Helicotylenchus exallus* Sher, 1966
(Plate No. 3, Fig. 18)

Measurements : Females : L = 0.61-0.65mm; a = 26-28; b = 6.0-6.2; c = 40-45; c' = 0.7-1.2; V = $10 \cdot 1160 \cdot 62^{8-10}$

Description : Female : Lip region hemispherical, marked by 4 annules. Stylet 25-27 μ m long, with flattened anteriorly directed basal knobs. Spermatheca set off, filled with sperms. Phasmids 3-5 annules anterior to anus. Tail more curved dorsally with slight ventral projection, marked by 12 annules.

Male : Not found.

Habitat and localities : Soil around roots of various plants. Plant parasitic. Alwar-Bharatpur Road; Sermathura, district Dholpur.

Distribution : Rajasthan, Gujarat and Sikkim.

19. *Helicotylenchus goodi* Tikyani et al., 1969.
(Plate No. 3, Fig. 19)

Measurements : Females : L = 0.64-0.84 mm; a = 21-28; b = 5.0-6.4; c = 70-80; V = 58-62.

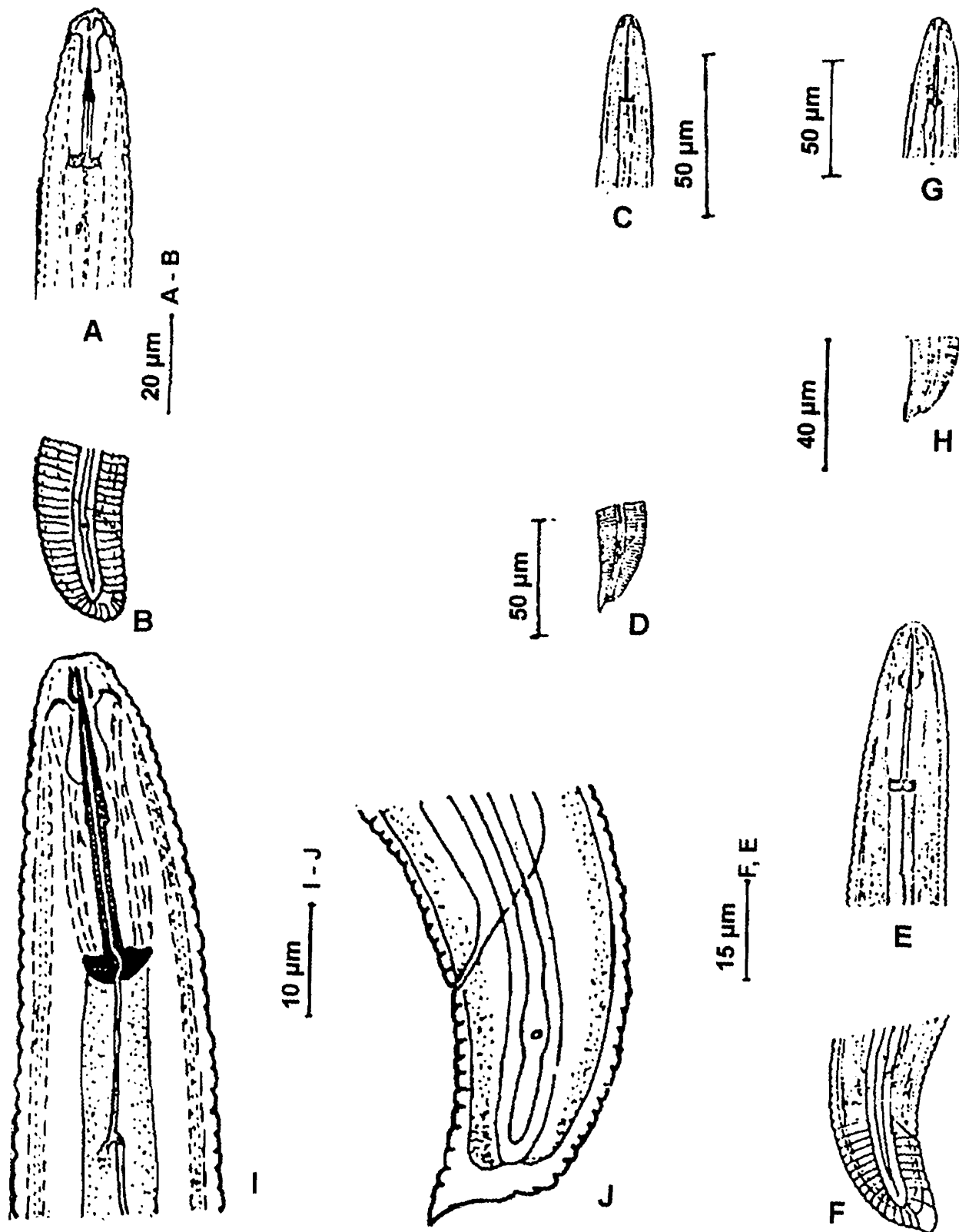


Fig. 4. A-B : *Helicotylenchus multicinctus* (Cobb, 1893) Golden, 1956. A-Female anterior end; B-Female tail; C-D: *Helicotylenchus erythrinae* (Zimmermann, 1904) Golden, 1956; C- Female anterior end; D-Female tail; E-F: *Helicotylenchus dihystra* (Cobb, 1893) Sher, 1961; E-Female anterior end; F-Female tail; G-H: *Helicotylenchus crenacauda* Sher, 1966; G-Female anterior end; H-Female tail; I-J: *Helicotylenchus pisi* Swarup & Sethi, 1968; I-Female anterior end; J-Female tail.

Description : Female : Lip region conoid-truncate, smooth. Stylet 23-25µm long with flat cupped anteriorly indented basal knobs. Lateral fields fused at one third of tail. Phasmids 0-13 annules anterior to anus. Tail hemispherical, with 13-19 annules, tail terminus annulated.

Habitat and locality : Soil around roots of various plants. Rajakheda, district Dholpur.

Distribution : Rajasthan, Gujarat, Uttar Pradesh, West Bengal.

20. *Helicotylenchus labiatus* Roman, 1965

(Plate No. 3, Fig. 20)

Measurements : Females : L = 0.50-0.60 mm; a = 21-24; b = 4.4-5.4; c = 35-48; V = 25-30/61-64²⁰⁻²⁷

Description : Female : Lip region truncate, marked by 3-4 labial striae. Cephalic frame work conspicuous. Stylet 25 µm long, with cupped basal knobs. Lateral fields marked by four incisures, middle incisures fused near tail terminus. Spermatheca filled with sperms. Tail convex-conoid. Phasmids preanal, 22-29 µm from terminus.

Male : Not found

Habitat and locality : Soil around roots of various plants. Parisal-Nadbai, district Bharatpur.

Distribution : Rajasthan.

21. *Helicotylenchus labiodiscinus* Sher, 1966

(Plate No. 3, Fig. 21)

Measurements : Females : L = 0.48-0.66 mm; a = 22-29; b = 4.9-6.5; c = 27-42; c' = 1.0-1.4; V = 58-63;

Description : Female : Body in loose spiral shape upon fixation. Lip region truncate without annulation, conspicuous labial disc. Stylet 23-27µm long with flattened anteriorly directed basal knobs. Excretory pore anterior to oesophago-intestinal valve. Reproductive system amphidelphic. Phasmids near middle of tail 7-8 annules posterior to anus. Tail more curved dorsally, terminus irregularly hemispherical, terminal annulation coarse, 15 annules.

Male : Not found

Habitat and locality : Soil around rhizosphere of various plants. Plant Parasitic. Parisal-Nadbai, district Bharatpur.

Distribution : Rajasthan.

22. *Helicotylenchus leiocephalus* Sher, 1966

(Plate No. 3, Fig. 22)

Measurements : Females : L = 0.77-0.80mm; a = 29-31; b = 5.9-6.2; c = 31-32; c' = 1.2; V = 17-1860-61¹⁸⁻¹⁹

Description : Female : Body spiral in shape upon fixation. Lip region conoid, labial annules indistinct. Stylet 26-28µm long with strong, slightly cupped basal knobs. Excretory pore at the end of oesophagus. Reproductive system amphidelphic. Spermatheca set off filled with sperms. Tail bluntly rounded, tail annules 12-15.

Male : Not found.

Habitat and locality : Soil around roots of various plants. Jatoli, district Bharatpur.

Distribution : Rajasthan.

23. *Helicotylenchus tropicus* Roman, 1965

(Plate No. 4, Fig. 23)

Measurements : Female : L = 0.50-0.70 mm; a = 25-29; b = 4.6-5.7; c = 35-57; V = 24-2959-64¹⁵⁻²⁵

Description : Female : Lip region truncate, marked by 3-4 labial striae. Cephalic framework conspicuous. Stylet 24-25 µm long; with cupped shaped basal knobs. Spermatheca filled with sperms. Tail with ventral projection. Phasmids preanal, 19-25 µm from tail terminus.

Male : Not found.

Habitat and locality : Soil inhabiting. Phytophagous. Parisal-Nadbai, district Bharatpur.

Distribution : Rajasthan.

24. *Helicotylenchus microdorus* Prasad *et al*, 1965

(Plate No. 4, Fig. 24)

Measurements : Females : L = 0.65-0.74 mm; a = 32-35; b = 5.0-7.0; c = 36-44; V = 60-66.

Description : Female : Body spiral in shape upon fixation. Lip region conoid rounded, marked by 3 striae. Labial framework moderately sclerotized. Stylet 18-21 µm long with anteriorly directed basal knobs. Reproductive system amphidelphic. Tail dorsally convex with bluntly rounded terminus with 9-12 tail annules.

Male : Not found

Habitat and locality : Soil around roots of various plants. Plant parasitic. Madhogarh, district Alwar.

Distribution : Delhi, Rajasthan.

25. *Helicotylenchus glissus* Thorne & Malek, 1968
(Plate No. 4, Fig. 25)

Measurements : Females : L = 0.70-0.71mm; a = 25-26; b = 6.5-6.6; c = 44-44.1; V = 19-2061-62¹⁶⁻¹⁷

Description : Female : Lip region smooth or lip annules very fine, 5 in number. Stylet 24-25µm long, with slightly cupped basal knobs. Isthmus as long as body width. Excretory pore slightly posterior to junction of oesophagus and intestine. Spermatheca setoff filled with sperms. Tail digitate with 5-7 ventral annules. Phasmids 3-6 annules anterior to anus.

Male : Not found

Habitat and locality : Soil around roots of various plants. Rajdoli, district Alwar.

Distribution : Rajasthan.

26. *Helicotylenchus pisi* Swarup & Sethi, 1968
(Fig. 4, I-J)

Measurements :

Females : L = 0.70-0.72 mm; a = 17-18; b = 6.3-6.5; c = 32-35; c' = 1.0-1.2; V = 14-1560-65¹³⁻¹⁴.

Description : Female : Body spirally curved upon fixation. Cuticle coarsely striated, 1-1.5 µm apart at mid body. Lip region conoid, marked by 4-5 striae. Labial sclerotization conspicuous. Lateral fields marked by four incisures. Stylet 25-27 µm long. Basal knobs anteriorly directed, 4-5 µm wide. Hemizonid anterior to excretory pore. Female reproductive system amphidelphic. Spermatheca non functional. Tail 20-22 µm long, dorsally curved with a well developed ventral projection which is marked by two annules. Phasmid 3-4 striae posterior to anus.

Male : Not found

Habitat and locality : Collected from soil around roots of wheat at Darrah, district Kota.

Distribution : Rajasthan.

Family ROTYLENCHULIDAE Husain & Khan, 1967 (Husain, 1976)

Diagnosis : Marked sexual dimorphism in adult body shape and in anterior region. Mature Female swollen, kidney shaped. Cephalic region high, rounded or truncate. Male vermiform, with reduced cephalic sclerotization, stylet and pharynx. Phasmids pore like, on tail near anus.

Type subfamily : ROTYLENCHULINAE Husain & Khan, 1967 (Husain, 1976)

**Key to subfamilies of ROTYLENCHULIDAE Husain & Khan, 1967
(Husain, 1976)**

1. Female and Male with distinct tails, young vermiform migratory Female stage present; bursa present 2
- Female and male with very reduced tails, young vermiform migratory female stage absent; bursa absent VERUTINAE
2. Pharyngeal glands mostly dorsal to intestine; one functional ovary; male head inflated; juveniles almost straight on death ACONTYLINAE
- Pharyngeal glands mostly ventral to intestine; one functional ovaries; male head not inflated; juveniles curved on death ROTYLENCHULINAE

Subfamily ROTYLENCHULINAE Husain & Khan, 1967

Diagnosis : Small sized (0.5 mm long or less). Mature Female saccate or kidney-shaped while the young female vermiform. Lip region high, continuous, with or without distinct annules. Labial sclerotization, stylet and median oesophageal bulb well developed in juveniles and Females, regressed in males. Male stylet weaker than that of female. Oesophageal glands in juveniles elongated, overlapping intestine mostly ventrally or laterally. Female reproductive system didelphic. Ovaries reflexed and coiled in mature Female. Young Female and Male tails similar. Tail persists in mature swollen Female. Bursa present. Juvenile tail tapering to a round tip, 2-3 anal body-width long; hyaline terminal portion smaller than that in young female and in male.

Type genus : *Rotylenchulus* Linford & Oliveira, 1940

Other genus : *Senegalonema* Germani, Luc & Baldwin, 1984

Key to genera of Rotyenchulinae

1. Dorsal oesophageal gland orifice at less than half stylet length behind stylet base; young Female with outstretched ovaries; bursa enclosing tail tip .. ***Senegalonema***
- Dorsal oesophageal gland orifice at more than half stylet length behind stylet base; young Female with ovaries having double flexures; bursa not enclosing tail tip ***Rotylenchulus***

Genus *Rotylenchulus* Linford & Oliveira, 1940

Diagnosis : Juveniles, males and young females vermiform, arcuate to spiral upon fixation. Mature Female kidney-shaped, with an irregular, less swollen neck, a post median vulva and a short pointed tail. Cuticle transversely striated. Lateral fields with four incisures. Labial region high, continuous. Stylet in juveniles and females 2-3 times the lip region width. Orifice of dorsal oesophageal gland usually about one stylet length posterior to

stylet base. Immature female vermiform, migratory. Ovaries paired with double flexures. Tail elongate-conoid, with prominent hyaline terminal portion. In males, stylet and oesophagus regressed, tail similar to that of young female, bursa terminal, low not quite projecting beyond tail. Phasmids located on tail in its anterior region. Spicules slender, lacking distal flanges; gubernaculum fixed. Cloacal lips pointed.

27. *Rotylenchulus reniformis* Linford & Oliveira, 1940

(Plate No. 4, Fig. 27 & 5, A-E)

Measurements : Females (immature) : L = 0.34-0.42 mm; a = 22-27; b = 3.6-4.3; b' = 2.4-3.5; c = 14-17; c = 2.6-3.4; V = 68-73; Stylet = 16-18 μ m; Females (mature) : L = 0.38-0.52 mm; a = 4-5; V = 68-73.

Males : L = 0.38-0.43 mm; a = 24-29; b¹ = 2.8-4.8; c = 12-17; T = 35-45; stylet = 12-15 μ m; spicules = 19-23 mm; gubernaculum = 7-9 μ m;

Juveniles : L = 0.35-0.41 mm; a = 20-24; b' = 3.5-4.1; c = 12-16; stylet = 13-15 μ m.

Description : Immature female : Body slender, open c-shaped. Lip region elevated; conoid, continuous with body. Cephalic framework heavily sclerotized. Stylet knobs rounded, sloping posteriorly. Oesophageal glands overlapping intestine ventrally and laterally. Ovaries immature. Tail tapering to narrow, rounded terminus and distinct hyaline portion. Mature female : Obese, kidney-shaped, neck contour irregular. Vulva raised. Body beyond anus hemispherical, with a 5-9 μ m long slender terminal portion. Eggs laid in gelatinous matrix.

Male : Anterior region degenerate, stylet and oesophagus degenerate. Spicules elongate slender, ventrally arcuate; gubernaculums linear; bursa reduced, subterminal.

Remarks : *R. reniformis* is a sedentary and semi-endoparasite attacking several crops and fruit trees in India.

Family PRATYLENCHIDAE Thorne, 1949 (Siddiqi, 1963)

Migratory Endoparasitic Hoplolamoidea

Diagnosis : The family contains elongate-slender nematodes with a low arched, strongly sclerotized, cephalic region generally with two or three annules, well-developed stylet usually not more than three head width-long, moderate size tails and oesophageal glands overlapping intestine with sub ventrals extending past the dorsal gland. Juveniles, females and the males in some groups (Pratylenchinae, Hirschmanniellinae) are capable of penetrating and feeding on internal root tissues.

Species of *Pratylenchus*, popularly known as root lesion or meadow nematodes, are worldwide in distribution. Species *Pratylenchus brachyurus*; *P. coffeae*; *P. pentetans*, *P. zae* attack and damage several important crops.

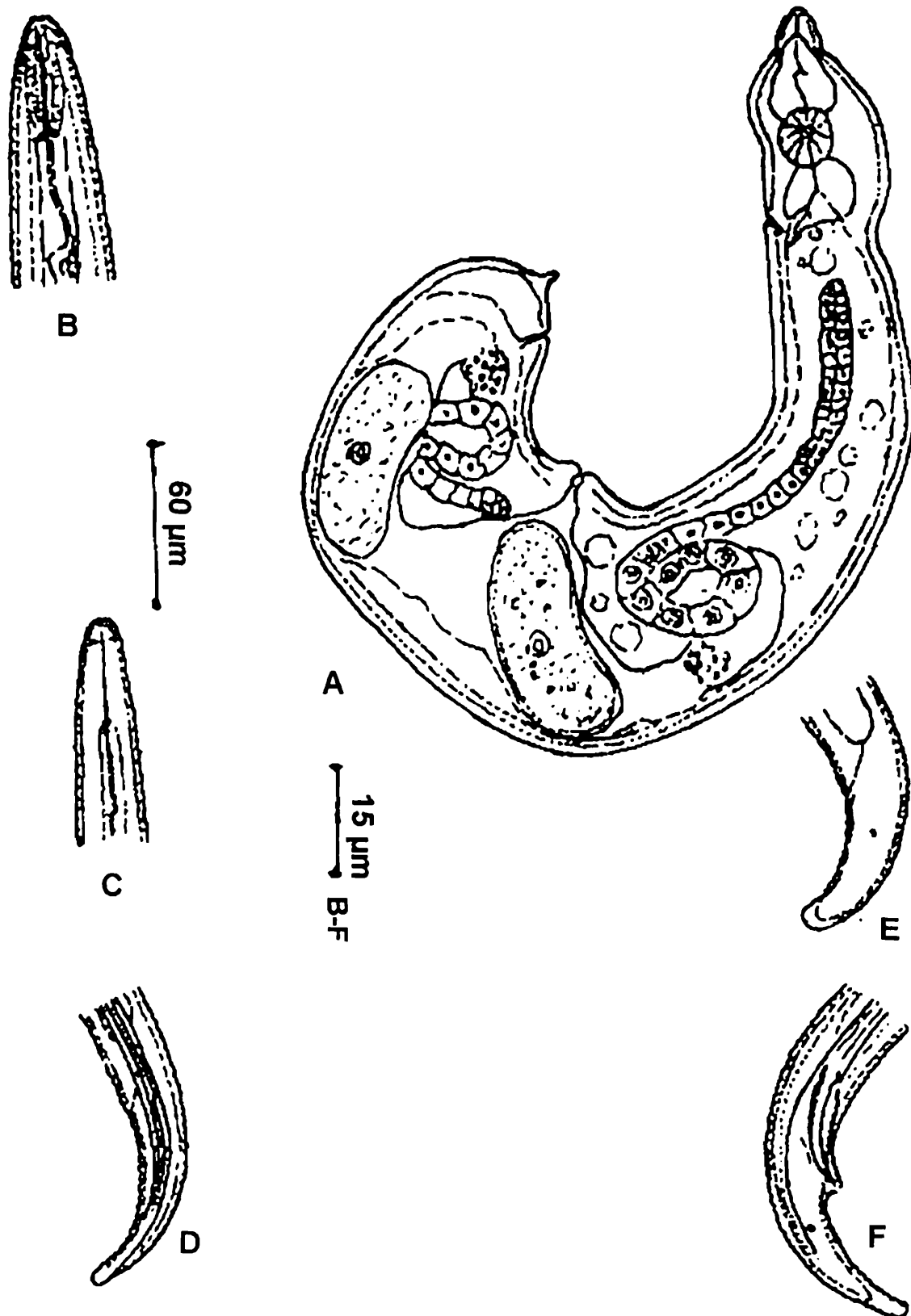


Fig. 5. *Rotylenchulus reniformis* Linford & Oliveira, 1940. A-Mature Female; B-Anterior end of immature female; C-Male anterior end; D & E-Immature female tails; F-Male tail.

Hirschmanniella spp. are well adapted to aquatic life and parasitize paddy and several aquatic grasses. *Hirschmanniella oryzae*; *H. mucronata* and some other species of genus are economically important pest of rice in India.

Key to subfamilies of PRATYLENCHIDAE Thorne, 1949 (Siddiqi, 1963)

1. Pharyngeal glands extending over intestine mostly ventrally and ventrolaterally; no marked sexual dimorphism in anterior region 2
 - Pharyngeal glands extending over intestine mostly dorsally and dorsolaterally; with marked sexual dimorphism in anterior region 3
2. Tails similar between sexes; phasmids near terminus HIRSCHMANNIELLINAE
 - Tails dissimilar between sexes; phasmids at near terminus PRATYLENCHINAE
3. Mature female spindle-shaped or batatiform, with numerous eggs within body, gall inciting NACOBBINAE
 - Mature female not spindle-shaped or batatiform, not with numerous eggs within body, not-inciting galls RADOPHOLINAE

Subfamily PRATYLENCHINAE Thorne, 1949

Diagnosis : No marked sexual dimorphism in anterior region. Small-sized (under 1 mm long). Lateral field with four to six incisures. Cephalic region low, usually flattened, with two to three annules. Stylet generally less than 20 µm long. Oesophageal gland overlap intestine mostly ventrally. Ovaries paired or single. Female tail three anal body width or less long, subcylindrical to conoid, lacking mucro. Male tail conoid, arcuate, completely enveloped by a bursa. Phasmids near middle of tail. Spicules arcuate, cephalated with subterminal pore usually on ventral side. Gubernaculum fixed. Hypoptygma generally present. Endoparasites of roots causing lesions, rarely attacking aquatic or marsh plants.

Type genus : *Pratylenchus* Filipjev, 1936

Other genus : *Zygotylenchus* Siddiqi, 1963

Key to genera of Pratylenchinae

1. One functional ovary *Pratylenchus*
- Two functional ovaries *Zygotylenchus*

Genus *Pratylenchus* Filipjev, 1936

Diagnosis : No marked sexual dimorphism in anterior region. Lateral fields each with four to six incisures. Phasmids near middle of tail. Cephalic region low, flattened anteriorly or rarely rounded, continuous with adjoining body. Vulva in posterior region (usually 70-80%). Pseudo-mono-prodelphic, with only anterior ovary functional. Postvulval uterus present. Spermatheca large, rounded, usually axial. Female tail subcylindrical to conoid,

usually two to three anal body width long; terminus smooth or annulated, devoid of mucro. Bursa enclosing tail terminus. Spicules with subterminal pore on dorsal side. Gubernaculum simple, trough-like, fixed.

About more than 100 species have been described under genus *Pratylenchus* Filipjev, 1936. The following species have been recorded from Rajasthan : *Pratylenchus loosi*; *P. neglectus*, *P. uralensis*; *P. brachyurus*; *P. zae*; *P. goodeyi*; *P. thornei*; *P. macrostylus*.

28. *Pratylenchus loosi* Loof, 1960

(Plate No. 4, Fig. 28)

Measurements : Females : L = 0.43-0.46 mm; a = 24-25; b = 3.5-3.6; c = 17-18; c' = 1.7; V = 71-74¹⁵⁻¹⁷

Description : Female : Body more or less straight. Lip region marked by two annules. Stylet 14-16 µm long. Female reproductive system prodelphic. Spermatheca filled with sperms. Tail terminus narrowly rounded to subacute.

Male : Not found.

Habitat and locality : Soil around roots of various plants. Plant parasitic. Madhogarh, district Alwar.

Distribution : West Bengal, Sikkim, Rajasthan.

29. *Pratylenchus negelectus* (Rensch, 1924) Filipjev & Schuur, 1941

(Plate No. 4, Fig. 29)

Measurements : Females : L = 0.54-0.56; a = 32.2-33.7; b = 4.1-4.4 ; c = 11.4-12.4; V = 86-87.

Description : Female : Lip region composed of two annules. Lateral fields marked by five incisures. Stylet 15-16 µm long. Spermatheca empty. Tail 44-47 µm with broadly rounded, truncate terminus.

Male : Not found.

Habitat and locality : Soil inhabiting. Plant parasitic. Mandriad, district Karauli.

Distribution : Rajasthan, West Bengal.

Remarks : Almost cosmopolitan : Northern temperate zone

30. *Pratylenchus uralensis* Romanenko, 1966

(Plate No. 4, Fig. 30)

Measurements : Females : L = 0.50 mm; a = 27.2-28.1; b = 4.0-4.2; c = 30.1-31.6; V = 72-73.

Description : Females : Lip annules three. Stylet 12-13 µm long. Reproductive system prodelphic. Spermatheca empty. Males unknown. Tail terminus oblique-truncate, with two small protruberances.

Male : Not found.

Habitat and locality : Soil around roots of various plants. Plant parasitic. Madhogarh, district Alwar.

Distribution : Rajasthan.

31. ***Pratylenchus brachyurus*** (Godfrey, 1929) Filipjev & Schuur. Stekh., 1941
(Plate No. 4, Fig. 31)

Measurements : Females : L = 0.50-0.52; a = 30.2-31.6; b = 4.4-4.8; c = 29.8-30.1; V = 87.1-88.7

Description : Female : Lip annules two, outer margin of lip region angular. Stylet 21-22 µm long. Spermatheca empty. Tail subcylindrical, terminus smooth, rounded to truncate.

Male : Not found

Habitat and locality : Soil around roots of various plants. Plant parasitic. Madhogarh, district Alwar.

Distribution : Rajasthan.

Remarks : Tropical and subtropical countries.

32. ***Pratylenchus zeae*** Graham, 1951
(Plate No. 5, Fig. 32)

Measurements : Females : L = 0.38-0.57 mm; a = 18-22; b = 6.0-6.5; c = 14-18; V = 69-74.

Description : Female : Body almost straight. Lip region marked by three annules. Stylet 15-16 µm long. Tail marked by 20-25 annules, tip bluntly pointed, smooth.

Male : Not found

Habitat and locality : Soil around roots of various plants. Plant parasitic. Bharatpur-Alwar Road.

Distribution : Gujarat, Haryana, Maharashtra, Punjab, Rajasthan.

33. ***Pratylenchus goodeyi*** Sher & Allen, 1958
(Plate No. 5, Fig. 33)

Measurements : Females : L = 0.59-0.60 mm; a = 35-38; b = 3.5-4.2; c = 7.7-8.7; V = 71-73.

Description : Female : Body slightly curved ventrally. Cuticle with transverse and longitudinal striations. Lip region continuous, marked by three to four annules; labial sclerotization extending backwards on two or three body annules. Stylet 15-16 µm long.

Spermatheca without sperms. Tail 4.9-5.5 anal body width long, with 27-28 annules, tip broadly rounded to truncate.

Male : Not found

Habitat and locality : Soil around roots of various plants. Plant Parasitic. Sermathura, district Dholpur.

Distribution : Gujarat, Haryana, Punjab, Rajasthan.

34. ***Pratylenchus thornei*** Sher & Allen, 1953
(Plate No. 5, Fig. 34)

Measurements : Females : L = 0.45-0.53 mm; a = 25-27; b = 4.6-4.9; c = 18-21; V = 77-78¹⁷⁻¹⁸

Description : Female : Lip region continuous, marked by three annules; labial sclerotization extending backwards on two or three body annules. Stylet 19-20 µm long. Spermatheca without sperms. Tail tip broadly rounded to truncate, smooth.

Male : Not found

Habitat and locality : Soil around roots of various plants. Plant parasitic. Parisal-Nadbai, district Bharatpur

Distribution : Gujarat, Haryana, Punjab, Rajasthan.

35. ***Pratylenchus macrostylus*** Wu, 1971
(Plate No. 5, Fig. 35)

Measurements : Females : L = 0.50-0.53 mm; a = 28.2-29.4 ; b = 4.2-4.5 ; c = 26.3-28.1; V = 84-85.

Description : Female : Lip annules two. Lip region high and rounded. Stylet 21-25µm long. Spermatheca empty. Males rare. Tail conoid.

Male : Not found

Habitat and locality : Soil around roots of various plants. Plant parasitic. Madhogarh, district Alwar.

Distribution : Rajasthan.

Subfamily HIRSCHMANNIELLINAE Fotedar & Handoo, 1978

Diagnosis : Moderate to large (1-4 mm) and slender (a = 50-70 usually). No marked sexual dimorphism in anterior region. Cuticle finely annulated. Lateral fields with four incisures. Cephalic region continuous, usually hemispherical, framework strongly sclerotized. Didelphic, amphidelphic. Tail elongate conoid, with a terminal mucro, similar between sexes. Bursa large, subterminal. Spicules with subterminal pore on dorsal side.

Gubernaculum simple, fixed. Phasmids in posterior third of tail. Endoparasites of roots mostly aquatic plants.

Type and only genus : Hirschmanniella Luc & Goodey, 1964

Genus ***Hirschmanniella*** Luc & Goodey, 1964

Diagnosis : Long and slender nematodes ($L = 1-4$ mm; $a = 40-79$), straight to arcuate upon fixation. Lateral fields with four incisures. Aerolated towards extremities. Cephalic region continuous, anteriorly flattened or hemispherical; framework heavily sclerotized, labial disc indistinct; stylet massive $15-46\ \mu\text{m}$ long; basal knobs large rounded. Oesophageal glands elongated lying ventrally to intestine. Vulva transverse. Two branches Female reproductive organs equally developed and outstretched in opposite directions. Spermatheca round to oval axial. Males with outstretched testis. Spicule with subterminal pore. Gubernaculum fixed. Tails similar between sexes, elongate-conoid, usually with a terminal mucro. Males carrying a simple, crenate, subterminal bursa lacking phasmidial pseudoribs.

Type species : *Hirschmanniella spinicaudata* (Schuurmans Stekhoven, 1944) Luc & Goodey, 1964; *Hirschmanniella oryzae* and *H. caudacrena* are dealt in the book.

36. *Hirschmanniella oryzae* (van Breda de Haan, 1902) Luc & Goodey, 1963
(Plate No. 5, Fig. 36)

Measurements : Females : $L = 1.14-1.63$ mm; $a = 50-67$; $b = 8.8-12.1$; $c = 15-19$; $V = 50-55$;

Males : $L = 1.01-1.40$ mm; $a = 52-61$; $b = 9.1-11.3$; $c = 16-18$; $T = 50-51$.

Description : Female : Body straight or slightly curved ventrally. Lip region continuous with body, low, flattened with rounded apex, marked by three to four annules. Stylet robust, $16-19\ \mu\text{m}$ long, with rounded basal knobs. Female reproductive system amphidelphic. Spermatheca with sperms. Intestine not overlapping rectum. Tail elongate conoid $4.3-6.5$ anal body width long, with mucronate terminus. Phasmids located in the posterior half of tail.

Male : Spicules cephalated, slightly arcuate, $18-28\ \mu\text{m}$ long. Gubernaculum $7-9\ \mu\text{m}$ long. Bursa subterminal. Tail with a pointed ventral mucro.

Habitat : Found in rice field.

Distribution : West Bengal, Bihar, Rajasthan.

Remarks : *H. oryzae* is widely distributed and considered a key pest of rice in far east and tropical countries (including India).

37. *Hirschmanniella caudacrena* Sher, 1968
(Plate No. 6 Fig. 37)

Measurements : Females : $L = 1.19-1.20$ mm; $a = 46.9-48.6$; $b = 5.3-5.9$; $c = 29.8-30.4$; $V = 49-50$.

Description : Female : Body slightly curved ventrally. Lip region continuous with body, flattened, marked by four to five annules. Stylet robust, 19-20 μm long, with rounded basal knobs. Female reproductive system amphidelphic. Spermatheca filled with sperms. Intestine not overlapping rectum. Tail elongate conoid, 1.9-2.2 anal body width long, with mucronate terminus. Phasmids located in the posterior half of tail.

Male : Not found.

Habitat and locality : Rice field. Parasitic. Malvarun forest range, KWLS, district Rajsamand.

Distribution : Rajasthan.

Family MELOIDOGYNIDAE

Diagnosis : Mature Female round, pear or lemon-shaped behind neck, with anus terminal or near so; with stylet smaller than that of Male. Excretory pore in mature Female opposite to median bulb, Female labial disc dorsoventrally elongated, Male with large lip cap and large transverse slit like amphidial apertures, gall inciting. Tail very short or absent.

Key to subfamilies of MELOIDOGYNIDAE Skarbilovich, 1959 (Wouts, 1973)

1. Preadult Female and Female juveniles of third and fourth stage saccate; mature Female with anus at base of dorsal lip of vulva; male tail hemispherical MELOIDOGYNINAE
2. Preadult female and female juveniles of third and fourth stage vermiform; mature female with anus at some distance from base of dorsal lip of vulva; male tail conoid-rounded NACOBODERINAE

Type subfamily : MELOIDOGYNINAE Skarbilovich, 1959

Other subfamily : NACBODEIRINAE Golden & Jensen, 1974

Subfamily MELOIDOGYNINAE Skarbilovich, 1959

Diagnosis : Seditary, obligate parasites of roots, forming galls. Lip region non striated with a distinct disc. Labial sclerotization light. Lateral fields with 4-5 incisures. Stylet in juveniles and females weak. Orifice of dorsal oesophageal gland close to stylet base. Oesophageal glands elongated, extending over intestine, mostly ventrally. Excretory pore in females opposite or anterior to median bulb, in male usually behind median bulb. Large rectal glands in females produce gelatinous matrix, expelled through anus. Third and fourth stage juveniles saccate, enveloped with in second stage cuticle, lacking stylet. Female saccate, round to pear-shaped with a short neck. Perineal cuticular patterns of striae present. Vulva terminal. Anus dorsolateral at base of dorsal lip, tail absent. Female reproductive system didelphic-prodelphic; ovaries coiled. Male develops by metamorphosis. Testis single or paired. Male tail end twisted, less than one anal body-width long, rounded. Bursa absent.

The species of the genus *Meloidogyne* are serious pest of vegetable and crops. Out of 11 root-knot species known from India, only *M. incognita* has been recorded from Rajasthan.

Type genus : *Meloidogyne* Goeldi, 1892

Other genus : *Spartonema* Siddiqi, 1986

Key to genera of Meloidogyninae

- Rectal glands in Female enormously developed; eggs laid in a gelatinous matrix forming egg sac; second-stage juvenile under 0.6 mm long ***Meloidogyne***
- Rectal glands in Female not developed; eggs laid in plant tissues, egg sac not formed; second stage juveniles 0.6-0.9 mm long ***Spartonema***

Genus *Meloidogyne* Goeldi, 1892

Diagnosis : Mature female : Round to pear-shaped with short projecting neck, white, sedentary. Vulva and anus close together, terminal, with a finger print like cuticular perineal pattern, not elevated. Cuticle striated. Stylet slender, 12-14 μm long, with small basal knobs. Ovaries pale, prodelphic, convoluted. Rectal glands six. Eggs not retained in body.

Male : Vermiform. Cuticle strongly striated. Lateral fields marked by four incisures. Lip region not set off. Stylet robust, 18-25 μm long, with large basal knobs. Oesophageal glands overlap intestine ventrally. Spicules slender, generally 25-33 μm long. Gubernaculum 7-11 μm long. Testis single or paired. Tail rounded.

Second stage larvae : Infective stage. Vermiform, migratory, straight to arcuate upon fixation. Lip region with coarse striae (1-4). Labial disc distinct, sclerotization light. Stylet slender. Median bulb with large oval valve plates. Tail with conspicuous hyaline region.

Type species : *Meloidogyne exigua* Goeldi, 1892

The members of the genus *Meloidogyne* incite the root galls and thus are called root-knot nematodes. They are obligate endoparasites of all kind of plants in the temperate as well as tropical countries. In fact, these nematodes are the perfect example of highly adapted root parasitism and cause serious damage to the agricultural as well as horticultural crops.

Meloidogyne incognita is very common in the State and it is found to attack several vegetable and other plants.

38. *Meloidogyne incognita* (Kofoid & White, 1919) Chitwood, 1949 (Plate No. 6, Fig. 38 & 6, A-F)

Measurements : Females : L = 0.50-0.72 mm; width = 331-520 μm ; stylet = 13-16 μm . Males : L = 1.10-1.95 mm; a = 31-35; head height = 6.8-8.6; stylet = 23-27 μm ; spicules = 29-40 μm ; gubernaculum = 24.9-31.5 μm . Second stage juveniles : L = 0.33-0.40 mm; a = 24-31; b = 2.0-2.14; c = 6.4-8.4; stylet = 9-10 μm .

Description : Female : Body spherical with projecting neck. Lip region bearing 2-3 striae behind head cap. Lateral fields not clear. Stylet knobs rounded. Posterior cuticular pattern highly variable, with striae closely spaced; wavy to zigzag, especially dorsally and laterally.

Male : Body slender, cuticle transversely striated. Lateral fields marked by four incisures. Lip region almost continuous with body, truncate, cone-shaped, marked by distinct striae. Stylet with flat concave basal knobs. Tail bluntly rounded with smooth terminus. Phasmids at cloacal level. Male : Spicules curved. Gubernaculum crescent-shaped. Second stage juvenile : Lateral fields marked by four incisures. Lip region continuous, truncate, cone-shaped in lateral view, marked by two striae in lateral view and three striae in dorsal or ventral view. Lip cap wide. Tail tapering to subacute terminus.

Habitat : Sedentary parasites of roots.

Distribution : Himachal Pradesh, West Bengal, Delhi, Karnataka, Uttar Pradesh, Kerala, Tamil Nadu, Assam, Rajasthan, Haryana, Orissa, Bihar, Maharashtra, Madhya Pradesh.

Family HETERODERIDAE

Mature female round, pear or lemon-shaped behind neck, with anus terminal or near so; with stylet smaller than that of male. Excretory pore in mature female behind median bulb, female labial disc rounded, male with small lip cap and with small oval to round amphidial apertures, not gall inciting. Tail very short or absent. The genera of family Heteroderidae are economically very important. *Heterodera avenae* is a causative agent of molya disease in wheat, baley and maize. Thus yield loss of cereal crops.

Key to subfamilies of HETERDERIDAE

1. Vulva equatorial, male development not through metamorphosis MELOIDODORINAE
- Vulva terminal or subterminal; male development through metamorphosis 2
2. Female turns into a hard-walled cyst HETERODORINAE
- Female does not turn into a hard walled cyst ATALODERINAE

Subfamily HETERODERINAE Filipjev & Schuurmans Stekhoven, 1941

Diagnosis : Mature Female spherical, pear or lemon-shaped, with a short neck; turns into a tough hard-walled yellowish, light to dark brown or black-cyst containing eggs and juveniles. Cuticle surface with a zig-zag or lace-like pattern; annulations absent on mature Female and cyst. Vulva and anus close together, almost terminal, on a raised vulval cone or in a flat to concave vulval basin. Clear hyaline vulval fenestra(e) present, an anal fenestra present only in *Punctodera*. Male develops through metamorphosis, has an annulated cephalic region. Lateral fields with four incisures. Extremely short hemispherical tail, rarely tail absent. Bursa absent. Second stage juveniles with four incisures in lateral fields.

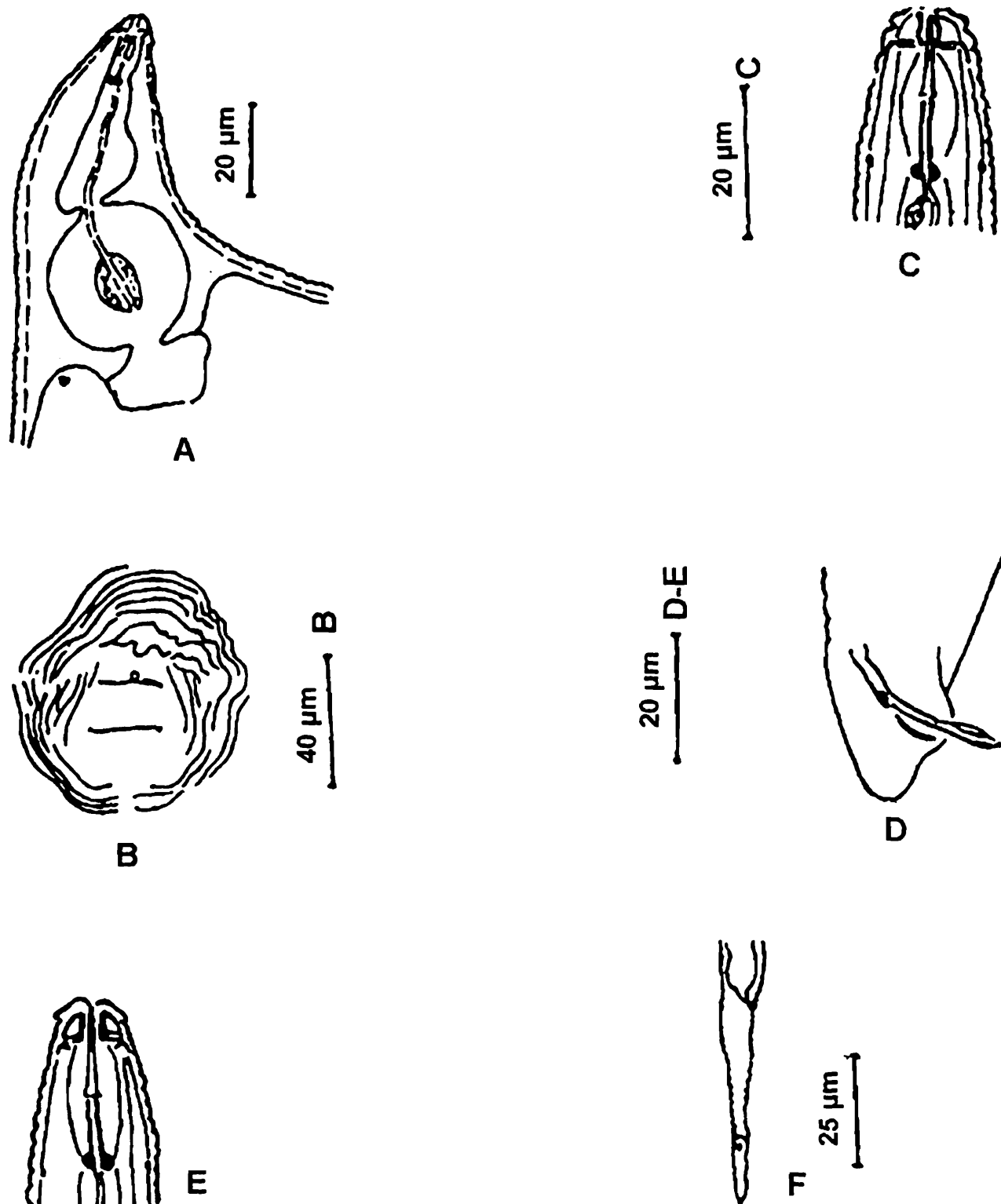


Fig. 6. *Meloidogyne incognita* (Kofoid & White, 1919) Chitwood, 1949. A-B : Adult Female : A- Anterior end; B-Posterior cuticular patterns of female; C&D : Male : C-Anterior end; D-Tail, E-F : Second stage juvenile; E-Anterior end; F-Tail.

Type genus : *Heterodera* Schmidt, 1871

Other genera : *Cactodera* Krall & Krall, 1978; *Dolichodera* Mulvey & Ebsary, 1980; *Ephippiodera* Shagalina & Krall, 1981; *Globodera* Skabilovich, 1959; *Punctodera* Mulvey & Stone, 1976; *Sarisodera* Wouts & Sher, 1971

Key to genera of Heteroderinae

1. Vulval fenestration absent ***Afenestrata***
- Vulval fenestration present 2
2. Body with terminal cone 3
- Body without terminal cone 4
3. Cuticular surface with roughly parallel ridges; vulval denticles present; circumfenestrate ***Cactodera***
- Cuticular surface with lace-like or zig-zag; vulval denticles generally absent; rarely circumfenestrate ***Heterodera***
4. Anal region with fenestration ***Punctodera***
- Anal region without fenestration ***Globodera***
5. Mature Female and cyst spheroidal; perineal tubercles present; bullae present ***Dolichodera***

Genus *Heterodera* Schmidt, 1871

Diagnosis : Mature female & cyst : Body lemon-shaped, with short neck and terminal cone; turns in to a hard walled cyst, brown to black in colour with lace like or zig-zag pattern. Vulval terminal. Anus subterminal. Vulval fenestration present, ambifenestrate, bifenestrate or very rarely circumfenestrate. Vaginal remnant, under bridge and bullae often present. Eggs retained in body.

Male : Lateral fields with four incisures. Lip region set off by constriction and marked by 3-6 striae. Tail end twisted. Spicules robust, over 30µm long, with blunt bifid or single tip.

Second stage juvenile : Body slender, straight to arcuate. Lip region continuous. Stylet less than 30µm long. Oesophageal glands filling-body width. Tail with prominent terminal hyaline part.

Type species : *Heterodera schachtii* A. Schmidt, 1871

The nematodes belonging to the genus *Heterodera* are popularly known as cyst nematodes which are very well adapted to a variety of climatic conditions. Formation of

cyst among *Heterodera* is an example of defensive adaptation found among phytonematodes. Within the cyst, larvae may lie quiescent for long period when favourable conditions are not available. The cyst nematode cause 'Moly's disease' in wheat and barley. The disease was first time reported from Rajasthan State, Prasad, Mathur & Sehgal (1959).

39. *Heterodera avenae* Wollenweber, 1924
(Plate No. 6, Fig. 39 & 7, A-H)

Measurements : Females : L = 0.55-0.77 mm; width = 0.36-0.50 mm.

Males : L = 1.07-1.59 mm; a = 32-55; b = 7-12; b' = 5.5-6.8; c = subterminal; T = 40-50; stylet = 27-31 μ m; spicules = 33-38 μ m.

Second stage larvae : L = 0.52-0.61 mm; width = 20-24 μ m; tail length = 45-70 μ m; stylet = 24-28 μ m.

Description : Female : Adult lemon-shaped, with prominent neck and vulval cone. Lip region annulated. Stylet straight to slightly arcuate, 26-32 μ m long; basal knobs rounded. Vulva 12-13 μ m long slit. Zig-zag rugose cuticular surface pattern. Subcrystalline layer conspicuous, sloughing off as the dark brown cyst is formed. Bullae prominent, crowded beneath vulval cone. Ambifenstrate. Most cysts contain 200-500 eggs. Average cyst size 0.71x0.50mm. Male : Lateral fields with four incisures, outer bands usually aerolated. Lip region rounded set off, marked with 4-6 annules; labial frame-work heavily sclerotized.

Male : Spicules arcuate with notched end. Tail end usually twisted.

Second stage larvae : Lateral fields with four incisures. Lip region rounded, set off with 2-4 annules, stylet well developed with large anteriorly flattened concave basal knobs. Tail 3-4.5 anal body-width long, sharply pointed.

Habitat : Cereal cyst nematode.

Distribution : Haryana, Punjab, Rajasthan, Jammu and Kashmir.

Remark : Causes Moly's disease in Wheat, Barley and Maize.

Key to families of DOLICHODOROIDEA

1. Tails similar between sexes, generally filiform; Bursa adanal PSILENCHIDAE
- Tails dissimilar between sexes, not filiform; bursa enveloping entire tail 2
2. Cephalic region generally four-lobed, basal plate or vaginal wall not strongly sclerotized TELOTYLENCHIDAE
3. Oesophageal glands not overlapping intestine; oesophago-intestinal junction more than two body-widths from median bulb; bursa trilobed *Dolichodoridae*
- Oesophageal glands overlapping intestine; oesophago-intestinal junction about one body width from median bulb; Bursa simple, not trilobed BELONODLAIMIDAE

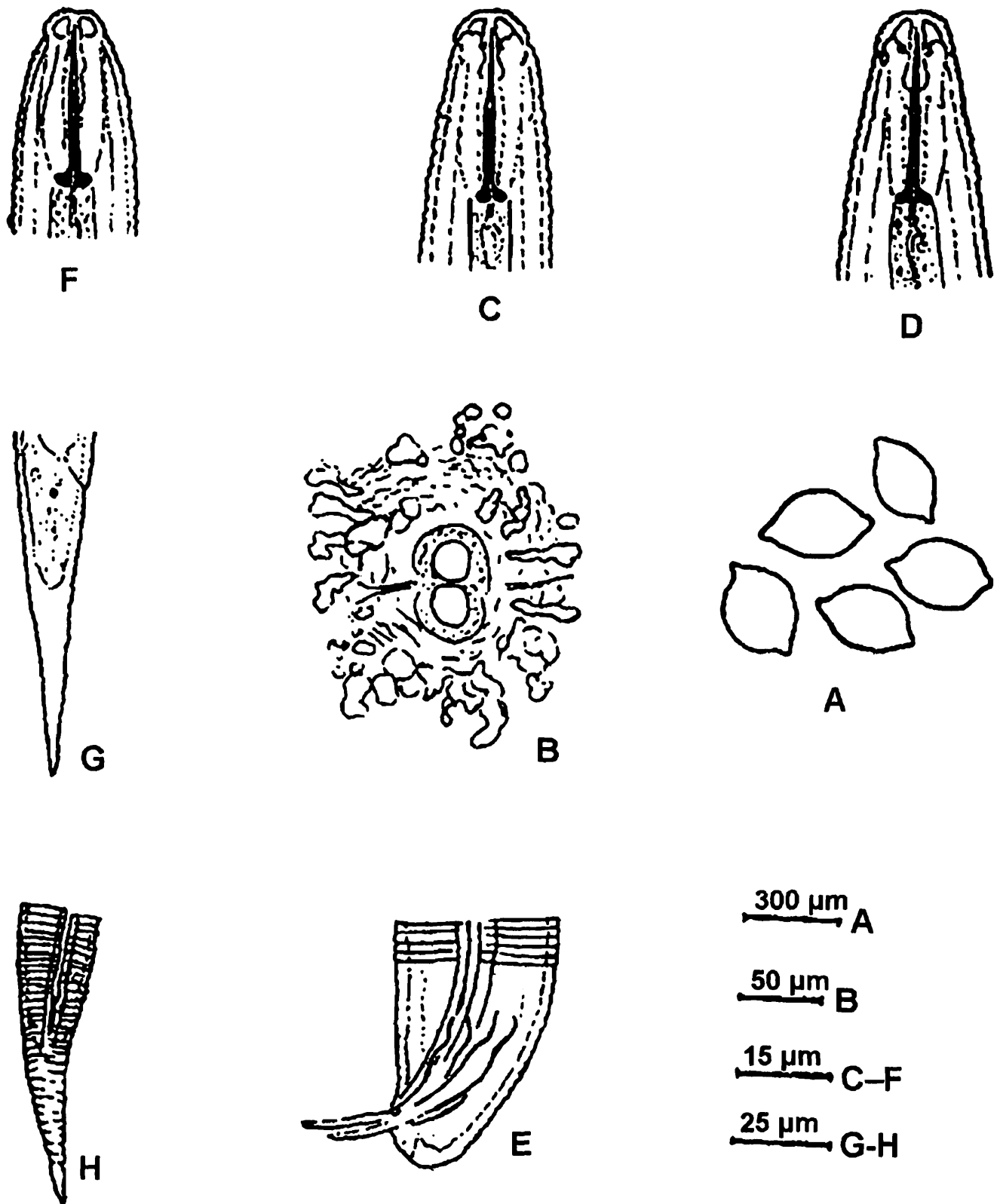


Fig. 7. *Heterodera avenae* Wollenweber, 1924. A-B: Female : A-Cyst; B-En face view vulval cone. C-E : Male : C&D-Anterior end; E-Tail; F-H : Second stage juvenile: F-Anterior end; G&H-Tails.

Family PSILENCHIDAE Paramonov, 1967 (Khan, 1969)

Diagnosis : Body small to moderate sized (0.5-1.8 mm). Cuticle distinctly striated. Lateral fields marked by four incisures. Amphidial apertures pore-like or slit-like at base of lip region. Deirids present. Phasmids distinct, pore-like on tail. Lip region generally continuous, finely striated. Stylet slender, conus much shorter than shaft; basal knobs present or absent. Median oesophageal bulb muscular, valvate. Basal bulb set off from intestine, cardia distinct. Female reproductive system amphidelphic. Ovaries paired, outstretched. Spermatheca axial (Psilenchinae) or lobed. Vulva median or submedian. Tail filiform or elongate-conoid, similar between sexes. Bursa simple, adanal. Spicules tylenchoid, cephalated, pointed distally. Gubernaculum simple, trough-like, fixed.

Type subfamily : Psilenchinae Paramonov, 1967

Other subfamily : Antarctenchinae Spaull, 1972

Subfamily PSILENCHINAE Paramonov, 1967

Diagnosis : Lip region smooth or annulated, conoid rounded or broadly rounded. Labial sclerotization light. Amphidial apertures distinct, oval slit-like near outer margin of lip areas. Stylet slender, without basal knobs. Orifice of dorsal oesophageal gland at some distance from stylet base. Vulva near middle of body. Spermatheca axial, elongate. Tail elongate-conoid, filiform or clavate. In males bursa large adanal.

Type genus : *Psilenchus* de Man, 1921

Other genus : *Atetylenchus* S.H. Khan, 1973

Genus ***Psilenchus*** de Man, 1921

Diagnosis : Body 0.7-1.7 mm long, ventrally curved upon fixation. Lateral fields marked with four incisures, inner two may be indistinct or absent. Amphidial apertures transverse slit-like at base of lateral lips. Lip region elevated, rounded or conoid, smooth or striated. Labial sclerotization light. Stylet 20-24µm long, without basal knobs, conus distinctly shorter than shaft. Median oesophageal bulb prominent generally oval. Basal bulb small, pyriform. Cardia discoidal or rounded. Female reproductive system amphidelphic. Spermatheca elongate, axial. Tail elongate, with clavate or nonclavate tip. Bursa prominent, adanal. Spicules tylenchoid, 25-33 µm long. Gubernaculum simple, trough-shaped.

40. ***Psilenchus hilarulus*** de Man, 1921

(Fig. 8, L-M)

Measurement : Females : L = 1.25 – 1.30 mm; a = 28-30; b = 7; c = 11.5-11.8; c' = 4.9-5.0; V = 6-747-54⁸⁻⁹.

Description : Female : Body more or less straight upon fixation. Cuticle finely striated, striae 1 µm apart. Lip region elevated, dome-shaped, smooth, continuous. Amphidial

apertures transverse slit-like. Stylet cylindrical, 18-20 μm long, without basal knobs. Dorsal oesophageal gland opening 6-7 μm posterior to stylet base. Median oesophageal bulb prominent, oval. Basal bulb small pyriform. Cardia conoid, obscure. Female reproductive system amphidelphic. Ovaries outstretched. Tail elongate, tapering to clavate terminus, 108-110 μm long or 4.9-5.0 anal body-width long. Phasmids less than one anal body-width posterior to anus.

Male : Not found

Habitat and locality : Collected from soil around roots of wheat at Pipali Ki Dhani, district Jaipur.

Distribution : Rajasthan, Gujarat.

Family TELOTYLENCHIDAE

The Stunt Nematode

The stunt nematode, e.g. *Tylenchorhynchus*, *Quinisulcius*, *Merlinius* and *Bitylenchus* spp. are root surface tissue feeders, phytophagous in nature and are commonly found in vegetable fields, grass lands and forest soils. Small to medium sized (0.5-1.1 mm). cuticle prominently annulated; longitudinal striae and grooves may be present. Lateral fields each with three to six incisures. Deirids absent except in Merlininae. Amphidial apertures pore like, labial, at lateral margins of labial disc. Cephalic region annulated, labial disc indistinct and not marked off from cephalic annules. Stylet under 45 μm long, conus about as long as shaft except *Macrotrophurus* in which stylet is over 80 μm long. Oesophageal glands enclosed in a basal bulb or extending over intestine laterally. Vulva transverse. Vagina not sclerotized. Ovaries paired. Female tail generally two to four anal body widths long, terminus variable. Male tail elongate-conoid, enveloped by a simple bursa or trilobed in Meiodorinae. Spicules arcuate with large distal flanges (vela), tip narrowly pointed or indented. Gubernaculum rod-like, protrusible or fixed. Ectoparasites of roots

Key to subfamily TELOTYLENCHIDAE Siddiqi, 1960

1. Deirids present (except in *Scutylenchus*), lateral field with six incisures; male with hypopygium; spicules cylindrical, not flanged MERLINIINAE
- Deirids absent, lateral field with two to five incisures; male without hypopygium; spicules flanged 2
2. Amphidial apertures conspicuous, post labial; stylet over 80 μm long MACROTROPHURINAE
- Amphidial apertures inconspicuous, labial; stylet under 50 μm long 3
3. Male tail conspicuously shorter than that of female; bursa trilobed...MEIODORINAE
- Male tail not conspicuously shorter than that of female; bursa simple TELOTYLENCHINAE

Subfamily TELOTYLENCHINAE Siddiqi, 1960

Diagnosis : Cuticle prominently annulated; longitudinal striae and grooves may be present. Lateral fields marked by three to five striae. Cephalic region annulated; rounded. Labial disc indistinct. Cephalic sclerotization light to moderate. Stylet small to moderately long (about 11-40 μm), with distinct basal knobs. Meidan oesophageal bulb well developed. Oesophageal glands enclosed in a basal bulb or dorsal gland enlarged, forming a long lobe extending over intestine. Vulva slit-like, lacking epiptygma. Spermatheca round axial. Post rectal intestine sac geneally absent. Present in *Bitylenchus* and *Histotylenchus*. Female tail conoid, subcylindrical, cylindroids or subclavate, rarely spicate, about two to six anal body width long. Male tail conical, about as long as that of female. Bursa simple, well developed, enveloping tail; its tip may be doubly indented (*Neodolicholynchus*). Spicules arcuate, with large distal flanges and pointed or indented tip. Gubernaculum rod-like, usually protrusible.

Type genus : *Telotylenchus* Siddiqi, 1960

Other genera : *Bitylenchus* Filipjev, 1934; *Histotylenchus* Siddiqi, 1971; **Neodolichorhynchus* Jairajpuri & Hunt, 1984; *Paratrophurus* Arias, 1970; *Quinisulcius* Siddiqi, 1971; *Sauretylenchus* Sher, 1974; *Telotylenchenchoides* Siddiqi, 1971; *Trichotylenchus* Whitehead, 1960; *Trophurus* Loof, 1956; *Tylenchorhynchus* Cobb, 1913; *Uliginotylenchus* Siddiqi, 1971

Key to genera of Telotylenchinae

1. Oesophagela glands extending over intestine 2
 - Oesophageal glands not extending over intestine 5
2. Conus of stylet asymmetrical, with lumen becoming angular near its base; intestine extending over rectum into tail ***Histotylenchus***

Conus of stylet symmetrical, with straight lumen; intestine not extending over rectum into tail 3
3. Cephalic region narrow, conoid-rounded; tail with abnormally thickened cuticle at terminus ***Telotylenchoides***
 - Cephalic region broadly rounded; tail without thickened cuticle 4
4. Lateral fields with three incisures; stylet extremely attenuated; Proximal end of gubernaculum directed posteriorly ***Trichotylenchus***
 - Lateral fields with four incisures; stylet not attenuated; proximal end of gubernaculum not directed posteriorly ***Telotylenchus***
5. Posterior branch of female reproductive system reduced to a sac ***Trophurus***
 - Posterior branch of female reproductive system normal 6

6. Cuticle with prominent longitudinal ridges outside lateral fields **Neodolichorhynchus**
- Cuticle without prominent longitudinal ridges outside lateral fields 7
7. Lateral fields with five incisures **Quinisulcius**
- Lateral fields with three or four incisures 8
8. Lateral fields with three incisures, areolated; vulva in a body depression, with small epiptygma; proximal end of gubernaculum posteriorly directed..... **Uliginotylenchus**
- Lateral fields with three or four incisures, if three then not areolated; vulva generally not in a body depression, without epiptygma; proximal end of gubernaculum not posteriorly directed 9
9. Cephalic region annules indented laterally; outer bands of lateral fields areolated, gubernaculum lacking a crest 10
- Cephalic region annules not indented laterally; outer bands of lateral fields generally not areolated, gubernaculum having a crest 11
10. Labial disc conspicuous; stylet over 30µm long **Sauertylenchus**
- Labial disc not conspicuous; stylet under 30 µm long **Bitylenchus**
11. Tail terminal cuticle abnormally thickened **Paratrophurus**
- Tail terminal cuticle not abnormally thickened **Tylenchorhynchus**

Genus **Telotylenchus** Siddiqi, 1960

Diagnosis : Small to medium sized. Lateral fields with four incisures. Lip region hemispherical to broadly rounded, set off, marked with 5-8 distinct striae. Labial disc indistinct. Stylet moderately developed, conus appearing solid anteriorly, straight; basal knobs distinct. Dorsal oesophageal gland elongate, extending over intestine, mostly laterally. Female reproductive system amphidelphic. Ovaries paired, outstretched. Spermatheca round, axial. Intestine not extending into tail. Female tail elongate-conical to subcylindrical, 2-4 anal body-width long. Bursa large, crenate, completely enveloping tail. Spicules distally flanged gubernaculum large, protrusible. Two species under genus *Telotylenchus* dealt here.

Type species : *Telotylenchus indicus* Siddiqi, 1960

41. **Telotylenchus indicus** Siddiqi, 1960 (Fig. 8,H-I)

Measurement : Female : L = 0.66 mm; a = 33; b = 5.1; c = 17.8; c' = 2.5; V = 1150⁸.
Male : L = 0.67 mm ; a = 37; b = 5.4; c = 15.9; c' = 2.8; T = 53.

Description : Female : Body slightly curved ventrally, tapering gradually towards both

extremities. Cuticle with distinct transverse striae, stria 1 μm apart. Lateral fields marked by four incisures, outer ones are crenate. Lip region rounded, set off, marked by 7 striae. Labial sclerotization absent. Stylet 17 μm long, with slightly anteriorly directed basal knobs. Excretory pore at 100 μm from anterior end. Median oesophageal bulb at 55% from anterior end. Vulva a transverse slit. Female reproductive system amphidelphic. Tail 37 μm long, elongate-conoid, with bluntly rounded terminus, marked by 34 striae. Phasmids pore-like in anterior half of tail.

Male : Similar to female in general shape and morphology, except the reproductive system and tail. Spicules 22 μm long, cephalated. Gubernaculum 11 μm long, simple. Bursa completely enveloping tail.

Habitat and locality : Collected from soil around roots of wheat at Netwada, district Dausa.

Distribution : Rajasthan, West Bengal and Uttar Pradesh.

42. *Telotylenchus aerolatus* Baqri & Jairajpuri, 1969
(Fig. 8, J-K)

Measurements : Female : L = 0.80 mm; a = 38; b = 5.3; c = 17.7; c' = 3.0; V = 10539

Description : Female : Body slightly curved ventrally. Cuticle marked with distinct transverse striae, about 1 μm apart. Lip region set off, flat at apex, marked by 8 striae. Labial framework sclerotized, lateral fields marked by four incisures, outer ones are crenate. Lateral fields irregularly aerolated throughout the length. Stylet 17 μm long; with rounded posteriorly sloping basal knobs. Dorsal oesophageal gland opens 2 μm posterior to stylet base. Oesophagus overlapping intestine for about two body-width long. Female reproductive system amphidelphic. Vulva transverse. Tail elongate 45 μm , cylindrical, with rounded terminus; marked with 36 striae; three anal body-width long. Phasmids in anterior third of tail.

Male : Not found

Habitat and locality : Collected from soil around roots of millet at Jas Nagar, district Nagaur.

Genus *Tylenchorhynchus* Cobb, 1913

Diagnosis : Body 1 mm or less. Cuticle distinctly transversely striated, may be marked by longitudinal striae. Lateral fields with 3-4 incisures. Lip region set off from body or continuous, striated or rarely smooth. Labial framework light to moderately sclerotized. Stylet well developed, 15-25 μm long; conus anteriorly appearing solid, basal knobs distinct. Median bulb rounded or oval with valves. Basal bulb set off from intestine, its base may slightly overlap intestine. Cardia distinct. Vulva near middle of body. Ovaries paired, outstretched. Female tail conoid with blunt tip, subcylindroid, cylindroids or subclavate;

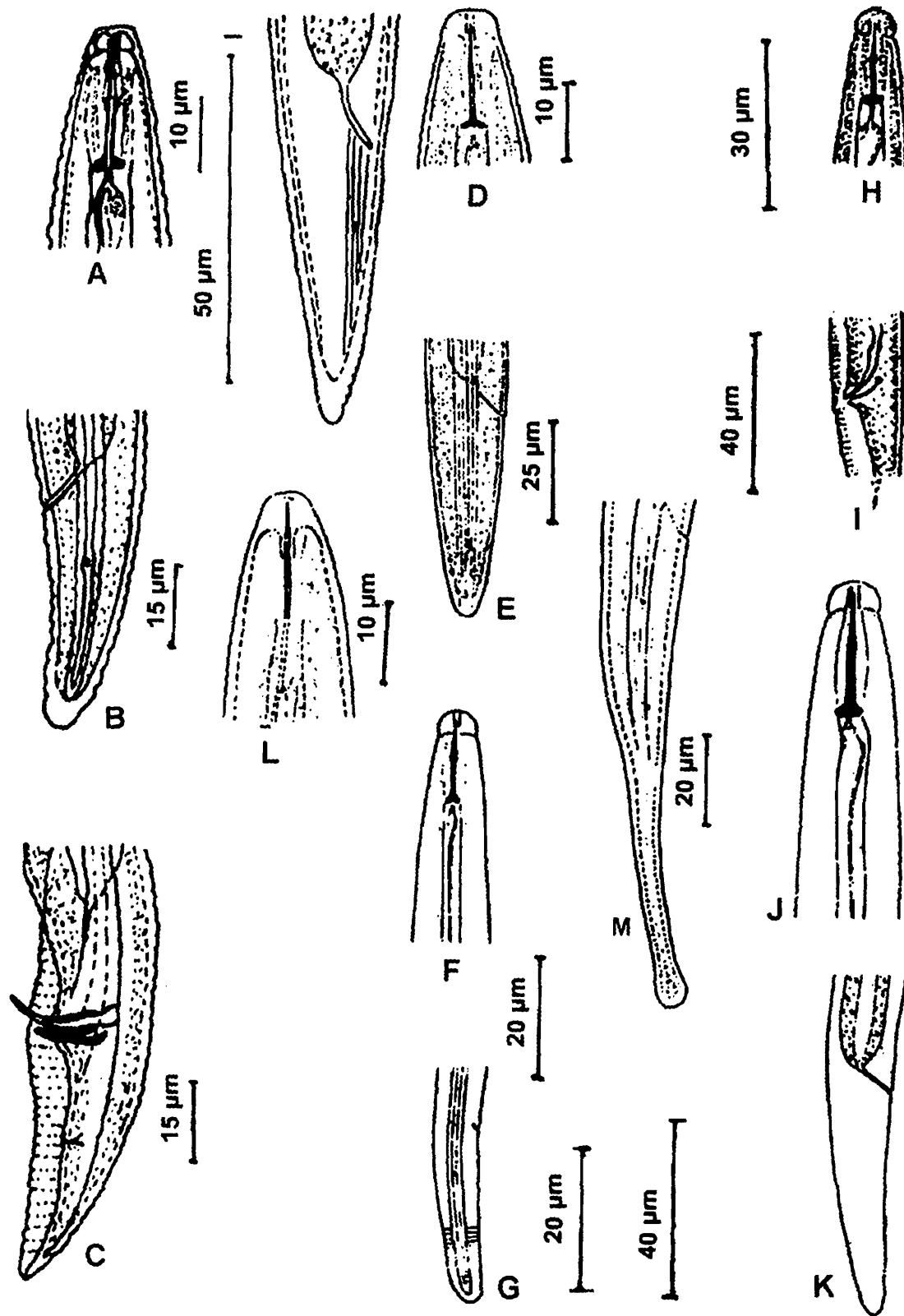


Fig. 8. A-C : *Tylenchorhynchus mashhoodi* Siddiqi & Basir, 1959. A-Female anterior end; B-Female tail; C-Male tail; D-E: *Bitylenchus brevilineatus* (Williams, 1960) Siddiqi, 1986. D-Female anterior end; E-Female tail; F-G: *Bitylenchus goffarti* (Sturhan, 1966) Siddiqi, 1986; F-Female anterior end; G-Female tail; H-I: *Telotylenchus indicus* Siddiqi, 1960; H-Female anterior end; I-Female tail; I-Male tail; J-K: *Telotylenchus aerolatus* Baqri & Jairajpuri, 1969. J-Female anterior end; K-Female tail. L-M: *Psilenchus hilarulus* de Man, 1921. L-Female anterior end; M-Female tail.

terminus smooth, rarely striated. Male tail completely enveloped by bursa. Spicules distally flanged, terminus narrow, indented or pointed. gubernaculum well developed, about half of spicules length, protrusible. About 20 species of genus *Tylenchorhynchus* are known from the State. Eight species of *Tylenchorhynchus*, one species of *Uliginotylenchus* and *Quinisulcius*; two species of *Merlinius* and three species of *Bitylenchus* are dealt with.

43. *Tylenchorhynchus clarus* Allen, 1955

(Plate No. 6, Fig. 43)

Measurements : Females : L = 0.56-0.57mm; a = 24-25; c = 19; V = 61-62

Male : L = 0.68 mm; a = 24; c = 18;

Description : Female : Lip region continuous, marked by 5 annules. Labial sclerotization inconspicuous. Stylet 15-16 μ m long. Reproductive system amphidelphic. Spermatheca round, axial. Ovaries outstretched. Tail 34-35 μ m long, bearing 10-15 striae and 2.7-2.8 anal body width long.

Male : Spicules 23 μ m long. Gubernaculum 15 μ m long. Bursa 48 μ m long, enveloping entire tail length, tail tip pointed.

Habitat and locality : Soil around roots of various plants. Plant parasitic. Sapau road, district Dholpur.

Distribution : Rajasthan.

44. *Tylenchorhynchus mashhoodi* Siddiqi & Basir, 1959

(Plate No. 7, Fig. 44 & 8,A-C)

Measurements : Females : L = 0.54-0.72 mm; a = 28-37; b = 4.4-5.8; c = 13-18; c' = 2.5-4.0; V = 52-58; stylet = 16-19 μ m.

Males : L = 0.57-0.66 mm; a = 27-35; b = 4.5-5.6; c = 14-17; T = 36-50; spicules = 18-25 μ m; gubernaculum = 10-15 μ m.

Description : Females : Cuticle marked with distinct transverse striae. Lip region continuous with adjacent body, bearing 3-4 annules. Labial frame work lightly sclerotized. Stylet 16-19 μ m long with rounded basal knobs which may be slightly flattened anteriorly. Vulva a transverse slit. Reproductive system amphidelphic. Spermatheca rounded, functional. Tail cylindrical to subcylindrical in shape, smooth terminus, marked with 14-29 striae.

Male : Male tail elongate-conoid with acute or subacute terminus.

Habitat and localities : Soil around roots of various plants at Oasion, Mathania, agricultural fields from Sursagar district Jodhpur. Plant parasitic.

Distribution : Widely distributed in India attacking large number of host plants.

Remark : It is widely distributed species in the State.

45. *Tylenchorhynchus robustus* Thorne & Malek, 1968
(Plate No. 7, Fig. 45)

Measurements : Female : L = 1.0 mm; a = 31; b = 7; c = 15; V = $^{22}52^{23}$

Male : L = 0.85 mm; a = 28; b = 6.2; c = 15; T = 42

Description : Female : Body arcuate upon fixation, tapering anteriorly to bluntly conoid lip region. Labial annules indistinct. The outer incisures are crenate. Stylet 23 μ m long, with slightly cupped knobs. Spermatheca about half as long as body width, filled with sperms. Intestine extending entire length of tail cavity. Tail 42-45 μ m long, bearing 40-45 tail annules with hemispheroid smooth terminus.

Male : Spicules 25 μ m long. Gubernaculum 13 μ m long. Bursa enveloping entire tail length; 52 μ m long. Male tail terminus pointed.

Habitat and locality : Soil around roots of various plants. Plant parasitic. Sermathura, district Dholpur.

Distribution : Andaman and Nicobar, Rajasthan.

46. *Tylenchorhynchus triglyphus* Seinhorst, 1963
(Plate No. 7, Fig. 46)

Measurements : Females : L = 0.61-0.73 mm; a = 24-26; b = 3.9-4.1; c = 15-18; V = 48-50.

Description : Female : Body almost straight upon fixation. Cuticle marked by coarse striae, about 2 μ m apart in mid body. Lip region continuous with body, marked by 4-5 annules. Labial frame work slightly sclerotized. Stylet 13-16 μ m long, with rounded basal knobs which may be slightly flattened anteriorly. Female reproductive system amphidelphic. Spermatheca with sperms. Tail conoid, 2.5-3.1 anal body width long, marked with striae. Phasmids in anterior half of tail.

Male : Not found.

Habitat and locality : Soil inhabiting. Phthoragous. Plant parasitic. Bhadoli, district Dausa

Distribution : Rajasthan, Gujarat.

47. *Tylenchorhynchus brassicae* Siddiqi, 1961
(Plate No. 7, Fig. 47)

Measurements : Female : L = 0.64 mm; a = 37; b = 4.8; c = 14; V = 55.

Male : L = 0.58 mm; a = 48; b = 4.1; c = 15; T = 49.

Description : Female : Cephalic region set off, sclerotization moderate. Labial annules 5. Stylet 17 μ m long; with rounded basal knobs. Spermatheca filled with sperms. Tail 15 μ m or 3.0 anal body width long, conoid with a large conoid obtuse terminus. Phasmids located a little anterior to middle of tail.

Male : Spicules 21µm long, ventrally arcuate cephalated. Gubernaculum 10µm long. Bursa large with coarsely crenate margins, enveloping entire tail. Phasmids located at 1/3rd of tail length from cloaca.

Habitat and locality : Soil around roots of various plants. Plant parasitic. Kumhar, district Bharatpur.

Distribution : Delhi, Haryana, Maharashtra, Punjab, Uttar Pradesh, Rajasthan.

48. *Tylenchorhynchus latus* Allen, 1955
(Plate No. 7, Fig. 48)

Measurements : Females : L = 0.58-0.72 mm; a = 32-39; b = 4.6-5.2; c = 17-21; V = 55-62.

Description : Female : Lip region offset, marked by 6 annules. Labial framework slightly sclerotized. Stylet 15-17 µm long, with anteriorly directed basal knobs. Female reproductive system amphidelphic. Tail conoid, with bluntly pointed to smooth terminus, marked with 15-16 annules, 2.1-2.3 anal body width long.

Male : Not found.

Habitat and locality : Soil inhabiting. Plant Parasitic. Gudala, district Karauli.

Distribution : Gujarat, Rajasthan

49. *Tylenchorhynchus marudharensis* Lal, Mathur & Rajan, 1990.
(Plate No. 7, Fig. 49)

Measurements : Females : L = 0.64-0.81; a = 37-38; b = 6.0-6.6; c = 14-19; V = 52-55;

Males : L = 0.59-0.71; a = 34-37; b = 5.0-6.1

Description : Female : Cephalic region set off from body. Lip annules 7-8. Labial sclerotization moderate. Stylet 15-16 µm long, basal knobs indented posteriorly. Median oesophageal bulb rounded. Spermatheca small, rounded, axial, with sperms. Tail 35-42 µm long, bearing 35-42 annules, conoid with smooth terminus and 3.0-3.7 anal body-width long.

Male : Spicules 23-25µm long; Gubernaculum 11-13µm long. Tail 45-52 µm; tail tip pointed. Bursa enveloping entire tail.

Habitat and localities : Soil around roots of various plants. Plant parasitic. Durgapura and Umarao Ki Dhani, district Dholpur.

Distribution : Punjab, Haryana, Rajasthan (Thar).

50. *Tylenchorhynchus delhiensis* Chawla, Bhamburkar, Khan & Prasad, 1968
(Plate No. 8, Fig. 50)

Measurements : Females : L = 0.6-0.7 mm; a = 27-33; b = 6-7; c = 14-17; V = 46-57.

Description : Female : Body slightly ventrally arcuate upon fixation, tapering gradually at both extremities. Lip region rounded, slightly setoff from adjacent body. Lateral fields marked by four incisures. Stylet 13-15 μm long, with rounded basal knobs. Excretory pore located in region of pharyngeal bulb. Female reproductive system amphidelphic. Tail sub cylindrical, about four anal body-diameter long, marked by 28-30 striae, with rounded terminus. Phasmids located in the anterior half of tail.

Male : Not found.

Habitat and locality : Soil around roots of various plants. Plant parasitic. Kumhar, district Bharatpur.

Distribution : Rajasthan, Gujarat.

Genus ***Bitylenchus*** Filipjev, 1934 (Siddiqi, 1986)

Diagnosis : Body small to medium sized (0.45-1.5 mm). Cuticle distinctly but finely striated. Lateral fields marked by four incisures, outer bands are areolated. Lip region finely striated, generally set off by a constriction or depression. Stylet moderately developed (11-24 μm) with rounded basal knobs, slopping backwards. Median bulb well developed but not set off from procorpus. Postanal intestinal sac very large. Ovaries paired. Female tail cylindrical, subcylindrical or subclavate, with rounded tip. Male tail completely enveloped by bursa. Spicules distally flanged (19-30 μm long). Gubernaculum 10-16 μm long, not protrusible, without titillate or telamon.

Type species : *Bitylenchus dubius* (Butschli, 1873) Siddiqi, 1986

51. ***Bitylenchus goffarti*** (Sturhan, 1966)

(Plate No. 8, Fig. 51 & 8, F-G)

Measurements : Females : L = 0.53-0.74 mm; a = 24-41; b = 4.8-6.3; c = 11-15; V = 51-56.

Males : L = 0.52-0.67 mm; a = 35-43; b = 5.0-5.8; c = 12-15; T = 41-51

Description : Female : Lip region set off from body by depression. Labial sclerotization moderate. Stylet 14-17 μm long. Median oesophageal bulb oval. Vulva transverse. Post anal intestinal sac present. Tail 35-42 μm long conoid with smooth terminus.

Male : Spicules 23-25 μm long. Gubernaculum 10-11 μm long. Bursa enveloping entire tail length. Tail tip pointed.

Habitat and locality : Soil around roots of various plants. Plant parasitic. Gudala, district Kaurali.

Distribution : West Bengal, Rajasthan, Gujarat.

52. ***Bitylennchus brevilineatus*** Williams, 1960
(Plate No. 8, Fig. 52&8, D-E)

Measurements : Females : L = 0.50-0.71 mm; a = 33-41; b = 4.4-6.1; c = 12-18; V = 51-57.

Males : L = 0.55-0.65 mm; a = 36-38; b = 4.5-6.0; c = 11-17;

Description : Females : Lip region set off from body, annules 5-6. Labial sclerotization present. Cuticle marked with both longitudinal and transverse striae. Longitudinal lines only confined to oesophageal region. Stylet 13-18 μ m long. Basal knobs indented posteriorly. Reproductive system amphidelphic. Tail 40-46 μ m bearing 40-42 tail annules, hemispheroid tail terminus smooth; 2.5-2.9 anal body width long.

Male : Spicules 20-26 μ m long. Gubernaculum 10-14 μ m long. Tail 43-45 μ m long; tip pointed.

Habitat and locality : Soil around roots of various plants. Plant parasitic. Narpura, district Dholpur.

Distribution : Rajasthan, Uttar Pradesh, West Bengal, Delhi.

53. ***Bitylennchus dubius*** (Butschli, 1873) Filipjev, 1934
(Plate No. 9, Fig. 53)

Measurements : Female : L = 0.80 mm; a = 35; b = 5.2; c = 19; V = 53.

Description : Female : Cephalic region set off from body by depression. Stylet 14 μ m long. Median oesophageal bulb oval. Vulva transverse slit. Spermatheca round axial. Post anal intestinal sac large, filling one quarter or more of tail cavity. Tail 42 μ m long, sub-cylindrical, 2.4 anal body-width long.

Male : Not found.

Habitat and localities : Soil around roots of various plants. Collected from agricultural fields at Kela Devi Road, Karauli, Kumher Bharatpur. Plant parasitic.

Distribution : Rajasthan.

Genus ***Uliginotylennchus*** Siddiqi, 1971

Diagnosis : Body 0.4-1 mm long, slender (a = 25-50) arcuate. Annules distinct, smooth. Lateral fields with three incisures, aerolated. Cephalic region elevated, continuous or slightly off set, finely but distinctly annulated; labial disc indistinct; framework moderately sclerotized. Stylet attenuated, 14-27 μ m long; knobs small rounded. Vulva in body cavity or depression with epiptygma. Spermatheca pouch-like, usually off set. Female tail elongate subclavate to cylindroids with broadly rounded, usually, annulated terminus and over 25 annules. Male with large distal flanges, 18-30 μ m long. Gubernaculum 8-12 μ m long, rod-like, protrusible, with proximal portion directed dorsally.

Type species : *Uliginotylennchus uliginosus* (Siddiqi, 1970) Siddiqi, 1971

54. ***Uliginotynlenchus rhopalocerus*** (Seinhorst, 1963) Siddiqi, 1971
(Plate No. 8, Fig. 54)

Measurements : Female : L = 0.6-0.7 mm; a = 27-33; b = 6-7; c = 14-17; V = 46-57.

Description : Female : Body ventrally arcuate upon fixation, tapering gradually at both extremities. Lip region rounded, slightly setoff from adjacent body. Lateral fields marked by three incisures, areolated. Stylet 17-18 μ m long, with rounded, small basal knobs. Female reproductive system amphidelphic. Vulva in depression. Tail elongate to cylindrical, five to six anal body-diameter long, marked by 26-35 striae, with rounded terminus. Phasmids located in the anterior half of tail.

Male : Not found.

Habitat and locality : Soil around roots of various plants. Plant parasitic Sermathura, district Dholpur.

Distribution : Rajasthan.

Genus ***Quinisulcius*** Siddiqi, 1971

Diagnosis : Small sized (0.47-0.9 mm), strongly curved upon fixation annules distinct. Lateral fields with five incisures. Cephalic region offset, rounded, fine annulated; labial disc indistinct; framework with light moderate sclerotization. Stylet 12-24 μ m long, knobs rounded rarely cupped anteriorly. Median bulb oval. Basal bulb large, usually off set from intestine. Vulva at 51-59%, lips not modified. Spermathecae round axial. Ovaries paired outstretched. Female tail conoid, usually ventrally arcuate, terminal annule enlarged, smooth or striated. Males rare or absent. Bursa well developed, simple, enveloping entire tail. Spicules arcuate with poorly developed distal flanges, 14-24 μ m long. Gubernaculum modified, with proximal end directed dorsally.

Type species : *Quinisulcius capitatus* (Allen, 1955) Siddiqi, 1971

55. ***Quinisulcius curvus*** (Williams, 1960) Siddiqi, 1971
(Plate No. 8, Fig. 55)

Measurements : Females : L = 0.49-0.63 mm; a = .05-.07; b = 4.6-5.5; c = 15-18; V = 52-57.

Description : Female : Lip region set off, marked by 4-5 annules. Labial sclerotization indistinct. Stylet 16-17 μ m. Basal knobs posteriorly sloping. Spermatheca round, axial or slightly set off. Tail 15-23 μ m long, with smooth terminus. Tail annules 15-23.

Male : Not found

Habitat and locality : Soil inhabiting collected from grasses at Thandi Beri, KWLS, Udaipur.

Distribution : Car Nicobar Island, Andaman

Subfamily MERLINIINAE Siddiqi, 1971

Diagnosis : Lateral fields each with six incisures. Deirids present. Cephalic region annulated; labial disc indistinct or distinct. Stylet small to very long (11-130 μm long), with distinct basal knobs. Median and basal bulbs well developed. Vulva small, pore like or slit like, usually with epiptygma. Ovaries paired. Spermathecae two to four lobed. Post rectal intesitna sac absent. Female tail conoid, subcylindroid o rsubclavate, about 2 to 6 anal body width long. Male tail conical. Bursa simple, moderately developed, enveloping tail. Hypoptygma always present. Spicules cylindroids in distal half, straight to arcuate with distal end broadly rounded, notched and devoid of ventro-lateral flanges. Gubernaculum simple, trough like, fixed.

Typegenus : *Merlinius* Siddiqi, 1970

Other genera : *Amphimerlinius* Siddiqi, 1976; *Geocenamus* Thorne & Malek, 1968; *Nagelus* Thorne & Malek, 1968; *Scutylenchus* Jairajpuri, 1971

Key to genera of Merliniinae

1. Body cuticle with longitudinal striae or grooves; deirids absent ***Scutylenchus***
- Body cuticle without longitudinal striae or grooves; deirids present 2
2. Cephalic annules broken by radial grooves 3
- Cephalic annules not broken 4
3. Stylet elongate (25-130 μm), with conus more than 50% of its total length; perioral disc well marked, rounded ***Geocenamus***
- Stylet not so elongate, with conus less than 50% of its total length; perioral disc not marked, rectangular to oval ***Merlinius***
4. Cephalic region continuous; female tail cylindrical to subclavate, terminal cuticle abnormally thickened ***Amplimerlinius***
- Cephalic region slightly offset; female tail tapering, terminal cuticle slightly thickened ***Nagelus***

Genus *Merlinius* Siddiqi, 1970

Diagnosis : Under 1mm long, straight to arcuate upon fixation. Cuticle lacking longitudinal striae or grooves, lateral fields with six incisures. Cephalic region continuous or lsightly offset. Stylet usually under 20 μm long. Median bulb at or anterior to oesophagous. Vulva closed, slit-like; epiptygma indistinct. Female tail conoid to subcylindrical. Spicules cylindroid, straight to lsightly arcuate, tip blunt and notched. Gubernaculum crescent-shaped.

Type species : *Merlinius brevidens* (Allen, 1955) Siddiqi, 1970

56. ***Merlinius brevidens*** (Allen, 1955) Siddiqi, 1970.
(Plate No. 9, Fig. 56)

Measurements : Females : L = 0.54-0.69 mm; a = 36-40; b = 4.2-5.2; c = 11-13; V = 53-57.

Males : L = 0.53-0.59mm; a = 34-35; b = 4.0-4.9; c = 9-10.

Description : Female : Cephalic region continuous, perioral disc indistinct. Lip annules 6. Lip region moderately sclerotized. Stylet 14 μ m long. Basal knobs indented posteriorly. Median bulb slightly anterior to middle of oesophagus. Vulva slit like, epitygma indistinct. Tail 42-45 μ m, bearing 42-49 tail annules; tail subcylindrical with hemispherical smooth terminus.

Male : Spicules 15 μ m long. Gubernaculum 10 μ m length. Tail 45-50 μ m long; tail tip pointed. Bursa enveloping entire tail.

Habitat and locality : Soil around roots of various plants. Plant parasitic. Tijara road, district Alwar

Distribution : Uttar Pradesh, Rajasthan.

57. ***Merlinius nanus*** (Allen, 1955) Siddiqi, 1970
(Plate No. 9, Fig. 57)

Measurements : Female : L = 0.54 mm; a = ; b = 5.0; c = 15.4; V = 56;

Male : L = 0.57 mm; a = ; b = 5.4; c = 14.4; T = 55.

Description : Female : Cephalic region continuous, perioral disc indistinct. Stylet 13 μ m long. Oesophagus typical of the genus. Vulva pore like, epitygma indistinct. Tail 35 μ m, sub cylindrical, terminus smooth.

Male : Spicules 20 μ m long. Gubernaculum crescent shaped. Bursa 51 μ m, subterminal. Tail 40 μ m arcuate with blunt tip and notched.

Habitat and locality : Soil around roots of various plants. Plant parasitic. Sermathura, district Dholpur.

Distribution : West Bengal, Uttar Pradesh, Rajasthan.

Key to genera of Dolichodorinae

1. Lateral fields with three incisures; female tail spicate or filiform***Dolichodorus***
- Lateral fields with four incisures; female tail obtuse or mammillate***Neodolichodorus***

Genus *Neodolichorhynchus* Jairajpuri & Hunt, 1984

Diagnosis : Small sized (under 1 mm), ventrally arcuate or strongly curved upon relaxation. Annules distinct marked by deep transverse striae. Cuticle with 6-14 longitudinal

ridges or lamellae outside lateral fields. Lateral fields each with one (two incisures) or three ridges (four incisures), variably aerolated. Cephalic region rounded with dorsal and ventral indentation. Labial framework light to moderately sclerotized. Stylet 12-17 μm long. Median bulb round to oval. Basal bulb off set from intestine. Vulva median or submedian. Ovaries paired, outstretched. Female tail conoid to subcylindrical. Male tail enveloped by a large bursa, which may or may not be doubly notched or indented at tail terminus to appear trilobed. Spicules with distal flanges. Gubernaculum large, protrusible.

Type genus : *Neodolichorhynchus* Jairajpuri & Hunt, 1984

Other subgenera : *Mulkorhynchus* Jairajpuri, 1988; *Prodolichorhynchus* Jairajpuri, 1985.

Key to subgenera of *Neodolichorhynchus*

1. Lateral field with a single ridge ***Prodolichorhynchus***
- Lateral field with three ridges 2
2. Vulva with minute lateral cuticular membranes; bursa generally notched at tail tip ***Mulkorhynchus***
- Vulva without lateral cuticular membranes; bursa not notched at tail tip ***Neodolichorhynchus***

58. *Neodolichorhynchus (Mulkorhynchus) phaseoli*

(Sethi & Swarup, 1968) Talavera & Tobar, 1997

(Plate No. 9, Fig. 58)

Measurements : Females : L = 0.60-0.65 mm; a = 27-27.4; b = 5.2-5.3; c = 20-20.5; V = 56.

Males : L = 0.50-0.55 mm; a = 25-26; b = 5.0-5.1; c = 15.15.4

Description : Female : Lip region cap-like, set off from body. Lateral fields completely aerolated. Stylet 14-15 μm long. Stylet knobs 2-3 μm wide. Reproductive system amphidelphic. Spermatheca set off, rounded, filled with sperms. Tail 13-14 μm long, cylindrical. Tail terminus smooth.

Male : Spicules 17-18 μm . Bursa enveloping entire tail and doubly notched at tail tip. Gubernaculum usually with projections at proximal end.

Habitat and locality : Soil around roots of various plants. Plant parasitic. Tijara road, district Alwar.

Distribution : Punjab, Haryana, Rajasthan.

Suborder CRICONEMATINA Siddiqi, 1980

Diagnosis : Exclusively root-parasites; males and some juveniles lack a stylet or degenerate one. Cuticle either thin or finely annulate or thick and coarsely annulated.

Annules may have retrose annules. Female : vermiform, sausage shaped, or obese only in Tylenchuloide. Cephalic region smooth or usually with one to three coarse annules. Stylet knobs anchor shaped. Oesophagous criconematoid. Basal bulb small, containing three oesophageal glands. Intestine syncitial lacking a definite lumen. Monodelphic, prodelphic. Vulva transversely slit-like, located posteriorly generally at 85% of body from anterior end. Males vermiform, oesophagus degenerate. Bursa weakly developed.

Type genus : ***Criconema*** Hofmanner & Menzel, 1914

Type Superfamily : CRICONEMATOIDEA Taylor, 1936 (1914)

Other Superfamilies : HEMICYCLIOPHORA Skarbilovich, 1959; TYLENCHULOIDEA Skarbilovich, 1947

Key to superfamilies of CRICONEMATINA

1. Females and juveniles with thick cuticle, bearing coarse, round or retrose annules; oesophagus with isthmus broad and amalgamated with basal bulb 2
 - Femals and juveniles with thin cuticle bearing fine round annules; Oesophagus with isthmus not amalgamated with basal bulb TYLENCHULOIDEA
2. Females and juveniles elongate-vermiform, usually over 0.6 mm long; annules round, lacking cuticular outgrowths; Male with elongate tail and high bursa, does not develop by metamorphosis HEMICYCLIOPHOROIDEA
 - Females and juveniles spindle or sausage-shaped, usually under 0.5 mm long; annules retrose (except secondarily becoming rounded in Females of most *Hemicriconemoides* spp.), may have cuticular outgrowths; male with short tail and low or no bursa, develops by metamorphosis CRICONEMATOIDEA

Family CRICONEMATIDAE Taylor, 1936 (1914) (Thorne, 1945)

The ring nematodes

The members of this family have a short, sausage-shaped body that may curve in a ring when relaxed. Small sized (seldom over 0.8 mm), showing marked sexual dimorphism. Females and juveniles sausage to spindle-shaped with thick cuticle and coarse retrose annules, with or without scales, spines and other configurations; males vermiform with not so thick cuticle and annules always rounded and a degenerate oesophagus hardly showing any structure. Lateral fields with incisures in males, absent in juveniles and Females. Stylet well developed in juveniles and Females. Conus markedly longer than shaft, latter usually about 10-12 μ m long, basal knobs prominent, appearing anchor-shaped orifice of oesophageal gland 3-6 μ m behind stylet base; stylet absent in males. Oesophagus comprises precorpus, postcorpus having large, elongated refractive thickenings; the two parts forming a broad Cylindrical muscular corpus filling the body width. Isthmus short broad and amalgamated with a small reduced basal bulb offset from intestine and

containing the three oesophageal glands. A small non-cellular cardia may present. Intestine syncytial lacking lumen. Vulva far posterior, ovary outstretched. Post vulval intestine sac absent. Males develop by metamorphosis with in a sausage-shaped juvenile. Spicules elongate-setose, almost straight to arcuate, proximally Cephalated and distally pointed, gubernaculum simple, fixed. Male tail short, bursa low, adanal subterminal or terminal, occasionally absent. Ectoparasites of roots.

Subfamily HEMICRICONEMOIDINAE Andrassy, 1979

Diagnosis : Female : Body enclosed in a cuticular sheath, attached to it at head, vulva sometimes tail tip. Annules on body and sheath equal in number, round or occasionally retrose, lacking scales, spines etc. Stylet and oesophagus typical of the family. Tail end conoid or rounded. Male : Body sheath absent. Lateral fields usually with four incisures. Cephalic region rounded or conoid-rounded. Bursa low, subterminal, almost terminal or absent. Spicules slender, ventrally arcuate. Juveniles: No body sheath. Annules with scales which are smooth, dentate or spined and arranged usually in alternating row or irregular.

Type genus : *Hemicriconemoides* Chitwood & Birchfield, 1957

No other genus

Genus *Hemicriconemoides* Chitwood & Birchfield, 1957

Diagnosis : Female elongate cylindrical, with double cuticle. Female cephalic region with two, rarely three annules, continuous or offset, variable in shape. Pseudolips inconspicuous, submedian lobes absent, rarely present. Stylet elongate with anteriorly cupped knobs appearing anchor-shaped. Vulva open or closed, with or without cuticular flaps. Female tail variable, bluntly rounded to pointed. Males usually with four incisures in lateral field, cephalic region rounded or conoid-rounded; tail conoid to subcylindroid and bursa if present subterminal and terminal. Spicules setose, arcuate. Gubernaculum simple, small. Juveniles with single cuticle with smooth, dentate or spined scales, arranged in longitudinal, usually alternating rows or irregular on body, rarely without scales or spines. Stylet knobs anchor shaped.

Type species : *Hemicriconemoides wessoni* Chitwood & Birchfield, 1957

59. *Hemicriconemoides cocophyllus* (Loss, 1949) Chitwood & Birchfield, 1957 (Plate No. 9, Fig. 59)

Measurements : Females : L = 0.46-0.50 mm; a = 14-15; b = 4.0-5.0; c = 16-17; V = 91-92; v¹ = 36-42; VL/VB = 1.2-1.7; R = 108-113; RV = 9-10; Ran = 8-9; stylet = 50-57 µm; prothorax = 40-47 µm; Rex = 31-32.

Description : Females : Cuticular sheath attached to body at anterior end, may or may not be separated on tail. Head slightly set off; Labial annules 2-3; usually 2; first annule

smaller than the second. Labial disc slightly elevated. Stylet 5-7 μm posterior to bae of stylet knobs base. Vulvar sheath well developed, present in both sheath and body cuticle. Tail convex-conoid to attenuated.

Male : Not found.

Habitat and locality : Soil around roots of various plants. Plant parasitic. Rahar, district Bharatpur.

Distribution : India : Rajasthan, Haryana, Punjab

60. *Hemicriconemoides mangiferae* Siddiqi, 1961
(Plate No. 9, Fig. 60)

Measurements : Females : L = 0.49-0.58mm; a = 16-19; b = 4.2-5.0; c = 16-19; V = 91-92; V^1 = 35-42; VL/VB = 1.3-1.6;

Description : Female : Cuticular sheath attached to body at anterior end and vulval opening sometimes on tail. Lip region slightly set off, with 2 annules; first annule smaller than second or about equal to second, angular, directed outward. Labial disc slightly elevated, rounded at top, inconspicuous in some specimens. Annules 3-4 μm wide in middle of body. Stylet 78-81 μm long. Stylet knobs 5-7 μm across. Excretory pore 34-38 annules from anterior end. Vulvar sheath lacking. Tail convex-conoid the last 3-4 annules narrow abruptly.

Male : Not found.

Habitat and locality : Soil around roots of various plants. Plant parasitic. Parisal-Nadbai, district Bharatpur.

Distribution : Andaman Nicobar, West Bengal, Uttar Pradesh, Rajasthan.

61. *Hemicriconemoides brachyurus* (Loss, 1949) Chitwood & Birchfield, 1957
(Plate No. 9, Fig. 61)

Measurements : Females : L = 0.40-0.54 mm; a = 13-17; b = 4.3-5.2; c = 16-25; V = 93-95; V^1 = 26-37; VL/VB = 1.0-1.4

Description : Female : Cuticular sheath attached to body at anterior end and well separated on tail. Lip region slightly set off from body, with 2 annules; first annule smaller than second. Labial disc slightly elevated, flattened at anterior. Annules 2-3 μm wide in mid body. Stylet 56-64 μm long. Stylet knobs 8-11 μm across. Vulvar sheath present. Tail acutely conoid.

Male : Not found

Habitat and locality : Soil around roots of various plants and fruit trees. Plant parasitic. Kumhar, district Bharatpur.

Distribution : West Bengal, Rajasthan.

Family TYLENCHULIDAE

Diagnosis : Small nematodes with marked sexual dimorphism in body form and anterior region. Female elongate-obese, ventrally curved, with a distinct postvulval region. Stylet about 15 μm or shorter. Excretory pore generally well behind pharynx. Tail present, short.

Subfamily TYLENCHULIDAE Skarbilovich, 1947

Diagnosis : With characters of family

Genus *Tylenchulus* Cobb, 1913

Diagnosis : Preadult Female migratory, adult Female sedentary. Male non feeding. Mature Female : Elongate obese, enlarging behind median bulb, mostly on dorsal side, ventrally arcuate, not spiral; neck elongate, irregular in outline; post vulval part elongate-tapering. Cuticle 3-5 μm thick near middle. Stylet 11-15 μm long, knobs prominent. Excretory system well developed. Excretory pore 12-19 μm in front of vulva at 68-85% of body length from anterior end. Vulva a distinct transverse slit, lips bulging; post vulval uterine sac absent. Ovaries coiled with one or two flexures. Anus obscure or absent non functional.

Immature Juveniles : Vermiform, slender, straight to arcuate upon relaxation. Cuticle distinctly striated. Stylet and oesophagus as in mature Female. Ovaries immature.

Males : Slender, straight or slightly arcuate ventrally 0.33-0.46 mm long. Stylet and oesophagous degenerate but not completely absent testis outstretched. Spicules slender. Tail elongate conoid, tip rounded or with a peg.

Second Stage Juveniles : Lateral fields narrow each with two incisures. Cephalic region rounded, labial disc indistinct. Stylet 11-15 μm long knobs rounded. Median bulb oval or usiform. Basal bulb offset. Rectum and anus obscure. Tail elongate conoid, tip rounded or deeply furcated.

Type species : **Tylenchulus semipenetrans* Cobb, 1913

62. *Tylenchulus semipenetrans* Cobb, 1913

(Plate No. 9, Fig. 62)

Measurements : Mature Adult Females : = 0.31-0.46 mm; width = 66-114 μm ; a = 3.5-6.4; b = 2.4-4.3; V = 88-93; stylet = 11-12 μm .

Males : L = 0.34-0.38 mm; a = 28-35; b = 2.9-3.7; c = 7.7-10.1; T = 25-36; stylet = 9-10 μm ; spicules = 15-18 μm ; gubernaculum = 3-4 μm ; tail = 35-45 μm .

Second stage juvenile : L = 0.33-0.38mm; a = 25-29; b = 3.0-3.7; c = 7-8; stylet = 12-13 μm

Common Name : Citrus Nematode

Description : Female : Body translucent, white 60-70% of body variably saccate, widest at excretory pore, narrowing abruptly at vulva and ending in a digitate terminus. Lip region hemispherical, smooth; labial sclerotization inconspicuous. Stylet knobs rounded. Procorpus cylindrical; metacarpus oval. Basal bulb elongate-saccate. Excretory pore located at 78-84% from anterior end. Gonads convalated, extending anteriorly to basal bulb. Anus and rectum invisible.

Male : Males with degenerated stylet and oesophagous, Excretory pore post-equatorial. Spicules slender, arcuate. Tail slightly tapering to a broadly rounded tip.

Habitat : The Females are obligate parasites on the roots of various species of citrus.

Distribution : Most common in citrus producing states.

CHAPTER-2

Order APHELENCHIDA Siddiqi, 1980

Suborder APHELENCHINA Geraert, 1966

Family APHELENCHIDAE Fuchs, 1937

Subfamily APHELENCHINAE Fuchs, 1937

Genus *Aphelenchus* Bastian, 1865*Aphelenchus avenae* Bastian, 1865

Order APHELENCHIDA Siddiqi, 1980

Diagnosis : Body small to long. Cuticle thin. Cephalic region low, rounded. Basal knobs of stylet weakly develop or entirely absent. Pharynx with strongly developed, offset, ovoid to rounded rectangular median bulb with valve plates and well developed pharyngeal glands forming a dorsal overlapping lobe. Female reproductive system monoprodelphic, usually outstretched. Male with single testis. Bursa usually absent.

Type and only suborder : Aphelenchina Geraert, 1966

Key to superfamilies of APHELENCHINA Geraert, 1966

1. Spicules slender, cephalated. Gubernaculum well developed. Lateral fields with six or more incisures. Pharynx with distinct isthmus and nerve ring circumpharyngeal APHELENCHOIDEA
- Spicules robust. Gubernaculum absent, if present than reduced. Lateral fields usually with four or fewer incisures, exceptionally six. Pharynx with indistinct isthmus and nerve ring circumintestinal APHELENCHOIDOIDEA

Superfamily APHELENCHOIDEA Fuchs, 1937 (Thorne, 1949)

Diagnosis : Lateral fields with six or more incisures. Pharynx with a distinct isthmus. Nerve ring circum-pharyngeal. Vulva a transverse slit. Female tail short, sub-cylindrical to conoid and with a broadly rounded terminus which may be mucronate. Spicules slender, ventrally arcuate; cephalated. Gubernaculum well developed, elongate. Bursa present or absent.

Type family : APHELENCHIDAE Fuchs, 1937

Key to families of APHELENCHOIDEA

1. Male with prominent peloderan bursa. Female vulval aperture in the form of an oval pore. Pharyngeal glands forming a long dorsally overlapping lobe APHELENCHIDAE
- Male lacking a bursa. Vulva in the form of a transverse slit. Pharyngeal glands small, retained within a non-overlapping basal bulb PARAPHELENCHIDAE

Family APHELENCHIDAE Fuchs, 1937 (Steiner, 1949)

Diagnosis : Soil dwelling or found in decaying plant material. Lateral fields marked with more than six incisures. (usually 10-12). Vulval aperture in the form of a transverse oval pore. Oesophageal glands free, forming a dorsally overlapping lobe. Female tail short, cylindroids with rounded tip. Males has well developed true bursa, peloderan in form and with four pairs of supporting ribs, i.e., one pair adanal and other three post anal.

Type genus : *Aphelenchus* Bastian, 1865

Type species : *Aphelenchus avenae* Bastian, 1865

Genus ***Aphelenchus*** Bastian, 1865

Diagnosis : Medium sized (0.5-2.2 mm) body length. Cuticle finely striated. Lip reigon low, rounded and slightly set off. Lateral fields with more than 10 incisures. Stylet slender with slight basal swellings. Procoprus cylindrical, narrowing just before joining the large, ovoid, median bulb with centrally placed crescentic valve plates. Oesophageal glands in a dorsal lobe. Nerve ring posterior to median bulb or opposite to excretory pore. Vulva at 70-80% of body length. Vulva lips slightly protuberant and body just narrowing behind the vulva. Genital tract monoprodlephic, outstretched. Posterior uterine sac extending up to half the vulva-anus distance. Tail short, cylindroids, slightly ventrally concave, ending in a broadly rounded terminus. Male with paired slender spicules, slightly well developed. Tail short, conoid, tapering to a narrowly rounded point.

Type species : *Aphelenchus avenae* Bastian, 1865

63. ***Aphelenchus avenae*** Bastian, 1865

(Fig. 9, A-D)

Measurements : Females : L = 0.55-0.86 mm; a = 25-39; b = 4.9-6.9; b' = 7.2-9.2; c = 2634; V = ²⁹⁻³⁶74-78⁶⁻⁸.

Males : L = 0.63-0.81 mm; a = 27-33; b = 5.5-5.9; b' = 8.1-9.6; c = 24-29; T = 47-65.

Description : Female : Body slightly ventrally arcuate upon fixation, narrowing just posterior to vulva. Lip region rounded to flattened, not set off from body, with three to four faint labial striae. Lateral fields widest in mid-body, marked by 10-12 incisures. Stylet 10-12 µm long, without basal swellings. Procorpus of oesophagus cylindrical, Median bulb widening abruptly from procorpus, well developed, rectangular to oval in shape. Dorsal lobe of oesophageal gland overlaps intestine on subdorsal side. Vulva a short transverse oval slit. Vulval lips slightly protruded. Female reproductive system monoprodlephic, ovary outstretched. Posterior uterine sac reaching about half way from to vulva to the anus. Tail usually bluntly rounded, 16-33 µm long or 0.7 to 1.0 anal body-width long.

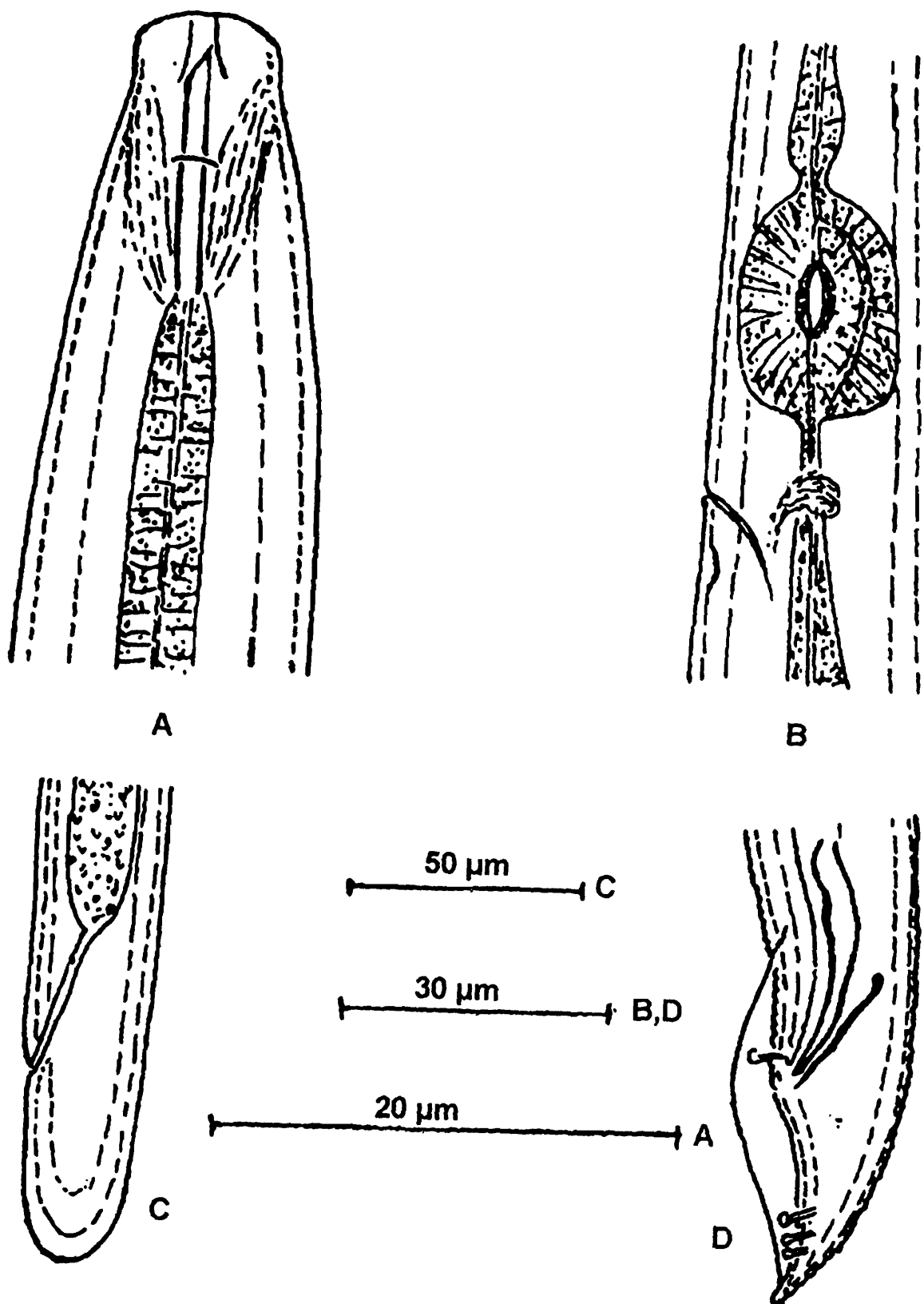


Fig. 9. *Aphelenchus avenae* Bastian, 1865. F-Female anterior end; B-Middle oesophageal region; C-Female tail; D-Male tail.

Male : Similar to female except for sexual dimorphism in tail shape. Spicules slender 28-30 μm long, paired, separate cephalated, ventrally curved and gradually tapering towards the pointed distal ends. Gubernaculum present, 14-16 μm long with narrow proximal end. Tail conical and enveloped by a bursa.

Though, the males are extremely rare, the present study reports three males from Dausa population.

Habitat and locality : Collected from soil around roots of wheat at Lalsot, district Dausa.

Other habitats and localities : Also collected from around roots of maize, millet and sorghum at Moda Gar, district Ajmer; Vasangar, district Baran; Tonk Road, district Tonk; Jas Nagar, district Nagaur; Bari and Dholighati, district Udaipur; Sewana, district Barmer; Tal Chappar, district Churu; Khanpur, district Jhalawar; Ganganagar Road, district Sawai Madhopur; Mathania and Bijawal, district Jodhpur; Kota; Sridi Khera, district Bhilwara; Sam area, district Jaisalmer.

CHAPTER-3

SYSTEMATIC LIST OF SPECIES OF ORDER DORYLAIMIDA Pearse, 1942

Order DORYLAIMIDA Pearse, 1942

Suborder DORYLAIMINA Pearse, 1936

Family DORYLAIMIDAE de Man, 1876

Genus *Dorylaimus* Dujardin, 1845

Dorylaimus stagnalis Dujardin, 1845

Dorylaimus murlii Bohra & Sultana, 2008

Ischiodorylaimus rathori Bohra & Baqri, 2005

Ischiodorylaimus baqrii Bohra & Sultana, 2008

Genus *Mesodorylaimus* Andrassy, 1959

Mesodorylaimus bhansalii Baqri & Bohra, 2001

Mesodorylaimus kauli Baqri & Bohra, 2001

Mesodorylaimus mesonyctius (Kreis, 1930) Andrassy, 1959

Mesodorylaimus margeritus Basson & Heyns, 1974

Mesodorylaimus litoralis Loof, 1969

Genus *Calodorylaimus* Andrassy, 1969

Calodorylaimus wasimi Baqri & Bohra, 2003

Genus *Laimydorus* Siddiqi, 1969

Laimydorus baldus Baqri & Jana, 1982

Laimydorus siddiqii Baqri & Jana, 1982

Laimydorus finalis Thorne, 1975

Laimydorus serpentines (Thorne & Swanger 1936) Siddiqi, 1969

Laimydorus kherai Baqri & Jana, 1982

Laimydorus thornei Andrassy, 1969

Genus *Thornenema* Andrassy, 1959

Thornenema mauritianum (Williams, 1959) Baqri & Jairajpuri, 1967

Genus *Sicaguttur* Siddiqi, 1971

Sicaguttur sartum Siddiqi, 1971

Genus *Prothornenema* Baqri & Bohra, 2003

Prothornenema capitatum Baqri & Bohra, 2003

Genus *Opisthodorylaimus* Ahmad & Jairajpuri, 1982

Opisthodorylaimus caulcanti (Lordellow, 1955) Carbonell & Coomans, 1986

Family APORCELAIMINAE Heyns, 1965

Subfamily APORCELAIMINAE Heyns, 1965

Genus **Aporcellaimellus** Heyns, 1965

Aporcellaimellus obscurus (Thorne & Swanger, 1936) Heyns, 1965

Aporcellaimellus heynsi Baqri & Jairajpuri, 1968

Genus **Tubixiba** Monteiro & Lordello, 1980

Tubixiba parva Pretorius, Kruger and Heyns, 1987

Family QUDSIANEMATIDAE Jairajpuri, 1965

Subfamily QUDSIANEMATINAE Jairajpuri, 1965

Genus **Labronema** Thorne, 1939

Labronema confusum Andrassy, 1985

Genus **Eudorylaimus** Andrassy, 1959

Eudorylaimus chauhani (Baqri & Khera, 1978) Andrassy, 1986

Genus **Ecumenicus** Thorne, 1974

Ecumenicus monohystera (de Man, 1880) Thorne, 1974

Genus **Torumanawa** Yeates, 1967

Torumanawa shinensis Bohra & Sultata, 2008

Genus **Labronemella** Andrassy, 1985

Labronemella andrassyi (Baqri & Khera, 1975) Andrassy, 1985

Genus **Microdorylaimus** Andrassy, 1986

Microdorylaimus modicus (Krijanova, 1951) Andrassy, 1956

Subfamily DISCOLAIMINAE Siddiqi, 1969

Genus **Discolaimus** Cobb, 1913

Discolaimus major Thorne, 1939

Discolaimus tenax Siddiqi, 1964

Discolaimus laksi Khan & Laha, 1982

Genus **Mylodiscus** Thorne, 1939

Mylodiscus nanus Thorne, 1939

Mylodiscus magnus Bohra & Sultana, 2008

Genus **Discolaimium** Thorne, 1939

Discolaimium mukhtarpurens Baqri & Jairajpuri, 1969

Genus **Discolaimoides** Heyns, 1963

Discolaimoides bulbiferus (Cobb, 1906), Heyns, 1963

Genus **Latocephalus** Patil & Khan, 1982

Latocephalus conicaudatus Baqri & Bohra, 2003

Latocephalus laetanus Siddiqi, 2003

Latocephalus lotus Siddiqi, 2003

Latocephalus smithi Heyns, 1963

Latocephalus gracile Patil & Khan, 1982

Latocephalus oostenbriki (Ali, Suryawanshi & Prabha, 1973) Patil & Khan, 1982

Subfamily LORDOLLEMATINAE Siddiqi, 1969

Genus ***Poronemella*** Siddiqi, 1969

Poronemella shamimi Baqri & Bohra, 2003

Poronemella amini Siddiqi, 1969

Family NORDIIDAE Jairajpuri & A.H. Siddiqi, 1964

Subfamily NORDIINAE Jairajpuri & A.H. Siddiqi, 1964

Genus ***Longidorella*** Thorne, 1939

Longidorella xenura Khan & Siddiqi, 1963

Subfamily PUNGENTINAE Siddiqi, 1969

Genus ***Kochinema*** Heyns, 1963

Kochinema caudatum Baqri & Bohra, 2001

Kochinema farodai Baqri & Bohra, 2001

Family ACTINOLAIMIDAE Thorne, 1939

Subfamily NEOACTINOLAIMINAE Thorne, 1967

Genus ***Neoactinolaimus*** Thorne, 1967

Neoactinolaimus rajasthanensis Bohra & Sultana, 2008

Neoactinolaimus kosambus Khan, Ahmad & Jairajpuri, 1994

Family CARCHAROLAIMIDAE Thorne, 1967

Subfamily CHARCHAROLAIMINAE Thorne, 1967

Genus ***Charcharolaimus*** Thorne, 1939

Carcharolaimus masoodi Jairajpuri, 1968

Family LONGIDORIDAE Thorne, 1935

Subfamily LONGIDORINAE Thorne, 1935

Genus ***Longidorus*** Micoletzky, 1922

Longidorus pisi Edward, Misra & Singh, 1964

Longidorus sylphus Thorne, 1939

Longidorus elongatus (de Man, 1876) Micoletzky, 1922

Genus ***Paralongidorus*** Siddiqi, Hooper & Khan, 1963

Paralongidorus major Verma, 1973

Paralongidorus microlaimus Siddiqi, 1964

Paralongidorus beryllus (Siddiqi & Husain, 1965) Hunt, 1993

Family XIPHINEMATIDAE Dalmasso, 1969

Subfamily XIPHINEMATINAE Dalmasso, 1969

Genus *Xiphinema* Cobb, 1913

Xiphinema orbum Siddiqi, 1963

Xiphinema elongatum Schuurmans Stekhoven & Tunissen, 1938

Xiphinema basiri Siddiqi, 1959

Xiphinema insigne Loos, 1949

Xiphinema americanum Cobb, 1913

Family BELONDIRIDAE Thorne, 1939

Subfamily BELONDIRINAE Thorne, 1939

Genus ***Belondira*** Thorne, 1939

Belondira aquaticus Ferris, Ferris & Goseco, 1983

Subfamily DORYLAIMILLINAE Jairajpuri, 1964

Genus ***Dorylaimellus*** Cobb, 1913

Subgenus ***Mesodorylaimellus*** Jairajpuri & Ahmad, 1980

Dorylaimellus (Mesodorylaimellus) jacobii Baqri & Jairajpuri, 1968

Subgenus ***Axodorylaimellus*** Jairajpuri & Ahmad, 1980

Dorylaimellus (Axodorylaimellus) devitatus Baqri & Jairajpuri, 1968

Dorylaimellus (A.) parvulus Thorne, 1939

Subgenus ***Belondorylaimellus*** Jairajpuri & Ahmad, 1980

Dorylaimellus (Belondorylaimellus) discocephalus, Siddiqi, 1964

Family TYLENCHOLAIMIDAE Filipjev, 1934

Subfamily TYLENCHOLAIMINAE Filipjev, 1934

Genus ***Tylencholaimus*** de Man, 1876

Tylencholaimus minutus Vinciguera, 1986

Tylencholaimus annulatus Baqri & Bohra, 2001

Tylencholaimus gertii Kruger, 1965

Tylencholaimus innebus Ahmad & Jairajpuri, 1980

Tylencholaimus decens Andrassy, 1991

Tylencholaimus mongolicus Andrassy, 1967

Tylencholaimus obscurus Jairajpuri, 1965

Tylencholaimus proximus Thorne, 1939

Tylencholaimus suryawanshi Ali & Chisty, 1934

Tylencholaimus nagaurensis Baqri & Bohra, 2001

Family LEPTONCHIDAE Thorne, 1935

Subfamily LEPTONCHINAE Thorne, 1935

Genus **Leptonchus** Cobb, 1920

Leptonchus granulosus Cobb, 1920

Family MYDONOMIDAE Thorne, 1964

Subfamily MYDONOMINAE Thorne, 1964

Genus **Dorylaimoides** Thorne & Swanger, 1936

Dorylaimoides (Dorylaimoides) parateres Siddiqi, 1964

Dorylaimoides (Longidorylaimoides) leptura Siddiqi, 1965

Dorylaimoides (Digidorylaimoides) micoletzky (de Man, 1921) Thorne & Swanger, 1936

Dorylaimoides (Digidorylaimoides) pakistanensis Siddiqi, 1964

Dorylaimoides (Arcidorylaimoides) constrictus Baqri & Jairajpuri, 1969

Suborder NYGOLAIMINA Ahmad & Jairajpuri, 1979

Family NYGOLAIMIDAE Thorne, 1935

Subfamily NYGOLAIMINAE Thorne, 1935

Genus **Nygolaimus** Cobb, 1913

Nygolaimus annecki Heyns, 1968

Nygolaimus harishi Ahmad & Jairajpuri, 1980

Nygolaimus captivitatus (Andrassy, 1962) Heyns, 1968

Nygolaimus hyans Thorne, 1974

Nygolaimus shamimi Bohra & Sultana, 2008

Genus **Aquatides** Heyns, 1968

Aquatides thornei (Schneider, 1937) Ahmad & Jairajpuri, 1982

Aquatides aquaticus (Thorne, 1930) Thorne, 1974

Order DORYLIAMIDA

The members of order Dorylaimida are commonly known as 'dorylaims'. The dorylaims are found in all types of soils, in every conceivable type of habitat and usually dominate both in numbers and in species over all other soil-inhabiting nematodes. The nematodes are easily recognizable at lower magnifications by their smooth cuticle, usually "dagger-shaped" feeding apparatus; bipartite oesophagus and the absence of bursa in the male. These nematodes possess highly diversified types of feeding apparatus. The species (e.g. long-speared dorylaims) which possess fine needle-like odontostyle are capable of feeding on plant roots. Some of the dorylaims are suspected plant parasites. The majority of dorylaims according to recent researches proved that a large number of dorylaims feed by predation especially on other types of nematodes, including Tylenchida and hence, may help in biological control.

The dorylaim nematodes are colourless, bilaterally symmetrical, (radial symmetry in lip region). The average size of the body is little over 1.0mm; but species may be as small as 0.3-0.4 mm or as large as 12 mm (*Paralongidorus epimikis*). The dorylaims have cylindrical bodies and generally assume a ventrally arcuate shape upon fixation. The body wall of nematodes consists of cuticle. The dorsal, ventral and lateral sides of the body bear pores arranged medially or submedially. These pores, which may be in the form of depression on the outer surface, are arranged in one or two rows, and open into very slender cuticularised sensillar canals leading inward to the hypodermal chords. These pores function as chemoreceptors since they come into direct contact with the environment. The pores may be numerous.

The oral aperture surrounded by six lips is situated at the apical end of the body and this region is referred to as the 'lip region'. This region may or may not be marked off from the adjoining body. The oral aperture may be pore-like or circular. The amphids are well developed and are situated behind the lateral lips. They are generally cup, pouch or goblet-shaped, but their shape and size is variable.

The feeding apparatus is the anterior most part of the stomodeum, formed of two embryologically distinct regions. The upper one is called the cheilostome (Vestibulum), the guiding ring is located at its base. This is followed by the guiding sheath with the odontostyle or mural tooth situated at its base. Guiding apparatus consists of a fixed guiding ring and a thin, membranous and flexible, sleeve-like guiding sheath.

There is great variation in form of odontostyle in length, width and thickness and it is very important taxonomic characters for identification of species. The odontostyle composed of hard cuticles and is highly variable in size and shape. Odontostyle is tubular with a dorsal aperture. The size of aperture, the width of the lumen and walls of the odontostyle are highly variable in different groups of dorylaims. The size of odontostyle in relation to width of lip region and the length of the odontophore are quite useful characters in identification. The variations in odontostyle are far too many to be described here. In Nygolaims odontostyle is in the form of mural tooth, which is also of various types.

Odontophore is very important part of feeding apparatus. It is formed by cuticularisation of the anterior most part of the oesophagus. Posteriorly the odontophore is joined to the oesophageal lumen, the junction generally being surrounded by a well developed ellipsoidal swelling except in specialized forms such as longidorids. The odontophore also shows some structural diversity in length and thickness as well as in the presence of specialized structures, such as knobs or flanges at its base.

The oesophagus or pharynx is the last and longest part of stomodeum. The dorylaim oesophagus is bipartite, consisting of an anterior narrow or slender part and a posterior expanded part or basal bulb. The anterior slender part is enveloped about mid-length by a nerve ring while the posterior expanded part contains the oesophageal glands, their nuclei and orifices. In Belondirids nematodes the expanded part of the oesophagus

enveloped in muscular sheath; in tylencholaimid genera forming 'triquetrous chamber'. On the basis of structural changes, the oesophagus of dorylaims are: (i) Dorylaimoid type (ii) Nygolaimoid type (iii) Belondiroid type (iv) Tylencholaimoid type (iv) Longidoroid type. The basal expanded part of oesophagus contains five unicellular, uninucleate glands of large size and irregular shape.

The oesophago-intestinal junction is controlled by a valve which is known as 'cardia'.

The intestine or mesentron of dorylaims is single and tubular and consists of a single layer. Intestine is clearly divided into a longer anterior part, the (intestine proper) and a smaller posterior part, (the prerectum). The two regions are clearly distinguished at low magnification.

The rectum represents the last part of the alimentary canal and is termed as proctodeum. In Female the rectum is a simple tube leading to the anus, whereas in male the ejaculatory duct opens into rectum and form the cloaca which contains the copulatory structures.

The dorylaims are generally dioecious or amphigonous, with separate Females and males. Hermaphroditism does not occur in this group. There are many records (Jairajpuri et al, 1979) of intersexes in dorylaims.

The Female reproductive system consists of either of two sets of reproductive organ (didelphic) or only one set (monodelphic). In didelphic condition the vulva is mostly equatorial, one set lying anterior and other posterior to it (amphidelphic). In monodelphic Females the sexual branch is either anterior (prodelphic) or posterior to the vulva (opisthodelphic). These three conditions (amphidelphic, mono-prodelphic and mono-opisthodelphic) are important taxonomically and are regarded as characters of generic rank.

The male reproductive organs of the dorylaim nematodes of two testes (diorchic), which lead into common vasdeferens. The latter joins the ejaculatory duct and posteriorly opens into the rectum to form cloaca. The spicules in dorylaims are always paired, well built and heavily cuticularised. Lateral guiding pieces on the lateral sides of the spicules present. Gubernaculum is rarely present in dorylaims (*Aquatides*, *Laevides*, *Aulolaimoides*). The copulatory or genital papillae are called supplements. These are a series of well-developed papillae situated in the adanal pair and a series of medioventral or ventromedian or ventral supplements. Usually there is a gap between the adanal pair and the ventromedians.

The tail (post anal axial elongation of the main body) is a unique feature of nematodes as it is not found in any other group of invertebrate animals. The dorylaim nematodes exhibit a wide variety of tails that differ not only in size but also in shape. Various sizes and shapes are very useful even in a low magnification for species recognition.

In the present book 77 species of Order Dorylaimida belonging to 33 genera of 12 families have been described. Information about their diagnostic character, habitat and localities and their distribution have been provided.

Key to suborderds of Dorylaimida Pearse, 1936

(after Jairajpuri & Ahmed, 1992 (amended))

1. Feeding apparatus provided with odontostyle **Dorylaimina**
- Feeding apparatus provided with mural tooth 2
2. Mural tooth located on sub-dorsal wall of pharyngeal cavity; basal part of pharynx small, with a strongly developed triquetrous chamber **Campydorina**
- Mural tooth located on sub-ventral wall of pharyngeal cavity; basal expanded part of pharynx fairly long and without triquetrous chamber **Nygolaimina**

Suborder DORYLAIMINA Pearse, 1936

Diagnosis : Stoma simple or sclerotized. Cuticular pieces may be present around oral aperture. Amphids stirrup-shaped, with slit-like apertures. Odontostyle axial and of varying thickness and size. Guidng ring single or double. Odontophore rod-like, sometimes with small basal knobs or flanges at base. Basal expanded part of oesophagus occupies one-third to half of total oesophageal length. Oesophageal nuclei generally five, rarely three. Cardia variable in shape and size with or without disc. Femlae reproductive system monodelphic (monoprodelfic or opisthodelphic) or amphidelphic. Vulva transverse, longitudinal or pore-like. Vagina with or without sclerotization. Males with paired opposed testes, spicules paired. Gubernaculum and lateral guiding pieces may be present or absent. Ventromedian supplements few to numerous spaced or contiguous. Prerectum variable in length. Tail shapes and sizes variable, similar or dissimilar in sexes.

Type superfamily : DORYLAIMOIDEA De Man, 1876

Other superfamily : ACTINOLAIMOIDEA Thorne, 1939; LONGIDOROIDEA Thorne, 1935; BELONDIROIDEA Thorne, 1939; TYLENCHOLAIMOIDEA Filipjev, 1934

Key to superfamilies of DORYLAIMINA Pearse, 1936

1. Cheilostom strongly sclerotised, provided with plate- or basket-like structures, frequently accompanied by large onchia with or without denticles ACTINOLAIMOIDEA
- Cheilostom usually thin-walled, without onchia or denticles 2
2. Odontostyle long and attenuated; pharynx with only three glands LONGIDOROIDEA
- Odontostyle comparatively much smaller; pharynx with five glands 3
3. Expanded part of pharynx enclosed in spiral muscular sheath .. BELONDOROIDEA
- Expanded part of pharynx not enclosed in spiral muscular sheath 4
4. Sub-cuticle coarsely striated, provided with abundant radial striae; expanded part of pharynx usually a small basal bulb TYLENCHOLAIMOIDEA

- Sub-cuticle not striated, radial striae few; if present; expanded part of pharynx usually about one-half total pharyngeal length DORYLAIMOIDEA

Superfamily DORYLAIMOIDEA De Man, 1876

Diagnosis : Vestibule straight, tubular. Odontostyle hollow. Amphids usually stirrup-shaped. Odontophore rod-like, rarely with knobs or flanges at base. Expanded part of pharynx occupying about one-third to one-half of total pharyngeal length. Female reproductive system monodelphic or amphidelphic. Males with paired testis and spicules. Prerectum distinct. Tail similar or dissimilar in sexes.

Type family : DORYLAIMIDAE De Man, 1876

Other families : NORDIIDAE Jairajpuri & A.H. Siddiqi, 1964; APORCELAIMIDAE Heyns, 1965; QUDSIANEMATIDAE Jairajpuri, 1965

Key to families of DORYLAIMOIDEA De Man, 1876

1. Odontostyle with wide aperture occupying usually more than one-half its length; guiding ring not sclerotised, plicated APORCELAIMIDAE
- Odontostyle with smaller aperture, usually one-third or less its length; Guiding ring sclerotised 2
2. Odontostyle attenuated, usually longer than width of lip region NORDIIDAE
- Odontostyle not attenuated and usually about as long as width of lip region 3
3. Large and stout nematodes; usually with long filiform tail exhibiting sexual dimorphism DORYLAIMIDAE
- Medium-sized nematodes, with short tail similar in sexes QUDSIANEMATIDAE

Family DORYLAIMIDAE De Man, 1876

Diagnosis : Cuticle with fine transverse striae, rarely with distinct longitudinal ridges. Odontostyle with wide lumen and aperture. Odontophore rod-like, lacking basal knobs or flanges. Guiding ring single or double. Expanded part of oesophagus one-third to one-half oesophageal length. Female reproductive system mono-opisthodelphic or amphidelphic. Males with few to numerous ventro-median supplements, spaced contiguous or grouped. Tail similar or dissimilar in sexes. In Rajasthan, the family Dorylaimidae is represented by 16 species belonging to the following genera: *Dorylaimus* (2 spp.); *Ischiodorylaimus* (2 spp.); *Mesodorylaimus* (5 spp.); *Calodorylaimus* (1 sp.); *Laimydorus* (6 spp.); *Thornenema* (1 sp.); *Prothornenema* (1 sp.); *Sicaguttur* (1 sp.) and *Opisthodorylaimus* (1 sp.).

Type subfamily : DORYLAIMINAE de Man, 1876

Other subfamilies : LAIMYDORINAE Andrassy, 1969; THORNENEMATINAE Siddiqi, 1969; ARCTIDORYLAIMINAE (Mulvey & Anderson, 1979) Jairajpuri & Ahmad, 1992

Key to subfamilies of DORYLAIMIDAE De Man, 1876

1. Cuticle with longitudinal ridges 2
- Cuticle without longitudinal ridges 3
2. Tail similar in sexes, elongate-conoid ARCTIDORYLAIMINAE
- Tail dissimilar in sexes, elongate-conoid to filiform in Females and short, bluntly conoid in males DORYLAIMINAE
3. Vestibule provided with minute to strongly developed sclerotised plates; S2N located much anterior to pharyngeal base THORNENEMATINAE
- Vestibule not provided with sclerotised plates; S2N towards pharyngeal base LAIMYDORINAE

Subfamily DORYLAIMINAE De Man, 1876

Diagnosis : Large-sized nematodes. Cuticle with distinct longitudinal ridges. Odontostyle tubular with wide lumen and aperture. Guiding ring 'double' Odontophore rod-like. Expanded part of oesophagus 50% of neck length. Vulva transverse or pore-like. Female reproductive system amphidelphic. Tail elongate conoid to long filiform in Females and short conoid in males.

Type genus : *Dorylaimus* Dujardin, 1845

Key to genera of Dorylaiminae

1. Ventromedian supplements arranged in contiguous series of 25-55 *Dorylaimus*
- Ventromedian supplements in 2-3 groups (fascicles) *Ischiodorylaimus*

Type genus : *Dorylaimus* Dujardin, 1845

Other genus : *Ischiodorylaimus* Andrassy, 1969

Genus *Dorylaimus* Dujardin, 1845

Diagnosis : Large sized nematodes, 2-5 mm long. Lip region continuous with body; amphidial apertures with stirrup shaped fovea and slit-like apertures. Odontostyle well developed, with wide lumen and aperture. Guiding ring 'double' Odontophore rod-like. Oesophagus fairly muscular enlarging near middle. Carida elongate-conoid. Female reproductive amphidelphic. Vulva transverse or pore-like. Prerectum in males long; beginning before region of supplements. Lateral guiding pieces present. Ventromedian supplement numerous (25-55), contiguous. Tail elongate-conoid to filiform in Females and short, conoid with rounded terminus in males.

Type species : *Dorylaimus stagnalis* Dujardin, 1845

64. *Dorylaimus stagnalis* Dujardin, 1845
(Plate No. 10, Fig 64.)

Measurements : Females : L = 3.5-4.0; a = 38-41; b = 4.2-5.0; c = 13-16; V = 36-38.

Description : Female : Body slightly ventrally curved in posterior half upon fixation, tapering at both ends; more in anterior region. Cuticle with longitudinal lines. Ventral body pores distinct. Lip region slightly set off from adjacent body. Odontostyle as thick as or thinner than cuticle at the same level. Odontophore rod-like. Basal expanded part of oesophagus occupies 46-53% of neck length. Reproductive system amphidelphic. Vulva a transverse slit. Prerectum 4.2-5.4 anal body width long. Tail elongate conoid with rounded terminus.

Male : Not found.

Habitat and locality : Soil inhabiting. It is commonly found species in the State.

Distribution : Rajasthan, Gujarat.

65 *Dorylaimus murlii* Bohra & Sultana, 2008
(Plate No. 10, Fig. 6 5 & 10, A-K)

Measurements : Females : L = 2.30-2.37 mm; a = 33-45; b = 4.8-4.9; c = 14.7-15.9; c' = 4.1-6.4; V = 44-46.

Males : L = 2.40-2.81 mm; a = 35; c = 109-122; c' = 0.88-0.92; T = 50-55.

Description : Female : Body slightly ventrally curved in posterior half upon fixation, cuticle marked by 32-34 longitudinal lines. Ventral body pores distinct. Lip region narrower than body; marked with slight depression. Odontostyle 29-32 μ m long; its aperture 6-9 μ m. Odontophore 34-36 μ m long. Basal expanded part of oesophagus occupies 42-55% of neck length. Vulva a transverse slit. Prerectum 194-205 μ m or 5.8-6.0 anal body width long. Rectum 40 μ m or 0.77-1.1 anal body-width. Tail elongate conoid with rounded terminus 145-161 μ m long or 4.1-5.3 anal body-width long.

Male : Spicules 54-58 μ m long; lateral guiding pieces 18-20 μ m long. Supplements consist of an adanal and 24-28 contiguous series of ventromedians. Prerectum 300-325 μ m or 8.1-8.5 anal body-width long. Tail short bluntly rounded, 0.88-0.92 anal body-width long.

Type habitat and locality : Collected from soil around roots of Jowar (*Sorghum vulgare*) at district Alwar, Rajasthan.

Distribution : Rajasthan.

Remarks : Bohra and Sultana (2008) described this species as new to Science from the State.

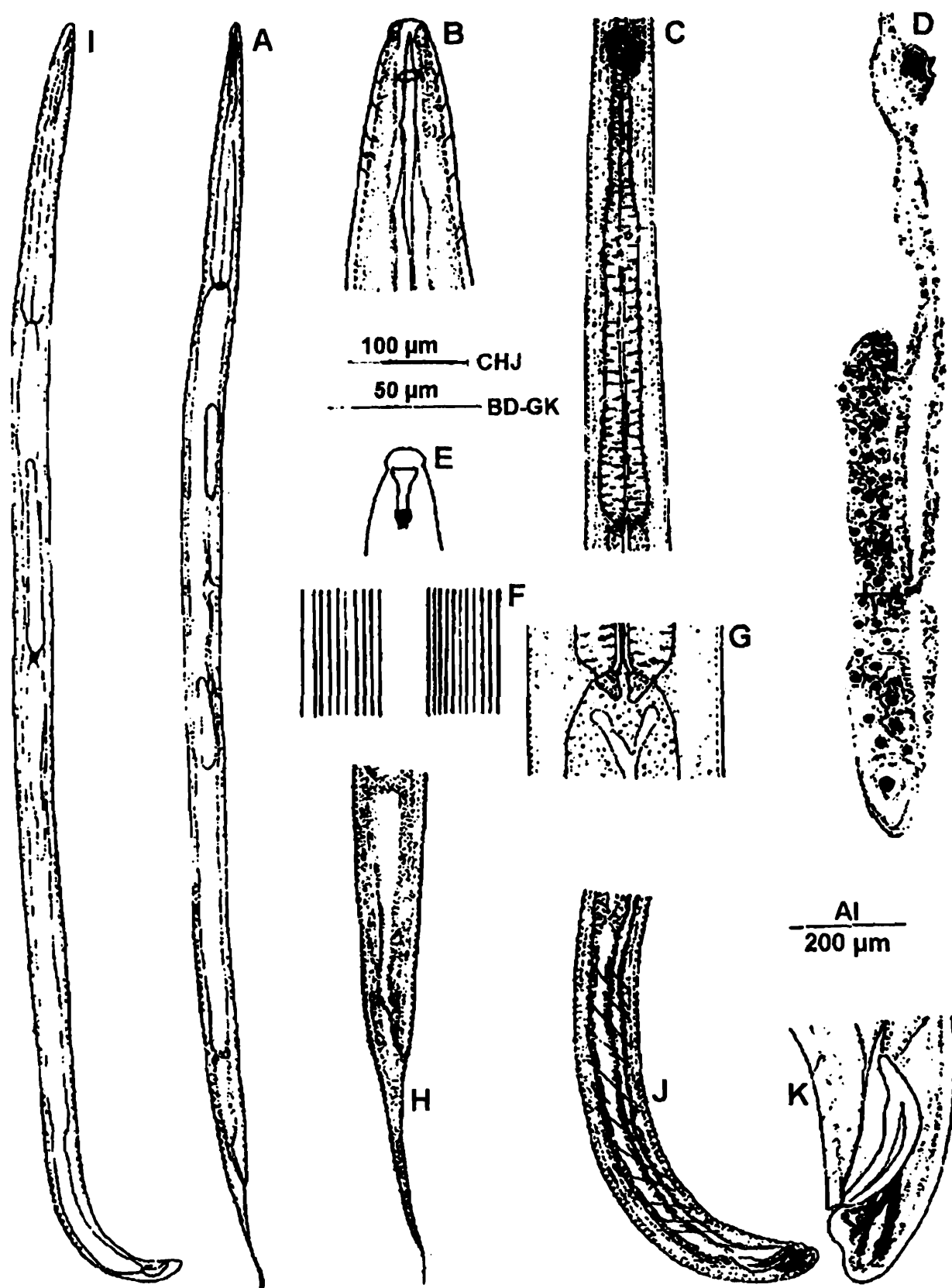


Fig. 10. *Dorylaimus murlii* Bohra & Sultana, 2008. Female (A-H) A-Entire female; B : Anterior end; C-Pharynx, D-Posterior genital Branch of female; E-Amphid, F-Longitudinal lines; G-Cardiac region; H-Posterior end of tail. Male (I-K) 1-Entire male; J-K: Posterior end of tail.

Genus *Ischiodorylaimus* Andrassy, 1969

Diagnosis : Body usually 6-8 mm long. Lip region continuous with body. Amphids with stirrup-shaped fovea. Odontostyle massive with wide lumen and aperture. Guiding ring 'double' Odontophore rod-like. Oesophagus enlarging near middle. Reproductive system amphidelphic. Prerectum in male long beginning before region of supplement. Ventromedian supplements in two groups (fascicles), single supplement present in between these groups. Males with developed copulation pad. Tail long, filiform in Females and short, conoid in males.

Type species : *Ischiodorylaimus gulliver* (Andrassy, 1964) Andrassy, 1969

66. *Ischiodorylaimus baqrii* Bohra & Sultana, 2008
(Plate No. 10, Fig. 66. & 11, A-K)

Measurements : Female : L = 3.05 mm; a = 38; b = 4.3; c = 15; c' = 5.2; V = 45; odontostyle = 44 µm; odontophore = 45 µm; tail = 228 µm.

Males : L = 2.70 mm; a = 37; b = 4.0; c = 77.2 c' = 0.81; T = 55.

Description : Female : Body slightly ventrally curved upon fixation, tapering more in posterior region. Lip region narrower, marked by depression. Longitudinal line 36-40. Odontostyle 44 µm long; aperture 15 µm or 34% of odontostyle length. Odontophore 45 µm long. Basal expanded part of oesophagus occupies 49-52% of neck length. Vulva a transvers slit. Prerectum 245 µm or 5.2 anal body-width long. Rectum 1.0 anal body-width long. Tail elongate conoid with rounded terminus, 238 µm long or 5.2 anal body-width long.

Male : Spicules 85 µm long. Lateral guiding pieces well developed 13 µm long. Supplements consist of an adanal and 21+5+15 ventromedians, arranged in two fascicles while five irregularly supplement present in between two fascicles. Prerectum 325 µm or 7.7 anal body-widths long. Tail short bluntly rounded 35 µm long or 0.81 anal body-widths long.

Type habitat and locality : Collected from soil around roots of Pearl millet (*Pennisetum sativa*) at district Dholpur, Rajasthan.

Distribution : Rajasthan.

Remark : Bohra and Sultana (2008) described this species as new to Science.

67. *Ischiodorylaimus rathori* Bohra & Baqri, 2005
(Plate No. 10, Fig. 67 & 12, A-I)

Measurements : Females : L = 2.67-2.99 mm; a = 32.5-35.0; b = 4.5-4.8; c = 14.1-15.8; c' = 4.8-5.3; V = 16-17/41-43¹⁹⁻²¹

Males : L = 2.37-2.55 mm; a = 30.5-36.5; b = 3.9-4.0; c = 75-84; c' = 0.65-0.77; T = 58-60.

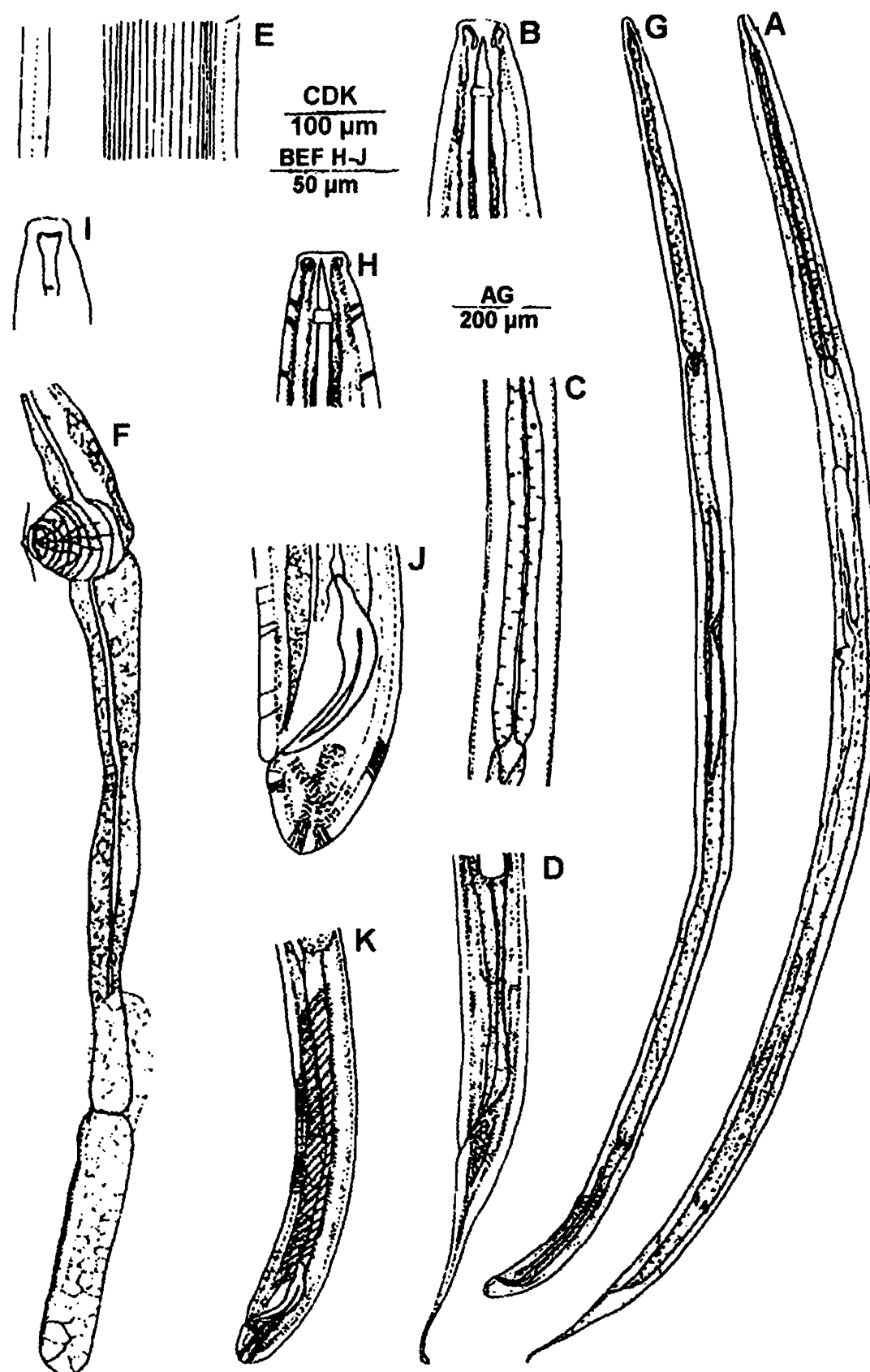


Fig. 11. *Ischiodyrillaimus baqrii* Bohra & Sultana, 2008. Female (A-F) A-Entire female; B-Anterior end; C-Pharynx; D-Posterior end of female; E-Posterior genital branch of female. Male (G-K) G-Entire male; H-Anterior end; I-Amphid; J-K-Posterior end of male.

Description : Female : Body slightly ventrally curved in posterior half upon fixation, Longitudinal line 30-32 μm , Lip region amalgamated marked with slight depression, flat at apex. Odontostyle 40-41 μm long; its aperture 11-12 μm . Guiding ring 18-19 μm from anterior end. Odontophore 42-44 μm long. Basal expanded part of oesophagus occupies 46-48% of neck length. Vulva transverse slit. Reproductive system amphidelphic. Prerectum 192-200 μm or 5.0-5.2 anal body-width long. Rectum 54-55 μm or 1.3-1.5 anal body-width long. Tail 168-212 μm elongate conoid with rounded terminus 4.4-5.3 anal body-width long, with two caudal pores on each side.

Male : Spicules 65-75 μm long. Lateral guiding pieces 15-16 μm long. The supplements consists of an adanal and 21-24 ventromedians. The ventromedian supplements are arranged in two fascicles while 3-4 irregularly spaced supplements are present in between the two fascicles. Prerectum 397-427 μm or 9.2-9.7 anal body-width long. Tail 28-34 μm short bluntly rounded, 0.65-0.77 anal body-width long, five caudal pores on each side.

Type habitat and locality : Collected from soil around water body at Ranthombhore National Park Sawai Madhopur, Rajasthan, India.

Distribution : Rajasthan.

Remark : Bohra and Baqri (2005) described this species as new to Science.

Subfamily LAIMYDORINAE Andr ssy, 1969

Diagnosis : Cuticle without longitudinal ridges. Odontostyle with wide lumen and aperture. Odontophore rod-like. Guiding ring single or double. Expanded part of oesophagus about one half of oesophageal length. Position of oesophageal gland nuclei and their orifices as in Dorylaiminae. Vulva transverse or longitudinal. Female reproductive system amphidelphic. Ventromedian supplements contiguous or spaced. Tails either similar or dissimilar in sexes.

Type genus : *Laimydorus* Siddiqi, 1969

Other genera : *Mesodorylaimus* Andrassy, 1959; *Prodorylaimus* Andrassy, 1959; *Amphidorylaimus* Andrassy, 1964; *Afrodorylaimus* Andrassy, 1964; *Jairajpuri*, 1966; *Calodorylaimus* Andrassy, 1969; *Idiodorylaimus* Andrassy, 1969; *Prodorylaimium* Andrassy, 1969; *Minidorylaimus* Andrassy, 1972; *Calcaridorylaimus* Andrassy, 1986; *Miodorylaimus* Andrassy, 1986; *Laimydorus* Siddiqi, 1969.

Key to genera of Laimydorinae

1. Tail similar in sexes 2
 Tail dissimilar in sexes 4
2. Lip region set off; spicules narrow, non-dorylaimoid ***Amphidorylaimus***
 Lip region continuous; spicules broad, dorylaimoid 3

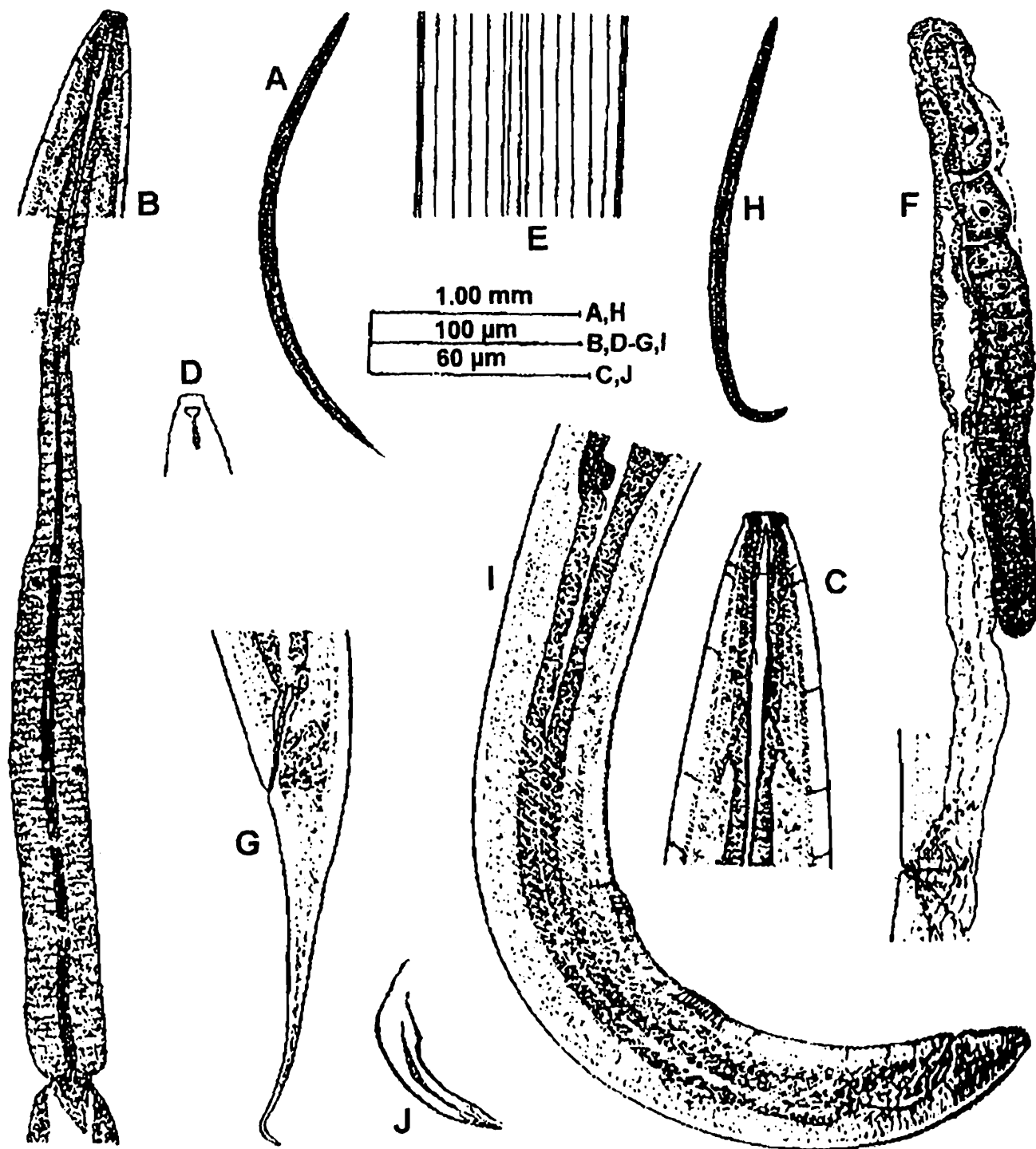


Fig. 12. *Ischiodorylaimus rathori* Bohra & Baqri, 2005. A-Entire female; B-Oesophageal region; C-Anterior end; D-Anterior end showing Amphid; E-Longitudinal lines; F-Female anterior genital tract; G-Female Posterior end; H-Entire male; I-Male posterior region; J-Spicule and lateral guiding piece.

3. Ventromedian supplements numerous, contiguous ***Prodorylaimus***
 Ventromedian supplements few, spaced ***Prodorylaimium***
4. Guiding ring sclerotized, 'double'; prerectum in male beginning well in front of supplements 5
 – Guiding ring not sclerotized, single or weakly 'double'; prerectum in males short, usually beginning within range of supplements 6
5. Sub-cuticle with coarse striations or annulations ***Idiodorylaimus***
 – Sub-cuticle without coarse striations or annulations ***Laimydorus***
6. Male tail with rounded terminus 7
 – Male tail with pointed terminus ***Afrodorylaimus***
7. Odontostyle asymmetrical; two parts of oesophagus not clearly demarcated
 ***Drepanodorylaimus***
 – Odontostyle symmetrical; two parts of oesophagus clearly demarcated 8
8. Odontophore slightly swollen at base ***Minidorylaimus***
 – Odontophore rod-like 9
9. Ventromedian supplements contiguous or spaced 10
 Ventromedian supplements in two groups (fascicles) ***Calodorylaimus***
10. Cuticle thin; vulva not sclerotised; spicules comparatively weak; prerectum extending much beyond range of supplements ***Miodorylaimus***
 – Cuticle thick; vulva sclerotised; spicules well developed; prerectum beginning within range of supplements or slightly anterior to them 11
11. Spicules large, with double contour on dorsal side and spur near tip; supplements very small ***Calcaridorylaimus***
 – Spicules without double contour on dorsal side and spur near tip absent; supplements well developed ***Mesodorylaimus***

Genus ***Mesodorylaimus*** Andrassy, 1959

Diagnosis : Small to moderately medium sized nematodes (0.8 to 2.3 mm). Cuticle smooth, rarely finely striated. Lip region continuous or set off by depression. Lips angular or rounded. Amphids stirrup-shaped. Odontostyle slightly longer than one lip region-width. Odontostyle length varies from 7 to 25 μ m, aperture occupying one third of its length. Guiding ring thin single. Odontophore rod-like. Oesophagus muscular, enlarged in its middle or posterior to it. Cardia conoid.

Type species : *Mesodorylaimus mesonyctius* (Kreis, 1930) Andrassy, 1959

The representatives of *Mesodorylaimus* are distributed over the world and fairly common in various terrestrial and limnic habitats. Five species of genus *Mesodorylaimus* are described hereunder.

68. *Mesodorylaimus bhansalii* Baqri & Bohra, 2001

(Plate No. 11, Fig. 68 & 13, A-G)

Measurements : Females : L = 1.18-1.2 mm; a = 25-26; b = 5.4-6.0; c = 9-10; V = 45-47.

Males : L = 1.07-1.09 mm; a = 21-22; b = 4.5-5.0; c = 54-59

Description : Female : Cuticle thick finely striated. Lip region dome-shaped. Amphids with sirrup-shaped fovea and slit like aperture. Odontostyle 11-14 μ m long. Odontophore rod like, 15-17 μ m long, 1.2-1.3 times the odontostyle length. Pharyngo-intestinal disc absent. Female reproductive system amphidelphic. Prerectum 2.6-2.8 anal body width long. Tail elongate, 5.3-5.4 anal body width long, with two caudal pores on each side.

Male : Spicules 35-37 μ m long. Lateral guiding pieces rod-shaped, 7-8 μ m long.

Habitat and locality : Collected from soil around roots of maize (*Zea mays*) at Gogunda, district Udaipur.

Distribution : Rajasthan.

Remarks : Baqri and Bohra (2001) described this species as new to Science from the State.

69. *Mesodorylaimus kauli* Baqri & Bohra, 2001.

(Plate No. 11, Fig. 69 & 14 A-H)

Measurements : Females : L = 1.00-1.4mm; a = 25-32; b = 3.7-5.0; c = 27-30; V = 17-18 52-54¹⁸⁻¹⁹

Males : L = 1.10-1.33 mm; a = 31-32; b = 3.7-5.0; c = 60-65; T = 60-65.

Description : Female : Lip region slightly narrower than adjoining body, demarcated by a slight depression. Odontostyle 10-13 μ m long. Guiding ring 7-8 μ m from anterior end. Odontophore 19-20 μ m long. Basal expanded part of oesophagus occupies 34-40% of neck region. Prerectum 75-76 μ m or 3.4-3.9 anal body width long. Rectum 22-24 μ m or 1.1-1.2 anal body-width. Tail convex-conoid with a dorsally bent elongated tip, 1.8-1.9 anal body long.

Male : Spicules 40-42 μ m long. Lateral guiding pieces 8-10 μ m long. One adanal pair, and 10-11 regularly spaced ventromedian supplements. Prerectum 95-100 μ m long, begins from third or fourth ventromedian supplements. Tail 20-22 μ m conoid rounded or one anal body width long.

Habitat and locality : Collected from soil around roots of wheat (*Triticum aestivum*) at Jhalawar Road, district Jhalawar.

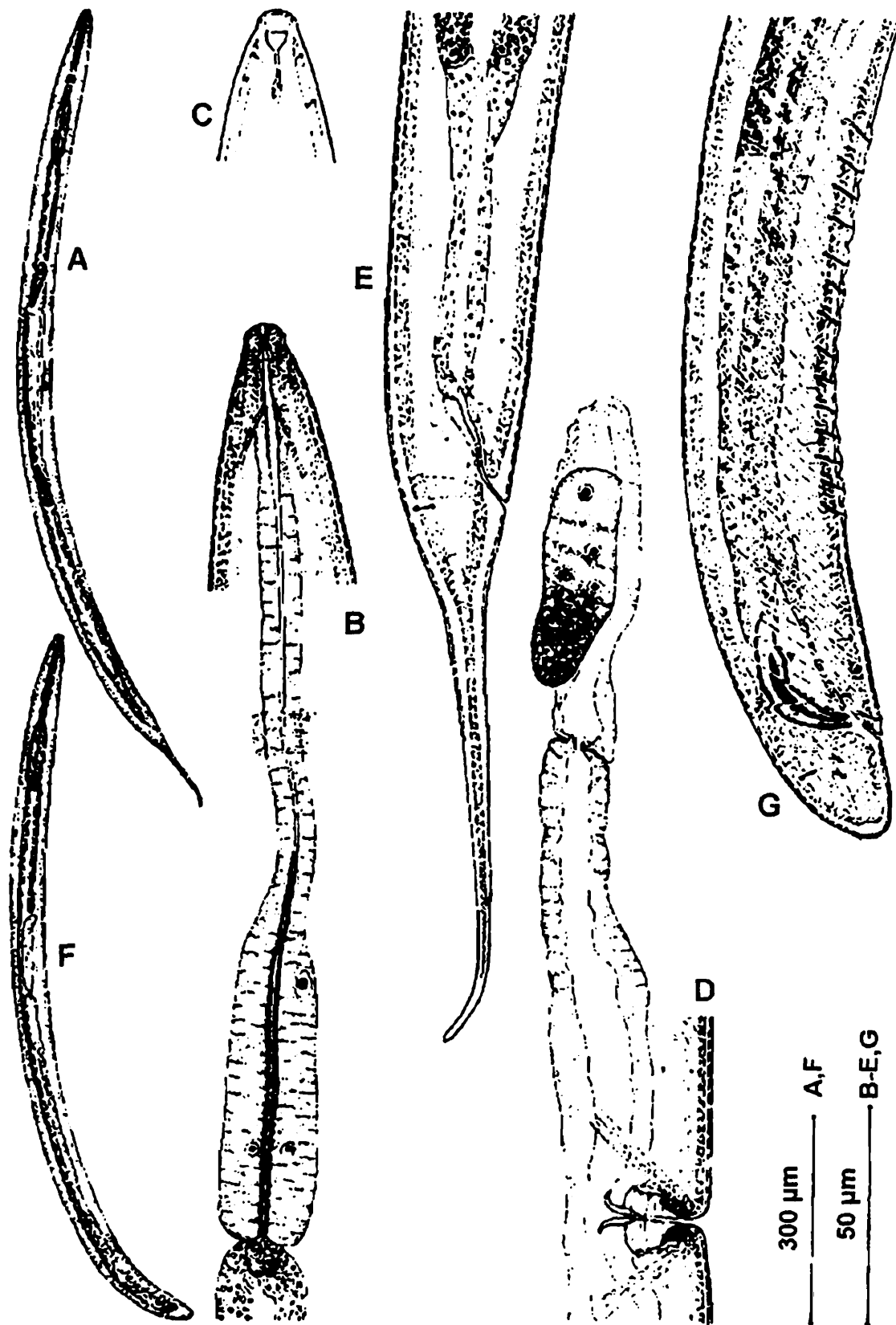


Fig. 13. *Mesodorylaimus bhansalii* Baqri & Bohra, 2001. Female (A-E) and Male (F-G) A-Entire female; B-Pharyngeal region; C-Anterior end (surface view); D-Anterior genital branch; E-Tail; F-Entire male; G-Posterior region.

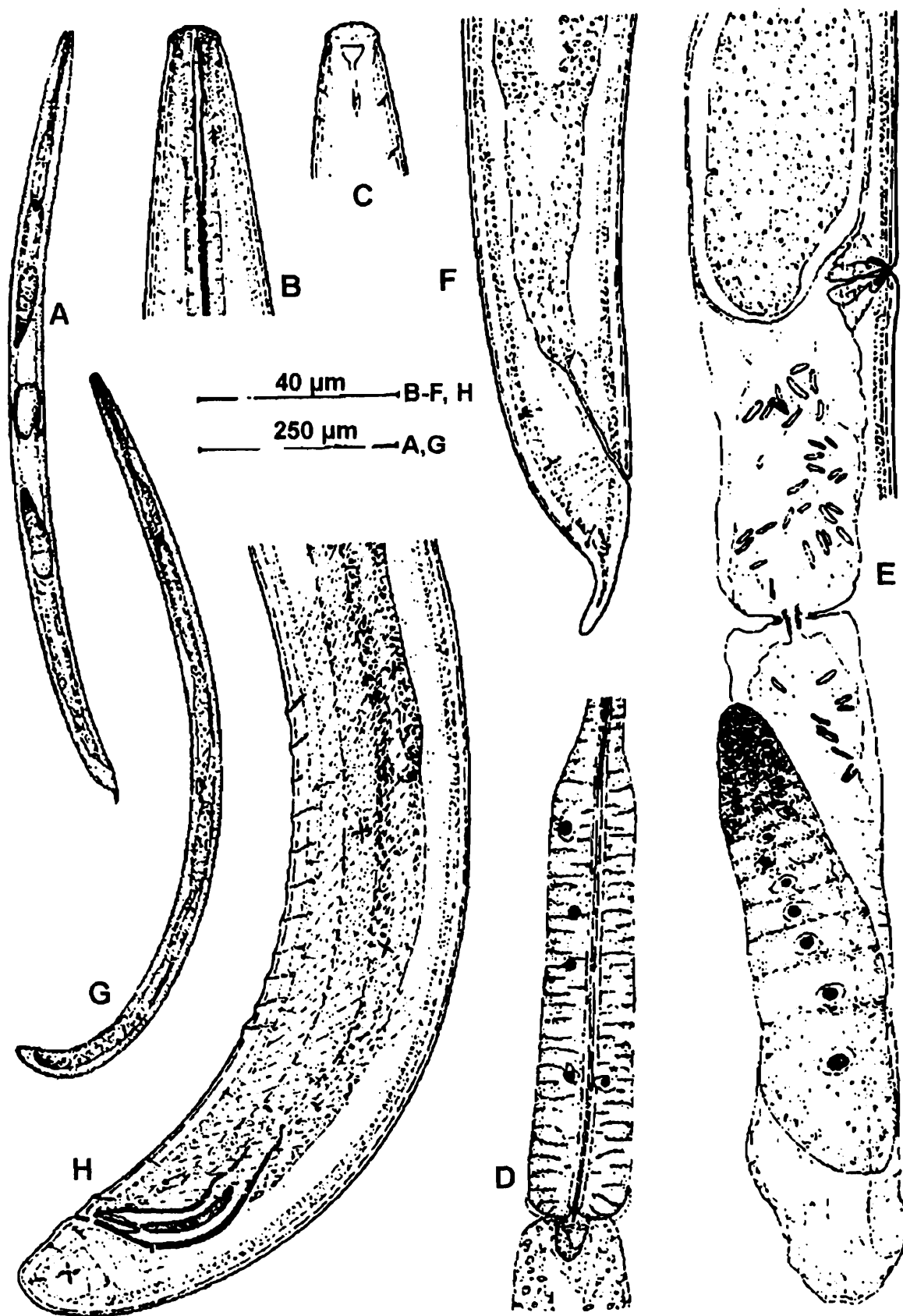


Fig. 14. *Mesodorylaimus kauli* Baqri & Bohra, 2001. Female (A-F) and Male (G-H). A-Entire Female; B-Anterior end; C-Anterior end (surface view) D-Pharyngeal region; E-Posterior genital branch; F-Tail; G-Entire male; H-Posterior region.

Other Localities : Gogunda, district, Udaipur.

Distribution : Rajasthan, Gujarat.

Remarks : Baqri and Bohra (2001) described this species as new to Science from the State.

70. *Mesodorylaimus mesonyctius* (Kreis, 1930) Andrassy, 1959
(Plate No. 11, Fig. 70 & 15, A-C)

Measurements : Females : L = 1.30-1.37 mm; a = 27-32; b = 4.8-5.4; c = 16-19; V = 1-1249-52¹¹⁻¹².

Males : L = 1.23-1.25 mm; a = 27-28, b = 4.4-5.0; c = 44-45; T = 45-50.

Description : Female : Lip region marked by a constriction. Odontostyle 12-14 μ m long, its aperture 3-4 μ m. Odontophore 16-18 μ m long. Guiding ring at 7-8 μ m from anterior end. Basal portion of oesophagus 39-45% of oesophageal length. Prerectum 80-105 μ m or 4.0-4.3 anal body-width long. Tail 60-75 μ m or 3.0-3.5 anal body-width long, conoid then spicate.

Male : Spicules 38-43 μ m long. Ventromedian supplements nine; spaced irregularly. Tail short, rounded conoid, 27-28 μ m long or 0.9-1.2 anal body-width long.

Habitat and localities : Soil inhabiting. Darrah, district Kota; Peeh, district Nagaur; Kela Devi road, district Karauli.

Distribution : Rajasthan, Gujarat, Andaman and Nicobar Islands.

71. *Mesodorylaimus margeritus* Basson & Heyns, 1974
(Plate No. 12, Fig. 71 & 15, F-G)

Measurements : Females : L = 1.47-1.54 mm; a = 48-49; b = 4.2-4.8; c = 18-19; V = 7-858-59⁷⁻⁸.

Description : Female : Lip region distinctly set off. Odontostyle 12-13 μ m long; aperture 4-5 μ m. Odontophore 18-19 μ m long. Guiding ring 8-9 μ m from anterior end. Basal expanded part of oesophagus occupies 45-47% of oesophageal length. Female tail elongate conoid, 78-80 μ m or 3.0 anal body-width long, dorsally bent in posterior half.

Male : Not found.

Habitat and localities : Soil inhabiting. Jas Nagar, district Nagaur; Rajakheda, district Dholpur.

Distribution : Rajasthan, Gujarat.

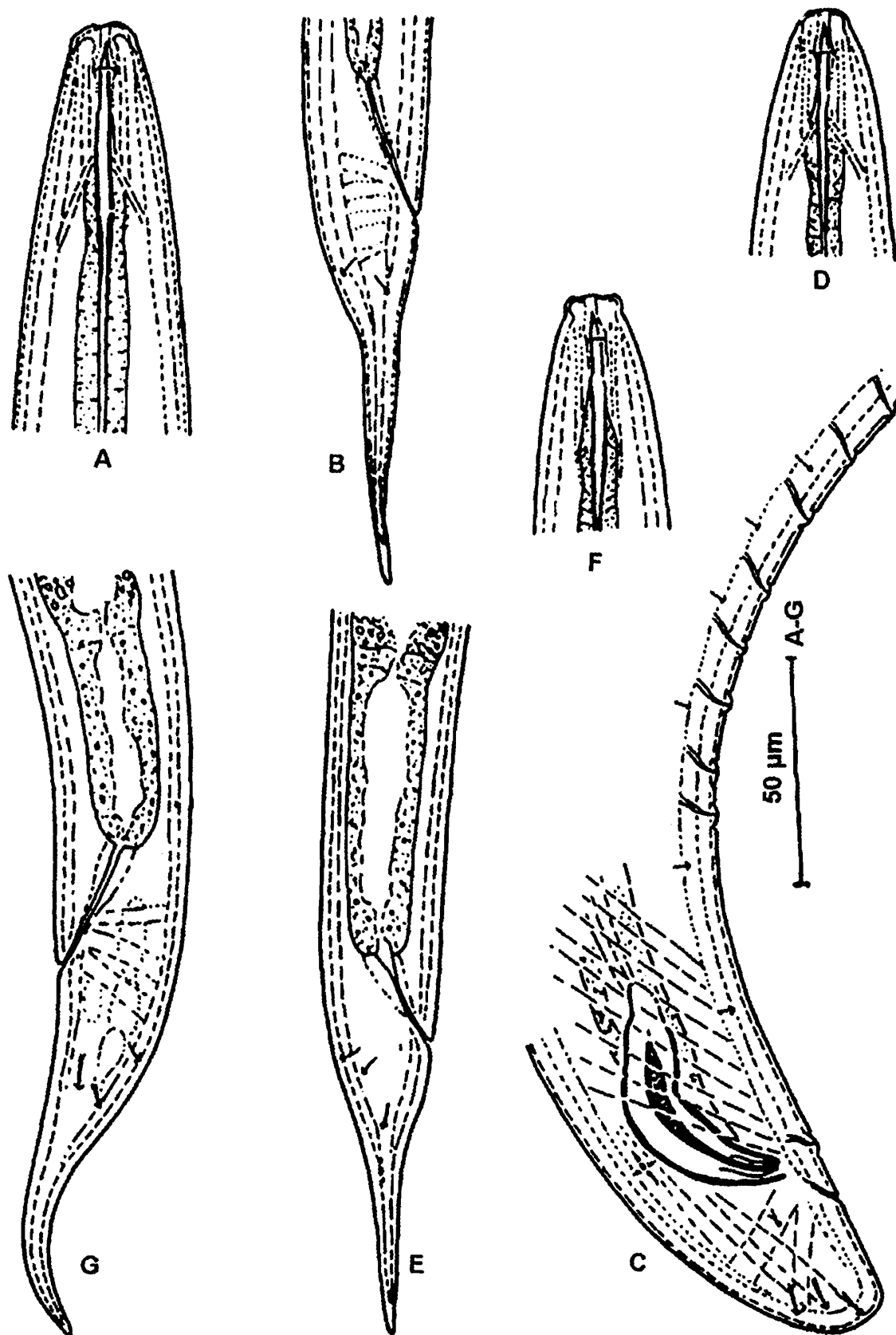


Fig. 15. A-C: *Mesodorylaimus mesonyctius* (Kreis, 1930) Andrassy, 1959; A-Female anterior end; B-Female tail; C-Male tail; D-E: *Mesodorylaimus litoralis* Loof, 1969. D-Female anterior end; E-Female tail; F-G: *Mesodorylaimus margeritus* Basson & Heyns, 1974. F-Female anterior end; G-Female tail.

72. *Mesodorylaimus litoralis* Loof, 1969
(Fig. 15, D-E)

Measurements : Females : L = 1.20-1.43 mm; a = 29 - 31; b = 4.5 - 4.7; c = 15-17; V = 1547-50¹⁶

Description : Female : Body almost straight upon fixation, tapering slightly at both extremities. Cuticle 2-4 µm thick, finely striated. Lip region marked by slight depression. Odontostyle 13-15 µm long; aperture 4-5 µm or 30-33% of odontostyle length. Odontophore 24-26 µm long. Guiding ring 7-8 µm or about 3/4th of head-width from anterior end. Basal expanded part of oesophagus occupies 45-46% of total oesophageal length. Female reproductive system amphidelphic. Ovaries reflexed. Prerectum 110-112 µm or 4 times the anal body-width. Rectum 55-60 µm or two anal body-width long. Female tail elongate, 80-82 µm or 2.8 anal body-width long, with two caudal pores on each side.

Male : Not found

Habitat and locality : Collected from soil around roots of rice at Gogunda, district Udaipur.

Genus *Calodorylaimus* Andrassy, 1969

Diagnosis : Large sized nematodes 2-4 mm long. Cuticle finely striated. Lip region truncate, offset by depression, wider than adjoining body. Odontostyle long, its aperture about one third of its length. Guiding ring single. Odontophore rod-like. Oesophagus muscular, enlarging gradually near middle. Cardia elongate-conoid. Female reproductive system amphidelphic. Vulva transverse; vagina distally sclerotized. Prerectum long in both sexes. Ventromedian supplements in two groups, single supplement also present in between groups. Tail long, filiform in Females and short, conoid in males. Caudal papillae numerous.

Type species : *Calodorylaimus octo* Andrassy, 1960.

73. *Calodorylaimus wasimi* Baqri & Bohra, 2003.
(Plate No. 12, Fig. 73 & 16, A-J)

Measurements : Females : L = 1.69-1.73 mm; a = 31-33; b = 4.6-4.8; c = 9.6-10.8; V = 45-46.

Males : L = 1.37-1.40 mm; a = 31-33; b = 4.0-4.5; c = 63-65; c' = 1.0; T = 55.

Description : Female : Body slightly curved ventrally upon fixation, gradually tapering towards both extremities. Lip region narrower than adjoining body, marked by depression, flat at apex. Odontostyle 20-21 µm long; aperture 4-5 µm or 18-23% of odontostyle length. Guiding ring 0.6-0.7 lip region-width from anterior end. Odontophore 25-26 µm long, rod-like. Basal expanded part of oesophagus occupies 40-43% of neck length. Vulva a transverse slit. Reproductive system amphidelphic. Prerectum 85-86 µm long or 4 anal body width long. Rectum 1.6-1.7 anal body-width long. Tail 156-180 µm long, elongate filiform, 8.2-9.4 times anal body-width long.

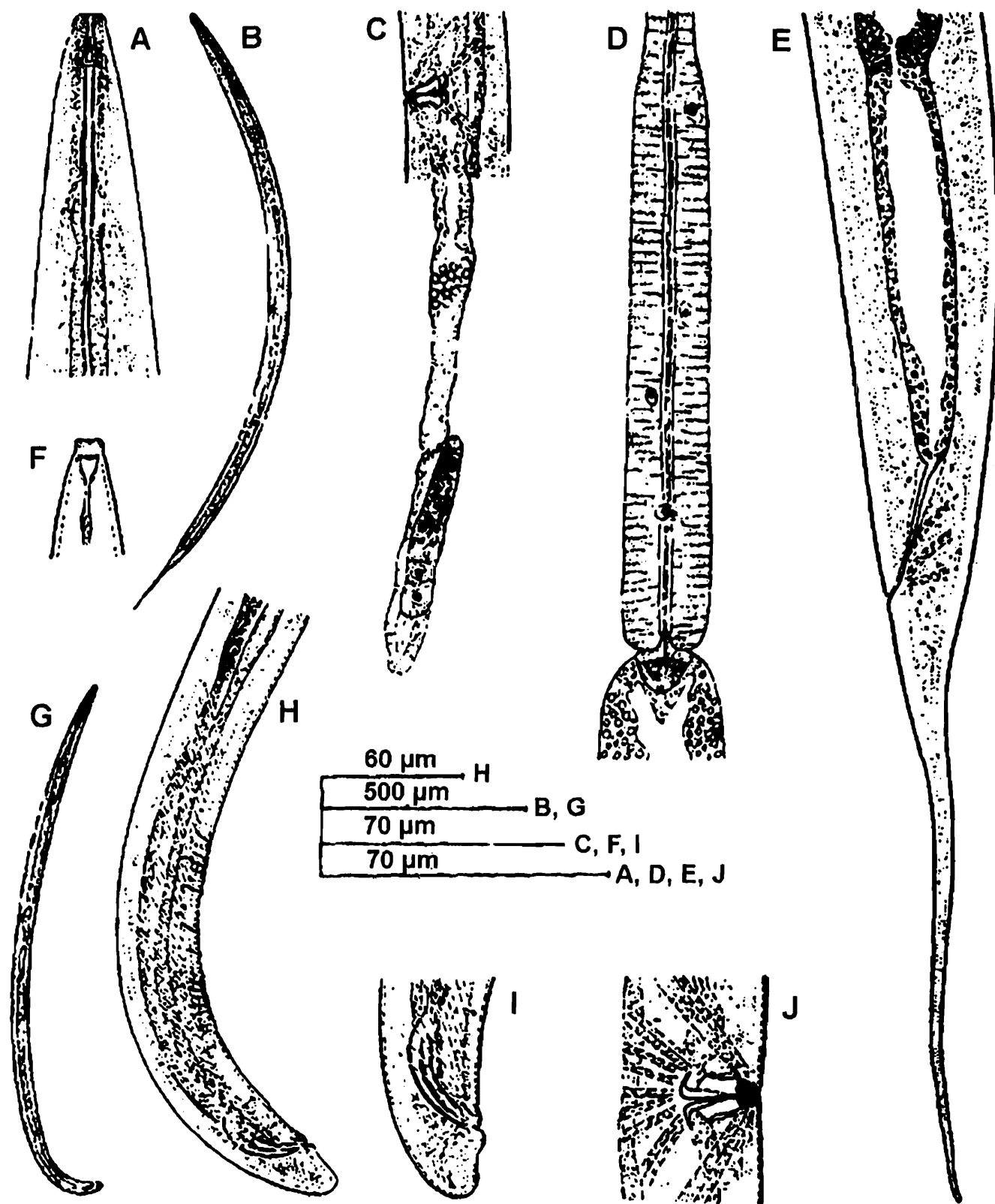


Fig. 16. *Calodorylaimus wasimi* Baqri & Bohra, 2003. A-Female anterior end; B-Entire female; C-Female posterior genital tract; D-Expanded parts of oesophagus; E-Female posterior end; F-Anterior end showing amphid; G-Entire male; H-Male posterior region; I-Male tail end; J-Vulval region.

Male : Spicules 36-38 μm long. Lateral guiding pieces 7-8 μm long. Ventromedian supplements arranged in two groups, two spaced supplements in between, 7+2+9 to 9+2+8. Prerectum 197-205 μm long or 9.8 anal body-width long. Tail rounded conoid, about one anal body-width long.

Habitat and locality : Collected from soil around roots of gram (*Phaseolus* sp.) from Bansda, district Navsari, Gujarat, India.

Other localities : Tijara road, district Alwar.

Distribution : Rajasthan, Gujarat.

Remarks : Baqri and Bohra (2003) described this species as new to Science from the Gujarat State.

Genus *Laimydorus* Siddiqi, 1969

Diagnosis : Body more than 2 mm long. Cuticle thick, with fine striae, without ridges or punctuations, sometimes with scattered radial striae. Lip region may be continuous or set off, lips amalgamated. Amphids with stirrup-shaped fovea and large aperture. Odontostyle massive with wide lumen and aperture. Guiding ring double and sclerotized. Odontophore rod-like. Oesophagus muscular, gradually enlarging near middle to form the basal expanded portion. Cardia distinct, digitate. Female reproductive system amphidelphic. Vulva longitudinal. Ventromedian supplements numerous, contiguous. Spicules long dorylaimoid with lateral guiding pieces. Tail long filiform in Females and short conoid with rounded tip in males.

Type species : *Laimydorus prolificus* (Thorne & Swanger, 1936) Siddiqi, 1969

The species of genus *Laimydorus* are widely distributed in India. In the present study, six known species have been collected of which brief description are provided hereunder.

74. *Laimydorus baldus* Baqri & Jana, 1982 (Plate No. 12, Fig. 74 & 17,C-D)

Measurements : Females : L = 2.11-2.44 mm; a = 34-36; b = 4.8-5.1; c = 10.8-11.8; V = 12-14/43-48/13-15

Males : L = 2.37-2.41 mm; a = 33-35; b = 4.7-4.9; c = 11.5-11.8; T = 50-55.

Description : Female : Lip region marked by a depression from body. Odontostyle 24-25 μm long, aperture 42-46% of odontostyle length. Guiding ring 14-15 μm from anterior end. Odontophore 29-30 μm . Basal part of oesophagus occupies 46-52% of neck region. The 'Z' organs observed in middle of uteri. Tail elongate-filiform, 190-224 μm or 7-8 anal body width long.

Male : Spicules 53-55 μm long. Lateral guiding pieces rod-shaped, 8-9 μm long. Prerectum 230 μm or 8 anal body width long. Supplements consist of an adanal pair and a series of 24 contiguous ventromedians. Tail bluntly rounded, 21-22 μm or 0.8 anal body widths long.

Habitat and localities : Soil inhabiting. Gogunda, district Udaipur; Mathania, district Jodhpur.

Distribution : Rajasthan, West Bengal.

75. *Laimydorus siddiqii* Baqri & Jana, 1982

(Plate No. 12, Fig. 75)

Measurements : Females : L = 2.3-2.5; a = 47-49; b = 4.4-4.7; c = 7.9-8.1; V = 46-48.

Males : L = 2.5-2.6 mm; a = 44-46; b = 4.1-4.2; c = 93-102.

Description : Females : Body almost straight, slightly ventrally curved posterior to vulva upon fixation. Lip region continuous with body contour. Odontostyle 27-30 μ m long, aperture 38-43% of odontostyle length. Guiding ring 1.0-1.1 lip region-width from anterior end. Odontophore 30-36 μ m long. Basal expanded part of pharynx occupies 52-60% of the pharyngeal length. Female reproductive system amphidelphic. Prerectum 31-34 μ m long. Rectum 32-35 μ m or 1.1-1.3 anal body width long. Tail elongate filiform, 12-13 anal body width long.

Male : Similar to Female in morphology except reproductive organs. Sperms spindle shape. Spicules 52-56 μ m long. Lateral guiding pieces 10-13 μ m long. Tail bluntly rounded.

Habitat and locality : Soil inhabiting. Phytophagous. Desuri, Rajsamand, KWLS, Udaipur.

Distribution : Rajasthan.

76. *Laimydorus finalis* Thorne, 1974

(Plate No. 13, Fig. 76)

Measurements : Female : L = 4.15 mm; a = 38; b = 5.4; c = 16; V = 8.941^{8-9} .

Male : L = 3.91 mm; a = 35; b = 6.3; c = 97; T = 45.

Description : Female : Lip region marked by a depression. Odontostyle 49 μ m long; its aperture 18 μ m wide. Odontophore 50 μ m long. Guiding ring at 29 μ m from anterior end. Basal expanded portion of oesophagus occupies 49% of oesophageal length. Prerectum 350 μ m or 7.6 anal body width long. Tail elongate filiform, 250 μ m or 5.4 anal body-width long.

Male : Spicules 83 μ m long. Guiding pieces 15 μ m long. Supplements consist of an adanal pair and 42 contiguous ventromedians. Tail bluntly rounded, 40 μ m long or 0.7 anal body width long.

Habitat and localities : Soil inhabiting. Sumer, district Rajsamand; Keladevi road, district Karauli.

Distribution : West Bengal, Rajasthan, Gujarat.

77. *Laimydorus serpentinus* (Thorne & Swanger, 1936) Siddiqi, 1969
(Plate No. 13, Fig. 77)

Measurements : Females : L = 3.56-3.67 mm; a = 46.3-47.1; b = 11.8-12.6; c = 14.1-15.9; V = 39-40.

Male : L = 3.68-3.70 mm; a = 40.2-42.5; b = 11.2-11.9; c = 0.7-0.8

Description : Female : Lip region continuous with adjacent body contour. Odontostyle robust, 45-46 μ m long, twice as long as width of lip region, aperture occupying one-third of its length. Odontophore rod-like, 40-42 μ m long. Basal expanded part of pharynx occupies 46-48% of neck region. Female reproductive system amphidelphic. Prerectum 6-7 and rectum 1.3-1.4 anal body-width long. Tail 220-230 μ m long, about 5.3 anal body-width long.

Male : Similar to Female in general morphology except more curved ventrally tail and reproductive system. Spicules 85-90 μ m long. Tail about 0.8 anal body width long. Ventromedian supplements.

Habitat and locality : Soil inhabiting. Sermathura, district Dholpur.

Distribution : Rajasthan.

78. *Laimydorus kherai* Baqri, 1985
(Plate No. 13, Fig. 78 & 17, F-G)

Measurements : Females : L = 2.64-3.0 mm; a = 40-45; b = 4.6-5.0; c = 12-13; V = 15-17; 45-47¹⁶⁻¹⁸

Males : L = 2.38-2.56mm; a = 33-36; b = 4.6-4.7; c = 102-103; T = 52-59.

Description : Female : Body slightly ventrally curved in posterior half upon fixation. Cuticle 2-5 μ m thick, finely striated. Lip region marked by slight depression from body. Odontostyle 30-33 μ m; aperture 13-15 μ m or about two-third of odontostyle length. Guiding ring at 17-18 μ m or one lip region-width from anterior end. Odontophore 35-37 μ m long. Basal expanded part of oesophagus occupies 44-45% of the oesophageal length. Prerectum 125-135 μ m or about 4 anal body-width long. Rectum 35-40 μ m or about 1.0-1.2 anal body-width long. Tail elongate filiform, 214-230 μ m or 6.9-7.1 anal body-width long, with three caudal pores.

Male : Spicules 59-60 μ m long, arcuate with lateal guiding pieces. One adanal and 25-26 contiguous ventromedian supplements. The first ventromedian supplement situated 2.3-2.5 anal body-width from cloacal opening. Prerectum 130-135 μ m or 4.8-5.0 anal body-width long. Rectum 30-35 or about 0.8-0.9 anal body-width long. Tail bluntly rounded 23-25 μ m long or 0.8 anal body-width long, with three caudal pores on each side.

Habitat and locality : Soil inhabiting. Collected from soil around millet at Ghumti, district Pali.

Distribution : Rajasthan.

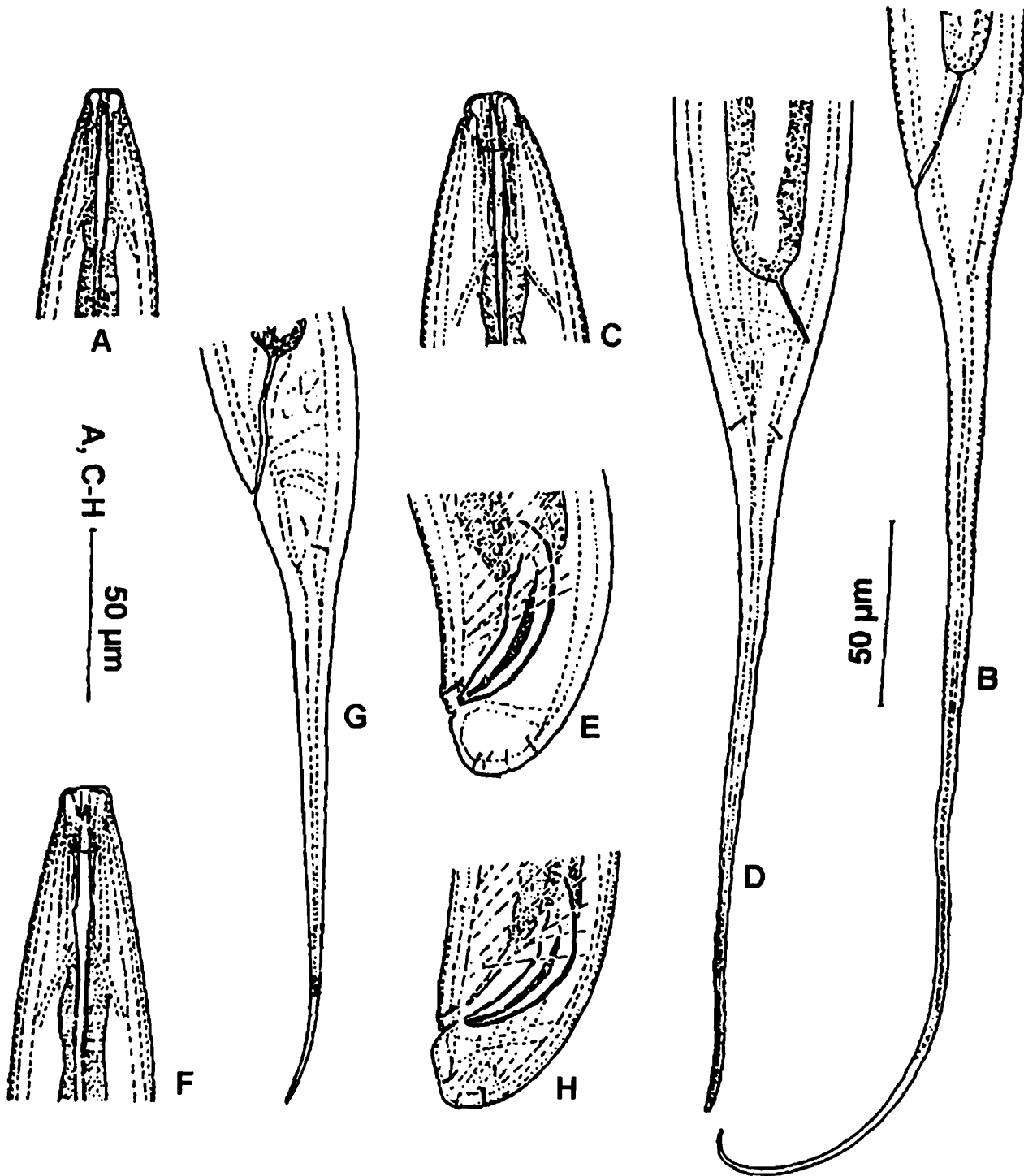


Fig. 17. A-B: *Laimydorus thornei* Andrassy, 1969: A-Female anterior end; B-Female tail; C-E: *Laimydorus baldus* Baqri & Jana, 1982. C-Female anterior end; D-Female tail; E-Male tail. F-G: *Laimydorus kherai* Baqri, 1985. F-Female anterior end; G-Female tail; H-Male tail.

79. *Laimydorus thornei* Andrassy, 1969
(Fig. 17, A-B)

Measurement : Female : L = 1.90 mm; a = 32; b = 4.9; c = 5.5; V = 947¹⁰

Description : Female : Body almost straight upon fixation. Cuticle finely striated, 2-5 µm thick (thickest at tail). Lip region continuous with body; lips obscure. Odontostyle 20 µm; its aperture 7 µm or 35% of odontostyle length. Odontophore 22 µm long. Guiding ring double, 8 µm from anterior extremity. Basal expanded part of oesophagus occupies 44% of total oesophageal length. Vulva a transverse slit. Vagina 24 µm long, distally sclerotized. Female reproductive system amphidelphic. Ovaries reflexed. Prerectum 70 µm or 2.5 anal body-width long. Rectum 35 µm or 1.2 anal body-width long. Tail 345 µm or 12 anal body-width long, first concave conoid then setaceous.

Male : Not found

Habitat and locality : Collected from soil around roots of wheat at Darrah, district Kota.

Key to genera of subfamily THORNENEMATINAE

1. Female reproductive system mono-opisthodelphic 2
 - Female reproductive system amphidelphic 6
2. Female tail short, rounded 3
 - Female tail elongate-conoid to long, filiform 4
3. Labial and post-labial sclerotisation present..... **Sclerolabia**
 - Labial and post-labial sclerottisation absent **Willinema**
4. Tail similar in sexes, elongate-conoid **Indodorylaimus**
 - Tail dissimilar in sexes, elongate-conoid to long, filiform in Females and short, conoid in males 5
5. Odontostyle broad, with wide lumen and aperture; labial sclerotisation absent **Opisthodorylaimus**
 - Odontostyle narrow; labial sclerotisation present **Thornenema**
6. Odontostyle broad, with wide lumen and aperture; labial sclerotisation absent **Coomansinema**
 - Odontostyle comparatively narrow; labial sclerotisation present 7
7. Cheilorhabdions strongly sclerotised and forming chamber-like structure 8
 - Cheilorhabdions sclerotised but not forming chamber-like structure 9
8. Guiding ring single, plicated; tail short, bluntly rounded **Silvallis**

- Guiding ring 'double'; tail long, filiform **Fuscheila**
- 9. Female tail short and rounded **Timminema**
- Female tail long and filiform **Sicaguttur**

Type genus : **Thornenema** Andrassy, 1959

Other genera : **Willinema** Baqri & Jairajpuri, 1967; **Sicaguttur** Siddiqi, 1971; **Indodorylaimus** Ali & Prabha, 1974; **Timminema** Khan, 1977; **Opisthodorylaimus** Ahmad & Jairajpuri, 1982; **Fuscheila** Siddiqi, 1982; **Sclerolabia** Carbonell & Coomans, 1980; **Silvalis** Ahmad & Jairajpuri, 1986; **Coomansinema** Ahmad & Jairajpuri, 1986; **Prothornenema** Baqri & Bohra, 2003

Genus **Thornenema** Andrassy, 1959

Diagnosis : Body 0.5 to 2.0 mm long, moderately slender upon fixation. Cuticle smooth or finely striated transversally. Lip region rounded conoid or truncated; continuous with body or set off by depression. Labial framework sclerotized, post labial sclerotization present. Amphids caliciform, their apertures $1/3^{\text{rd}}$ to $1/2$ of corresponding body-width. Odontostyle slender, 9-15 μm long; aperture occupying $1/4$ to $1/3^{\text{rd}}$ of its length. Guiding ring thin, about one lip region-width from anterior end. Odontophore rod-like. Basal expanded part of oesophagus occupies about 30-50% of total oesophageal length. Female reproductive organs mono-opisthodelphic. Anterior genital branch vestigial. Vulva transverse, pre-equatorial. Female prerectum 1.5-5.0 times as long as anal body-width. Male prerectum begins within the range of ventromedian supplements. Spicules doyrilaimoid. Supplements 3 to 6, spaced. Tails different in both sexes, in Females attenuated to filiform, 4 to 14 anal body-width long while in males short and bluntly rounded.

80. **Thornenema mauritianum** (Williams, 1959) Baqri & Jairajpuri, 1967 (Plate No. 13, Fig. 80 & 18, A-B)

Measurements : Females : L = 1.02-1.65 mm; a = 26-36; b = 5.2-6.0; c = 6.3-7.1; V = 32-43¹⁰⁻¹³

Description : Female : Lip region rounded, narrower than body, marked by a slight depression, moderately sclerotized. Odontostyle 13-16 μm long, aperture 4-5 μm . Odontophore 22-25 μm . Basal expanded part of oesophagus occupies 38-46% of oesophageal length. Female reproductive system mono-opisthodelphic. Tail filiform with smooth rounded terminus, 143-260 μm or 8-10 anal body-width long.

Male : Not found.

Habitat : Soil inhabiting.

Distribution : Delhi, Rajasthan, West Bengal, Uttar Pradesh, Gujarat.

Remarks : This is commonly found species in the State.

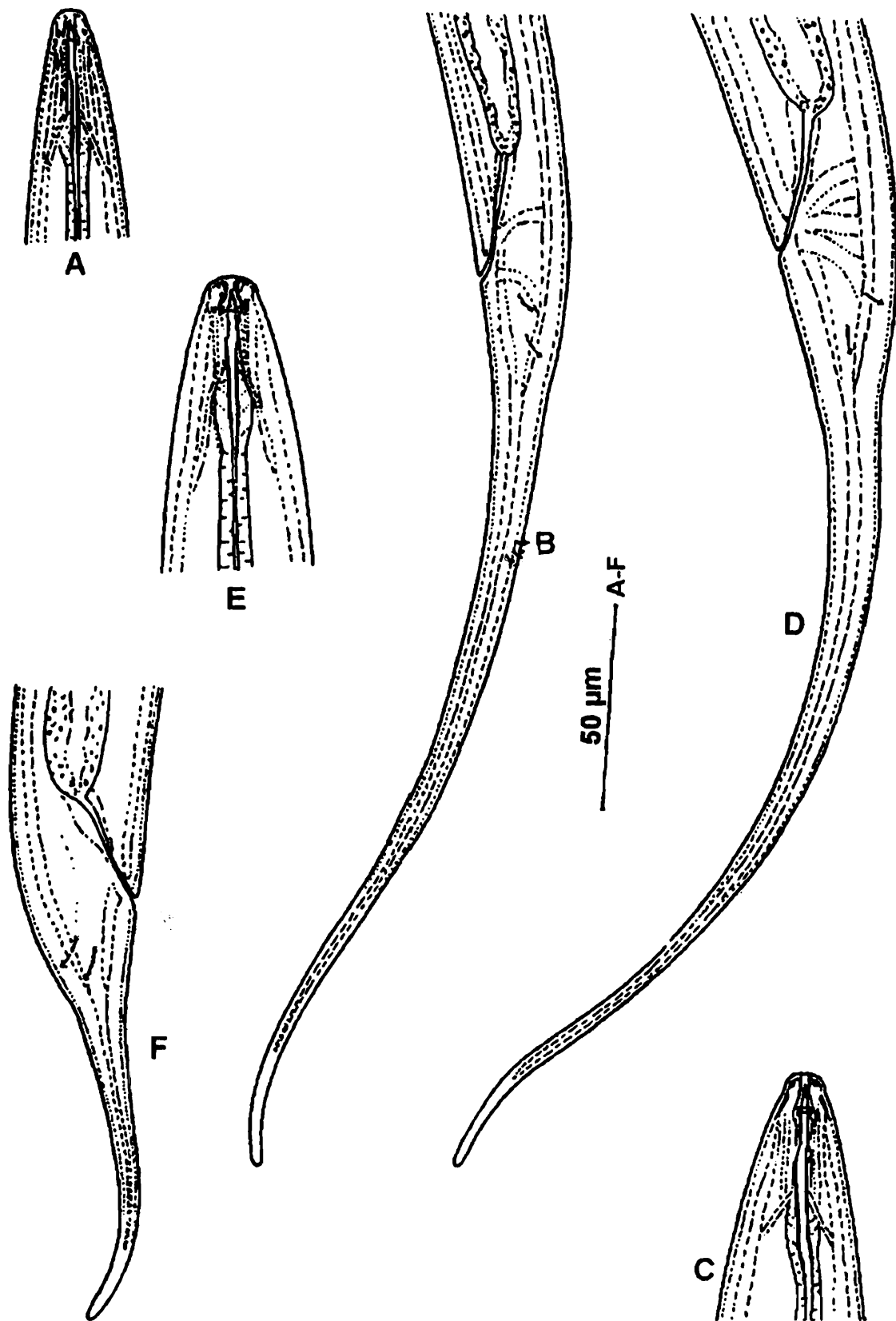


Fig. 18. A-B: *Thornea mauritianum* (Williams, 1959) Baqri & Jairajpuri, 1967. A-Female anterior end; B-Female tail. C-D: *Sicaguttur sartum* Siddiqi, 1971. C-Female anterior end; D-Female tail. E-F: *Opisthodorylaimus cavalcanti* (Lordello, 1955) Carbonell & Coomans, 1985. E-Female anterior end; F-Female tail.

Genus ***Prothornenema*** Baqri & Bohra, 2003

Diagnosis : Thornenematina. Body 1.0 to 1.3 mm long. Lip region cap-like, set off from adjoining body, with moderate labial and post labial sclerotization. Amphids stirrup-shaped. Odontostyle cylindrical; aperture one third of odontostyle length. Odontophore simple, dorylaimoid type. Basal expanded part of oesophagus about $1/3^{\text{rd}}$ of neck region. Vulva transverse, pre-equatorial. Female with amphidelphic reproductive system, both sexual branches equally developed. Males with contiguous ventromedian supplements. Tails dissimilar in sexes; Female tail elongate conoid or filiform while male tail short conoid with broadly rounded terminus.

Type and only species : *Pothornenema capitatum* Baqri & Bohra, 2003.

81. ***Prothornenema capitatum*** Baqri & Bohra, 2003

(Plate No. 14, Fig. 81 & 19, A-H)

Measurements : Females : L = 1.03-1.10mm; a = 28-32; b = 5.7-5.8; c = 9.1-14.6; V = 15-15.846-42^{15.5-15.6}

Males : L = 1.03-1.11 mm; a = 32-33; b = 5.7-6.0; c = 54-58; T = 56-60

Description : Female : Lip region cap-like set off from the body by constriction, with moderate labial and post labial sclerotization. Odontostyle 10-11 μm ; its aperture 4 μm or 30-36% odontophore length. Odontophore 12-13 μm long. Guiding ring 6-7 μm or one lip region width from anterior end. Basal expanded part of oesophagus 30-34% of neck region. Reproductive system amphidelphic. Prerectum 50-55 μm or 2.6-3.0 anal body-width long. Tail elongate conoid to filiform 72-120 μm long 3.7-8.1 anal body-width long.

Male : Spiculs 30 μm long or 1.5 times anal body-width long. Lateral guiding pieces 6-7 μm long. Ventromedian supplements contiguous 15-17 in numbers. Prerectum 75-80 or 3.9-4.2 anal body-width long. Tail 19 μm or about one anal body-width long, short conoid with broadly rounded terminus.

Habitat and locality : Soil inhabiting. Collected from soil around roots of lasora (*Cordia dichotoma*) at Ranthambhore National Park, district Sawai Madhopur.

Distribution : Rajasthan.

Remarks : Baqri and Bohra (2003) described new genus and new species from the States of Rajasthan and Gujarat.

Genus ***Sicaguttur*** Siddiqi, 1971

Diagnosis : Body 1-2 mm long. Cuticle finely striated. Lip region conoid, truncated, continuous or marked by depression. Labial and post labial sclerotization present. Odontostyle cylindrical. Odontophore rod-like. Basal expanded part less than half of total oesophageal length. Cardia large, elongate, sub-digitate. Female reproductive system amphidelphic, both genital branches are equally developed. Vulva transverse, pre-equatorial.

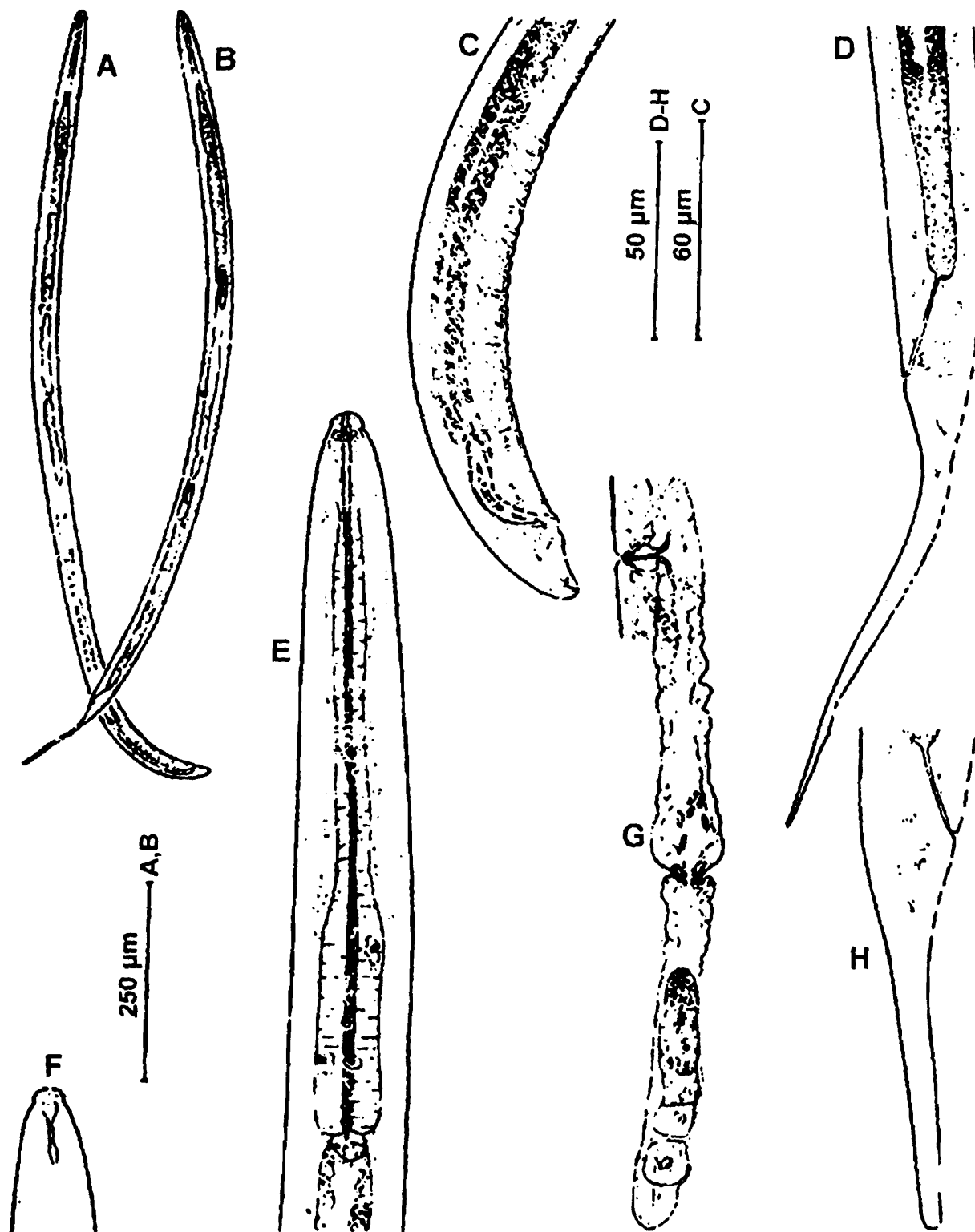


Fig. 19. *Prothornenema capitatum* Baqri & Bohra, 2003. A-Entire male; B-Entire female; C-Male posterior region; E-Female posterior end; E-Female oesophageal region; F-Anterior end showing amphid; G-Female posterior genital tract; H-Female posterior end showing tail variation.

Male with dorylaimoid spicules, lateral guiding pieces and a series of spaced ventromedian supplements. Tail long, tapering to an acute or sub acute tip, similar in sexes.

82. *Sicaguttur sartum* Siddiqi, 1971

(Plate No. 14, Fig. 82 & 18,C-D)

Measurements : Females : L = 1.09-1.97 mm; a = 23-30, b = 5.5-6.6; c = 6.1-6.4; V = 8-936-429-11

Description : Female : Lip region rounded, narrower than adjoining body, marked by depression. Labial sclerotization prominent. Odontostyle 15-18 μm ; aperture 4-5 μm . Odontophore 20-24 μm . Basal expanded part of oesophagus 42-44% of oesophageal length. Prerectum 80-97 μm or 2.0-2.5 anal body-width long. Tail 177-305 μm or 4.2-6.7 anal body-widths long, tapering to an acute or subacute tip.

Male : Not found.

Habitat and localities : Soil inhabiting. Collected from soil around roots of maize at Gogunda, district Udaipur.

Distribution : Rajasthan, West Bengal, Gujarat, Maharashtra.

Genus *Opisthodorylaimus* Ahmad & Jairajpuri, 1982

Diagnosis : Body 0.7-2.3 mm long, moderately slender. Cuticle fairly thick, smooth or finely striated. Lips amalgamated. Lip region slightly narrower than adjoining body, continuous with body or set off by depression or expansion. Labial and post labial sclerotization absent. Odontostyle cylindrical, 10-21 μm long; aperture about $\frac{1}{4}$ to $\frac{1}{3}$ of odontostyle length. Guiding ring simple, located less than one lip region posterior from anterior end of body. Odontophore rod-like. Basal expanded part of oesophagus occupies about $\frac{1}{3}$ rd to $\frac{1}{2}$ of total oesophageal length. Female reproductive organ monopisthodelfic. Anterior genital branch may be present, reduced or complete. Males with dorylaimoid spicules. Supplements 5-11, widely or closely spaced. Female tail attenuated to filiform, 2 to 25 anal body-width long, in males short and conoid-rounded.

Type species : *Opisthodorylaimus maqsoodi* Ahmad & Jäirajpuri, 1982

83. *Opisthodorylaimus cavalcantii* (Lordello, 1955) Carbonell & Coomans, 1985
(Fig, 18, E-F)

Measurements : Females : L = 1.15-1.18 mm; a = 21-22; b = 4.5-5.2; c = 9-11; V = 44-45¹¹⁻¹².

Description : Female : Body slightly ventrally curved upon fixation, tapering towards both extremities. Cuticle 2-4 μm thick, finely striated. Lip region set off, marked by slight depression. Odontostyle 13-15 μm ; aperture 4-5 μm or 30-33% of odontostyle length. Odontophore 22-24 μm . Basal expanded part of oesophagus occupies 42-46% of

oesophageal length. Vulva a transverse slit. Vagina extending 15-17 μm or about half of the corresponding body-width. Female reproductive system mono-opisthodelphic, with 20-22 μm long anterior uterine sac. Prerectum 60-67 μm or 1.5-2.0 anal body-width long. Rectum 30-32 μm or 1.1-1.2 anal body-width long. Tail 103-120 μm or 3.7-4.1 anal body-width long, elongate conoid with rounded terminus.

Male : Not found

Habitat and locality : Collected from soil around roots of maize at Posali, district Sirohi.

Family APORCELAIMIDAE Heyns, 1965

Medium to large-sized nematodes. Cuticle thick, smooth or finely transversely striated, often with criss-cross lines or punctuations, and usually with numerous body pores. Lip region set off by constriction. Amphids with sclerotized median support, fovea often duplex. Odontostyle axial with wide aperture or 'mural tooth' set on ventral wall of pharynx. Guiding ring plicated. Basal expanded part of oesophagus highly muscular, with prominent glandular tubules, and gland nuclei. Cardia well developed, cardiac disc or glands sometimes present. Female reproductive system amphidelphic. Vulva transverse or pore-like. Males dorylaimoid spicules, lateral guiding pieces and spaced ventromedian supplements. Tail short, bluntly rounded or conoid or rarely filiform, similar in sexes.

Key to subfamilies of APORCELAIMIDAE Heyns, 1965

1. Body sharply tapering towards anterior end PARAXONCHIINAE
- Body normal, to sharply tapering towards anterior end 2
2. Odontostyle axial, with wide aperture APORCELAIMINAE
- Odontostyle a mural tooth SECTIONEMATIAE

Subfamily APORCELAIMINAE Heyns, 1965

Diagnosis : Cuticle thick. Lip region set off by deep depression or constriction. Odontostyle with wide lumen and aperture, guiding ring simple, plicated. Odontophore simple, rod-like. Oesophageal expansion gradual. Dorsal oesophageal gland nucleus usually far from its orifice. First pair of sub-ventrals widely separated. Cardia with disc. Female reproductive system amphidelphic. Vulva transvers, longitudinal or pore-like. Males with dorylaimoid spicules, lateral guiding pieces and spaced ventromedian supplements. Tail short, conoid (long filiform in *Aporcedorus*). Similar in sexes.

Type genus : *Aporcelaimus* Thorne & Swanger, 1936

Other genera : *Aporcelaimellus*; *Makatinus* Heyns, 1965; *Aporcelaimium* Loof & Coomans, 1970; *Akrotonus* Thorne, 1974; *Tubixibia* Monterio & Lordellow, 1980; *Aporcedorus* Jairajpuri & Ahmad, 1983

Key to Genera of Aporcelaiminae

1. Layering of cuticle inconspicuous, without criss-cross lines or punctuations 2
 - Layering of cuticle conspicuous, with transverse markings or criss-cross lines or punctaiton 3
2. Female tail long, filiform **Aporcedorus**
 - Female tail short, conoid **Aporcelaimium**
3. Lip region offset by slight depression; vulva longitudinal **Makatinus**
 - Lip region offset by deep constriction; vulva transverse or pore-like 4
4. Lip region rounded, papillae not projecting above contour; ventromedian supplements only two **Akrotonus**
 - Lip region angular, papillae projecting above contour; Ventromedian supplements more than two 5
5. Body unusually long (9-11 mm); odontostyle aperture about one-third its length **Tubixaba**
 - Body size not exceeding 6 mm; odontostyle aperture slightly less than one-half to more than half its length 6
6. Cuticle with faint longitudinal markings or criss-cross lines 7
 - Cuticle with transverse striations 8
7. Body relatively small; three cardiac glands present at oesophago-intestinal junction **Torumanawa**
 - Body large; cardiac glands absent..... **Aporcelaimus**
8. Oral aperture circular..... **Takamangi**
 - Oral aperture hexagonal **Aporcelaimellus**

Genus *Aporcelaimellus* Heyns, 1965

Diagnosis : Meidum to large sized nematodes, with stout body. Cuticle finely striated, generally thickened at anterior and posterior ends. Body pores generally distinct. Lip region set off by deep constriction. Lips angular, separated from one another. Oral aperture apparently hexagonal. Odontostyle with wide lumen and aperture; the latter occupying about one half of odontostyle length. Amphids may be with duplex fovea. Cardia distinct. Cardiac disc may be present. Female reproductive system amphidelphic. Vulva transverse or pore-like. Males with dorylaimoid spicules, lateral guiding pieces and non contiguous ventomedian supplements. Tail short, bluntly rounded, conoid or slightly digitate, similar in sexes.

Type species : *Aporcelaimellus obscureus* (Thorne & Swanger, 1936) Heyns, 1965

84. *Aporcelaimellus obscurus* (Thorne & Swanger, 1936) Heyns, 1965
(Plate No. 14, Fig. 84 & 20, A-B)

Measurements : Females : L = 1.39-2.19 mm; a = 14-23; b = 3.5-4.2; c = 33-48; V = 11-12⁵²⁻⁵⁴12-13

Description : Female : Body slightly ventrally curved in posterior half upon fixation. Cuticle 2-6 µm thick (thickest at tail) finely striated. Lip region set off from body by a deep constriction. Odontostyle 23-28 µm long; aperture 17-19 µm or 65-67% of odontostyle length. Odontophore 35-50 µm long. Guiding ring 10-12 µm from anterior end. Basal expanded part of oesophagus occupies 50-52% of neck region. Prerectum 135-145 µm or 2.4-2.5 anal body-width long. Rectum 40-45 or 0.5-0.6 anal body-width long. Tail convex conoid, 41-45 µm or 0.7 anal body-width long.

Male : Not found.

Habitat and localities : Soil inhabiting. Collected from soil around millet at Mathania, district Jodhpur; Peeh, district Nagaur.

Distribution : Rajasthan, Gujarat.

85. *Aporcelaimellus heynsi* Baqri & Jairajpuri, 1968
(Plate No. 14, Fig. 85 & 20, C-D)

Measurements : Females : L = 1.02-1.33 mm; a = 24-26; b = 3.0-4.6; c = 26-33; V = 10-11⁵⁰⁻⁵³8-9.

Description : Female : Body slightly ventrally curved upon fixation. Cuticle 2-4 µm thick (thickest on tail), finely striated. Lip region set off from body by constriction. Lips separate, subangular. Labial papillae distinct. Odontostyle 13-15 µm long; aperture 9-10 µm or 66-69% of odontostyle length. Odontophore 18-20 µm long. Guiding ring 6-7 µm from anterior end. Prerectum 95-110 µm 3.8-4.6 anal body-width long. Tail conoid with rounded terminus, 38-40 µm long or 1.5-1.6 anal body-width long.

Male : Not found

Habitat and localities : Soil inhabiting. Collected from soil around roots of Sorghum at Osian, district Jodhpur. Thanti Beri, KWLS, Udaipur, Rajakheda, district Dholpur.

Distribution : Gujarat, West Bengal, Uttar Pradesh, Rajasthan.

Remarks : Widely distributed species.

Genus ***Tubixiba*** Monteiro & Lordello, 1980

Diagnosis : Large sized nematodes, 3-10 mm long. Cuticle thick. Lip region set off, lips distinctly separate. Odontostyle dorylaimoid, aperture occupying about one-third length. Odontophore simple, rod-like. Oesophago-intestinal disc absent. Female reproductive system amphidelphic. Vulva a transverse slit, without cuticularised labia. Spicules

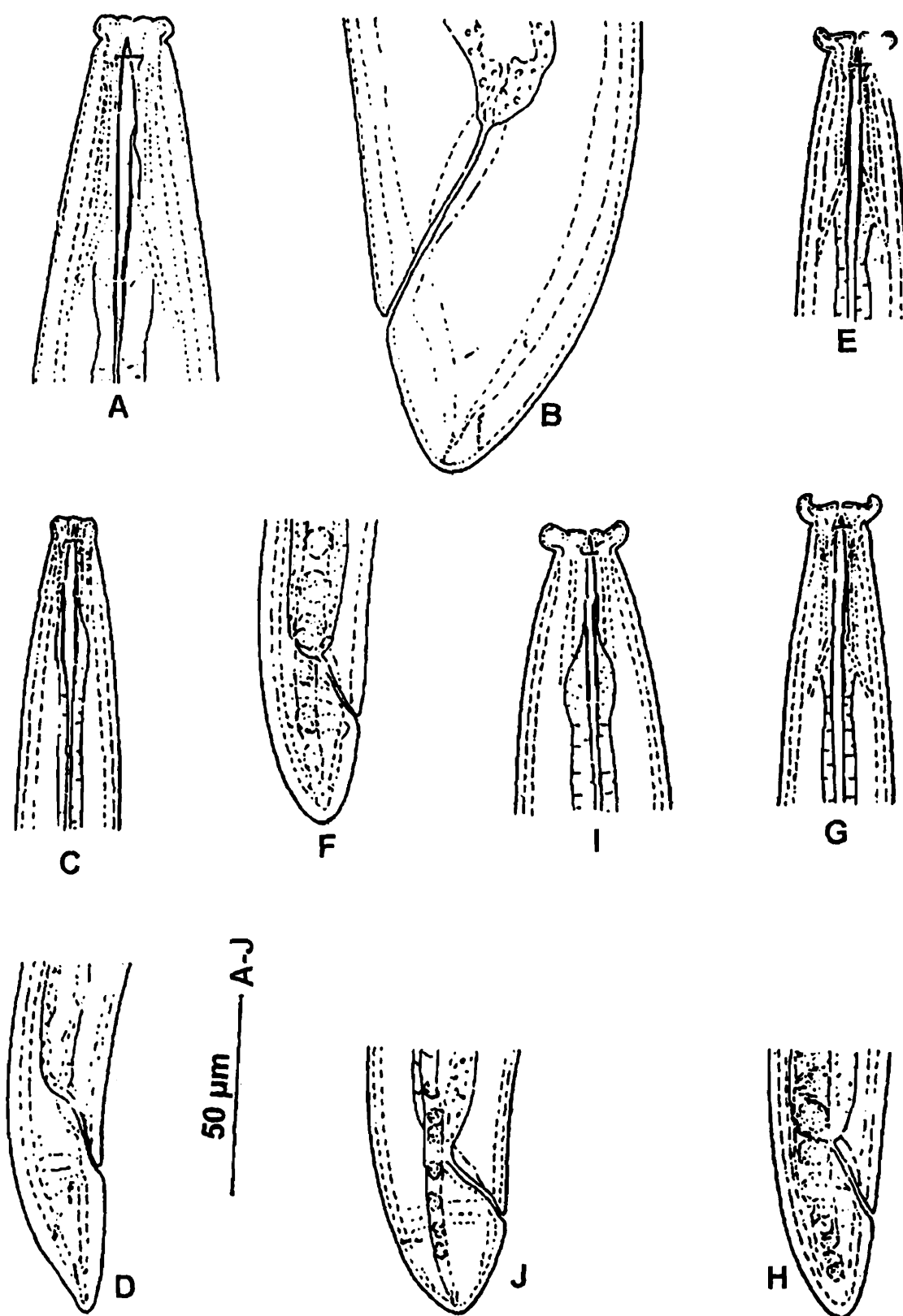


Fig. 20. A-B: *Aporcelaimellus obscurus* (Thorne & Swanger, 1936) Heyns, 1965. A-Female anterior end; B-Female tail. C-D: *Aporcelaimellus heynsi* Baqri & Jairajpuri, 1968. C-Female anterior end; D-Female tail. E-F: *Discolaimus major* Thorne, 1939. E-Female anterior end; F-Female tail. G-H: *Discolaimus tenax* Siddiqi, 1964. G-Female anterior end; H-Female tail. I-J: *Discolaimus laksii* Khan & Laha, 1982. I-Female anterior end. J-Female tail.

dorylaimoid, ventromedian supplements irregularly spaced. Tail short, conoid, bluntly rounded, similar in sexes.

Type species : *Tubixiba tuxana* Monteiro & Lordellow, 1980

86. *Tubixiba parva* Pretorius, Kruger & Heyns, 1987

(Plate No. 14, Fig. 86 & 21, A-F)

Measurements : Females : L = 3.12-3.78 mm; a = 45-52; b = 4.0-4.6; c = 89-96; V = 7-854-557-8

Description : Female : Lip region distinctly set off by deep constriction. Lips twice as wide as high; separated. Odontostyle 15-17 μ m long; its aperture 5-6 μ m. Odontophore 26-30 μ m long. Guiding ring 9-10 μ m from anterior end. Basal expanded part of oesophagus occupies 51-54% of neck region. Tail bluntly conoid; 32-34 μ m or 0.7-1.1 anal body width long.

Male : Not found.

Habitat and localities : Soil inhabiting. Collected from soil around roots of millet at Bijapur, district Pali, from guar at Peeh, district Nagaur.

Distribution : Gujarat, Rajasthan.

Remarks : Widely distributed species.

Family QUDSIANEMATIDAE Jairajpuri, 1965

Body medium-sized. Lateral hypodermal chords may be provided with distinct glandular bodies. Lip region continuous or set off by depression or constriction, may be discoid. Amphids small to large, with stirrup shaped fovea. Odontostyle cylindrical, dorylaimoid, with distinct lumen and aperture. Guiding ring single or double. Odontophore rod-like or with sclerotized basal flanges or knobs. Basal expanded part of oesophagus about one-half oesophageal length. Cardia hemispheroid to elongate-conoid. Cardiac glands present or absent. Vulva transverse or longitudinal. Female reproductive system mono-opisthodelphic or amphidelphic. Males with dorylaimoid spicules; lateral guiding pieces present. Males with few to numerous, spaced or contiguous; Ventromedian supplement. Tail short, hemispheroid to elongate-conoid, similar in sexes.

The present publication provides brief description of following 12 genera. *Labronema* (1 sp.); *Eudorylaimus* (1 sp.); *Ecumenicus* (1 sp.); *Discolaimus* (3 sp.); *Discomaimoides* (1 sp.); *Discolaimium* (1 sp.); *Torumanawa* (1 sp.); *Latocephalus* (6 spp.); *Mylodiscus* (2 spp.); *Microdorylaimus* (1 sp.); *Labronemella* (1 sp.). Keys upto generic level have been provided.

Key to subfamilies of Qudsianematidae Jairajpuri, 1965

1. Cuticle with coarse transverse striations 2
- Cuticle with fine transverse striations 3

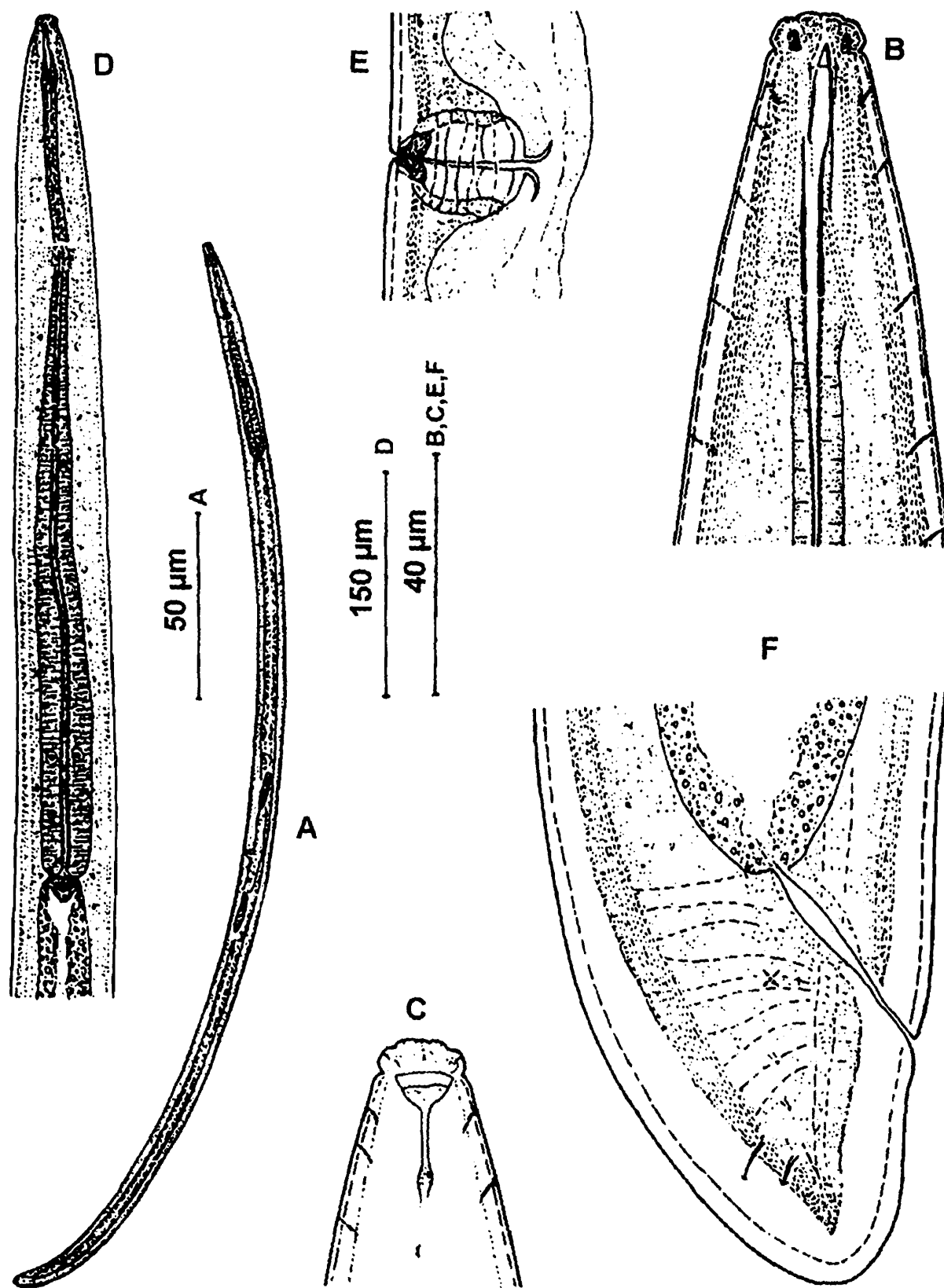


Fig. 21. *Tubixiba parva* Pretorius, Kruger & Heyns, 1963. F: Female; A-Entire female; B-Anterior end; C-Anterior end (surface view); D-Oesophageal region; E-Vulva-Vagina; F-Female tail.

2. Body slender; body pores indistinct; odontostyle attenuated CRATERONEMATINAE
- Body not slender; body pores distinct; odontostyle not attenuated LORDELLONEMATINAE
3. Lip region discoid; well developed hypodermal glands present DISCOLAIMINAE
- Lip region not discoid; hypodermal glands usually absent or poorly developed 4
4. Lip region continuous; lips amalgamated 5
- Lip region set off, lips usually separated 6
5. Tail short, hemispheroid in both sexes; only adanal pair of supplements present (rarely a single ventromedian) THORNIINAE
- Tail elongate-conoid in both sexes; in addition to adanal pair, a series of ventromedian supplements present CHRYSONEMATINAE
6. Dorsal pharyngeal gland nucleus near beginning of pharyngeal enlargement; Female tail short, hemispherical to elongate-conoid QUDSIANEMATINAE
- Dorsal pharyngeal gland nucleus two or more body widths posterior to beginning of pharyngeal enlargement; Female tail long, filiform HULQINAE

Subfamily QUDSIANEMATINAE Jairajpuri, 1965

Diagnosis : Cuticle smooth or finely striated. Lateral hypodermal chords may be provided with distinct glandular organs. Oesophagus gradually expands, unusually thick and muscular in its anterior half. First pair of subventral nuclei very small. Prerectum short. Vulva transverse, sclerotized. Female reproductive system amphidelphic. Males with dorylaimoid spicules. Ventromedian supplements about 30, closely arranged. Tail in both sexes similar, broadly rounded, shorter than anal body-width.

Type genus : *Qudsianema* Jairajpuri, 1965

Key to Genera of Qudsianematinae

1. Female gonad single, opisthodelphic *Ecumenicus* Thorne
- Female gonad double, amphidelphic 2
2. Tail conoid or convex-conoid, straight or ventrally arcuate, predominately well longer than anal body diameter 3
- Tail conoid-rounded to rounded, in general nearly as long as anal body diameter ... 7
3. Tail comparatively long, 4-8 anal diameters 4
- Tail shorter, 1-3 anal diameters 5

4. Female tail straight, male with one supplement..... **Kallidorylaimus** Andrassy
 - Female tail ventrally bent; male with 4-9 supplements .. **Epidorylaimus** Andrassy
5. Precloacal space before ventromedial supplements present, wide, hindmost supplement anterior to the spicula **Eudorylaimus** Andrassy
 - Precloacal space absent (or practically absent), hindmost supplement level with specula 6
6. Very small animals, 0.3-0.8 mm; oesophagus about $\frac{1}{3}$ rd of total body length, far back (in 2/5) expanded **Microdorylaimus** Andrassy
 - Larger animals, 1-3 mm, oesophagus shorter, about $\frac{1}{4}$ of body length and expanded near middle **Allodorylaimus** Andrassy
7. The two parts of oesophagus separated by a distinct constriction **Skibbenema** Van Reenen & Heyns
 - The two parts of oesophagus connected by a gradual enlargement 8
8. Cardia provided with three glands **Torumanawa** Yeates
 - Cardia without glands 9
9. Vulva longitudinal; ventromedial supplements contiguous **Labronema** Thorne
 - Vulva transverse; ventromedial supplements predominantly spaced 10
10. Oral field sunk and surrounded by conspicuous inner liplets; spear slender (10-15 times as long as wide) **Labronemella** Andrassy
 - Oral field not sunk, inner liplets obscure or absent; spear more robust (5-8 times as long as wide) 11
11. Anterior part of oesophagus strongly muscular; spermatozoa minute, shorter than $\frac{1}{10}$ the body width **Crassogula** gen.n.
 - Anterior part of oesophagus weakly muscular thin; spermatozoa larger, $\frac{1}{4}$ - $\frac{1}{5}$ the body width 12
12. Tail subdigitate; guiding ring double **Talanema** gen.n
 - Tail broadly rounded; guiding ring simple **Takamangai** Yeates

Genus **Labronema** Thorne, 1939

Diagnosis : Body robust; 1.0-4.0 mm long. Cuticle finely striated. Lip region offset by deep constriction, broad and thick; inner flaps arched over vestibular region. Odontostyle dorylaimoid with wide lumen and aperture. Guiding ring sclerotised, 'double' Odontophore rod-like, Basal expanded part of oesophagous about one half of oesophageal length. Vulva longitudinal, rarely transverse; vagina distally sclerotized. Female reproductive system

amphidelphic. Males with dorylaimoid spicules, lateral guiding pieces and numerous contiguous ventromedian supplement. Tail hemispheroid to sub digitate, similar in sexes.

87. *Labronema confusum* (Jana & Baqri, 1983) Andrassy, 1991
(Plate No. 14, Fig. 87)

Measurements : Female : L = 0.94-1.18 mm; a = 29-37; b = 4.1-4.5; c = 43-54; V = $9.10^{48-54} 9.10^{9-10}$.

Description : Female : Lip region offset by constriction. Odontostyle 13-15 μ m long; its aperture 5-6 μ m. Odontophore 19-22 μ m long. Guiding ring sclerotized double. Basal expanded part of oesophagus occupies 37-39% of neck region. Female reproductive system amphidelphic. Tail 23-24 μ m long, obtusely rounded, about 0.8 anal body-width long.

Male : Not found.

Habitat and locality : Soil inhabiting. Collected around various plants from Mathania district Jodhpur; Nadbai, District Bharatpur.

Distribution : West Bengal, Rajasthan, Gujarat

Remarks : Abundantly found species in the State.

Genus ***Eudorylaimus*** Andrassy, 1959

Diagnosis : Small to large sized nematodes (0.8 to 3.5 mm long). Cuticle smooth or finely striated. Lip region set off from body by depression or deep constriction. Lips separated, generally angular or subangular. Amphids stirrup-shaped and with slit-like apertures. Odontostyle 11- 38 μ m long; aperture $1/3^{\text{rd}}$ of Odontostyle length. Guiding ring single. Odontophore simple, rod-like. Expansion of oesophagus starts slightly posterior to its middle. Female reproductive system amphidelphic. Vulva transverse, rarely longitudinal. Prerectum 1-5 times the anal body-diameter. Males with dorylaimoid spicules, lateral guiding pieces and 3-18 spaced ventromedian supplements. Tail short conoid, ventrally curved, rarely straight or slightly bent dorsally. Similar in sexes.

Type species : *Eudorylaimus carteri* (Bastian, 1865) Andrassy, 1959

88. *Eudorylaimus chauhani* (Baqri & Khera, 1975) Andrassy, 1986
(Plate No. 15, Fig. 88 & 22, A-B)

Measurements : Females : L = 1.29-1.75 mm; a = 21-24; b = 4.0-5.0; c = 33-40; V = $9.8^{48-53} 10^{10-11}$

Description : Female : Body slightly ventrally curved upon fixation. Lip region set off by constriction, slightly wider than adjoining body. Odontostyle 14-18 μ m long; aperture 4-5 μ m 27-28% of the odontostyle length. Guiding ring 6-7 μ m long from anterior end. Odontophore 33-36 μ m long. Basal expanded part of oesophagus occupies 40-50% of neck region. Female reproductive system amphidelphic. Tail dorsally convex-conoid, 38-43 μ m or 0.8-0.9 anal body-width long, with acute terminus.

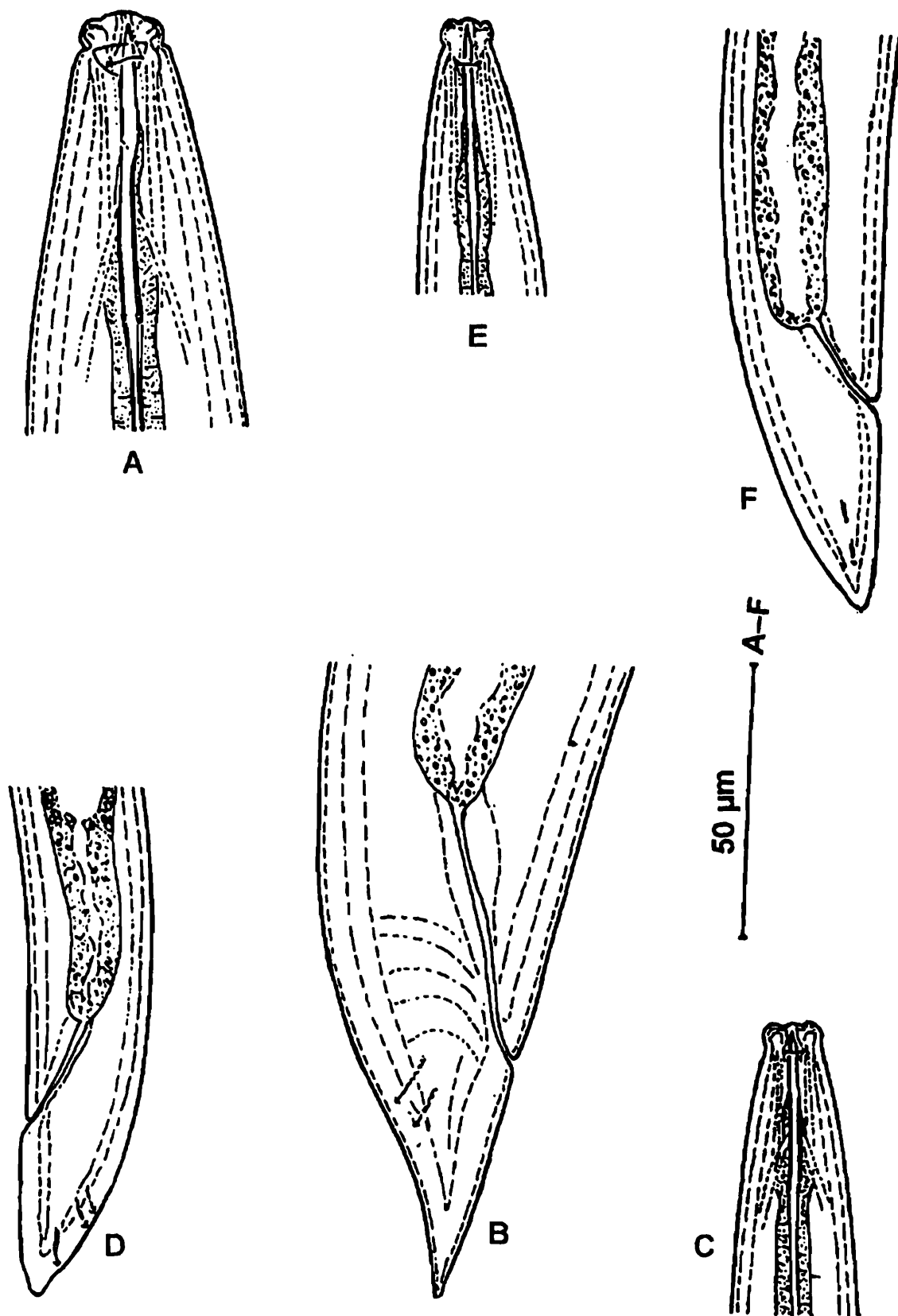


Fig. 22. A-B: *Eudorylaimus chauhani* (Baqri & Khera, 1975) Andrassy, 1986. A-Female anterior end; B-Female tail. C-D: *Ecumenicus monohystera* (de Man, 1880) Thorne, 1974. C- Female anterior end; D-Female tail. E-F: *Microdorylaimus modicus* (Kirjanova, 1951) Andrassy, 1986. E-Female anterior end; F-Female tail.

Male : Not found.

Habitat and localities : Soil inhabiting. Collected from soil around roots of maize at Mt. Abu, district Sirohi.

Distribution : Rajasthan, Gujarat, West Bengal.

Genus ***Ecumenicus*** Thorne, 1974

Diagnosis : Small sized nematodes, 0.7-1.3 mm long. Cuticle smooth or finely striated. Lips distinct. Lip region set off by a slight depression. Amphids caliciform situated more anteriorly in lip region. Odontostyle simple, 7-14µm or about as long as labial width; aperture $1/4^{\text{th}}$ - $1/3^{\text{rd}}$ of odontostyle length. Guiding ring single. Odontophore simple rod-like. Basal expanded part of oesophagus occupying less than one half of neck region. Female reproductive system mono-opisthodelphic. Vagina directed posteria. Males with dorylaimoid spicules and eight ventromedian supplements. Lateral guiding pieces absent. Tail bluntly conoid, similar in sexes.

Type species : *Ecumenicus monohystera* (de Man, 1880) Thorne, 1974

89. ***Ecumenicus monohystera*** (deMan, 1880) Thorne, 1974
(Plate No. 15, Fig. 89 & 22, C-D)

Measurements : Females : L = 1.07-1.64 mm; a = 27-30; b = 5.0-5.7; c = 35-43; V = 36-38⁷⁻¹¹

Description : Female : Lips set off. Odontostyle 12-15 µm long; aperture 3-4 µm. Odontophore 18-20 µm long rod-like. Guiding ring 6-7 µm long. Basal expanded part of oesophagus occupies 41-42% of neck region. Female reproductive system mono-opisthodelphic. Tail convex-conoid, 30-38 µm or 1.6-1.7 anal body-width long.

Male : Not found.

Habitat and localities : Soil inhabiting. Collected from soil around roots of maize at Gogunda, Udaipur, Peeh, district Nagaur.

Distribution : West Bengal, Rajasthan, Gujarat.

Genus ***Torumanawa*** Yeates, 1967

Diagnosis : Body medium sized (1.5-2.5 mm). Lip region offset by constriction. Odontostyle axial with large aperture. Guiding ring single. Odontophore simple, rod-like. Three prominent glands present at oesophago-intestinal junction. Cardia large. Female reproductive system amphidelphic. Vulva transverse slit with lightly cuticularised labia. Male with dorylaimoid spicules, lateral guiding pieces and a series of ventromedian supplement. Tail short conoid; similar in sexes.

Type species : *Torumanawa wahapuenis* Yeates, 1967

90. ***Torumanawa shinensis*** Bohra & Sultana, 2008

(Plate No. 15, Fig. 90 & 23, A-G)

Measurements : Females : L=1.4-1.6 mm; a=42-54; b=4.3-4.8; c = 38-50; V=50-52.**Description** : Female : Body ventrally curved upon fixation. Cuticle 1.5-2.0 μm thick at mid body. Lip region expanded, setoff from adjacent body. Odontostyle 10-12 μm long. Odontophore 15-17 μm long and ventrally curved. Pharyngeal expansion 51-53% of neck length. Female reproductive system amphidelphic. Vulva a horizontal slit. Prerectum 3.3-5.2 anal body width long. Tail convex-conoid with rounded terminus.

Male : Not found.

Type habitat and locality : Soil inhabiting. Collected from soil around roots of Shin (grass) weeds in the Bharatpur district of Rajasthan.**Distribution** : Rajasthan.**Remarks** : Bohra & Sultana (2008) described this species as new to Science.Genus ***Microdorylaimus*** Andrassy, 1986**Diagnosis** : Smaller nematodes, 0.3 to 0.8 mm long. Cuticle smooth. Lips separate and angular; lip region set off. Amphids calciform. Odontostyle 8-12 μm long, about as long as lip region-width; aperture $1/4^{\text{th}}$ - $1/3^{\text{rd}}$ of odontostyle length. Guiding ring single. Odontophore rod-like. Oesophagus abnormally long, nearly one third of total body length, abruptly expanding in posterior two fifth. Vulva transverse. Female reproductive system amphidelphic. Males rare, with three-eight ventromedian supplements, precloacal space absent. Tail conoid, ventrally curved, similar in sexes.**Type species** : *Microdorylaimus parvus* (de Man, 1880) Andrassy, 198691. ***Microdorylaimus modicus*** (Kirjanova, 1951) Andrassy, 1986

(Plate No. 15, Fig. 91 & 22, E-F)

Measurements : Females : L = 0.81-0.93 mm; a = 21-25; b = 3.9-4.0; c = 23-24; V = 6-747-525-6**Description** : Female : Body more or less straight upon fixation. Cuticle finely striated. Lip region set off by depression. Odontostyle 14-15 μm long; aperture 3-4 μm or 21-26% of odontostyle length. Guiding ring 5-6 μm from anterior end. Odontophore 18-20 μm long. Basal expanded part of oesophagus occupies 45-50% of total neck region. Prerectum 80-85 μm or 3.2-3.5 anal body-width long. Rectum 30-32 μm or 1.1-1.2 anal body-width long. Tail straight conoid 35-38 μm or 1.4 anal body-width long.

Male : Not found.

Habitat and locality : Soil inhabiting. Collected from soil around roots of maize at Mt. Abu, district Sirohi.**Distribution** : Rajasthan.

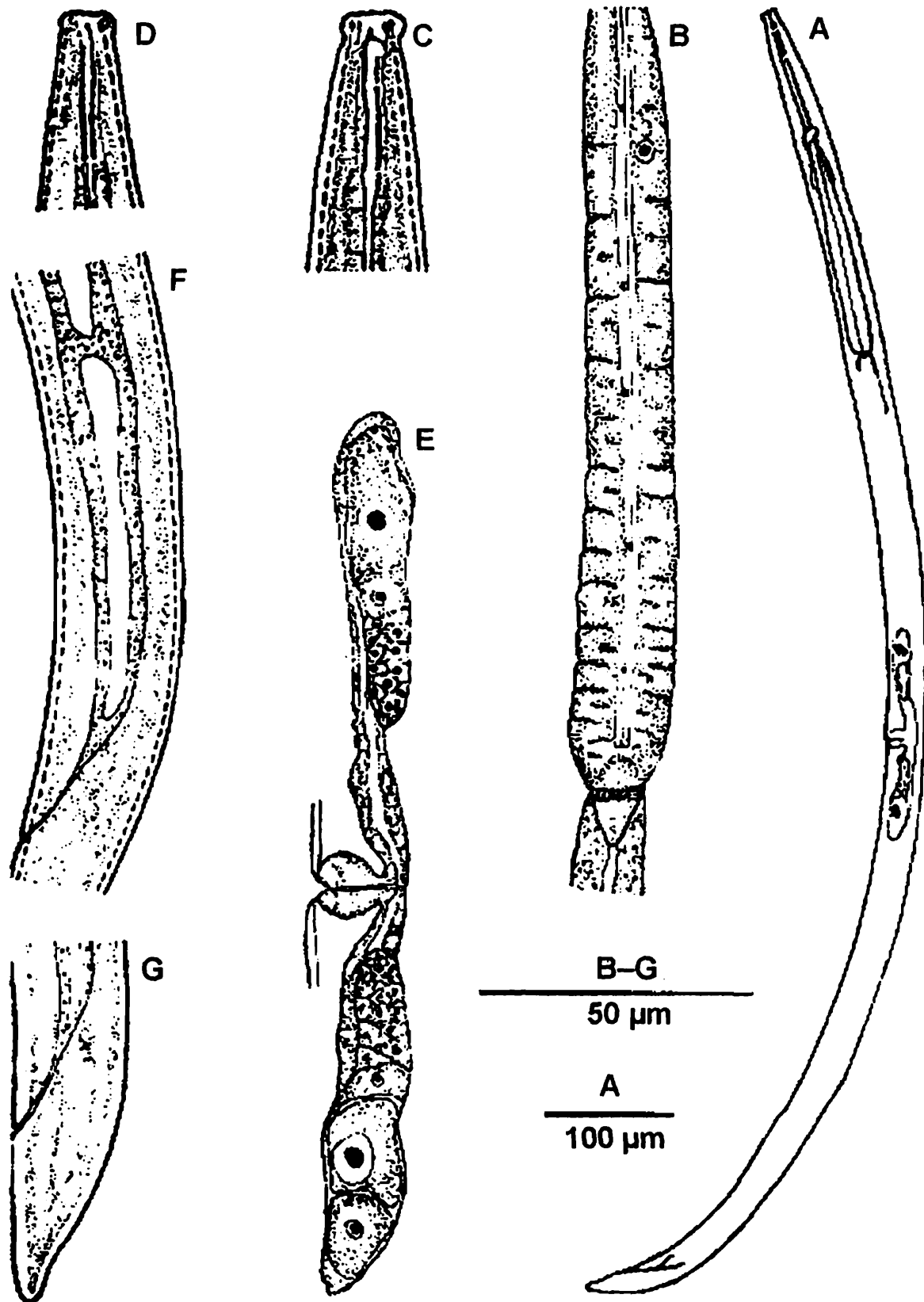


Fig. 23. *Torumanawa shinensis* Bohra & Sultana, 2008. A-Entire female; B-Expanded part of pharynx; C-D-Anterior end; E-Female reproductive system; F- Pre-rectum; G-Posterior end.

Genus *Labronemella* Andrassy, 1985

Diagnosis : Body 1.2-2.8 mm long. Cuticle with fine transverse striations; Lip region distinctly set off, somewhat discolaimoid; odontostyle slender, more than one lip region width long, with large aperture. Guiding ring 'double' Odontophore rod-like. Oesophagus muscular, expanding near middle. Female reproductive system amphidelphic. Spicules dorylaimoid; ventromedian supplements 11-21, very low and close-set. Tail short, conoid, similar in sexes.

Type species : *Labronemella labiata* Andrassy, 1985

92. *Labronemella andrassyi* (Baqri & Khara, 1975) Andrassy, 1985
(Plate No. 15, Fig. 92)

Measurements : Females : L = 1.50-1.58 mm; a = 33-39; b = 3.9-4.0; c = 79- ; V = ¹⁶53-54¹⁷

Description : Female : Body ventrally curved. Cuticle finely striated, 4-5 µm in mid body, 7-9 µm at tail. Lip region well set off by a constriction, slightly wider than adjoining body. Amphids stirrup shaped. Odontostyle 23-24 µm long; aperture 8-9 µm or 31-35% of odontostyle length. Guiding ring 14-15 µm from anterior end. Odontophore 38-40 µm long. Basal expanded part of oesophagus occupies 45-47% of neck region. Female reproductive system amphidelphic. Prerectum 55-76 µm or 1.6-2.5 anal body width long. Tail hemispheroid , 19-20 µm or 0.70-0.74 anal body- width long.

Male : Not found.

Habitat and locality : Soil around roots of plants.at Desuri ki Naal KWLS,Udaipur.

Distribution : Rajasthan, Andaman & Nicobar.

Subfamily DISCOLAIMINAE Siddiqi, 1969

Diagnosis : Medium to large sized nematodes. Cuticle fine striated. Lateral chords with glandular bodies. Lip region often expanded, discoidal or sucker like, rarely hexagonal. Odontostyle long and narrow, sometimes slightly nonaxial. Guiding ring single. Odontophore rode-like. Basal expanded part of oesophagus muscular, marked off by a sudden expansion, rarely enveloped in thin spiral muscular sheath. Female reproductive system nono-opisthodelphic or amphidelphic. Males with dorylaimoid spicules, lateral guiding pieces and spaced ventro median supplements. Tail in both sexes similar, short conoid or hemispheroid.

Type genus : *Discolaimus*, Cobb, 1913

Other genera : *Discolaimium* Thorne, 1939; *Mylodiscus* Thorne, 1939; *Discolaimoides* Heyns, 1963; *Latocephalus* Patil & Khan, 1982

Key to Genera of Discolaiminae

1. Lip region provided with cuticularised, shallow, bowl-like plates ***Mylodiscus***
 Lip region not provided with cuticularised plates 2
2. Lip region discoid ***Discolaimus***
 Lip region not discoid 3
3. Lip region offset by an expansion ***Discolaimoides***
 Lip region offset by constriction 4
4. Female reproductive system amphidelphic ***Discolaimium***
 Female reproductive system mono-opisthodelphic ***Latocphalus***

Genus ***Discolaimus*** Cobb, 1913

Diagnosis : Body 0.3 to 4.3 mm long, fairly slender. Lip region discoid, lips widely expanded, sucker shaped. Amphids caliciform. Odontostyle stout 11-43 μ m long, always less than labial diameter; aperture large, generally about half of odontostyle length. Guiding ring single. Oesophagus suddenly expands in its middle, basal expanded part sometimes encircled by a thin sheath. Female reproductive system amphidelphic or mono-opisthodelphic. Males with large dorylaimoid spicules, lateral guiding pieces and series of spaced ventromedian supplements.

93. ***Discolaimus major*** Thorne, 1939

(Plate No. 15, Fig. 93 & 20, E-F)

Measurements : Females : L = 1.4-2.63 mm; a = 32-36; b = 3.9-4.5; c = 46-58; V = 11-12 47-48¹¹⁻¹².

Description : Female : Lip region discoid. Lateral hypodermal chords with well developed 70-80 glandular bodies. Odontostyle 22-25 μ m long; aperture 50-52% of odontostyle length. Guiding ring single. Odontophore 30-35 μ m long. Basal expanded part of oesophagus occupies 50-55% of oesophageal length and surrounded by a conspicuous muscular sheath. Female reproductive system amphidelphic. Tail 30-35 μ m or 1.2-1.5 anal body-width long, conoid.

Male : Not found.

Habitat and localities : Soil inhabiting. Collected from soil around roots of millet at Osian, district Jodhpur.

Distribution : Rajasthan, Gujarat, Uttar Pradesh, West Bengal.

94. *Discolaimus tenax* Siddiqi, 1964
(Plate No.16, Fig. 94 & 20, G-H)

Measurements : Females : L = 1.06-1.38mm; a = 28-38; b = 3.4-4.1; c = 37-38; V = 11-13 49-52¹²⁻¹³

Description : Female : Body almost straight upon fixation. Cuticle finely striated. Lateral hypodermal chords $1/5$ - $1/4$ th of body-width, with well developed 90-105 glandular bodies. Lip region typical of the genus, set off by a deep constriction. Odontostyle 15-17 µm long; aperture 5-6 µm or about one third of odontostyle length. Odontophore rod-like 22-24 µm long. Guiding ring single 6-7 µm from anterior end. Basal expanded part of oesophagus occupies 52-54% of neck region. Female reproductive system amphidelphic. Ovaries reflexed. Prerectum 48-54 µm or 2.0 anal body-width long. Tail conoid with broadly rounded terminus, 28-36 µm long or 1.1-1.3 anal body-width long.

Male : Not found.

Habitat and locality : Soil inhabiting. Collected from soil around roots of millet at Bisalgarh, district Barmer.

Distribution : Rajasthan, Uttar Pradesh, Delhi.

95. *Discolaimus laksī* Khan & Laha, 1982
(Fig. 20,I-J)

Measurement : Females : L = 0.89-1.08 mm; a = 29-33; b = 3.3-4.2; c = 37-41; V = 10-11 47-48¹¹⁻¹²

Description : Female : Body almost straight upon fixation. Cuticle finely striated. Lateral chords $1/5$ - $1/4$ th of body-width, with well developed 50-62 glandular bodies. Lip region typical of the genus, set off by a deep constriction. Odontostyle 16-17 µm long; aperture 5-6 µm or about one third of odontostyle length. Odontophore rod-like, 24-25 µm long. Guiding ring single, 6-7 µm from anterior end. Basal expanded part of oesophagus occupies 53-55% of total neck region. Vulva a transverse slit. Vagina 7-8 µm or about one-fourth of corresponding body-width. Female reproductive system amphidelphic. Ovaries reflexed. Prerectum 34-37 µm or 1.0-1.5 anal body-width long. Rectum 24-25 µm or about one anal body-width long. Tail dorsally convex-conoid, 24-26 µm or 1.0-1.1 anal body-width long.

Male : Not found.

Habitat and locality : Collected from soil around roots of millet at Osian, district, Jodhpur.

Distribution : Rajasthan.

Genus *Myiodiscus* Thorne, 1939

Diagnosis : Body 1.1-1.8 mm long. Cuticle finely striated. Lip region disc like with inner bowl-shaped sclerotized lining with thickened bottom and radiating ridges. Lips clearly

demarcated. Odontostyle slender and conical with thickened tip, aperture small. Guiding ring 'double' Odontophore rod-like. Oesophageal expansion abrupt, DO and DN far from beginning of oesophageal expansion. Cardia dome shaped. Female reproductive system amphidelphic. Vulva transverse, with faintly sclerotized labia. Tail dorsally convex-conoid, with broadly rounded tip. Male not known.

Type species : *Myiodiscus nanus* Thorne, 1939

96. *Myiodiscus nanus* Thorne, 1939
(Plate No. 16, Fig. 96)

Measurements : Female : L = 1.25-1.38 mm; a=24-29; b=4.0-4.2; c = 58-67; V=55-58.

Description : Female : Lip region disc like with inner bowl-shaped sclerotized lining thickened bottom and radiating ridges. Odontostyle 12 µm long. Odontophore rod-like 12-13 µm long. Pharyngeal expansion abrupt. Female reproductive system amphidelphic. Prerectum 77-79 µm long. Tail 21-22 µm long, 0.7-0.8 anal body width long.

Male : Not found.

Habitat and locality : Soil inhabiting. Collected from soil around roots of various host plants at Jaisalmer, Jalore and Jodhpur districts.

Distribution : Rajasthan, Andaman and Nicobar Island.

97. *Myiodiscus magnus* Bohra & Sultana, 2008
(Plate No. 16, Fig. 97 & 24, A-E)

Measurements : Females : L = 0.81-1.0 mm; a = 30-37; b = 3.7-4.4; c = 33-42; V = 47-50.

Description : Female : Body moderately long, straight upon fixation. Cuticle 1.5 µm thick. Odontostyle 9-10 µm long, simple, with thickened tip. Odontophore 17-18 µm long. Pharynx abruptly enlarges at mid point. Pharyngeal bulb enveloped in distinct sheath. Prerectum 1.2 anal body widths long. Tail dorsally convex-conoid, with rounded tip.

Male : Not found.

Type habitat and locality : Soil inhabiting. Collected from soil around roots of moong (*Phaseolus* sp.) at Dholpur district, Rajasthan.

Distribution : Rajasthan.

Genus *Discolaimium* Thorne, 1939

Diagnosis : Body small to medium sized, 0.4-2.2 mm long, slender. Cuticle smooth. Lateral chords with distinct subcuticular glands, numbering 20 to 80 in each side of body. Lip region set off by deep constriction, discoid, but of same width as body; lips separate.

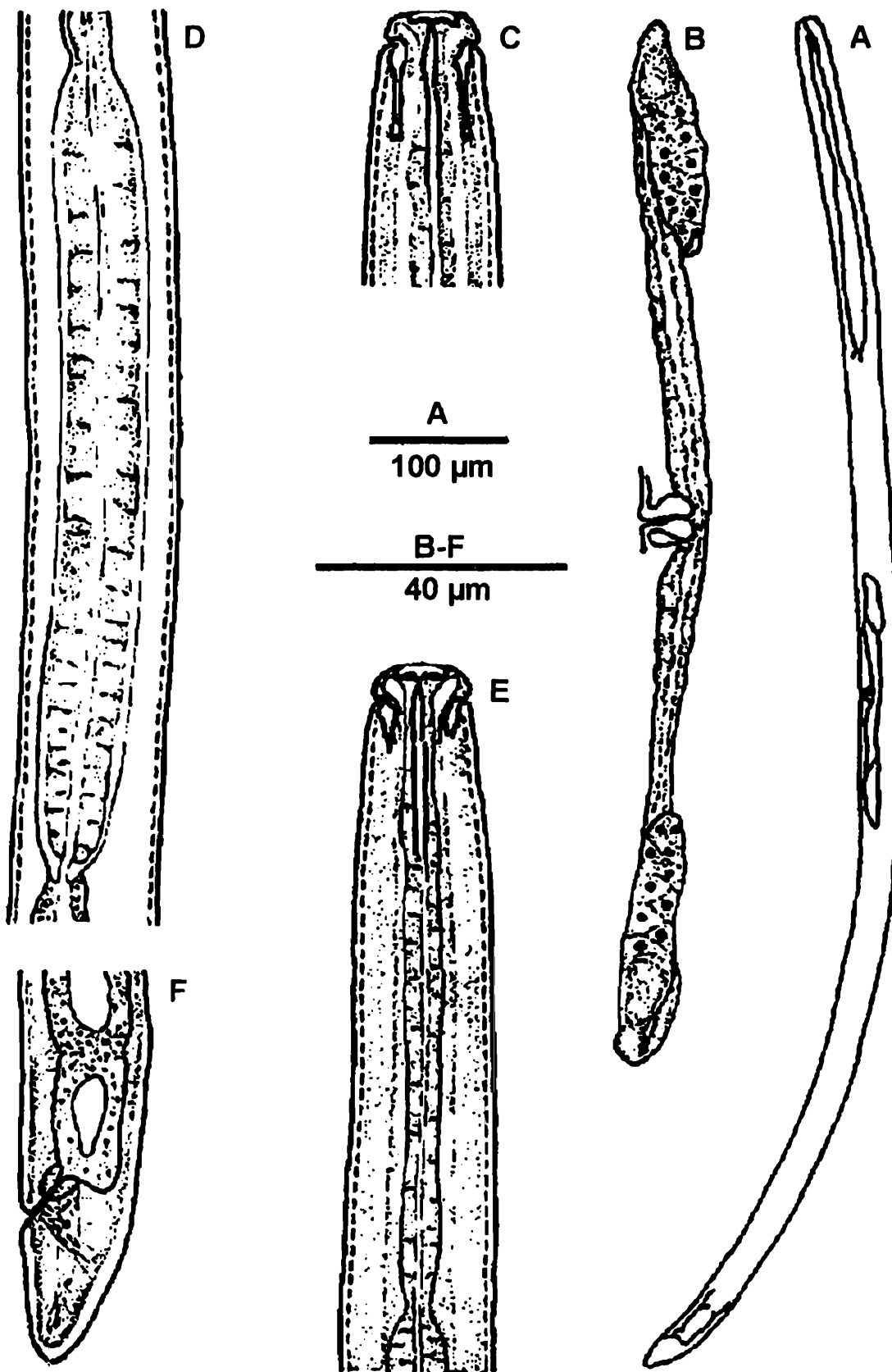


Fig. 24. *Mylodiscus magnus* Bohra & Sultana, 2008. A-Entire female; B-Female reproductive system; C-Anterior end; D-Expanded part of pharynx; E-Anterior part of pharynx; F-Posterior end.

Odontostyle short, dorylaimoid. Guiding ring single; aperture occupying $1/3^{\text{rd}}$ or $1/2$ of odontostyle length. Anterior part of oesophagus expanding abruptly from basal expanded part. Orifice of dorsal oesophageal gland at 0.3%, its nucleus at 6-10 % of oesophageal length from beginning of oesophageal expansion. Female reproductive system amphidelphic. Vulva transverse. Vagina not sclerotized. Males with dorylaimoid spicules and spaced ventromedian supplements. Tail short, conoid, rounded or sub digitate, similar in sexes.

Type species : *Discolaimium cylindricum* Thorne, 1939

98. *Discolaimium mukhtarpuriense* Baqri & Jairajpuri, 1969

(Fig. 25, A-B)

Measurements : Females : L = 0.80 - 0.87 mm; a = 25-32; b = 3.8-4.2; c = 28-29; V = 10^{-11} 53-55 10^{-11}

Description : Female : Body slender, slightly tapering in posterior third of its length upon fixation. Cuticle smooth. Lateral chords $1/5^{\text{th}}$ – $1/4^{\text{th}}$ of body-width, with well developed 60-70 glandular bodies. Lip region set off. Odontostyle 14-16 μm long; its aperture 506 μm . Guiding ring single. Odontophore 15-17 μm long. Basal expanded part of oesophagus occupies 33-36% of total neck region. Vulva transverse. Vagina 9-10 μm or about one third of corresponding body-width. Female reproductive system amphidelphic. Ovaries reflexed. Prerectum 72-102 μm or about 3-5 anal body-width long. Rectum 30-32 μm or about one anal body-width long. Tail 28-30 μm or 1.2 anal body-width long, convex-conoid, with a rounded terminus.

Male : Not found.

Habitat and locality : Collected from soil around roots of maize at Gogunda, district Udaipur.

Other habitat and locality : Five Females were also collected around roots of millet at Peeh, district Nagaur, and Nasirabad Road, district Ajmer.

Distribution : Rajasthan.

Genus *Discolaimoides* Heyns, 1963

Diagnosis : Body 0.9-2.1 mm long, tapering anteriorly. Lateral hypodermal glands present. Lip region expanded but not set off by constriction; lips not discoid. Odontostyle short, with aperture occupying about one-half its length. Posterior part of oesophagus strongly widened. Orifice of dorsal oesophageal gland at 6-8% and nucleus at 11-13% of oesophageal length from the beginning of expansion zone. Female genital organs amphidelphic. Vulva transverse, vagina not sclerotized. Males with dorylaimoid spicules and a few spaced ventromedian supplements. Tail similar in both sexes; conoid or sub-digitate, slightly bent ventrally, 2 to 5 times the anal diameter.

Type species : *Discolaimoides bulbiferus* (Cobb, 1906) Heyns, 1963

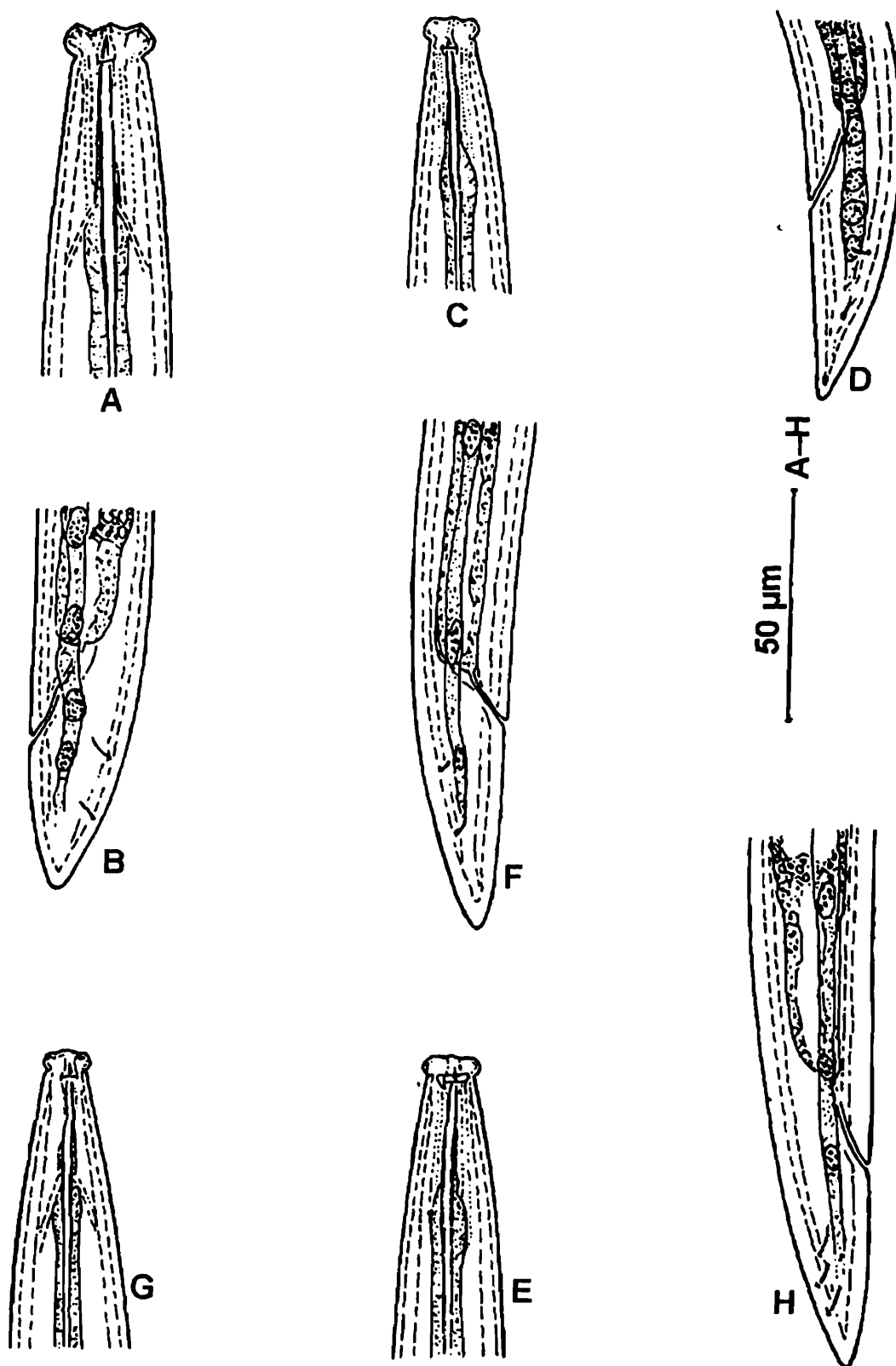


Fig. 25. A-B: *Discolaimium mukhtarpurens* Baqri & Jairajpuri, 1969. A-Female anterior end; B-Female tail. C-D : *Discolaimoides bulbiferus* (Cobb, 1906) Heyns, 1963. C-Female anterior end; D-Female tail. E-F : *Latocephalus smithi* (Heyns, 1963) Patil & Khan, 1982. E-Female anterior end; F-Female tail. G-H : *Latocephalus oostenbrinki* (Ali, Suryawanshi & Prabha, 1973) Patil & Khan, 1982. G-Female anterior end; H-Female tail.

99. ***Discolaimoides bulbiferus*** (Cobb, 1906) Heyns, 1963
(Plate No. 16, Fig. 99 & 25, C-D)

Measurements : Females : L = 1.40-1.65 mm; a = 46-55; b = 4.0-5.2; c = 35-36; V = 8-10⁴⁵⁻⁵³⁸⁻¹⁰.

Description : Female : Lip region expanded, set off by constriction. Lateral glandular bodies 80-90 in entire length. Odontostyle 15-17 µm long; aperture about half of odontostyle length. Odontophore 22-25 µm long. Basal expanded part of oesophagus occupies 52-60% of oesophageal length. Female reproductive system amphidelphic. Tail 40-45 µm or 1.8 anal body-width long, conoid with rounded terminus.

Male : Not found.

Habitat : Soil inhabiting.

Distribution : Rajasthan, West Bengal, Maharashtra, Gujarat.

Remarks : Commonly found species in the State.

Genus ***Latocephalus*** Patil & Khan, 1982

Diagnosis : Body medium to large sized, 0.7 to 1.5 mm slender to very slender. Cuticle smooth, lateral chords with 30-60 glandular bodies on each side of body. Lip region expanded, set off by constriction and wider than adjoining body. Amphids caliciform. Odontostyle 7 to 17 µm; aperture occupying 1/3rd to 1/2 of odontostyle length. Guiding ring single. Oesophagus enlarged near its middle. Dorsal gland at one to two oesophagus width from the beginning of expansion zone. Female reproductive system mono-opisthodelphic. Tail 2-4 anal body-width, convex-conoid with rounded tip, more or less curved ventrally.

Male : Not known.

Type species : *Latocephalus gracile* Patil & Khan, 1982

100. ***Latocephalus conicaudatus*** Baqri & Bohra, 2003
(Plate No. 16, Fig.100 & 26, A-F)

Measurements : Females : L = 1.85-2.01 mm; a = 61-62; b = 5.4-5.9; c = 38-39; V = 0.81-86³⁴⁻³⁵¹³⁻¹⁴.

Description : Female : Body slender, slightly curved ventrally in the posterior region upon fixation, Lateral hypodermal glands 63-68 in numbers. Lip region wider than adjoining body. Odontostyle 12 µm long; its aperture 5-6µm. Odontophore 22-23 µm long; Guiding ring 5-6 µm from anterior end. Basal expanded part of oesophagus occupies 52-54% of neck region. Reproductive system mono-opisthodelphic. Anterior uterine sac 15-16µm long. Prerectum 35-36 or 1-5 anal body width long. Tail 50-52 µm convex-conoid with rounded tip, about 2.2 anal body width long.

Male : Not found.

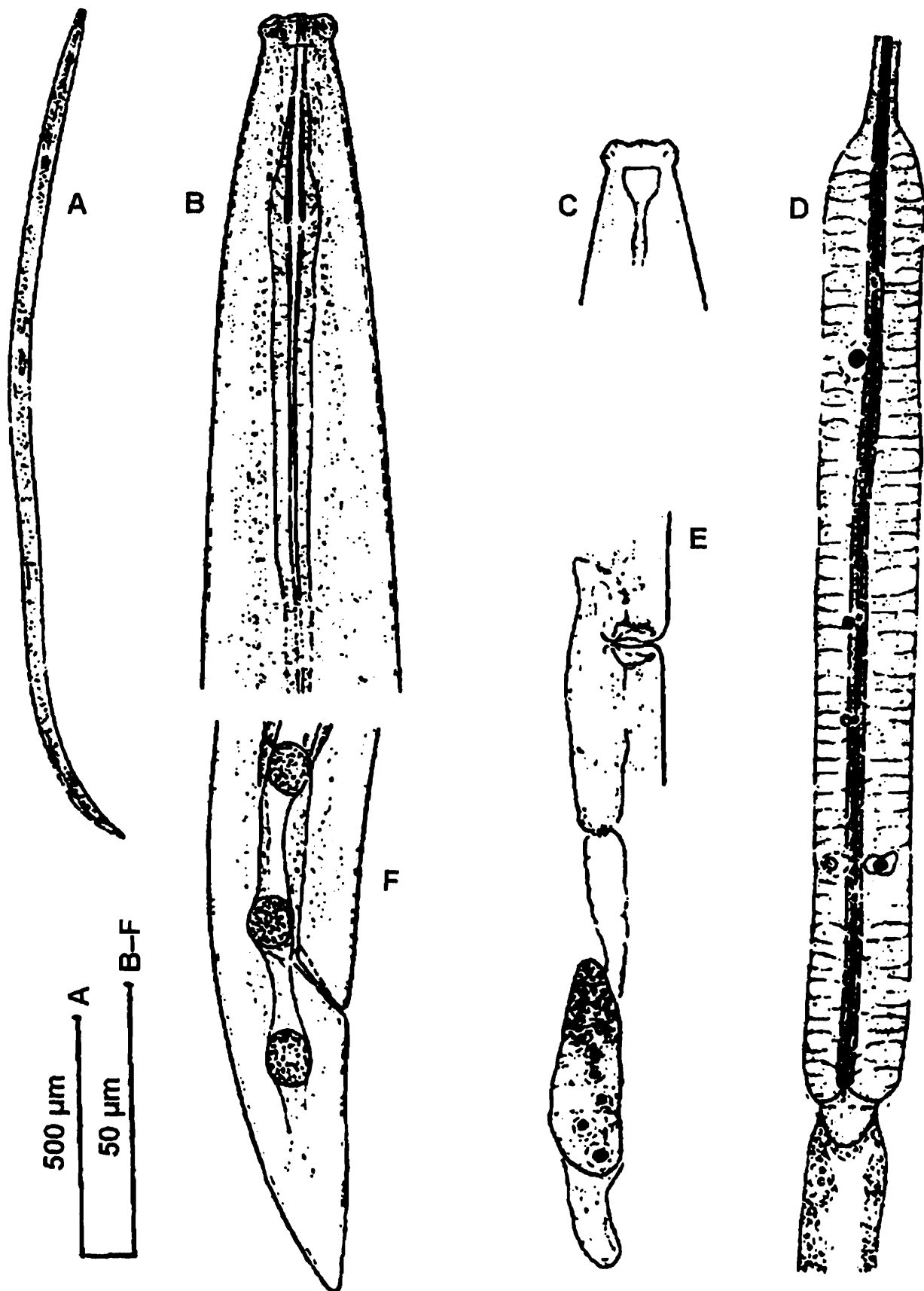


Fig. 26. *Latocephalus conicaudatus* Baqri & Bohra, 2003. A-Entire female; B-Female anterior end; C-Anterior end showing amphid; D-Expanded part of oesophagus; E-Female genital tract; F-Female posterior end.

Habitat and locality : Collected from soil around roots of lasora (*Cardia dischotoma*) at Ranthambhore National Park, Sawai Madhopur district, Rajasthan.

Other localities : Kela Devi road, district Karauli.

Distribution : Rajasthan

101. *Latocephalus laetanus* Siddiqi, 2003
(Plate No. 16, Fig. 101)

Measurements : Females : L = 1.15-1.27 mm; a = 42-55; b = 4.5-5.1; c = 41-42; V = 5-741-459¹⁰

Description : Female : Body ventrally arcuate to open C-shaped upon fixation. Lip region set off by a depression, slightly wider than adjoining body. Odontostyle with wide lumen, 8-9 µm long; its aperture 2/5 of odontostyle length. Odontophore 10-15µm long. Guiding ring plicate, 3-5 µm from anterior end. Basal expanded part of oesophagus occupies 37-44% of neck region. Reproductive system opisthodelphic. Anterior uterine sac absent. Prerectum 50-65 µm or about 2-3 anal body width long. Tail 27-31 µm long or 2.0-2.4 anal body width long; conoid to a small rounded terminus.

Male : Not found

Habitat and locality : Soil inhabiting. Collected from unidentified host from Sariska Tiger Reserve and Tijara road, district Alwar.

Distribution : Rajasthan.

102. *Latocephalus lotus* Siddiqi, 2003
(Plate No. 17, Fig. 102)

Measurements : Females : L = 0.98-1.07 mm; a = 38-46; b = 3.3-3.6; c = 32-36; V = 43-47.

Description : Female : Body ventrally curved upon fixation. Cuticle thin, smooth. Amphidial fovea stirrup-shaped. Odontostyle 8-10 µm long. Odontophore simple, rod like, 17-19 µm long. Vulva a transverse slit. Female reproductive system opisthodelphic, lacking anterior uterine sac. Prerectum 54-65 µm and rectum 16-19 µm long. Tail 1.8-2.2 anal body width long.

Male : Not found.

Habitat and locality : Soil inhabiting. Thanagachi, district Alwar

Distribution : Rajasthan.

103. ***Latocephalus smithi*** (Heyns, 1963) Patil & Khan, 1982
(Plate No. 17, Fig. 103 & 25,E-F)

Measurements : Females : L = 0.81-1.14 mm; a = 43-51; b = 3.6-4.5; c = 32-40; V = $2.347-50^{6-10}$

Description : Female : Body slightly ventrally curved. Lip region expanded. Odontostyle 8-9 μ m long; its aperture 2/5 of its length. Odontophore 16-17 μ m long. Guidng ring 5-6 μ m from anterior end. Basal expanded part of oesophagus occupies 45-47% of neck region. Lateral hypodermal glandular organs 60-65 in number, very distinct especially in tail region. Reproductive system opisthodelphic. Anterior uterine sac 9-10 μ m long. Prerectum 35-40 μ m or 2-2.5 anal body width long. Tail 25-27 μ m long convex-conoid about 0.5-0.6 anal body -width long.

Male : Not found

Habitat and locality : Soil inhabiting. Thanagachi, district Alwar.

Distribution : Rajasthan, Gujarat.

104. ***Latocephalus gracile*** Patil & Khan, 1982
(Plate No. 17, Fig. 104)

Measurements : Female : L = 1.19 mm; a = 44.40; b = 4.28; c = 51-55; V = 38.

Description : Female : Lip region expanded; 8 μ m wide and 5 μ m high. Odontostyle 9 μ m long. Odontophore 20 μ m long. Guiding ring 5 μ m from anterior end. Basal expanded part of oesophagus occupies about 46% of neck region. Female reproductive system mono-opisthodelphic. Anterior uterine sac 10 μ m. Prerectum about 45 μ m or 3 anal body-width long. Tail elongate conoid, 38 μ m long or 2.5 anal body-width long.

Male : Not found.

Habitat and locality : Soil inhabiting. Collected from soil around roots of millet at Dikwala, district Jalore.

Distribution : Maharashtra, Rajasthan, Gujarat.

105. ***Latocephalus oostenbrinki*** (Ali, Suryawanshi & Prabha, 1973) Patil & Khan, 1982
(Fig. 25,G-H)

Measurements : Female : L = 1.77 mm; a = 52; b = 5.4; c = 42; V = 38⁸.

Description : Female : Body slender, slightly ventrally curved in posterior region. Cuticle transversely striated. Lateral chords about 1/4th of body-width near middle, with 30 glandular organs on each side. Lip region set off from body by a deep constriction; lips separate. Odontostyle 12 μ m long; aperture 4 μ m or about one-third of odontostyle length. Odontophore 15 μ m long. Basal expanded part of oesophagus occupies 50% of neck region.

Vulva a transverse slit. Vagina slightly posteriorly directed and about one-third of corresponding body-width. Female reproductive system mono-opisthodelphic. Anterior uterine sac absent. Prerectum 50 μm or 2.5 anal body-width long. Rectum 20 μm or anal body-width long. Tail elongate conoid, 42 μm long or 2.1 anal body-width rounded terminus.

Male : Not found.

Habitat and locality : Collected from soil around roots of millet around Bijawal, dis Jodhpur.

Distribution : Rajasthan.

Subfamily LORDELLONEMATINAE Siddiqi, 1969

Diagnosis : Cuticle tylencholaimoid type. Somatic musculature apparently meromyarian. Body pores usually distinct, leading to prominent cuticularised ducts. Lip region off set by constriction. Odontostyle dorylaimoid, with wide lumen and aperture. Odontophore simple, rod-like. Anterior pair of sub-ventral glands widely separated from each other, anterior one being close to dorsal gland. Female reproductive system monodelphic or amphidelphic.

Males very rare. Spicules with or without median stiffening piece. Tail short, conoid to elongate-conoid; similar in sexes.

Type genus : *Lordellonema* Andrassy, 1960

Other genera : *Poronemella* Siddiqi, 1969; *Moshajia* Siddiqi, 1982; *Sicorinema* Siddiqi, 1982

Key to genera of Lordellonematinae

1. Body pores indistinct; Female reproductive system mono-opisthodelphic ***Sicorinema***
- Body pores distinct; Female reproductive system monodelphic 2
2. Ventral body pores restricted to oesophageal region; tail elongate-conoid, dorsally bent ***Poronemella***
- Ventral body pores occur a long entire length of body; tail short conoid, or sub-digitate 3
3. Odontostyle aperture more than one-half its length; spicules non-dorylaimoid ***Moshajia***
- Odontostyle aperture less than one-half its length; spicules dorylaimoid ***Lordellonema***

Genus ***Poronemella*** Siddiqi, 1969

Diagnosis : Body slender, 1.0-1.7 mm long. Body pores distinct. Lip region angular, off set. Odontostyle well developed, with wide aperture and lumen. Odontophore enlarging near middle. Female reproductive system amphidelphic. Vulva pore-like. Tail elongate conoid, distal end tending to curved dorsally.

Males : Not known.

Type species : *Poronemella porifer* (Loof, 1964) Siddiqi, 1969

106. ***Poronemella shamimi*** Baqri & Bohra, 2003
(Plate No. 17, Fig. 106 & 27, A-F)

Measurements : Females : L = 1.63-1.74 mm; a = 32-34; b = 3.6-3.8; c = 58-60; V = 52-53

Description : Females : Body slightly ventrally curved upon fixation. Body pores distinct only in oesophageal region. Lip region set off from adjoining body. Odontostyle 26-27 μm long; aperture 10 μm or 37-38% of odontostyle. Guiding ring situated at 0.75-0.76 lip region width from anterior end. Odontophore 32-33 μm long. Basal expanded part of oesophagus occupies 49-50% of neck length. Reproductive system amphidelphic. Prerectum 72-78 μm long or 2.4-2.6 anal body-width long. Tail 28-30 μm long, bluntly rounded, one anal body-width long.

Male : Not found.

Habitat and locality : Soil inhabiting. Collected from soil around roots of cotton (*Gossypium* sp.) and brinjal.

Distribution : Rajasthan and Gujarat.

Remarks : Baqri & Bohra(2003) described this species as new to Science from Gujarat State.

107. ***Poronemella amini*** Siddiqi, 1969
(Plate No. 17, Fig. 107)

Measurements : Females : L = 1.4-1.7 mm; a = 43-51; b = 3.5-4.2; c = 13-15; V = 49-54; Odontostyle = 15-17 μm ; Odontophore = 18-20 μm .

Description : Female : Body ventrally arcuate upon fixation. Lips well developed. Lateral and ventral body pores distinct. Lip region set off from adjacent body by constriction. Oesophagus expansion gradual. Female reproductive system amphidelphic. Prerectum about 2 anal body width. Tail elongate conoid with distal portion tending to bent dorsally.

Male : Not found.

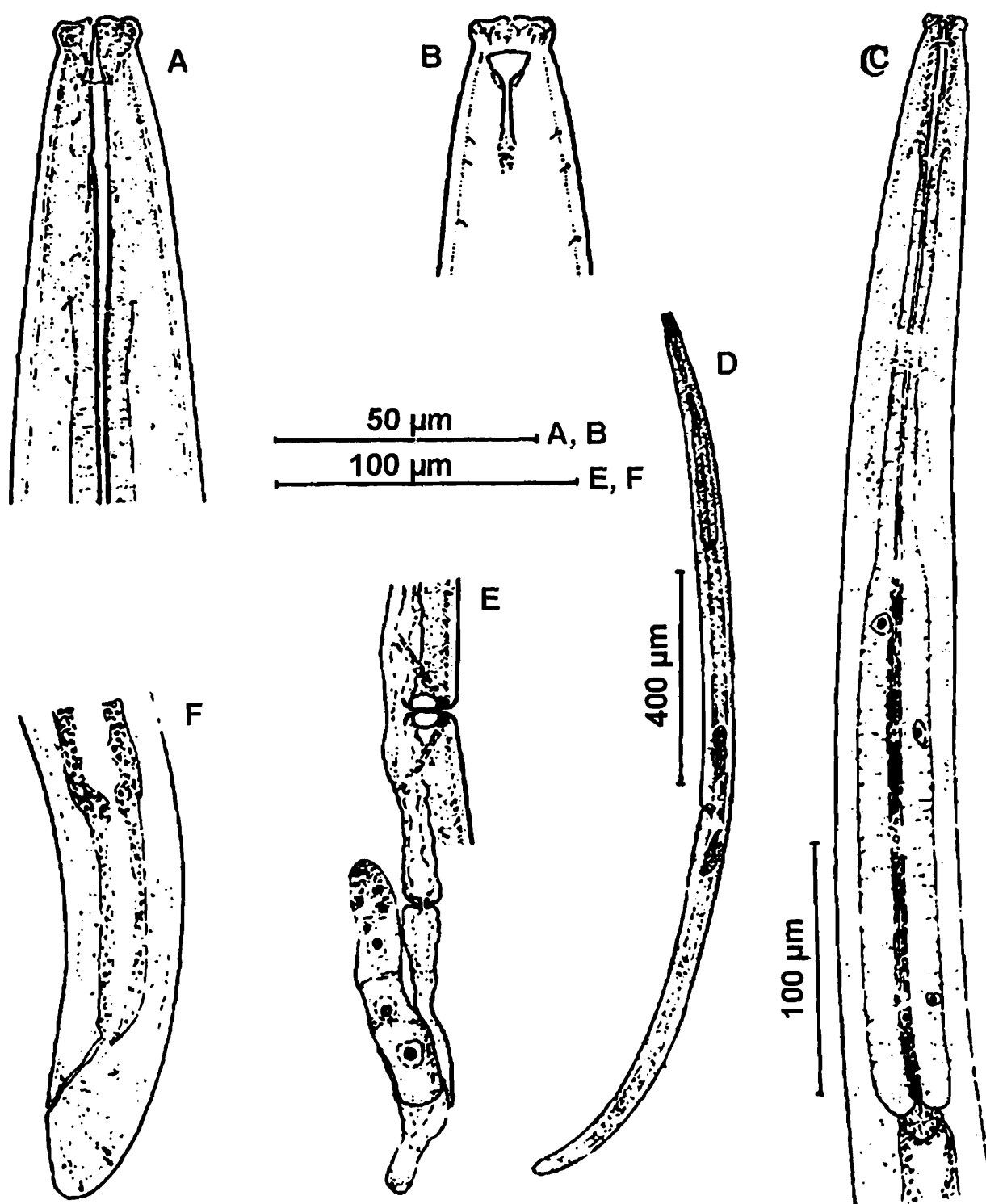


Fig. 27. *Poronemella shamimi* Baqri & Bohra, 2003. A-Female anterior end; B-Anterior end showing amphid; C-Female oesophageal region; D-Entire Female; E-Female posterior genital tract; F-Female posterior end.

Habitat and localities : Soil around roots of fruit trees and other plants. Kanot, district Jaipur; Mehendipur Balaji road, district Dausa.

Distribution : Rajasthan, Gujarat.

Family NORDIIDAE Jairajpuri & A.H. Siddiqi, 1964

Body 0.4-7.0mm long. Cuticle finely striated. Lip region continuous or off set by depression or constriction, lips amalgamated or well separated; labial papillae raised or seliform. Amphids with strrup-shaped fovea and slit-like aperture. Odontostyle slender, attenuated, long, with narrow lumen and aperture. Guiding ring single or double. Odontophore elongate, rod-like or with basal swelling or basal swelling or flanges. Basal expanded part of oesophagus about 50% of oesophagus. Vulva transverse slit; vagina sometime distally sclerotized. Female reproductive system mono-opisthodelphic or amphidelphic. Tail similar in sexes; hemispherical to long, filiform.

Key to subfamilies of NORDIIDAE Jairajpuri & A.H. Siddiqi, 1964

1. Labial papillae enlarged, rising significantly above lip contour 2
 - Labial papillae not enlarged 3
2. Cuticle with longitudinal and transverse groove-like striations forming lamelliform pattern on body HELMABIINAE
 - Cuticle smooth, groove-like striations absent CEPHALODORYLAIMINAE
3. Odontophore usually flanged PUNGENTINAE
 - Odontophore not flanged 4
4. Body usually robust; odontostyle three-five lip region widths long NORDIINAE
 - Body usually slender; odontostyle generally not more than two lip region widths long ACTINOLAIMOIDINAE

Subfamily PUNGENTINAE Siddiqi, 1969

Diagnosis : Small to medium-sized nematodes (0.8-2.8 mm). Cuticle finely striated. Radial striations and saccate bodies may be present. Body pores indistinct. Lip region continuous or set-off by constriction; labial papillae distinctly visible. Cuticularised pieces may be present around oral aperture. Amphids with stirrup-shaped fovea and slit-like aperture, labial or post-labial in position. Odontostyle small to very long (8-70 μ m), with narrow lumen and aperture. Guiding ring single or 'double' Odontophore rod-like usually with small knobs or broad flanges. Oesophagus expanding beyond its middle. Cardia hemispherical or elongate. Vulva transverse. Female reproductive system usually amphidelphic, rarely mono-opisthodelphic. Spicules arcuate, lateral guiding pieces present and ventromedian supplements 4-12, spaced. Tail hemispheroid to long, filiform; similar in sexes.

Type genus : *Pungentus* Thorne and Swanger, 1936.

Key to Genera of Pungentinae

1. Tail short to elongate-conoid 2
 - Tail long, filiform 6
2. Odontostyle very long, over 50 μm **Californidorus**
 - Odontostyle shorter, under 50 μm 3
3. Amphids labial **Kochinema**
 - Amphids post-labial 4
4. Cuticle near vulva coarsely striated **Rhysocolpus**
 - Cuticle near vulva not striated 5
5. Cuticularised platelets present around stoma **Pungentus**
 - Cuticularised platelets not present around stoma **Enchodelus**
6. Odontostyle under 10 μm ; ventromedian supplements few, spaced **Enchodorus**
 - Odontostyle over 15 μm ; ventromedian supplements numerous, mammiform, contiguous **Lenonchium**

Genus *Kochinema* Heyns, 1963

Diagnosis : Small to medium-sized. Lip region expanded but not discoid. Amphids labial in position, with stirrup-shaped fovea and slit-like aperture. Odontostyle long, slender, with short aperture. Guiding ring 'double' Odontophore rod-like, well developed. Expanded part of oesophagus about one half oesophageal length, anterior slender part muscular. Vulva transverse. Female reproductive system amphidelphic. Spicules typical dorylaimoid; lateral guiding pieces present and ventromedian supplements few, spaced. Tail short-conoid; similar in sexes.

Type species : *Kochinema proamphidum* Heyns, 1963

108. *Kochinema caudatum* Baqri & Bohra, 2001

(Plate No. 17, Fig. 108 & 28, A-F)

Measurements : Females : L = 0.81-0.95 mm; a = 25-30; b = 3.7-4.2; c = 24-27; V = 12-13/54-57¹²⁻¹³.

Description : Female : Lip region offset from body, wider than adjoining body. Odontostyle 36-38 μm long. Odontophore 30-32 μm long. Guiding ring 28-30 μm . Basal expanded part of oesophagus occupies 37-40% of oesophageal length. Female reproductive system amphidelphic. Tail 32-35 μm long, conoid with rounded tip, 1.6-1.7 anal body-width long.

Male : Not found.

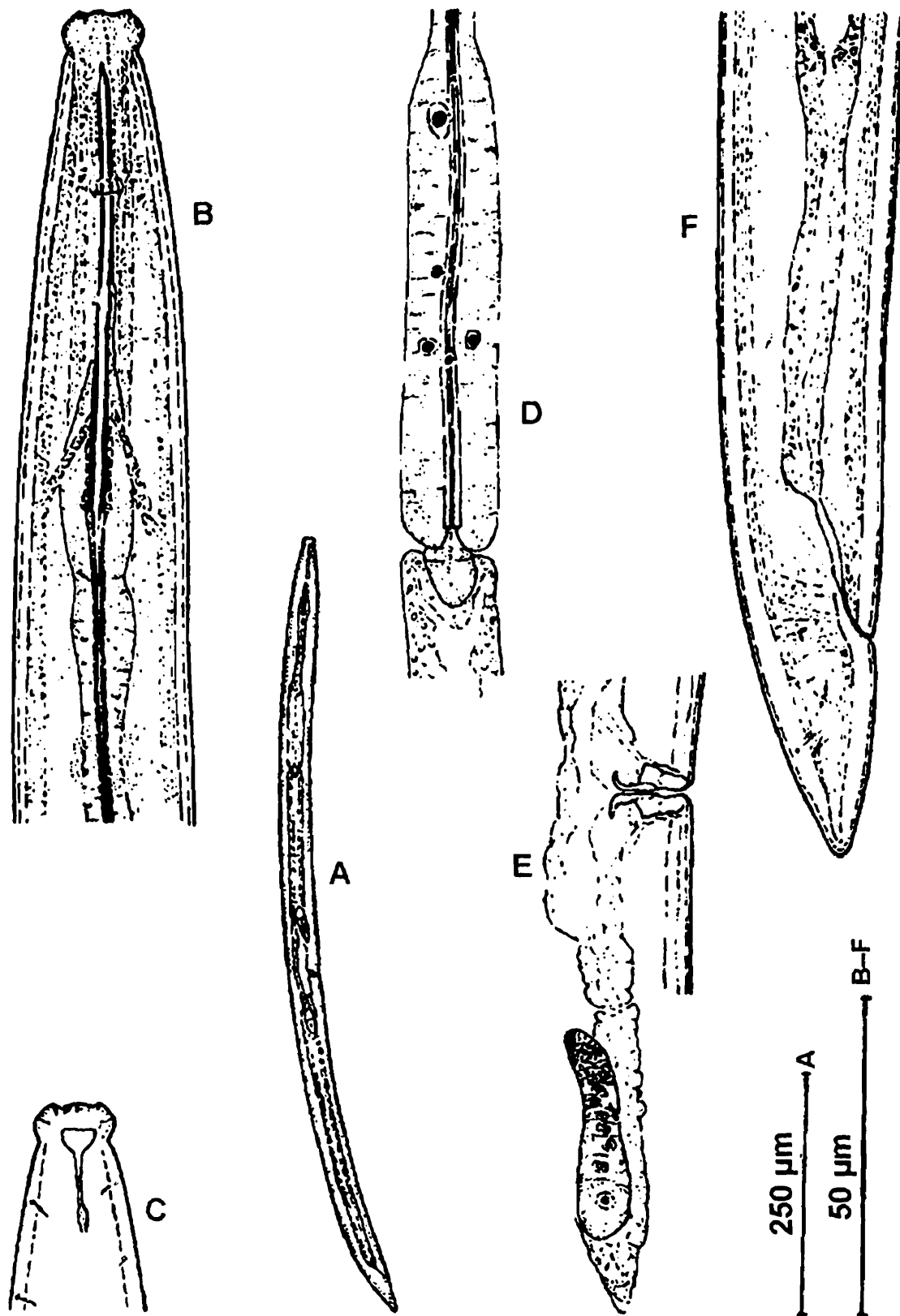


Fig. 28. *Kochinema caudatum* Baqri & Bohra, 2001. A-Entire Female; B-Anterior end; C-Anterior end (surface view); D-Pharyngeal region; E-Posterior genital branch; F-Tail.

Type habitat and locality : Collected from soil around roots of wheat (*Triticum aestivum*) at Peeh, district Nagaur, Rajasthan, India.

Other localities : Collected from soil around various plants Rajakheda, district Dholpur, Mathania, Jodhpur.

Distribution : Rajasthan, Gujarat.

109. ***Kochinema farodai*** Baqri & Bohra, 2001

(Plate No. 18, Fig. 109 & 29, A-F)

Measurements : Females : L = 0.96-1.08 mm; a = 29-32; b = 4.1-4.5; c = 30-33; V = 10-11 52-54¹⁰⁻¹¹

Description : Female : Lip region distinctly set-off from body, wider than adjoining body. Odontostyle 17-19 µm long. Odontophore 19-22 µm long, rod-like. Guiding ring 10 - 11 µm from anterior end. Basal expanded part of oesophagus occupies 41-44% of neck length. Female reproductive system amphidelphic. Tail 32-35µm long; 1.4-1.6 anal body-width long, convex-conoid with rounded terminus.

Male : Not found.

Type habitat and locality : Collected from soil around roots of wheat (*Triticum aestivum*) at Kelwada, district Udaipur, Rajasthan, India.

Distribution : Rajasthan, Gujarat.

Remarks : Collected from almost every district surveyed in the State.

Subfamily NORDIINAE Jairajpuri and A.H. Siddiqi, 1964

Diagnosis : Body short and robust. Cuticle usually thick. Lip region continuous or offset by a constriction. Odontostyle long, attenuated, three-five times width of lip region. Odontophore as long as odontostyle. Oesophagus long, with slender anterior and well-developed expanded posterior part; latter usually about one-third to less than one-half oesophageal length. Female reproductive system mono-opisthodelphic or amphidelphic. Tail usually short, dorsally convex-conoid; similar in sexes.

Type genus : *Longidorella* Thorne, 1939

Key to Genera of NORDIINAE

Body robust; odontostyle three-five lip region widths long

..... *Longidorella*/*Saevadorella*

Body slender; odontostyle two lip region widths long *Thornedia*

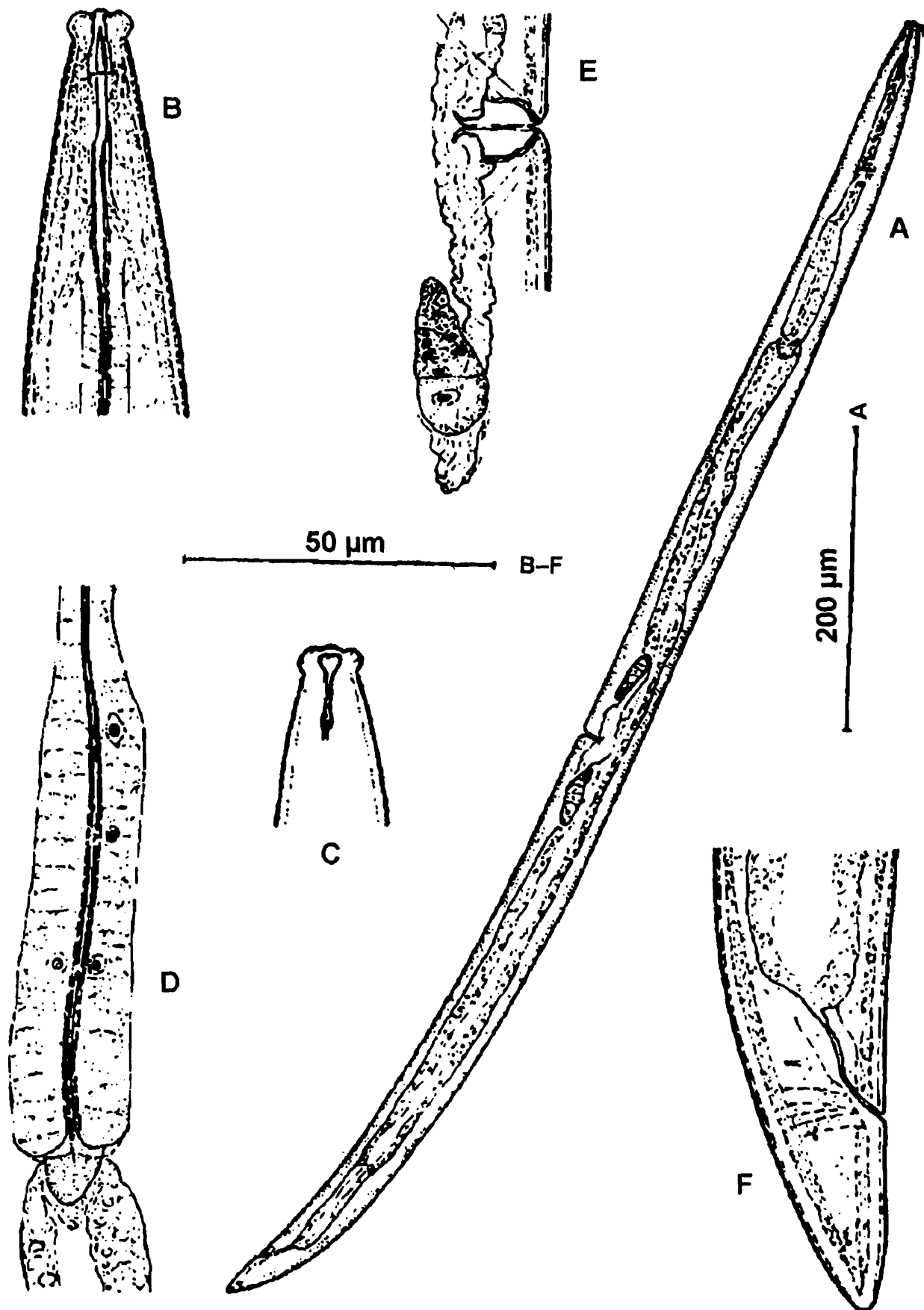


Fig. 29. *Kochinema farodai* Baqri & Bohra, 2001. A-Entire Female; B-Anterior end; C-Anterior end (surface view); D-Pharyngeal region; E-Posterior genital branch; F-Tail.

Genus ***Longidorella*** Thorne, 1939

Diagnosis : Body short and robust, usually under 1 mm. Lip region continuous set off from body contour. Odontostyle long, usually three-five lip region width long. Guiding ring single. Odontophore long. Amphids stirrup-shaped fovea with slit-like apertures. Oesophagus long, anterior slender and posterior expanded part. A constriction may or may not be present at junction of two parts of oesophagus. Female reproductive system usually amphidelphic, rarely monodelphic. Spicules dorylaimoid, lateral guiding pieces present and ventromedian supplement spaced. Tail short, dorsally convex-conoid to hemispheroid; similar in sexes.

Type species : *Longidorella parva* Thorne, 1939

110. ***Longidorella xenura*** Khan & Siddiqi, 1963
(Plate No. 18, Fig. 110)

Measurements : Females : L = 0.75; a = 22; b = 3.2; c = 10.6; V = 56.

Description : Female : Body short, robust. Lip region rounded, continuous with body contour. Odontostyle 45 µm long, attenuated. Odontophore 40 µm long, rod shape. Expanded part of pharynx 38% of pharyngeal length. Female reproductive system amphidelphic. Prerectum 25 µm or about one anal body width long. Tail elongate-conoid.

Male : Not found.

Habitat and localities : Soil inhabiting. Peeh, district Nagaur; Osian, district Jodhpur.

Distribution : Himachal Pradesh, Maharashtra and Rajasthan.

Superfamily ACTINOLAIMOIDEA Thorne, 1939

Diagnosis : Lip region with sclerotised pharyngeal walls varying from simple plates to strong refractive basket-like or ribbed structure, frequently accompanied by four large onchia which may be fused into a spear guide or accompanied by muscular other mural denticles. Strong basal shield present at base of pharynx. Female reproductive system amphidelphic very rarely mono-opisthodelphic. Tail short, conoid to long, filiform; similar or dissimilar in sexes.

Type family : ACTINOLAIMIDAE Thorne, 1939

Key to families of ACTINOLAIMOIDEA Thorne, 1939

1. Female tail shorter than two anal body widths, conical or rounded; vestibule with basket-like structures CARCHAROLAIMIDAE
- Female tail at least four anal body widths long, no basket-like structures present in vestibule 2
2. Vestibule with four massive onchia with or without denticles ACTINOLAIMIDAE

- Vestibule without onchia but with corrugated ring and several transverse rows of mural denticles TRACHYPLEUROSIDAE

Family ACTINOLAIMIDAE Thorne, 1939

Body cylindroids; lip continuous or off set by constriction or expansion. Vestibule with four massive onchia with or without denticles. Odontostyle dorylaimoid, with distinct aperture. Expanded part of oesophagus about one-half oesophageal length. Basal shield at base of oesophagus present or absnt. Vulva transverse, longitudinal or pore-like. Female reproductive system mono-opisthodelpic or amphidelphic. Males with dorylaimoid spicules, lateral guiding pieces and ventromedian supplement arranged in series or grouped in two or three fassicles. Tail elongates-conoid to long, filiform, similar or dissimilar in sexes. The genera *Neoactinolaimus* and *Carcharolaimus* of the fmaily Actinolaimidae are represented by two and one species in Rajasthan.

Subfamily NEOACTINOLAIMINAE Thorne, 1967

Diagnosis : Cuticle not longitudinally striated, only with minute transverse striations. Vestibule armed with four massive onchia but without denticles. Odontostyle large, with aperture about one-half length. Post-extension constriction of oeosphagus absent or present. Oesophagus with or without shield. Female reproductive system amphidelphic. Males with dorylaimoid spicules, lateral guiding pieces and supplements in ventral series or in fassicles. Female tail elongate to filiform; male tail obtusely rounded.

Type genus : *Neoactinolaimus* Meyl, 1967

Key to Genera of Neoactinolaiminae

1. Vestibule armed with four onchia
 - Vestibule armed with six onchia ***Hexactinolaimus***
2. Onchbia fused, forming strongly developed secondary spear guide
 - ***Metactinolaimus***
 - Onchia not fused, not forming secondary spear guide 3
3. Ventromedian supplements arranged in two-three fassicles ***Neoactinolaimus***
 - Ventromedian supplements arranged in series ***Egtitus***

Genus *Neoactinolaimus* Thorne, 1967

Diagnosis : Body cylindroid except at ends. Vesitbules armed with four large onchia, devoid of denticles. Odontostyle dorylaimoid, aperture one-half to two-fifths length. Guiding ring 'double' Odontophore simple, rod-like, lightly sclerotized. Post-extension constriction of oesophagus present. Anterior part of oesophagus with radial muscles. Female reproductive system amphidelphic. Spicules dorylaimoid with lateral guiding pieces.

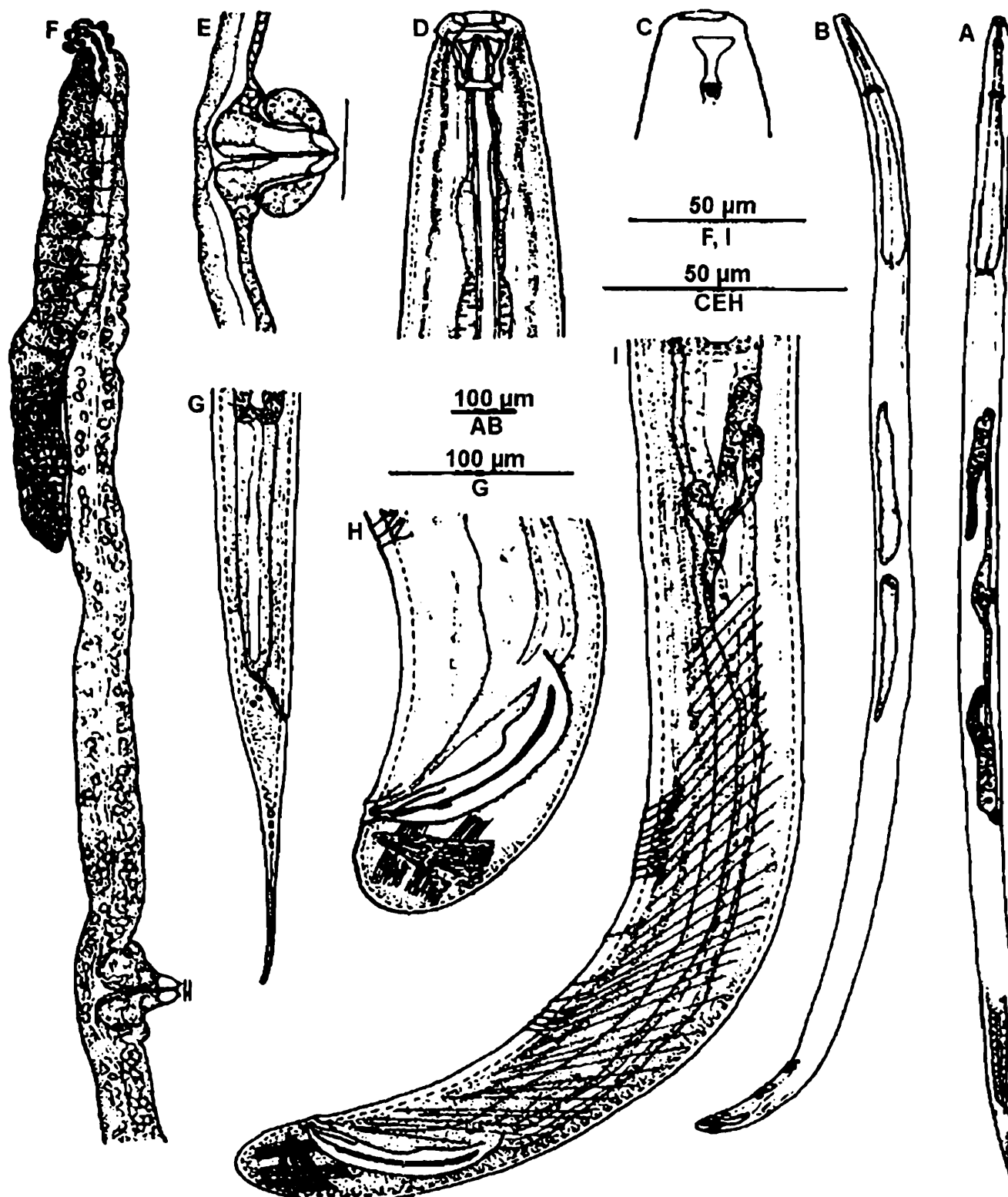


Fig. 30. *Neoactinolaimus rajasthanensis* Bohra & Sultana, 2008. A-Entire Female; B-Anterior end; C-Amphid; D-Anterior end; E-Vulval region; F-Anterior branch of female reproductive system; G-Posterior end of female; H and I: Posterior ends of female.

Supplements an adnal pair and ventromedians arranged in two-three fascicles; occasionally a few ventral supplements also occur in between fascicles. Female tail elongate to long, filiform; tail obtusely rounded.

Type species : *Neoactinolaimus agilis* Thorne, 1967

111. *Neoactinolaimus rajasthanensis* Bohra & Sultana, 2008

(Plate No. 18, Fig. 111 & 30, A-H)

Measurements : Female : L = 2.3-2.6 mm; a = 44-49; b = 4.3-4.7; c = 12.9-15.1; V = 43.7-49.3.

Male : L = 2.2-2.4 mm; a = 40-50; b = 3.5-4.6; c = 92.2-121.2.

Description : Female : Body almost straight upon fixation. Cuticle smooth. Lip region rounded, expanded, set off by a slight constriction. Amphids stirrup-shaped with slit-like aperture and located 7-8 μ m from anterior end. Odontostyle 10-11 μ m long or 1.2-1.3 lip region diameter long. Odontophore simple rod-like. Female reproductive system amphidelphic. Prerectum 7-8 and rectum 1.2-1.7 anal body diameter long. Tail tapering gradually into filiform, terminal portion with rounded tip.

Male : Spicules 60-66 μ m long. Lateral guiding pieces well distinct, 13-15 μ m long. Four ejaculatory glands distinct in region of prerectum.

Type habitat and locality : Soil inhabiting. Predatory. Collected from flooded area of Kawas Village, district Barmer, Rajasthan.

Distribution : Rajasthan.

Remarks : Bohra & Sultana (2008) described this species as new to Science.

112. *Neoactinolaimus kosambus* Khan, Ahmad & Jairajpuri, 1994

(Plate No. 18, Fig. 112)

Measurements : Females : L=2.0-2.1 mm; a = 31-38; b=3.7-4.2; c = 10-11; V = 46-56.

Male : L = 1.9-2.0 mm; a = 37-39; b = 3.8-4.2; c = 132-149.

Description : Female : Cheilostome armed with four large onchia, each onchium provided with a secondary tooth. Odontostyle 25 μ m long. Odontophore 23-25 μ m long. Basal expanded part of pharynx 51-54% of pharyngeal length. Female reproductive system amphidelphic. Prerectum 5.7-6.2 anal body width long. Tail 5.7-5.9 anal body width long.

Male : Spicules 48-51 μ m long. Lateral guiding pieces 11-12 μ m long.

Habitat and locality : Soil inhabiting. Predatory. Gudala, district Karauli.

Distribution : Rajasthan.

Family CARCHAROLAIMIDAE Thorne, 1967

Diagnosis : Medium sized nematodes. Cuticle with fine transverse striations. Lateral chords with distinct spaced glandular bodies from which the single row of pores arises. Lip region large, wider than body, sharply set off, showing a sclerotized basket-like structure composed of ribs, teeth and minute denticles. Pharynx around anterior part of odontostyle sclerotized as well. Odontostyle shorter or longer than labial width, predominantly with large aperture. Guiding ring single or double, sometimes heavily sclerotized. Anterior part of oesophagus non-muscular while basal expanded part muscular. Basal shield often present. Female genital system amphidelphic. Vulva longitudinal or transverse. Males with dorylaimoid spicules and spaced ventro-median supplements. Tail short conoid or bluntly rounded; similar in both sexes.

Type subfamily : CARCHAROLAIMINAE Thorne, 1967

Other subfamily : Caribenematinae Thorne, 1967

Key to subfamilies of CARCHAROLAIMIDAE Thorne, 1967

1. Stoma narrowing behind guiding ring CARCHAROLAIMINAE
- Stoma not narrowing behind guiding ring CARIBENEMATINAE

Subfamily CARCHAROLAIMINAE Thorne, 1967

Diagnosis : Lip region distinctly set off by constriction. Labial framework basket-like with ribs, denticles or small onchia, or with six strong forwardly directed onchia or pair of plates. Odontostyle less than width of lip region; aperture one half or less of odontostyle length. Cardia elongate-conoid or cylindroids. Female reproductive system amphidelphic. Tail short conoid to bluntly rounded; similar in sexes.

Key to Genera of Carcharolaiminae

1. Lip region set off; tail conoid, ventrally curved 2
- Lip region continuous; tail elongate and straight **Brasilaimus**
2. Lips angular, petaloid, bearing rods and plates **Antholaimus**
- Lips not angular, without rods or plates 3
3. Cephalic framework basket-like 4
- Cephalic framework provided with two plates-shallow bowl-like posterior and small anterior **Mylodiscoides**
4. Cephalic framework with strong onchia 5
- Cephalic framework with ribs, denticles or small teeth **Carcharolaimus**

5. Onchia six **Carcharoides**
 Onchia four **Caryboca**

Genus **Carcharolaimus**, 1939

Diagnosis : Body medium sized (1.0 to 2.7 mm). Cuticle finely striated transversely. Lip region set off by deep constriction; lips well developed; cephalic framework basket-like, with ribs, denticles or small basal onchia. Odontostyle 11-21 μm long ; aperture about one half of odontostyle length. Anterior part of oesophagus a slender. Hyaline tube, posterior part broad and muscular, with strong radial musculature and dense glandular tissues. Vulva transverse. Femlae reproductive system amphidelphic. Ovaries reflexed. Males with dorylaimoid spicules Ventromedian supplements 7 to 20, spaced. Tail in both sexes similar, short conoid or predominantly bluntly rounded.

Type species : *Carcharolaimus teres* Thorne, 1939

113. **Carcharolaimus masoodi**, Jairajpuri, 1968

(Plate No. 18, Fig. 113 & 31, A-E)

Measurements : Females : L = 1.59-1.60 mm; a = 48-49; b = 4.2-4.5; c = 64-72; V = 5-650-514-5

Description : Female : Body tapering slightly towards extremities. Outer cuticle 2-4 μm thick (thickest at tail). Lateral chords about $1/4^{\text{th}}$ of body-width at mid-body. Lateral glandular organs vary from 102-130, more conspicuous on tail. Of these, 20-27 are in oesophageal region. Lips large, angular, labial papillae visible 21-22 μm wide or as wide as about $2/3^{\text{rd}}$ of body-width at the base of oesophagus. Amphids cup-shaped, situated 7-9 μm from anterior end, 6-7 μm wide. Odontostyle 11-13 μm long; aperture 5-6 μm or 45-46% of odontostyle length. Guiding ring 9-11 μm from anterior end. Odontophore 20-24 μm long. Nerve ring encircles oesophagus at about 93-102 μm from anterior end. Basal expanded part of oesophagus occupies 55-60% of total neck region. Oesophageal lumen sclerotized, 2-4 μm wide. Cardia hemispheroid. Prerectum 35-50 μm long or 1.5-1.6 anal body-width long. Rectum 19-23 μm or 0.9-1.1 anal body-width long. Female reproductive system amphidelphic. Vulva a transverse slit. Vagina 13-15 μm or $1/3^{\text{rd}}$ of to $1/4^{\text{th}}$ of corresponding body-width long. Both genital branches are equally developed. Ovaries reflexed. Tail rounded conoid, 22-25 μm long or 1.1-1.2 anal body-width long, with two caudal pores on each side.

Male : Not found.

Habitat and localities : Soil inhabiting- Predatory. Desuri ki naal, district Udiapur, Dikwala, district Jalore and Jhunjhunu.

Distribution : Rajasthan, Gujarat, Uttar Pradesh.

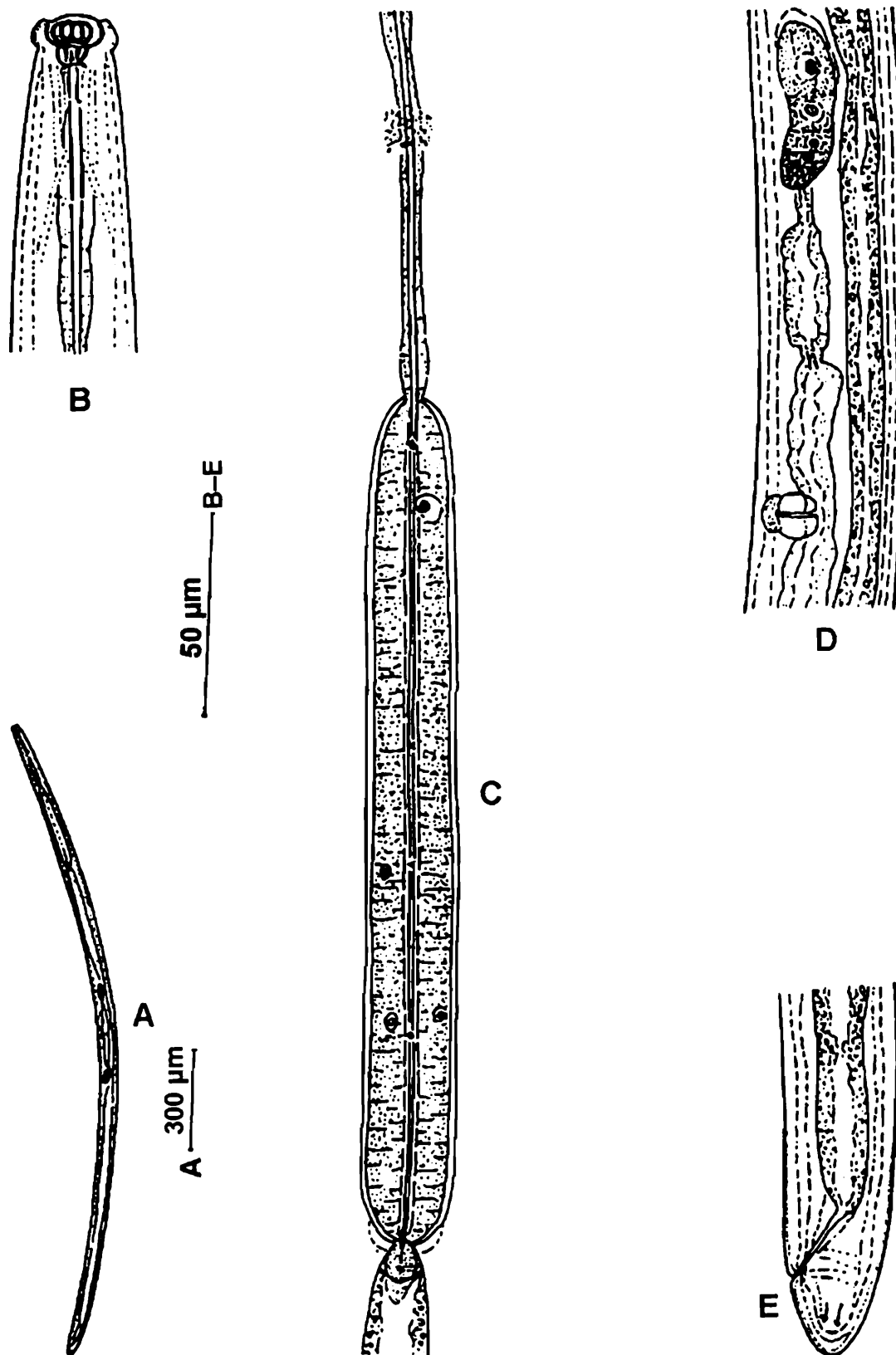


Fig. 31. *Carcharolaimus masoodi* Jairajpuri, 1968. A-E: Female: A-Entire female; B-Anterior end; C-Oesophageal region; D-Anterior sexual branch; E-Female tail.

Superfamily LONGIDOROIDEA Thorne, 1935

Diagnosis : Odontostyle long and attenuated, with fine lumen and aperture. Odontophore simple, rod-like or with basal flanges. Junction between odontostyle and odontophore simple or complex. Slender part of pharynx set off from posterior expanded part. Female reproductive system monodelphic or amphidelphic. Spicules arcuate, lateral guiding pieces and ventromedian supplements present. Tail similar in sexes.

Type family : LONGIDORIDAE Thorne, 1935

Key to families of LONGIDOROIDEA Thorne, 1935

1. Guiding ring double; odontophore flanged XIPHINEMATIDAE
- Guiding ring single; odontophore not flanged LONGIDORIDAE

Family LONGIDORIDAE Thorne, 1935

Diagnosis : Lip region continuous or off set by constriction. Amphids with pouch, funnel or stirrup-shaped fovea and pore or slit-like aperture. Guiding ring single. Junction between odontostyle and odontophore simple. Female reproductive system amphidelphic. Tail short, conoid; similar in sexes.

Subfamily LONGIDORINAE Thorne, 1935

Diagnosis : Amphids with pouch, funnel or stirrup-shaped fovea and pore or slit-like aperture. Guiding ring single. Odontostyle-odontophore junction simple. Female reproductive system amphidelphic. Tail short, conoid; similar in sexes.

Type genus : *Longidorus* Micoletzky, 1922.

Key to genera of LONGIDORINAE

1. Amphids with stirrup-shaped fovea ***Paralongidorus***
- Amphids with pouch-like fovea 2
2. Amphidial apertures pore-like or inconspicuous ***Longidorus***
- Amphidial apertures slit-like ***Longidoroides***

Genus *Longidorus* Micoletzky, 1922

Diagnosis : Body long and slender. Lips amalgamated. Amphids large, fovea pouch-like with unlobed or symmetrically or asymmetrically bilobed base. Amphidial apertures minute, pore-like, often inconspicuous. Odontostyle long and attenuated. Odontophore without basal flanges. Junction of odontostyle and odontophore simple. Guiding ring

situated anteriorly. Female reproductive system amphidelphic. Vulva transverse. Males with dorylaimoid spicules, lateral guiding pieces and ventromedian supplements. Tail short, conoid to bluntly rounded; similar in sexes.

Type species : *Longidorus elongatus* (De Man, 1876) Thorne & Swanger, 1936

114. *Longidorus pisi* Edward, Mishra & Singh, 1964
(Plate No. 19, Fig. 114)

Measurements : Females : L = 2.79-3.12mm; a=111-115; b = 10-11; c = 91-93; V = 7-8 53-54⁷⁻⁸

Description : Female : Body long and slender, open c-shaped upon fixation. Lip region flattened anteriorly. Amphids large, pouch-like. Odontostyle 60-62 µm long. Odontophore 37-38 µm long. Guiding ring 30-32 µm from anterior end. Prerectum 150-152 or about 8.8 anal body-width long. Tail cylindrical, dorsally convex, ventrally flattened or very slightly concave, 30-34 µm or about 2.0 anal body-width long, with rounded terminus.

Male : Not found.

Habitat and localities : Soil around rhizosphere of roots of crops and other plants. Phytoparasites. Manai agricultural field and Balsamand, district Jodhpur.

Distribution : Rajasthan, Gujarat, Uttar Pradesh.

115. *Longidorus sylphus* Thorne, 1939
(Plate No. 19, Fig. 115)

Measurements : Females : L = 4.1-4.3 mm; a = 86-88; b = 12.0-12.3; c = 86-88; V = 46-48.

Description : Female : Body ventrally curved upon fixation. Lip region continuous with body contour. Amphids with short, slit-like apertures. Odontostyle 84 µm long. Odontophore 50 µm long. Cardia bluntly conoid. Prerectum 5-10 body-width long. Tail dorsally convex-conoid to the blunt terminus.

Male : Not found.

Habitat and localities : Soil inhabiting. Parasitic. Mathania agricultural field, district Jodhpur.

Distribution : Rajasthan.

116. *Longidorus elongatus* (de Man, 1876) Micoletzky, 1922
(Plate No. 19, Fig. 116)

Measurements : Females : L = 4.5-5.6 mm; a = 76-123; b = 9.7-12.5; c = 73-133; V = 6-10 45-52⁶⁻¹⁰

Description : Female : Body long and narrow, open c-shaped upon fixation. Lip region flattened anteriorly. Amphids large, pouch-like. Odontostyle 82-100 μm long. Odontophore 35-65 μm long. Guiding ring 30- 32 μm from anterior end. Prerectum 122-124 μm or about 10 anal body-width long. Tail dorsally convex, ventrally flattened or very slightly concave, 28-32 μm or about 1.3 anal body-width long with roundly conoid terminus.

Male : Not found.

Habitat and localities : Soil around rhizosphere of crops and other plants. Phytoparasites and also virus vector. Kelwada, district Udaipur; Desuri ki naal, district Jodhpur.

Distribution : Rajasthan, Gujarat.

Genus *Paralongidorus* Siddiqi, Hooper & Khan, 1963

Diagnosis : Long and slender nematodes, up to 12 mm long, assume 'C' shape upon fixation. Lip region continuous or set off by deep constriction. Amphidial apertures in the form of transverse slit. Odontostyle long, attenuated. Odontophore rod-like. Odontostyle and odontophore junction simple. Guiding ring single, situated anteriorly. Oesophagus typical longidoroid type. DN at some distance from DO. SVN generally more developed than DN. Female reproductive system amphidelphic. Males with dorylaimoid spicules. Tail short conoid; similar in sexes.

Type species : *Paralongidorus sali* Siddiqi, Hooper & Khan, 1963

117. *Paralongidorus major* Verma, 1973 (Plate No. 19, Fig. 117)

Measurements : Females : L = 5.95-6.41 mm; a = 116-238; b = 10.3-12.1; c = 192-206; V = $8.942-44^{8.9}$

Description : Female : Body ventrally curved upon fixation. Lip region broadly rounded, set off from body by a constriction. Amphidial apertures slit like. Amphidial pouch short, cup-like. Odontostyle 120-122 μm long. Odontophore 63-65 μm long. Guiding ring 32-33 μm from anterior end. Basal expanded part of oesophagus 25-27% of neck length. Prerectum 165-170 μm long or about 7.5-7.7 anal body-width long. Tail 31 μm , with convex rounded terminus, less than one anal body-width long.

Male : Not found.

Habitat and localities : Soil inhabiting. Parasitic. Parisal Nadbai, district Bharatpur, Sermathura, district Dholpur.

Distribution : Rajasthan.

118. *Paralongidorus microlaimus* Siddiqi, 1964 (Plate No. 19, Fig. 118)

Measurements : Female : L = 3.27mm; a = 91.0; b = 10.9; c = 109.2; V = $7.8537-8$.

Description : Female : Lip region set off from body. Odontostyle 76 μm long. Odontophore 35 μm long. Guiding ring 27 μm from anterior end. Lip region width 2.1. Basal expanded part of oesophagus occupies 25% of neck region. Prerectum 175 μm or 6.4 anal body-width long. Tail 26 μm or about one anal body-width long, rounded conoid.

Male : Not found.

Habitat and localities : Soil around roots of rhizosphere of various crops and other plants. Parasitic. Manai agricultural field, district Jodhpur.

Distribution : Rajasthan, Gujarat.

119. ***Paralongidorus berryllus*** (Siddiqi & Husain 1965) Hunt, 1993
(Plate No. 19, Fig. 119)

Measurements : Females : L = 3.77-4.47 mm; a = 86-89; b = 10.8-11.6; c = 86-94; V = 6.747-48⁶⁻⁷.

Description : Female : Lip region expanded. Amphid apertures half of corresponding body-width. Odontostyle 84-85 μm long. Odontophore 55-60 μm long. Guiding ring 28-30 μm from anterior end. Lip region width 1.8-2.0. Basal expanded part of oesophagus occupies 22-27% of neck region. Tail 45-50 μm or 1.2-1.6 anal body-width long, conoid.

Male : Not found.

Habitat and locality : Soil inhabiting. Parasitic. Kela Devi road, district Karauli.

Distribution : Rajasthan.

Family XIPHINEMATIDAE Dalmasso, 1969

Diagnosis : Body length 1.5 to 6 mm. Lip region continuous or set off by constriction. Amphidial apertures broad, transverse slit; amphidial fovea stirrup-shaped. Odontostyle heavily sclerotized and forked at base. Odontophore with moderate to well developed basal flanges. Female reproductive system monodelphic or amphidelphic. Tail variable in shape and size; similar in sexes.

Type subfamily : XIPHINEMATINAE Dalmasso, 1969

Other subfamily : XIPHIDORINAE (Khan, Chawla & Saha, 1978) Jairajpuri & Ahmad, 1992

Key to subfamilies of XIPHINEMATIDAE Dalmasso, 1969

1. Amphids stirrup-shaped with slit-like apertures; DN at same level as DO
..... XIPHINEMATINAE
- Amphids pouch-like with pore-like apertures; DN far behind DO .. XIPHIDORINAE

Subfamily XIPHINEMATINAE Dalmasso, 1969

Diagnosis : Amphids with stirrup-shaped fovea and slit-like apertures. Guiding ring double. Odontostyle forked at its junction with odontophore. Odontophore with well developed basal flanges. DN at same level as DO. Female reproductive system monodelphic or amphidelphic. Tail short, conoid to long, filiform, similar in sexes.

Type and only genus : *Xiphinema* Cobb, 1913

Genus *Xiphinema* Cobb, 1913

Diagnosis : Body long to very long (1.5-6 mm) and fairly stout, ventrally arcuate or C-shaped upon fixation. Cuticle smooth. Lip region continuous or slightly to well set off from body. Amphidial apertures broad slits, extending for almost entire lip-width. Amphids stirrup or funnel-shaped fovea. Odontostyle elongate, needle like, heavily sclerotized. Guiding apparatus tubular with strongly sclerotized posterior ring and lightly sclerotized anterior ring. Proximal end of odontostyle forked at its junction with odontophore. Odontophore with three massive basal flanges. Expanded part of oesophagus about one-third of total oesophageal length. Only three oesophageal nuclei present. Female reproductive system monodelphic or pseudo-monodelphic or amphidelphic. 'Z'-organs may be present in uterus. Males with dorylaimoid spicules, lateral guiding pieces and ventromedian supplements. Tail highly variable in shape and size, may be short, conoid to long filiform; similar in sexes.

Type species : *Xiphinema americanum* Cobb, 1913

120. *Xiphinema orbum* Siddiqi, 1963

(Plate No. 20, Fig. 120)

Measurements : Females : L = 2.19-2.24 mm; a = 43-48; b = 6.0-6.4; c = 29-32; V = 1.53-1.55¹⁰⁻¹²

Description : Female : Lip region rounded, distinctly set off from body. Odontostyle 100-103 µm long. Odontophore 57-60 µm long. Guiding ring at 83-85 µm or about 8 lip region-width from anterior end. Basal expanded part of oesophagus 20% of neck length. Female reproductive system amphidelphic, but the anterior genital branch and the ovary is greatly reduced. Prerectum 63-75 µm or 2.3-2.5 anal body-width long. Tail elongate conoid, 67-77 µm or 2.3-2.7 anal body-width long.

Male : Not found.

Habitat and localities : Soil inhabiting. Parasitic. Ghumti, district Pali; Mathania, district Jodhpur.

Distribution : Rajasthan.

121. *Xiphinema elongatum* Schuurmans Stekhoven & Teunissen, 1938

(Plate No. 20, Fig. 121)

Measurements : Females : L = 2.13-2.42 mm; a = 47-60; b = 5.4-6.7; c = 40-44; V = ¹⁰⁻¹²43-47¹⁰⁻¹¹.

Description : Female : Lip region rounded, offset from body. Odontostyle 105-107 µm or about 8.7-8.9 head-width long. Odontophore 57-59 µm long. Guiding ring at 90-95 µm or 8-9 lip region- width. Tail 45-56 µm or about 2.0-2.1 anal body-width long, elongate conoid with subdigitate terminus.

Male : Not found.

Habitat and localities : Soil around roots of various crops and other plants. Phytoparasites. Agriculture field near Mandore, district Jodhpur.

Distribution : Karnataka, Rajasthan, Gujarat.

122. *Xiphinema basiri* Siddiqi, 1959

(Plate No. 20, Fig. 122)

Measurements : Female : L=2.01 mm; a = 44; b = 5.0; c = 41; c = 1.6; V = ¹¹⁻¹³47¹¹⁻¹³.

Description : Female : Lip region rounded, setoff from body. Odontostyle 106 µm. Odontophore 63 µm or nearly one half of the odontostyle length. The guiding ring at 80 µm or about 8 lip region-width from anterior end. Female reproductive system amphidelphic. Z-organs present in the uteri. Prerectum 321 µm or about 13 anal body-width long. Tail conoid, digitate, about 1.6 anal body-width long.

Male : Not found.

Habitat and locality : Soil around rhizosphere of various crops and other plants. Phytoparasites. Ghumti, district Pali.

Distribution : Rajasthan, Tamil Nadu, Maharashtra, Gujarat.

123. *Xiphinema insigne* Loos, 1949

(Plate No. 20, Fig. 123)

Measurements : Females : L = 2.21-2.41 mm; a = 58-79; b = 6.1-7.0; c = 27-33; V = 30-33.

Description : Female : Lip region almost flat or rounded at apex, and slightly offset from body. Odontostyle 105-108 µm long. Fixed guiding ring 86-90 µm or 7.8-8.0 lip region-width from anterior end. Basal expanded part of oesophagus 23-28% of neck length. Vulva transverse. Reproductive system amphidelphic, each sexual branch consisting of a reflexed ovary. Tail 72-81 µm, narrow, elongate conoid, 3.1-3.6 anal body-width long.

Male : Not found.

Habitat and localities : Soil around roots of rhizosphere of various crops and other plants. Phytoparasites. Agricultural field near Balsamand, district Jodhpur.

Distribution : West Bengal, Punjab, Sikkim, Uttar Pradesh, Rajasthan, Gujarat.

124. ***Xiphinema americanum*** Cobb, 1913
(Plate No. 20, Fig. 124)

Measurements : Females : L = 1.61-1.72 mm; a=42; b=5.4; c = 45-55; V = ¹³⁻¹⁵50¹²⁻¹³.

Description : Female : Body 'C' shaped upon fixation. Lip region set off from body. Odontostyle 74-76 µm long. Odontophore 50-52 µm long. Fixed guiding ring at 63-66 µm or 6-8 lip region width from anterior end. Basal expanded part of oesophagus 25-26% of neck region. Reproductive system amphidelphic, each sexual branch consists of a reflexed ovary. Tail short, convex-conoid 30-32 µm or 1.4-1.6 anal body-width long.

Male : Not found.

Habitat and localities : Soil around roots of various crops and other plants. Phytoparasites. Ghumti, district Pali.

Distribution : West Bengal, Uttar Pradesh, Punjab, Rajasthan, Gujarat.

Superfamily BELONDIROIDEA

Diagnosis : Lip region narrow; lips small, angular or rounded. Odontostyle usually small, odontophore rod-like, rarely flanged. Basal expanded part of pharynx enveloped by thick sheath of muscles, generally with spiral, rarely with longitudinal bands. Female reproductive system monodelphic or amphidelphic. Ventromedian supplements few to numerous. Tail variable in shape; similar or dissimilar in sexes.

Type and only family : Belonidiridae Thorne, 1939

Family BELONDIRIDAE

Diagnosis : Lip region narrow, continuous or set off from body contour. Odontostyle small, linear or fusiform, with narrow or wide aperture. Odontophore rod-like or flanged. Anterior narrow and posterior expanded part of oesophagus continuous or separated by distinct isthmus-like constriction. Basal expanded part of oesophagus greatly variable in size and musculature. Cardia short, conoid to elongate, isthmus-like. Female reproductive system monodelphic or amphidelphic. Vulva transverse or longitudinal. Spicules variable in size and shape. Ventromedian supplements few to numerous. Tail short, bluntly rounded to long, filiform, similar or dissimilar in sexes. Species belonging to genera *Belondira* (1sp.) and *Dorylaimellus* (4 spp.) have been recorded from Rajasthan.

Key to subfamilies of BELONDIRIDAE Thorne, 1939

1. Cuticularised pieces present around oral aperture; odontophore flanged
..... DORYLAIMELLINAE

- Cuticularised pieces not present around oral aperture; odontophore rod-like 2
- 2. Female tail short, digitate, conoid or rounded BELONDIRINAE
- Female tail long, filiform SWANGERIINAE

Subfamily BELONDIRINAE Thorne, 1939

Diagnosis : Lip region continuous or offset. Odontostyle linear or fusiform. Odontophore rod-like. Anterior slender part of oesophagus either continuous with posterior expanded portion or set off by constriction. Female reproductive system mono-opisthodelphic or amphidelphic. Spicules variable in shape and size. Tail short, conoid to bluntly rounded, often clavate due to thickened cuticle; similar in sexes.

Type genus : *Belondira* Thorne, 1939

Other genera : *Axonchium* Cobb, 1920; *Belondirella* Thorne, 1964; *Axonchoides* Thorne, 1967; *Anchobelondira* Nair and Coomans, 1971; *Dactyluraxonchium* Coomans and Nair, 1975 (Jairajpuri and Dhanachand, 1979); *Heynsaxonchium* Coomans and Nair, 1975 (Jairajpuri and Dhanachand, 1979); *Phallaxonchium* Jarajpuri and Dhanachand, 1979; *Nimigula* Andrassy, 1985; *Amphibelondira* Rahman, Jairajpuri, Ahmad and Ahmad, 1987

Key to genera of subfamily BELONDIRINAE

1. Female reproductive system amphidelphic 2
 - Female reproductive system mono-opisthodelphic 4
2. Anterior part of oesophagus set off by constriction ***Anchobelondira***
 - Anterior part of oesophagus not set off by constriction 3
3. Lip region with six liplets; ventromedian supplements two ***Belondirella***
 - Lip region without liplets; ventromedian supplements absent ***Amphibelondira***
4. Oesophagus more than one-half body length; vulva located anterior to oesophago-intestinal junction ***Nimigula***
 - Oesophagus less than one-half body length; vulva located posterior to oesophago-intestinal junction 5
5. Anterior part of oesophagus set off by constriction or isthmus-like section 6
 - Anterior part of oesophagus continuous ***Belondira***
6. Tail apically digitate ***Dactyluraxonchium***
 - Tail apically hemispherical 7
7. Spicules very long, narrow and alate, without median pieces ***Phallaxonchium***
 - Spicules massive, non-alate, without median pieces 8

8. Odontostyle narrow, more than two lip region widths long **Heynsaxonchium**
- Odontostyle fusiform to cylindroids, less than two lip region widths long 9
9. Labial framework semi-sclerotised; cephalic papillae mammiform; anterior part of oesophagus non-muscular **Axonchoides**
- Labial framework not sclerotised; cephalic papillae not mammiform; anterior part of oesophagus muscular **Axonchium**

Genus **Belondira** Thorne, 1939

Diagnosis : Body 0.7-2.0 mm long, almost straight to slightly ventrally curved. Lip region rounded, papillae not raised. Outer part of cephalic frame work weakly to moderately sclerotized. Odontostyle narrow, usually less than width of lip region. Guiding ring indistinct. Odontophore rod-like. Anterior slender part of oesophagus expanding below ellipsoidal swelling, then gradually narrowing until it forms basal expanded part; later encircled by thick sheath of spiral muscles bands. Cardia conoid or rounded. Female reproductive system mono-opisthodelphic. Anterior uterine branch vestigial, saccate. Males with well developed spicules, lateral guiding pieces and one or two widely spaced ventromedian supplements. Tail rounded to clavate, usually with thick cuticle, similar in sexes.

Type species : *Belondira aquaticus* Thorne, 1939

125. **Belondira aquatica** Ferris, Ferris & Goseco, 1983
(Plate No. 20, Fig. 125)

Measurements : Females : L = 1.26-1.36 mm; a = 43-46; b = 3.7-4.2; c = 75-85;
V = 3-439-41¹⁰⁻¹¹

Male : L = 1.39 mm; a = 44; b = 4.0; c = 80.

Description : Female : Body straight. Lip region rounded. Cephalic frame-work distinctly sclerotized. Odontostyle 5-6 μ m long, its aperture distinct. Odontophore 12-13 μ m long. Basal expanded part of oesophagus occupies 57-60% of neck region and enveloped in sheath. Anterior uterine sac 3-4 μ m, posterior genital branch normal. Prerectum 112-128 μ m long or about 5-6 anal body width long. Tail 16-17 μ m long, rounded, 0.7-0.8 anal body width long.

Male : Spicules 31 μ m long, slightly arcuate, lateral guiding pieces 6 μ m long. One adanal pair and one preanal ventro-submedian supplements. Tail similar to Female.

Habitat and locality : Soil inhabiting. Thanagachi, district Alwar.

Distribution : Rajasthan, Gujarat, Andaman and Nicobar, Uttar Pradesh.

Subfamily DORYLAIMELLINAE Jairajpuri, 1964

Diagnosis : Lip region narrow, truncated, set off from body. Cuticularised pieces present around oral aperture. Odontostyle small. Odontophore bipartite, basal part bearing three

broad flanges. Vulva longitudinal or transverse. Female reproductive system monodelphic or amphidelphic. Spicules usually proximally broad with abrupt ventral angles often arcuate, dorylaimoid. Lateral guiding pieces present. Ventromedian supplements arranged in pairs or spaced. Tail varies from short, bluntly rounded to long, filiform; similar in sexes.

Type and only genus : Dorylaimellus Cobb, 1913

Genus ***Dorylaimellus*** Cobb, 1913

Diagnosis : Body 0.4-1.8 mm long. Cuticle finely striated, lateral chords with glandular organs. Lip region narrow, truncated, setoff by constriction, labial papillae raised, labial disc may be present, encircling oral aperture. Four cuticularised pieces present around oral aperture, amphidial aperture slit like. Odontostyle small. Guiding ring single. Odontophore in two parts; basal part bearing three broad flanges. Basal expanded part of oesophagus enclosed in thick sheath of spiral muscles. Cardia conoid to hemispheroid. Female reproductive system monodelphic. Vulva longitudinal or transverse. Spicules usually massive proximally broad, with abrupt ventral angles, often arcuate. Ventromedian supplements usually arranged in series or spaced. Lateral guiding pieces present. Tail variable in shape, similar in sexes.

Type subgenus : Dorylaimellus Cobb, 1913

Remarks : Jairajpuri and Ahmad, M. (1980) observed the heterogenous nature of the species under *Dorylaimellus* Cobb, 1913 and proposed eight subgenera for the sake of convenience. Jairajpuri and Ahmad, W. (1992) in their book have further added four subgenera under *Dorylaimellus*. The surveys conducted in Rajasthan state have yielded four species, *Dorylaimellus (B) discocephalus*, *Dorylaimellus (M) jacobi*, *Dorylaimellus (A) paravulus*; and *Dorylaimellus (A) deviatus* brief description are given below :

Key to subgenera of *Dorylaimellus*

1. Female reproductive system monodelphic 22
 - Female reproductive system amphidelphic 6
2. Female reproductive system mono-prodelphic 3
 - Female reproductive system mono-opisthodelphic 4
3. Vulva and vagina vera transverse ***Mesodorylaimellus***
 - Vulva and vagina vera longitudinal ***Ibadanus***
4. Peri-oral disc present; odontostyle attenuated ***Sindellus***
 - Peri-oral disc absent; odontostyle with distinct lumen 5
5. Tail hemispheroid or conoid ***Metadorylaimellus***
 - Tail elongate, attenuated ***Amazonema***

6. Lip region continuous with body contour **Capitellus**
- Lip region set off from body 7
7. Peri-oral disc present..... 8
- Peri-oral disc absent 10
8. Vulva transverse **Axodorylaimellus**
- Vulva pore-like or longitudinal 9
9. Vulva longitudinal; tail cylindroids or sub-cylindroid **Belondorylaimellus**
- Vulva pore-like, tail elongate, attenuated **Jamilius**
10. Vulva transverse **Rashidanema**
- Vulva longitudinal 11
11. Tail terminus clavate **Clavidorylaimellus**
- Tail terminus not clavate 12
12. Tail digitate or sub-digitate **Dorylaimellus**
- Tail elongate-conoid to filiform 13
13. Tail very long (c = 4-5); spicules with abrupt ventral angle; ventromedian supplements in pairs **Elongidorylaimellus**
- Tail long (c = 8-16); spicules do dorylaimoid; ventromedian supplements spaced ..
..... **Filidorylaimellus**

Subgenus **Mesodorylaimellus** Jairajpuri and Ahmad, 1980

Diagnosis : Lip region offset, knob-like. Peri-oral disc absent. Peri-oral sclerotisation indistinct or absent. Female reproductive system mono-prodelphic. Vulva and vagina vera transverse. Spicules arcuate, dorylaimoid. Ventromedian supplements spaced. Tail short, cylindroids, subcylindrical to conoid, rounded.

Type species : *Dorylaimellus (Mesodorylaimellus) jacobi* Baqri and Jairajpuri, 1968.

126. ***Dorylaimellus (Mesodorylaimellus) jacobi*** Jairajpuri & Ahmad, 1980
(Plate No. 21, Fig. 126)

Measurements : Females : L = 1.00-1.01 mm; a = 32.4; b = 6.0-6.1; c = 34.6;
V = 57-58⁸⁻⁹

Description : Female : Lip region offset, knob like. Peri-oral disc absent. Peri-oral sclerotization indistinct or absent. Odontostyle 9-10µm long; its aperture 2-3 µm. Odontophore 8-9 µm long with flanges. Basal expanded part of oesophagus occupies 57-58% of neck region. Female reproductive system mono-prodelphic. Prerectum 28-29 µm or 1.8-1.9 anal body width long. Tail 28-29 µm short cylindroid-conoid-rounded.

Male : Not found.

Habitat and locality : Soil inhabiting. Thanagachi, district, Alwar.

Distribution : Uttar Pradesh, Rajasthan.

Subgenus ***Axodorylaimellus*** Jairajpuri and Ahmad, 1980
(Fig. 98, I-N)

Diagnosis : Lip region offset, with peri-oral disc. Peri-oral sclerotisation distinct. Oesophagus very long. Female reproductive system amphidelphic, poorly developed. Vulva and vagina transverse. Tail short cylindroids, sub-cylindroid, hemispheroid or clavate, with abnormally thickened cuticle at tip.

Type species : *Dorylaimellus (Axodorylaimellus) parvulus* Thorne, 1939

127. *Dorylaimellus (Axodorylaimellus) deviatus* Baqri & Jairajpuri, 1969
(Plate No. 21, Fig. 127)

Measurements : Females : L = 1.00-1.04 mm; a = 45-45.3; b = 6.3-6.4; c = 37-38; V = 7-8/51-52/7-8

Description : Female : Lip region set off, with peri-oral disc. Perioral sclerotization distinct. Odontostyle 8-9 µm long; its aperture 3-4 µm. Odontophore 11-12 µm long with flanges. Oesophagus very long, basal expanded part of oesophagus occupies 45-46% of neck region. Female reproductive system amphidelphic. Prerectum 3-4 anal body width long. Tail 27-28 µm long, short cylindroids, about 1.6-1.7 anal body -width long.

Male : Not found.

Habitat and locality : Soil inhabiting. Tijara road, district Alwar.

Distribution : Rajasthan, Gujarat, Uttar Pradesh.

128. *Dorylaimellus (Axodorylaimellus) parvulus* Thorne, 1939
(Plate No. 21, Fig. 128)

Measurements : Females : l = 0.42-0.51 mm; a = 23-30; b = 2.5-2.6; c = 27-32, V = 5-6/56-59/5-6

Description : Females : Body cylindrical, almost straight upon fixation. Lip region set off from adjacent body contour. Odontostyle 5-6 µm long. Odontophore 8-9 µm long with flanges. Basal expanded part of oesophagus occupied 51-52% of neck region. Female reproductive system amphidelphic. Prerectum about 4 anal body diameter long. Tail 15-20 µm or 1-1.5 anal body diameter long.

Male : Not found.

Habitat and locality : Soil inhabiting. Paras Ram Mahadev forest area, district Pali.

Distribution : Rajasthan.

Subgenus ***Belondorylaimellus*** Jairajpuri and Ahmad, 1980

Diagnosis : Lip region set off, with peri-oral disc. Peri-oral sclerotization distinct. Odontostyle with distinct lumen. Female reproductive system amphidelphic. Vulva longitudinal. Tail cylindroid to subcylindroid, with obtuse tip.

Type species : *Dorylaimellus (Belondorylaimellus) belondirelloides* Siddiqi, 1968

129. ***Dorylaimellus (Belondorylaimellus) discocephalus*** Siddiqi, 1964
(Plate No. 21, Fig. 129 & 32, A-B)

Measurements : Females : L = 1.03-1.31 mm; a = 37-38; b = 4.2-4.5; c = 39-46;
V = 7-8 50-52⁷⁻⁸

Description : Female : Lip region well set off Lateral glandular organs conspicuous, 70-72 in number, variable in size and irregular in arrangements. Odontostyle 6-7 µm, its aperture 2-3 µm. Odontophore 9-11 µm long; with typical flanges. Basal expanded part of oesophagus occupies 55-57% of neck region. Female reproductive system amphidelphic. Prerectum 50-60 µm or 2-3 anal body- width long. Tail 26-28 µm, cylindrical with bluntly rounded terminus, about 1.4 anal body width long.

Male : Not found

Habitat and localities : Soil inhabiting. Paras Ram Mahadev forest KWLS, district, Udaipur; Peeh, district Nagaur.

Distribution : Rajasthan, Gujarat, West Bengal, Uttar Pradesh etc.

Remarks : Commonly found species in the State.

Superfamily TYLENCHOLAIMOIDEA Filipjev, 1934

Diagnosis : Lip region may bear labial disc or inner liplets around oral aperture. Odontostyle rod-like or arcuate, with or without basal knobs or flanges. Pharynx terminating in small pyriform or cylindroids basal bulb, or large dorylaimoid type. Female reproductive system monodelphic or amphidelphic. Males with arcuate spicules, lateral guiding pieces and generally a few spaced ventromedian supplements. Tail greatly variable in shape and size; similar in sexes.

Type family : Tylencholaimidae Filipjev, 1934

Key to families of Tylencholaimoidea Filipjev, 1934

1. Pharynx consisting of three sections AULOLAIMOIDIDIAE
- Pharynx consisting of two sections 2

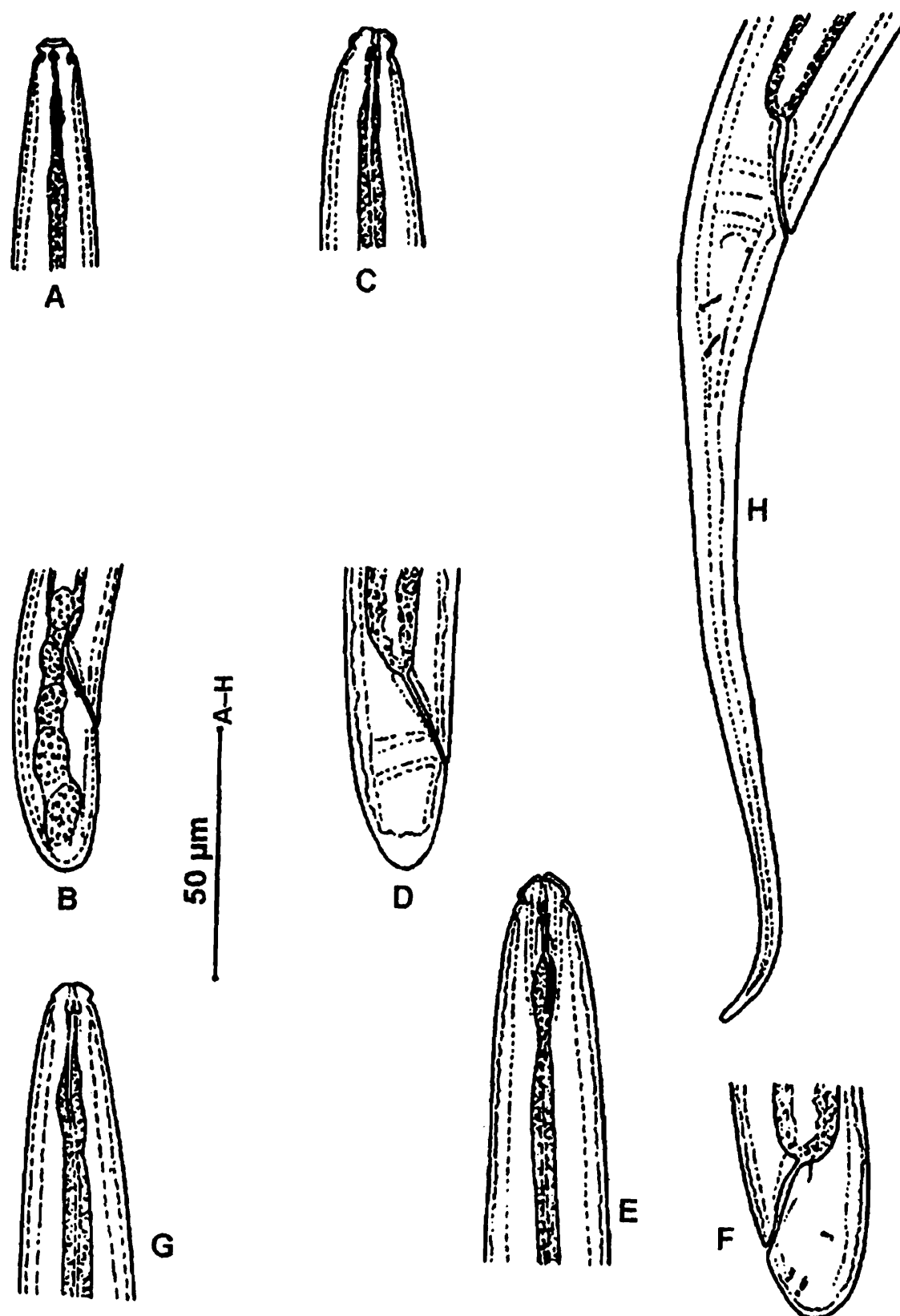


Fig. 32. A-B: *Dorylaimellus (Belondorylaimellus) discocephalus* Siddiqi, 1964. A-Female anterior end; B-Female tail. C-D: *Tylencholaimus suryawanshi* Ali & Chisty, 1972. C-Female anterior end; D-Female tail. E-F: *Leptonchus granulosus* Cobb, 1920. E-Female anterior end; F-Female tail. G-H: *Dorylaimoides (Digidorylaimoides) pakistanensis* Siddiqi, 1964. G-Female anterior end; H-Female tail.

2. Odontostyle usually well developed; expanded part of pharynx about one-half pharyngeal length TYLENCHOLAIMIDAE
- Odontostyle usually slender; expanded part of pharynx short, cylindrical or pyriform bulb 3
3. Odontostyle asymmetrical with distinct aperture; pharyngeal bulb cylindroids MYDONOMIDAE
- Odontostyle symmetrical, attenuated, often solid, needle-like; pharyngeal bulb usually pyriform LEPTONCHIDAE

Family TYLENCHOLAIMIDAE Filipjev, 1934

Diagnosis : Cuticle loose, with radial striations and fixation folds. Body pores indistinct. Lip region cap-like, generally set off by constriction; lips angular and labial papillae not raised. Labial disc may be present around oral aperture. Amphids with slit or pore-like apertures. Odontostyle small, dorylaimoid, symmetrical or asymmetrical, with distinct dorsal aperture. Odontophore rod-like, with or without basal knobs or flanges. Oesophagus dorylaimoid; basal expanded part with thickened inner lining. Cardia usually hemispherical. Female reproductive system monodelphic or amphidelphic. Vulva transverse or longitudinal. Males with well-developed spicules, lateral guiding pieces and ventromedian supplements. Tail varying from almost rounded to long; filiform; similar in sexes.

Key to subfamilies of Tylencholaimidae Filipjev, 1934

1. Amphids small, pouch-shaped, with oval aperture; odontostyle asymmetrical MUMTAZIINAE
- Amphids stirrup-shaped, with slit-like aperture; odontostyle symmetrical 2
2. Odontostyle massive, with very thick walls VANDERLINDIINAE
- Odontostyle not massive, walls not thick 3
3. Odontostyle long, attenuated, with fine lumen and aperture; odontophore usually flanged XIPHINEMELLINAE
- Odontostyle generally small, attenuated, with fine lumen and aperture; odontophore usually knobbed TYLENCHOLAIMINAE

Subfamily TYLENCHOLAIMINAE Filipjev, 1934

Diagnosis : Small to medium sized nematodes. Lip region set off from body; lips amalgamated; labial papillae not raised. Labial disc may or may not be present. Amphids small with pore or slit-like apertures. Odontostyle simple, dorylaimoid or attenuated. Odontophore, rod-like, with basal swellings or distinct basal knobs. Basal expanded part of oesophagus elongate-cylindroid. Female reproductive system monodelphic or

amphidelphic. Vulva transverse or longitudinal. Males with well developed spicules, lateral guiding pieces and a few spaced ventromedian supplements. Tail variable in shape, rounded to elongate-conoid; similar in sexes.

Type genus : *Tylencholaimus* de Man, 1876

Other genera : *Discomyctus* Thorne, 1939; *Utahnema* Thorne, 1939; *Meylonema* Andrassy, 1960; *Chitwoodius* Furstenberg & Heyns, 1966; *Capilonchus* Siddiqi, 1982; *Tantunema* Siddiqi, 1982; *Sclerolaimus* Jairajpuri & Ahmad, 1992

Key to genera of Tylencholaiminae

1. Amphids with small pore-like aperture ***Tantunema***
 - Amphids with slit-like aperture 2
2. Odontophore with distinct basal knobs 3
 - Odontophore without basal knobs 4
3. Tail short-conoid or elongate-conoid ***Tylencholaimus***
 - Tail long, filiform ***Discomyctus***
4. Odontostyle about two lip region widths long 5
 - Odontostyle about one lip region width long 7
5. Body less than 1 mm long; odontostyle long and very fine; vulva transverse 6
 - Body about 2 mm long; odontostyle long and robust; vulva longitudinal ***Chitwoodius***
6. Female reproductive system mono-prodelphic ***Meylonema***
 - Female reproductive system amphidelphic ***Utahnema***
7. Six small cuticularised pieces present around oral opening; labial disc absent; reproductive system amphidelphic ***Sclerolaimus***
 - Cuticularised pieces not present around oral opening; labial disc present; reproductive system mono-prodelphic ***Capilonchus***

Genus *Tylencholaimus* De Man, 1876

Diagnosis : Body generally less than 1.5 mm long, robust. Cuticle and sub-cuticle finely striated. Lip region cap-like, distinctly set off by deep constriction or shallow depression. Amphids with cyathiform fovea. Odontostyle generally as long as lip region-width. Guiding ring simple. Odontophore rod-like, with basal knobs. Basal expanded part of oesophagus short. Cardia hemispheroid. Female reproductive system monodelphic or amphidelphic. Vulva transverse. Males with dorylaimoid spicules, lateral guiding pieces and few spaced ventromedian supplements. Tail hemispheroid to elongate conoid; similar in sexes.

Type species : Tylencholaimus mirabilis (Butschli, 1873) de Man, 1876

Jairajpuri and Ahmad (1992) have split the genus *Tylencholaimus* into seven subgenera because of great morphological variability in the species grouped under the genus. However, Santiago and Coomans (1996) have not accepted those subgenera because they felt that the species *Tylencholaimus* can still be identified, without splitting the genus, on the basis of prodelphic, amphidelphic or opisthodelphic Female genital branches. The present author has accepted the latest position in reporting eight species of *Tylencholaimus* from Rajasthan.

130. *Tylencholaimus minutus* Vinciguera, 1986
(Plate No. 21, Fig. 130)

Measurements : Females : L = 0.45-0.46 mm; a = 21-25; b = 3.1-3.6; c = 21-25; V = 71-72.

Description : Female : Body size small. Lip region globose and set off by constriction, lips cap like. Odontostyle 5-6 μ m long. Odontophore 8-10 μ m long with distinct basal knobs. Oesophageal expansion abruptly expanded into basal part of oesophagus which occupies 57-60% of neck length. Reproductive system prodelphic. Post uterine sac absent. Prerectum 3-4 anal body-width long. Rectum one anal body -width long. Tail 18-19 μ m conoid, subdigitate about one anal body width long.

Male : Not found

Habitat and locality : Soil inhabiting. Thanagachi, district Alwar.

Distribution : Rajasthan.

131. *Tylencholaimus annulatus* Baqri & Bohra, 2001
(Plate No. 22, Fig. 131 & 33, A-E)

Measurements : Females : L = 0.50-0.59 mm; a = 14-19; b = 3.1-3.9; c = 17-19; V = 10^{-11} 48-54 10^{-11}

Description : Female : Lip region marked off from body by a constriction. Odontostyle 10-12 μ m long. Odontophore, 13-15 μ m long, with small basal thickenings. Basal portion of oesophagus 30-33% of neck region. Female reproductive system amphidelphic. Prerectum 53-60 μ m long or about 2 anal body-width long. Tail 28-32 μ m, conical with rounded tip, 1.5-1.6 anal body-width long.

Male : Not found.

Type habitat and locality : Collected from soil around roots of sorghum (*Sorghum vulgare*) at Thakina village, district Pali, Rajasthan, India.

Other localities : Mathania, district Jodhpur.

Distribution : Rajasthan, Gujarat.

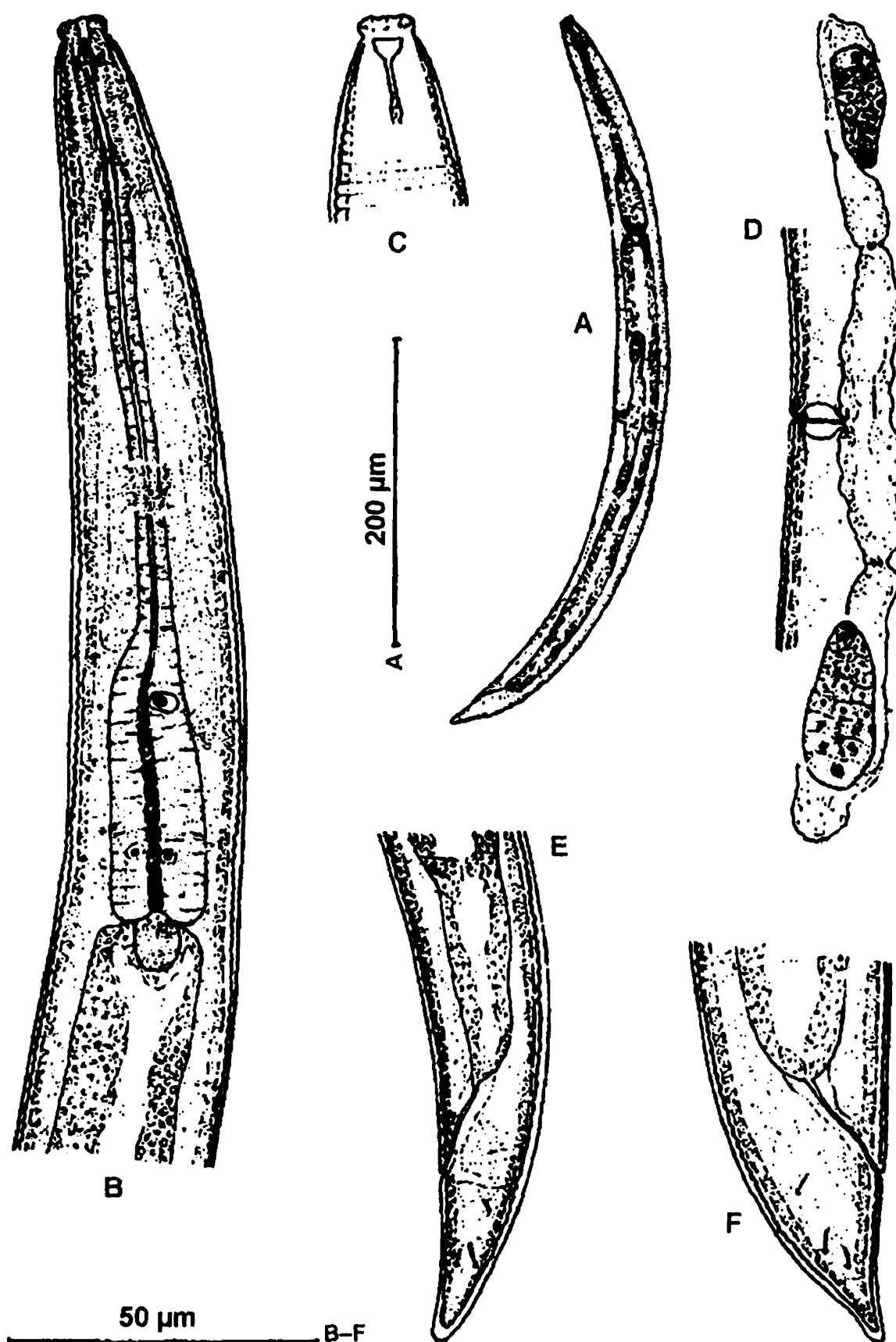


Fig. 33. *Tylencholaimus annulatus* Baqri & Bohra, 2001. A-Entire female; B-Pharyngeal region; C-Anterior end (surface view); D-Female genital system; E-Tail (normal); F-Tail (flattened)

132. *Tylencholaimus gertii* Kruger, 1965

(Plate No. 22, Fig. 132 & 34, A-E)

Measurements : Females : L = 0.61-0.62 mm; a = 17-21; b = 3.6; c = 22-24; V = 46¹⁶

Description : Female : Body almost straight upon fixation. Lip region set off by a deep constriction. Odontostyle 7-8 μ m long; its aperture one fourth of its length. Odontophore 9-10 μ m long. Basal expanded part of oesophagus occupies 49-50% of neck length. Reproductive system opisthodelphic. Anterior uterine sac absent, if present very small. Prerectum 5-6 anal body width long. Rectum one anal body width long. Tail 16-18 μ m, bluntly convex-conoid with characteristic bowl shaped terminal core, about less than one anal body-width long.

Male : Not found

Habitat and localities : Soil inhabiting. Rahar, district Bharatpur., Osian district Jodhpur, Jaisalmer, Barmer.

Distribution : Rajasthan, Gujarat.

133. *Tylencholaimus decens* Andrassy, 1991

(Plate No. 22, Fig. 133)

Measurements : Females : L = 0.64-0.66mm; a = 26.7-26.9; b = 3.7-4.0; c = 26-29; V = 66-68

Description : Female : Body slender. Lip region set off from body. Odontostyle 6-7 μ m long; its aperture 2-3 μ m. Odontophore 10-11 μ m long with basal thickening. Basal expanded part of oesophagus occupies 45-47% of neck length. Reproductive system prodelphic, posterior uterine sac 18-19 μ m less than corresponding body width. Prerectum 1-2 anal body width long. Rectum 0.8-0.9 anal body width long. Tail 20-21 μ m conoid 0.9-1.1 anal body- width long.

Male : Not found

Habitat and localities : Soil inhabiting. Rahar, district Bharatpur; Thanagachi, district Alwar.

Distribution : Rajasthan.

134. *Tylencholaimus innebus* Ahmad & Jairajpuri, 1980

(Plate No. 22, Fig. 134)

Measurements : Females : L = 0.68-0.86 mm; a = 27-30; b = 3.7-4.5; c = 34-36; V = 13-15 62-64¹³⁻¹⁵

Description : Female : Body ventrally curved upon fixation. Lip region cap-like, set off from body contour, about twice as wide as high. Odontostyle 7-8 μ m long; its aperture about one fourth of its length. Guiding ring single 4-5 μ m from anterior end. Odontophore rod-like, with small basal thickenings, about 1.4 odontostyle length. Basal expanded part

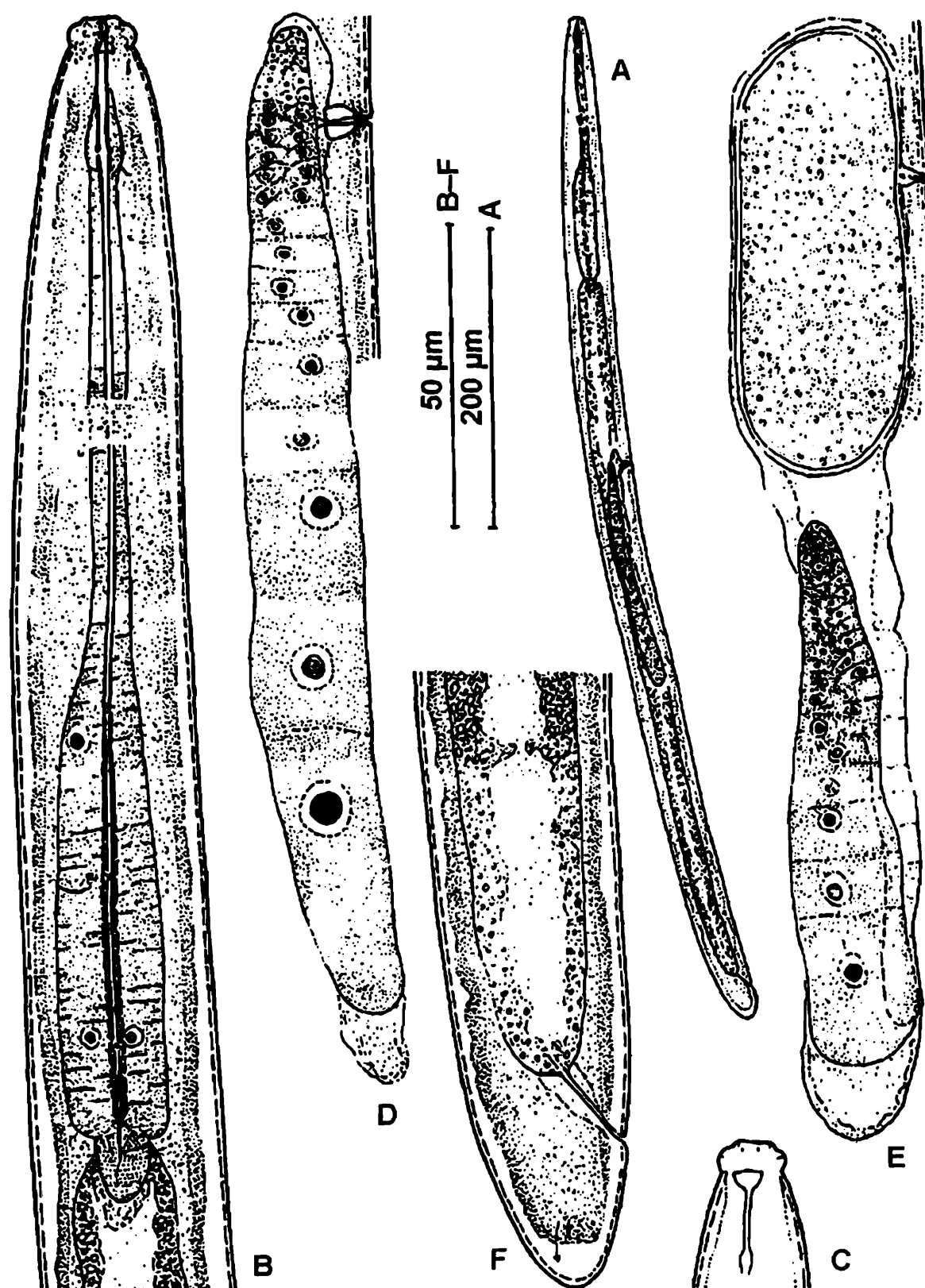


Fig. 34. *Tylencholaimus gertii* Kruger, 1965. F: Female; A-Entire female; B-Oesophageal region; C-Anterior end (surface view); D-Posterior sexual branch (normal), E-Posterior sexual branch having similar ovary and an egg; F-Female tail.

of oesophagus occupies about 36-37% of oesophageal length. Vulva transverse slit. Female reproductive system amphidelphic. Prerectum 2-3 anal body-width long. Rectum one anal body width long. Tail 24-25 hemispherical, about one anal body-width long.

Male : Not found.

Habitat and locality : Soil inhabiting. Badola and Chikani, district Alwar.

Distribution : Uttar Pradesh, Uttarakhand.

135. *Tylencholaimus mongolicus* Andrassy, 1967

(Plate No. 22, Fig. 135)

Measurements : Females : L = 0.82-0.86 mm; a = 25-27; b = 3.1-3.9; c = 34-36; V = 8-960-62⁸⁻⁹

Description : Female : Body almost straight upon fixation. Odontostyle 7-8 μ m long, with aperture about 30% of its length. Odontophore 10-11 μ m long with small basal thickenings. Pharyngeal expansion gradual. Female reproductive system amphidelphic. Tail short-conoid to hemispherical.

Male : Not found.

Habitat and locality : Soil inhabiting. Phytophagous. Keladevi road, district Karauli.

Distribution : Rajasthan.

136. *Tylencholaimus obscurus* Jairajpuri, 1965

(Plate No. 22, Fig. 136)

Measurements : Females : L = 0.75-0.08 mm; a = 21-25; b = 3.9-4.0; c = 34-38; V = 9-1066-675⁶.

Description : Female : Body slender. Lip region set off by a deep constriction. Odontostyle 7-8 μ m long; its aperture one fourth of its length. Guiding ring single 4-5 μ m from anterior end. Odontophore 9-10 μ m long; Basal expanded part of oesophagus occupies 40-44% of neck length. Reproductive system prodelphic. Posterior uterine sac 35% of corresponding body width. Prerectum 2-3 anal body width long. Rectum 0.6-0.7 anal body width long. Tail 19-20 μ m convex-conoid.

Male : Not found.

Habitat and locality : Soil inhabiting. Chikani, district Alwar and Bari, district Dholpur.

Distribution : Uttar Pradesh, Gujarat, Rajasthan.

137. *Tylencholaimus proximus* Thorne, 1939

(Plate No. 23, Fig. 137)

Measurements : Females : L = 0.64-0.75 mm; a = 26-30; b = 4.0-4.1; c = 29-34; V = 10-1166-68

Description : Female : Body slender upon fixation. Lip region cap-like, set off from adjacent body by deep constriction. Odontostyle 7-8 μm long; its aperture one third of its length. Guiding ring 4-5 μm from anterior end. Odontophore 8-9 μm long with basal knobs. Basal expanded part occupies 30-40% of neck length. Reproductive system prodelphic. Posterior uterine sac absent or if present rudimentary, about less one third of corresponding body-width. Prerectum 2.2-4.0 anal body-width long. Rectum 0.8-0.9 anal body width long. Tail 20-22 μm convex-conoid with bluntly rounded terminus, about 1.1-1.2 anal body-width long.

Male : Not found.

Habitat and locality : Soil inhabiting. Sermathura, district Dholpur.

Distribution : Rajasthan.

138. *Tylencholaimus suryawanshii* Ali & Chisty, 1972

(Fig. 32,C-D)

Measurements : Females : L = 0.71-0.75 mm; a = 21-29; b = 3.8-4.7; c = 31-33; V = 10-1152-55¹⁰⁻¹².

Description : Female : Body slightly ventrally arcuate upon fixation, tapering gradually towards both ends. Inner cuticle striated. Lip region set off from body by constriction. Odontostyle 8-9 μm long; aperture 3-4 μm or one-fourth of odontostyle length. Odontophore 10-11 μm with small basal thickenings. Basal expanded part of oesophagus occupies 40-43% of neck region. Vulva a transverse slit. Vagina 10-12 μm , extending inward about 1/4th-1/3rd of corresponding body-width. Female reproductive system amphidelphic, ovaries reflexed. Prerectum 42-45 μm or 2.2-2.3 anal body-width long. Rectum 17-19 μm or 0.8 to 1.0 anal body-width long. Tail 21-24 μm or 1.1-1.2 anal body-width long with hemispheroid terminus.

Male : Not found.

Habitat and locality : Collected from soil around roots of wheat and millet at Jas Nagar, district Nagaur.

Distribution : Rajasthan and Gujarat.

139. *Tylencholaimus nagaurensis* Baqri & Bohra, 2001

(Fig. 35, A-E)

Measurements : Females : L = 0.64-0.74 mm; a = 19-22; b = 3.6-4.0; c = 32-33; V = 19-2064-67

Description : Female : Lip region cap-like, marked off from body by a constriction, twice as wide as high. Lips amalgamated with their inner parts elevated forming a marked perioral disc. Odontostyle 8-9 μm long. Odontophore 10-11 μm , with small basal thickenings. Basal expanded portion of oesophagus 37-39% of neck region. Female reproductive system mono-prodelphic. Prerectum 40-42 μm or about 2.2-2.5 anal body-

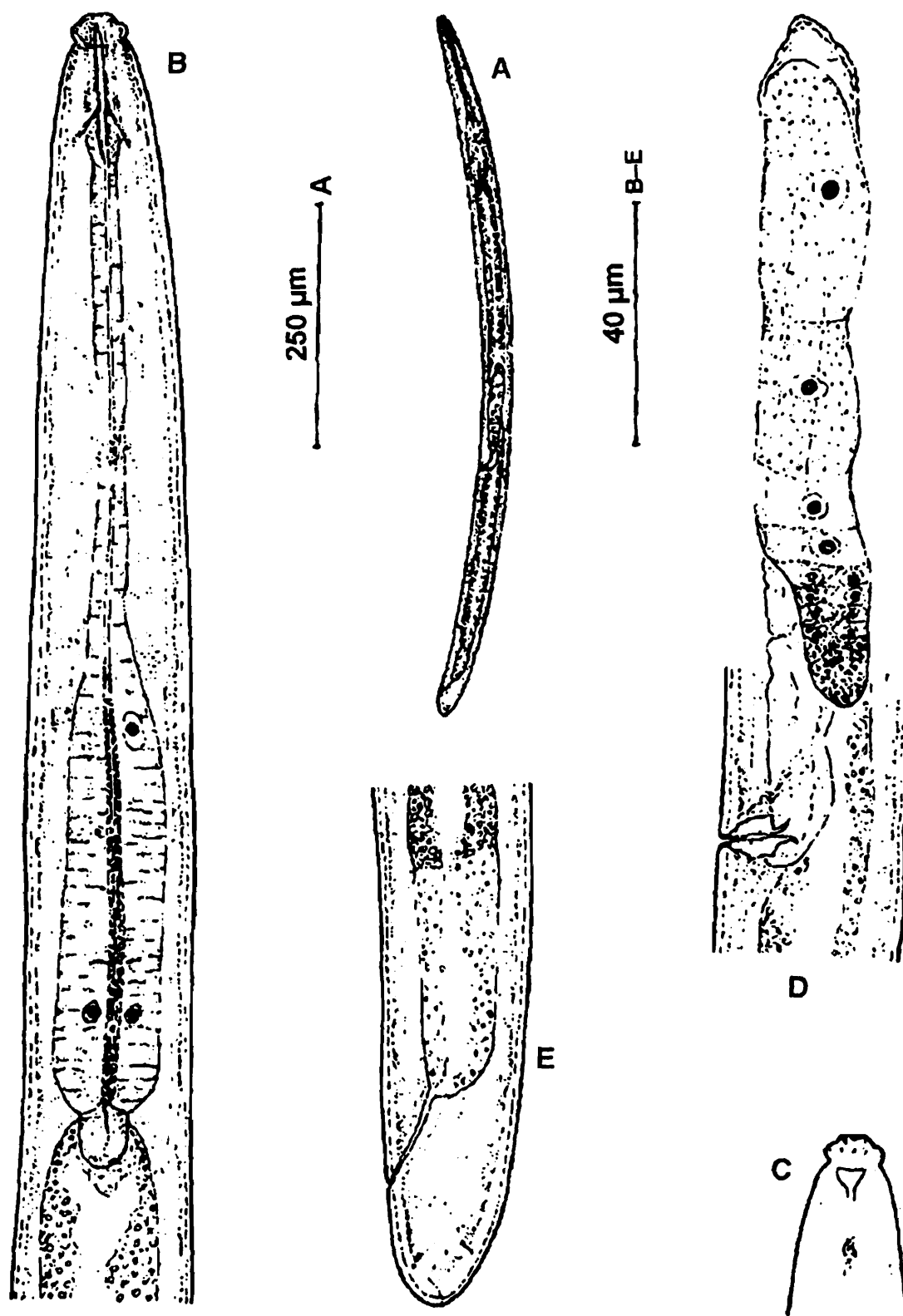


Fig. 35. *Tylencholaimus nagauriensis* Baqri & Bohra, 2001. A-Entire female; B-Pharyngeal region; C-Anterior end (surface view); D-Anterior genital branch; E-Tail.

width long. Rectum 20-22 μm or about one anal body-width long. Tail convex-conoid with rounded terminus, 20-22 μm or about 1.0-1.2 anal body-width long.

Male : Not found.

Type habitat and locality : Collected from soil around roots of wheat (*Triticum aestivum*) at Peeh district Nagaur, Rajasthan, India.

Distribution : Rajasthan and Gujarat

Family LEPTONCHIDAE

Diagnosis : Cuticle and sub-cuticle usually finely striated, refractive elements and radial striae present; lateral pores usually arranged in two rows. Lip region usually set off, labial disc may be present around oral aperture. Amphids cyathiform, simple or 'duplex' Odontostyle slender, attenuated, often solid, needle-like. Odontophore rod-like, arcuate, or provided with basal flanges. Oesophagus a slender tube ending in a small basal bulb, either pyriform or cylindroids, rarely constricted; inner cuticular lining of basal bulb may be thickened. Cardia hemispheroid or elongated. Vulva transverse or longitudinal. Female reproductive system monodelphic or amphidelphic. Male : Males with arcuate spicules, lateral guiding pieces and a few spaced ventromedian supplements. Tail rounded or long, filiform, similar in sexes.

Key to subfamilies of Leptonchidae Thorne, 1935

1. Cuticle heavily annulated and with longitudinal striations forming lamelliform pattern; cephalic setae present ENCHOLAIMINAE
- Cuticle finely striated, longitudinal striations and cephalic setae absent 2
2. Odontostyle asymmetrical; amphids strongly sclerotised ATHERNEMATINAE
- Odontostyle symmetrical; amphids not sclerotised 3
3. Odontostyle solid; needle-like, without distinct lumen BELONENCHINAE
- Odontostyle neither solid nor needle-like, with distinct lumen 4
4. Odontophore with distinct knobs or flanges TYLENCHOLAIMELLINAE
- Odontophore without knobs, very rarely flanged 5
5. Odontostyle slender; inner cuticular lining of pharyngeal bulb not prominently thickened LEPTONCHINAE
6. Odontostyle robust; inner cuticular lining of pharyngeal bulb prominently thickened TYLEPTINAE

Subfamily LEPTONCHINAE Thorne, 1935

Diagnosis : Cuticle finely striated, generally with distinct radial refractive elements; sub-cuticle sometimes loose and coarsely striated. Lip region well set off. Labial disc may

be present. Stoma sclerotized. Odontostyle slender. Odontophore simple or arcuate, sometimes flanged. Oesophageal bulb short, pyriform or cylindroids, constricted or not constricted. Female reproductive system monodelphic or amphidelphic. Vulva transverse or longitudinal. Males with spicules, lateral guiding pieces and few spaced ventromedian supplements. Tail short, usually bluntly rounded; similar in sexes.

Type genus : *Leptonchus* Cobb, 1938

Key to genera of Leptonchinae

1. Oesophageal bulb constricted 2
 - Oesophageal bulb not constricted 4
2. Lip region distinctly offset; labial disc present; Female reproductive system amphidelphic **Meylis**
 - Lip region slightly offset, labial disc absent; Female reproductive system monodelphic 3
3. Odontophore flanged; tail digitate-spicate **Proleptonchoides**
 - Odontophore not flanged; tail hemispherical or bluntly conoid **Proleptonchus**
4. Vulva longitudinal; oesophageal bulb cylindroids **Funaria**
 - Vulva transverse or pore-like; oesophageal bulb pyriform 5
5. Lip region continuous; stomal ring present **Bertzuckermania**
 - Lip region offset; stomal ring absent 6
6. Odontophore sclerotised, arcuate; vulva transverse **Leptonchus**
 - Odontophore sclerotised only at base, straight; vulva pore-like **Apoleptonchus**

Genus *Leptonchus* Cobb, 1920

Diagnosis : Body 0.7-1.5 mm long. Cuticle finely striated, sub cuticle coarsely striated. Radial refractive elements present. Lip region cap-like, set off by constriction. Amphids duplex. Stoma cuticularised. Odontostyle usually slender. Odontophore cuticularised and arcuate. Oesophagus slender terminating in small basal bulb. Female reproductive system amphidelphic. Prerectum distinct, generally long. Males with dorylaimoid spicules, lateral guiding pieces, spaced ventromedian supplements. Tail hemispheroid to bluntly conoid, similar in sexes.

Type species : *Leptonchus granulosus* Cobb, 1920

140. ***Leptonchus granulosus*** Cobb, 1920
(Plate No. 23, Fig. 140 & 32, E-F)

Measurements : Females : L = 0.9-1.14 mm; a = 24-30; b = 5-6; c=57; V = $6.959-60.69$

Description : Female : Body almost straight upon fixation. Lip region set off by constriction, lips and papillae distinct. Labial framework prominent. Odontostyle 9-10 μ m long, with narrow lumen and small aperture. Odontophore 10-12 μ m long, arcuate. Basal pyriform bulb occupies 18-25% of neck region. Female reproductive system amphidelphic. Intestine-prerectum junction located anterior to vulva, prerectum 420-450 μ m or 16-21 anal body-width long. Tail bluntly conoid, 17-20 μ m or one anal body-width long.

Male : Not found.

Habitat : Soil inhabiting.

Distribution : Rajasthan, Uttar Pradesh and Gujarat.

Remarks : Commonly found species.

Family MYDONOMIDAE

Diagnosis : Cuticle and sub-cuticle finely striated. Lip region continuous or set off; lips rounded. Odontostyle asymmetrical. Odontophore straight or arcuate. Guiding ring thin or thick, sclerotized. Oesophageal bulb cylindroids, usually elongate. Female reproductive system mono-opisthodelphic or amphidelphic. Males with well developed arcuate spicules, lateral guiding pieces and a few spaced ventromedian supplements. Tail short and conoid to long, filiform; similar or dissimilar in sexes. Family Mydonomidae is represented by one genus *Dorylaimoides*, of which five species have been recorded in Rajasthan State, of which four species have been dealt with in this paper.

Key to subfamilies of MYDONOMIDAE

- Odontophore straight, rod-like; guiding ring thick CALOLAIMINAE
- Odontophore angular; guiding ring not thick MYDONOMINAE

Subfamily MYDONOMINAE Thorne, 1964

Diagnosis : Lip region, continuous or slightly offset. Odontostyle asymmetrical. Guiding ring thin. Odontophore arcuate, surrounded by distinct oesophageal tissue. Oesophageal bulb elongate, cylindroids, one-third to one-fourth total oesophageal length, may be enclosed in a muscular sheath. Female reproductive system mono-opisthodelphic or amphidelphic. Tail short, conoid to long, filiform; similar or dissimilar in sexes.

Type genus : *Mydonomus* Thorne, 1964

Other genera : *Dorylaimoides* Thorne and Swanger, 1936; *Morasia* Baqri and Jairajpuri, 1969

Key to Genera of Mydonominae

1. Oesophageal bulb enclosed in muscular sheath **Mydonomus**
- Oesophageal bulb not enclosed in muscular sheath 2
2. Tail similar in sexes **Dorylaimoides**
- Tail dissimilar in sexes **Morasia**

Genus **Dorylaimoides** Thorne and Swanger, 1936

Diagnosis : Body length usually less than 2 mm. Cuticle and sub-cuticle finely striated. Radial striae and refractive elements absent. Lip region slightly offset. Odontostyle asymmetrical, dorsal arm longer than ventral. Guiding ring single. Odontophore usually arcuate or angular, enveloped by distinct oesophageal tissue. Oesophageal bulb cylindroids, sometimes slightly constricted, usually about one-fourth to one-third oesophageal length. Female reproductive system mono-opisthodelphic or amphidelphic. Vulva transverse. Male with dorylaimoid spicules, lateral guiding pieces and series of spaced ventromedian supplements. Tail hemispheroid to long, filiform; similar in sexes.

Type subgenus : *Dorylaimoides* (Thorne and Swanger, 1936) Jairajpuri & Ahmad, 1992

Other subgenera : *Tarjania* (Brzeski & Szczgiel, 1961) Jairajpuri & Ahmad, 1992; *Shamimonema* Chawla, Khan and Prasad, 1965, Jairajpuri & Ahmad, 1992; *Arcidorylaimoides* Jairajpuri & Ahmad, 1992; *Digidorylaimoides* Jairajpuri & Ahmad, 1992; *Longidorylaimoides* Jairajpuri & Ahmad, 1992

Key to Subgenera of **Dorylaimoides**

1. Female reproductive system amphidelphic 2
- Female reproductive system mono-opisthodelphic 4
2. Tail long, filiform **Longidorylaimoides**
- Tail not long, filiform 3
3. Tail short, conoid to hemispheroid **Dorylaimoides**
- Tail sub-digitate or dorsally bent **Digidorylaimoides**
4. Tail short, conoid or digitate **Shamimonema**
- Tail elongate, conoid or long, filiform 5
5. Tail elongate, conoid, ventrally arcuate **Arcidorylaimoides**
- Tail elongate, conoid, dorsally bent or long, filiform **Tarjania**

Subgenus ***Dorylaimoides*** (Thorne and Swanger, 1936) Jairajpuri & Ahmad, 1992

Diagnosis : Body 0.98-1.65 mm long. Cuticle and sub-cuticle finely striated. Odontostyle asymmetrical. Guiding ring single. Odontophore arcuate or angular. Oesophageal bulb cylindroids, usually without constriction. Female reproductive system amphidelphic. Tail short, conoid to hemispheroid; similar in sexes.

Type species : *Dorylaimoides (Dorylaimoides) teres* Thorne and Swanger, 1936

Other species : *D. (D.) arcuicaudatus* Baqri and Jairajpuri, 1969; *D. (D.) buccinator* Sauer, 1967; *D. (D.) chamoliensis* Ahmad and Jairajpuri, 1983; *D. (D.) chathamii* Yeates, 1979; *D. (D.) enodis* Goseco, Ferris and Ferris, 1976; *D. (D.) indicus* Jairajpuri, 1965; *D. (D.) parateres* Siddiqi, 1964; *D. (D.) theocoalaimus* Heyns, 1965; *D. (D.) websteri* Sauer, 1967

141. ***Dorylaimoides (Dorylaimoides) parateres*** Siddiqi, 1964

(Plate No. 23, Fig. 141)

Measurements : Female : L = 1.50 mm; a = 35; b = 6.8; c = 50; V = ¹⁴⁻¹⁵42¹⁴⁻¹⁵

Description : Female : Lip region slightly set off. Odontostyle dorylaimoid, ventral side 8 µm long, dorsal side extending further posteriorly. Odontophore 19 µm long, arcuate, sclerotized. Basal expanded part of oesophagus occupies 28% of neck region. Reproductive system amphidelphic. Prerectum 164 µm or about 6.5 anal body-width long. Tail 30 µm or about 1.2 anal body-width long, obtusely round.

Male : Not found.

Habitat and locality : Soil inhabiting. Thandi Beri, KWLS, Udaipur.

Distribution : Rajasthan, Uttar Pradesh.

Subgenus ***Longidorylaimoides*** Jairajpuri & Ahmad, 1992

Diagnosis : Body 0.9-2.0 mm long. Cuticle and sub-cuticle finely striated. Odontostyle asymmetrical. Guiding ring single. Odontophore arcuate or angular. Oesophageal bulb cylindrical, generally non-constricted. Female reproductive system amphidelphic. Tail elongate, conoid to long, filiform; similar in sexes.

Type species : *Dorylaimoides (Longidorylaimoides) longicaudatus* (Imamura, 1931) Thorne and Swanger, 1936

142. ***Dorylaimoides (Longidorylaimoides) leptura***, Siddiqi, 1965

(Plate No. 23, Fig. 142)

Measurements : Female : L = 1.70-2.17 mm; a = 40-55; b = 6.3-7.9; c = 9-11; V = ¹⁰⁻¹¹38-40¹¹⁻¹²

Description : Females : Body ventrally arcuate. Lip region slightly set off from body. Odontostyle asymmetrical, ventral side 4-5 μm and 8-9 μm long dorsally. Odontophore arcuate, 16-17 μm long. Basal expanded part of oesophagus 29-32% of neck region. Female reproductive system amphidelphic. Prerectum 203-210 μm long or 9.2-10 anal body-width long. Tail 189-230 μm elongate filiform, 189-230 μm or about 9-11 anal body-width long, dorsally bent posteriorly.

Male : Not found.

Habitat and locality : Soil inhabiting. Phytophagous. Rajkheda, district Dholpur.

Distribution : Rajasthan, West Bengal and Maharashtra.

Sugenus *Digidorylaimoides* Jairajpuri & Ahmad, 1992

Diagnosis : Body 1.0-1.3 mm long. Cuticle and sub-cuticle fine striated. Odontostyle asymmetrical. Guiding ring single. Odontophore arcuate. Oesophageal bulb without constriction. Female reproductive system amphidelphic. Tail elongate, sub-digitate or dorsally bent; similar in sexes.

Type species : *Dorylaimoides (Digidorylaimoides) elegans* (De Man, 1880) Thorne and Swanger, 1936.

Other Species : *D. (D.) leptus* Husian and Khan, 1968; *D. (D.) micoletzkyi* (De Man, 1921) Thorne and Swanger, 1936; *D. (D.) pakistanensis* Siddiqi, 1964.

143 *Dorylaimoides (Digidorylaimoides) micoletzkyi* (de Man, 1921)

Thorne & Swanger, 1936

(Plate No. 23, Fig. 143)

Measurements : Female : L = 1.33 mm; a = 36; b = 6.4; c = 11.9; V = $12\text{-}1342^{13\text{-}14}$

Male : L = 1.22 mm; a = 43; b = 6.70; c = 75; T = 49.

Description : Female : Lip region set off by a slight depression from body. Odontostyle 9 μm ventrally and 13 μm dorsally. Odontophore typical to the genus, 16 μm long. Female reproductive system amphidelphic. Prerectum 115 μm or 5.5 anal body-width long. Tail elongate conoid, 112 μm or 5.0 anal body-width long, terminus bent dorsally.

Male : Spicules 35 μm long. Lateral guiding pieces 8 μm long. In addition to the adanal pair, 5 irregularly spaced ventromedian supplements. Tail elongate-conoid, 79 μm or 3.4 anal body-width long.

Habitat and locality : Soil inhabiting. Phytophagous. Thandi Beri, KWLS, district Udaipur.

Distribution : Rajasthan, West Bengal and Sikkim.

144. *Dorylaimoides (Digidorylaimoides) pakistanensis* Siddiqi, 1964
(Fig. 32, G-H)

Measurements : Female : L = 0.79-1.00 mm; a = 40-43; b = 5.2-5.5; c = 4.7-5.8; V = 14-15/38-41/15-17

Description : Female : Body ventrally arcuate upon fixation. Cuticle with fine transverse striations. Lip region rounded, set off from body by a constriction. Odontostyle 7-8 μ m long; aperture 2-3 μ m or one-third of odontostyle length. Odontophore 14-15 μ m long. Guiding ring single, 6-7 μ m from anterior end. Oesophagus typical to the genus. Basal expanded part occupies 40-42% of neck region. Vulva a transverse slit. Vagina 20-22 μ m or extending inwards about two-fifth of corresponding body-width. Female reproductive system amphidelphic. Ovaries reflexed. Prerectum 95-98 μ m or 4.0-4.1 anal body-width long. Rectum 25-26 μ m or one anal body-width long. Tail elongate, regularly conoid to rounded terminus, 165-170 μ m or 7.0-7.1 anal body-width long.

Habitat and locality : Collected from soil around roots of wheat at Kota.

Distribution : Rajasthan.

Subgenus *Arcidorylaimoides* Jairajpuri & Ahmad, 1992

Diagnosis : Body 0.8-0.99 mm long. Cuticle and sub-cuticle finely striated. Odontostyle asymmetrical. Guiding ring single. Odontophore arcuate or angular. Oesophageal expansion constricted or non-constricted. Female reproductive system mono-opisthodelphic. Anterior uterine sac one-two body -widths long. Tail elongate, conoid, ventrally arcuate; similar in sexes.

145. *Dorylaimoides (Arcidorylaimoides) constrictus* Baqri & Jairajpuri, 1969
(Plate No. 23, Fig. 145)

Measurements : Female : L = 0.88-0.89 mm; a = 41-43; b = 6-7; c = 8-9; V = 28-30.

Description : Female : Body arcuate, lip region slightly set off. Amphids cup-shaped, 4-5 μ m wide. Odontostyle 9-10 μ m long. Pharyngeal bulb 24-26% of pharyngeal length. Female reproductive system amphidelphic. Anterior gonad reduced, posterior normal. Prerectum 5-6 anal body-width long. Tail long, filiform, 7-9 anal body width long.

Male : Not found.

Habitat and locality : Soil inhabiting. Paras Ram Mahadev forest area, district Pali.

Distribution : Rajasthan, Uttar Pradesh.

Suborder NYGOLAIMINAE Ahmad & Jairajpuri, 1979

Diagnosis : Mural tooth located on subventral walls of pharynx. Pharynx eversible and may be divided into distal, median and proximal portion. Proximal and median parts

thick-walled while distal part thin-walled. Oesophagus with an anterior slender and posterior expanded basal parts. Oesophagus with an anterior slender and posterior expanded basal parts. Three cardiac glands usually present at oesophago-intestinal junction. Female reproductive system amphidelphic, rarely mono-opisthodelphic. Prerectum present. Males with paired testes, spicules, lateral guiding pieces. Gubernaculum may or may not be present. Tails vary in shape and structure; similar in sexes.

Type and only superfamily : NYGOLAIMOIDEA Thorne, 1935

Superfamily NYGOLAIMOIDEA Thorne, 1935

Diagnosis : Medium sized nematodes. The posterior basal expanded part of oesophagus usually enclosed in thin or conspicuous sheath forming basal pockets. Mural tooth on left sub-ventral wall of pharynx. Pharynx in three section. Three cardiac glands or cardiac disc present at junction of pharynx and intestine. Female reproductive system amphidelphic, rarely mono-opisthodelphic. Males generally with massive spicules, lateral guiding pieces and ventromedian supplements. Gubernaculum present or absent.

Type family : NYGOLAIMIDAE Thorne, 1935

Other families : NYGELLIDAE Andrassy, 1958; NYGOLAIMELLIDAE Clark, 1961; AETHOLAIMIDAE Jairajpuri, 1965

Key to families of Nygolaimoidea Thorne, 1935

1. Basal expanded part of pharynx enclosed in thick sheath of spiral muscles; Female reproductive system mono-opisthodelphic NYGELLIDAE
 - Basal expanded part of pharynx not enclosed in muscular sheath; Female reproductive system amphidelphic 2
2. Stoma sclerotised AETHOLAIMIDAE
 - Stoma not sclerotised 3
3. Basal expanded part of pharynx about one-half pharyngeal length; cardiac glands present NYGOLAIMIDAE
 - Basal expanded part of pharynx about two-third pharyngeal length, bibulbar; cardiac disc present NYGOLAIMELLIDAE

Family NYGOLAIMIDAE Thorne, 1935

Diagnosis : Cuticle thin. Lip region either confluent with or off set from body contour; lips usually closely amalgamated. Mural tooth variable in shape and size. Stoma simple, without sclerotization. Pharynx reversible, in three sections. Basal expanded part of oesophagus enclosed in thin or conspicuous sheath forming basal pockets. Three well

developed cardiac glands present at base of oesophagus. Female reproductive system amphidelphic. Vulva transverse, rarely longitudinal. Males with well developed spicules, lateral guiding pieces and ventromedian supplements. Gubernaculum present or absent. Tail variable in shape and size; similar in sexes.

Type subfamily : NYGOLAIMINAE Thorne, 1935

Other subfamily : SOLIDIDENTINAE Ahmad & Jairajpuri, 1982

Key to Subfamilies of Nygolaimidae

- Mural tooth deltoid to linear or dorylaimoid NYGOLAIMINAE
- Mural tooth solididentoid or acicular SOLIDIDENTINAE

Subfamily NYGOLAIMINAE

Diagnosis : Body (0.7-7.2 mm) long, almost straight to ventrally curved upon fixation. Cuticle transversely striated. Lip region continuous or set off from body contour. Mural tooth linear, deltoid or dorylaimoid in shape. Cardiac glands large, rounded or ovoid. Vulva transverse. Female reproductive system amphidelphic. Males with arcuate spicules, lateral guiding pieces and ventromedian supplements. Gubernaculum present or absent. Tail varies from short convex-conoid, elongate-conoid, hemispherical, obtusely rounded to clavate.

Type genus : *Nygolaimus* Cobb, 1913

Other genera : *Aquatides* Heyns, 1968; *Afronygus* Heyns, 1968

Key to genera of Nygolaiminae

1. Vulva longitudinal; paravulvae usually present ***Paravulvus***
 - Vulva transverse; paravulvae absent 2
2. Tail elongate, conoid, ventrally arcuate ***Anfronygus***
 - Tail short, convex-conoid, hemispheroid or clavate 3
3. Tooth dorylaimoid ***Laevides***
 - Tooth deltoid or linear 4
4. Lip region set off by constriction 5
 - Lip region continuous (except in *Aquatides christei*) 6
5. Males without gubernaculums and with weakly developed ventromedian supplements ***Nygolaimus***

- Males with gubernaculum and well-developed ventromedian supplements ***Paranygolaimus***
- 6. Tooth linear; body usually straight; tails convex-conoid to hemispheroid ***Aquatides***
- Tooth deltoid to linear; body ventrally curved; tail hemispheroid to clavate ***Clavicaudoides***

Genus ***Nygolaimus*** Cobb, 1913

Diagnosis : Body small to large sized (0.7-4 mm). Cuticle finely striated. Mural tooth deltoid, less than or equal to the length of lip region. Lip region rounded, set off from body. Basal expanded part of oesophagus enclosed in sheath. Cardia small. Three rounded cardiac glands well developed. Female reproductive system amphidelphic. Males with arcuate spicules and small lateral guiding pieces. Gubernaculum absent. Ventromedian supplements weakly developed, may be absent. Prerectum two anal body-widths long. Tail convex-conoid or conical; similar in sexes.

Type species : *Nygolaimus pachydermatus* Cobb, 1913

146. ***Nygolaimus anneckei*** Heyns, 1968
(Plate No. 24, Fig. 146 & 36, F-G)

Measurements : Females : L = 1.25-1.34 mm; a = 43-44; b = 4.3-4.5; c = 67-69;
V = $6.8 \cdot 43 \cdot 44^{6.8}$

Description : Female : Body almost straight upon fixation. Lip region set off by constriction. Tooth deltoid, 7-8µm long somewhat dorsally curved. Basal expanded part of oesophagus occupies 48-50% of neck length. Cardiac glands present. Amphidelphic reproductive system, both genital branches equally developed. Prerectum 1.8-1.9 anal body width. Tail 18-19µm dorsally convex-conoid bluntly rounded.

Male : Not found.

Habitat and locality : Soil inhabiting. Peeh, district Nagaur

Distribution : Rajasthan, Gujarat, Andaman and Nicobar

147. ***Nygolaimus harishi*** Ahmad and Jairajpuri, 1988
(Plate No. 24, Fig. 147 & 36, A-E)

Measurements : Females : L = 1.07-1.17 mm; a = 40-42; b = 3.7-3.9; c = 61-66;
V = $7.8 \cdot 41 \cdot 43^{8.10}$

Description : Female : Body almost straight upon fixation. Cuticle transversely striated, 2-3µm thick (thickest at tail). Lip region distinctly set off from body. Tooth deltoid, 6-7µm long. Basal expanded part of oesophagus occupies 50-52% of neck length. Cardiac gland

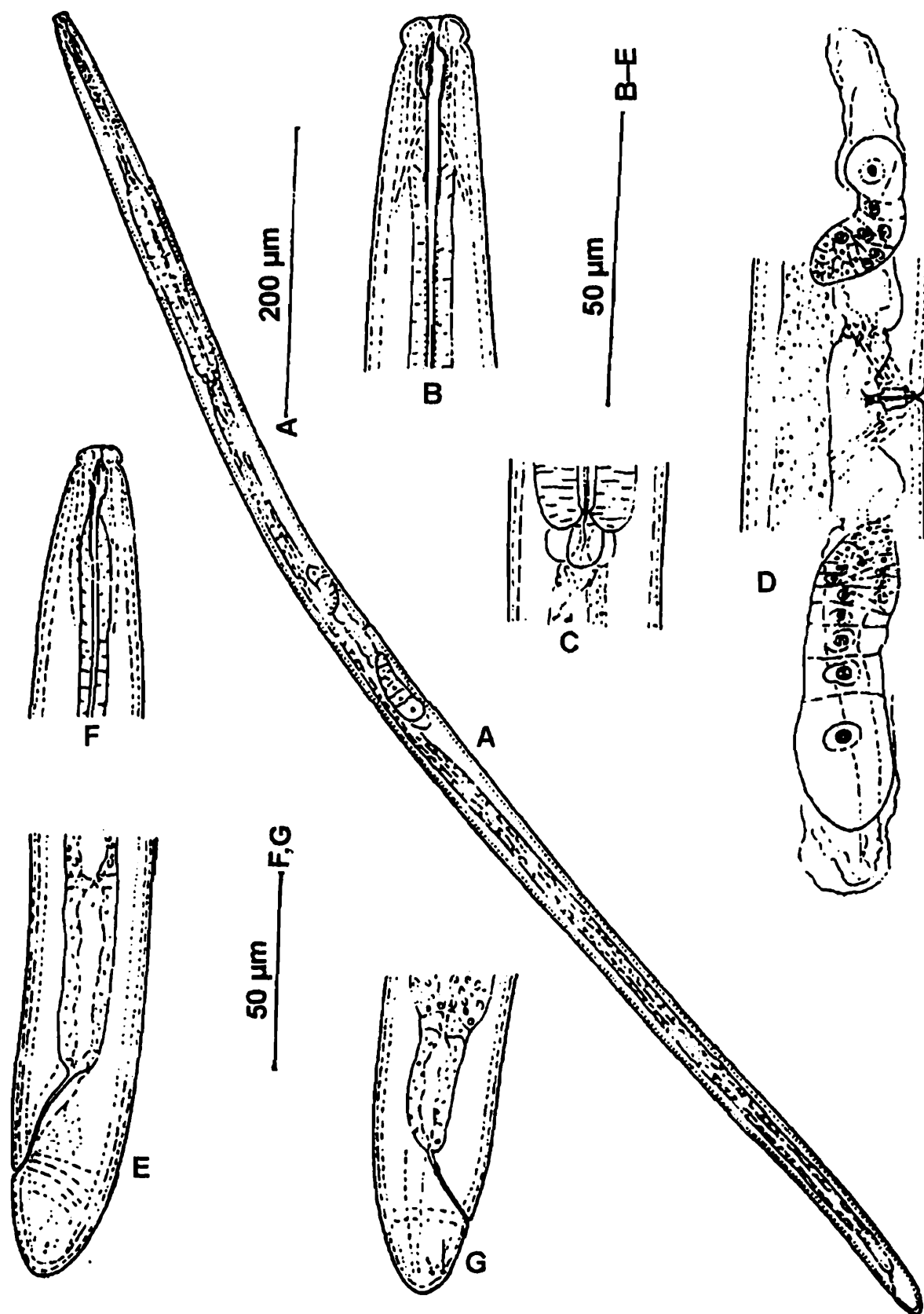


Fig. 36. *Nygolaimus harishi* Ahmad & Jairajpuri, 1980. A-E : Female: A-Entire female (abnormal); B-Anterior end; C-Oesophago-intestinal junction; D-Female reproductive organ; E-Female tail. F-G: *Nygolaimus anneckeii* Heyns, 1968. F-Female anterior end; G-Female tail.

rounded. Vulva transverse. Female reproductive system amphidelphic. Anterior genital branch reduced. Prerectum 1.5-1.6 anal body - width. Rectum about one anal body width long. Tail 16-18µm, straight-conoid with rounded terminus, about anal body width long.

Male : Not found.

Habitat and localities : Soil inhabiting. Sambhar, district Jaipur; Jhunjhunu

Distribution : Rajasthan, Haryana, Punjab, Gujarat, Himachal Pradesh.

148. *Nygolaimus captivitatis* (Heyns, 1968) Ahmad & Jairajpuri, 1980
(Plate No. 24, Fig. 148)

Measurements : Females : L = 1.21-1.34 mm; a = 39-40; b = 4.0-4.2; c = 60-61; V = 7-8⁴⁷⁻⁴⁸

Description : Female : Body almost straight upon fixation. Lip region set off by constriction. Tooth deltoid, 7-8 µm long. Basal expanded part of oesophagus occupies 54-56% of neck length with somewhat constriction near its middle. Female reproductive system amphidelphic. Prerectum 1.3-1.4 anal body width long. Tail 17-18µm bluntly convex-conoid, about one anal body- width long.

Male : Not found.

Habitat and locality : Soil inhabiting. Bhuragaon, district Bharatpur

Distribution : Rajasthan, Uttar Pradesh.

149. *Nygolaimus hyans* Thorne, 1974
(Plate No. 24, Fig. 149)

Measurements : Females ; L = 1.23-1.35 mm; a = 40-41; b = 3.9-4.1; c = 60-61; V = 7-8⁵⁸⁻⁵⁹

Description : Female : Body almost straight upon fixation. Lip region rounded, set off from body by distinct constriction. Tooth deltoid, 9µm long. Basal expanded part of oesophagus occupies 53-54% of neck length. Cardiac glands present. Prerectum 4.0-4.2 anal body width. Tail 18-19 µm convex conoid with rounded terminus, about 1-3 anal body width long.

Male : Not found.

Habitat and locality : Soil inhabiting. Bhuragaon, district Bharatpur

Distribution : Rajasthan.

150. *Nygolaimus shamimi* Bohra & Sultana, 2008
(Plate No. 24, Fig. 150 & 37, A-H)

Measurements : Females : L = 1.09-1.13 mm; a = 42-43; b = 3.2-3.8; c = 54-68; V = 40-43.

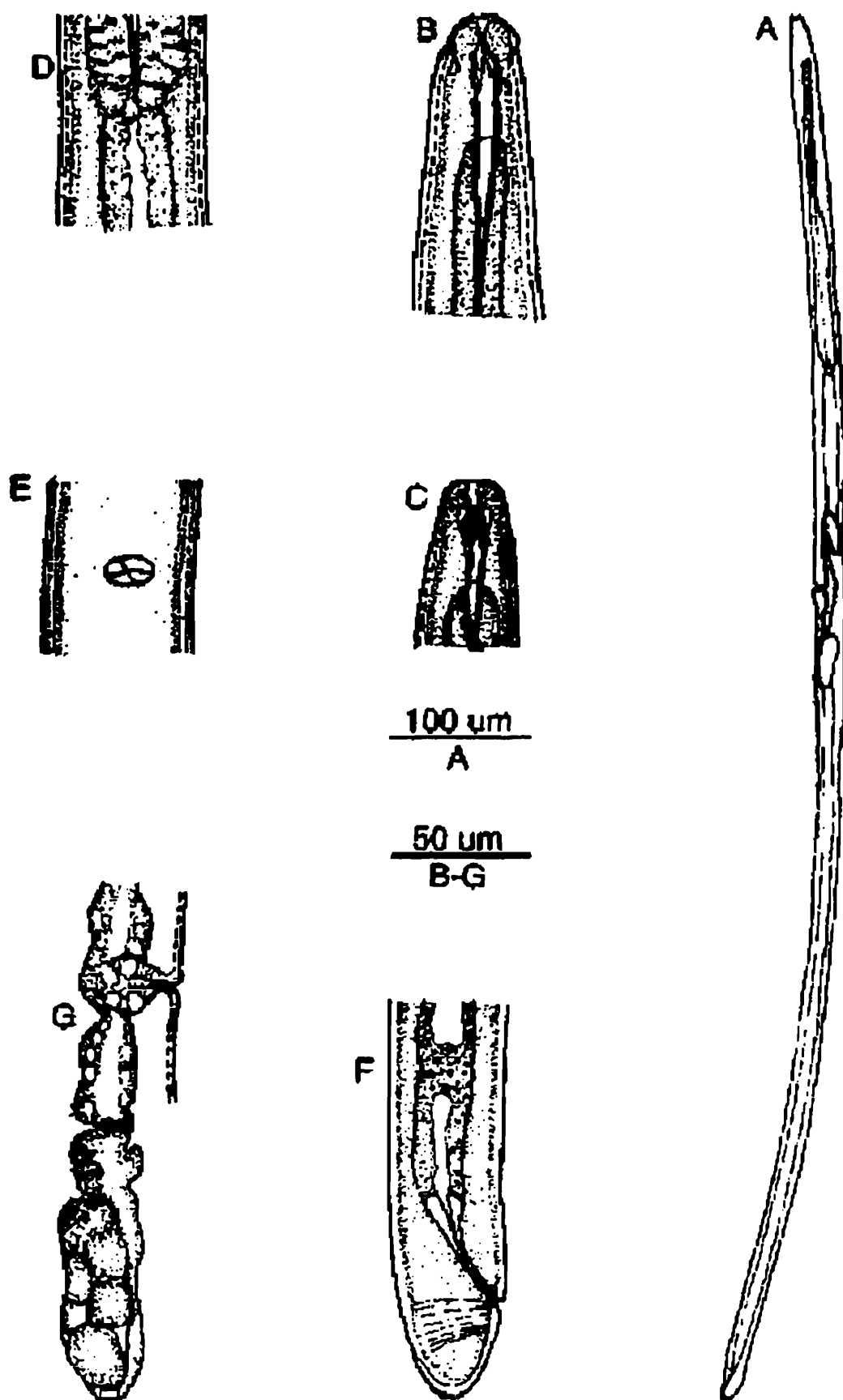


Fig. 37. *Nygolaimus shamimi* Bohra & Sultana, 2008. A-Entire female; B-Anterior end; C-Amphid; D-Cardiac Region; E-Vulval opening (ventral view); F-Posterior end of tail, G-Posterior genital branch of female.

Description : Female : Body almost straight upon fixation. Lip region distinctly set off from body contour. Lips rounded. Tooth 3-4.5 μm ; deltoid type (ventral arm longer). Basal expanded part of pharynx occupying about 54-58% of neck length; with somewhat constriction near its middle. Cardiac gland present at oesophago-intestinal junction. Tail 0.9-1.0 anal body-width long.

Male : Not found.

Type habitat and locality : Collected from soil around roots of sagwan at Chikani, district Alwar, Rajasthan.

Distribution : Rajasthan.

Genus *Aquatides* Heyns, 1968

Diagnosis : Body length usually 1-4 mm. Cuticle and sub-cuticle finely striated. Tooth linear, usually longer than width of lip region. Lip region truncate or rounded, set off by slight depression. Basal expanded part of oesophagus enclosed in a conspicuous sheath, usually forming basal pockets. Cardiac glands well developed, spheroid to ovoid. Cardia well developed. Vulva transverse. Female reproductive system amphidelphic. Males with massive arcuate spicules, well developed gubernaculum, lateral guiding pieces and ventromedian supplements. Prerectum usually one-fourth anal body-widths long. Tail bluntly convex-conoid to hemispheroid; similar in sexes.

Type species : *Aquatides aquaticus* (Thorne, 1930) Thorne, 1974

151. *Aquatides thornei* (Schneider, 1937) Ahmad & Jairajpuri, 1982 (Plate No. 24, Fig. 151)

Measurements : Females : L = 1.66-1.76 mm; a = 32-55; b = 4.1-4.5; c = 65-66; V = 12-13/47-49¹²⁻¹³

Male : L = 1.44 mm; a = 33; b = 4.0; c = 53; T- 52.

Description : Female : Lip region continuous with body. Labial papillae not elevated. Tooth linear, 12-13 μm or equal to lip region-width. Basal expanded part of oesophagus enclosed in a conspicuous sheath forming basal pockets. Cardia hemispherical. Cardiac glands rounded. Female reproductive system amphidelphic. Prerectum 65-70 μm or two anal body-width long. Tail hemispheroid, slightly clavate, 25-27 μm or about one anal body-width long.

Male : Spicules 45 μm long, lateral guiding pieces 9 μm long. Gubernaculum 8 μm long. Ventromedian supplements 5. Tail hemispherical, 27 μm long.

Habitat and locality : Soil around roots of various crops and other plants. Predatory. Golaiya – Lal sot road, district Dausa.

Distribution : Bihar, Gujarat, Rajasthan, Andaman and Nicobar Islands.

152. *Aquatides aquaticus* (Thorne, 1930) Thorne, 1974
(Plate No. 25, Fig. 152)

Measurements : Females : L = 1.80-2.06 mm; a = 39-42; b = 5.0-5.2; c = 81-82; V = ¹³⁻¹⁴47-52¹³⁻¹⁵.

Male : L = 2.04 mm; a = 40; b = 4.0; c = 56; T = 65.

Description : Female : Body almost straight upon fixation. Lip region continuous with body, labial papillae elevated. Tooth linear, 15-18 μ m or equal to lip region width. Basal expanded part of oesophagus occupies 45-48% of oesophageal length, enclosed in a conspicuous sheath forming basal pockets. Cardiac glands well developed. Female reproductive system amphidelphic. Prerectum 65-75 μ m or 2-3 anal body-width long. Tail 22-25 μ m long, shorter than anal body-width, convex-conoid or bluntly rounded.

Male : Spicules massive, arcuate, 50-58 μ m medially. Gubernaculum 9-10 μ m long. Lateral guiding pieces well developed, 11-13 μ m long. In addition to adanal pair, 5-6 ventromedian supplements present. Tail 36 μ m long, convex-conoid.

Habitat : Soil inhabiting.

Distribution : Rajasthan, Gujarat, Uttar Pradesh.

CHAPTER-4

Order TRIPLONCHIDA Cobb, 1920

Suborder DIPHTHEROPHORINA Coomans & Loof, 1970

Family TRICHODORIDAE Thorne, 1935 (Siddiqi, 1961)

Subfamily TRICHODORINAE Thorne, 1935

Genus *Paratrichodours* Siddiqi, 1974

Paratrichodorus minor (Colbran, 1956) Siddiqi, 1974

Paratrichodorus porosus (Allen, 1957) Siddiqi, 1974

Order TRIPLONCHIDA

The members of order Triplonchida are relatively distinctive under the stereomicroscope because of their plump, cigar-shaped bodies which are rounded at both ends but lack of an easily recognizable spear or 'onchiostyles'. The body length varies from 0.5-1.5 mm but is usually less than 1mm. The tail is very short and rounded in both sexes, particularly so in Females where the anus is subterminal.

The cuticle is thick and smooth and is lacking in transverse striae when viewed under light microscope. It is loose and wrinkly and may swell upon fixation. The lip region is rounded and slightly set off, the outer ring of papillae sometimes being prominent. The amphidial apertures are located just posterior to the lip region and take form of short gaping, ellipsoid structures about one third to half the head width in size. The body pores may or may not be present.

The stoma is sclerotized and forms a simple guiding tube around the anterior part of 'onchiostyle', the proximal part appearing as a ring or collar. The anterior section consists of a dorsal tooth which is predominantly solid, but proximally hollow. This is formed with the region of the stoma and is attached posteriorly to an extension which is fused to the dorsal wall of the pharynx and serves for attachment of the protractor muscles. The onchiostyle is used as a pick to penetrate cell walls and no food passes through its structure in contrast to the hollow odontostyle and stylet of the dorylaeids and tylenchids/apphelenchids respectively. Onchiostyle length varies from about 25 μm to 150 μm .

The oesophagus comprises two parts: a narrow, tubular anterior section and a posterior, non-muscular bulboid expansion which accommodate the oesophageal glands. The shape of the oesophagus is noticeably different to that of dorylaeids, the posterior section gradually expanding to form a spatulate bulb as opposed to the cylindrical form in the other groups. There are five oesophageal glands. According to Raksi *et al.* (1969) the dorsal and posterior ventro sublateral glands have a radiating system of sinuses which drain the secretions to their respective orifice.

The intestine is a simple, relatively undifferentiated tube which may form an anterior extension overlapping the gland lobe both dorsally and subdorsally. The posterior intestine

is not differentiated into a prorrectum as is the case in dorylaims. The rectum is lined with cuticle and oriented virtually parallel to the body axis. The anus is subterminal crescentic or oval aperture in the Female, the cloaca being located more anterior in the male.

The vulva is median to post ($V = 50-60\%$) in *Trichodorus* and *Paratrichodorus* but far posterior in *Monotrichodorus* ($V = 75-86\%$) and *Allotrichodorus* ($V = 80-90\%$). The vulval aperture takes form of a small pore or slit, either transverse or longitudinal, and often located in depression.

The Female genital tract is either amphidelphic with the telogonic ovary reflexed in those forms having median vulva or monoprodelphic, reflexed in those with a posterior vulva. The later group has a post uterine sac which may be short or well developed. An axial spermatheca is well developed in *Trichodorus* but may be present or absent in other genera.

The male genital tract is monarchic and outstretched. The spems are usually large and subcylindrical with sausage-shaped nuclei, but may be small and rounded or even filiform (Decraemer and Chaves, 1988; Decraemer, 1989). The spicules are paired, separate an either ventrally arcuate or modified these form as in *Trichodorus* or more or less straight with the distal tips curved ventral. There is a series of one to four ventromedian copulatory supplements anterior to cloaca. A bursa may be absent, as in *Trichodorus* well developed as in most *Paratrichodorus* or merely represented by a flattening and thickening of the ventrosublateral cuticle of the cloacal opening.

Trichodorids are polyphagous migratory ectoparasites of the roots of perennial and woody plants. They were capable of transmitting plant viruses (Harrison, 1961, 1966, 1967; van Hoof, 1962, 1964; Sanger, 1961; Sol *et al.*, 1960; Walkinshaw *et al.*, 1961).

The direct feeding of trichodorids can cause severe damage to the host, e.g. 'Docking disorder' of sugarbeet caused by, amongst other factors, several species of *Trichdorus* and *Paratrichodorus* feeding on young seedlings and resulting in patchy growth (Whitehead and Hooper, 1970; Whitehead *et al.*, 1971).

Trichodorids appear to be a most widespread and abundant in light sandy soils (Winfield and Cook, 1975). In general, *Trichodorus* species are predominantly distributed in cooler, temperate soils and *Paratrichodorus* species mostly in warmer, tropical and subtropical soils.

In the present book 2 species of Order Triplonchida belonging to 1 genus of 1 family has been described. Informaiton about their diagnostic character, habitat and localities and their distribution have been provided.

In the present book 2 species of Order Triplonchida belonging to 1 genus of 1 family hasbeen described. Informaiton about their diagnostic character, habitat and localities and their distribution have been provided.

Superfamily TRICHODOROIDEA

Diagnosis : Body 0.5-1.5 mm long, plump, Females cigar-shaped, males straight or J-shaped upon fixation. Cuticle thick, smooth; swell abnormally upon fixation. Amphidial apertures wide, gaping ellipses; sensilla sac separated from the fovea only by a constriction. Onchiostyle distally solid, dorsally convex, attached to the dorsal wall of the pharynx. Guiding ring single. Oesophagus consisting of a narrow anterior section expanding into a posterior bulboid section of spatulate or pyriform shape containing five glands – one dorsal, two anterior ventro-sublateral and two posterior ventro-sublateral. Distinct excretory pore present, located either within the oesophageal region or slightly posterior. Prerectum absent. Vulva small, median to slightly post median or more posterior in position depending on whether genital system is amphidelphic, reflexed or monoprodelphic, reflexed. Spermatheca present or absent. Female anus almost terminal. Male genital tract monarchic, outstretched. Spicules straight or curved with the spicule protractor muscles forming a capsule around the proximal half of the retracted spicules. Bursa present or absent. Tail very short and rounded.

Family TRICHODORIDAE Thorne, 1935 (Siddiqi, 1961)

Diagnosis : Trichodoroidea. With the characters of the superfamily.

Type Genus : *Trichodorus* Cobb, 1913

Other Genera : *Allotrichodorus* Rodriguez-M., Sher and Siddiqi, 1978; *Monotrichodorus* Andrassy, 1976; *Paratrichodorus* Siddiqi, 1974; *Atlantadorus* Siddiqi, 1974 (Siddiqi, 1980); *P. (Nanidorus)* Siddiqi, 1974; *Nanidorus* Siddiqi, 1974 (Siddiqi, 1980)

Key to Genera

Female :

1. Female genital tract amphidelphic 2
- Female genital tract monoprodelphic 3
2. Vagina extending halfway into body, musculature well developed; lateral body pores within one body-width of vulva; cuticle not abnormally swollen on fixation ***Trichodorus***
- Vagina extending for up to a third of the corresponding body-width; no lateral body pores within one body-width of vulva; cuticle abnormally swollen on fixation ***Paratrichodorus***
3. Lateral body pores present near vulva ***Monotrichodorus***
- Lateral body pores absent ***Allotrichodorus***

Male :

1. Diagonal copulatory muscles extending far anterior to head of retracted spicules. Tail region sharply curved (habitus J-shaped) on heat relaxation **Trichodorus**
 - Diagonal copulatory muscles wither within the range of the retracted spicules or only extending about one body-width anterior to spicule head. Tail region almost straight and not sharply recurved on heat relaxation 2
2. Three ventromedian copulatory supplements more or less within the range of the retracted spicules, bursa present **Allotrichodorus**
 - Only one or two ventromedian copulatory supplements within the range of the retracted spicules, bursa present or absent 3
3. Spicule protractor capsule weakly developed, bursa usually prominent, diagonal copulatory muscles within range of the retracted spicules **Paratrichodorus**
 - Spicule protractor capsule prominent, bursa absent, diagonal copulatory muscles extending just anterior to retracted spicules **Monotrichodorus**

Genus *Paratrichodorus* Siddiqi, 1974

Diagnosis : Trichodoridae. Body plump, cigar-shaped, heat relaxed form more or less straight in both sexes. Cuticle swelling strongly after heat relaxation. Lateral body pores present in about half the species, but typically not present within a body-width of the vulva. Onchiostyle dorsally convex. Oesophagus consisting of a narrow anterior section expanding posteriorly to form a bulb which usually overlaps the intestine ventrally. Posterior ventrosublateral nuclei located near to the oesophago-intestinal junction, the dorsal nucleus usually being near the oesophageal enlargement. An extension of the intestine along the dorsal side of the bulb may be present or absent. Vulva a minute median pore or small transverse or longitudinal slit. Vagina extending into the body for up to one third the corresponding diameter, musculature weakly developed and inconspicuous; sclerotization poorly developed. Genital tract amphididelphic, reflexed. Spermatheca present or absent. Anus subterminal, tail rounded. Males lacking or rare in about 40% of the nominal species. Ventromedian cervical papillae absent or, if present, consisting of a single papilla near, and anterior to, the excretory pore. Lateral cervical pores absent or, if present, usually represented by a single pair (one pore on each side) near the onchiostyle base or excretory pore. Testis single, outstretched. Sperm variously shaped (large subcylindroid; small and oval or rounded; filiform). Spicules normally straight; transversely striated, except at the extremities; gubernaculum present. Spicule suspensor muscles forming an inconspicuous elongate-oval capsule. Bursa present, but may be inconspicuous. Ventromedian copulatory supplements numbering one to three, exceptionally four; the first two supplements usually being within the range of the bursa. Oblique copulatory muscles extending no further than the proximal tips of the retracted spicules. Tail short, rounded, with one, sometimes two pairs of ventrosubmedian papillae. Caudal pores usually present, but absent in those species formerly included under *Nanidorus*.

Type species : *Paratrichodorus tunisiensis* (Siddiqi, 1963) Siddiqi, 1974

153. ***Paratrichodorus minor*** (Colbran, 1956) Siddiqi, 1974
(Plate No. 25, Fig. 153)

Measurements : Females : L = 0.48-0.55 mm; a = 17-23; b = 4.2-5.7; V = 52-57.

Description : Female : Body almost straight upon fixation, tapering slightly at both ends. Cephalic region rounded with slightly protruding papillae. Onchiostyle typical of genus. Pharynx gradually expands to form spatulate to pyriform basal bulb overlapping intestine ventrally and subventrally. Female reproductive system amphidelphic. Anus subterminal. Tail bluntly rounded.

Male : Not found.

Habitat and localities : Soil inhabiting. Parasitic. Rahar, district Bharatpur.

Distribution : Tropical and subtropical regions.

154. ***Paratrichodorus porosus*** (Allen, 1957) Siddiqi, 1974
(Plate No. 25, Fig. 154)

Measurements : Females : L = 0.42-0.80; a = 13-24; b = 3.0-5.8; V = 50-58.

Description : Females : Body stout, almost straight upon fixation. Cuticle swelled upon fixation. Onchiostyle 38-58 μ m. Intestine often overlapping the pharyngeal bulb for some distance dorsally. Female reproductive system amphidelphic. Vulva equatorial, pore like. Vagina weakly sclerotized.

Male : Not found.

Habitat : Soil inhabiting, Plant parasitic.

Distribution : Tropical and subtropical regions.

CHAPTER-5

Order MONONCHIDA Jairajpuri, 1969

Suborder MONONCHINA Kirjanova & Krall, 1969

Family MONONCHIDAE Filipjev, 1934

Subfamily MONOCHINAE Filipjev, 1934

Genus **Mononchus** Bastian, 1865

Mononchus aquaticus Coetzee, 1968

Subfamily PRIONCHULINAE Andrassy, 1976

Genus **Coomansus** Jairajpuri & Khan, 1977

Coomansus icarus Jairajpuri & Khan, 1982

Family MYLONCHULIDAE Jairajpuri, 1969

Subfamily MYLONCHULINAE Jairajpuri, 1969

Genus **Mylonchulus** Cobb, 1916

Mylonchulus hawaiiensis (Cassidy, 1931) Andrassy, 1958

Mylonchulus contractus Jairajpuri, 1970

Mylonchulus amurus Khan & Jairajpuri, 1979

Mylonchulus dentatus Jairajpuri, 1970

Mylonchulus brachyuris (Butschli, 1873) Altherr, 1953

Mylonchulus subsimilis (Cobb, 1917) Meyl, 1957

Mylonchulus minor (Cobb, 1893) Andrassy, 1958

Mylonchulus lacustris (N.A. Cobb in M.V. Cobb, 1915) Andrassy, 1958

Family ANATONCHIDAE Jairajpuri, 1969

Subfamily MICONCHINAE Andrassy, 1976

Genus **Miconchus** Andrassy, 1958

Miconchus studeri (Steiner, 1914) Jairajpuri, 1981

Family IOTONCHIDAE Jairajpuri, 1969

Subfamily IOTONCHINAE Jairajpuri, 1969

Genus **Iotonchus** Cobb, 1916

Iotonchus indicus Jairajpuri, 1969

Subfamily HADRONCHINAE Khan & Jairajpuri, 1980

Genus **Parahadronchus** Mulvey, 1978

Parahadronchus shakili (Jairajpuri, 1969) Mulvey, 1978

Suborder BATHYDONTINA Coomans & Loof, 1970

Family BATHYDONTIDAE Clark, 1961

Genus ***Bathydontus*** Fielding, 1950*Bathyodontus cylindricus* Fielding 1950

Family MONONCHULIDAE De Coninck, 1965

Genus ***Oionchus*** Cobb, 1913*Oionchus obtusus* Cobb, 1913

Order MONONCHIDA

The members of order Mononchida Jairajpuri, 1969 generally called predatory nematodes because of their feeding habit cannibalism also noted can easily be recognized and differentiated from other groups of nematodes by their large bodies, in having strongly sclerotized and well developed feeding apparatus (buccal cavity); a long and highly muscular cylindroid oesophagus, in the absence of prerectum and in the presence of caudal glands, spinneret and males with gubernaculum. The body size varies from 0.55mm (*Mylonchulus contractus*) to 7.00 mm (*Miconchus rex*). Upon fixation the body generally assumes, a ventrally arcuate posture or may become C-shaped.

The outer layer of cuticle generally appears smooth without any external markings or striations, but sometimes it is the inner layer which may possess fine transverse striations. The thickness of cuticle varies considerably from 1-12µm in different regions of the body. The body pores may or may not be present. The hypodermal chord is distinct.

The amphidial apertures are small slit-like, situated below the lateral lips. The size and shape of amphids is variable. Lip region may be marked off by a depression or clearly set off from the adjoining body. In some genera like *Mononchus* and *Paramononchus* the lip region is almost continuous with the body.

The digestive organs consists of a large strongly developed and sclerotized stoma or buccal cavity followed by a highly muscular oesophagus, a well developed oesophago-intestinal junction, tubular intestine, and a short rectum opening to the exterior through a anus.

The buccal cavity of mononchids is very important character from the taxonomic point of view. The buccal cavity may be barrel-shaped, globular, oval, rectangular or it may be long cylindrical, thin-walled. The length and width of buccal cavity in different species of mononchs though highly variable, is quite useful in identification. The wall of buccal cavity is heavily cuticularize. The arrangement of tooth/teeth and denticles and position of dorsal tooth from the base of buccal cavity is of great taxonomic importance for identification up to species level.

The nerve ring is a conspicuous, broad collar-like structure, located 22-40% of the oesophageal length from the anterior end of body. It may show a slight ventral slant. Its position in different species may be variable but it is of no taxonomic importance. The excretory system is usually obscure. Cobb (1917) had doubtfully reported the presence of an excretory pore little behind the nerve ring in *Clarkus papillatus* and *Iotonchus trichuris*.

The oesophagus is strongly muscular, long and cylindroid without any narrowing or swellings. The oesophageal lumen is interrupted by orifices of oesophageal gland nuclei. The position of oesophageal gland nuclei and their orifices are of quite important taxonomic characters.

The oesophago-intestinal junction of two types :

(i) *Tuberculate Type* : The peripheral ends of three arms of the sclerotized lining become inflated, and generally thickened forming conspicuous hollow 'tubercles'. From this point a narrow duct extends posteriorly and forms the anterior part of the tripartite, funnel-shaped valves. The members of super family Anatonchidae have tuberculate type of oesophago-intestinal junctions. The tubercles were first reported by Ditlevsen (1911) in *Anatonchus dolichurus* and later by Steiner (1914) in *Miconchus studeri*.

(ii) *Non tuberculate Type* : There is an abrupt change in the shape of oesophageal lumen. It becomes narrow at the base of oesophagus and opens into the transparent zone through a simple funnel and does not form tubercles.

The members of family Mononchoidea have non-tuberculate type of oesophago-intestinal junctions.

The intestine of mononchids is straight, simple, tube. The intestinal lumen of mononchids is exceptionally wider and as they feed on soil micro-organisms like protozoa, rotifers small oligochaets, nematodes etc. it may contain remnants of these.

The posterior part of intestine is connected to a dorsoventrally compressed tube, the rectum. The intestine-rectum junction is guarded by sphincter muscles, the intestine-rectal valves. The rectal glands may or may not be present.

The Female reproductive system may comprise one set (monodelphic, either pro or opisthodelphic) or two sets (didelphic, amphidelphic). Each set possesses vulva, vagina, uterus, oviduct and ovary. The sexual branches are usually large and well developed. The gonads are telogonic and the proliferation of the germ cells takes place only at the apical end of the ovary. The terminal and growth zones are clearly demarcated.

The male reproductive system comprises testes, vas deference and an ejaculatory duct. The copulatory apparatus is made up of spicules, gubernaculum, accessory pieces and the ventromedian supplements. The male gonad is also telogonic.

The tail in both sexes of mononchs is similar, but it varies in shape and size in different species viz., very long filiform (*Iotonchus trichuris*), moderately long filiform (*Hadrochus*, *Parahadrochus*), elongate (*Mononchus*, *Miconchus*), conoid (*Mylonchulus* sp.) convex-conoid to obtusely rounded (*Mylonchulus museoli*), bluntly rounded to hemispherical. The length and shape of tail is regarded as one of the diagnostic characters in Mononchida at species or generic level.

Three unicellular glands are usually present in the anterior part of tail. In species where they are well developed, these glands join in common duct which opens to exterior at or near the tail tip. The gland opening is guarded by a well developed cuticularized

structures the 'spinneret' It may be terminal, subterminal, subdorsal etc. the presence or the absence, the nature and the deposition of the caudal glands and spinneret are very important taxonomic characters.

In the present book 15 species of Order Mononchida belonging to 8 genera of 5 families have been described. Information about their diagnostic character, habitat and their distribution have been provided.

Key to suborders of Mononchida Jairajpuri, 1969

1. Stoma heavily sclerotised, barrel or cup-shaped, armed with a large dorsal tooth
..... **Mononchina**
- Stoma moderately sclerotised, elongate or narrow, armed with subventral tooth
..... **Bathyodontina**

Suborders MONONCHINA Kirjanova & Krall, 1969

Diagnosis : Large sized nematodes. Lip region large and wide. Buccal cavity prominent, with dorsal tooth, ventral ridges and subventral teeth may or may not be present. Ventral ridges with or without denticles; sub ventral teeth may be as large as dorsal tooth or in the form of denticles. Gubernaculum well developed, with lateral accessory pieces.

Type Superfamily : MONONCHOIDEA Chitwood, 1937

Other Superfamily : ANTANCHOIDEA Jairajpuri, 1969

Key to superfamilies of Mononchina Jairajpuri, 1969

1. Pharyngo-intestinal junction non tuberculate; buccal cavity tapering at base
..... MONONCHOIDEA
- Pharyngo-intestinal junction tuberculate; buccal cavity broad and flat at base
..... ANATONCHOIDEA

Superfamily MONONCHOIDEA Chitwood, 1937

Diagnosis : Buccal cavity thick-walled, tapering at base, dorsal tooth medium to large. Ventral longitudinal ridges, if present, with or without denticles. Pharyngo-intestinal junction non-tuberculate.

Type family : MONONCHIDAE Chitwood, 1937

Other families : MONONCHIDAE Chitwood, 1937; MYLONCHULIDAE Jairajpuri, 1969

Key to families of Mononchoidea Chitwood, 1937

1. Subventral and dorsal teeth nearly similar in shape and size COBBONCHIDAE
- Subventral teeth if present, much smaller 2

2. Denticles either absent or arranged along a longitudinal rib MONONCHIDAE
 – Denticles arranged in transverse rows or scattered or both MYLONCHULIDAE

Family MONONCHIDAE

Diagnosis : Dorsal tooth usually large, pointing forward. Caudal glands and spinneret present or absent.

Type subfamily : MONONCHINAE Chitwood, 1937

Key to subfamilies of Mononchidae Chitwood, 1937

1. Lips and labial papillae poorly developed; tail elongate cylindroids, caudal glands and spinneret well developed MONONCHINAE
 – Lips and labial papillae well developed; tail generally short conoid, caudal glands and spinneret absent or poorly developed PRIONCHULINAE

Subfamily MONONCHINAE Chitwood, 1937

Diagnosis : Lips and labial papillae poorly developed, lip region almost continuous with body. Dorsal tooth in anterior half or anterior third of buccal cavity. Spicules and accessory pieces extremely long and slender. Tails elongate, terminus rounded. Caudal glands, their ducts and spinneret well developed.

Type genus : *Mononchus* Bastian, 1865

Key to genera of Mononchinae

- Dorsal tooth opposed by a short rib with two small subventral teeth at base of rib ***Paramononchus***
 – Dorsal tooth not opposed by any rib or small denticles ***Mononchus***

Genus *Mononchus* Bastian, 1865

Diagnosis : Lip region almost continuous with body, lips and labial papillae poorly developed. Buccal cavity elongate-cylindroid, thin-walled, tapering at base. Dorsal tooth small, in anterior half of buccal cavity, apex directed forward. Oesophago-intestinal junction non-tuberculate. Female reproductive system amphidelphic. Spicules and accessory pieces extremely long and slender, gubernaculum crescent-shaped. Tail tip rounded to clavate. Caudal glands and spinneret well developed.

Type genus : *Mononchus* Bastian, 1865

155. ***Mononchus aquaticus*** Coetzee, 1968
(Plate No. 26, Fig. 155)

Measurements : Females : L = 1.77 mm; a = 42.19; b = 5.77; c = 18.65; V = $10^{-11}559^{-10}$

Description : Female : Lip region 21 μ m wide and 9 μ m high. Amphidial apertures 3 μ m wide, located at 8 μ m from anterior end. Buccal cavity 36 $\times$ 14 μ m. The apex of dorsal tooth at 24 μ m or 66% of buccal cavity from base. Female reproductive system amphidelphic. Tail elongate conoid with clavate tip, 94 μ m or 3.7 anal body-width long. Caudal glands well developed, spinneret terminal.

Male : Not found.

Habitat and locality : Soil inhabiting. Feeds on larvae of insects, other nematodes, predatory nematodes. Thandi Beri, KWLS, district Udaipur.

Distribution : West Bengal, Rajasthan, Gujarat.

Subfamily PRIONCHULINAE Andrassy, 1976

Diagnosis : Lips and labial papillae well developed, lip region set off from body. Dorsal tooth usually large, may or may not be opposed by a denticulate or non-denticulate longitudinal ridge. Tail short and conoid, caudal glands and spinneret generally absent or obscure.

Type genus : *Prionchulus* (Cobb, 1916) Wu & Hoeppli, 1929

Key to genera of Prionchulinae

1. Dorsal tooth opposed by longitudinal ventral ridge 2
 Dorsal tooth not opposed by longitudinal ventral ridge 3
2. Ventral ridge denticulate ***Prionchulus***
 – Ventral ridge non denticulate ***Clarkus***
3. Subventral walls bearing two longitudinal rows of denticles ***Actus***
 – Subventral walls without longitudinal rows of denticles ***Coomansus***

Genus ***Coomanus*** Jairajpuri & Khan, 1977

Diagnosis : Buccal cavity barrel-shaped, tapering at base. Dorsal tooth situated in middle or anterior half of buccal cavity, its apex directed anteriorly. Subventral walls of buccal cavity without ridges or denticles. Oesophago-intestinal junction non-tuberculate. Female reproductive system amphidelphic. Spicules and accessory pieces short and stout, gubernaculum simple. Tail short conoid ventrally arcuate. Caudal glands poorly developed or absent, spinneret inconspicuous or absent.

Type species : *Coomansus parvus* (de Man, 1880) Jairajpuri & Khan, 1977

156. *Coomansus icarus* Jairajpuri & Khan, 1981
(Plate No. 26, Fig. 156)

Measurements : Females : L = 2.41-2.48 mm; a = 31-33; b=3.9-4.1; c=15-17; V=60-62.

Description : Female : Body ventrally arcuate upon fixation. Lip region slightly expanded from body adjacent contour. Amphidial aperture 3-4 μ m wide located at 14-16 μ m from anterior end. Dorsal tooth of medium size, situated in anterior half of buccal cavity. Subventral walls without denticles. Female reproductive system amphidelphic. Tail conoid, rounded at tip, 3-4 anal body diameter long. Cardiac glands rudimentary.

Male : Not found.

Habitat and locality : Feeds on larvae of insects, other nematodes. Predatory. Thandi Beri, KWLS., district Udaipur.

Distribution : Himachal Pradesh, Rajasthan.

Family MYLONCHULIDAE Jairajpuri, 1969

Diagnosis : Dorsal tooth opposed by several rows of denticles, arranged in transverse rows or scattered or both. Tail generally short, conoid and arcuate, caudal glands and spinneret usually well developed, rarely absent.

Key to subfamilies of Mylonchulidae Jairajpuri, 1969

1. Denticles arranged in transverse row(s) MYLONCHULINAE
- Denticles scattered irregularly SPORONCHULINAE

Subfamily MYLONCHULINAE Jairajpuri, 1969

Diagnosis : Buccal cavity goblet-shaped, tapering at base. Dorsal tooth large to massive, situated in anterior half of buccal cavity. Denticles arranged both in transverse and longitudinal rows. Subventral teeth present or absent. Female reproductive system monodelphic, opisthodelphic or amphidelphic. Tail variable in shape. Caudal glands and spinneret generally well developed.

Type genus : *Mylonchulus* (Cobb, 1916) Altherr, 1953

Genus *Mylonchulus* (Cobb, 1916) Altherr, 1953

Diagnosis : Buccal cavity goblet-shaped, tapering at the base. Dorsal tooth large to massive, situated in anterior half of buccal cavity. Subventral walls bearing three to numerous transverse rows of denticles, forming rasp like areas. A pair of ventral teeth opposite to base of dorsal tooth usually present. Oesophago-intestinal junction non-tuberculate. Female reproductive system amphidelphic. Spicules short, gubernaculum simple or bidentate, with or without lateral accessory pieces. Tail variable in shape. Caudal glands grouped or tandem. Spinneret terminal or subterminal.

Type species : *Mylonchulus minor* (Cobb, 1893) Andrassy, 1958

157. *Mylonchulus hawaiiensis* (Cassidy, 1931) Andrassy, 1958
(Plate No. 26, Fig. 157)

Measurements : Females : L = 1.00-1.07 mm; a = 25-27; b=2.83-3.48; V = 7⁻⁸59-647⁻⁸

Description : Female : Lip region 18-20 × 5-6 µm. Amphidial apertures 3-5 µm wide, located at 7-10 µm from anterior end. Buccal cavity 21-22 × 13-14 µm. Dorsal tooth large, situated in anterior half of buccal cavity, its apex at 16-17 µm or 63-77% of buccal cavity from base. Subventral walls bearing 5 or 6 transverse rows of denticles. Submedian teeth present. Female reproductive system amphidelphic. Tail tip slightly clavate, 30-42 µm or about 1.0-1.8 anal body-width long. Caudal glands tandem, rarely grouped. Spinneret terminal.

Male : Not found.

Habitat and locality : Soil inhabiting. Predatory. Thandi Beri, KWLS., district, Udaipur.

Distribution : Andaman Nicobar, Sikkim, Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

158. *Mylonchulus contractus* Jairajpuri, 1970
(Plate No. 26, Fig. 158 & 38, G-H)

Measurements : Female : L = 0.95 mm; a = 29; b = 3.5; c = 25; V = 7567.

Description : Female : Body ventrally arcuate upon fixation, tapering towards both extremities. Cuticle 2 µm thick. Lip region 20 µm wide and 2 µm high. Buccal cavity 21×12 µm. Apex of dorsal tooth 15 µm from the base of stoma. Five transverse rows of denticles. Submedian teeth small. Female reproductive system amphidelphic; ovaries reflexed, intestine contracted dorsally in the region of gonads. Tail 37 µm or one and half anal body-width long, arcuate-conoid with blunt terminus. Caudal glands grouped. Spinneret subdorsal.

Male : Not found.

Habitat and locality : Soil around roots of various plants. Predatory. Mathania, district, Jodhpur.

Distribution : Rajasthan, Gujarat.

159. *Mylonchulus amurus* Khan & Jairajpuri, 1979
(Plate No. 26, Fig. 159)

Measurements : Females : L=0.82-1.12 mm; a=16-22; b=2.6-3.1; c=27-40; V=57-62.

Description : Female : Body robust, ventrally arcuate upon fixation. Lip region 26-30 µm wide. Amphidial aperture 3-4 µm wide, located at 9-12 µm from anterior end. Dorsal tooth medium sized, located at 70-78% of the length of buccal cavity from base. Submedian teeth absent. Subventral walls bearing 5 transverse rows of denticles. Female reproductive

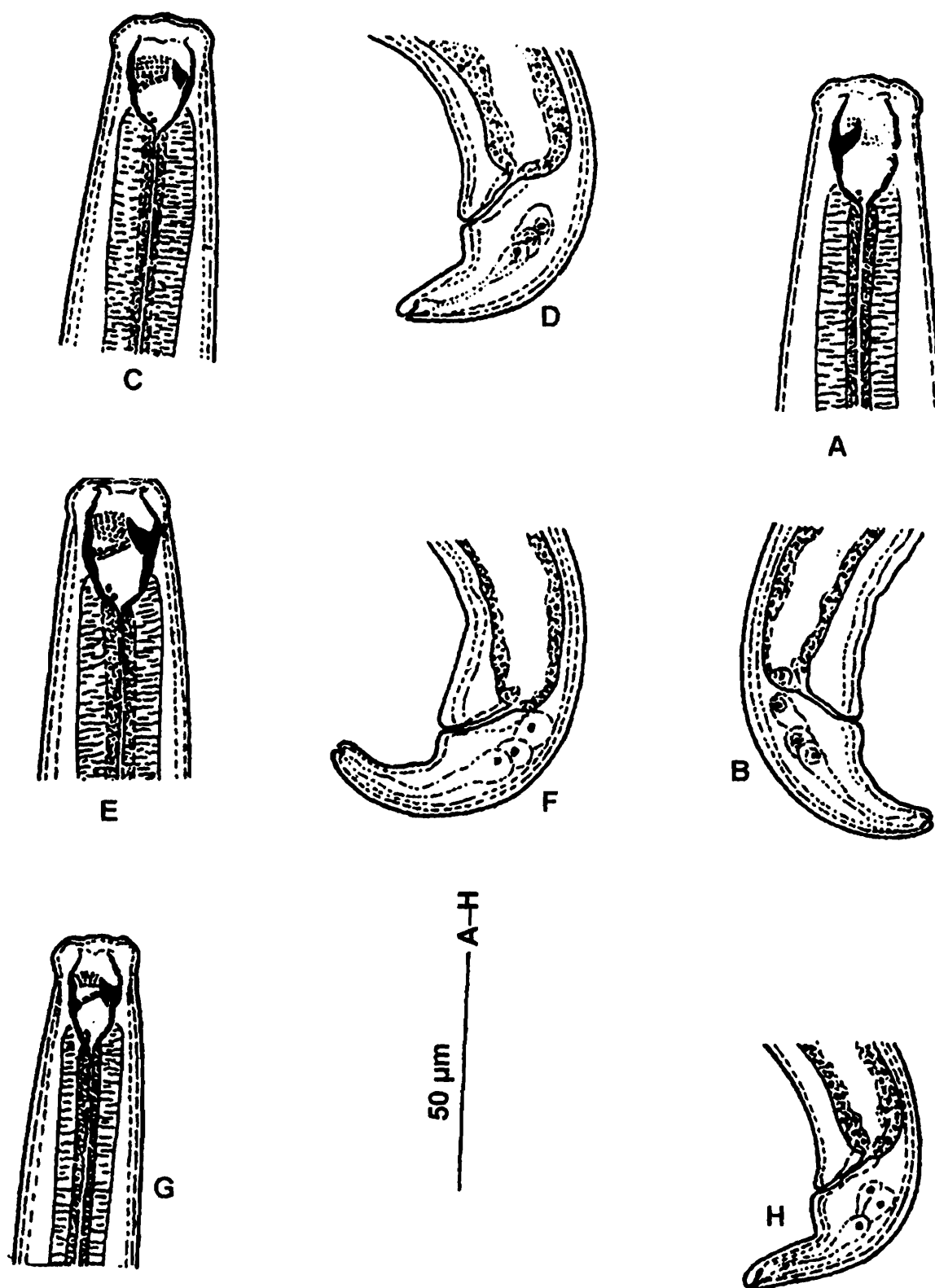


Fig. 38. A-B: *Mylonchulus minor* (Cobb, 1893) Andrassy, 1958. A-Female anterior end; B-Female tail. C-D: *Mylonchulus brachyuris* (Butschli, 1873) Andrassy, 1958. C-Female anterior end; D-Female tail. E-F: *Mylonchulus lacustris* (N.A. Cobb in M.V. Cobb, 1915) Andrassy, 1958. E-Female anterior end; F-Female tail. G-H: *Mylonchulus contractus* Jairajpuri, 1970. G-Female anterior end; H-female tail.

system amphidelphic. Uterus with eggs. Tail conoid with clavate terminus, 1.2-1.4 anal body diameter long. Caudal glands grouped. Spinneret terminal.

Male : Not found.

Habitat and locality : Soil inhabiting. Soil around roots of millet (*Pennisetum americanum*), Ranakpur, Kumbhalgarh Wildlife Sanctuary.

Distribution : Rajasthan and Himachal Pradesh.

160. ***Mylonchulus dentatus*** Jairajpuri, 1970
(Plate No. 26, Fig. 160)

Measurements : Females : L = 1.5-1.8 mm; a = 29-41; b = 3.5-4.1; c = 30-42; V = 8-961-678-9.

Description : Female : Body ventrally arcuate upon fixation. Lip region 27-32 μ m wide. Amphidial apertures 5-6 μ m wide, located at 8-12 μ m from anterior end. Dorsal tooth massive, 78-80% of the length of buccal cavity from base. Buccal cavity 20 $\times$ 23 μ m long. Subventral walls bearing multiple transverse rows of denticles, not arranged in definite rows. Submedian teeth prominent. Female reproductive system amphidelphic. Tail conoid with blunt terminus. Caudal glands grouped. Spinneret terminal.

Male : Not found.

Habitat and locality : Soil inhabiting. Predatory. Soil around roots of Onion (*Allium cepa*), Thandi Beri, Kumbhalgarh Wildlife Sanctuary.

Distribution : Rajasthan and Himachal Pradesh.

161. ***Mylonchulus brachyuris*** (Bütschli, 1873) Altherr, 1953
(Plate No. 27, Fig. 161 & 38,C-D)

Measurements : Females : L = 0.82-1.21 mm; a = 23-27; b = 2.8-3.5; c = 30-45; V = 8-959-679-10.

Description : Female : Body ventrally arcuate upon fixation. Lip region 23-24 μ m wide. Amphidial aperture 3-4 μ m wide, located at 8-9 μ m from anterior end. Buccal cavity 22 $\times$ 29 μ m long. Dorsal tooth massive, 70-75% of the length of buccal cavity from base. Subventral walls bearing 6 transverse rows of denticles. Submedian teeth present. Female reproductive system amphidelphic. Uterus filled with eggs. Tail conoid with blunt terminus. Caudal glands grouped. Spinneret subterminal.

Male : Not found.

Habitat and locality : Soil inhabiting, Predatory. Soil around roots of bean (*Phaseolus* sp.), Malgad, Kumbhalgarh Wildlife Sanctuary.

Distribution : Rajasthan, Himachal Pradesh and Gujarat.

162. ***Mylonchulus subsimilis*** (Cobb, 1917) Meyl, 1957
(Plate No. 27, Fig. 162)

Measurements : Female : L=1.0-1.2 mm; a=25-45; b=3.5-3.7; c=35-38; V=57-59.

Description : Female : Lip region 20 μ m wide. Amphidial apertures 3 μ m wide, located at 8 μ m from anterior end. Buccal cavity 22x $\times$ 13 μ m. Apex of dorsal tooth at 16 μ m or 72% of the buccal cavity from base. Subventral walls bearing 5 rows of denticles. Submedian teeth present. Female reproductive system amphidelphic. Tail conoid, 26 μ m or about one anal body width long with tip bluntly rounded. Caudal glands and terminal opening absent.

Male : Not found.

Habitat and locality : Soil inhabiting. Predatory. Gogunda, district Udaipur.

Distribution : Rajasthan, Gujarat.

163. ***Mylonchulus minor*** (Cobb, 1893) Andr  ssy, 1958
(Plate No. 27, Fig. 163&38, A-B)

Measurements : Females : L = 0.74-0.89 mm; a = 28-32; b = 3.23-3.52; c = 24-28; V = 8-9.59-60⁸⁻⁹

Description : Female : Lip region 20-22x5-6mm. Amphidial apertures 3-4 μ m wide, located at 8-9mm from anterior end. Buccal cavity 23-25 $\times$ 14-15 μ m. Dorsal tooth situated in anterior-half of buccal cavity, its apex at 17-18 μ m or 72-73% of the buccal cavity from base. Subventral walls with 5-6 transverse rows of denticles. Submedian teeth present. Reproductive system amphidelphic. Tail arcuate conoid with rounded terminus, 30-32 μ m or 1.0-1.2 anal body-width long. Caudal glands tandem. Spinneret terminal.

Male : Not found.

Habitat and locality : Soil inhabiting. Predatory. Gogunda, district Udaipur.

Distribution : Rajasthan, Maharashtra, Andhra Pradesh and Uttar Pradesh.

164. ***Mylonchulus lacustris*** (N.A. Cobb in M.V. Cobb, 1915) Andrassy, 1958
(Plate No. 27, Fig. 164&38,E-F)

Measurements : Females : L = 1.36-1.44 mm; a = 36-44; b = 3.66-4.18; c = 31-34; V = 6-7.60-65⁶⁻⁷

Description : Female : Lip region set off, 21-23 $\times$ 7-8 μ m. Amphidial apertures 4-5 μ m wide, located at 9-12 μ m from anterior end. Buccal cavity 28-29 $\times$ 17-18 μ m. Dorsal tooth massive, its apex 75% of the buccal cavity from base of buccal cavity. Subventral walls bearing 6-7 transverse rows of denticles. Submedian teeth well developed. Female reproductive system amphidelphic. Tail conoid, arcuate, 42-45 μ m or more than one anal body-width long. Caudal gland tandem. Spinneret terminal.

Male : Not found.

Habitat and locality : Soil inhabiting. Predatory. Gogunda, district Udaipur.

Distribution : West Bengal, Rajasthan, Uttaranchal, Uttar Pradesh.

Family ANATONCHIDAE Jairajpuri, 1969

Diagnosis : Dorsal and subventral teeth almost equal in size and similar in position, their apices pointing forwards or backwards.

Type subfamily : ANATONCHINAE Jairajpuri, 1969

Subfamily MICONCHINAE Andrassy, 1976

Diagnosis : Dorsal and subventral teeth basal or near middle of buccal cavity, their apices directed anteriorly.

Type genus : *Miconchus* Andrassy, 1958

Genus *Miconchoides* Khan & Jairajpuri, 1982

Diagnosis : Miconchinae. Buccal cavity barrel-shaped, flattened at base. Dorsal tooth opposed by a pair of subventral teeth which are flanked by three pairs of smaller suprabasal teeth. Oesophago-intestinal junction tuberculate. Female reproductive system amphidelphic. Spicules and gubernaculum simple. Tail short, conoid. Caudal glands and terminal opening present.

Type species : *Miconchoides studei* (Steiner, 1914) Jairajpuri & Ahmad, 1982

Discussion : recently, Khan & Coomans (1980) have published observations on *M. studei* based on the material from available land at Boxmeer, The Netherlands. They have expressed doubts about the buccal denticular structure as interpreted by Mulvey (1962). We, however, still feel that *M. studei* represents a group quite distinct from *M. digiturus*, but do not rule out the possibility that in future the definition of *Miconchoides* may be amended to include other amphidelphic species of *Miconchus* also.

165. *Miconchoides studei* (Steiner, 1914) Jairajpuri, 1981
(Plate No. 27, Fig. 165)

Measurements : Females : L=2.02-2.20 mm; a=41-44; b=3.9-4.4; c=20; V=69-71.

Description : Female : Lip region 30-31 μ m wide, 11-12 μ m high. Buccal cavity 55-60 μ m barrel shaped, flattened at base. Dorsal tooth opposed by sub ventral tooth. Oesophago-intestinal junction tuberculate. Nerve ring at 85 μ m from anterior end. Female reproductive system amphidelphic. Tail 100-108 μ m or 2.7-3.2 anal body-width long conoid, arcuate elongate, with blunt terminus. Spinneret terminal.

Male : Not found.

Habitat and locality : Soil inhabiting - Predaceous. Gogunda, district Udaipur.

Distribution : Rajasthan, Gujarat, Uttranchal, Himachal Pradesh.

Family IOTONCHIDAE

Dorsal tooth variable in size and position subventral teeth, if present, different from dorsal

Type subfamily : *Iotonchinae* Jairajpuri, 1969.

Subfamily IOTONCHINAE Jairajpuri, 1969

Diagnosis : Dorsal tooth of small to medium size, apex directed anteriorly, subventral teeth absent.

Type genus : *Iotonchus* (Cobb, 1916) Altherr, 1950

Genus *Iotonchus* (Cobb, 1916) Altherr, 1950

Diagnosis : Buccal cavity generally barrel-shaped and flattened at base. Dorsal tooth small to medium-sized, variable in position from base to anterior half of buccal cavity, subventral teeth absent. Oesophago-intestinal junction tuberculate. Female reproductive system amphidelphic or mono-prodelphic. Spicules long and arcuate, with or without lateral accessory pieces, gubernaculum simple or bidentate. Tail variable in size and shape. Caudal glands and terminal opening usually present.

Type species : *Iotonchus gymnolaimus* (Cobb, 1893) Andrassy, 1958.

166. *Iotonchus indicus* Jairajpuri, 1969
(Plate No. 27, Fig. 166)

Measurements : Females : L = 1.71 mm; a = 29; b = 4.5; c = 6.7; V = 9619

Description : Female : Body ventrally curved upon fixation. Cuticle 4-6 µm thick, thickest at tail. Lip region set off, wider than adjoining body 36 µm wide and 17 µm high. Amphids small cup-shaped, their apertures 5 µm wide. Buccal cavity 28-32 µm. Apex of dorsal tooth 8 µm from base of buccal cavity. Oesophago-intestinal junction tuberculate. Sclerotized pieces present at vulva-vagina junction. Tail 254 µm or about 6.3 anal body-width long elongate conoid tapering gradually. Caudal glands present, opening subterminal dorsally.

Male : Not found.

Habitat and locality : Soil inhabiting. Predaceous. Thandi Beri, KWLS, district Udaipur.

Distribution : Rajasthan, Gujarat.

Subfamily HADRONCHINAE Khan & Jairajpuri, 1980

Diagnosis : Dorsal tooth large, subventral teeth in two longitudinal rows of few to numerous denticles.

Type genus : *Hadronchus* Mulvey & Jensen, 1967

Key to genera of Hadronchinae

1. Dorsal tooth in posterior half, subventral denticles fewer ***Parahadronchus***
- Dorsal tooth middle to anterior half, subventral denticles numerous 2
2. Longitudinal ribs extending anteriorly forming loops ***Prionchulellus***

Out of above mentioned two genera, species of genus *Parahadronchus* is so far being reported from India.

Genus *Parahadronchus* Mulvey, 1978

Diagnosis : Buccal cavity barrel-shaped, thick walled, flattened at base. Dorsal tooth large, situated in posterior half of buccal cavity, apex directed forward, opposed by few large denticles on subventral walls. Oesophago-intestinal junction tuberculate. Female reproductive system amphidelphic or mono-prodelphic, spicules large; lateral accessory pieces prominent, gubernaculum simple. Tail long; filiform. Caudal glands and terminal opening well developed.

Type species : *Parahadronchus andamanicus* (Jairajpuri, 1969) Mulvey, 1967; *Parahadronchus shakili* (Jairajpuri, 1969) Mulvey, 1978

167. *Parahodronchus shakili* (Jairajpuri, 1969) Mulvey, 1978 (Plate No. 28, Fig. 167)

Measurements : Females : L = 1.86-2.0 mm; a = 30-35; b = 4.1-4.7; c = 4.2-4.5; V = 9-10 56-58 9-10

Description : Female : Body ventrally curved upon fixation. Cuticle 4-6 µm thick, thickest at tail. Lip region set off by a constriction, wider than adjoining body; 38-42 µm wide and 14-16 µm high. Amphids striup shaped, their apertures 7-8 µm wide. Buccal cavity 43-45 × 29-32 µm. Apex of dorsal tooth 15-16 µm from base of stoma. Nerve ring 120-145 µm from anterior end. Oesophago-intestinal junction tuberculate. Sclerotized pieces present at vulva-vagina junction. Tail 402-475 µm or about 11-13 anal body-width long. Spinneret terminal.

Male : Not found.

Habitat and locality : Soil inhabiting. Predaceous. Gogunda, district Udaipur.

Distribution : Rajasthan, Gujarat, Andman and Nicobar.

Suborder BATHYDONTINA Coomans & Loof, 1970

Diagnosis : Stoma narrow, composed of several sections, embedded almost entirely in oesophageal tissues, weakly to strongly sclerotized. A distinct tooth of varying size present, with or without denticles. Dorsal oesophageal gland nucleus far behind dorsal oesophageal

gland orifice, sometimes at level of first subventral gland nuclei, first subventral gland nuclei far behind first subventral gland opening.

Type superfamily : BATHYDONTIDAE

Key to superfamilies of Bathyodontina Coomans & Loof, 1970

1. Stoma thin and narrow, tooth very small; polymyarian BATHYDONTOIDEA
- Stoma comparatively thick, tooth grooved and large; meromyarian
..... MONONCHULAOIDEA

Superfamily BATHYDONTOIDEA Clark, 1961

Diagnosis : Stoma elongate, tooth very small. Denticles may be present in anterior part of stoma. Second sub-ventral gland nuclei far behind second subventral gland opening.

Type and only family : BATHYDONTIDAE Clark, 1961

Family BATHYDONTIDAE

Diagnosis : Stoma very long and narrow, composed of three sections. Tooth at junction of anterior two parts. Denticles at base of anterior part of stoma. Tail short and rounded with caudal glands and terminal duct.

Type and only genus : *Bathyodontus* Fielding, 1950

Genus *Bathyodontus* Fielding, 1950

Diagnosis : Buccal cavity long and thin, composed of three sections, a cylindrical anterior part, a shorter much thicker and narrower middle portion and a longer tubular posterior part. Oesophagus cylindrical, oesophagus cylindrical, oesophago-intestinal junction nontuberculate, cellular apparatus present. Reproductive system amphidelphic. Caudal glands and terminal opening present. Males not known.

Type species : *Bathyodontus cylindricus* Fielding, 1950

168. *Bathyodontus cylindricus* Fielding, 1950 (Plate No. 28, Fig. 168)

Measurements : Females : L = 0.76-0.88 mm; a = 13-20; c = 33-53; b = 2.5-3.0; V = 8-951-568-9

Description : Female : Body almost straight upon fixation. Lip region 14-17 µm wide, 7-9 µm high, slightly set off, lips conoid with amalgamated bases. Anterior wide part of buccal cavity 16-19 µm long, 5-6 µm wide. Vento-sublateral denticle small, but distinctly visible. Reproductive system amphidelphic. Tail 15-16 µm, rounded, less than one anal body width long. Spinneret terminal.

Male : Not found.

Habitat and localities : Soil inhabiting. Predatory. Kumhar, district Bharatpur and Rajakheda, district Dholpur.

Distribution : Uttarakhand, Rajasthan.

Family MONONCHULIDAE

Diagnosis : Stoma long and deep with thick walls. Tooth large, denticles present. Tail short, hemispherical with well developed caudal glands and spinneret.

Type genus : *Mononchulus* Cobb, 1918

Other genus : *Oionchus* Cobb, 1913

Genus ***Oionchus*** Cobb, 1913

Diagnosis : Buccal cavity long, cylindrical, thick-walled with a large mural tooth arising from the junction of anterior and posterior parts of buccal cavity. Amphids stirrup-shaped. Oesophago-intestinal junction with three glands, each consisting of four cells. Reproductive system mono-prodelphic. Tails hemispheroid, caudal glands and terminal opening present. Males not known.

Type species : *Oionchus obtusus* Cobb, 1913.

169. ***Oionchus obtusus*** Cobb, 1913
(Plate No. 28, Fig. 169)

Measurements : Females : L=0.67-1.2 mm; a=19-33; b=3.0-3.9; c=41-55; V=58-66.

Description : Female : Body almost straight upon fixation. Lip region 12-14 μ m wide, 4-6 μ m high. Anterior wider part of buccal cavity 11-13 μ m long, 6-8 μ m wide. Mural tooth large, sub ventral walls bearing two transverse rows of denticles. Reproductive system mono-prodelphic, post-uterine sac 6-8 μ m. Tail hemispherical, 18-22 μ m or less than one anal body-width long. Spinneret subterminal dorsally.

Male : Not found

Habitat and locality : Soil-inhabiting. Keladevi road, district Karauli.

Distribution : Punjab, Uttarakhand, Uttar Pradesh, Rajasthan, Gujarat.

CHAPTER-6

Order ISOLAIMIDA Timm, 1969

Family ISOLAIMIDAE Timm, 1969

Genus *Isolaimium* Cobb, 1920*Isolaimium rajasthanicus* Bohra & Sultana, 2008170. *Isolaimium rajasthanicus* Bohra & Sultana, 2008

(Plate No. 28, Fig. 170 & 39, A-I)

Measurements : Male : L = 3.8 mm; a = 60; b = 15.5; c = 65.5; c' = 1.0; Stoma = 90 μ m; Pharynx = 245 μ m; nerve ring = 157 μ m; spicules = 52 μ m; gubernaculum = 12 μ m; anal body width = 54 μ m; tail = 58 μ m.

(Juvenile) Females : L = 2.4-3.5 mm; a = 43-61; b = 8.9-14.5; c = 75.7-76.9; nerve ring = 132-189 μ m; rectum = 26-33 μ m; anal body width = 33-39 μ m; tail = 33-46 μ m.

Male : Body slender, 63 μ m wide at midbody, open c-shaped, ventrally curved upon fixation. Cuticle 3 μ m thick at midbody, 6 μ m thick at tail region, marked by about 65 fine longitudinal lines. Transverse lines indistinct. Body uniformly tapering towards anterior end. Lateral chords prominent, 6 μ m wide. Lip region continuous with body contour. Lips closely amalgamated. Six prominent cuticularised tubes surround stomal aperture. Amphids funnel-shaped, aperture distinct. Stoma tubular with sclerotized walls more near anterior end, 6 μ m wide, 36.7% of total pharynx length, 2.3% of entire body length. Posterior 7 μ m parts of stoma surrounded by pharyngeal tissue. Body at pharyngeal base 3.3 times as wide as lip region diameter. Expanded part of pharynx occupies 63.2 % of total pharyngeal length. Cardia 10 μ m long. Intestine vacuolated with narrow lumen. Spicules cephalated, robust, ventrally arcuate, internally divided and 0.9 value smaller than anal body-width. Gubernaculum parallel to spicules, with posterior apophysis. Posterior end of body provided with seventeen midventral supplements with distinct innervations and irregularly spaced. Tail one anal body-width. long, with 2 pairs precloacal papillae and three pairs postcloacal papillae.

Type habitat and locality : Collected from soil around roots of mausami (*Citrus* sp.) at Chikani, district Alwar, Rajasthan, India; collected by the first author during September, 2005.

Remarks : *Isolaimium* Cobb, 1920 is a rare genus of rather uncertain taxonomic position. Timm (1969) proposed a separate order, Isolaimiida, of it, which occupies a position between the orders Dorylaimida and Trichosyringida. Andrassy (1976) regarded it to belong to the order Dorylaimida, suborder Mermithina and superfamily Isolaimoidea. Swart and Heyns (1991) retained Isolaimiida as a separate order, probably most closely related to Dorylaimida. The family Isolaimidae Timm, 1969 contains the only genus *Isolaimium*.

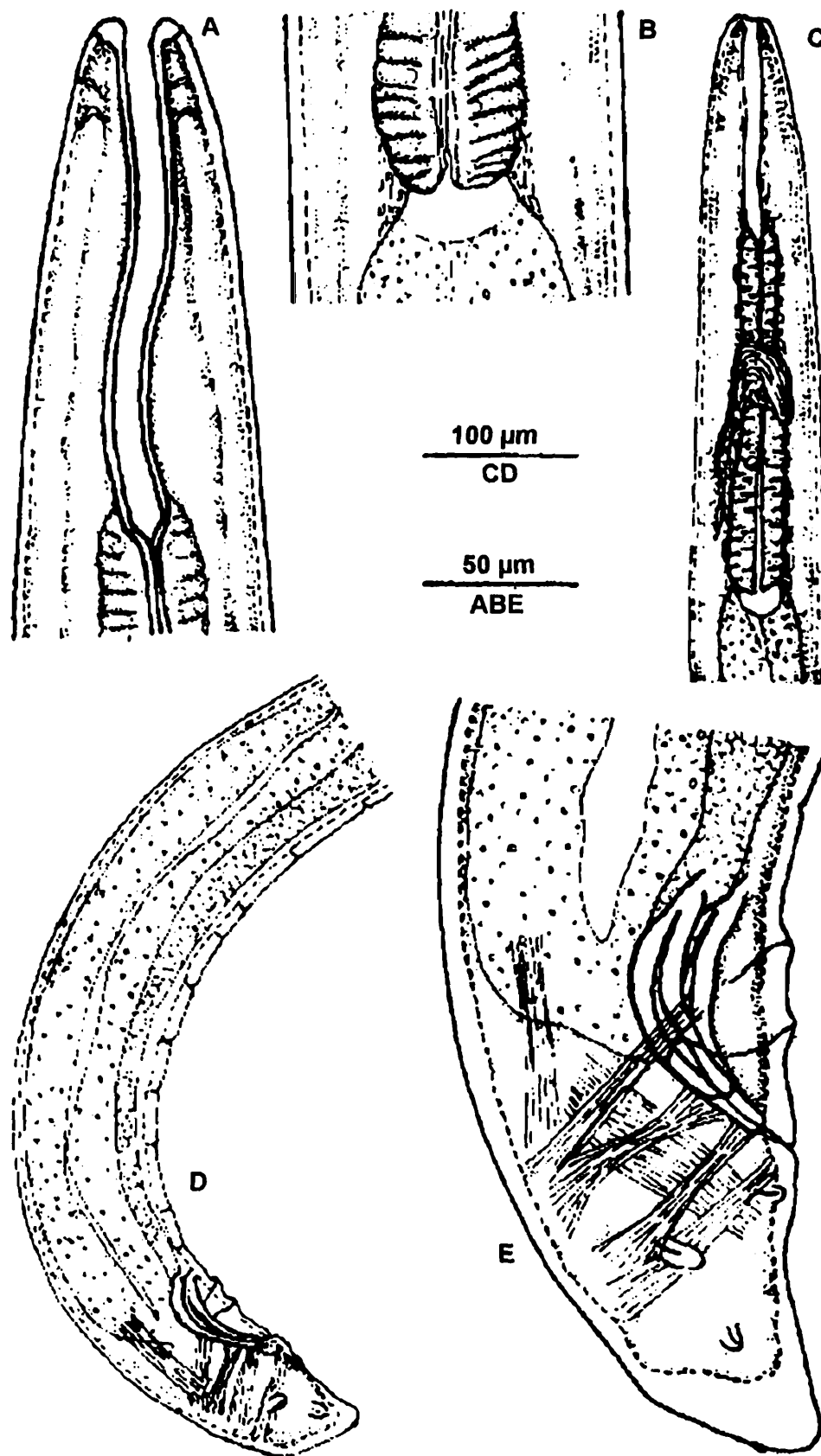


Fig. 39. *Isolaimium rajasthanensis* Bohra & Sultana, 2008. A-Entire end; B-Cardiac region; C-Pharynx, D-E: Posterior end.

CHAPTER-7

Order CHROMADORIDA Chitwood, 1933

Suborder CYATHOLAIMINA De Coninck, 1965

Superfamily CYATHOLAIMOIDEA Filipjev, 1918

Family CYATHOLAIMIDAE Filipjev, 1918

Subfamily CYATHOLAIMINAE Filipjev, 1918

Order CHROMADORIDA Chitwood, 1933

Diagnosis : Cephalic setae 4, 4+6 or more. Cuticle with fine punctuation or ornamentation. Amphids mostly spirally coiled, rounded, rarely slit like. Stoma funnel-shaped always possessing denticles: one dorsal tooth and two subventral teeth. Pharynx muscular, cylindrical or with prominent posterior swelling. Female reproductive system didelphic, ovaries reflexed. Pre anal copulatory organs, whenever present, small, cuticularized, knob-like. Caudal glands and spinneret present.

Type suborder : CHROMADORINA Chitwood and Chitwood, 1937

Key to suborders of Chromadorida Chitwood, 1933

1. Amphids slit-like, often indistinct; pharyngeal bulb robust..... **Chromadorina**
- Amphids spiral, prominent; pharyngeal bulb absent 2
2. Cuticle with ornamentation. Amphids mostly spiral with narrow coils **Cyatholamina**
- Cuticle without ornamentation. Amphids spiral widely coiled **Desmodorina**

Suborder CYATHOLAIMINA De Coninck, 1965

Diagnosis : Cuticle annulated only rarely smooth, mostly with transverse rows of punctuation. Lips provided with 4, 4+6 or more sensilla. Amphids mostly spiral, well conspicuous. Stoma with three teeth. Pharynx with or without bulb.

Only superfamily : CYATHOLAIMOIDEA Filipjev, 1918

Superfamily CYATHOLAIMOIDEA Filipjev, 1918

Diagnosis : Cuticle transversely striated, mostly punctated. Cephalic setae usually longer than labials. Amphids spiral, conspicuous. Stoma with three equal teeth or with one powerful dorsal tooth and two smaller subventral teeth. Pharynx with or without bulb.

Type family : CYATHOLAIMIDAE Filipjev, 1918

Key to families of Cyatholaimoidea Filipjev, 1918

1. Stoma cylindrical, surrounded by separate pharyngeal swelling. Tooth prominently large ETHMOLAIMIDAE
- Stoma funnel-shaped without separate pharyngeal swelling. Dorsal tooth powerful than two subventral teeth CYATHOLAIMIDAE

Family CYATHOLAIMIDAE Filipjev, 1918

Diagnosis : Lips with 4+6 sensilla. Cuticular annules with fine punctations. Amphids spiral-shaped, at middle or base of stoma. Stoma funnel-shaped with one large dorsal tooth and two smaller subventral teeth. Pharynx not noticeably swollen in stomal region, with or without bulb. Female reproductive system didelphic, amphidelphic ovaries reflexed. Spicules relatively shorter. Pre-anal supplements when present, small, cuticularized. Tail with long spinneret.

Type subfamily : CYATHOLAIMINAE Filipjev, 1918

Key to subfamilies of Cyatholaimidae Filipjev, 1918

1. Pharyngeal bulb present. Males with insignificant pre anal organ CYATHOLAIMINAE
- Pharyngeal bulb absent, Female with bristle like pre anal organ PARACANTHOCHINAE

Subfamily CYATHOLAIMINAE Filipjev, 1918

171. *Achromadora ruricola* Khera, 1975 (Plate No. 29, Fig. 171)

Measurements : Females : L = 0.4-0.5 mm; a = 22-25; b = 5.4-5.8; c = 5.6-6.0; V = 46-50.

Description : Female : Body small-sized, open C-shape upon fixation. Somatic setae a few in number. Stoma narrow, funnel-shape, with a large dorsal tooth and two smaller ventral teeth. Amphids 5-6 μ m from anterior end. Pharynx a muscular tube, with a basal bulb. Cardia small. Intestine with wide lumen. Female reproductive system amphidelphic. Ovaries reflexed. Pre-rectum absent. Rectum about one anal body diameter long. Tail with three caudal glands and terminal mucro.

Male : Not found.

Habitat and locality : Around roots of unidentified grasses of village Manaklaw, Jodhpur.

Distribution : Rajasthan, UP.

CHAPTER-8

Order ARAEOLAIMIDA De Coninck and Schuurmans Stekhoven, 1933

Suborder ARAEOLAIMINA De Coninck and Schuurmans Stekhoven, 1933

Superfamily LEPTOLAIMOIDEA Örley, 1880

Family LEPTOLAIMIDAE Örley, 1880

Subfamily LEPTOLAIMINAE Örley, 1880

Chronogaster daoi Loof, 1964

Chronogaster typica (De Man, 1921) De Coninck, 1935

Superfamily HALIPLECTOIDEA Chitwood, 1951

Family RHABDOLAIMIDAE Chitwood, 1951

Subfamily RHABDOLAIMINAE Chitwood, 1951

Order ARAEOLAIMIDA De Coninck and Schuurmans Stekhoven, 1933

Diagnosis : Cuticle annulated without punctations. Cephalic setae 4. Amphids simple circular or open spiral i.e., hook-like. Somatic setae sparse, fine thin. Stoma narrow, anteriorly widened, rarely with denticles. Pharynx bearing terminal bulb or bulb-like swelling. Cardia muscular. Female reproductive system mostly paired. Male papillae tubular, cuticularized, only rarely papillae form.

Type and only suborder : Araeolaimina De Coninck and Schuurmans Stekhoven, 1933.

**Key to suborders of Araeolaimida De Coninck and
Schuurmans Stekhoven, 1933**

1. Stoma narrow, tubular, simple; pharynx swollen proximally; head with 4 setae or setae absent **Araeolaimina**

Suborder ARAEOLAIMINA De Coninck and Schuurmans Stekhoven, 1933

Diagnosis : Cephalic papillae minute, setae 4 or absent. Stoma narrow, tubular. Pharynx with proximal swelling. Annules broken through by ring-like pores.

Type superfamily : ARAEOLAIMOIDEA De Coninck and Schuurmans Stekhoven, 1933

**Key to superfamilies of Araeolaimina De Coninck and
Schuurmans Stekhoven, 1933**

1. Pharyngeal bulb provided with well-developed valve plates PLECTOIDEA
- Pharyngeal bulb absent or without valve plates 2
2. Pre anal supplements of males cuticularized, tubular or cup-shaped, often reaching up to pharynx LEPTOLAIMOIDEA

- Pre anal supplements of males, if present not cuticularized, papilliform.. 3
- 3. Stoma with three teeth. Terminal pharyngeal bulb muscular HALIPLECTOIDEA
- Stoma without teeth. Terminal pharyngeal bulb less muscular
..... ARAEOLAIMOIDEA

Superfamily LEPTOLAIMOIDEA Örley, 1880

Diagnosis : Amphids spiral, mostly big. Female reproductive system amphidelphic. Pre anal organ tubular.

Type family : Leptolaimidae Örley, 1880

Key to families of Leptolaimoidea Örley, 1880

- 1. Stoma long, tubular. Pharynx with basal bulb, with muscular cardia
..... LEPTOLAIMIDAE
- Stoma small, prismatic. Pharynx without basal bulb and muscular cardia
..... HALAPHANOLAIMIDAE

Family LEPTOLAIMIDAE Örley, 1880

Diagnosis : Cuticle finely striated. Cephalic setae 4. Amphids spiral, small. Stoma tubular, cuticularised. Pharynx with swollen basal bulb and large muscular cardia. Female reproductive system amphidelphic or monoprodelphic.

Type and only subfamily : LEPTOLAIMINAE Örley, 1880

Subfamily LEPTOLAIMINAE Örley, 1880

172. *Chronogaster daoï* Loof, 1964 (Plate No. 29, Fig. 172)

Measurements : Females : L = 0.7-0.8 mm; a=46-51; b=4.1-4.8; c=6.8-7.8; V=49-52

Description : Female : Body medium-sized, tapering towards both extremities, open C-shape after fixation. Cuticle annulated, annuli 1.5 µm wide. Lip region continuous with body contour. Lips amalgamated, with setose papillae. Cephalic setae 4-5 µm or about one labial width long. Anterior part of stoma cylindrical, 5 µm long, posterior part 15-16 µm long. Amphid at middle of anterior stoma. Pharynx cylindrical, with 13-16 µm long basal bulb. Cardia large. Female reproductive system monoprodelphic. Ovary reflexed. Tail 10-11 times of anal body diameter long, ventrally curved with a small mucro.

Male : Not found.

Habitat : Around roots of various plants.

Distribution : Rajasthan, Uttar Pradesh.

173. *Chronogaster typica* (De Man, 1921) De Coninck, 1935
(Plate No. 29, Fig. 173)

Measurements : Females : L = 1.0-1.3 mm; a=45-62; b=4.5-5.2; c=6.1-8.4; V=45-51.

Description : Female : Body medium-sized, tapering towards both extremities. Cuticle 1 µm thick, annulated, annuli 1 µm wide. Lip region anteriorly rounded, continuous with body contour. Cephalic setae 7-9 µm long, 1.0-1.2 times of labial diameter. Lateral field 1/4th-1/5th of corresponding body diameter. Anterior part of stoma, 7 µm long. Pharynx cylindrical, with 20-25 µm long basal bulb. Cardia large, 20-25 µm long. Female reproductive system monoprodelphic, with 6-7 µm long post-uterine sac. Tail uniformly tapering, 8-11 times of anal body diameter, with small dorsal mucro.

Male : Not found.

Habitat : Around roots of various plants.

Distribution : Rajasthan, Uttar Pradesh.

Superfamily HALIPLECTOIDEA Chitwood, 1951

Diagnosis : Cephalic setae present or absent. Stoma very narrow with fine tooth/teeth. Pharyngeal bulb present. Female gonad usually didelphic-amphidelphic, rarely monodelphic. Males usually with small, papilliform pre cloacal supplements. Tail with terminal spinneret.

Type subfamily : Rhabdolaimidae Chitwood, 1951

Key to superfamily of Haliplectoidea Chitwood, 1951

1. Amphids conspicuous, circular, tooth absent in stoma HALIPLECTIDAE
- Amphids inconspicuous, oval, 3 small teeth present in stoma .. RHABDOLAIMIDAE

Family RHABDOLAIMIDAE Chitwood, 1951

Diagnosis : Cephalic setae present or absent. Amphids small, rounded. Stoma long and narrow with three small anteriorly-located teeth. Female reproductive system mostly paired with ovary/ies outstretched or reflexed. Males without pre cloacal supplements. Tail with terminal spinneret.

Type subfamily : RHABDOLAIMINAE Chitwood, 1951

Key to subfamilies of Rhabdolaimidae Chitwood, 1951

1. Cheilostom with twelve longitudinal rugae, stoma with three denticles, arranged in two separate groups; female reproductive system mono-prodelphic
..... MONOCHROMADORINAE

2. Stoma with three denticles arranged in one group, female reproductive system didelphic
 RHABDOLAIMINAE

Subfamily RHABDOLAIMINAE Chitwood, 1951

174. *Rhabdolaimus aquaticus* de Man, 1880
 (Plate No. 29, Fig. 174)

Measurements : Females : L = 0.6mm; a = 30-35; b = 4.0-5.1; c = 3.2-4.1; V = 44-46

Description : Female : Large-sized species. Body slightly ventrally curved, tapering at both extremities, but more towards posterior. Cuticle thin, annulated, annuli less than 1 μ m wide. Lip region continuous with body contour. Stoma 21-27 μ m long, with a dorsal tooth at anterior end. Pharynx cylindrical, with pear-shape basal bulb. Cardia small. Intestine with thin wall and wide lumen. Female reproductive system amphidelphic. Ovaries reflexed. Vagina 3-4 μ m long. Vulva sunken. Rectum 7-9 μ m long. Tail 10-12 anal body diameter long, with cylindroid spinneret.

Male : Not found.

Habitat : Soil inhabiting.

Distribution : Rajasthan, UP.

175. *Rhabdolaimus terrestris* De Man, 1880
 (Plate No. 29, Fig. 175)

Measurements : Females : L=0.4-0.5 mm; a = 27-30; b = 4.2-5.3; c = 3.1-4.7; V=41-46

Description : Female : Medium-sized species. Body straight to slightly curved ventrally upon fixation. Cuticle thin, finely striated. Lip region continuous with body contour. Anterior stoma with a small dorsal tooth. Stoma 25-28 μ m long. Pharynx a muscular tube, with rounded basal bulb. Cardia small. Intestine with wide lumen. Female reproductive system amphidelphic. Ovaries reflexed. Tail gradually narrowing, 8.0-10 anal body diameter long, with spinneret.

Male : Not found.

Habitat : Soil inhabiting.

Distribution : Rajasthan, UP.

CHAPTER-9

Order RHABDITIDA Chitwood, 1933

Suborder RHABDITINA Chitwood, 1933

Superfamily RHABDITOIDEA Örley, 1880

Family RHABDITIDAE Örley, 1880

Subfamily MESORHABDITINAE Andrassy, 1976

Mesorhabditis anisomorpha (Sudhaus, 1978) Andrassy, 1983

Cuticularia oxycerca (De Man, 1895) Andrassy, 1983

Distolabrellus veechi Anderson, 1983

Suborder DIPLOGASTRINA Micoletzky, 1922

Superfamily DIPLOGASTROIDEA Micoletzky, 1922

Family DIPLOGASTRIDAE Micoletzky, 1922

Subfamily DIPLOGASTRINAE Micoletzky, 1922

Mononchoides longicaudatus (Khera, 1965) Andrassy, 1984

Butlerius okai Rahm, 1938

Suborder CEPHALOBINA Andrassy, 1974

Superfamily CEPHALOBOIDEA Filipjev, 1934

Family CEPHALOBIDAE Filipjev, 1934

Subfamily ACROBELINAE Thorne, 1937

Chiloplacus sclerovaginitatus Sumenkova & Razzhivlm, 1968

Zeldia minor Allen & Noffsinger, 1972

Acrobeles complexus Thorne, 1925

Subfamily CEPHALOBINAE Filipjev, 1934

Eucephalobus hooperi Marinari-Palmisano,

Eucephalobus arcticus Loof, 1971

Order RHABDITIDA Chitwood, 1933

Diagnosis : Cuticle smooth or annulated. Lips mostly three or six, rarely four. Stoma generally prismatic/tubular, longer than wide, fixed, non-protrusible; composed of cheilostom, gymnostom and stegostom. Pharynx composed of corpus, metacarpus, isthmus and basal bulb. Valve plates present in median or terminal bulb. Female reproductive system didelphic, amphidelphic or monodelphic, prodelphic. Vulva median or far posterior near anus. Males with single testis. Bursa present or absent, if present, always bearing paired genital papillae. Spicules free, occasionally fused distally. Gubernaculum simple or provided with sleeves. Phasmids distinct, often tubular.

Type suborder : RHABDITINA Chitwood, 1933

Key to suborders of Rhabditida (Örley, 1880) Chitwood, 1933

1. Stoma well developed, either long, tubular or wide, spacious; pharynx usually with a median bulb or swelling, Female gonad generally didelphic, bursa present or secondarily reduced 2
- Stoma small mostly quite narrow, pharynx without a median bulb or swelling, Female gonad generally monodelphic, prodelphic; bursa primarily lacking 3
2. Pharynx usually with a valvate, muscular median bulb and a valveless terminal one; stoma often wide with usually large conspicuous teeth; bursa reduced in most cases **Diplogasterina**
- Pharynx with a valvate terminal bulb; stoma usually tubular with small or minute denticles; bursa well-developed, only occasionally reduced **Rhabditina**
3. Head margins strongly cuticularized and notched; amphids post-labial, mostly well discernible; Female gonad amphidelphic or monodelphic **Teratocephalina**
- Head margins not cuticularized, rarely notched, amphids on lips exceptionally post-labial; Female reproductive system always monodelphic, prodelphic **Cephalobina**

Suborder RHABDITINA Chitwood, 1933

Diagnosis : Cuticle usually striated. Lips three or six, rarely four. Labial sensilla papilliform or setose. Cheilostom generally not cuticularized; gymnostom and stegostom fused to form stomal tube. Stegostom surrounded by a thin pharyngeal collar. Metastegostom usually with three swellings each bearing 1-3 or more small teeth or denticles. Telostegostom short, continuing into pharyngeal lumen. Pharynx with three distinct parts: corpus, isthmus and basal bulb. Female reproductive system mostly didelphic, amphidelphic, rarely monodelphic, prodelphic. Vulva equatorial or post-equatorial. Ovary / ies reflexed. Spicules separate or fused distally; gubernaculum present. Bursa usually well-developed: peloderan, pseudopeloderan or leptoderan, rarely reduced; with seven to nine pairs of tubular genital papillae. Bursal edges open or closed anteriorly. Tails of both sexes similar or Female tail longer.

Type superfamily : Rhabditoidea Örley, 1880

Key to superfamilies of Rhabditina Chitwood, 1933

1. Stoma *Panagrolaimus*-type i.e. short and wide, weakly cuticularized; bursa absent. ALLOINEMATOIDEA
- Stoma *Rhabditis*-type i.e., narrow and tubular, well cuticularized; bursa present ... 2
2. Body distinctly asymmetrical: left side with longitudinal ridges, right side with various ornamentations (network, tubercles, warts, fins etc.) BUNONEMATOIDEA
- Body symmetrical bilaterally, without such ornamentations RHABDITOIDEA

Superfamily RHABDITOIDEA Örley, 1880

Diagnosis : Lips usually six. Stoma tubular or prismatic, longer than wide. Metastegostom with three swellings with each bearing small warts or denticles; telostegostom short. Pharyngeal corpus often swollen proximally. Female reproductive system didelphic, amphidelphic or monodelphic, prodelphic. Spicules separate or fused distally. Bursa present, generally well-developed, rarely reduced.

Type family : RHABDITIDAE Örley, 1880

Key to families of RHABDITOIDEA Örley, 1880

1. Dorsal and ventral lips transformed into hook-like structures DIPLOSCAPTERIDAE
- Lips normal, not hook-like 2
2. Anterior part of stegostom with a large, transverse dorsal tooth ODONTORHABDITIDAE
- Stoma without tooth, its walls parallel 3
3. Stoma short, about twice as long as wide; pharyngeal corpus cylindrical; bursa absent RHABDITONEMATIDAE
- Stoma usually more than three times longer than wide; pharyngeal corpus mostly swollen; bursa well-developed, rarely rudimentary RHABDITIDAE

Family RHABDITIDAE Örley, 1880

Diagnosis : Lip region generally with six distinct lips, rarely three lips in doublets. Stoma tubular or prismatic, usually three times longer than wide. Metastegostom with three swellings bearing warts or denticles. Female reproductive system didelphic, amphidelphic or monodelphic, prodelphic. Spicules separate or fused distally. Bursa mostly well-developed, peloderan or leptoderan, rarely rudimentary. Genital papillae generally seven to nine pairs. Tails of both sexes similar or male tail shorter.

Type subfamily : RHABDITINAE Örley, 1880

Key to subfamilies of Rhabditidae Örley, 1880

1. Anterior intestinal region with stomach-like folds; bursa absent STOMACHORHABDITINAE
- Anterior intestinal region without folds; bursa present 2
2. Amphids large, conspicuous, at anterior level of stoma AMPHIDIRABDITINAE
- Amphids mostly very small, inconspicuous, on lateral lips 3

3. Stoma having distinct metastegostomal swellings with denticles 4
 - Stoma lack distinct metastegostomal swellings with denticles PROTORHABDITINAE
4. Female reproductive system prodelphic; vulva far posterior; lips prominent, separate, mostly with setose papillae MESORHABDITINAE
 - Female reproductive system didelphic; lips rarely separate, without setose papillae 5
5. Bursa peloderan, encircling tail tip PELODERINAE
 - Bursa leptoderan, leaving tail tip free 6
6. Lips with fine ciliae or setose projections; pharyngeal collar longer than half stomal length ABLECHROIULINAE
 - Lips without ciliae; pharyngeal collar usually shorter than half stomal length RHABDITINAE

Subfamily MESORHABDITINAE Andr ssy, 1976

176. ***Mesorhabditis anisomorpha*** (Sudhaus, 1978) Andr ssy, 1983
(Plate No. 29, Fig. 176)

Measurements : Females : L=0.6-0.7 mm; a=14-20; b=4.1-4.4; c=8.2-9.8; V=76-80.

Description : Female : Body medium-sized, almost straight to very slightly curved ventrally upon fixation. Cuticle 1 μ m thick, finely annulated. Lip region offset from adjoining body. Lip six, rounded, separate, each with setose papilla. Cheilostom rounded. Stoma tubular, cuticularised, 18-21 μ m long. Metastegostomal swelling asymmetrical. Pharynx with narrow isthmus and pear-shape basal bulb. Cardia small, conoid. Excretory pore in isthmus region. Female reproductive system monoprodelphic, with small post uterine sac. Ovary reflexed. Vulva-anus distance smaller than tail. Tail 4.0-4.5 anal body diameter long.

Male : Not found.

Habitat : Sewage drain of district Jodhpur.

Distribution : Rajasthan, UP.

177. ***Cuticularia oxycerca*** (De Man, 1895) Andr ssy, 1983
(Plate No. 30, Fig. 177)

Measurements : Females : L=0.5-0.8 mm; a=16-22; b=4.1-5.0; c=28-59; V = 54-58

Males : L = 0.6-0.8 mm; a = 13-17; b = 4.0-5.0; c = 18-28

Description : Female : Body medium-sized, plum, slightly ventrally curved upon fixation. Cuticle finely annulated, annuli 1 μ m wide. Stoma tubular, 22-24 μ m long. Metastegostom

with denticles. Pharyngeal corpus with medium swelling, narrow isthmus, pear-shape basal bulb. Cardia small, conoid. Nerve ring encircles mid isthmus. Excretory pore in posterior part of isthmus. Intestine with wide lumen. Rectum about 1.2 anal body diameter long. Female reproductive system amphidelphic. Ovaries reflexed. Vagina transverse. Tail elongate.

Male : Similar to Female in general morphology except reproductive system. Testis single, distal part reflexed ventrally. Spicules 28-40 µm long, ventrally curved. Gubernaculum 14-18 µm long.

Habitat : Sewage drain of district Jodhpur.

Distribution : Rajasthan, UP.

178. ***Distolabrellus veechi*** Anderson, 1983
(Plate No. 30, Fig. 178)

Measurements : Females : L=1.2-1.3 mm; a=14-20; b = 4.9-6.4; c = 10-21; V = 83-87

Males : L = 0.8-1.0 mm; a = 17-19; b = 2.9-4.8; c = 18-20

Description : Female : Body large-sized, tapering towards both extremities, almost straight upon fixation. Cuticle about 1 µm thick, prominently annulated, annuli 1-2 µm wide. Lateral field 4-5 µm wide, comprises of four lateral lines. Lip region slightly offset from adjoining body. Lips six, with six liplets. Lip papillae very small. Stoma 21-25 µm long, tubular. Metastegostom with denticles. Pharynx with swollen corpus, narrow isthmus and pear-shape basal bulb. Excretory pore in isthmus region. Female reproductive system monoprodelphic. Ovary reflexed. Uterus filled with eggs. Vagina anteriorly directed. Vulva-anus distance smaller than tail. Tail elongate, 2.3-4.6 anal body diameter long.

Male : Similar to Female in general morphology. Spicules 60-71 µm long, distally fused. Gubernaculum cuticularised, 34-40 µm long. Genital papillae in 2+1+C+4+2 arrangement.

Habitat : Sewage drain of district Jodhpur.

Distribution : Rajasthan, UP.

Suborder DIPLOGASTRINA Micoletzky, 1922

Diagnosis : Body smooth. Lips six, labial sensilla papilliform; cephalic sensilla usually setose in male. Stoma tubular or wide. Stegostom usually asymmetrical: dorsal metastegostomal plate mostly stronger and differently structured than the subventrals and often with large movable claw-like tooth. Pharynx divisible into anterior muscular procorpus continuing into strongly swollen median bulb with valve plates and posterior part with isthmus and glandular terminal bulb. Female reproductive system mostly didelphic, amphidelphic, rarely monodelphic. Spicules free, rarely fused. Bursa rudimentary or completely absent. Tail in both sexes long, usually filiform.

Type superfamily : DIPLOGASTROIDEA Micoletzky, 1922

Key to the superfamilies of DIPLOGASTRINA Micoletzky, 1922

1. Pharynx with prominent valvated median bulb DIPLOGASTROIDEA
- Pharynx without distinct median bulb 2
2. Stoma extraordinarily long, narrow, thin, about 1/4th of entire pharyngeal length or longer, without distinct tooth CYLINDROCORPOROIDEA
- Stoma small, wide, with distinct tooth ODONTOPHARYNGOIDEA

Superfamily DIPLOGASTROIDEA Micoletzky, 1922

Diagnosis : Lips six. Amphidial opening either small or indistinct on lips or large and post labial. Cheilostomal mostly cuticularised. Metastegostom armed with tooth. Pharynx always with valvate median bulb and a distinguishable terminal bulb. Female reproductive system amphidelphic, rarely monodelphic. Bursa reduced, rudimentary or absent.

Type family : Diplogastridae Micoletzky, 1922

Key to the families of DIPLOGASTROIDEA Micoletzky, 1922

1. Body asymmetrical; left side marked with warts, right side showing longitudinal ridges; medial bulb unusually strong; spicules usually long HETROPLEURONEMATIDAE
- Body symmetrical; median bulb normal; spicules short 2
2. Both anterior and posterior pharyngeal parts well built, terminal bulb with a grinder PSEUDODIPLOGASTROIDIDAE
- Anterior part of pharynx muscular, posterior part with weak terminal bulb without a grinder 3
3. Cheilostom simple, without ribs/rugae Telostegostom unusually long, tubular, with three conical tubercles at base TYLOPHARYNGIDAE
- Cheilostom with ribs/rugae. Telostegostom only rarely long, without conical tubercle 4
4. Stoma distinctly longer than wide; cheilostom weakly or not cuticularised, metastegostom with small tooth; amphids similar in both sexes DIPLOGASTEROIDIDAE
- Stoma usually wide, exceptionally longer; cheilostom cuticularised; metastegostom with strong tooth 5
5. Stoma asymmetrical with right subventral metastegostom having one large claw-like tooth, left side with either smooth or with a denticulate plate; telostegostom tubular NEODIPLOGASTRIDAE

- Dorsal tooth immovable; stoma symmetrical with identical subventral metastegostomal plates; telostegostom insignificant DIPLOGASTRIDAE

Family DIPLOGASTRIDAE Micoletzky, 1922

Diagnosis : Cuticle finely striated, often provided with longitudinal striations. Amphids small, anteriorly located, occasionally wide and posteriorly located. Cheilostom cuticularised often divided into rods. Gymnostom rarely tubular with cuticularised walls. Stegostomal walls with prominent conspicuous teeth. Dorsal tooth immovable, always stronger than subventrals. Pharynx with well developed median and terminal bulb. Female reproductive system amphidelphic. Bursa always rudimentary. Spicules free. Caudal papillae 7-10 pairs.

Type subfamily : Diplogastrinae Micoletzky, 1922

Key to the subfamilies of DIPLOGASTRIDAE Micoletzky, 1922

1. Median bulb long; double so longer than wide; dorsal tooth plate-like, not fixed..... DEMANIELLINAE
- Medium bulb round; dorsal tooth claw-like, movable 2
2. Cheilostom smooth, rarely weakly striated; each subventral metastegostomal swelling with a small comma-like tooth..... DIPLOGASTRINAE
- Cheilostom longitudinally striated; subventral metastegostomal swelling either smooth, unarmed or notched..... PAROIGOLAIMELLINAE

Subfamily DIPLOGASTRINAE Micoletzky, 1922

179. ***Mononchoides longicaudatus*** (Khera, 1965) Andrásy, 1984
(Plate No. 30, Fig. 179)

Measurements : Females : L=1.1-1.3 mm; a=21-26; b=6.0-7.2; c=2.3-2.4; V=35-40.

Description : Female : Body large-sized, tapering at both extremities, but more towards posterior, almost straight upon fixation. Lip region continuous with adjacent body. Metastegostom with claw-like tooth, telostegostom double as long as broad. Pharynx with strong valvated medium bulb, narrow isthmus and weak basal bulb. Intestine with thick wall and wide lumen. Rectum about one anal body diameter long. Female reproductive system amphidelphic. Ovary reflexed. Tail long filiform, about 20 anal body diameter long.

Male : Not found.

Habitat : Sewage drain of district Jodhpur.

Distribution : Rajasthan, UP.

180. ***Butlerius okai*** Rahm, 1938
(Plate No. 30, Fig. 180)

Measurements : Females : L=0.9-1.1 mm; a=28-34; b=4.3-5.1; c = 3.9-4.5; V = 48-49

Description : Female : Body large-sized, almost straight upon fixation. Cuticle thin, finely striated. Lip region continuous with body contour. Labial setae $1/4^{\text{th}}$ - $1/5^{\text{th}}$ of labial diameter. Stoma 10 μm long, 6 μm wide, with strong dorsal tooth. Pharynx with prominent medium bulb, narrow isthmus and basal bulb of 23-25 $\times$ 20-21 dimension. Nerve ring at 75% of pharyngeal length. Cardia small, conoid. Female reproductive system amphidelphic. Ovaries reflexed. Tail long filiform, 255-267 μm long, 3.2-3.8 anal body diameter long.

Male : Not found.

Habitat : Sewage drain of District Jodhpur.

Distribution : Rajasthan, UP.

Suborder CEPHALOBINA Andr ssy, 1974

Diagnosis : Lip margins smooth or notched, with or without complex processes. Stoma narrow, with distinct cheilostom, gymnostom and stegostom. Pharynx tripartite; corpus cylindrical, isthmus thin, basal bulb rounded with distinct valve plate. Female reproductive system monodelphic, prodelphic with offset spermatheca. Ovary reflexed directed posterior with or without double flexure near germinal zone. Males monarchic, without bursa.

Type superfamily : Cephaloboidea Filipjev, 1934

Key to superfamilies of Cephalobina Andr ssy, 1974

1. Pharynx simple, cylindrical, corpus, isthmus and bulb not distinct
..... DRILONEMATOIDEA
- Pharynx tripartite, with distinct corpus, isthmus and basal bulb 2
2. Stoma narrow, ovary reflexed with 1-2 flexure posterior to vulva
..... CEPHALOBOIDEA
- Stoma at least in anterior part spacious, post vulval part of ovary attenuated and double reflexed 3
3. Labial region bordered laterally by membranous fins/flap.. ELAPHONEMATOIDEA
- Body without probolae, fins/flap 4
4. Bursa present, with large bursal papillae, spicules absent..... MYOLAIMOIDEA
- Bursa absent, male with small bursal papillae, spicules always present
..... PANAGROLAIMOIDEA

Superfamily CEPHALOBOIDEA Filipjev, 1934

Diagnosis : Cuticle distinctly annulated. Lip region with complex processes. Stoma narrow, with distinct rhabdions. Pharynx tripartite; corpus cylindrical to fusiform without median bulb, isthmus thin, basal bulb rounded valvate. Female reproductive system monodelphic, prodelphic with offset spermatheca, ovary reflexed directed posteriorly and having double flexure near germinal zone. Males monarchic, without bursa.

Type family : Cephalobidae Filipjev, 1934

Key to families of CEPHALOBOIDEA Filipjev, 1934

1. Vulva posteriorly situated, very close to anal opening, post vulval sac absent METACROBILADAE
- Vulva not closed with anal opening, mostly at two third of body length, post vulval sac absent CEPHALOBIDAE

Family CEPHALOBIDAE Filipjev, 1934

Diagnosis : Cuticle single or double, distinctly annulated. Lips six in duplex or amalgamated, with or without probolae. Stoma with distinct rhabdions. Pharynx cylindrical anteriorly, with valvated terminal bulb. Female reproductive system prodelphic, ovary reflexed, with or without flexure posterior to vulva. Post-vulval uterine sac more or less developed. Males with single testis, separate spicules and small cuticularised gubernaculum. Bursa absent. Genital papillae about eight pairs typically arranged.

Type subfamily : Cephalobinae Filipjev, 1934

Key to subfamilies of Cephalobidae Filipjev, 1934

1. Lip region notched, with labial and cephalic probolae 2
- Lip region smooth, without probolae 3
2. Lip region with large cephalic and insignificant labial probolae KIRJANOVIINAE
- Cephalic probolae small, always shorter than labial probolae ACROBELINAE
3. Cheilostom and promesostom broader than stegostom part of stoma PANAGROCEPHALINAE
- Only cheilostom broader than remaining part of stoma CEPHALOBINAE

Subfamily ACROBELINAE Thorne, 1937

181. ***Chiloplacus sclerovaginitus*** Sumenkova & Razzhivlm, 1968
(Plate No. 30, Fig. 181)

Measurements : Females : L=0.5-0.7 mm; a=16-22; b=3.2-4.5; c=15-20; V=62-66.
Males : L = 0.5-0.7 mm; a = 17-21; b = 3.0-4.5; c = 14-22

Description : Female : Body small-sized, ventrally curved after fixation. Lip region continuous with body contour. Cuticle finely annulated. Labial probolae slightly concave, 3-4 μm long. Stoma cephaloboid, with distinct rhabdions. Pharynx cylindrical, with pear-shape basal bulb. Nerve ring encircles base of corpus. Cardia small, conoid. Intestine wall thick, with distinct lumen. Female reproductive system cephaloboid. Ovary reflexed. Spermatheca distinct. Vagina about half of corresponding body diameter. Tail 1.9-2.3 anal body diameter long, with 12-15 ventral annuli.

Male : Similar to Females in general morphology. Testis single. Spicules cephalated, 32-38 μm long, ventrally curved. Gubernaculum 20-24 μm long.

Habitat and locality : Around roots of various grasses, district Barmer, Jodhpur, Jaisalmer.

Distribution : Rajasthan, UP.

182. *Zeldia minor* Allen & Noffsinger, 1972
(Plate No. 30, Fig. 182)

Measurements : Females : L=0.7-0.8 mm; a=15-23; b=3.1-4.2; c=15-22; V=65-67.

Description : Female : Body medium-sized, tapering towards both extremities, straight upon fixation. Lip region continuous with body contour. Labial probolae rounded. Cephalic probolae flap-like. Cephalic axils narrow, deep with very small dentate point. Cuticle annulated, annuli 1.5-2.0 μm wide. Stoma cephaloboid. Pharynx cylindrical with pear-shape basal bulb. Nerve ring encircles base of corpus. Cardia small, 3 μm long. Intestine with wide lumen. Female reproductive system typical cephaloboid. Tail 1.4-2.3 anal body diameter long. Phasmid in anterior half of tail.

Male : Not found.

Habitat : Soil inhabiting.

Distribution : Rajasthan, UP.

183. *Acrobeles complexus* Thorne, 1925
(Plate No. 31, Fig. 183)

Measurements : Females : L=0.5-0.8 mm; a=11-19; b=3.2-4.4; c=8.0-11; V=56-60.

Males : L = 0.6-0.7 mm; a = 14-24; b = 3.3-4.1; c = 10-14

Description : Female : Body medium-sized, tapering towards both extremities, open c-shape upon fixation. Cuticle double; inner more cuticularised than outer, prominently annulated, annuli 2-3 μm wide. Lip region slightly offset from adjacent body. Labial probolae 5-6 μm long, bifurcated, each with 5-6 tines. Cephalic probolae triangular, with tines. Stoma cephaloboid. Pharynx cylindrical, corpus 3 times of isthmus length. Female reproductive system cephaloboid. Post uterine sac 1.2-2.4 corresponding body diameter long. Tail 2-3 anal body diameter long.

Male : Similar to Female in general morphology. Testis single, distally reflexed. Spicules 35-41 μm long, ventrally curved. Gubernaculum 18-21 μm long, cuticularised. Posterior end with 3 pair precloacal and 5 pairs post cloacal genital papillae. Tail 1.5-2.1 anal body diameter long.

Habitat and locality : Around roots of various grasses, district Barmer.

Distribution : Rajasthan, UP.

Subfamily CEPHALOBINAE Filipjev, 1934

184. *Eucephalobus hooperi* Marinari-Palmisano
(Plate No. 31, Fig. 184)

Measurements : Females : L=0.3-0.5 mm; a=16-28; b=2.6-4.1; c=9.1-10; V=62-64

Description : Female : Body small-sized, tapering towards both extremities, ventrally curved upon fixation. Lip region continuous with body contour. Labial probolae pointed. Cuticle 1 μm thick, annulated, annuli 1.0-1.5 μm wide. Lateral field $1/5^{\text{th}}$ - $1/6^{\text{th}}$ of corresponding body diameter. Stoma 10-14 μm long. Pharynx cylindrical, corpus four times of isthmus length. Cardia 3 μm long, conoid. Nerve ring encircles anterior half of isthmus. Female reproductive system cephaloboid. Ovary reflexed. Post uterine sac smaller than half of vulval body diameter. Rectum 1.3-1.5 times longer than anal body diameter. Tail 4-5 anal body diameter long, with 23-26 ventral annuli. Phasmid at mid of tail.

Male : Not found.

Habitat : Soil inhabiting.

Distribution : Rajasthan, UP.

185. *Eucephalobus arcticus* Loof, 1971
(Plate No. 31, Fig. 185)

Measurements : Females : L=0.6-1.0 mm; a=22-28; b=3.5-4.8; c=12-15; V=60-64.

Males : L = 0.7-0.9mm; a = 24-26; b = 3.6-4.3; c = 16-17

Description : Female : Body large-sized, strongly ventrally curved upon fixation. Cuticle 2-3 μm thick, annulated, annuli 2-3 μm wide. Lateral field comprises of three lateral lines. Labial probolae pointed. Stoma with distinct rhabdions. Pharyngeal corpus 4 times of isthmus length. Excretory pore at 60% of pharyngeal length. Intestine with thick walls and wide lumen. Female reproductive system cephaloboid. Ovary reflexed. Post uterine sac as long as body diameter. Tail 2.5-3.0 times of anal body diameter long, with small mucro.

Male : Similar to Female in general morphology except reproductive system. Spicules 24 μm long, ventrally curved. Gubernaculum 11-13 μm long.

Habitat : Soil inhabiting.

Distribution : Rajasthan, UP.

CHAPTER-10

Order ENOPLIDA Chitwood, 1933

Suborder TRIPYLINA Andr ssy, 1974

Superfamily TRIPYLOIDEA de Man, 1876

Family PRISMATOLAIMIDAE Micoletzky, 1922

Subfamily PRISMATOLAIMINAE Micoletzky, 1922

Prismatolaimus primitivus Loof, 1971

Family TRIPYLIDAE de Man, 1876

Subfamily TOBRILIINAE Andr ssy, 2007

Tobrilus sexsetiferous Khera, 1975

Tobrilus stefanskii Micoletzky, 1922

Order ENOPLIDA Chitwood, 1933

Diagnosis : Cuticle mostly smooth or weakly striated. Lip sensilla representing 6+6+4 setae in two or three circles; the setae can be jointed. Amphidial aperture non-spiral, mostly slit-like with amphidial fovea pocket-like, rarely spiral. Stoma varying in form mostly provided with teeth/denticles. Pharynx cylindrical, often with wider base, rarely with bulb-like swelling. Female reproductive system typically didelphic, amphidelphic rarely monodelphic, prodelphic; ovaries antidromously reflexed. Male reproductive system diorchic with opposed testis, pre cloacal supplements papilloid or cuticularised. Caudal glands and spinneret usually present.

Type suborder : Enoplina Chitwood, 1933

Key to suborders of Enoplida Chitwood, 1933

1. Stoma spacious, with one large dorsal and two or more subventral teeth; pharyngeal tissue surrounds proximal end of stoma **Oncholaimina**
- Stoma narrower, with weakly cuticularised walls, different arrangement of teeth, pharyngeal tissue surrounds distal end of stoma 2
2. Cuticle at lip region double; stoma complicated; pre cloacal supplements cuticularised, tubular **Enoplina**
- Cuticle at lip region single; stoma simple, supplements papilloid or setose **Tripylina**

Suborder **Tripylina** Andr ssy, 1974

Diagnosis : Cuticle smooth rarely annulated, weakly thickened on lip region. Cephalic

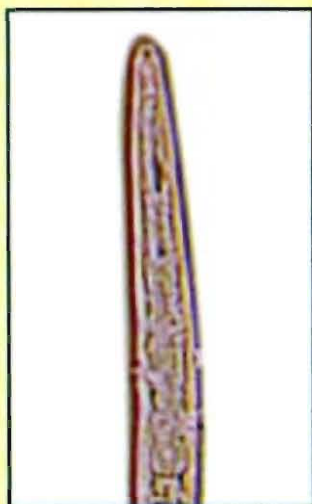
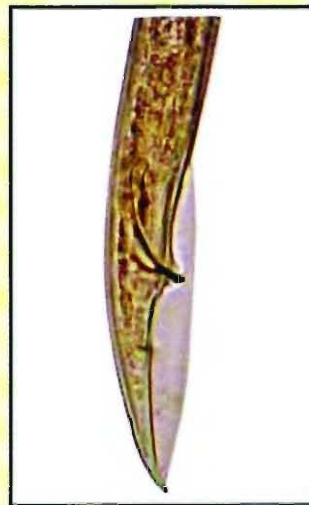
Plate-1



1. *Tylenchus ritai*



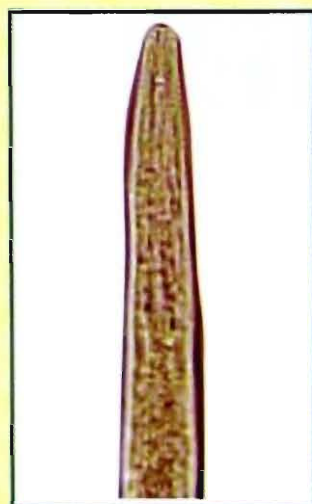
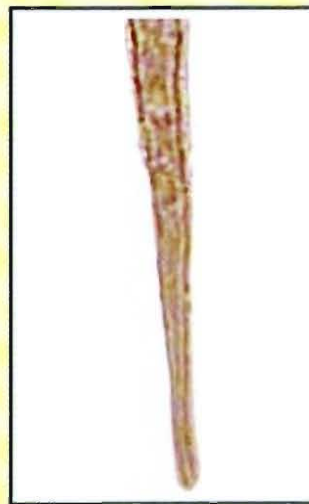
2. *Tylenchus magnus*



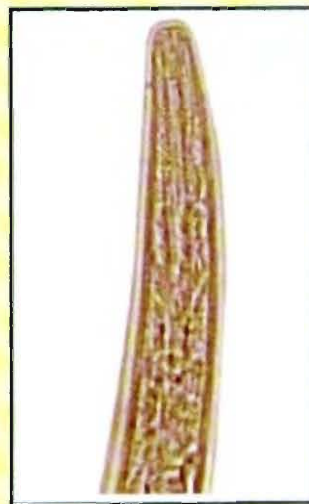
3. *Aglenchus agricola*



4. *Filenchus filiformis*



5. *Sakia alii*



6. *Boleodorus brevistylus*

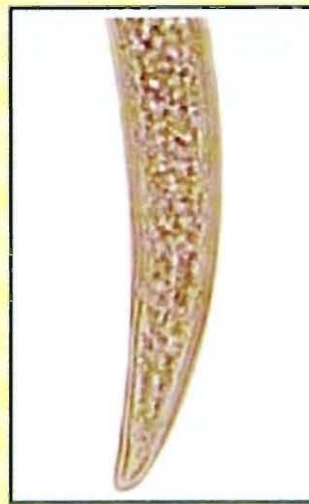
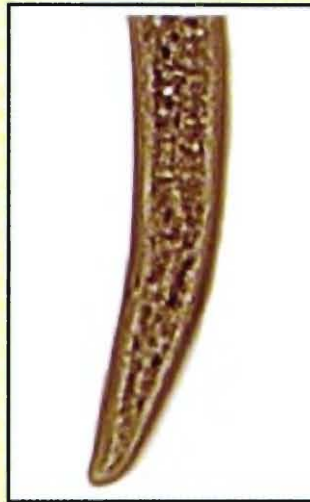


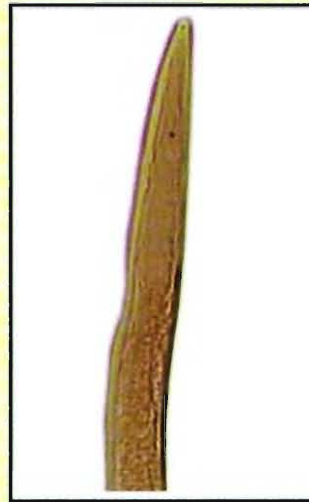
Plate-2



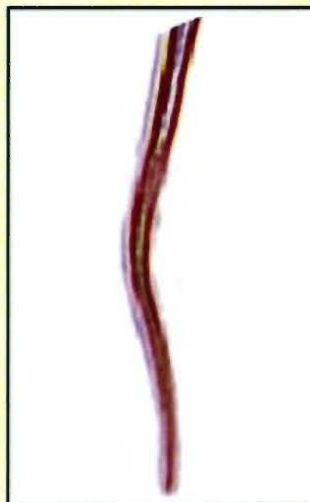
7. *Boleodorus thylactus*



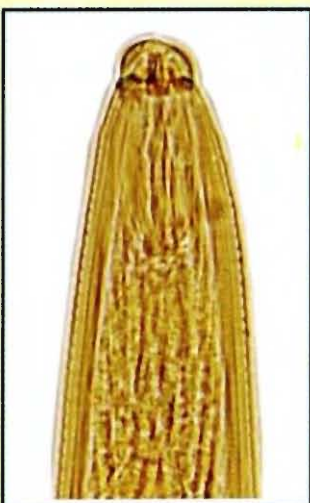
8. *Basiria graminophila*



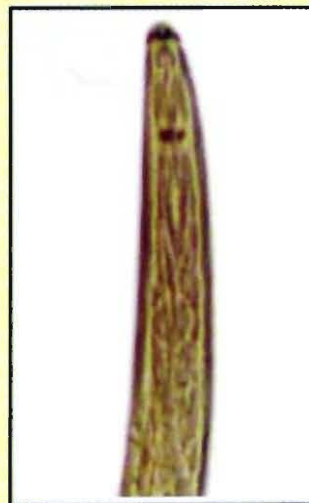
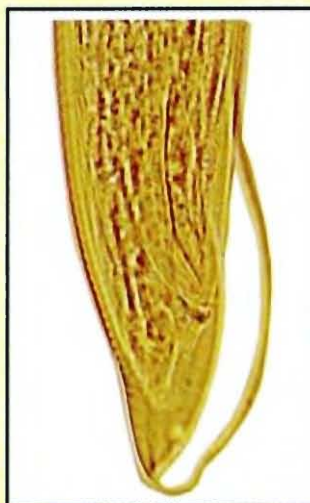
9. *Malenchus (M.) holchomatus*



10. *Ottolenchus equisetus*



12. *Hopolaimus indicus*



13. *Helicotylenchus multicinctus*



Plate-3



14. *H. conicephalus*



15. *H. crenacauda*



16. *H. dihystra*



17. *H. erytherinae*



18. *H. exallus*



19. *H. goodi*



20. *H. labiatus*

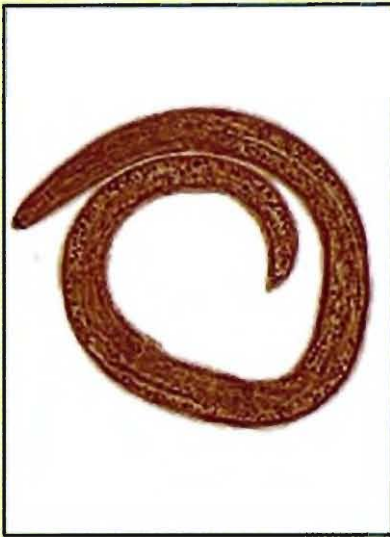


21. *H. labiodiscinus*



22. *H. leiocephalus*

Plate-4



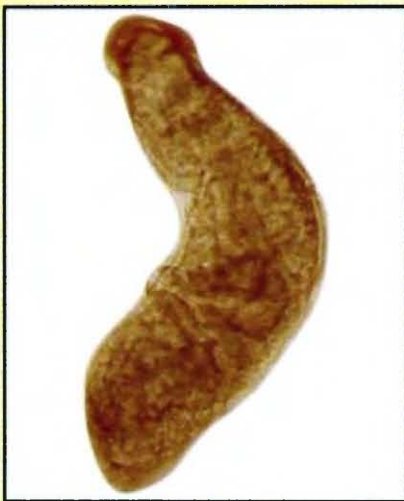
23. *H. tropicus*



24. *H. microdorus*



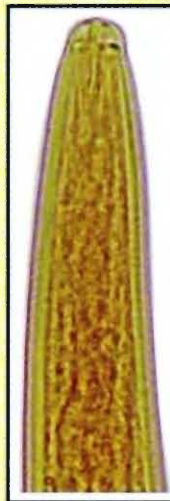
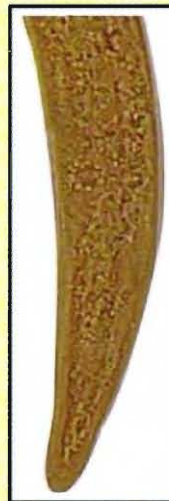
25. *H. glissus*



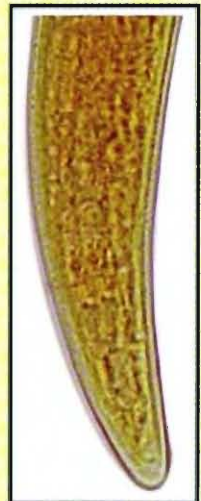
27. *Rotylenchulus reniformis*



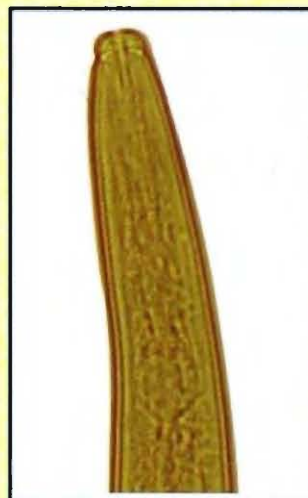
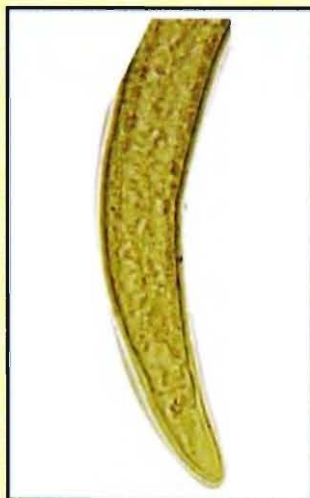
28. *Pratylenchus loosi*



29. *Pratylenchus neglectus*



30. *Pratylenchus uralensis*



31. *Pratylenchus brachyurus*

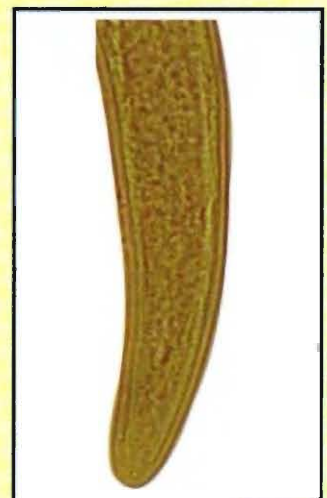
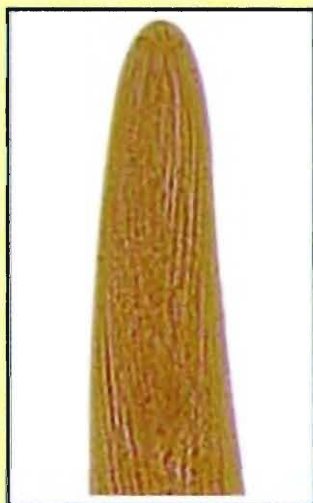
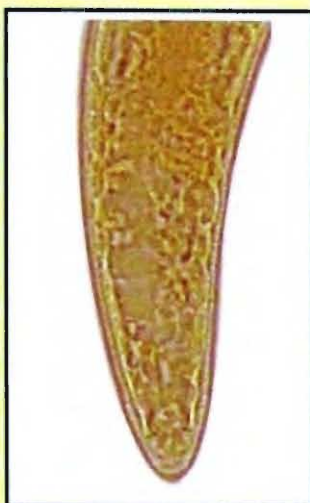


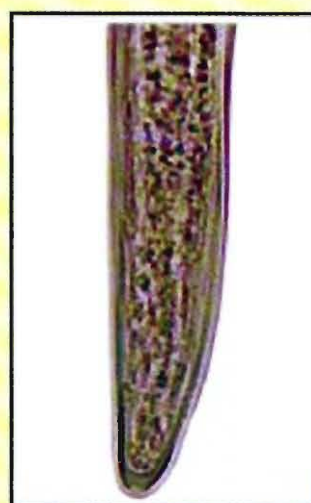
Plate-5



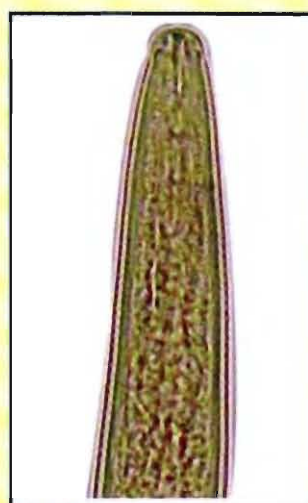
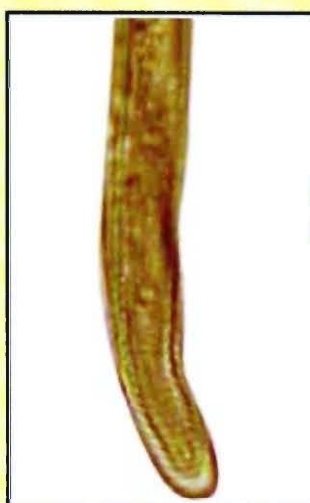
32. *Pratylenchus zeae*



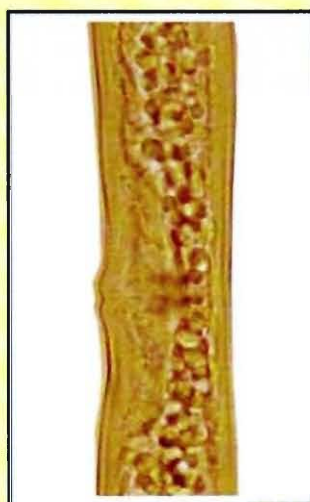
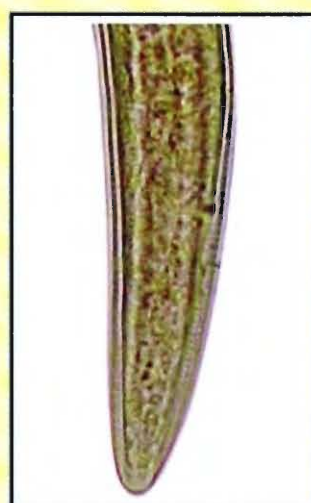
33. *Pratylenchus goodeyi*



34. *Pratylenchus thornei*



35. *Pratylenchus macrostylus*



36. *Hirschmanniella oryzae*

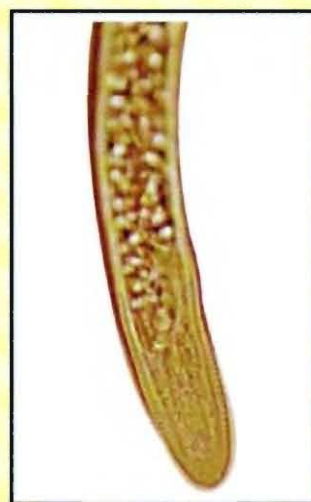
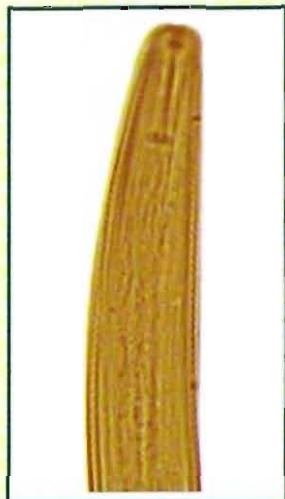


Plate-6



37. *Hirschmanniella caudarcena*



38. *Meloidogyne incognita*



39. *Heterodea avenae*

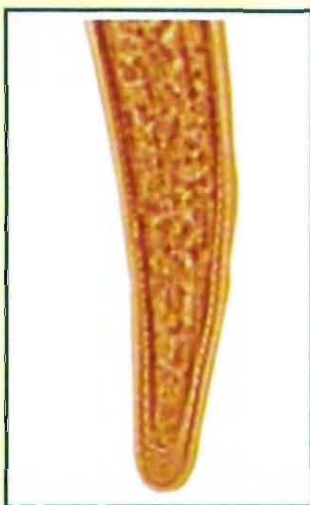


43. *Tylenchorhynchus clarus*

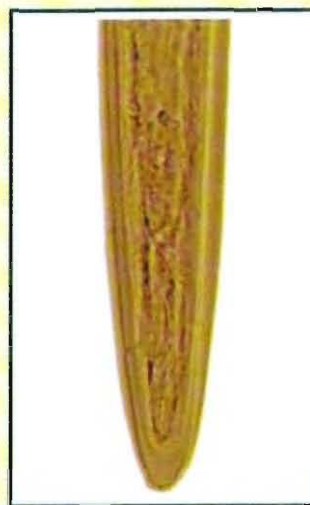
Plate-7



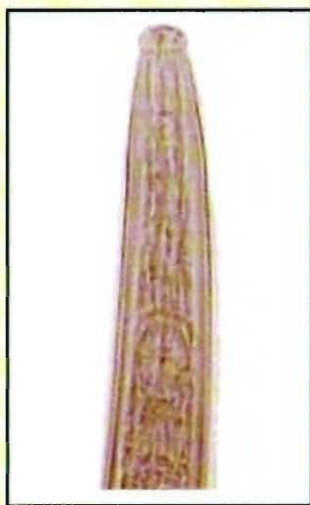
44. *Tylenchorhynchus mashoodi*



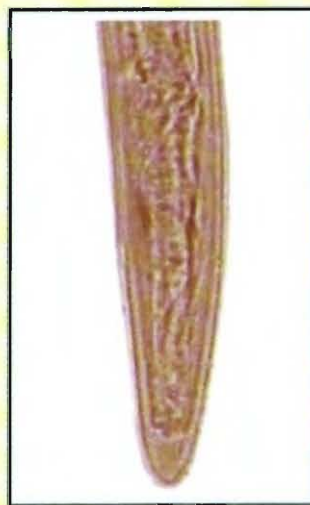
45. *Tylenchorhynchus robustus*



46. *Tylenchorhynchus triglyphus*



47. *Tylenchorhynchus brassicae*



48. *Tylenchorhynchus latus*



49. *Tylenchorhynchus marudhariensis*

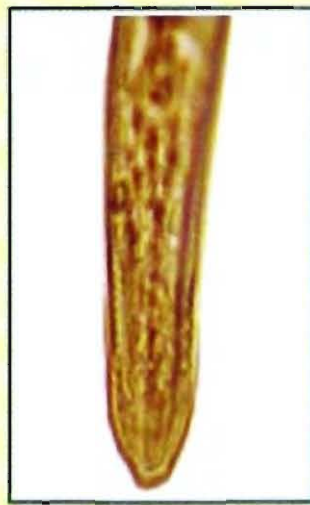
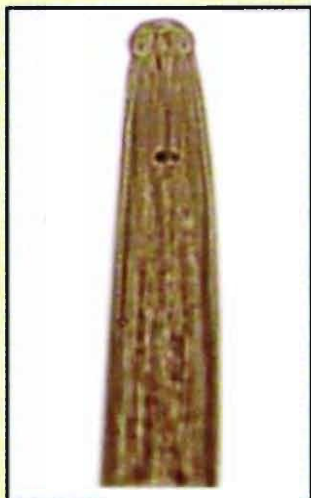


Plate-8



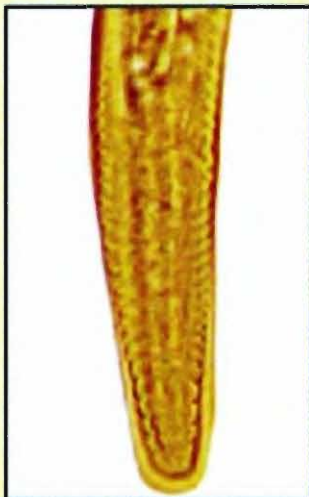
50. *Tylenchorhynchus delhiensis*



51. *Bitylenchus goofarti*



52. *Bitylenchus brevilineatus*



53. *Bitylenchus dubius*



54. *Uliginotylenchus rhopalocerus*



55. *Quinisulcius curvus*

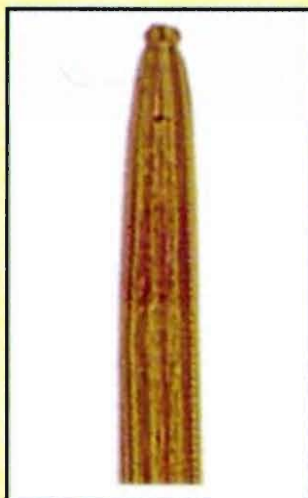
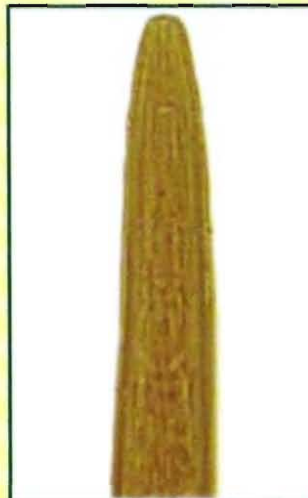
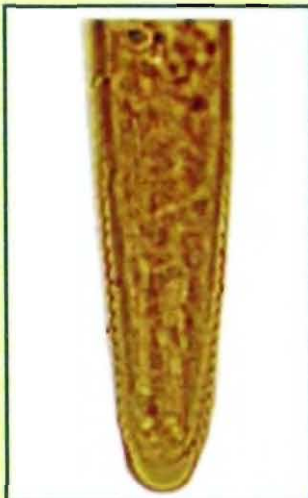


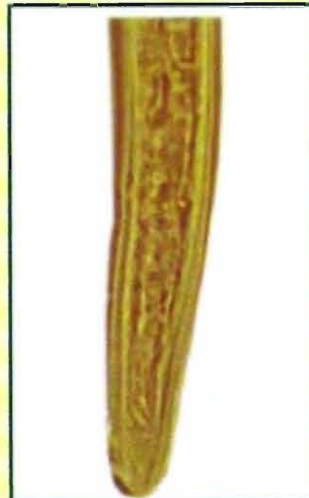
Plate-9



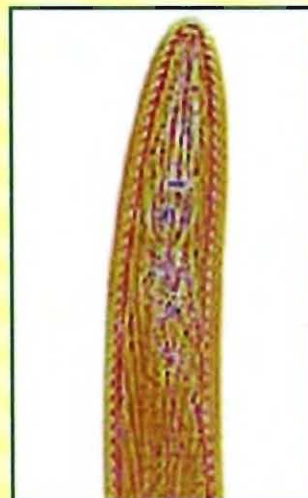
56. *Merlinius brevidense*



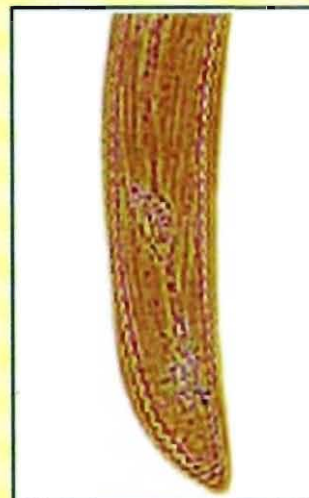
57. *Merlinius nanus*



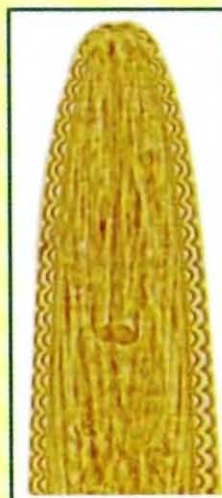
58. *Neodolychorhynchus phaseoli*



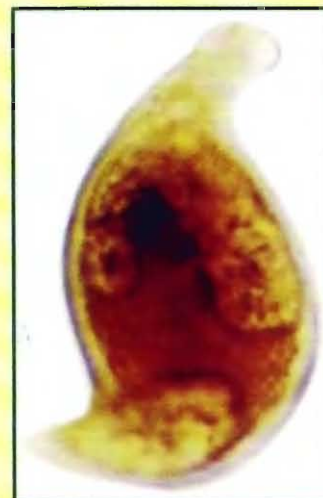
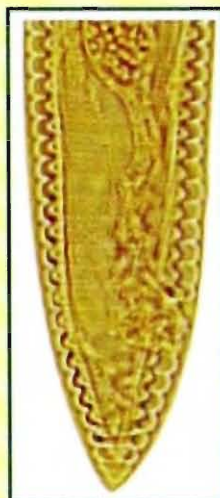
59. *Hemicriconemoides cocophilus*



60. *Hemicriconemoides mangiferae*

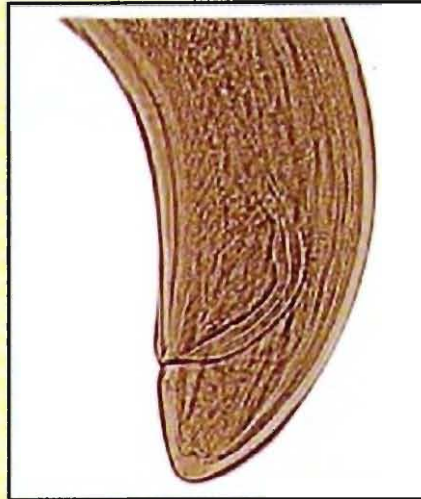


61. *Hemicriconemoides brachyurus*

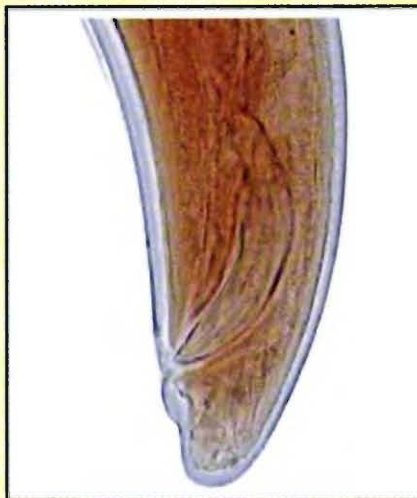
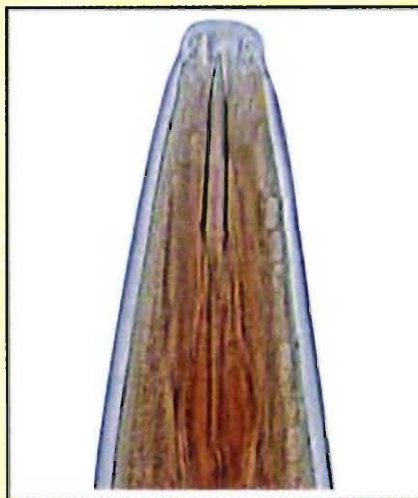


62. *Tylenchulus semipenetrans*

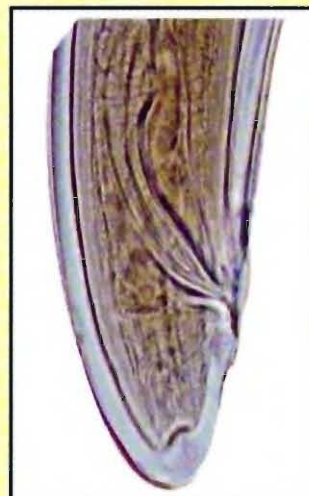
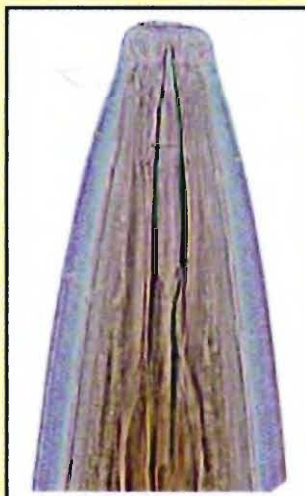
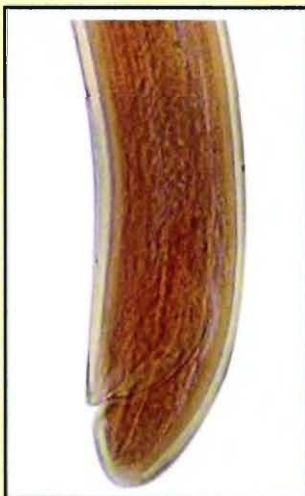
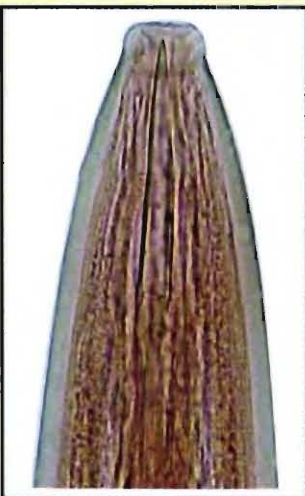
Plate-10



64. *Dorylaimus stagnalis*



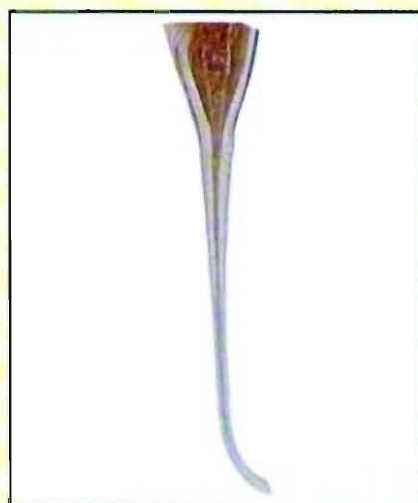
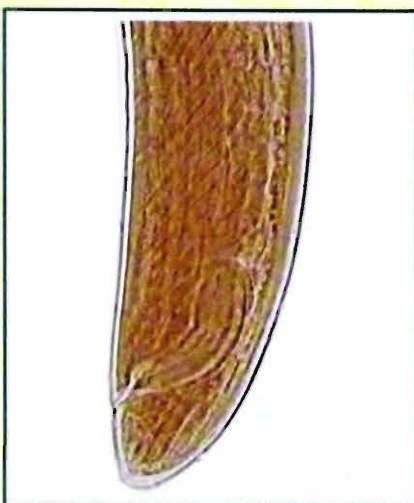
65. *Dorylaimus murlii*



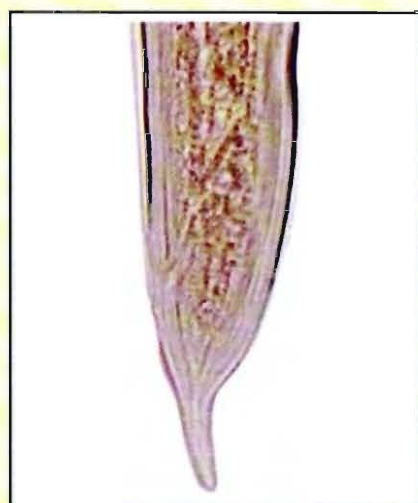
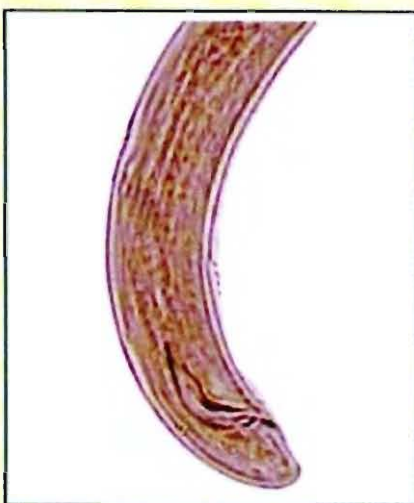
66. *Ischiodorylaimus baqrii*

67. *Ischiodorylaimus rathori*

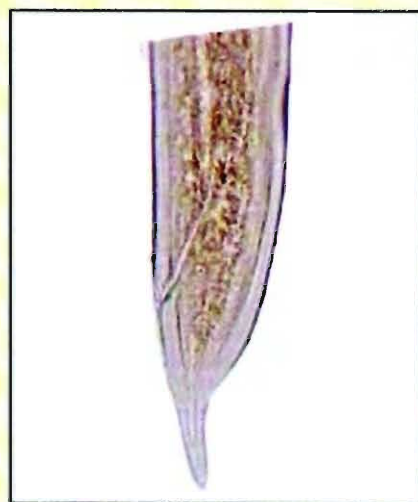
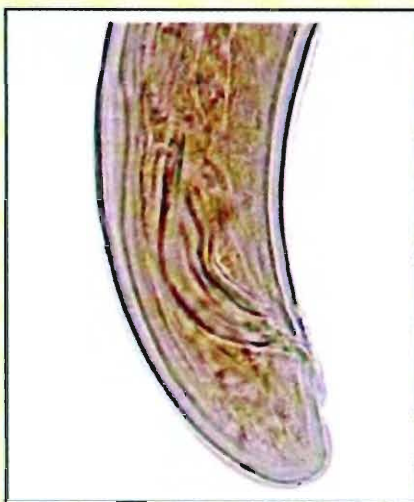
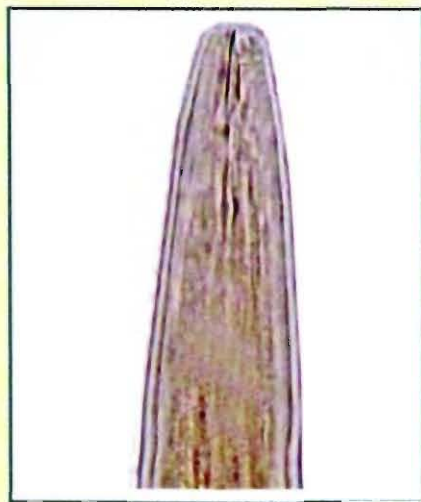
Plate-11



68. *Mesodorylaimus bhansalii*



69. *Mesodorylaimus kauli*

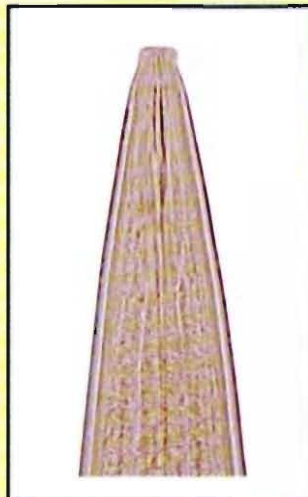


70. *Mesodorylaimus mesonyctius*

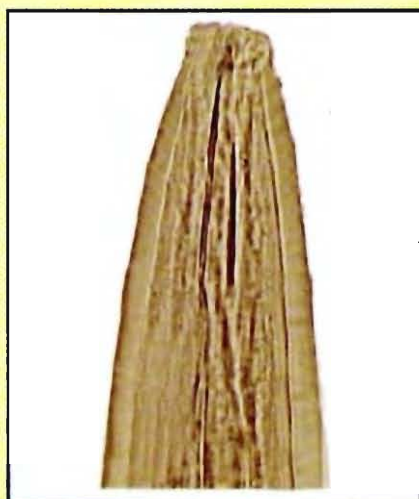
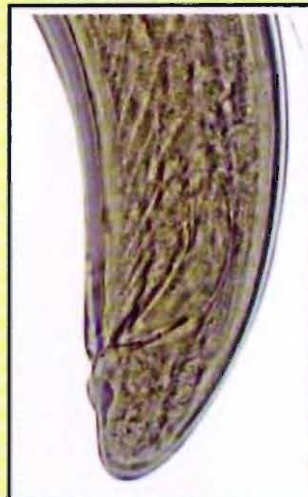
Plate-12



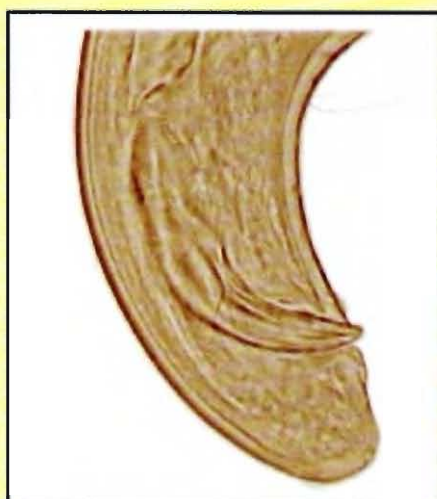
71. *Mesodorylaimus margeritus*



73. *Calodorylaimus wasimi*



74. *Laimydorus baldus*



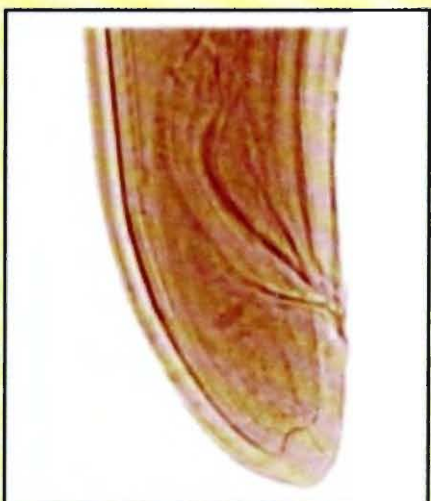
75. *Laimydorus siddiqii*



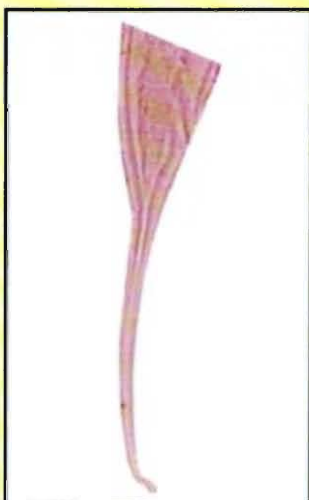
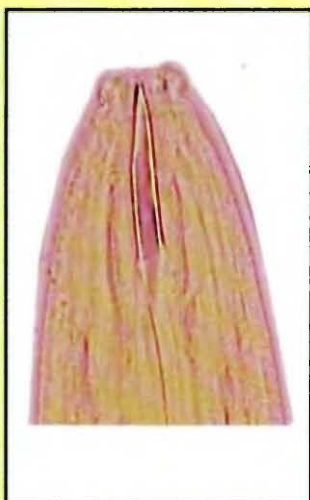
Plate-13



76. *Laimydotus finalis*



77. *Laimydotus serpentinus*



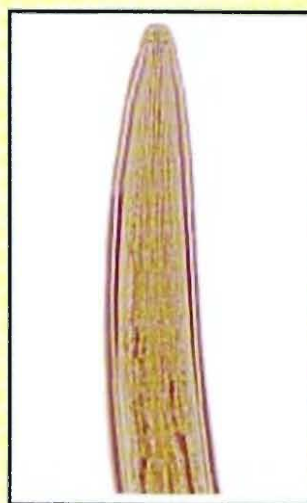
78. *Laimydotus kherai*

80. *Thornenema mauritianum*

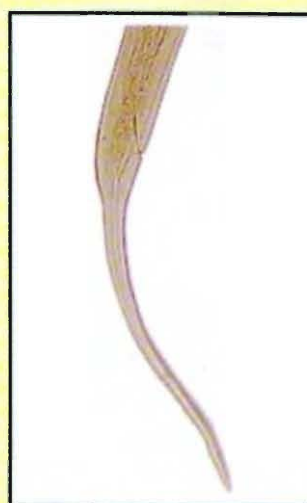
Plate-14



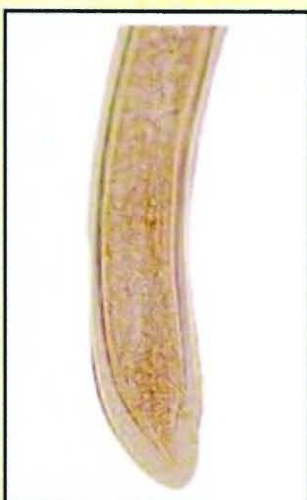
81. *Prothornenema capitatum*



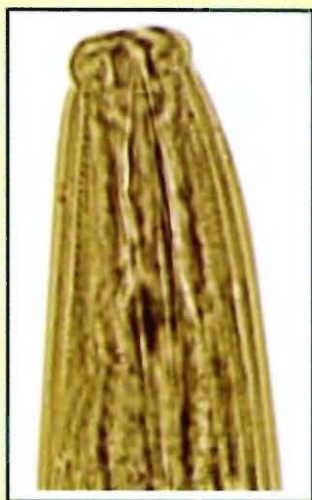
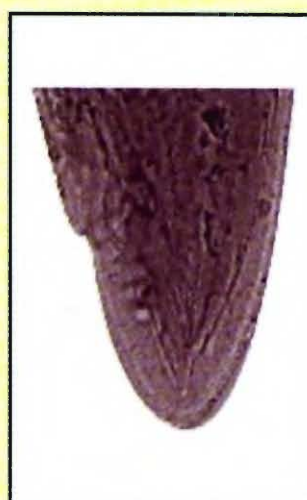
82. *Sicaguttar sartum*



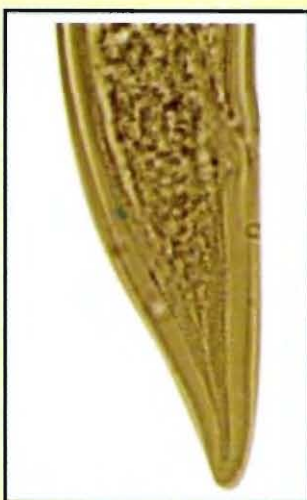
86. *Tubixaba parva*



84. *Aporcelaimellus obscurus*



85. *Aporcelaimellus hensyi*



87. *Labronema confusum*

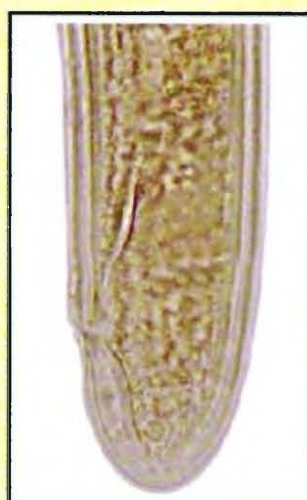
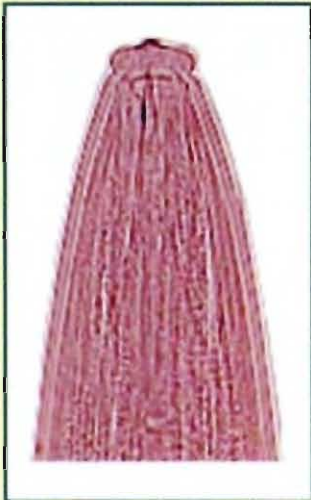
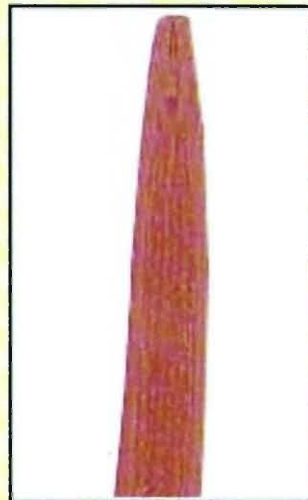
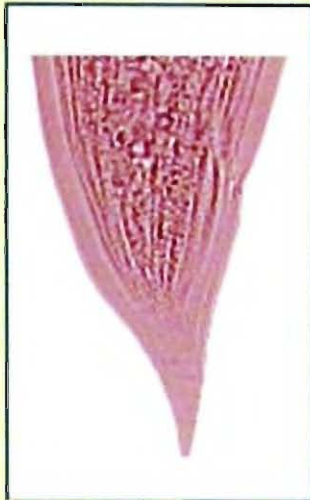


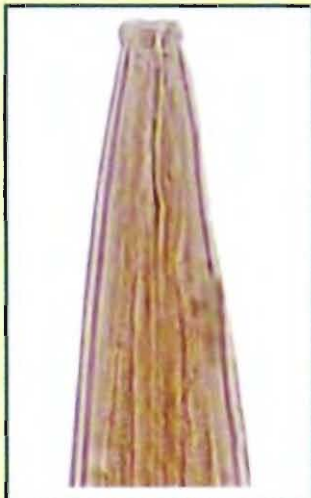
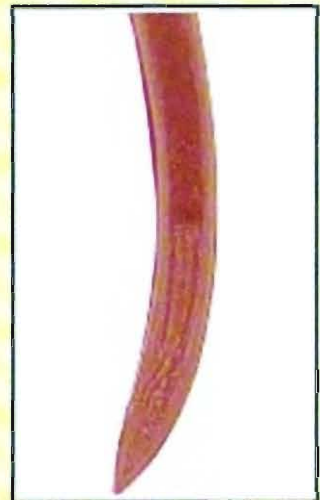
Plate-15



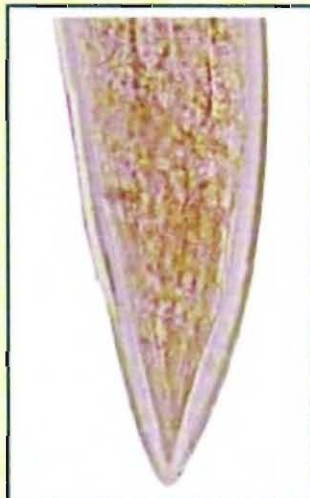
88. *Eudorylamus chauhani*



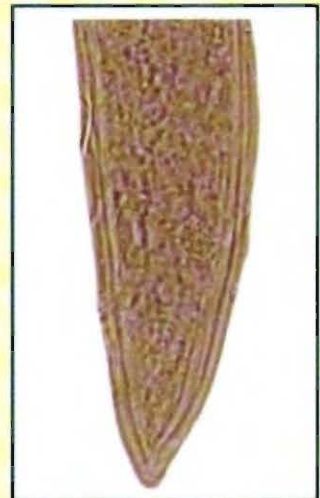
89. *Ecumenicus monhystera*



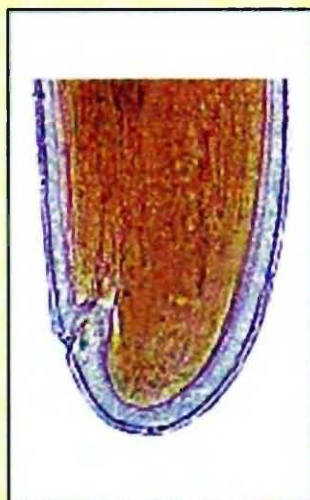
90. *Torumanawa shinensis*



91. *Microdorylaimus modicus*



92. *Labronemella andrassyi*



93. *Discolaimus major*

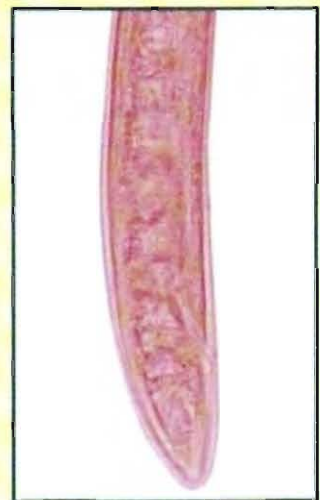
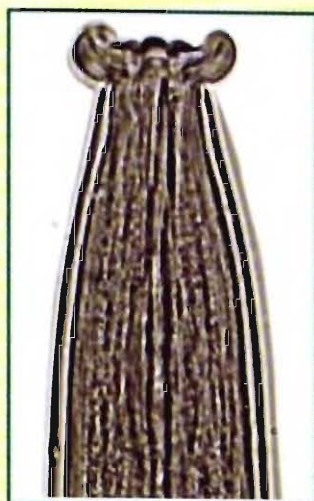
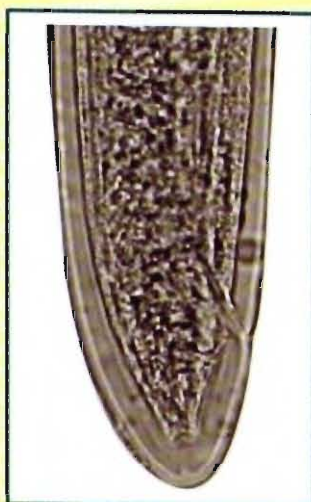


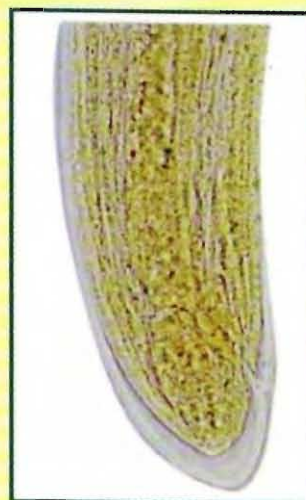
Plate-16



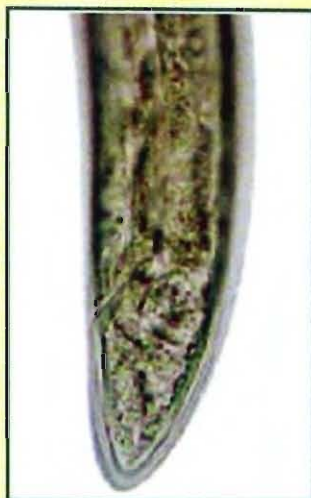
94. *Discolaimus tenax*



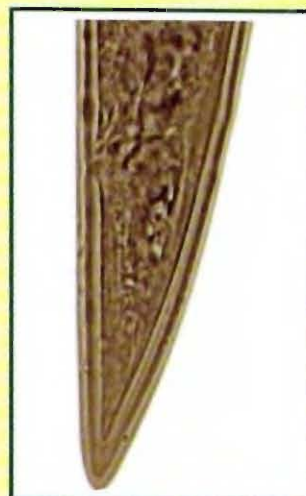
96. *Mylodiscus nanus*



97. *Mylodiscus magnus*



99. *Discolaimoides bulbiferus*



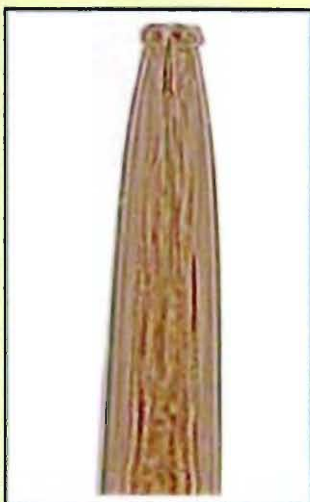
100. *Latocephalus conicaudatus*



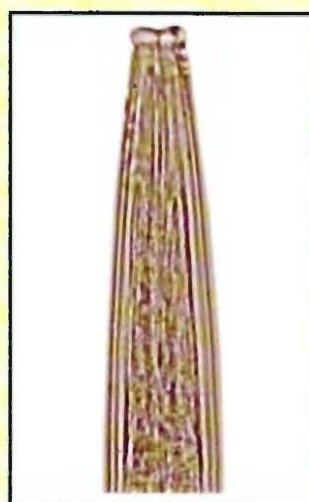
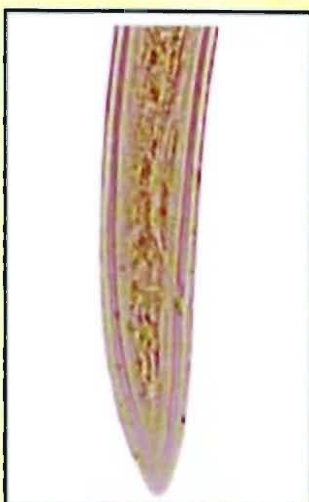
101. *Latocephalus laetanes*



Plate-17



102. *Latocephalus lotus*



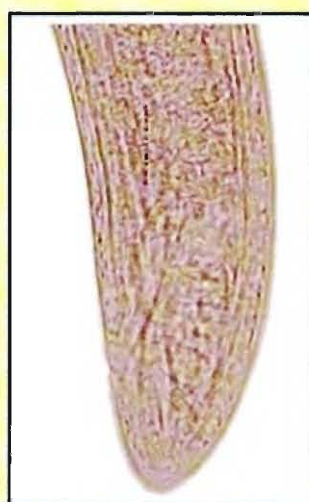
103. *Latocephalus smithi*



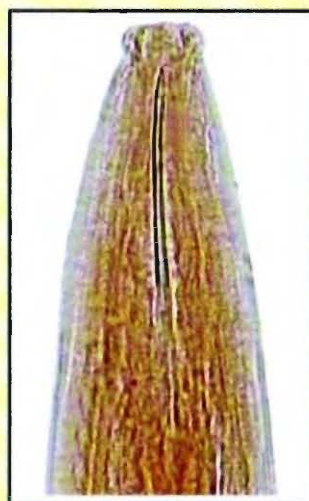
104. *Latocephalus gracile*



106. *Poronemella shamimi*



107. *Poronemella amini*



108. *Kochinema caudatum*

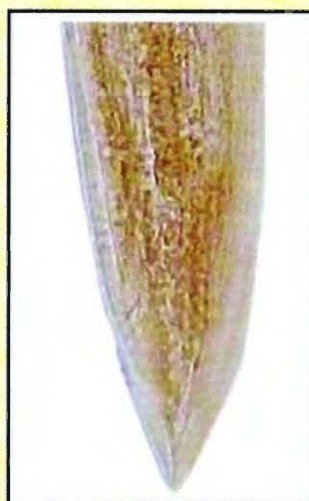
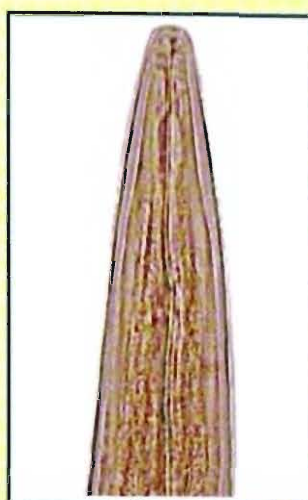


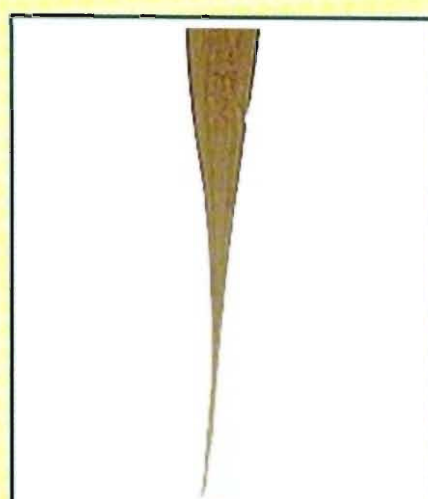
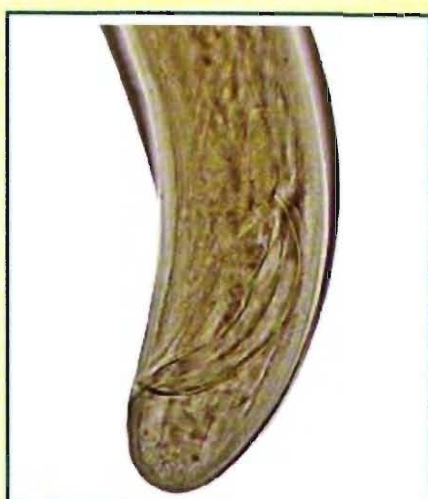
Plate-18



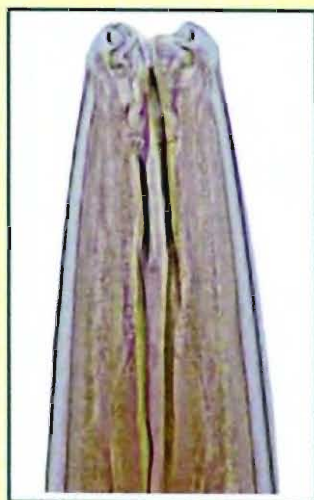
109. *Kochinema farodai*



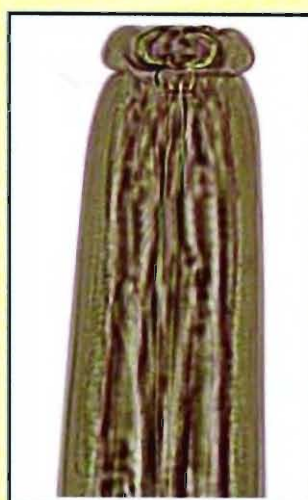
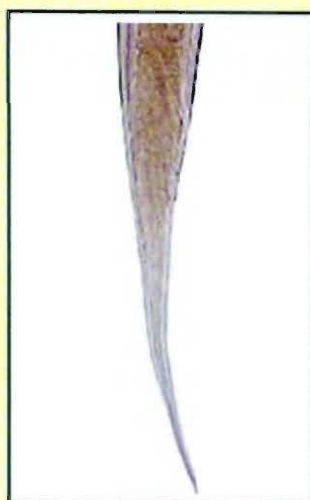
110. *Longidorella xinura*



111. *Neoactinolaimus rajasthanensis*



112. *Neoactinolaimus kosambus*



113. *Carcharolaimus masoodi*

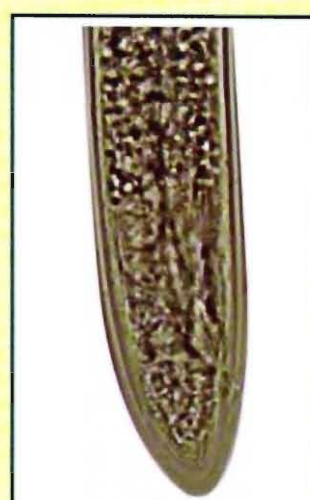
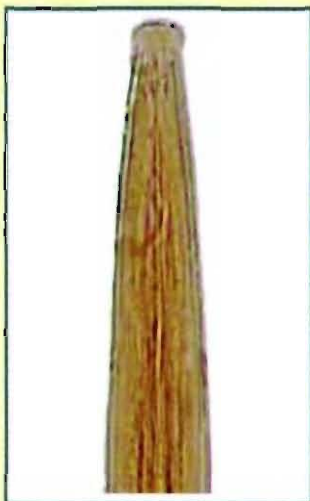
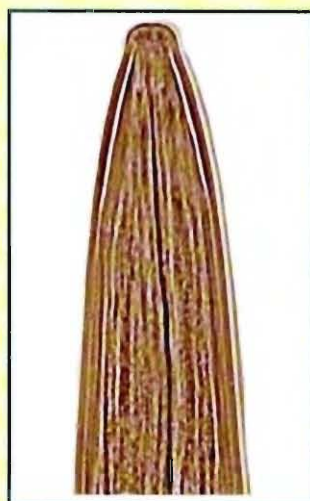
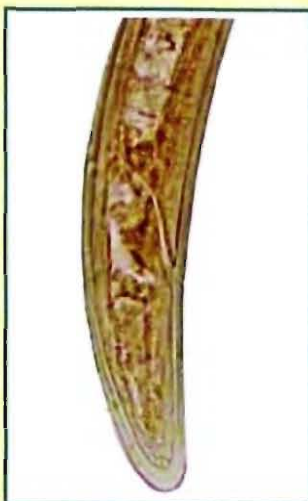


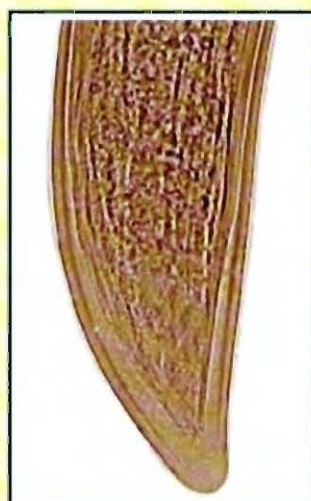
Plate-19



114. *Longidorus pisi*



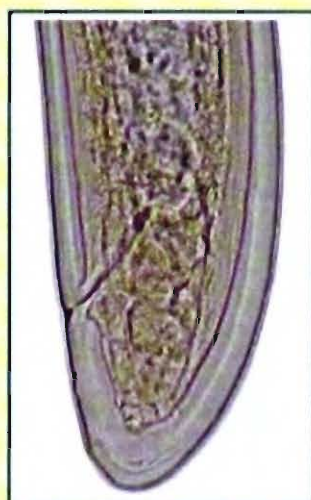
115. *Longidorus sylphus*



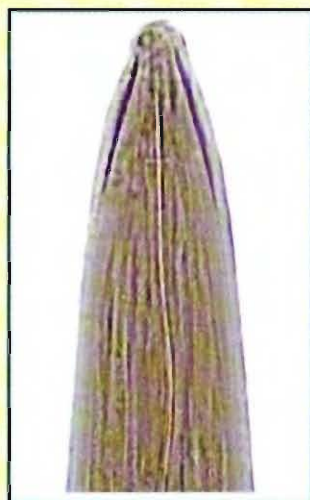
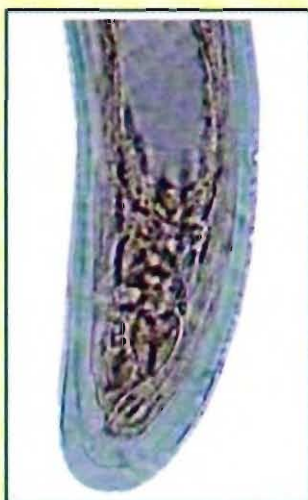
116. *Longidorus elongatus*



117. *Paralongidorus major*



118. *Paralongidorus microlaimus*



119. *Paralongidorus beryllus*

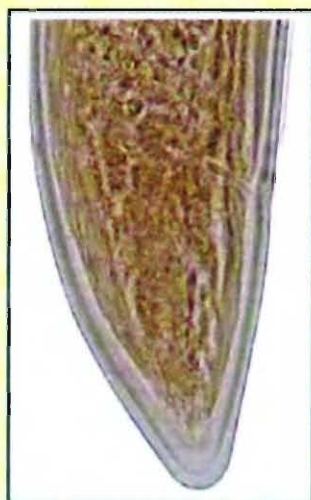
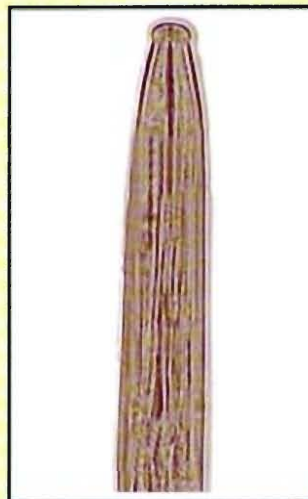


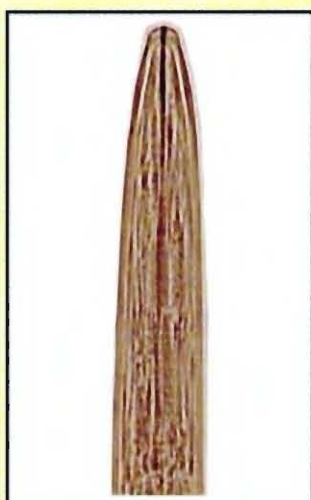
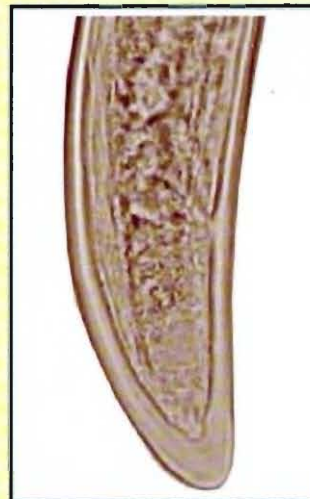
Plate-20



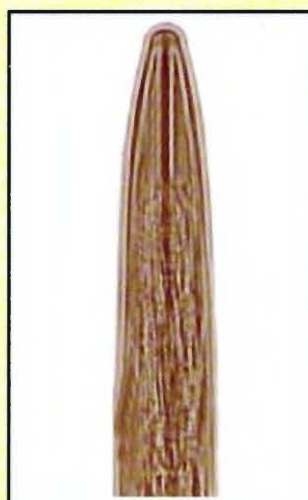
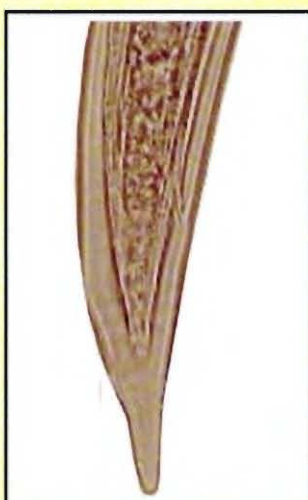
120. *Xiphinema orbum*



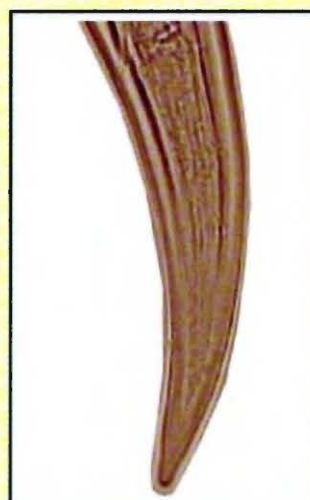
121. *Xiphinema elongatum*



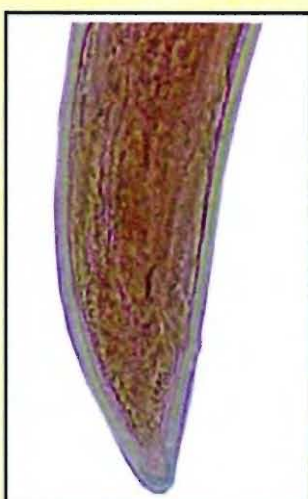
122. *Xiphinema basiri*



123. *Xiphinema insigne*



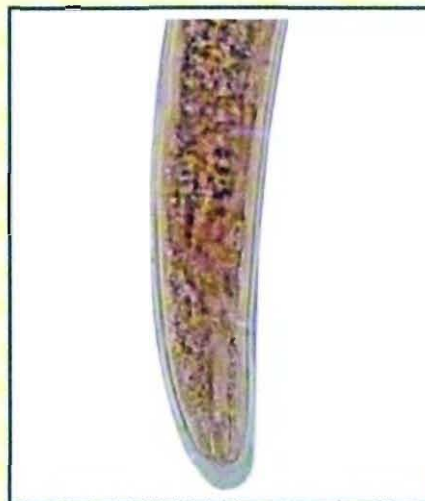
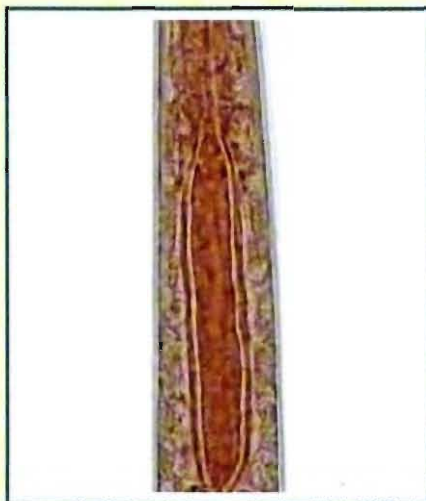
124. *Xiphinema americanum*



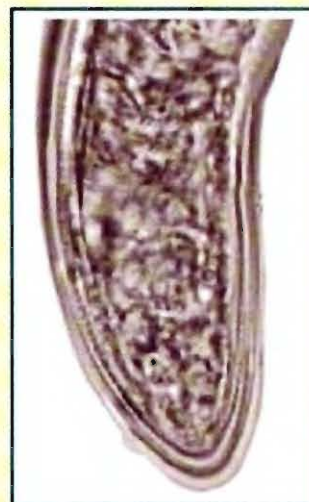
125. *Belondira aquatica*



Plate-21

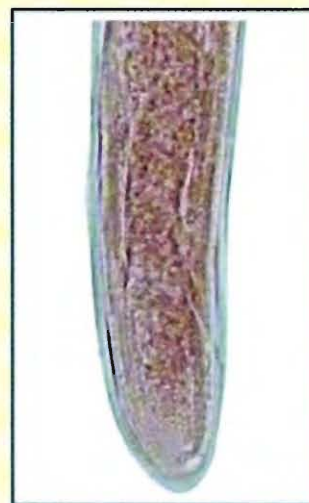


126. *Dorylaimellus (M.) jacobi*



127. *Dorylaimellus (A.) deviatus*

129. *Dorylaimellus (B.) discocephalus*



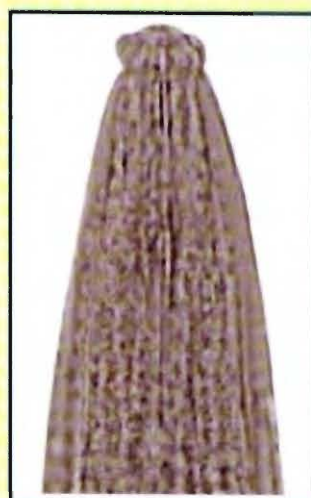
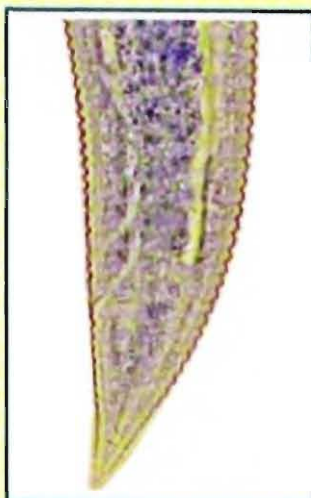
128. *Dorylaimellus (A.) paravulvas*

130. *Tylencholaimus minutus*

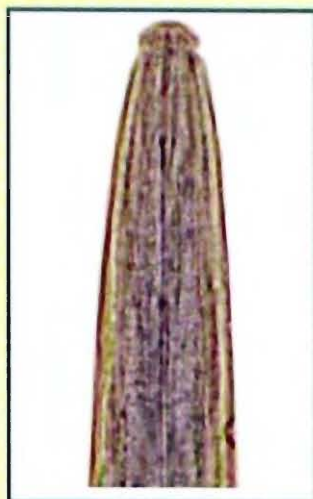
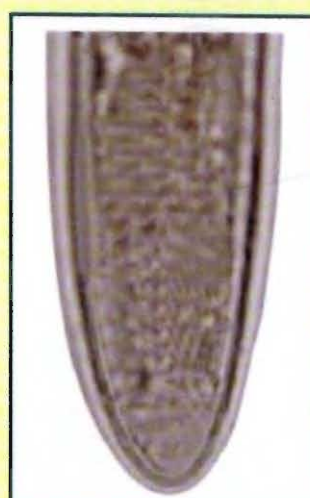
Plate-22



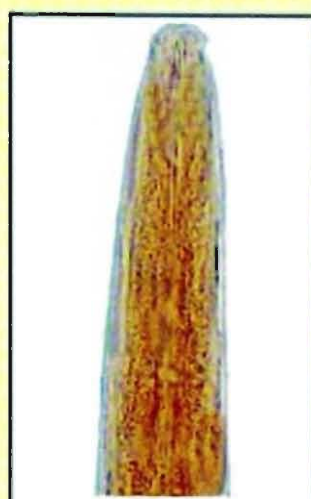
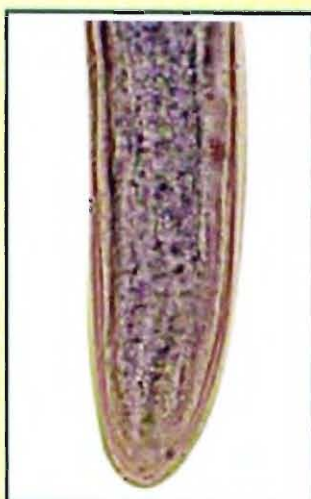
131. *Tylencholaimus annulatus*



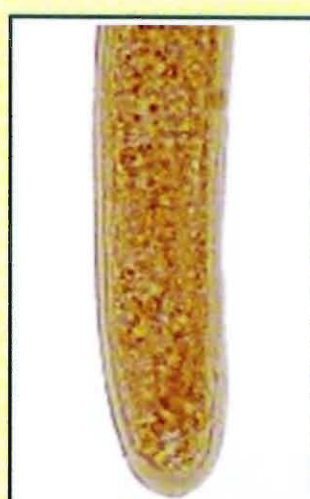
132. *Tylencholaimus gertii*



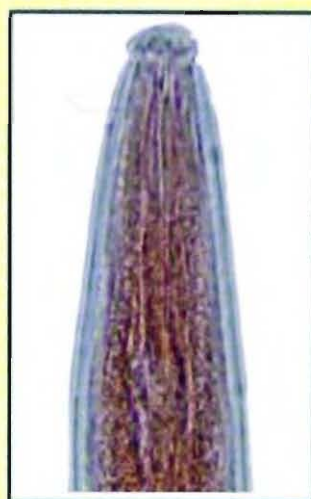
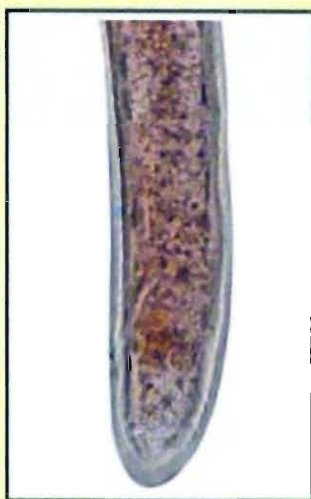
133. *Tylencholaimus decence*



134. *Tylencholaimus innebus*



135. *Tylencholaimus mangolicus*



136. *Tylencholaimus obscurus*

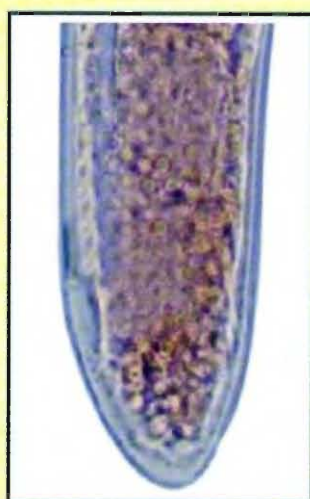
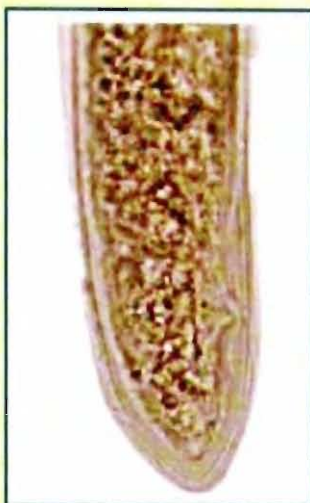


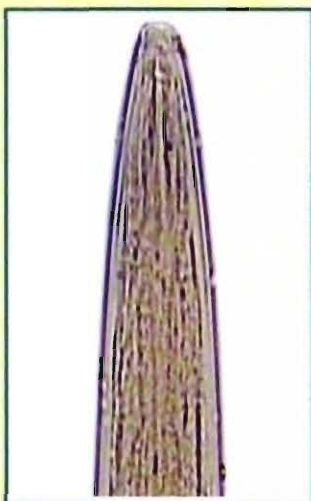
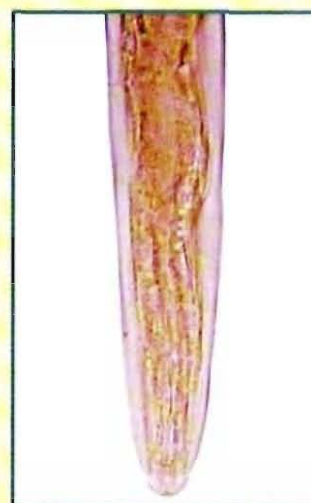
Plate-23



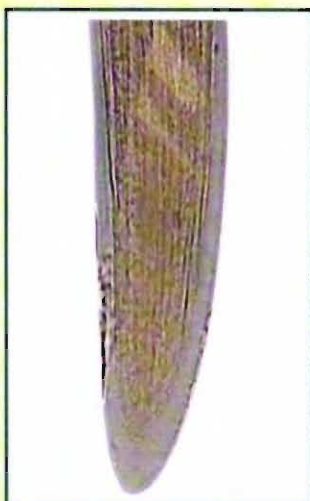
137. *Tylencholaimus proximus*



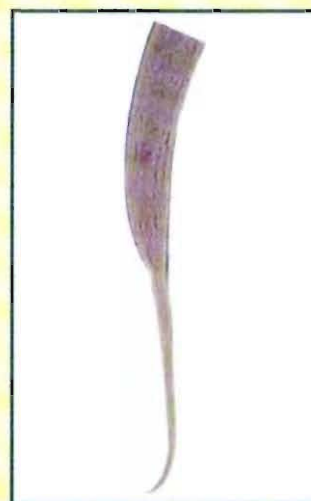
140. *Leptonchus granulatus*



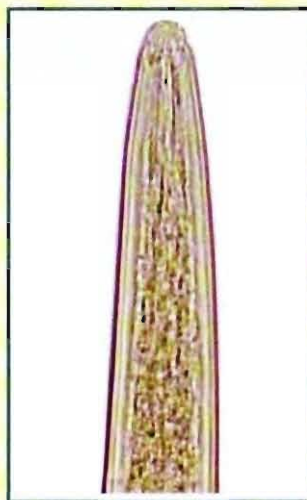
141. *Dorylaimoides (D.) parateres*



142. *Dorylaimoides (L.) leptura*



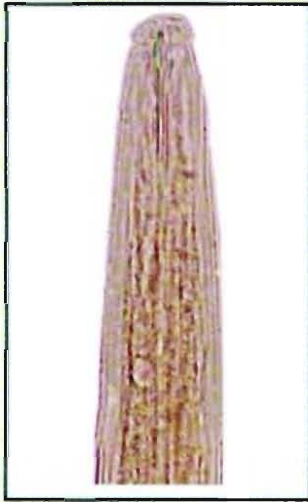
143. *Dorylaimoides (D.) micoletkyi*



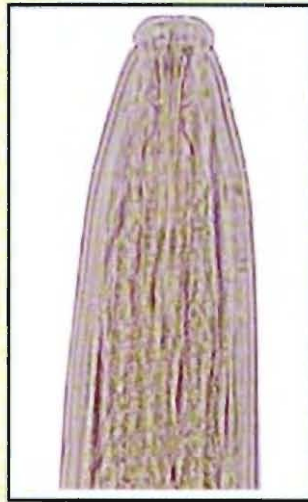
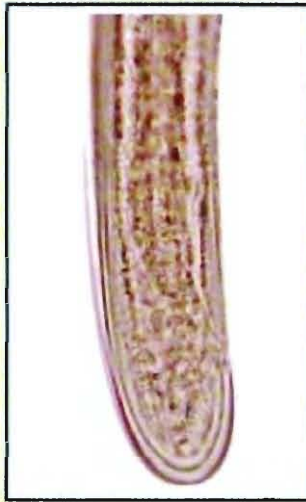
145. *Dorylaimoides (A.) constrictus*



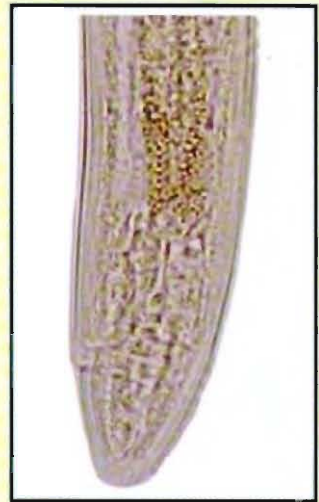
Plate-24



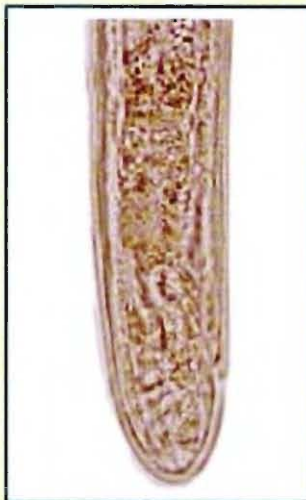
146. *N. anneckeii*



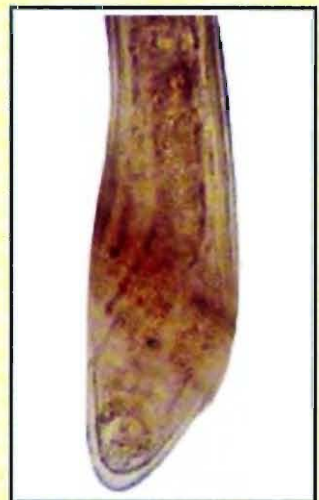
147. *Nygolaimus harishi*



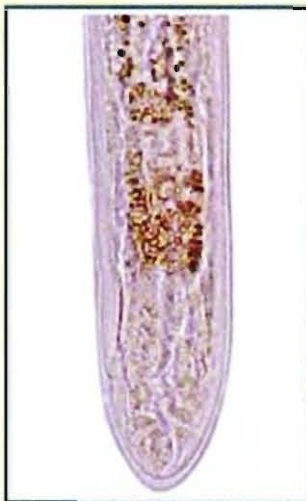
148. *Nygolaimus captivatus*



149. *Nygolaimus hyans*



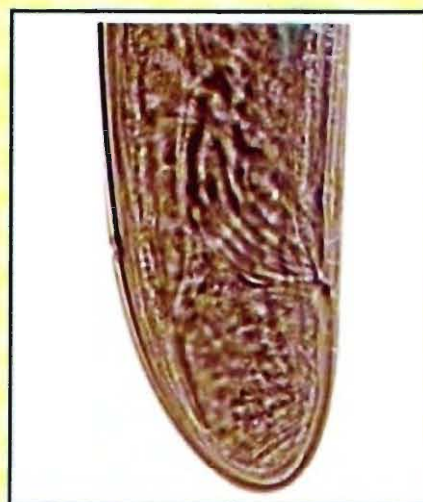
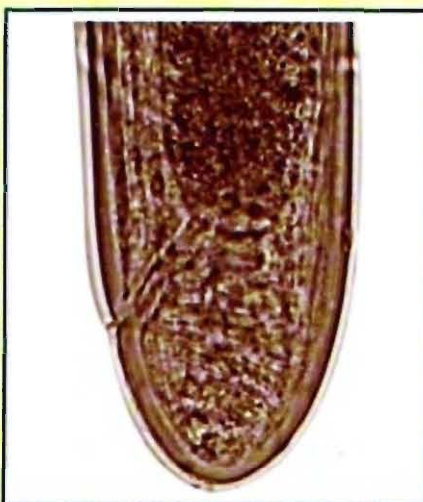
150. *Nygolaimus shamimi*



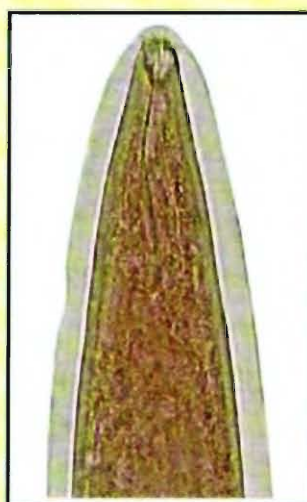
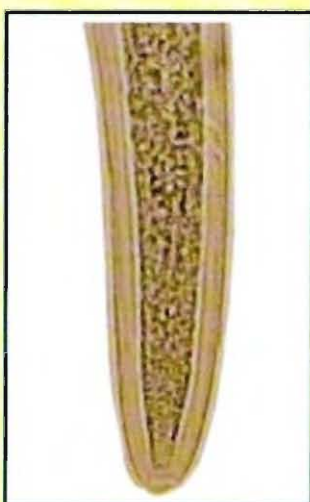
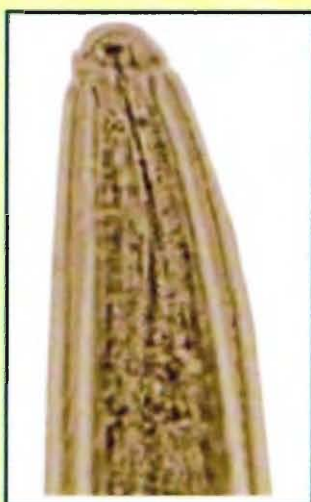
151. *Aquatides thornei*



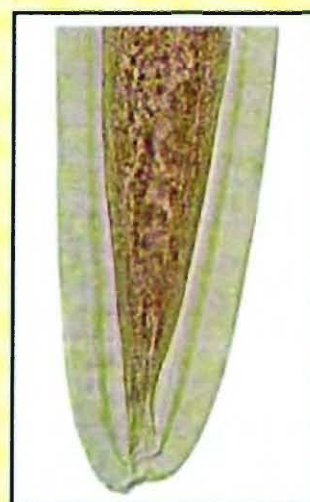
Plate-25



152. *Aquatides aquaticus*

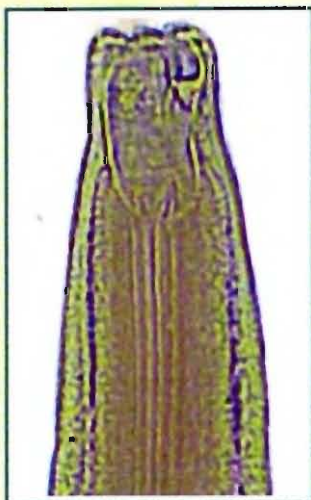


153. *Paratrichodorus minor*

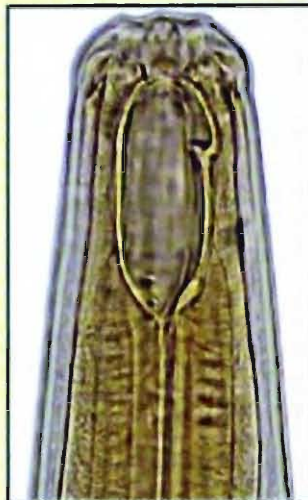
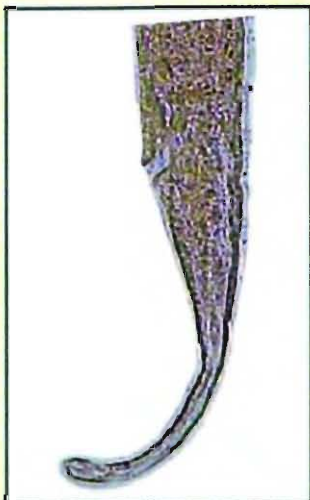


154. *Paratrichodorus porosus*

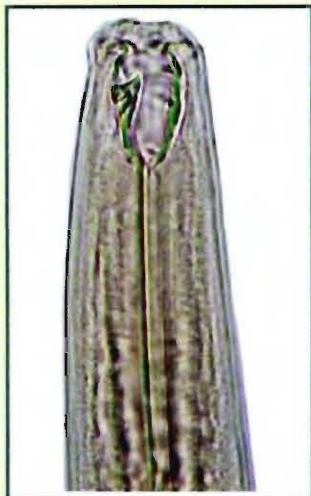
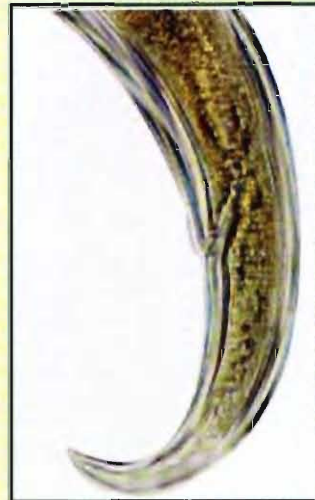
Plate-26



155. *Mononchus aquaticus*



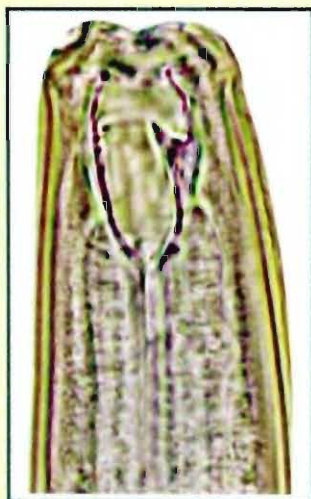
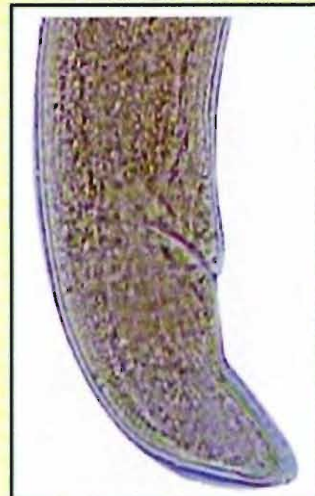
156. *Coomansus icarus*



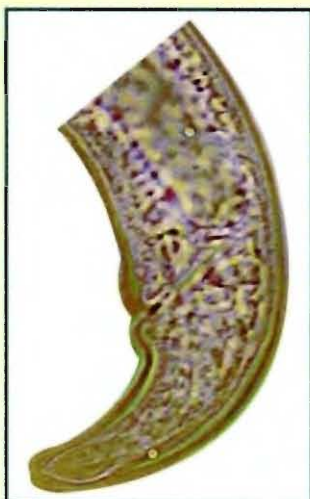
157. *Mylonchulus hawaiiensis*



158. *Mylonchulus contractus*



159. *Mylonchulus amurus*



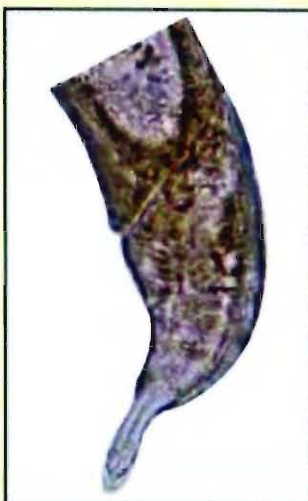
160. *Mylonchulus dentatus*



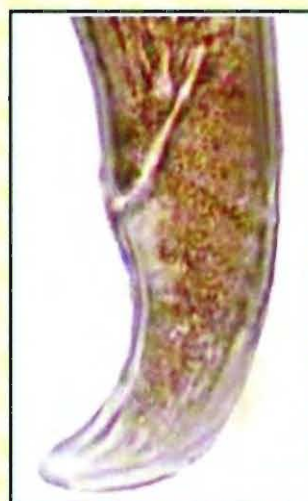
Plate-27



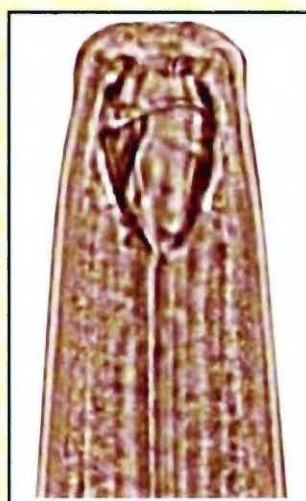
161. *Mylonchulus brachyurus*



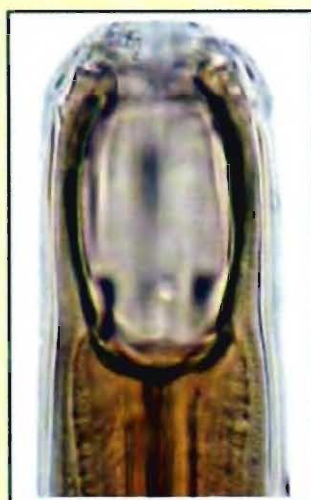
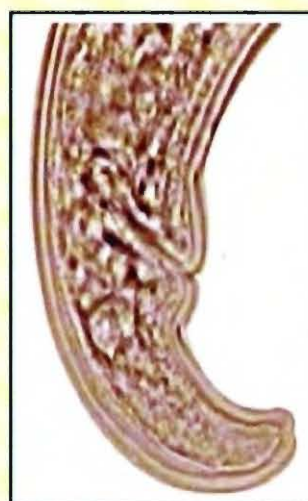
162. *Mylonchulus subsimilis*



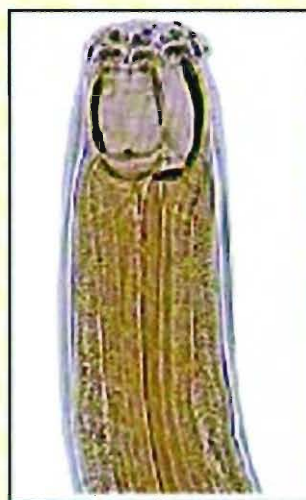
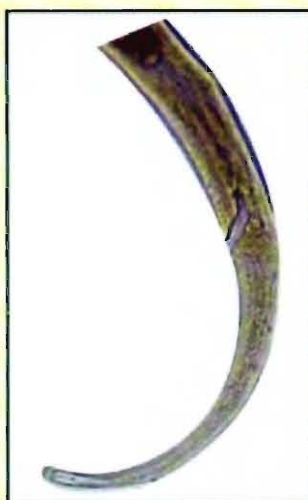
163. *Mylonchulus minor*



164. *Mylonchulus lacustris*



165. *Miconchus studeri*



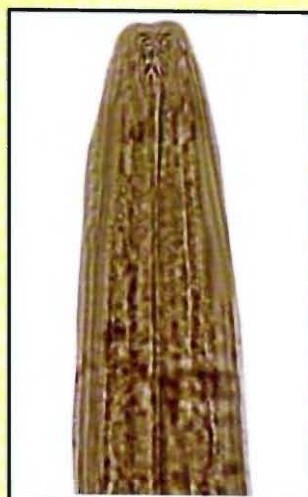
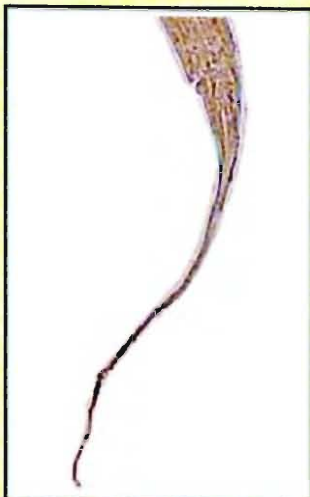
166. *Iotonchus indicus*



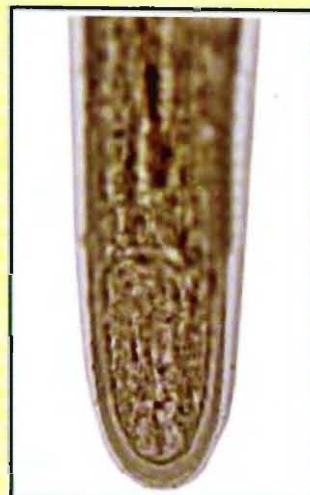
Plate-28



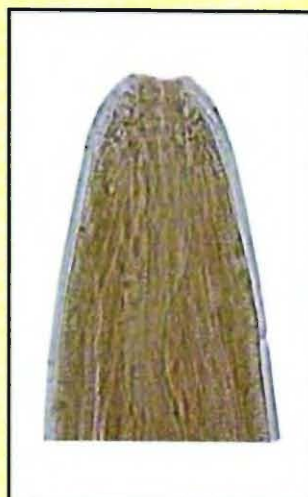
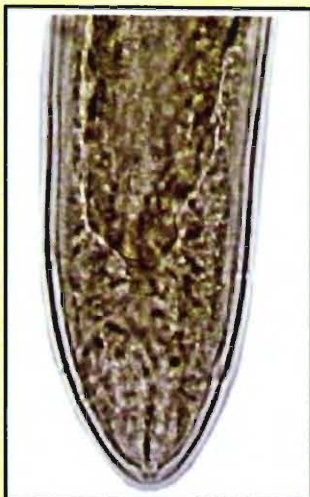
167. *Parahadronchus shakili*



169. *Oionchus obtusus*



168. *Bathyodontus cylindricus*



170. *Isolaimium rajasthanicus*

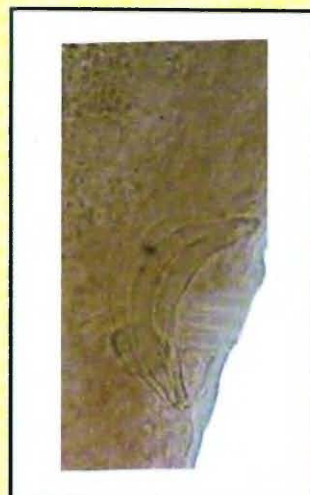
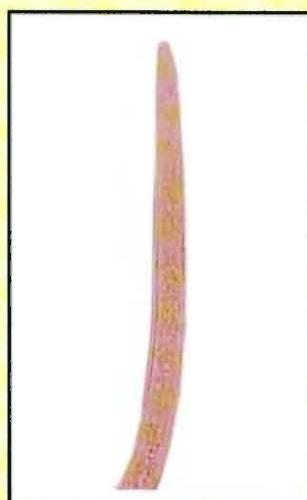


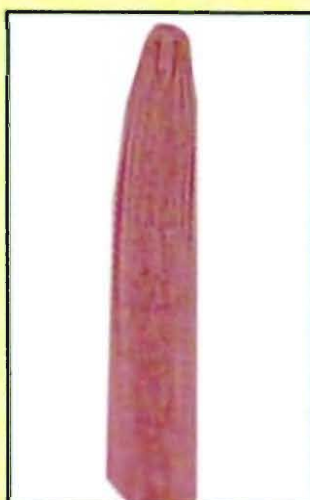
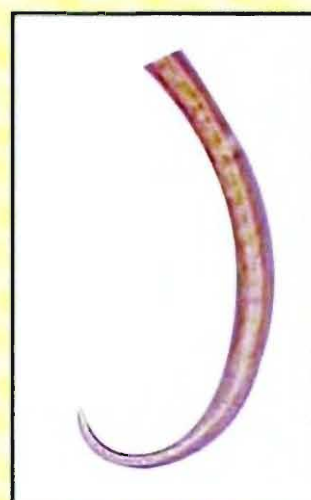
Plate-29



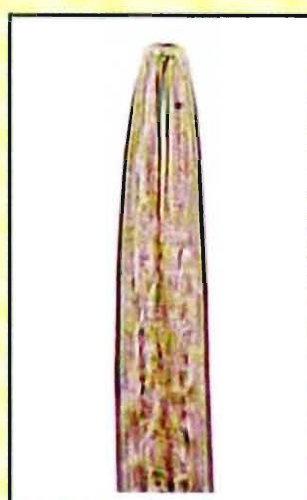
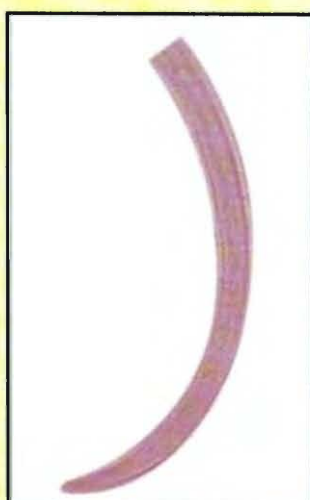
171. *Achromadora ruricola*



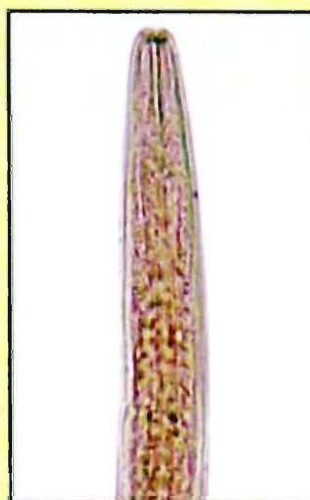
172. *Chronogaster daoii*



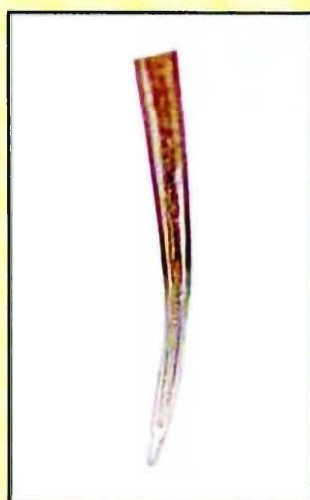
173. *Chronogaster typica*



174. *Rhabdolaimus aquaticus*



175. *Rhabdolaimus terrestris*



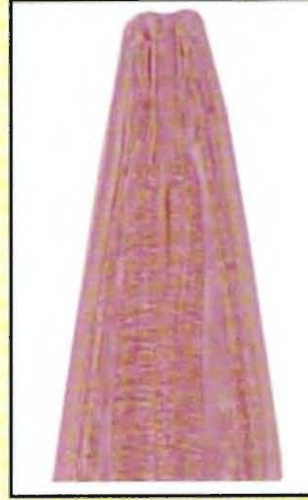
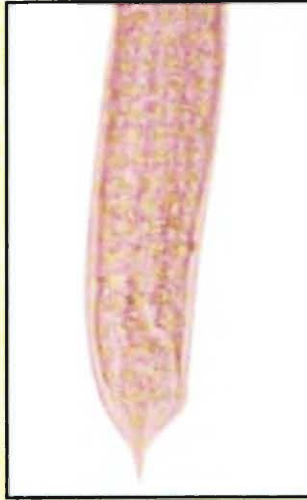
176. *Mesorhabdites anisomorpha*



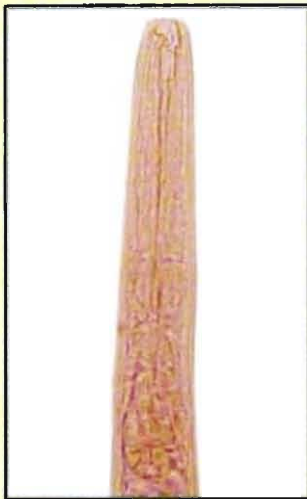
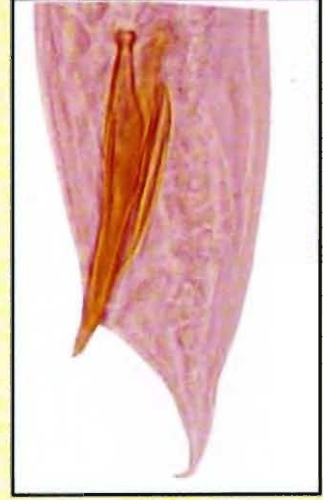
Plate-30



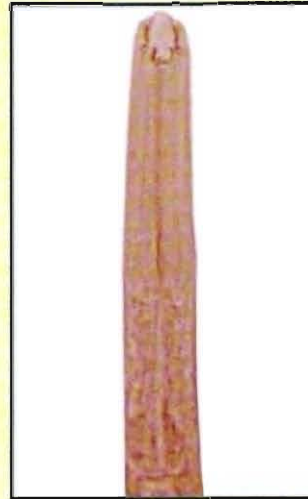
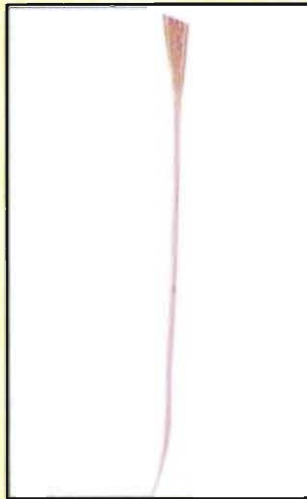
177. *Cuticularia oxycerca*



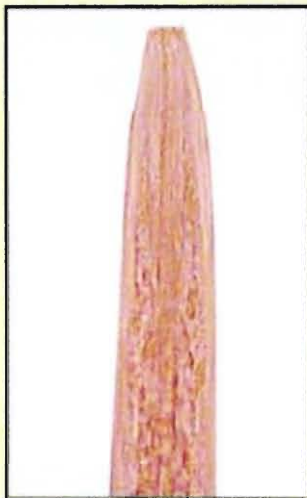
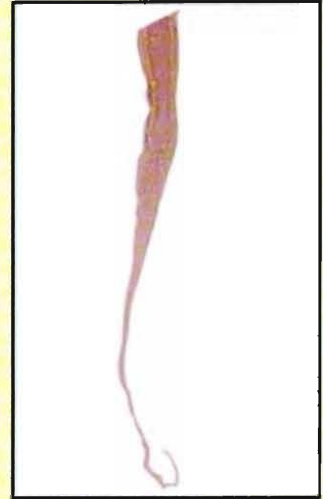
178. *Distolabrellus veechi*



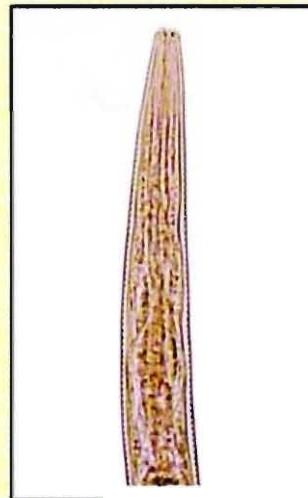
179. *Mononchoides longicaudatus*



180. *Butlerius okai*



181. *Chiloplacus sclerovaginatus*



182. *Zeldia minor*

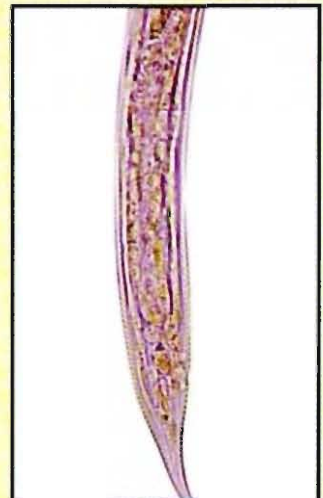
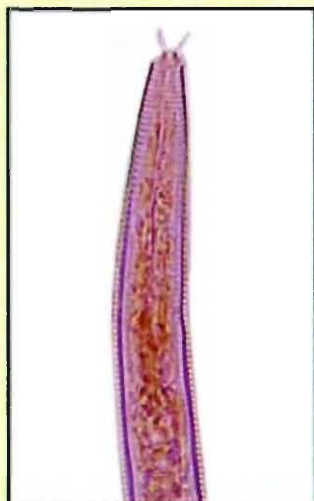
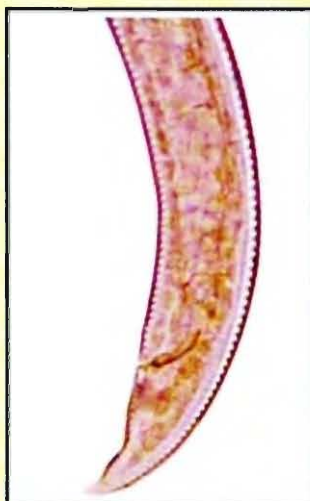


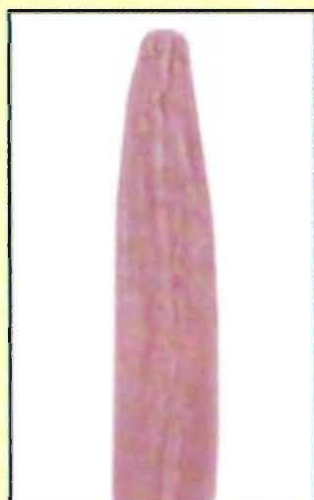
Plate-31



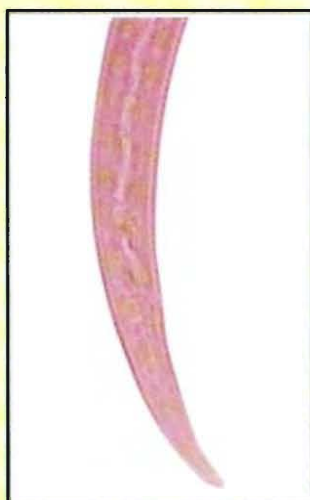
183. *Acrobeles complexus*



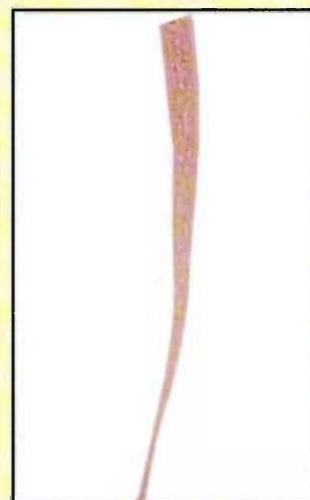
184. *Eucephalobus hooperi*



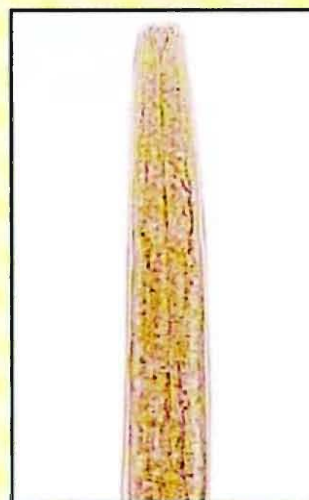
185. *Eucephalobus arcticus*



186. *Pristomatolaimus premitivus*



187. *Tobrilus sexsetiflorus*



188. *Tobrilus stefanskii*



setae short papilloid or lacking. Amphidial aperture small, slit-like. Stoma simple, funnel-shaped, cylindrical or quite narrow, mostly bearing denticles, Pharynx cylindroid or gradual widening posteriad. Males with gubernaculum and papilliform or setose pre cloacal supplements, the latter often very large, vesiculate.

Type superfamily : Tripyloidea de Man, 1876

Key to superfamilies of Tripylina Andrásy, 1974

1. Stoma practically absent; amphids often enlarged longitudinally; body slender OXYSTOMINOIDEA
- Stoma present exceptionally narrow; amphids narrow; body stouter 2
2. Stoma tubular, long, with parallel walls, teeth when present, lying at proximal or distal end of stoma IRONOIDEA
- Stoma funnel- or barrel-shaped, teeth arising from walls of stoma *Tripyloidea*

Superfamily TRIPYLOIDEA de Man, 1876

Diagnosis : Lips separate; amphidial aperture slit-like. Stoma barrel-shaped, with or without teeth. Supplements in males either papilloid or setose, vestibulate.

Type family : TRIPYLIDAE de Man, 1876

Key to families of Tripyloidea de Man, 1876

1. Female genital duct opening in to cloaca or lying quite near to it LAURTONEMATIDAE
- Female genital opening well separated from anus 2
2. Stoma large barrel-shaped or prismatic, pharyngeal tissue areolated PRISMATOLAIMIDAE
- Stoma narrow, funnel-shaped or quite straight; pharyngeal tissue more or less homogeneous TRIPYLIDAE

Family PRISMATOLAIMIDAE Micoletzky, 1922

Diagnosis : Cuticle finely annulated with scattered setae. Six longer outer labials and four shorter cephalic setae, either located one or two circlets. Buccal cavity spacious with sclerotised walls, armed with one or three teeth. Pharynx transversely areolated, cylindrical. Cardia multinucleate, surrounded by coelomocytes. Behind cardia, organellum dorsale may be present. Female genital system amphi- or mono-prodelphic. Males rare. Spicules simple with anterior sheath; precloacal supplements small, extending occasionally up to pharyngeal region. Tail in both sexes similar, long and finely attenuated.

Type subfamily : Prismatolaiminae Micoletzky, 1922

Subfamily PRISMATOLAIMINAE Micoletzky, 1922

186. *Prismatolaimus primitivus* Loof, 1971

(Plate No.31, Fig. 186)

Measurements : Females : L=0.5-0.7 mm; a=39-48; b=3.6-5.1; c=2.9-4.2; V=42-46

Description : Female : Body medium-sized, slender, tapering at both extremities, ventrally curved upon fixation. Cuticle thin, finely annulated. Somatic setae scattered, very short. Cervical setae in a single circlet. Stoma 2 times as long as wide. Pharynx a muscular tube. Cardia spherical. Rectum about one anal body diameter long. Female reproductive system amphidelphic. Vulva-anus distance shorter than tail length. Tail long, gradually tapering, with a small mucro.

Male : Not found.

Habitat and locality : Around the roots of onion (*Allium cepa*), village Manai, Jodhpur.*Distribution* : Rajasthan, UP.

Family TRIPYLIDAE de Man, 1876

Diagnosis : Body length ranging from 0.4-3.4 mm. Cuticle striated or smooth under LM. Crystalloids present all over body. Lip region continuous. Lip three with small inner labial sensilla. Sensilla of outer periphery comprising of 6+4 setae, arranged in one or two circles; six outer labials usually longer than cephalics. Amphids cup-shaped, at level of stoma. Stoma quite narrow, non sclerotized with three small teeth at its base, rarely at middle. Pharynx cylindrical without terminal bulb. Cardiac glands three. Female reproductive system didelphic, amphidelphic or monodelphic, prodelphic, ovaries reflexed. Testis diorchic. Spicules more or less enclosed in a muscular pouch. Ventromedian supplements papilloid generally extending to pharyngeal region. Caudal glands and terminal spinneret usually well developed.

Type subfamily : Tripylinae de Man, 1876

Subfamily TOBRILIINAE Andr ssy, 2007

187. *Tobrilus sexsetiferous* Khera, 1975

(Plate No. 31, Fig. 187)

Measurements : Females : L=1.1-1.3 mm; a=26-34; b=6.0-6.5; c=8.4-9.0; V=39-45.

Description : Female : Body large-sized, almost straight to slightly curved ventrally upon fixation. Cuticle smooth without setae. Lip region 20-22 μ m wide, continuous with body contour. Six cephalic setae about 1/4th of labial diameter long. Amphids large, cup-shaped at base of cephalic setae. Stoma longer 20-24 μ m long, distinct in three section. Pharynx cylindrical, broadening posteriorly, 200-226 μ m long. Nerve ring encircles pharynx at 30-35% of its length. Intestine with thin walls and wide lumen. Rectum 17-19 μ m long. Female reproductive system amphidelphic. Ovaries reflexed. Tail conical, ending in a fine point.

Male : Not found.

Habitat and locality : Sediment from a small pond of district Jodhpur.

Distribution : Rajasthan, UP.

188. ***Tobrilus stefanskii*** Micoletzky, 1922

(Plate No. 31, Fig. 188)

Measurements : Females : L = 1.3-1.8 mm; a = 27-39; b = 5-6; c = 7.3-11.6; V = 40-46.

Description : Female : Body large-sized, ventrally curved upon fixation. Cuticle smooth without setae. Lip region 18 µm wide, continuous with body contour. Six cephalic setae, each about 1/6th of labial diameter long. Amphids large posterior to base of cephalic setae. Stoma longer than wide. Pharynx cylindrical, broadening posteriorly. Intestine granular. Rectum 10-12 µm long, about half of anal body diameter. Female reproductive system amphidelphic. Tail elongate, almost straight, 4 times of anal body diameter.

Male : Not found.

Habitat and locality : Sediment from a small pond of district Jodhpur.

Distribution : Rajasthan, UP.

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REFERENCES

- Ali, S.M., Farooqui, M.N. and Tejpal, S. 1969. *Neotylocephalus annonae* n. gen., n. sp. (Nematoda : Wilsonematinæ) from Marathwada, India. *Rivista di Parasitologia*, **30** : 287-290.
- Andrássy, I. 1976. *Evolution as a basis for the systematization of nematodes*. Pitman Publishing Ltd., London, UK. 288pp.
- Arya, H.C. 1957. Root-knot disease of tomatoes in Jodhpur. *Sci. & Cult.*, **22** : 391-393.
- Baqri and Bohra, P. 2002. Diversity of Plant and Soil Nematodes in the Fragile Ecosystem of Indian Thar Desert. In : *Nematode Diversity* (Ed. M.S. Jairajpuri). Silverline, P.S. Nagar, Hyderabad. Pp. 336-358.

- Baqri, Q.H. and Bohra, P. 2003. *Prothornenema* gen. n. and four new species of Dorylaimoidea. (Nematoda : Dorylaimida) from India. *International Journal of Nematology*, **13**(2) : 185-194.
- Baqri, Q.H. and Bohra, P. 2005. Plant and Soil Nematodes. India. *Fauna of Western Himalaya* (Part-2) *Zool. Surv. India*, Kolkata. Pp. 23-37.
- Baqri, Q.H. 1994. Phytophagous nematodes and natural zone; *Fauna from the Thar Desert (Arid Zone) in India*. C.B. Srivastava Comm. Vol. *Adv. Parasitol.* ed; K.C. Pandey; *Helminth. Soc. India & Zool. Soc. India*; Dept. of Zoology, Lucknow University, Lucknow, India 27-38 pp.
- Baqri, Q.H. 1996. Faunal diversity of Nematoda in the Thar Desert : Assessment and futuristic approach. In: *Faunal Diversity in the Thar Desert: Gaps in Research* (Eds. A.K. Ghosh, Q.H. Baqri & I. Prakash). Scientific Publishers, Jodhpur, India. pp. 51-70.
- Bohra, P and Baqri, Q.H. 1997. Plant and Soil Nematodes. In : *Fauna of Delhi. State Fauna Series, Zool. Surv. India* (Ed. Director, Zoological Survey of India, Calcutta). **6** : 75-108.
- Bohra, P and Baqri, Q.H. 2000. Nematodes from Rajasthan. II. Six new records of order Dorylaimida from India. *Rec. zool. Surv. India*; **98**(part-4) : 117-122.
- Bohra, P and Baqri, Q.H. 2004. Nematoda. *Fauna of Gujarat, State Fauna Series*, **8** : 355-400, *Zool. Surv. India*.
- Bohra, P and Baqri, Q.H. 2005. Plant and Soil nematodes from Ranthambore National Park, Rajasthan, India. *Zoos'Print Journal*, **21**(1) : 21-26.
- Bohra, P and Baqri, Q.H. 2005. Biodiversity of Plant and soil Nematodes from Andman and Car Nicobar Islands. *Rec. zool. Surv. India*; **105**(Part 3-4) : 43-49.
- Bohra, P and Baqri, Q.H. 2005. Two new species of Dorylaimida (Nematoda) from India. *Indian J. Nematol*; **35**(2) : 107-111.
- Bohra, P and Baqri, Q.H. 2010. Plant and Soil nematodes. Fauna of Ranthambore National Park. *Conservation Area Series, Zool. Surv. India*, Kolkata. **43** : 45-56.
- Bohra, P and Baqri, Q.H. 2004. Plant and soil Nematodes. *Fauna of Desert National Park, Conservation Area Series*, **19** : 33-38. *Zool. Surv. India*.
- Bohra, P. 2008. Qualitative and Quantitative Studies of Plant and Soil Nematodes associated with crops of economic importance in Rajasthan. *Rec. zool. Surv. India, Occasional Paper*, **278** : 1-80
- Bohra, P. and Sultana, R. 2008. Description of *Neoactinolaimus rajasthanicus* sp. N. (Nematoda : Dorylaimida) from India. *International Journal of Nematology*. **18**(2) : 128-132.

- Bohra, P. and Sultana, R. 2008. Description of two new species of rare genera (Nematoda: Dorylaimoidea) from Rajasthan, India. *Nematol. Medit.* **36** : 179-183.
- Bohra, P. and Sultana, R. 2008. Four new species of Nematodes Order Nematoda: Dorylaimida and Isolaimida) from Rajasthan. *Rec. zool. Surv. India.* **108**(1) : 1-13.
- Bohra, P. and Sultana, R. 2009. Description of a new species of genus *Rostrulium* Siddiqi, 1995 (Dorylaimida : Tylencholaimidae) from Rajasthan, India. *Biosystematica.* **3** : 15-20.
- Bohra, P., Baqri, Q.H. 2004. Plant and soil nematodes collection, preservation and identification of animals 33-38 (Ed. By JRB Alfred & Ramakrishna).
- Butschli, O. 1873. Beitrage Zur Kenntnis der freilebenden Nematoden. *Nova. Acta Acad. Nat. Curios,* **36** : 1-124.
- Chitwood, B.G. & Chitwood, M.B. 1950. *Introduction to Nematology*, Monumental Printing Company, Baltimore, revised edition, 213.
- Chitwood, B.G. 1933. A revised classification of the Nematoda. *Journal of Parasitology* **20**, 131.
- Cobb, N.A. 1917. The Mononchs (*Monochus* Bastian, 1865). A genus of free living predatory nematodes. *Soil Sci.*, **3** : 431-486.
- De Coninck, L.A.P. 1965. Classe des Nématodes- Systématique des Nématodes et sous-classe des Adenophorea. In: Grasse, P. (Ed.). *Traité de Zoologie*. Tome IV, Fasc. II. Paris: Masson et Cie, 217p.
- Decraemer, W. 1989. Morphologic variability and value of the characters used for species identification in *Paratrichodorus* Siddiqi, 1974 (Nematoda: Trichodoridae) *Nematologica*, **35** : 37-61.
- Decraemer, W. and Chaves, E. 1988. Morphology of the reproductive system and structure of the genus *Paratrichodorus* with uncommon males (Nematoda: Diptherophorina). *Revue de Nematologie*, **11** : 405-409.
- Diltevesen, H. 1911. Danish free-living nematodes. *Vidensk. Medd. Dansk. Naturh. Forening Kobenhavn*, **63** : 213-256.
- Fielding, M. J. 1951. Observation on the length of dormancy in certain plant infecting nematodes. *Proc. Helminth. Soc. Wash.*, **18** : 110-112.
- Ganguly, S. & Khan, E. 1986. A new genus of the family Wilsonematidae rank n. (Plectoidea: Nematoda). *Indian Journal of Nematology* **16**, 226-230.
- Harrison, B.D. 1961. Soil-borne viruses—tobacco rattle virus. Report, Rothamsted Experimental Station, 1960, 118p.
- Harrison, B.D. 1966. Further studies on a British form of pea early-browning virus. *Annals of Applied Biology*, **57** : 121-129.

- Harrison, B.D. 1967. Pea early-browning virus (PEBV). Report, Rothamsted Experimental station 1966, 115p.
- Hunt, D.J. 1993. *Apelenchida, Longidoridae and Trichodoridae* : Their Systematic and bionomics. CAB International Wallingford, Oxon OX10 8DE, UK.
- Jairajpuri M.S. & Ahmad, W. 1992. *Dorylaimida; Free-living, Predaceous and Plant-parasitic Nematodes*. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
- Jairajpuri, M.S. 2001. *Taxonomy – Endangered and Doomed to extinction*. In. Nematode Taxonomy : Concepts and recent trends (eds. M.S. Jairajpuri & P.F. Rahman). Proceedings of the Workshop on Nematode Taxonomy. MANUU, Hyderabad, 11-34p.
- Jairajpuri, M.S., Ahmad, I. and Ahmad, M. 1979. Record of an intersex of *Aquatides thornei* with remarks on the phenomenon of intersexuality in nematodes. *Indian J. Nematol.*, 7(1977), 176-182.
- Khera, S. 1967. *Acrobelinema cornis* N.G., n. sp. subfamily Acrobelinae Thorne from rhizosphere of millets from India. *Indian J. Helminthology*, 21(2) : 159-163.
- Khera, S. 1969. Nematodes from the banks of still and running waters. VI. Order Rhabditida from Sewarage. *J. Helminthol.*, XLIII (3&4) : 347-363.
- Khera, S. 1971. Nematodes from the banks of still and running waters. VII. Family Monhysteridae. *Nematologica* (1970) 16 : 492-502.
- Khera, S. 1972. Nematodes from the banks of still and running waters. 12. Order Araeolaimida. *Proc. Zool. Soc. Calcutta*, 25 : 49-58.
- Koshey, P. K., Swarup, G. and Sethi, L. 'Heterodera zae n. sp. (Nematoda : Heteroderidae), a cyst nematode on Zea mays' *Nematologica*, 16 : 511-516, 1971.
- Koshy, P. K., Sosamma, V.K. and Nair, C.P.R. (1976). Preliminary studies on *Rhadopholus similis* (Cob, 1893) Thorne, 1949 infesting coconut and arecanut palms in South India. *Indian J. Nematol.*, 5(1975), 26-35.
- Kreis, H.A. 1930. *Freilebende terrestrische Nematoden aus der Umgebung Von Peking (China). II. Zool. Anz. Leipzig*, 87(3-6), 67-87.
- Lal, A., Mathur, V.K. and Rajan, 1990. Description of *Tylenchorhynchus marudharensis* sp.n. with a note on *Safianema anchilisposoma* (Nematoda: Tylenchida) m from Thar region, India. *Indian. J. Nematol.* (1989), 19 : 51-54.
- De Man, J.G. 1884. Die Frei in der reinen Erde und in sussen Waser lebenden Nematoden der me der Liandischen. Fauna Leiden, 1-206.
- Orley, L. 1880. (Monograph of the Anguillulids) Termeset Fuzetek, 4 : 16-150 (in Magyar and German.)
- Platt, H.M. and Warwick, R. M. 1980. *The significance of free-living nematodes to the*

- Littoral ecosystem*. In. The Shore Environment. 2. Ecosystems. Price, J.H. Irvin, D.E.G. & Farnham, W. F. (editors). London & New Yourk, Academic Press, 729-759p.
- Raski, D.J., Jones, N.O. and Roggen, D.R. 1969. On the morphology and ultrastructure of the esophageal region of *Trichodorus allius* Jensen. Proceedings of the *Helminthological Society of Washington*, **36**, 106-118.
- Sänger, H.L. 1961. Untersuchungen über schwer übertragbare Formen des Rattlevirus. Proc. 4th Conf. Potato Virus Dis., Braunschweig, Germany, 1960, 22-28pp.
- Sasser, J.N. 1979. Economic importance of *Meloidogyne* in tropical contries, In : Lamberti, E and Taylor, C.E. (eds) Root-knot Nematodes (*Meloidogyne* speceies, *Systematics, Biology* and Control. Academic Press, Inc; London and New York, **341-374**.
- Schuermans Stekhoven, J.H. & De Coninck, L.A.P. 1933. Morphologisches Fragen zur Systematik der freilebenden Nematoden. *Verhandlungen der Deutschen Zoologischen Gesellschaft*, **35** : 138-143.
- Schacht, H. 1859. Über eingie Feinde der Rubenfelder. Z. Ver. Rubenzuekerindustrie, **9** : 175-179.
- Schmidt, A. 1871. Über den Ruben-Nematoden (*Heterodera schachtii* A.S.) Z. Zucklnd. Zoolversein, **21** : 1-19.
- Scopoli, G.A. 1777. *Introductio ad historiam naturalem sistens genera lapidum, plantarum et animalium hactenus detecta, characteribus essentialibus donate, in tribus divisa, subinde ad leges naturae*, Prague, 506 pp.
- Sethi, C. L. and Swarup, G. 'Plant parasitic nematodes of north-western India III. The genus *Pratylenchus*' *Indian Phytopath*, **24** : 10-412, 1971.
- Sharma, I. R. and Trivedi, P.C. 'Distribution of phytoparasitic nematodes in the rhizosphere of *Hordeum vulgare* Linn. In Jaipur district, Rajasthan, India' *Curr. Nematol.*, **4** : 135-141, 1993.
- Siddiqi, M.R. 2000. *Tylenchida; Parasites of plants and insects*, 2nd edition. CAB International Wallingford Oxon OX 10 8DE, UK.
- Sol, H.H., van Heuven, J.C. and Seinhorst, J.W. 1960. Transmission of rattle virus and *Atropa belladonna* mosaic virus by nematodes. *Tijdschrift over Plantenziekten*, **66** : 228-231.
- Steiner, G. 1914. Freilebende nematoden aus der Schweiz 2. Teil einer vorläufigen Mitteilung. *Arch. Hydrobiol. Planktonk.*, **9** : 259-276
- Swarup, G. and Sethi, C.L. 'Plant parasitic nematodes of north-western India II. The genus *Helicotylenchus*' *Bull. Ent.*, **9** : 76-80, 1968.
- Tahseen, Q. 2001. A new and a known species of *Achromadora* Cobb, 1913 (Nematoda: Cyatholaimidae) from India. *Journal of Morphology and Systematics*, **3** : 101-108.

- Tahseen, Q., Ahmad, I. & Jairajpuri, M.S. 1995. Two new species of Plectidae from India (Nematoda : Araeolaimida). *Fundamental and Applied Nematology*, **18** : 471-477.
- Tahseen, Q., Hussain, A., Tomar, V., Shah, A.A. & Jairajpuri, M.S. 2004. Description of *Metarhabditis andrassyana* gen. n., sp. n. (Nematoda : Rhabditidae) from India. *International Journal of Nematology*, **14** : 163-168.
- Tahseen, Q.; Jairajpuri, M. S. & Ahmad, I. 1992. Description and developmental biology of *Plectus zelli* n. sp. (Nematoda : Araeolaimida). *Fundamentals and applied Nematology*. **15** : 503-510.
- Van Hoof, H. A. 1962. *Trichodorus pachydermus* and *T. teres*, vectors of the early browning virus of peas. *Tijdschrift Plantenziekten*, **68** : 391-396.
- Van Hoof, H.A. 1964. Serial transmission of rattle virus by a single male of *Trichodorus pachydermus* Seinhorst. *Nematologica*, **10** : 141-144.
- Walia, K.K. & Bajaj, H.K. 1999. *Wilsereptus indicus* sp. n. (Wilsonematidae : Nematoda) from the rhizosphere of cotton from Haryana, India. *Haryana Agricultural University Journal of Research*, **29** : 35-38.
- Walkinshaw, C.H., Griffin, G.D. and Larson, R.H. 1961. *Trichodorus christiei* as a vector of potato corky ring-spot (tobacco rattle) virus. *Phytopathology*, **51** : 806-808.
- Whitehead, A.G., and Hooper, D.J. 1970. Needle nematodes (*Longidorus* spp.) and stubby-root nematodes (*Trichodorus* spp.) harmful to sugar beet and other field crops in England. *Annals of Applied Biology*. **65** : 339-350.
- Whitehead, A.G., Dunning, R.A. and Cooke, D.A. 1971. Docking disorder and root ecoparasitic nematodes of sugar beet. Report of Rothamsted Experimental Station, 1970 : 219-236pp.
- Winfield, A.L. and Cooke, D.A. 1975. The ecology of *Trichodorus*. In : Lamberti, F., Taylor, C. E. and Seinhorst, J. W. (eds), *Nematode vectors of Plant Viruses*. Plenum Press, London : 309-341.
- Yadav, B.S. and Verma, A.C. 1971. 'Cereal cyst eelworm and other nematodes associated with maize in Rajasthan' *Indian J. Nematol.*, **1** : 97-98. 1971.
- Yeates, G.W., Bongers, T., De Goede, R.G.M., D.W. and Georgieva, S.S. 1993. Feeding habits in Nematode families and genera – an outline for soil ecologists. *Journal of Nematology*, **25** : 315-331.