INTRODUCTION

Nematodes are one of the most important and highly diversified groups of multicellular invertebrate animals. Like bacteria, viruses and insects they are found in all kinds of habitat. Most species are free living in soil, salt and fresh waters, while others live as parasites of animals and plants. Cobb (1944) has opined, "... if all the matters in the universe except the nematodes were swept away, our world would still be dimly recognisable .... we would find its mountains, hills, valleys, rivers, lakes and oceans represented by a film of nematodes". According to him, every species of vertebrate is infested usually with two species of nematodes. Since we have about 50,000 species of vertebrates, they should harbour some 100,000 species of nematodes. If we add to this the nematodes associated with invertebrates, plants and those living in soil and waters, it would perhaps be fair to estimate about 500,000 species of nematodes in this world. Out of this huge number, only about 15,000 are known to science till date. Hence, we have so far explored hardly 3.3% of the nematode fauna.

Our knowledge of nematode parasites of man and animals dates back to 4,500 B.C. in the ancient Egyptian history and 2,700 B.C. in China. Hippocrates in 430 B.C. was the first to record the pinworm, Enterobius vermicularis. It will be worthwhile to mention here the names of some earlier workers who have contributed significantly to our knowledge of nematode parasites:
Celsus (53 B.C. - 7 A.D.), Galen (130 - 200 A.D.), Vegetius (400 A.D.), Abertus Maquus (1200 - 1230 A.D.) and Caesalpinus (1600 A.D.). Leidy, Virchow, Herbst and Leukart also made important contributions in this field during 16th to 19th century.

Though the knowledge of animal nematodes is very ancient, the plant and soil nematodes were not discovered until the 17th century mainly because of their small size and the technical difficulties involved in their isolation from the soil and plant tissues. Borellus (1656) recorded the first free living nematode, while Needham (1743) was the first to discover the wheat gall nematode now known as Anguina tritici. Linnaeus (1767), Scopoli (1777), Steinbuech (1799) and others recorded the same species and noted it to be a serious pest of some other cereal also. Berkeley (1855) recorded the second plant parasitic nematode, Meloidogyne sp., while observing the galls produced on greenhouse grown cucumbers in England. Two years later, in 1857, Kuhn found yet another important nematode species which is now known as Delitzschus dispacil from the malformed floral heads of fuller's taesel.

The economic importance of plant parasitic nematodes was first realized when the production of commercially important sugar beet crop suddenly declined in Germany in the second half of the 19th century. In 1859, Schacht discovered a serious disease on sugar beets caused by a species of cyst nematode which was named later Heterodera schachtii by Schmiit (1871). Due to
serious losses in the production of sugarbeets caused by H. schachtii, serious efforts were made by many subsequent workers (Kuhn, Liebchen, Mols, Muller, Chatin and others) to study its life history, habits, distribution and methods of control. In the meantime, Muller (1786), Bory (1824), Dujardin (1845), Carter (1859), Sberth (1863) and a few others reported a large number of species of free living nematodes from the fresh and salt waters.

According to Thorne (1921), the monograph on Anguillulidae published by Bastian (1965) marked the beginning of nematology. In this monograph, Bastian described 100 new species of plant and soil nematodes but the descriptions and illustrations were rather poor. Büchli (1973) for the first time provided detailed descriptions of free living nematode species and also gave a few parameters for differentiating the genera and species. De Man, a Dutch nematologist published in 1876 an excellent and authoritative monograph on plant, soil and fresh water nematodes. The de Manian formula for giving body dimensions of nematodes is still universally used in taxonomical studies on plant and soil nematodes. The excellent compilation by Örley (1931) of 302 species belonging to 27 genera of free living and plant nematodes became a valuable source of reference for nematologists in the coming years. All these significant contributions of the nineteenth century attracted many scientists to nematology during the early 20th century.
A real breakthrough in the history of nematology came when N.A. Cobb joined the U.S. Department of Agriculture in 1907. He (1890-1933) published a series of excellent papers on the taxonomy of fresh water, marine, soil, plant nematodes etc. Detailed morphological studies were carried out and new terminologies were coined by him. The illustrations prepared by Chambers for the scientific research papers of Cobb are still unmatched. An interesting phase of nematology started when Christie and others started to work on applied aspects of some important species of plant-parasitic nematodes in 1936. The history of nematology will remain incomplete without mentioning the valuable contributions made by nematologists like Nicoletsky, Hoffmanner, Fusch, Menzil, Stefanski, Steiner, Coffart, Schneider, Chitwood, T. Coodey, Shuurnans Stekhoven, De Coninck, Thorne etc. during the first half of the 20th century. The books by Chitwood (1937, 50) and De Coninck (1965) on the morphology of nematodes revolutionised the taxonomy of nematodes. Thorne's monographs (1933-75) are landmarks in the history of nematology. Amongst those who pioneered the work in nematology during the last four decades are: Taylor, Golden, Allen, Tarjan, Kralj, Raski, Costenbrink, J. B. Coodey, Jones, Wayns, Andrássy, Coomans, Croll, Loof, Lamberti, Luc, Jairajpuri, Siddiqi, V. Ferris, Ceraert and some others.

After the second world war, due to the awareness of the role played by plant nematodes in limiting agricultural productivity, the nematology has emerged as an independent discipline of biological and agricultural sciences. The nematodes are divided
under two main groups, viz., the nematode parasites of human beings and animals which are included in Helminthology, and the plant and soil nematodes which are dealt under Nematology. The marine and some fresh water nematodes are usually studied independently. Since the nematodes are highly diversified animals, the two main groups of nematodes, viz., animal nematodes and plant and soil nematodes, differ significantly and the taxonomists involved in research on these groups have different priorities and use different parameters in their identification procedures. As a result, the taxonomy of the nematodes has become quite a specialised job requiring our in-depth knowledge of these animals. The specialists of the two nematode groups rarely get an opportunity to exchange their views in national and international conferences and symposia. In fact, this situation has further aggravated the problems in bringing uniformity in the classification of nematodes.

A significant breakthrough in the development of nematology was achieved when the publication of the first international journal, *Nematologica*, began in 1956. At present seven international journals of high standard are published from different parts of the world which are exclusively devoted to papers on plant and soil nematodes. Some research papers are also published in peripheral journals. Every year a large number of papers are published on different aspects of nematodes like taxonomy, morphology, ecology, genetics, physiology, pathogenicity, crop losses, soil amendments, host-parasite relationships, control, etc.
Taxonomy papers get sufficient space in all these journals. A rapid growth in nematode taxonomy may be noted during recent years on the basis of available data. Only 9000 species were known till 1950 whereas the present figure is about 15,000 known species. The descriptions of about 300 new species are published every year. The use of Transmission and Scanning electron microscopes has brought a revolution in the nematode taxonomy. In spite of all the modern facilities and concepts available, the morphological characters appear to be most practical and dominate the present day nematode taxonomy and would perhaps do so in the coming years. However, it does not mean that we should discard all other characters like genetics, embryology, ecology, ethology, physiology, serology, etc. Since the majority of nematode fauna is yet to be explored, the taxonomy must be based on simplicity and should provide quick informations.

In the recent years, taxonomical studies have become more important because the correct identification is the pre-requisite for all applied/experimental work. Sometimes all the money and energy could go waste due to wrong identifications of nematode species specially while controlling these pests by crop rotation. It has been noted that many closely related species of Heterodera, Meloidogyne, Pratylenchus, Ditylenchus and other genera have different host preferences. Unless correct identification is made, it will be difficult to select proper crops. Achievements in finding out the resistant crop varieties also depend largely on the correct identity of the nematode pests.
The work on plant and soil nematodes in India started rather late, though a considerable work had been done on different aspects of animal nematodes. The first plant parasitic nematode (root-knot) was reported by Barber (1901) from tea gardens of South India. Butler (1906) encountered another species of root-knot nematode on black pepper in Kerala. In 1913, he also reported ufra disease of rice caused by *Ditylenchus anisatus* in Bengal. Cobb (1913) reported a species of *Grisacornis* (= now *Hemigrisacornisoides*) from around roots of mango tree in Bangalore (Karnataka). Only a few more stray references are available prior to 1950 (Krishnan, 1933; Ayyar, 1934; Dastur, 1936; Luthra and Vasudeva, 1939; Thapar, 1941; Thomas, 1948; Sanwal, 1951, 1954; Singh, 1952). Cooley (1951) described two new species, *Ditylenchus drapanocercus* and *Aphelenchoides sphecocephalum* from India.

The Department of Zoology of Aligarh Muslim University became the first centre in India to initiate research on the taxonomy of plant and soil nematodes. It was under the able and dynamic leadership of (late) Prof. M. A. Basir that M. R. Siddiqui began his research on nematodes in 1955. Professor Basir had already made valuable contributions on animal nematodes including an authoritative monograph on insect nematodes. Siddiqui published his first paper on nematodes in 1959. In the meantime, Das (1960) from Osmania University published a valuable paper on the nematodes of Andhra Pradesh. F. Khan and S. H. Khan also joined the team of Professor Basir in 1960. In 1961, M. Shamim
Jairajpuri was enrolled as a Ph.D. student under guidance of Dr. Ather H. Siddiqi, a parasitologist of international repute and the present Chairman of the Zoology Department of the Aligarh Muslim University. In 1961, F. G. W. Jones of Rothamsted Experimental Station, U.K., visited Aligarh and imparted advanced training in nematology to the young and highly dedicated workers viz., Siddiqi, Jairajpuri, S. H. Khan, E. Khan, etc. These young and dedicated nematologists published about 100 papers on the taxonomy of nematodes and described more than 150 new species from India up to 1965. Most of these papers were published in journals of international repute. Drs. M. R. Siddiqi and E. Khan left the Zoology Department in 1964, the former joined the Botany Department at A.M.U., Aligarh and the latter IARI, New Delhi. Dr. Siddiqi later (1967) proceeded to U.K. as an employee of the Commonwealth Institute of Helminthology (now International Institute of Parasitology).

The Nematology in India developed with rapid pace after 1965. The Aligarh centre played a key role in taxonomical research in the country. Jairajpuri was the first one in India to initiate work on nematode behaviour and biological control. His book on Predatory nematodes and other publications on Tylenchida, Dorylaimida and Mononchida have become a landmark in the history of nematology of India. It is interesting to note that out of about 700 research papers published on nematode taxonomy from India to date, over 300 (including 3 monographs and a book) have been published from the Zoology Department of
Aligarh Muslim University. Of the remaining papers, about 50% have been published by taxonomists trained in this department; T. Khan at I.A.R.I., New Delhi; Baqri at Zoological Survey of India, Calcutta; Sultan at Punjab Agricultural University, Ludhiana; Bajaj at Haryana Agricultural University, Hisar; and Rahman at Assam Agricultural University, Jorhat. The post-graduate nematology courses were introduced for the first time in the Zoology Department in 1968.

Realising the importance of nematodes and encouraged by the achievements made by the Zoology Department, Dr. Aibarr M. Khan, a plant pathologist in the Department of Botany of the Aligarh Muslim University, organised research in nematology on basic as well as applied aspects. S. I. Husain (1962) started work on the taxonomy of nematodes and published some papers in the sixties. Meanwhile, Edvard and Misra from Muni Agricultural Institute, Allahabad also contributed to the taxonomy of ericoneematids of India.

In 1963, the basic work on nematodes was initiated at Indian Agricultural Research Institute by Prasad, Gopal Swarup and Chawla. At the same time, A. R. Seshadri and his co-workers undertook a research project on the potato cyst nematode in the Nilgiri Hills, Cooyamund, Tamil Nadu. The Government of India and Indian Council of Agricultural Research realised the economic importance of phytophagous nematodes and created an independent Division of Nematology at I.A.R.I., New Delhi in 1966. Dr. A. R. Seshadri was appointed as the first Head of the Division in 1967.
During the last 25 years a remarkable progress has been made in nematological research in India. Many young workers have received training by attending the South East Asia Post-graduate Nematology Courses (1967-79) organised jointly by the Aligarh Muslim University; I. A. R. I., New Delhi and the Agricultural University, Wageningen, The Netherlands. The Nematological Society of India was founded in 1969 and its official publication, Indian Journal of Nematology, was first published in 1971. This was a great achievement as this became the third international journal in the field of nematology. At present over 200 nematologists are involved in research at more than 30 centres, mainly located at Aligarh (Zoology), Aligarh (Botany), IARI, New Delhi; Hisar; Ludhiana; Udaimur; Kanpur; Jhansi; Bangalore; NBPGR, New Delhi; Pantnagar; Trivandrum; Bhubaneswar; Santiniketan; Pusa; Coimbatore and ZSI, Calcutta. Post-graduate teaching has also been initiated at almost all the agricultural universities.

The progress of research in nematology has been quite impressive in the field of taxonomy, ecology, behaviour, biology, pathogenicity, estimation of crop losses, disease complexes, physiology, control including soil amendments, etc. It would be worthwhile to mention here names of some of those who have brought the Indian Nematology to the fore-front in the international field: Jairajpuri, Seshadri, Dasgupta, S. Khan, Swarup, Bhatti, Yadav, Khara, S. V. Das, Mathur and a few others.
A large number of research papers are published every year from India in the Indian Journal of Nematology on different aspects of nematodes including taxonomy. Some of the taxonomical papers from India are also published in international journals like Nematologica, Revue de Nematologie and Nematologia Mediterranea etc. Despite this the basic research in nematology in India still suffers mainly due to lack of literature and some other facilities like the non-availability of good microscopes in many laboratories. This has obviously created some confusion in the early stages but the future of nematode taxonomy appears quite bright in India.

In January 1966, the present author initiated research work in nematology as a first Ph.D. student of Professor M. S. Jairajpuri in the Department of Zoology of the Aligarh Muslim University. The following fibrous crops of economic importance were selected for the study of nematodes: three species of cotton, viz., *Gossypium hirsutum* L., *G. herbaceum* L. and *G. arboraeum* L., the sun hemp, *Crotalaria juncea* L., and patson, *Hibiscus cannabinus* L. During the course of investigations, about 90 species belonging to the Orders Tylenchida, Dorylaimida and Mononchida were reported, 20 of which were described as new to the science. In addition, two new genera, *Jillinema* Baqri & Jairajpuri, 1967 and *Morasia* Baqri & Jairajpuri, 1968 were also proposed. The males of three known species were reported for the first time. The intraspecific variations were also studied in two commonly found species viz., *Tylenchorhynchus meshhoodi*.
Siddiqi & Basir, 1959 and *Thorneneura mauretianum* (Williams, 1960) Baqri & Jairajpuri, 1967. The emphasis was mainly on nematodes belonging to the Order Dorylaimida because some of the species of dorylaims having long ocellostyles either directly damage the plant roots or act as virus vectors. Moreover, the dorylaims are also important because majority of the species are suspected to be predaceous in their feeding behaviour.

In November 1969, I was awarded a fellowship by the Rijksuniversiteit, Gent, Belgium to participate in the first international post-graduate nematology course under the leadership of Professor L. A. P. De Coninck, the foremost nematologist in general nematode morphology and taxonomy of marine nematodes. During stay in Belgium, Professor A. Coomans, a person of dynamic leadership and a nematologist of great eminence suggested to me that I should revise the descriptions of dorylaim species reported by Schuurmans Stekhoven & Teunissen (1938) and Schuurmans Stekhoven (1944) from the Republic of Zaire. The material used in these two publications was brought to Belgium by Professor De Coninck. The revision was felt necessary because some of the new species had been described on single specimens or on juvenile(s). A few species had been described which were actually complex of several species as was evident from the illustrations. The revisionary work by the present author, under the supervision and collaboration of Professor Coomans, resulted in three important publications on nematodes of the families Dorylaimidae, Aporcellaimidae, Longidoridae,
Actinolaimidae and Belonolaimidae. Another paper on the species of *Belonidra* from Africa was also published in collaboration with Coomans.

In August 1971, I returned to India and joined the Department of Zoology at Aligarh Muslim University, as a Pool Officer of the CSIR, New Delhi. This gave me yet another opportunity to do research work in collaboration with my teacher, Professor Jairajpuri. We worked mainly on the nematodes of the high altitudes in India and published four papers during 1971-73. But in 1973, I was selected for the post of Zoologist in the Zoological Survey of India at Calcutta and had to leave Aligarh to join the new assignment. A challenging task and tremendous opportunity awaited me in Calcutta.

The Zoological Survey of India is a unique institution where scientists work on different animal groups and are mainly involved in the exploration and identification of the faunal wealth of the country. My first task was to initiate work on nematodes of fruit trees in West Bengal and this resulted in the publication of a series of papers entitled, "Nematodes from West Bengal (India)". In 1977, the Zoological Survey of India became one of the 14 centres of the All India Coordinated Research Project on Nematode Pests of Crops and their Control (sponsored by the DST and ICAR, New Delhi). As principal investigator of the project, I conducted many intensive and random surveys for the nematodes associated with paddy and citrus trees in the districts of West Bengal and the State of Sikkim. Besides
taxonomical studies, the object of these surveys was to identify the key and the potential pests of paddy and citrus in these two eastern states of India. From the qualitative and quantitative studies on different groups of nematodes it was concluded that *Hirschmanniella gracilis* (de Man, 1880) Luc & Goodey, 1963; *Helicotylenchus graminicola* Golden & Birchfield, 1965 *Helicotylenchus* spp. and *Tylencylorychus* spp. are important pests of paddy in West Bengal. *Scutellospora brachyrurum* (Steiner, 1933) Andrássy, 1933 appeared to be the key pest of citrus in Sikkim.

In the present study, an attempt has also been made to provide a guideline to the new taxonomists working on dorylaeans so that the quality of the descriptions and illustration of nematodes in their research papers may be improved. In this regard, a paper was prepared discussing all the morphological characters of taxonomical importance in the suborder Dorylaeina. Encouraged and convinced by the findings made by Loof and Coomans (1968) on the taxonomical importance of the positions of oesophageal gland nuclei and their orifices in different groups of dorylaeans, the author also prepared a paper on the location of oesophageal gland nuclei and their orifices in different families of the Order Mononchida.

The present thesis incorporates all the research papers reporting the results obtained by the author since 1966.
Under the Order Tylenchida 69 species have been reported belonging to the families Tylenchidae (10), Tylenchorhynchidae (12), Hoplolaimidae (20), Meloidogynidae (1) Pratylenchidae (6), Criconematidae (7), Hemicyclophoridae (2), Psilenchidae (2), Rotylenchulidae (1), Paratylenchidae (2) and Anguiniidae (6), A new genus *Indoditylenchus* under the family Anguiniidae has also been proposed. In fact, many of these species were described under different families, but at present the classification of the Order Tylenchida as proposed by Siddiqi (1986) has been followed except that of the family Tylenchorhynchidae which has been considered as valid. Twelve new species of the Order Tylenchida were found and these have been described in detail. It was also felt necessary by the present author to study the variations and to provide statistical analysis of different morphological characters in important and widely distributed species so that these may be identified correctly before any applied work is initiated. Moreover, the study on variability brings about stability to the taxonomy of a group and the related taxa. In view of these facts, the allometric and morphometric variations of the following commonly found parasite species have been studied: *Tylenchorhynchus meshhoodi* Siddiqi & Basir, 1959; *Tylenchorhynchus nudus* Allen, 1955; *Tylenchorhynchus coffarti* Sturhan, 1966; *Helicotylenchus crenacauda* Sher, 1966; *Helicotylenchus dihystraca* (Cobb, 1933) Sher, 1961; *Hirschmanniella gracilia* (de Man, 1880) Luc & Goodey, 1963; *Hirschmanniella oryzae* (v. Breda de Haan, 1902) Luc & Goodey, 1963; and *Scutellonema brachyurum* (Steiner, 1932) Andrássy, 1959. Keys to species of
the genera *Tylenchorhynchus* Cobb, 1913 and *Hoplolaimus* Daday, 1905 have been prepared.

The species of the Order Dorylaimida have been reported in large numbers. Out of about 200 species under 15 families, 76 have been described as new to science. A new subfamily and three new genera under the family Thorneematidae have been proposed. Another new genus under the family Dorylaimoididae has been described. A large number of known species have been redescribed. Several synonymies and new combinations have been proposed during the course of these investigations. The status and identification of many known taxa have been revised. The males of five known species have been described for the first time. Wherever necessary, keys for identification of genera and their species have been provided. A paper also discusses the characters to be considered important in the taxonomy of Dorylaimina.

During the last 20 years, many changes have been proposed in the classification of Dorylaimida. The inflation in the number of higher taxa has been noted with great concern by the author in recent years. The names of families and superfamilies have been avoided in the introduction of this thesis because the proposals of higher categories and the splitting of genera has created more problems rather than solving them. Though many higher categories have been accepted in the present study, these are still unsatisfactory. Since I am involved in the taxonomy of
lory claims for the last two decades, I intend proposing certain changes in the classification based on sound reasoning, but this will be first discussed in symposia before publication.

The thesis also includes the description of four new species and report of 13 known species belonging to 11 genera and 6 families of the Ordr Mononchida. One paper exclusively deals with the locations of oesophageal gland nuclei and their orifices. The male of *Anatoneschus singlemodontus* Mulvey, 1961 has been described for the first time. In addition, the soil nematodes belonging to some other Orders have also been studied. The diagnosis of the genus *Tridontus* Khara 1965 (Diplolocasteriidae) has been amended and the genus *Sysiella* Suryavanshi, 1971 has been synonymised with the former. Two new species from mangrove environments of the deltaic Sunderbans, West Bengal, India have also been described under the families Anoplochortidae and Oxystominae (one each). Sometimes, the soil samples or the nematodes were received through the courtesy of friends and well wishers from other parts of India and also from some foreign countries. These nematodes were studied and the results have been included in the present thesis. It may be pointed that the status of some of the taxa described as new by the author has changed recently due to splitting, synonymy etc., but for the sake or originality of the work these have been reported as such.

While revising the family Thorneematidae, the type species of the genus *Indorylaimus* Ali & Prabha, 1974 was found to be
mislabeled. As per code of Zoological Nomenclature, I sent an application to the Commission and proposed a new name for the specimens of Ali & Prabha. To this Siddiqi raised an objection which was suitably replied. The correspondence was published in Bull. Zool. Nom., 1984, and was subsequently referred to the members of the Commission. The opinion of the members supported my contention. Since this is an interesting nomenclatorial problem, the correspondence and the opinion of the members which was published in the Bull. Zool. Nom. is being incorporated in the thesis.

It may be concluded from the introductory write up that the taxonomy of plant and soil nematodes is passing through the alpha or early (descriptive) phase. Though it has progressed with rapid pace during the past 25 years, our knowledge of nematode fauna remains still very poor as only 3-4% of the estimated faunal wealth is known to us. The author feels that the taxonomy is a highly specialised job, particularly that of nematodes because their diagnostic characters are very minute. However, the nematode taxonomists are lucky to have modern sophisticated equipments, like Scanning and Transmission electron microscopes, many experimental and applied techniques, use of computers etc. which were not available to the taxonomists working on other groups (e.g., insects, helminths) of animals in the early stage of taxonomy. Unfortunately, these facilities are not available in all laboratories of the world, particularly those of the developing countries.
Under these circumstances, good training is required for the taxonomists not only to study morphological and other characters but also to prepare accurate drawings of the taxa. Faulty observations may confuse future workers as was noticed by the present author while revising the species described by Shuurmans Stekhoven & Teunissen (1938), Shuurmans Stekhoven (1944) and Khéra (1970). The accuracy of the drawings is also very important as has been pointed out by the present author in a paper on the characters to be considered in the taxonomy of Dorylaimina.

The inflation in the number of higher categories should be avoided as far as possible because our knowledge of nematode fauna is very meagre. The splitting of groups has further aggravated the problems and in many instances has obliterated natural inter-relationships of the taxa. In some cases it was noticed that it is far easier to identify certain genera rather than the families to which they belong. Hence, the rapid development in nematode taxonomy, particularly that of higher taxa, has created more problems for the taxonomists themselves. In fact, many gaps in the evolutionary process of nematodes are yet to be traced and filled up. Sometimes, new schemes of classifications together with the proposal of higher categories without proper knowledge of inter-relationship of the group become quite confusing. In groups like birds, mammals etc., where most of the species have been identified, it is easy to work out inter-relationships and present a satisfactory scheme of classification. But in nematodes it is difficult to give a sound classification at least for the
time being as the higher taxa are likely to be based on wrong assumptions.

In view of these facts, it is hereby proposed that we should have specialists on different groups of nematodes so that they may sort out the problems confronting that group more easily and authoritatively. Some people may disagree with this proposal because for them specialisation is only to know more and more about less and less. The author feels that it is the most appropriate time in the history of nematode taxonomy to know more and more about each group of nematodes. For the present, it is expected of the taxonomists to give descriptions of species as complete as possible in all respects adequately supported by well drawn illustrations. The genera should be proposed on the basis of well-defined groups of species and should be demarcated from one another as clearly as possible. The proposal of familial and Ordinal ranks should be restricted to minimum as these are likely to create confusion because of our limited knowledge of nematode taxa.

Since all the surveys conducted by the present author in West Bengal revealed that *Hirschmanniella gracilis* (de Man, 1880) Luc & Goodey, 1933 is a key pest of paddy crop, three field experiments were conducted during the course of the study, viz., seasonal variations in the population levels of *H. gracilis*, estimation of crop losses due to *H. gracilis* in paddy crop, and the effects of different sources of nitrogen on the management
of *H. gracilis*. Three papers based on the results obtained from the above mentioned experiments are added as supplement to the present thesis.

The contents of the thesis form the basis of 67 research papers. This also includes two abstracts of full papers published in the proceedings of symposia. However, these have not been incorporated because they have been included as part of other papers.