

Key to Genera of Plant-Parasitic

Nematodes (without Pictures)

(Based mainly on characteristics of adult females)

- 1a. Stylet absent. Not a plant parasite
- 1b. Stylet present 2
- 2a. Two-part esophagus, no valvulated apparatus, anterior part slender, posterior part glandular and muscular; stylet usually without basal swellings [Order Dorylaimida] 3
- 2b. Three-part esophagus usually with a valvulated metacarpus (median bulb) followed by a slender isthmus and glandular basal bulb; stylet usually with basal knobs [Orders Aphelenchida and Tylenchida] 6
- 3a. Stylet short, curved; body short and thick (0.45–1.5 mm long) *Paratrichodorus*
- 3b. Stylet long, straight, tapering to a long slender point with long extensions; body long and slender. 4
- 3c. Stylet straight, usually not very long (includes numerous genera of uncertain feeding habits; group contains no known plant pathogens) A large number of genera
- 4a. Stylet extensions with sclerotized basal flanges; guiding ring near base of stylet just anterior to junction of stylet and stylet extensions *Xiphinema*
- 4b. Stylet extensions without basal flanges; guiding ring near apex of stylet 5
- 5a. Amphid openings minute, slitlike; amphids consisting of large pouches that almost encircle the head *Longidorus*
- 5b. Amphid openings wide, sublabial, extending at least halfway across the neck at that point; amphid pouches funnel- to stirrup-shaped *Paralongidorus*
- 6a. Dorsal esophageal gland outlet in metacarpus, anterior to valve, or in that position when median bulb absent (usually difficult to see); metacarpus very large, often appears nearly as wide as the diameter of the body [Order Aphelenchida] 7
- 6b. Dorsal esophageal gland outlet in procarpus (usually can be seen more readily in recently prepared water mounts than in glycerine mounts); metacarpus moderate to reduced in size (less than three-fourths body width) [Order Tylenchida] 9
- 7a. Vulval flap absent; vagina normal; a (body length / greatest body width) less than 80 8
- 7b. Vulva with wide overlapping flap; vagina curved; a around 100 *Rhadinaphelenchus*
- 7c. Vulva with overlapping flap; male with large spicules, arcuate, paired, with sharply pointed rostrum and disclike expansions; a around 40 *Bursaphelenchus*
- 8a. Tail of female blunt; lateral field with 6–14 incisures; male with bursa and gubernaculum *Aphelenchus*
- 8b. Tail of female usually conoid, often with one or more sharp points at the terminus (mucronate); lateral field with two to four incisures; male without bursa or gubernaculum *Aphelenchoides*
- 9a. Head with setae; no plant parasites *Atylenchus*, *Eutylenchus*
- 9b. Head without setae; numerous plant parasites 10
- 10a. Metacarpus absent or reduced; if reduced, no sclerotized valve Examples: *Nothanguina*, *Nothotylenchus*
- 10b. Metacarpus with sclerotized valves present (usually can be seen more readily in recently prepared water mounts than in glycerine mounts). 11

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- 11a. Mature females greatly enlarged (pear-shaped, lemon-shaped, kidney-shaped, or saccate); found in roots of plants either embedded or attached by neck; some occur as cysts in soil 12
- 11b. Mature females vermiform; may be slender to slightly swollen 23
- 12a. Mature females soft, elongate-saccate, or kidney-shaped with tail (except for *Sphaeronema*, which is spherical without a tail) 13
- 12b. Mature females becoming cysts or remaining soft-bodied; pyriform-saccate, spheroid, or lemon-shaped, usually without a tail 18
- 13a. Mature female with two ovaries *Rotylenchulus*
- 13b. Mature female with one ovary 14
- 14a. Excretory pore located in normal position, near nerve ring 15
- 14b. Excretory pore located posterior to nerve ring 16
- 15a. Mature female subspherical; cuticle marked with coarse reticulate pattern; may have a prominently protruding vulva, subterminal in position *Sphaeronema*
- 15b. Mature female spiral, thickened; without protruding vulva *Trophonema*
- 16a. Circumoral elevation present in females and juveniles *Trophotylenchulus*
- 16b. Circumoral elevation absent 17
- 17a. Excretory pore near vulva *Tylenchulus*
- 17b. Excretory pore located near basal region of esophagus *Nacobbus*
- 18a. Females with irregular body annules around perineum (perineal pattern); excretory pore at level with stylet or close behind it; lip region with two lateral lips wider than four sublateral lips; second-stage juvenile stylet <20 μm ; weakly developed labial framework; usually induces marked galling of host roots *Meloidogyne*
- 18b. Females without irregular body annules around perineum; excretory pore posterior to median bulb; lip region with two lateral lips narrower than four sublateral lips; second-stage juvenile stylet usually >20 μm ; well-developed labial framework; usually no galling of host roots 19
- 19a. Vulva subequatorial; cuticle annulated *Meloidodera*
- 19b. Vulva terminal or subterminal; cuticle annulated or lacelike 20
- 20a. Cuticle annulated *Cryphodera*
- 20b. Cuticle with lacelike pattern 21
- 21a. Cyst stage present; vulva terminal, anus dorsal, not on vulval lip; or vulva sunken into terminal vulval cone with anus on upper inside of dorsal vulval lip 22
- 21b. No cyst stage; vulva and anus terminal on prominence *Atalodera*
- 21c. No cyst stage; vulva sunken into terminal vulval cone; anus on upper inside of dorsal vulval lip; second-stage juvenile stylet >38 μm *Sarisodera*
- 22a. Cysts generally lemon-shaped, rarely spherical and then with buttonlike protrusions; vulva on a terminal cone, with fenestration (circumfenestrate, bifenestrate, or ambifenestrate); bullae present or absent; stylet <30 μm *Heterodera*
- 22b. Cyst spherical or subspherical; bullae absent; second-stage juveniles with four incisures in lateral field *Globodera*
- 23a. Tail equal to or longer than six times the anal body diameter (tail filiform, with pointed or clavate terminus) 24
- 23b. Tail generally less than six times the anal body diameter; however, if longer, tail is cylindroid rather than filiform 28
- 24a. Female with two ovaries 25
- 24b. Female with one ovary 26

- 25a. Stylet without basal knobs, no cephalic sclerotization; tail filiform, usually with clavate terminus *Psilenchus*
- 25b. Stylet with basal knobs; heavy cephalic sclerotization; tail filiform, with pointed terminus *Brachydorus*
- 26a. Esophagus criconematoid; thick cuticle, coarsely annulated *Caloosia*
- 26b. Esophagus tylenchoid; thin cuticle, not coarsely annulated 27
- 27a. Stylet long; s (stylet length / body diameter measured at base of stylet) 2.5 or more *Tylodorus*
- 27b. Stylet short ($s < 2.5$) *Tylenchus* (and other members of the subfamily Tylenchinae)
- 28a. One ovary (vulva usually located in posterior third of body) 29
- 28b. One ovary (vulva located near center of body); lip region conical, not annulated; female tail tip rounded, cuticle of tail swollen *Trophurus*
- 28c. Two ovaries (vulva located near center of body) 44
- 29a. Procorpus and metacarpus not swollen and combined into a large valvular bulb 30
- 29b. Procorpus and metacarpus swollen and combined into a large valvular bulb [Suborder Criconematina] 37
- 30a. Stylet delicate ($\leq 15 \mu\text{m}$ long); tail acute or subacute 31
- 30b. Stylet strong (generally $> 15 \mu\text{m}$ long); tail tapering or bluntly rounded 33
- 31a. Ovary with oocytes in one or two lines, not arranged around a rachis; mature female slender or stout 32
- 31b. Ovary with multiple rows of oocytes arranged around a rachis; mature female usually obese; found in galls in leaves or flower parts *Anguina*
- 32a. Ovary with one or more flexures; moderately stout forms; found in root galls of Gramineae *Subanguina*
- 32b. Ovary outstretched; slender forms; found in bulbs, stems, leaves, and tubers *Ditylenchus*
- 33a. $s \geq 1.5$; tail generally 1.5 times anal body diameter or shorter *Rotylenchoides*
- 33b. $s < 1.5$; tail generally longer than 1.5 times anal body diameter 34
- 34a. Esophagus overlaps intestine ventrally *Pratylenchus*
- 34b. Esophagus overlaps intestine dorsally 35
- 35a. Lip region low, generally rounded; stylet knobs flattened anteriorly; marked sexual dimorphism *Radopholoides*
- 35b. Lip region high, conoid; stylet knobs sloping anteriorly or indented; males present or absent 36
- 36a. Female body swollen; posterior part of stylet knobs sloping anteriorly; marked sexual dimorphism *Acontylus*
- 36b. Female body slender; each stylet knob tapering anteriorly to a dentate tip; males unknown *Hoplotylus*
- 37a. Mature female without extra cuticle or sheath 38
- 37b. Mature female with extra cuticle or sheath 40
- 38a. Cuticle with prominent retrorse annules 39
- 38b. Cuticle without prominent retrorse annules 41
- 39a. Annules of female with spines, scales, plates, or stalked appendages on posterior margins *Criconema*
- 39b. Annules of female with smooth or crenate posterior margins *Criconemella*

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- 40a. Stylet knobs rounded, sloping anteriorly; cuticle usually with more than 200 annules *Hemicycliophora*
- 40b. Stylet knobs anchor-shaped with posterior projection; cuticle usually with less than 200 annules *Hemicriconemoides*
- 41a. Annules of female without membranous structures on posterior margins 42
- 41b. Annules of female with membranous structures on posterior margins *Bakernema*
- 42a. Cuticle of female ornamented with minute tubercles *Cacopaurus*
- 42b. Cuticle of female not ornamented with minute tubercles 43
- 43a. Female stylet $\leq 36 \mu\text{m}$ *Paratylenchus*
- 43b. Female stylet $45\text{--}120 \mu\text{m}$ *Gracilacus*
- 44a. $s \geq 2.5$ 45
- 44b. s generally < 2.5 49
- 45a. Esophageal glands not enclosed within a bulb, usually unequal in length, overlapping intestine... 46
- 45b. Esophageal glands enclosed within a bulb, usually not overlapping intestine 47
- 46a. Average body length usually $\geq 1.75 \text{ mm}$ *Belonolaimus*
- 46b. Average body length usually $< 1.75 \text{ mm}$ 48
- 47a. Lip region continuous *Macrotrophurus*
- 47b. Lip region set off by distinct constriction *Dolichodorus*
- 48a. Lateral field with four incisures *Morulaimus*
- 48b. Lateral field with two incisures *Carphodorus*
- 49a. Phasmids absent *Aphasmatylenchus*
- 49b. Phasmids present 50
- 50a. Tail generally less than 1.5 times anal body diameter 61
- 50b. Tail 1.5 or more times anal body diameter 51
- 51a. Esophageal glands usually unequal in length, overlapping the intestine dorsally or lateroventrally ... 52
- 51b. Esophageal glands usually enclosed within a bulb; if not enclosed, then of about equal length, and therefore considered as not overlapping the intestine 59
- [Certain conditions may cause either the dorsal or subventral glands to lengthen, thereby giving the impression of overlapping. Several specimens should be observed carefully in relation to this character. Some confusion may arise even with careful observation of the esophagus because the extent of the variation of this and other morphological characters has not been properly studied in many of the nematode genera described.]
- 52a. No cephalic framework, or framework only moderately developed; female head not low or flattened 53
- 52b. Well-developed cephalic framework; female head low, rounded or flattened 56
- 53a. Well-developed stylet; lateral field with four incisures 54
- 53b. Slender stylet with diverging basal knobs; lateral field with three incisures *Trichotylenchus*
- 54a. Female tail cylindroid with round terminus 55
- 54b. Female tail elongate-conoid with blunt terminus *Telotylenchus*
- 55a. Anterior portion of stylet asymmetrical; tail rather short, with broadly rounded terminus *Histotylenchus*
- 55b. Anterior portion of stylet symmetrical; female tail with broadly rounded to bulbous terminus, with strongly thickened cuticle *Telotylenchoides*

- 56a. Esophagus overlapping intestine dorsally 57
 56b. Esophagus overlapping intestine ventrally 58
- 57a. Short overlap; no marked sexual dimorphism *Pratylenchoides*
 57b. Long overlap; marked sexual dimorphism *Radopholus*
- 58a. Tail tip mucronate *Hirschmanniella*
 58b. Tail tip not mucronate *Zygotylenchus*
- 59a. Lateral field with four lines; female tail not acute. 60
 59b. Lateral field with six lines; female tail acute or subacute. *Merlinius*
- 60a. Female tail conoid, with terminus usually bluntly rounded *Tylenchorhynchus*
 60b. Female tail cylindroid, with terminus broadly rounded, and with strongly thickened cuticle
 *Paratrophurus*
 [*Paratrophurus lobatus* Loof, 1970 has overlapping glands, and for this reason it was placed in *Telotylenchoides* by Siddiqi (1971). A more accurate decision about the correct placement of this species in either of these two genera can be made only when the extent of the variation of the esophageal glands is properly studied and its validity as a taxonomic character in this case is established.]
- 61a. Phasmids small, porelike 62
 61b. Phasmids enlarged 63
- 62a. Esophagus overlapping intestine typically dorsally and laterally; lip region with or without annulation or striation; dorsal esophageal gland opening usually less than one-fourth of the stylet length behind stylet knobs *Rotylenchus*
 62b. Esophagus overlapping intestine typically ventrally; lip region without longitudinal striation; dorsal esophageal gland opening usually one-fourth or more of the stylet length behind stylet knobs ...
 *Helicotylenchus*
- 63a. Both phasmids located posterior to vulva. 64
 63b. One phasmid located anterior to vulva and one posterior to vulva 65
- 64a. Phasmids opposite or nearly opposite each other in region of anus; lip region with transverse striae ..
 *Scutellonema*
 64b. Phasmids not opposite each other, anterior to anus; lip region without striae *Peltamigratus*
- 65a. Spear knobs with distinct anterior projections; with four or fewer incisures areolated throughout length of lateral field *Hoplolaimus*
 65b. Spear knobs rounded or without distinct anterior projections; with four incisures areolated at phasmids and anteriorly *Aorolaimus*