

A reappraisal of Tylenchina (Nemata).

8. The family Hoplolaimidae Filip'ev, 1934⁽¹⁾

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SUMMARY

The classification of the family Hoplolaimidae is revised. The families Nemonchidae, Aphasmatylenchidae, and Rotylenchulidae are considered synonyms of Hoplolaimidae. Only two subfamilies are accepted within Hoplolaimidae : Hoplolaiminae (syn. : Nemonchinae, Rotylenchoidinae, Aphasmatylenchinae, Rotylenchinae, and Pararotylenchinae) with eight valid genera : *Hoplolaimus*, *Rotylenchus*, *Helicotylenchus*, *Scutellonema*, *Aorolaimus*, *Aphasmatylenchus*, *Antarctylus*, and *Pararotylenchus*; and Rotylenchulinae (syn. : Acontylinae) with *Rotylenchulus*, *Acontylus*, and *Senegalonema*. *Peltamigratus* and *Nectopelta* are proposed as new synonyms of *Aorolaimus*; *Hoplolaimoides* as a new synonym of *Hoplolaimus*; *Orientylus* and *Varotylylus* as new synonyms of *Rotylenchus*. A tabular key for the identification of the valid genera is presented. New combinations proposed for each accepted genus are listed.

RÉSUMÉ

Réévaluation des Tylenchina (Nemata). 8. La famille des Hoplolaimidae Filip'ev, 1934 (Tylenchoidea)

La classification de la famille Hoplolaimidae est révisée. Les familles des Nemonchidae, Aphasmatylenchidae et Rotylenchulidae sont considérées comme synonymes mineurs des Hoplolaimidae. Deux sous-familles sont acceptées à l'intérieur des Hoplolaimidae : Hoplolaiminae (= Nemonchinae, Rotylenchoidinae, Aphasmatylenchinae, Rotylenchinae et Pararotylenchinae) avec huit genres valides : *Hoplolaimus*, *Rotylenchus*, *Helicotylenchus*, *Scutellonema*, *Aorolaimus*, *Aphasmatylenchus*, *Antarctylus*, *Pararotylenchus*; et Rotylenchulinae (= Acontylinae) avec *Rotylenchulus*, *Acontylus* et *Senegalonema*. *Peltamigratus* et *Nectopelta* sont proposés comme nouveaux synonymes mineurs d'*Aorolaimus*; *Hoplolaimoides* comme nouveau synonyme mineur d'*Hoplolaimus*, et *Orientylus* et *Varotylylus* comme nouveaux synonymes mineurs de *Rotylenchus*. Une clé tabulaire pour l'identification des genres valides est présentée. Une liste des combinaisons nouvelles est présentée pour chaque genre valide.

The hoplolaimids were first proposed as a separate taxon by Filip'ev (1934). At the time, the nominal genus, *Hoplolaimus*, included some species that now belong to the criconematids (*H. annulifer*, *H. informis*, *H. menzeli*, etc., even *Criconema guernei* and *C. morgense* had belonged for a time to *Hoplolaimus*). Not surprisingly, Filip'ev included a number of criconematid genera [*Paratylenchus*, *Iota* (= *Ogma*), *Criconema*, *Procriconema* (= *Hemicycliophora*)] in his new subfamily Hoplolaiminae.

After the organization of the criconematids as a separate subfamily by Taylor (1936), Thorne (1949) rearranged the hoplolaimids to include the genera *Hoplolaimus*, *Rotylenchus*, and *Helicotylenchus* that are still

accepted today as the most typical representatives of the family.

The Thorneian concept of hoplolaimids has been accepted by all later authors. The contribution of the more recent classifications consisted mostly in the addition of newly described genera and the arrangement of recognized genera under various subfamilies. The validity of some of these genera rests on criteria of dubious taxonomic value. The increase in the number of subfamilies (seven subfamilies for eleven valid genera) raise some doubts on the necessity of creating higher rank taxa. The taxonomic position of some genera (*Rotylenchulus*, *Acontylus*) is still unsettled.

Wieser (1953) is generally credited for the upgrade of

(1) This article is part of a study on the classification of Tylenchina by the present author and E. Geraert (Rijksuniversiteit, Gent), M. Luc (ORSTOM, Paris), and A. R. Maggenti and D. J. Raski (University of California, Davis).

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Hoplolaiminae to family level. In fact, the author uses the name "Hoplolaimidae" in only one sentence (p. 452) out of a long article on the morphology of the oral cavity and its relationships with the ecology of marine nematodes. Discussing the cuticular differentiations of the "Monoposthiinae", Weiser continues, "Typisch ist diese Funktion der Kutikularanhänge bei der terrestrischen Familie *Hoplolaimidae* ausgeprägt, wo die Hautstacheln als Antagonisten des durch das Vorschneiden des Speeres erzeugten "Rückstosses" wirken (S. Stauffer, 1924)". (Transl. : "Typically, this function of the cuticular appendages is well marked in the terrestrial family *Hoplolaimidae*, in which the skin spikes act as antagonists of the "reverse push" caused by the thrust of the spear (Stauffer, 1924).")

It is evident that Wieser was not proposing to upgrade the subfamily, but that he was using the name "Hoplolaimidae" as a convenient term to refer to a group of taxa (see Art. 11, e of the International Code of Zoological Nomenclature). It can be noted that Wieser was unfamiliar with the family and was still including in it the criconematids in spite of the works of Taylor (1936) and Thorne (1949). It remains that, because of the coordinate status in the family group (Art. 36), the author of *Hoplolaimidae* is Filip'ev, 1936.

The nominal subfamily *Hoplolaiminae* was included by Goodey (1963) with several other subfamilies (*Rotylenchoidinae*, *Belonolaiminae*, *Dolichodorinae*, *Pratylenchinae*, and *Nacobbiniae*) in a higher rank taxon: *Hoplolaimidae*. Similarly, but at a higher level, Paramonov (1967) grouped *Hoplolaimidae*, *Pratylenchidae*, and *Heteroderidae* under the superfamily *Hoplolaimoidea*.

The present study does not include these higher rankings but presents a reasoned classification of the genera in *Hoplolaimidae* according to the guidelines from Luc *et al.* (1987) and to the classification of *Tylenchina* proposed by Maggenti *et al.* (1987).

Minimal lists of species are given for some genera. Additional information on species nomenclature can be found in Fortuner (1986b).

The family *Hoplolaimidae* Filip'ev, 1934

- = *Nemonchidae* Skarbilovich, 1959
- = *Aphasmatylenchidae* Sher, 1965
- = *Rotylenchulidae* Husain & Khan, 1967

DIAGNOSIS

Tylenchoidea. Lip region higher than 1/2 the diameter of the basal lip annulus, with rounded or trapezoidal outline in lateral view. Stylet strong, 2-1/2-3 times longer than the diameter of the basal lip annulus. Oesophageal glands generally overlapping the anterior intestine. Females with two genital branches, posterior branch sometimes reduced to a post-uterine sac. Columned uterus with three rows of four cells. Phasmids generally

located anterior to anus, rarely on the tail. Tail two body diameters long or less. Caudal alae of male leptoderan. Gubernaculum with titillae. Deirids absent.

The relationship between *Hoplolaimidae* and related families in *Tylenchina* have been discussed by Maggenti *et al.* (1987).

SUBFAMILIES AND GENERA IN HOPLOLAIMIDAE

Type subfamily :

- Hoplolaiminae* Filip'ev, 1934.
- = *Nemonchinae* Skarbilovich, 1959
- = *Rotylenchoidinae* Whitehead, 1958
- = *Aphasmatylenchinae* Sher, 1965 (n. syn.)
- = *Rotylenchinae* Golden, 1971 (n. syn.)
- = *Pararotylenchinae* Baldwin & Bell, 1981 (n. syn.)

- Hoplolaimus* von Daday, 1905
- Rotylenchus* Filip'ev, 1936
- Helicotylenchus* Steiner, 1945
- Scutellonema* Andrassy, 1958
- Aorolaimus* Sher, 1963
- Aphasmatylenchus* Sher, 1965
- Antarctylus* Sher, 1973
- Pararotylenchus* Baldwin & Bell, 1981

Other subfamily :

- Rotylenchulinae* Husain & Khan, 1967
- = *Acontylinae* Fotedar & Handoo, 1978
- Rotylenchulus* Lindford & Oliveira, 1940
- Acontylus* Meagher, 1968
- Senegalonema* Germani, Luc & Baldwin, 1983

COMMENTS

Description of *Hoplolaimidae*

Tylenchoidea. Female vermiform to kidney-shaped; when vermiform, habitus often spiral. Lip region high, typically higher than 1/2 the diameter of the basal lip annulus; anterior end with rounded or trapezoidal outline in lateral view, annulated, sometimes with longitudinal striae on basal lip annulus, rarely striae on other lip annuli. Lateral field typically with four lines, sometimes regressed (some *Hoplolaimus* spp.). Phasmids typically near anus level, rarely on tail, sometimes migrated far anteriorly (*Hoplolaimus*), generally small pore-like structures, sometimes enlarged into scutella, rarely absent (*Aphasmatylenchus*). Tail typically short, less than two tail diameters long, rarely longer; generally more curved dorsally, sometimes regularly rounded, rarely conical. Caudalids and cephalids generally present; deirids absent.

Labial framework strong, with high arches. Stylet strong, its length typically equals to 2-1/2 to 3 times the diameter of the basal lip annulus. Stylet knobs strong, rounded to indented, sometimes anchor-shaped. DGO at least 4 µm, sometimes more than 20 µm, from the stylet base. Median bulb strong, rounded. Oesophageal

glands arrangement variable but mostly overlapping the intestine. Esophago-intestinal junction a small triangular structure.

Two genital branches opposed, outstretched or rarely reflexed (*Rotylenchulus*); posterior branch may be degenerated or reduced to a PUS. Columned uterus with three rows of four cells. Epiptygma and vulval flaps generally present but sometimes inconspicuous.

Male with secondary sexual dimorphism present, with anterior end less developed than in females, sometimes degenerated and non-functional. Caudal alae generally enveloping the tail end, rarely stopping short of it (*Rotylenchulus*). Gubernaculum with titillae.

Biology : Typically, ecto or semi endo-parasites of higher plants.

Synonymization of families and subfamilies

Nemonchus, type genus of Nemonchinae and Nemonchidae, has been shown by Thorne (1935) to be identical with *Hoplolaimus* because the differentiating characters of *Nemonchus galeatus* are artefacts created by a bad fixation of *Hoplolaimus coronatus*. This makes the family Nemonchidae a junior synonym of *Hoplolaimidae*.

Rotylenchoidinae was created for the taxa with a single genital branch, differentiated from the other hoplolaimids with two genital branches. It has been argued (Fortuner, 1984 and see below the discussion on *Helicotylenchus*) that the regression of part of the female genital system is not a sound basis for generic differentiation, far less for the definition of a subfamily.

Aphasmatylenchinae, elevated to family rank by Fotedar and Handoo (1978), was differentiated from Hoplolaiminae by the absence of phasmids, the elongated amphid apertures, and the shape of the esophageal glands. The regression of an organ should not be used for taxonomic purposes. The amphids of *Aphasmatylenchus* were studied with SEM by Sher and Bell (1975). They are of the same relative length as the amphids of *Helicotylenchus hydrophilus* and *Antarctylus humus* (compare figs 6 A, 8 B, and 8 C in Sher & Bell, 1975). Sher and Bell (1975) concluded that *Aphasmatylenchus nigeriensis* "has a face view similar to the basic pattern seen in the Hoplolaimidae". Esophageal glands are variously arranged in different genera of Hoplolaimidae: abutting lobes in *Pararotylenchus*; dorsal overlap in *Rotylenchus*, *Scutellonema*, and *Hoplolaimus*; equal ventral and dorsal overlap in *Helicotylenchus*; unequal ventral and dorsal overlap in *Antarctylus*; ventral overlap short in *Aphasmatylenchus* and long in Rotylenchulinae. To accept the gland arrangement as a subfamily character would result in the creation of nearly as many subfamilies as there are valid genera in Hoplolaimidae.

Rotylenchinae groups *Rotylenchus* and *Helicotylenchus* with phasmids pore-like, differing from *Hoplolaimus* and related genera with enlarged scutella. There

exists a number of differences between *Rotylenchus* and *Helicotylenchus* (i.e., position of DGO, esophageal glands arrangement, striations of the basal lip annulus), that speaks against a close relationship between the two genera. On the other hand, *Rotylenchus*, except for the size of the phasmids, is remarkably similar to *Scutellonema*. *Rotylenchus* and *Scutellonema* should be kept in the same subfamily.

Pararotylenchinae would be the most acceptable of the proposed subfamilies. This monotypic taxon includes a genus very different from the rest of the Hoplolaimidae. Some species of *Pararotylenchus* were originally described in *Tylenchorhynchus*. In fact, *Pararotylenchus* can be seen as an evolutionary dead-end where some belonolaimid species engaged in the way to the hoplolaimids but were not quite successful in evolving the modified esophageal glands characteristics of the family. However, the main justification for Pararotylenchinae is the arrangement of the esophageal glands. As for Aphasmatylenchinae, Pararotylenchinae is rejected to avoid an inflation in the number of subfamilies.

The subfamily **Hoplolaiminae** Filip'ev, 1934

DIAGNOSIS

Hoplolaimidae. Adult female remains vermiform. Lateral field with four lines or less. Phasmids near anus or erratic, anteriorly migrated on body, rarely on tail, small or enlarged, rarely absent. Tail short, more curved dorsally with or without a ventral projection, or regularly rounded, rarely conoid. Caudalids and cephalids present, labial framework and stylet strong. DGO more or less far from stylet. Esophageal glands either of the same length and not overlapping the intestine, or variously enlarged and overlapping the intestine. Genital branches always outstretched, two of equal length or posterior branch smaller or reduced to a post-uterine sac (PUS).

Male with anterior end smaller than females but still functional. Caudal alae enveloping tail end.

Migratory ecto or semi-endo parasites of higher plants. Eggs not deposited in a gelatinous matrix.

Type genus : *Hoplolaimus* von Daday, 1905.

THE GENERA IN HOPLOLAIMINAE

Pararotylenchus Baldwin & Bell, 1981

Diagnosis :

Hoplolaiminae. *Female* : Body spiral to C-shaped. Labial region annulated; oral opening slit-like; round labial disc present; amphid apertures elongate at lateral edge of disc; first lip annulus divided into six lip sectors; lateral sectors smaller than the others (SEM). Lateral field with four lines. Labial framework, stylet and stylet knobs average sized for the family; knobs round to

indented. DGO about 4-7 μm from stylet base. Esophageal glands not overlapping intestine, symmetrically arranged around esophageal lumen. Two genital branches outstretched, equally developed. Epitygma double, present. Tail short, of variable shape, usually more curved on dorsal side; phasmids small, pore-like, near level of anus. *Male* : Caudal alae enveloping tail. Gubernaculum reflexed distally and with small titillae. Spicules trough-shaped. No secondary sexual dimorphism.

Type species :

Pararotylenchus hopperi Baldwin & Bell, 1984
= *P. brevicaudatus* (Hopper, 1959) Baldwin & Bell, 1981.

Other species :

See list in Baldwin and Bell (1981).

Discussion :

Pararotylenchus belongs to Hoplolaimidae because of the short tail, phasmids near anus level, DGO more than 4 μm from the stylet base, high labial region, strong stylet and labial framework, and spiral habitus. The esophageal glands not overlapping the intestine are similar to the glands in *Tylenchorhynchus* and some other Belonolaimidae. In the hypothesis that hoplolaimids originated from belonolaimid-like ancestral forms, *Pararotylenchus* can be seen as a relict of the intermediary forms where some but not all of the characters of Hoplolaimidae were present. If this hypothesis is true, the arrangement of the esophageal glands, that had been used (for example, by Thorne, 1949) to differentiate *Tylenchorhynchus* and the Tylenchinae from the Hoplolaimidae, was in fact the last character to evolve.

Pararotylenchus is very close to *Rotylenchus* and, except again for the arrangement of the glands, there is little to separate the two genera. It is probable that *Rotylenchus* evolved directly from proto-*Pararotylenchus* forms when the dorsal esophageal gland enlarged and overlapped the intestine. Other differences between the two genera, such as the presence of longitudinal striae on the lip annuli, appeared only later and are visible today only in some species of *Rotylenchus*. Baldwin and Bell (1981) noted that a morphological continuum exists from *Pararotylenchus*, with glands of equal length, not overlapping the intestine, and esophageal lumen symmetrically arranged between the three glands, to *Rotylenchus fallorobustus* and *R. breviglans* who also have glands of equal length not overlapping the intestine but where the esophageal lumen is shifted ventrally between the subventral glands, and finally to the typical *Rotylenchus* spp. with dorsal overlap.

Rotylenchus Filip'ev, 1936

= *Anguillulina* (*Rotylenchus*) Filip'ev, 1936
= *Gottholdsteineria* Andr ssy, 1958

= *Orientylus* Jairajpuri & Siddiqi, 1977
= *Calvatylus* Jairajpuri & Siddiqi, 1977
= *Varotylylus* Siddiqi, 1986 (n. syn.)

Diagnosis :

Hoplolaiminae. *Female* : Body spiral to C-shaped. Labial region offset or continuous with body contours, anteriorly rounded or flattened, generally annulated, with or without longitudinal striae on basal lip annulus. Lateral field with four lines, with or without scattered transverse striae. Labial framework, stylet, and stylet knobs average sized for the family; knobs with rounded to indented anterior surface. DGO often close to stylet (6 μm) but with a tendency to posteriorly directed migration (up to 16 μm). Esophageal glands overlap intestine dorsally and laterally; dorsal gland more developed than subventral glands; intestine symmetrically arranged between the subventral glands. Two genital branches outstretched, equally developed; posterior branch rarely degenerated. Epitygma single or double present. Tail short, hemispherical, rarely with small ventral projection; phasmids pore-like, small, near anus level. *Males* : Caudal alae enveloping tail, not lobed. Secondary sexual dimorphism not marked, sometimes anterior part of male body slightly smaller than female.

Type species :

Rotylenchus robustus (de Man, 1876) Filip'ev, 1936.
= *Hoplolaimus uniformis* Thorne, 1979
= *Scutellonema picea* Gubina, 1973

Other species :

R. abnormecaudatus Van den Berg & Heyns, 1974
R. acuspicaudatus Van den Berg & Heyns, 1974
R. agnetis Szczygiel, 1968
R. alpinus Eroshenko, 1976
R. basiri (Khan & Khan, 1982) n. comb.
= *Orientylus basiri* Khan & Khan, 1982
= *Varotylylus basiri* (Khan & Khan, 1982) Siddiqi, 1986
R. bialaebursus Van den Berg & Heyns, 1974
R. brevicaudatus Colbran, 1962
R. breviglans Sher, 1965
R. buxophilus Golden, 1956
= *R. sheri* Jairajpuri, 1964
R. calvus Sher, 1965
= *Calvatylus calvus* (Sher, 1965) Jairajpuri & Siddiqi, 1977
R. capensis Van den Berg & Heyns, 1974
R. capitatus Eroshenko, 1981
R. catharinae Van den Berg & Heyns, 1974
R. caudaphasmidius Sher, 1965
R. citri Rashid & Khan, 1974
= *Orientylus citri* (Rashid & Khan, 1974) Jairajpuri & Siddiqi, 1979
= *Varotylylus citri* (Rashid & Khan, 1974) Siddiqi, 1986
R. cypriensis Antoniou, 1980
R. dalhousiensis Sultan & Jairajpuri, 1979
R. desouzai (Kumar & Rao, 1976) Fortuner, 1984

- = *Rotylenchoides desouzai* Kumar & Rao, 1976
 = *Orienteilus desouzai* (Kumar & Rao, 1976) Orton Williams, 1984
R. devonensis Van den Berg, 1976
R. elegans (Khan & Khan, 1982) n. comb.
 = *Orienteilus elegans* Khan & Khan, 1982
 = *Varotylus elegans* (Khan & Khan, 1982) Siddiqi, 1986
R. eximius Siddiqi, 1964
R. fabalus Baïdulova, 1984
R. fallorobustus Sher, 1965
R. feroxcis Eroshenko, 1981
R. geraerti (Jairajpuri & Siddiqi, 1979) Zancada & Lima, 1986
 = *Orienteilus geraerti* Jairajpuri & Siddiqi, 1979
R. glabratus Kankina & Teben'kova, 1980
R. goodeyi Loof & Oostenbrink, 1958
R. gracilidens (Sauer, 1958) Sauer, 1958
R. helicus Husain & Khan, 1967
 = *Varotylus helicus* (Husain & Khan, 1967) Siddiqi, 1986
R. heredicus (Jairajpuri & Siddiqi, 1979) Ferraz, 1980
 = *Calvatylus heredicus* Jairajpuri & Siddiqi, 1979
R. himprus (Sultan, 1980) n. comb.
 = *Orienteilus himprus* Sultan, 1980
 = *Varotylus himprus* (Sultan, 1980) Siddiqi, 1986
R. impar (Phillips, 1971) Germani, Baldwin, Bell & Wu, 1986
 = *Scutellonema impar* Phillips, 1971
R. incisicaudatus (Phillips, 1971) Germani, Baldwin, Bell & Wu, 1986
 = *Scutellonema incisicaudatum* Phillips, 1971
R. incultus Sher, 1965
R. indorobustus Jairajpuri & Baqri, 1973
 = *Scutellonema petersi* Mahajan, 1977
R. insularis (Phillips, 1971) Germani, Baldwin, Bell & Wu, 1986
 = *Scutellonema insulare* Phillips, 1971
R. ivanovae Kankina & Teben'kova, 1980
R. jagatpurensis Sultan, 1985
R. karachiensis (Maqbool & Ghazala, 1984) n. comb.
 = *Orienteilus karachiensis* Maqbool & Ghazala, 1984
R. laurentinus Scognamiglio & Talame', 1973
R. leviflexus (Phillips, 1971) Germani, Baldwin, Bell & Wu, 1986
 = *Scutellonema leviflexus* Phillips, 1971
R. lobatus Sultan, 1985
R. microstriatus Siddiqi & Corbett, 1983
R. minutus (Sher, 1964) Germani, Baldwin, Bell & Wu, 1986
 = *Scutellonema minutum* Sher, 1964
R. neorobustus Sultan & Jairajpuri, 1979
R. nexus Ferraz, 1980
 = *Calvatylus nexus* (Ferraz, 1980) Siddiqi, 1986
R. orientalis Siddiqi & Husain, 1964
 = *Orienteilus orientalis* (Siddiqi & Husain, 1964) Jairajpuri & Siddiqi, 1977
 = *Helicotylenchus orientalis* (Siddiqi & Husain, 1964) Geraert, 1976
R. peculiaris (Khan & Khan, 1982) n. comb.
 = *Orienteilus peculiaris* Khan & Khan, 1982
 = *Varotylus peculiaris* (Khan & Khan, 1982) Siddiqi, 1986
R. phaliurus Siddiqi & Pinochet, 1979
R. pruni Rashid & Husain, 1972
R. pumilus (Perry in Perry, Darling & Thorne, 1959) Sher, 1961
R. quartus (Andrássy, 1958) Sher, 1961
 = *Gottholdsteineria quarta* Andrássy, 1958
R. ranapoi Darekar & Khan, 1982
 = *Varotylus ranapoi* (Darekar & Khan, 1982) Siddiqi, 1986
R. rugatocuticulatus Sher, 1965
R. satsilinicus Sultan, 1985
R. secundus Mulk & Jairajpuri, 1976
 = *Orienteilus secundus* (Mulk & Jairajpuri, 1976) Jairajpuri & Siddiqi, 1979
 = *Varotylus secundus* (Mulk & Jairajpuri, 1976) Siddiqi, 1986
R. siddiqii (Mulk & Jairajpuri, 1986)
 = *Orienteilus siddiqii* (Mulk & Jairajpuri, 1976) Jairajpuri & Siddiqi, 1979
 = *Varotylus siddiqii* (Mulk & Jairajpuri, 1976) Siddiqi, 1986
R. symmetricus (Sultan, 1980) n. comb.
 = *Orienteilus symmetricus* Sultan, 1980
 = *Varotylus symmetricus* (Sultan, 1980) Siddiqi, 1986
R. triannulatus Van den Berg & Heyns, 1974
R. uniformis (Thorne, 1949) Loof & Oostenbrink, 1958
R. unisexus Sher, 1965
R. usitatus Van den Berg & Heyns, 1974
R. varus (Jairajpuri & Siddiqi, 1979) Zancada & Lima, 1986
 = *Orienteilus varus* Jairajpuri & Siddiqi, 1979
 = *Varotylus varus* (Jairajpuri & Siddiqi, 1979) Siddiqi, 1986

The names *R. cognatus*, *R. julaharensis*, *R. yarikaensis*, *O. populus*, and *O. prominens* proposed in a thesis (Kapoor, 1982) are not available. *Tylenchus kreisi* Fortuner, 1985 (nom. nov. for *T. robustus exiguus* Kreis, 1926) and *R. steineri* (Stefanski, 1916) Siddiqi, 1986 (= *Aphelenchus steineri* Stefanski, 1916) were placed by Siddiqi (1986) in *species inquirendae* under *Rotylenchus*.

Discussion :

The name *Rotylenchus* was first proposed in 1934 in two separate works by Filip'ev but was not described at the time. The name became available only in July 1936 when Filip'ev proposed it again in a differentiating key (Sher, 1965).

The differentiation of *Rotylenchus* from related genera was difficult at first, partly because the status of the type species was not clear. Sher (1965) reviewed the discussion about the identity of the type species and accepted *R. robustus* (de Man, 1876) as the correct type species. He also synonymized *Gottholdsteineria* András-

sy, 1958 with *Rotylenchus* and differentiated *Rotylenchus* from *Helicotylenchus* primarily by the prominent dorsal overlap of the esophageal glands. Sher's conclusions have been universally accepted.

Recently some *Rotylenchus* spp. were transferred into two new genera, *Calvatylus* and *Orientylus*.

Calvatylus Jairajpuri & Siddiqi, 1977 was differentiated from *Rotylenchus* by a labial region non offset and without annuli nor longitudinal striae, and by a male tail shorter than the body width. Ferraz (1980) showed that labial characters may be variable within the same population, and that short-tailed males are known for some species of *Rotylenchus* s. str. The synonymization of *Calvatylus* with *Rotylenchus* proposed by Ferraz (1980) is accepted here.

Orientylus Jairajpuri & Siddiqi, 1977 differs from *Rotylenchus* by the more posterior position of the DGO and by the smaller, narrower lip region. Also there are no longitudinal striae on the basal lip annulus of the species in *Orientylus*.

There are several species of *Rotylenchus* s. str. with no striae on the basal annulus and/or with narrow head, for example *R. caudaphasmidius* Sher, 1965 and *R. breviglans* Sher, 1965. The position of the DGO remains the only difference between *Rotylenchus* and *Orientylus*.

The position of DGO is traditionally given as ratio 0. This ratio was shown by Fortuner (1984a) to be unsuited for taxonomic purposes. The actual distance in micrometers between stylet base and gland opening was estimated from holotype measurements, calculated from figures, or found given in the text, of descriptions of species of *Rotylenchus*. The distribution of specific values of DGO in *Rotylenchus* s.l. ranges from 4 to 15 μm and peaks at 6 μm . The distribution is heavy tailed to the right. The proposal of *Orientylus* can be seen as an attempt to restore normality in *Rotylenchus* by eliminating from this genus the species with DGO equal or greater than 11 μm . (However, *R. eximius* was kept in *Rotylenchus* in spite of its DGO = 11-13 μm , probably because of its offset labial region with striated basal lip annulus.)

There is no reason why the distribution of specific measurements should be normal in a genus. The distribution of specific DGO values in *Rotylenchus* results from a trend for posteriorly directed migration of the gland opening. This trend is manifest only in about a third of the species, but these species are not different (from the rest of their description) from the species where the posterior migration has not yet started. The creation of a separate genus for those species is not justified for systematic purposes.

It may also be noted that the acceptation of *Orientylus* is also not justified for generic identification. The range of specific values is about 4-12 μm in *Rotylenchus* s. str., 11-15 μm in *Orientylus*. No study has been found in the literature on intraspecific variability of DGO in *Rotylenchus*. In the related genus *Helicotylenchus*, DGO varies

from 9-13 μm (mean values) and 5-15 μm (individual values) in different populations of *H. pseudorobustus*. A similar specific variability in *Rotylenchus* would make impossible in many cases the identification of the genus *Orientylus*.

As already proposed by Zancada and Lima (1986) *Orientylus* Jairajpuri & Siddiqi, 1977 is here considered as a junior synonym of *Rotylenchus* Filip'ev, 1936.

Some species in *Orientylus* were placed by Siddiqi (1986) in a new genus, *Varotylylus*. The two genera are differentiated by the development of the female posterior genital branch, non-functional or absent in *Orientylus* s. str., well developed in *Varotylylus*. This character is not accepted at generic level. (See below the discussion on the synonymization of *Rotylenchoides* with *Helicotylenchus*.)

Varotylylus is here proposed as a new junior synonym of *Rotylenchus*.

Scutellonema Andr ssy, 1958

Diagnosis :

Hoplolaiminae. *Female* : Body spiral to C-shaped or almost straight. Labial region narrow truncate to offset rounded; annulated, with or without longitudinal striae. First labial annulus divided into six sectors, lateral sectors smaller than the others (SEM). Amphid apertures oval between labial disc and lateral sectors. Lateral field with four lines usually areolated near phasmids and anteriorly, sometimes transverse striae scattered over whole field. Labial framework, stylet and stylet knobs average sized for the family; knobs rounded to indented. DGO 4-8 μm from stylet base. Esophageal gland overlap dorsal and lateral. Two genital branches outstretched, equally developed. Epiptygma present. Tail short, rounded; phasmids enlarged (scutella) situated opposite each other, near anus level. *Male* : Caudal alae enveloping tail tip, regular or rarely deeply lobed. No secondary sexual dimorphism.

Type species :

Scutellonema blaberum (Steiner, 1937) Andr ssy, 1958.

Other species :

See list in Germani *et al.* (1986).

Discussion :

Scutellonema is close to *Rotylenchus*, as seen by size, general appearance, and mostly arrangement of the esophageal glands. There are some slight differences between the two genera, for example, *Scutellonema* has lateral field generally areolated at phasmids and anteriorly. However the primary difference between the two genera is the size of the phasmids enlarged to scutella in *Scutellonema*, pore-like in *Rotylenchus*.

In this aspect *Scutellonema* is intermediate between *Rotylenchus* with pore-like, adanal phasmids and *Hoplolaimus* where the migration of the scutella anteriorly to anus is often accompanied by the evolution of other characters.

***Aorolaimus* Sher, 1963**

- = *Peltamigratus* Sher, 1964 (n. syn.)
- = *Nectopelta* Siddiqi, 1986 (n. syn.)

Diagnosis :

Hoplolaiminae. *Female* : Body spiral to C-shaped, medium sized. Lip region slightly offset or continuous with body, with or without annuli and/or longitudinal striae. Lateral field with four or less incisures. Labial framework and stylet medium sized; stylet knobs flattened to indented anteriorly. DGO 3-10 µm from stylet base. Esophageal glands with three nuclei, overlap intestine dorsally and laterally; intestine symmetrically arranged between the subventral glands. Two genital branches outstretched, equally developed. Tail short, rounded. Phasmids enlarged to scutella erratically situated on body, not opposite each other, anterior to anus level; sometimes one scutellum is anterior to vulva level. *Male* : Caudal alae enveloping tail, lobed or regular. Secondary sexual dimorphism visible in labial region and esophageal structures smaller in males.

Type species :

Aorolaimus helicus Sher, 1963.

Other species :

- A. annulatus* (Mulk & Siddiqi, 1982) n. comb.
= *Peltamigratus annulatus* Mulk & Siddiqi, 1982
= *Nectopelta annulata* (Mulk & Siddiqi, 1982) Siddiqi, 1986
- A. baldus* Thorne & Malek, 1968
- A. brevicaudatus* (Doucet, 1984) n. comb.
= *P. brevicaudatus* Doucet, 1984
= *N. brevicaudata* (Doucet, 1984) Siddiqi, 1986
- A. browni* (Khan & Zakiuddin, 1968) n. comb.
= *P. browni* Khan & Zakiuddin, 1968
- A. capsici* Jiménez-Millán, Arias-Delgado & Fijo, 1964
- A. christiei* (Golden & Taylor, 1956) n. comb.
= *Rotylenchus christiei* Golden & Taylor, 1956
- A. conicori* (Doucet, 1984) n. comb.
= *P. conicori* Doucet, 1984
= *N. conicori* (Doucet, 1984) Siddiqi, 1986
- A. holdemani* (Sher, 1964) n. comb.
= *P. holdemani* Sher, 1984
- A. ibiboca* (Monteiro & Choudhury, 1978) n. comb.
= *P. ibiboca* Monteiro & Choudhury, 1978
- A. indicus* (Khan, 1972) n. comb.
= *P. indicus* Khan, 1972
- A. intermedius* Suryawanshi, 1971
- A. leiomerus* (de Guiran, 1963) de Guiran & Sher, 1969
= *Hoplolaimus leiomerus* de Guiran, 1963
= *A. israeli* Sher, 1963
- A. leipogrammus* Sher, 1963

- A. longistylus* (Doucet, 1980) n. comb.
= *P. longistylus* Doucet, 1980
= *N. longistylus* (Doucet, 1980) Siddiqi, 1986
- A. luci* (Sher, 1964) n. comb.
= *P. luci* Sher, 1964
- A. macbethi* (Sher, 1964) n. comb.
= *P. macbethi* Sher, 1964
- A. nigeriensis* (Sher, 1964) n. comb.
= *P. nigeriensis* Sher, 1964
- A. pachyurus* (Loof, 1964) n. comb.
= *P. pachyurus* Loof, 1964
- A. perscitus* (Doucet, 1980) n. comb.
= *P. perscitus* Doucet, 1980
= *N. perscitus* (Doucet, 1980) Siddiqi, 1986
- A. sheri* (Andrássy, 1968) n. comb.
= *P. sheri* Andrássy, 1968
- A. striatus* (Smit, 1971) n. comb.
= *P. striatus* Smit, 1971
- A. thornei* (Knobloch, 1969) n. comb.
= *P. thornei* Knobloch, 1969
- A. torpidus* Thorne & Malek, 1968
- A. triticeus* (Doucet, 1984) n. comb.
= *P. triticeus* Doucet, 1984
= *N. triticeus* (Doucet, 1984) Siddiqi, 1986

Discussion :

The original diagnosis of *Peltamigratus* used three characters to differentiate this genus from *Aorolaimus* : (i) position of phasmids (both between anus and vulva vs one anterior to vulva in *Aorolaimus*); (ii) lip annulation (lip region without striation vs annuli present in *Aorolaimus*); and (iii) shape of male caudal alae (indented vs regular in *Aorolaimus*).

Smit (1971) noted that some species, placed in *Peltamigratus* because of the position of the phasmids, do not follow the generic diagnosis for the other two characters. *P. christiei* and *P. holdemani* have sometimes a labial region finely striated; males of *P. holdemani* and *P. machbethi* have caudal alae with only two small indentations. Smit added a new species to the genus, *P. striatus*, with lips markedly annulated and male caudal alae not indented.

Doucet (1980) recently described *P. longistylus* with lips annulated and *P. perscitus* also with lip annulated and with caudal alae not indented.

Both Smit (1971) and Doucet (1980) noted that, of the three diagnostic characters proposed by Sher (1964), only the first one — position of the scutella — is valid.

The small difference in position of scutella is certainly a good character for specific identification, but its value for the taxonomic differentiation of the genus is questionable. The position of the scutella in the related genus *Hoplolaimus* may also vary. Some species in *Hoplolaimus* have both scutella posterior to vulva or both anterior to vulva.

Because a single identifying character is not a sound basis for the definition of a genus, *Peltamigratus* Sher,

1964 is here proposed as a new synonym of *Aorolaimus* Sher, 1963.

Siddiqi (1986) proposed a new genus, *Nectopelta*, for six species in *Peltamigratus* (*P. annulatus*, [type], *P. brevicaudatus*, *P. conicori*, *P. longistylus*, *P. perscitus*, and *P. triticeus*). *Nectopelta* was differentiated from *Peltamigratus* by three characters : i) labial region distinctly annulated; ii) marked by longitudinal grooves and; iii) areolations of lateral field at phasmid level.

A number of *Peltamigratus* spp. (s. str.) have labial region distinctly annulated, particularly so *P. striatus* and *P. holdemani*.

In the absence of SEM face views, it is difficult to prove the lack of longitudinal grooves in *Peltamigratus* s. str. Light microscope face views of several such species in Sher (1964) do show a six-sectored structure. Even if further studies prove the absence of grooves in *Peltamigratus* s. str., and their presence in *Nectopelta*, this character may not be acceptable at generic level. Face views as seen with SEM can vary within certain genera such as *Helicotylenchus* (Fortuner, 1986) or *Hemicyclophora* (Loof, 1986). Use of such a criterion needlessly would increase the number of genera.

Differences in areolation have been reported in many genera; for example, *Scutellonema* (Germani *et al.*, 1986). This character can be used only for species identification.

Nectopelta is here synonymized with *Aorolaimus* (= *Peltamigratus*).

- Hoplolaimus*** von Daday, 1905
- = *Nemonchus* Cobb, 1913
- = *Hoplolaimoides* Shakil, 1973
- = *Basirolaimus* Shamsi, 1979

Diagnosis :

Hoplolaiminae. *Female* : Body straight, large (1-2 mm long). Lip region offset from body, wide, anteriorly flattened, with clearly marked annuli, and with longitudinal striae. Lateral field with four lines or less, generally areolated at level of phasmids and anteriorly, sometimes with striae irregularly scattered over entire field, rarely not areolated. Labial framework and stylet massive; stylet knobs anchor or tulip-shaped. DGO 3-10 µm from stylet base. Esophageal glands overlap intestine dorsally and laterally; sometimes gland nuclei duplicated to a total of six nuclei; intestine symmetrically arranged between the subventral glands. Two genital branches outstretched, equally developed. Tail short, rounded, phasmids enlarged to scutella erratically situated on body, anteriorly to anus level, and sometimes anterior to vulva level, not opposite each other. *Male* : Caudal alae enveloping tail, regular. Secondary sexual dimorphism visible in labial region and esophageal structures smaller in males.

Type species :

Hoplolaimus tylenchiformis von Daday, 1905.

Other species :

See list in Luc, 1981.

Discussion :

Hoplolaimus was described originally from a single specimen of the type species. This specimen was re-described by Andrassy in 1954 then lost in 1956 (Sher, 1961).

The genus *Nemonchus* Cobb, 1913, was thought by Thorne (1935) to be the result of a fixation artifact. Filip'ev and Schuurmans Stekhoven (1941) accepted the opinion of Thorne and listed *Nemonchus galeatus*, type and only species of *Nemonchus*, as a synonym of *Hoplolaimus coronatus*. Sher (1961) formally recognized *Nemonchus* as a synonym of *Hoplolaimus*; transferred *Nemonchus galeatus* to *Hoplolaimus galeatus*; and restored the law of priority by listing *H. coronatus* Cobb, 1923 as a synonym of *H. galeatus* (Cobb, 1913).

Two new genera were recently proposed for species previously in *Hoplolaimus* : *Hoplolaimoides* Shakil, 1973, and *Basirolaimus* Shamsi, 1979.

Hoplolaimoides was proposed during the annual meeting of the National Academy of Science, India, in 1973. The proceedings of this meeting were printed and the new name is available according to the provisions of the International Code of Zoological Nomenclature.

Hoplolaimoides includes only one species, *H. californicus*, distinct from the species in *Hoplolaimus* s. str. in having both scutella posterior to vulva, an arrangement proposed as typical of *Peltamigratus* (Sher, 1964). Except for this posterior location of the scutella, *H. californicus* is a typical member of the genus *Hoplolaimus* and it does not seem justified to create a genus based on a single character. If *Hoplolaimoides* were accepted, a second new genus should be proposed for *H. puertoricensis* where the position of scutella is also different from the rest of *Hoplolaimus* (in *H. puertoricensis*, both scutella are anterior to vulva). The position of the scutella is a good character for identification but does not appear meaningful for the taxonomic differentiation of genera. *Hoplolaimoides* is here accepted as a junior synonym of *Hoplolaimus* as already proposed without arguments or justification by Siddiqi (1986).

Basirolaimus was established for the species in *Hoplolaimus* with six esophageal gland nuclei. Luc (1981) argued that the duplication of the normal complement of three nuclei to five or six nuclei was only an intra-generic variation. Luc (1981) proposed *Basirolaimus* as a junior synonym of *Hoplolaimus*.

Siddiqi (1986) rejected Luc's (1981) conclusion on the grounds that the extra nuclei in *Basirolaimus* result of duplication of the dorsal nucleus alone. This does not detract from the validity of Luc's reasoning (mere duplication of nuclei is not a valid generic character). The synonymization of *Basirolaimus* with *Hoplolaimus* is reinstated here.

Antarctylus Sher, 1973

Diagnosis :

Hoplolaiminae. *Female* : Body vermiform, spiral to C-shaped. Labial region rounded, continuous, annulated; anterior lip annulus not divided into sectors (SEM). Lateral field with four lines. Phasmids small, near anus. Caudalids not described. Tail rather long (2-3 body diameters long), conoid, pointed. Stylet and cephalic framework average sized. DGO about 10 µm from stylet base in the only species known in this genus. Median bulb oval/rounded with average sized valve. Glands overlapping the intestine; the dorsal gland and one subventral gland overlap dorsally, the second subventral gland overlaps ventrally for a short distance. Both subventral glands are shorter than the dorsal one. Esophago-intestinal junction a small triangular structure. Two equally developed genital branches. One or two epitygma present, inconspicuous. Vulval flap not described. *Male* : Slight secondary sexual dimorphism seen in smaller anterior end. Tail with long hyaline end. Caudal alae said to envelop tail end, but seen stopping just short of tail tip in original figure. Gubernaculum not described; titillae not figured.

Type and only species :

A. humus Sher, 1973.

Discussion :

The only species in the genus presents all the characters of Hoplolaiminae, except the female tail, longer and more pointed than usual. Some Rotylenchulinae also have long pointed tails.

The arrangement of the esophageal glands is similar to that of *Helicotylenchus*, but in *Antarctylus* the subventral glands are shorter than the dorsal one; all three glands are of equal length in *Helicotylenchus*. *Antarctylus* and most *Helicotylenchus* spp. have an undivided anterior lip annulus, different from the six-sectored lip annulus of the other Hoplolaiminae (Sher & Bell, 1975). Because of the long pointed tail, similar to tails of some taxa in Telotylenchinae (*Triversus* for example), this lone species from Antarctica may be seen as a relict of the ancestral forms that evolved into *Helicotylenchus*.

Helicotylenchus Steiner, 1945

= *Rotylenchoides* Whitehead, 1958

= *Zimmermannia* Shamsi, 1973

Diagnosis :

Hoplolaiminae. *Female* : Body vermiform, spiral to straight. Labial region continuous to slightly offset, rounded or anteriorly flattened, generally annulated but never longitudinally striated; anterior lip annulus generally not divided into sectors, with elongate amphid spertures (SEM). Rarely faint or marked lip sectors are present. Lateral field with four lines. Phasmids small,

near anus; cephalids and caudalid present. Tail 1 to 2 1/2 body diameters long, typically more curved dorsally, with or without a terminal ventral process, sometimes rounded. Stylet and labial framework average-sized. DGO from 6 to 16 µm from stylet base. Median bulb rounded with average-sized valve. Glands overlap intestine dorsally and ventrally, all three glands of about the same length. Two genital branches, the posterior one sometimes degenerated or reduced to a PUS. Epitygma present but folded inwards, into the vagina. Vulval flaps present, inconspicuous. *Male* : Slight secondary sexual dimorphism seen in smaller anterior end. Caudal alae enveloping tail end.

Type species :

Helicotylenchus dihystra (Cobb, 1893) Sher, 1961.

= *Tylenchus olaae* Cobb, 1906*

= *T. spiralis* Cassidy, 1930*

= *Aphelenchus dubius peruensis* Steiner, 1920

= *H. nannus* Steiner, 1945

= *H. crenatus* Das, 1960

= *H. flatus* Roman, 1965

= *H. rotundicauda* Sher, 1966

= *H. punicae* Swarup & Sethi, 1968

= *H. glissus* Thorne & Malek, 1968

= *H. dihystreroide*s Siddiqi, 1972

= *H. teleductus* Anderson, 1974

The original type species was *H. nannus* Steiner, 1945 but Sher (1961) proposed *H. nannus* as a synonym of *H. dihystra*.

Other species :

See list in Boag and Jairajpuri (1985) and additional names in Fortuner (1984b).

Discussion :

The genus *Rotylenchoides* Whitehead, 1958 has been synonymized with *Helicotylenchus* by Fortuner (1984b) because these two genera differ by a single character, namely the regression of the posterior genital branch in *Rotylenchoides*. A gradual regression of this organ is documented in the descriptions of some species of *Helicotylenchus* s. l. : (i) typical *Helicotylenchus* spp. have two equally developed branches; (ii) in some species (for example *H. multicinctus*) the posterior branch is smaller than the anterior one, but is still functional; (iii) *Rotylenchoides intermedius* Luc, 1960 and *Helicotylenchus neofornis* Siddiqi & Husain, 1964, have a posterior branch

* Siddiqi (1986) proposes *Helicotylenchus olaae* and *H. spiralis* (synonyms of *H. dihystra*) as new combinations. In fact, *Tylenchus olaae* and *T. spiralis* were brought into the genus *Helicotylenchus* by Sher (1961), when he synonymized both nominal species with *H. dihystra*. This action made Sher (1961) the author of the combinations of *olaae* and *spiralis* with *Helicotylenchus*, il and when they are needed.

reduced to a row of undifferentiated cells; a similar reduction is also observed in *Rotylenchoides desouzai*, however, because of the arrangement of its esophageal glands, this species is better placed in *Rotylenchus*, close to *Rotylenchus orientalis*; and (iv) the species that have been proposed as typical representative of *Rotylenchoides*, namely *R. brevis*, *R. variocaudatus* and *R. affinis* have a posterior branch reduced to a PUS. This synonymization was rejected by Siddiqi (1986). This author did not realize that the gradual regression of the female posterior genital branch in different species of *Helicotylenchus s. l.* makes this character irrelevant for generic differentiation. (See also discussion in Luc *et al.*, 1987).

Zimmermannia was proposed as a sub-genus of *Helicotylenchus* by Shamsi (1973) during a congress. Minutes of the congress were published according to the rules of the International Code of Zoological Nomenclature.

The new sub-genus, with *H. (Zimmermannia) erythrinae* as type and only species, was characterized by the male tail, with a terminal process longer than the caudal alae. The terminal ventral process in some species of *Helicotylenchus* and other genera is the remnant of the dorsal asymmetrical regression of the tail (Fortuner, 1986a). This remnant can be longer or shorter depending on the species and on individual variation (its length varies from 1 to 7 μm in a population of *H. erythrinae* from Riverside, California). When longer, it is quite natural that it may extend past the caudal alae. It seems inadequate to propose a separate genus on such a character.

Zimmermannia is here considered as a synonym of *Helicotylenchus* as already proposed without justification or arguments by Siddiqi (1986), and also by Fortuner (1986).

Aphasmatylenchus Sher, 1965

Diagnosis :

Hoplolaiminae. *Female* : Body vermiform, circle to C-shaped. Labial region slightly offset from body, annulated, but without longitudinal striae. First labial annulus divided into six equal sectors, elongate amphid apertures (SEM). Lateral field with four lines. Phasmids absent. Cephalids and caudalid not described. Tail 1.5 to 2 body diameters long, more curved dorsally with rounded end. Stylet and labial framework well developed. DGO about 8 μm from stylet base. Median bulb rounded. Glands overlap the intestine ventrally and laterally. Two genital branches equally developed. Epitygma and vulval flap not described. *Male* : Slight secondary sexual dimorphism seen in the smaller anterior end. Tail conoid, elongate, with a hyaline end. Caudal alae enveloping tail end. Gubernaculum with titillae.

Type species :

Aphasmatylenchus nigeriensis Sher, 1965.

Other species :

A. straturatus Germani, 1970

A. variabilis Germani & Luc, 1984

Discussion :

Aphasmatylenchus is remarkable by the absence of phasmids and also by the conoid elongate tail of the male that resembles male tails in Belonolaimidae. The shape of the labial region, the well developed stylet and framework, the posterior DGO, the shape of the female tail, are characteristics of Hoplolaimidae and *Aphasmatylenchus* has been accepted by its original descriptor and by later authors as a member of this family.

Within Hoplolaiminae, *Aphasmatylenchus* stands apart by its ventral glandular overlap. The exact arrangement of the glands has not been described, but seems to differ from both the symmetrical dorsal overlap of *Rotylenchus* and the asymmetrical dorsal and ventral overlap of *Helicotylenchus*. In fact the glands in *Aphasmatylenchus* are somewhat similar to those in *Rotylenchulinae* but are shorter than in this subfamily.

Aphasmatylenchus is known only from West Africa.

Because of the absence of any known intermediate genus between *Aphasmatylenchus* and the ancestral proto-Hoplolaimidae from which it evolved, it is impossible to propose any hypothesis on the origin of the genus. However there is no need to disguise our ignorance by creating a separate taxon for this genus and the subfamily *Aphasmatylenchinae* proposed by Sher (1965) is not accepted here.

The subfamily **Rotylenchulinae** Husain & Khan, 1967

DIAGNOSIS

Hoplolaimidae. Body of mature females swollen or kidney shaped. Lip region not as high as in Hoplolaiminae. Esophageal glands enlarged into a long lobe overlapping the intestine mostly laterally. *Rotylenchulinae* are sessile semi-endoparasites and lay their eggs in a gelatinous matrix, whereas Hoplolaiminae are ectoparasites or migratory semi-endoparasites and lay their eggs free in the soil.

DESCRIPTION OF ROTYLENCHULINAE

Lip region high, but lower than typical Hoplolaiminae, never striated longitudinally. Lateral field with four lines. Phasmids always pore-like, near anus or on tail. Tail short, rounded, or longer, conoid. Labial framework and stylet medium-sized. DGO far to very far from stylet. Genital branches outstretched or reflexed, posterior branch sometimes reduced to a PUS.

Male sexual dimorphism well marked with anterior end smaller than female, sometimes esophagus degenerate, nonfunctional. Caudal alae enveloping tail, sometimes not reaching tail end.

Rotylenchulus and the related genera are quite different from the genera in Hoplolaiminae (see below). Originally proposed as a "... Tylenchidae with characters of *Rotylenchus*..." (Lindford & Oliveira, 1940), *Rotylenchulus* was considered in Pratylenchinae by Thorne (1949) and Tom Goodey (1951), and in Nacobbinae by Chitwood (1950) and J. B. Goodey (1963). It was made the type of Rotylenchulinae by Husain and Khan, 1967. This subfamily was placed in Hoplolaimidae by the original authors and by Siddiqi (1971). Golden (1971) placed it in Nacobbidae, Heteroderoidea. Fotedar and Handoo (1978) evaded the problem by elevating Rotylenchulinae to family rank.

The resemblance between *Rotylenchulus* and *Nacobbus* is probably due to a convergence. Enlargement of the mature female body and sedentary semi-endoparasitism are phenomena that occurred in several lines of plant parasitic nematodes. A tendency towards body enlargement is already attested in some anguinids. Sedentary saccate females are known in Hoplolaimidae (*Rotylenchulus*), Pratylenchidae (*Nacobbus*), Criconematoidea (*Tylenchulus*), and Heteroderidae. The enlargement of the female body is not a reliable character for the definition of generic relationships and differentiation of families. *Rotylenchulus* should not be placed near *Nacobbus*.

Rotylenchulus has some characteristics of Hoplolaimidae (see below) but it has evolved so far from the typical hoplolaimids that it was tempting to accept it in a family of its own. However, two genera link *Rotylenchulus* to the rest of the hoplolaimids: *Senegalonema*, a genus recently described from Africa, and *Acontylus*, an Australian genus whose taxonomic status was heretofore unsettled. *Acontylus* has been in the past linked to *Hoplolytus*, a pratylenchid, or placed in a subfamily of its own, Acontylinae. It is proposed to accept it as a Rotylenchulinae.

The inclusion of *Senegalonema* and *Acontylus* in Rotylenchulinae makes it possible to accept this subfamily in Hoplolaimidae. This action makes unnecessary the elevation of Rotylenchulinae to family rank and the creation of Acontylinae.

Verutus Esser, 1981 was placed by Siddiqi (1986), in Rotylenchulidae. It is considered here to be closer to Heteroderidae (as seen among other characters by morphology of male sexual organs). It will be treated with this later family.

THE GENERA IN ROTYLENCHULINAE

Acontylus Meagher, 1968

Diagnosis :

Rotylenchulinae. *Female* : Body straight to slightly ventrally arcuate, swollen in the vulval area. Labial region high, slightly offset, trapezoid in lateral outline. Lateral field with four lines. Phasmids at anus level.

Cephalids and caudalid not described. Tail short, hemispherical. Labial framework and stylet well developed. Stylet knobs slopping backwards in the only known species. DGO 13 µm from stylet base. Median bulb strong, rounded. Anterior genital branch outstretched. Posterior branch reduced to a PUS. Epiptygma and vulval flap not described. *Male* : Vermiform. Labial region knob-like, high, rounded, distinctly offset. Stylet, labial framework and esophagus reduced in size. Caudal alae enveloping tail. *Juveniles* : Tail rounded with a long terminal projection.

Biology :

The females are semi-endoparasitic, their anterior portion is embedded in the root up to the level of the excretory pore. Males and larvae have not been observed feeding. The eggs are deposited singly in a gelatinous matrix.

Type and only species :

Acontylus vipriensis Meagher, 1968.

Discussion :

This genus is represented by a single species found in two localities in Australia. It is here accepted as a member of Hoplolaimidae because of the shape of the labial region, the strong stylet and labial framework, the posterior migration of the DGO, and the short rounded tail.

It is close to the genera in Rotylenchulinae by several characters: *i*) the mature females are swollen and embedded in the roots; *ii*) the esophageal glands overlap the intestine dorsally and laterally over a long distance; *iii*) the eggs are laid within a gelatinous matrix; and *iv*) the males have an esophageal region reduced and probably nonfunctional.

The arrangement of the esophageal glands in both sexes, and the degenerescence of the anterior extremity of the male are similar to those observed in several genera in Pratylenchidae, namely *Radopholus* and *Hoplolytus*. These genera lack the hoplolaimid characteristics that are evident in *Acontylus*.

The regression of the posterior genital branch on *Acontylus* has also been observed in some species of *Helicotylenchus* and *Rotylenchus*. In these two genera the arrangement of the esophageal glands is different to that in *Acontylus*, there is no marked secondary sexual dimorphism, mature females are not swollen and do not lay eggs in a gelatinous matrix.

Senegalonema Germani, Luc & Baldwin, 1984

Description :

Rotylenchulinae. *Immature female* : Body vermiform, C-shaped. Labial region high, not offset, not annulated; anterior lip annulus divided into six sectors, four submedian sectors triangular, adjacent two by two, dorsally and ventrally. Lateral field with four lines.

Phasmids pore-like near anus level. Tail conoid, 2 to 2.5 body anal diameter long, more than half its length nonprotoplasmic. Labial framework and stylet medium-sized. DGO about 5-7 μm from stylet base in the only known species. Median bulb oval, with strong valve. Glandular overlap mostly lateral, sometimes ventral. Two genital branches outstretched. *Mature females*: Body posteriorly swollen, variously shaped to kidney-shaped, annulated. Phasmids enlarged. DGO at 5-8 μm from stylet. Gland overlap expanded laterally. Tail short, conical. Vulva postequatorial. Two genital branches very long, convoluted. *Male*: Slight secondary sexual dimorphism seen in smaller anterior end. Esophagus functional. Caudal alae enveloping tail end. Gubernaculum with titillae.

Males and immature females free in soil. Mature females semi-endoparasitic, sessile in roots.

Type and only species:

Senegalonema sorghi Germani, Luc & Baldwin, 1984.

Discussion:

The relationships of this genus with *Rotylenchulus* and other genera have been discussed in detail by the original authors (Germani, Luc & Baldwin, 1984). *Senegalonema* differs from *Rotylenchulus* by shape of lip region, position of DGO, outstretched genital branches in immature females, nondegenerate anterior end of males, and caudal alae and titillae of males. The genus shares some characteristics with some genera in Heteroderidae, which points towards a common origin of this family and Hoplolaimidae.

Table 1
Tabular key to the genera in Hoplolaimidae (Females)

	<i>Body</i>	<i>Glands</i>	<i>DGO</i> (μm)	<i>Tail</i>	<i>Phasmids</i>	<i>Genital branches</i>
<i>Pararotylenchus</i>	vermiform	no overlap	4-7	short, more curved D	pore-like near anus	2
<i>Rotylenchus</i>	vermiform	D. overlap	6-16	short, more curved D to rounded	pore-like near anus	2 or 1
<i>Scutellonema</i>	vermiform	D. overlap	4-8	short, rounded	scutella near anus	2
<i>Aorolaimus</i>	vermiform	D. overlap	3-10	short, rounded	scutella on body	2
<i>Hoplolaimus</i>	vermiform	D. overlap	3-10	short, rounded	scutella on body	2
<i>Antarctylus</i>	vermiform	D + V, unequal overlap	10	long (2-3 \emptyset) conoid, pointed	pore-like near anus	2
<i>Helicotylenchus</i>	vermiform	D + V, equal overlap	6-16	short, more curved D to round	pore-like near anus	2 or 1
<i>Aphasmatylenchus</i>	vermiform	short lateral overlap	8	short, more curved D	no phasmids	2
<i>Acontylus</i>	swollen at vulva	long lateral overlap	13	short, rounded	pore-like near anus	1
<i>Senegalonema</i>	kidney-shaped	long lateral overlap	5-7	short, conoid	large	2, convoluted
<i>Senegalonema</i> (immature female)	vermiform	long lateral overlap	5-7	long (2-2.5 \emptyset) conoid	pore-like near anus	2, straight
<i>Rotylenchulus</i>	kidney-shaped	long lateral overlap	13-33	short, conoid	pore-like on tail	2, convoluted
<i>Rotylenchulus</i> (immature female)	vermiform	long lateral overlap	13-33	long (2-3 \emptyset) conoid	pore-like on tail	2, reflexed

Rotylenchulus Linford & Oliveira, 1940
 = *Spyrotylenchus* (= *Spirotylenchus*) Lordello & Cesnik, 1958.
 = *Leiperotylenchus* Das, 1960

Diagnosis :

Rotylenchulinae. *Immature female* : Body vermiform, spiral to C-shaped. Labial region variable, from low rounded to high flattened, not offset, annulated or not annulated; anterior lip annulus divided into six sectors of about the same size. Lateral field with four lines. Phasmids at mid-tail. Tail 2 to 3 body anal diameters long, conoid with rounded end. Labial framework and stylet strong. DGO 13 to 33 µm from stylet base. Median bulb oval with strong valve. Glandular overlap very long, mostly lateral. Two genital branches opposed, with double flexure. *Mature female* : Body obese, kidney-shaped. Cuticle thick. Tail conical pointed with or without hyaline extremity. Ovaries very long, convoluted. *Male* : Vermiform. Anterior end reduced. Caudal alae difficult to see, not quite reaching tail end.

Type species :

Rotylenchulus reniformis Linford & Oliveira, 1940.

Other species :

Rotylenchulus anamictus Dasgupta, Raski & Sher, 1968
R. borealis Loof & Oostenbrink, 1962
R. clavicaudatus Dasgupta, Raski & Sher, 1968
R. leptus Dasgupta, Raski & Sher, 1968
R. macrodoratus Dasgupta, Raski & Sher, 1968
R. macrosoma Dasgupta, Raski & Sher, 1968
R. parvus (Williams, 1960) Sher, 1961
 = *Helicotylenchus parvus* Williams, 1960
R. sacchari Van der Berg & Spaull, 1981
R. variabilis Dasgupta, Raski & Sher, 1968

Generic identification

To help with the practical differentiation of the genera discussed above, a tabular key for generic identification in Hoplolaimidae is presented in Table 1.

Note

Andrássy (1985) has proposed a new genus in Hoplolaimidae for *Hoplorhynchus riparius*. Luc (1986) gave good evidence that this species belongs to the genus *Pratylenchoides* Winslow (Pratylenchidae), and he proposed *Hoplorhynchus* as a junior synonym of the genus *Pratylenchoides*.

Eroshenko (1984) proposed two new genera in a new family in Hoplolaimoidea (Interrottylenchidae with Interrottylenchinae : *Interrottylenchus*, and Scutellonemoidinae : *Scutellonemoides*), for taxa previously in *Rotylenchus*. This article has not been seen and cannot be commented on here.

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Accepté pour publication le 29 août 1986.