

Review of the genus *Helicotylenchus* Steiner, 1945 (Nematoda: Hoplolaimidae) with updated diagnostic compendium

I. Uzma, K. Nasira, K. Firoza and F. Shahina[†]

National Nematological Research Centre, University of Karachi, Karachi-75270, Pakistan

[†]Corresponding author: shahinafayyaz@gmail.com

Abstract

A compendium of the genus *Helicotylenchus* based on 16 diagnostic characters to separate *Helicotylenchus* species viz., habitus, body length, ratios a, c, c', vulva position, DGO from base of stylet knobs, stylet length, shape of stylet knobs, shape of head, number of head annules, shape of tail, number of tail annules, position of phasmid in relation to anus, presence of male and female posterior genital branch is presented. These allometric and morphometric characters were derived from the original descriptions. An up to date list of 230 valid nominal species from world along with available illustrations and 32 species from Pakistan with diagnostic key is provided.

Keywords: Compendium, *Helicotylenchus*, diagnostic keys, illustrations.

In the order Tylenchida, *Helicotylenchus* Steiner, 1945 belongs to the subfamily Hoplolaiminae Filipiev, 1934 of the family Hoplolaimidae Filipiev, 1934 and infraorder Tylenchomorpha (De Ley & Blaxter, 2004). The genus *Helicotylenchus* was proposed by Steiner in 1945 with type species *H. nannus* Steiner, 1945. This species was then synonymised with *H. dihystera* Cobb, 1893 by Sher (1961). Since then the genus has grown to more than 193 nominal species (Firoza, 1996) and 200 (Marais, 2001).

The spiral nematodes of the genus *Helicotylenchus* are common and widely distributed migratory ectoparasites or semiendoparasites nematodes. They are associated with diverse crops of agricultural importance (Decraemer & Hunt, 2006; Subbotin *et al.*, 2015). Many species of the genus *Helicotylenchus* found in agricultural lands are parthenogenetic, those found in forest habitats are mostly bisexual (Siddiqi, 1995). In a number of species the males are either absent or extremely rare. The genus was characterized by lip region-continuous, dorsal oesophageal gland orifice is often

farther away from the style base (or $\frac{1}{4}$ - $\frac{1}{2}$ style length behind style base), oesophageal gland overlapping intestine ventrally, the body posture is often spiral, due to its spiral body posture it is often easy to identified under lower magnification, but separation of the species is very difficult (Andrássy, 2007).

The first comprehensive work of the genus was that of Golden, 1956 and Perry *et al.*, 1959 who gave the important information on the life history, distribution, host relationship and morphology of spiral nematodes. Morphometrical variability in *Helicotylenchus* has been given by Fortuner and his co-workers (1979-1984). Fortuner (1984) synonymized the genus *Rotylenchoides* Whitehead, 1958 with the genus *Helicotylenchus*. In this study the synonymization of *Rotylenchoides* to *Helicotylenchus* is followed.

A total of 32 species of the genus *Helicotylenchus* have so far been reported by various scientists (Table 1) from different host plants and localities in Pakistan (Maqbool & Shahina, 2001).

Table 1. List of *Helicotylenchus* species from Pakistan.

Species	Reference(s)
<i>H. abunaamai</i> Siddiqi, 1972	Firoza & Maqbool, 1991
<i>H. arachisi</i> Mulk & Jairajpuri, 1975	Firoza & Maqbool, 1991
<i>H. californicus</i> Sher, 1966	Maqbool, 1986
<i>H. canadensis</i> Waseem, 1961	Saeed, Khan, Khan & Qamar, 1986
<i>H. conicephalus</i> Siddiqi, 1972	Maqbool, 1986
<i>H. crenacauda</i> Sher, 1966	Maqbool, 1986
<i>H. digonicus</i> Perry in Perry, Darling & Thorne, 1959	Anwar & Chaudhary, 1976
<i>H. dihystra</i> (Cobb, 1893) Sher, 1961	Kafi, 1963
* <i>H. discocephalus</i> Firoza & Maqbool, 1993	Firoza & Maqbool, 1993
<i>H. egyptiensis</i> Tarjan, 1964	Maqbool, 1986
<i>H. erythrinae</i> (Zimmermann, 1904) Golden, 1956	Malik & Yasmeen, 1978
<i>H. exallus</i> Sher, 1966	Maqbool, Ghazala, Fatima & Qasim, 1985
<i>H. falcatus</i> Eroshenko & Nguen Vu Thanh, 1981	Firoza & Maqbool, 1991
<i>H. goodi</i> Tikyani, Khera & Bhatnagar, 1969	Khan, Kanzada & Aslam, 1987
* <i>H. handooi</i> Khan, Ghazi & Soomro, 2008	Khan, Ghazi & Soomro, 2008
<i>H. indicus</i> Siddiqi, 1963	Saeed & Ashrafi, 1973
* <i>H. lemoni</i> Firoza & Maqbool, 1996	Firoza & Maqbool, 1996
<i>H. macronatus</i> Mulk & Jairajpuri, 1975	Maqbool, Ghazala, Fatima & Qasim, 1985
<i>H. martini</i> Sher, 1966	Khan, Khan, Qamar & Seema, 1992
* <i>H. meloni</i> Firoza & Maqbool, 1994	Firoza & Maqbool, 1994
<i>H. microdorus</i> Prasad, Khan & Chawla, 1965	Maqbool, Zain & Shama, 1975
* <i>H. microtylus</i> Firoza & Maqbool, 1993	Firoza & Maqbool, 1993
<i>H. multicinctus</i> (Cobb, 1893) Golden 1956	Saeed & Ashrafi, 1973
* <i>H. obliquus</i> Maqbool & Shahina, 1986	Maqbool & Shahina, 1986
<i>H. oscephalus</i> Anderson, 1979	Firoza & Maqbool, 1992
<i>H. platyurus</i> Perry in Perry, Darling & Thorne, 1959	Firoza & Maqbool, 1991
<i>H. pseudorobustus</i> (Steiner, 1914) Golden, 1956	Maqbool, 1986
<i>H. seshadrii</i> Singh & Khera, 1994	Firoza & Maqbool, 1991
* <i>H. striatus</i> Firoza & Maqbool, 1994	Firoza & Maqbool, 1994
<i>H. thornei</i> Roman, 1965	Maqbool, 1986
* <i>H. verecundus</i> Zarina & Maqbool, 1991	Zarina & Maqbool, 1991
<i>H. willmottae</i> Siddiqi, 1972	Firoza & Maqbool, 1992

*New species

Updated key to the species of genus *Helicotylenchus* from Pakistan

1. Lateral field with oblique striae on most of its length *H. obliquus*
 Lateral field without oblique striae 2
2. Head truncate 3
 Head rounded or hemispherical 14
3. Lip region with a distinct labial disc 4
 Lip region without distinct labial disc 6
4. Tail hemispherical, no projection *H. goodi*
 Tail with projection 5
5. Tail with slight ventral projection, head smooth *H. conicephalus*
 Tail with large ventral projection, head with 4-5 annules *H. discocephalus*
6. Spermatheca functional *H. martini*
 Spermatheca non functional 7
7. Lip region smooth *H. falcatus*
 Lip region annulated 8
8. Stylet less than 24 μm 9
 Stylet more than 24 μm 12
9. Inner incisures of lateral field fused on tail *H. macronatus*
 Inner incisures of lateral field not fused on tail 10
10. Stylet knobs rounded to slopping backward, tail convex conoid with blunt terminus..... *H. indicus*
 Stylet knobs flattened, tail convex conoid 11
11. Tail slightly convex with bluntly rounded unstriated terminus, stylet knobs anteriorly directed
 *H. lemoni*
 Tail conoid with ventral projection, knobs flattened to concave..... *H. handooi*
12. Stylet 28-30 μm , stylet knobs anteriorly concave *H. canadensis*
 Stylet 24-28 μm , stylet not anteriorly concave 13
13. Stylet rounded, tail with distinct projection *H. egyptiensis*
 Stylet flattened anteriorly, tail hemispherical *H. digonicus*
14. Lip region smooth, phasmid always post anal *H. thornei*
 Lip region annulated, phasmid anterior to anus 15
15. Lip annules more than 5 16
 Lip annules less than 5 18
16. Stylet less than 24 μm , spermatheca filled, tail with V shaped projection *H. verecundus*
 Stylet more than 24 μm , spermatheca empty, tail without projection 17

17. Lip annules 6-8, spermatheca distinctly offset dorsally	<i>H. oscephalus</i>
Lip annules 5-6, spermatheca large and axil	<i>H. willmottae</i>
18. Stylet length less than 24	19
Stylet length more than 24	24
19. Spermatheca functional	20
Spermatheca non functional	21
20. Tail hemispherical lacking a ventral projection, stylet knobs rounded to flattened anteriorly, spermatheca slightly offset	<i>H. multincinctus</i>
Tail convex conoid with a large terminal annule projecting ventrally, stylet knobs flattened anteriorly, spermatheca not set off	<i>H. microtylus</i>
21. Tail rounded without ventral projection	22
Tail with slight ventral projection	<i>H. abunaamai</i>
22. Stylet less than 21µm, tail dorsally convex with bluntly rounded tail.....	<i>H. microdorus</i>
Stylet more than 21 µm, tail broadly rounded	23
23. Lateral field fused distally, stylet knobs flattened to concave stylet 21-23 µm	<i>H. arachisi</i>
Lateral field not fused distally, stylet knobs anteriorly directed stylet 22-24 µm	<i>H. striatus</i>
24. Spermatheca functional	25
Spermatheca non functional	27
25. Stylet knobs anteriorly indented, tail length more than 17 µm	<i>H. erythrinae</i>
Stylet knobs flattened anteriorly, tail length less than 17 µm	26
26. Tail with pronounced ventral projection with 8 annules	<i>H. californicus</i>
Tail with slight ventral projection with 12 annules	<i>H. exallus</i>
27. Tail with pronounced ventral projection	28
Tail with no ventral projection, tail terminus hemispherical	30
28. Inner incisures of lateral field fused distally, spermatheca not set off.....	<i>H. crenacauda</i>
Inner incisures of lateral field not fused distally, spermatheca offset	29
29. Inner incisures of lateral field in V shaped pattern, stylet knobs anteriorly indented	<i>H. dihystra</i>
Inner incisures of lateral field not fused, stylet knobs anteriorly flattened	<i>H. pseudorobustus</i>
30. Stylet length more than 25 µm, tail shaped hemispherical	31
Stylet length less than 25 µm, tail dorsally curved	<i>H. meloni</i>
31. Stylet 28-30 µm, anteriorly indented, tail cylindrical to hemispherical	<i>H. seshadrii</i>
Stylet 28-30 µm, knobs rounded, tail hemispherical, curved dorsally.....	<i>H. platyurus</i>

Out of 32 species, eight species viz., *H. handooi* Khan, Ghazi & Soomro, 2008, *H. lemoni* Firoza & Maqbool 1996, *H. meloni* Firoza & Maqbool, 1994, *H. striatus* Firoza & Maqbool, 1994, *H. discocephalus* Firoza & Maqbool, 1993, *H. microtylus* Firoza & Maqbool, 1993, *H. verecundus* Zarina & Maqbool, 1991 and *H. obliquus* Maqbool & Shahina, 1986 were new to science. A dichotomous key is also provided for the species reported from Pakistan. In the present study the diagnostic compendium of *Helicotylenchus* (Firoza & Maqbool, 1994) is being updated consisting of 230 nominal species along with available morphometric data and illustrations. The diagnostic characters used for identification are same as they were given in compendium of 1994.

Dichotomous or polytomous identification keys (Krall, 1978, Anderson, 1979, Fotedar & Kaul 1985, Boag & Jairajpuri; 1985) of spiral nematodes are especially helpful in the identification of the species but is not always reliable because many species share very similar diagnostic characters, some features have broad overlapping ranges and intra specific variability with characters. Identification of these nematodes by morphology alone often remains unresolved or uncertain due to limitation of the morphological analysis. Application of DNA sequence can help to confirm classical morphology-based identifications and resolve some of the problems experienced in the identification of *Helicotylenchus* species (Subbotin *et al.*, 2011).

Diagnostic characters of *Helicotylenchus* used in the compendium: In the compendium format (Table 2), 16 characters (allometric and morphometric) are used to separate *Helicotylenchus* species viz., habitus, body length, ratios a, c, c', vulva position, dorsal oesophageal gland opening (DGO) from base of stylet knobs, stylet length, shape of stylet knobs, shape of head, number of head annules, shape of tail, number of tail annules, position of phasmid in relation to anus, presence of male and female posterior genital branch. Some other characters

were not used because of their variability or frequent omission from species description.

Although majority of these characters are highly variable, they are commonly used in the identification of species.

Habitus: Habitus or body shape in relaxed position is used for species identification as relaxed specimens acquire different body shapes. In some specimens the body takes the shape of the letter 'C' but in most cases it is in the form of a spiral, from a single spiral to spirally coiled, hence their common name "spiral nematodes." According to Fortuner (1984) the spiral shape is constant for the species of *H. dihystra* and *H. pseudorobustus* whereas the species of *H. multicinctus* and *H. coomansi* seem to be constantly 'C' shaped to almost straight. In badly killed specimens the habitus may be distorted.

Body length: In most cases the body length range overlaps between species but it helps in species recognition because some are consistently larger than others and vice versa.

Ratio a: Ratio a is the relationship between the body length and the body diameter and is used to give the idea of the general slenderness of a species. Measurements of flattened specimens increase the body diameter without a corresponding increase of the body length which in turn change the value of ratio a.

Ratios c and c': Ratio c shows the relative length of the tail compared to the body length, while c' expresses the relationship of tail length and anal body width. Most *Helicotylenchus* species have short tails with high ratio c and small c' values. As tail length is unknown for most species of the genus, ratios c and c' are used here for identification.

Ratio V: It is the distance from the head to the vulva given as the percentage of the body length. It is used as a strong character because it is less variable within a species. According to Azmi and Jairajpuri (1978), ratio 'V' was more stable

than the other allometric characters in *H. indicus*.

Dorsal oesophageal gland opening: In *Helicotylenchus* the dorsal oesophageal gland opening (DGO) is more posteriorly located behind the stylet base than in other hoplolaimids except in *Rotylenchulus*. Its distance from stylet base as well as ratio 'o' (distance of dorsal oesophageal gland orifice from the stylet base expressed as a percentage of stylet length) are used in species identification of *Helicotylenchus*.

Stylet length: Stylet length is the most useful character for the diagnosis of species as its measurement is generally constant for a species. Slight differences might occur probably due to geographical variations or bad fixation.

Shape of stylet knobs: Many species of *Helicotylenchus* have anteriorly indented to anteriorly concave stylet knobs. Others have anteriorly flattened to rounded knobs, while still others have knobs sloping backwards. Stylet knobs may vary in shape within a species specially when the specimens are not properly killed and fixed.

Head shape and annulation: In this compendium, two terms are used for head shape: hemispherical (includes rounded, broadly rounded, elevated, hemispheroidal and bulbous) and truncate (includes anteriorly flattened, conical, conical truncate and trapezoidal). The number of cuticular annules in the head region is considered an important diagnostic feature. However, it is not consistent in all cases. Presence or absence of annules in head region seems to be a useful character.

Tail shape and tail annules: Tail shape and tail annules are often used to differentiate species of *Helicotylenchus*. However, in most cases these are quite variable, although a characteristic pattern can be found when several specimens are examined.

Phasmid: Phasmids are usually just preanal, but may also be adanal or postanal. In diagnosis, the distance between phasmids and the anal level is usually expressed in terms of number of cuticular annules.

Males: The presence or absence of males is used for identification of species. In a number of *Helicotylenchus* species males are either absent or extremely rare. If present, the females usually have sperms in their spermathecae. In the compendium therefore, the males are reported as present when females are found with spermathecae full of sperms.

Female posterior genital branch: The retardation in the development of posterior genital branch is used as diagnostic character because most species in *Helicotylenchus* have two genital branches equally, or almost equally developed except in *H. multicinctus* the posterior branch is slightly smaller than the anterior one but is functional.

Species which were previously in *Rotylenchoides* have either a non-functional, degenerate posterior branch or a postvulval uterine sac (PUS). Seven species of *Rotylenchoides* with a simple PUS are: *R. affinis*, *R. attenuatus*, *R. brevis*, *R. subterminalis*, *R. valdeclarus*, *R. variocaudatus* and *R. whiteheadi*; and two intermediate species with degenerate posterior branch are: *R. intermedius* and *R. neoformis*.

The increasing number of species described under this genus has already led to considerable difficulty in their identification, since many characters are variable and some of the species are poorly described. Hence the use of dichotomous keys has become increasingly more difficult. To overcome these difficulties, this diagnostic species compendium of *Helicotylenchus* is presented in a tabular form and for all species drawings of anterior and posterior ends are given. All illustrations are taken from the original descriptions, then either enlarged or reduced to a standard size.

Genus *Helicotylenchus* Steiner, 1945

Diagnosis: (emended after Siddiqi, 1986). Females: Small to medium sized (0.4-1.2mm), vermiform, usually spiral, rarely arcuate when killed with gentle heat. Lip region continuous to slightly offset, rounded, or anteriorly flattened (truncate) with or without annulation, longitudinal striations on annules absent. Lateral field with four incisures, areolated usually in anterior part of body only. Labial framework moderately to strongly sclerotized. Stylet well developed, with rounded or anteriorly indented knobs. Orifice of dorsal oesophageal gland one fourth or more of stylet length behind stylet base (6-16 μm from stylet base). Median oesophageal bulb rounded with well developed valvular apparatus. Excretory pore behind hemizonid. Oesophageal glands overlap intestine dorsally,

laterally and ventrally with lumen lying asymmetrically between the dorsal gland and one of the sub-ventral glands. Vulva posterior (60-70%). Both branches of female reproductive organs generally well developed, posterior branch sometimes degenerated or reduced to a PUS and nonfunctional. Epiptygma present, folded into the vagina. Vulval flaps inconspicuous. Tail short, 1-2 anal body diameters long, hemispherical, usually more curved dorsally, with or without ventral projection, sometimes rounded. Phasmids small, dot like, near the anus. Male tail short, less than two anal body width long. Spicules well developed, arcuate. Bursa reaching the tail tip. Gubernaculum trough or rod shaped, fixed. Slight secondary sexual dimorphism seen in smaller anterior end.

An up to date worldwide list of two hundred and thirty nominal species of the genus *Helicotylenchus* is presented here.

Valid species of *Helicotylenchus* Steiner, 1945

Type species

- Helicotylenchus dihystra* (Cobb, 1893) Sher, 1961
(syn. after Fortuner, 1987)
= *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. dihysteroides* Siddiqi, 1972
= *H. teleductus* Anderson, 1974

Other Species

- H. abuharazi* Zeidan & Geraert, 1990
H. abunaamai Siddiqi, 1972
H. acunae Fernandez, Razjivin, Ortega & Quincosa, 1980

- H. acutucaudatus* Fernandez, Razjivin, Ortega & Quincosa, 1980
H. acutus Tebenkova, 1983
H. affinis (Luc, 1960) Fortuner, 1984
= *Rotylenchoides affinis* Luc, 1960
H. africanus (Micoletzky, 1916) Andrásy, 1958
H. agricola Elmiligy, 1970
H. alinae Khan, Singh & Lal, 1998
H. amabilis Volkova, 1987
H. amplius Anderson & Eveleigh, 1981
H. angularis Mulk & Siddiqi, 1982
H. anhelicus Sher, 1966
H. annobonensis (Gadea, 1960) Siddiqi, 1972
H. apiculus Roman, 1965
H. aquali Khan & Nanjappa, 1972
H. arachisi Mulk & Jairajpuri, 1975
H. areolatus Van den Berg & Heyns, 1975
H. arliani Khan, Singh & Lal, 1998
H. assamensis Saha, Lal, Singh, Kaushal & Shama, 2000
H. astriatus Khan & Nanjappa, 1972
H. atlanticus Fernandez, Razjivin, Ortega & Quincosa, 1980
H. attenuatus Siddiqi, 1995
= *Rotylenchoides attenuatus* Siddiqi, 1995
H. australis Siddiqi, 1972
H. babikeri Zeidan & Geraert, 1990
H. bambesae Elmiligy, 1970
= *H. talonus* Siddiqi, 1972
H. bajoriensis Saha, Singh, Lal & Kaushal, 2002
H. belli Sher, 1996
H. belurensis Singh & Khara, 1979
H. bifurcatus Fernandez, Razjivin, Ortega & Quincosa, 1980
H. bihari Mulk & Jairajpuri, 1975
H. brassicae Rashid, 1972 (sp. inq. by Siddiq, 1986)
H. brevis (Whitehead, 1958) Fortuner, 1984
= *Rotylenchoides brevis* Whitehead, 1958
H. brevicaudatus Jain, Siddiqi & Parihar, 2000
H. caipora Monteior & Mendonca, 1972
H. californicus Sher, 1966
H. canadensis Waseem, 1961
= *H. cairnsi* Waseem, 1961
H. canalis Sher, 1966
H. caroliniensis Sher, 1966
H. caudatus Sultan, 1985

- H. cavenessi* Sher, 1966
H. cedreus Volkova, 1987
H. certus Eroshenko & Nguen Vu Thanh, 1981
H. cheni (Zhu, Lan, Hu, Yan & Wang, 1991) n. comb.
= *Rotylenchoides cheni* Zhu, Lan, Hu, Yan & Wang, 1991
H. clarkei Sher, 1966
H. coffae Eroshenko & Nguen Vu Thanh, 1981
H. concavus Roman, 1961
H. conicephalus Siddiqi, 1972
H. conicus Baidulova, 1981
H. constrictus Tarnita, Gambhir & Bina, 2012
H. coomansi Ali & Loof, 1975
H. cornurus Anderson, 1974
H. craigi Knobloch & Laughlin, 1973
H. crassatus Anderson, 1973
H. crenacauda Sher, 1966
H. crotonii Jain, Siddiqui & Parihar, 2000
H. curatus Marais, Berg, Swart & Tiedt, 2004
H. curvatus Roman, 1965
H. curvicaudatus Fernandez, Razjivin, Ortega & Quincosa, 1980
H. cuspidatus Saha, Lal, Singh, Kaushal & Sharma, 2000
H. delanus Marais, 1998
H. delhiensis Khan & Nanjappa, 1972
H. densibullatus Siddiqi, 1972
H. depressus Yeates, 1967
H. digitatus Siddiqi & Husain, 1964
H. digitiformis Ivanova, 1967
H. dignus Eroshenko & Nguen Vu Thanh, 1981
H. digonicus Perry in Perry, Darling & Thorne, 1959
= *H. broadbalkiensis* Yuen, 1964
H. discocephalus Firoza & Maqbool, 1993
H. distinctus Mohilal, Anandi & Dhanachand, 1998
H. dolichodoryphorus Sher, 1966
H. dumicola Siddiqi, 1995
H. egyptiensis Tarjan, 1964
H. elegans Roman, 1965
H. eletropicus Darekar & Khan, 1980
H. erythrinae (Zimmermann, 1904) Golden, 1956
= *H. melancholicus* (Lordello, 1955) Andrassy, 1958
= *H. spicaudatus* Tarjan, 1964
H. exallus Sher, 1966
= *H. regularis* Phillips, 1971
H. falcatus Eroshenko & Nguen Vu Thanh, 1981

- H. fericulus* Siddiqi, 1995
H. ferus Eroshenko & Nguen Vu Thanh, 1981
H. gerti Marais, Mekette & Tiedt, 2005
H. girus Saha, Chawla & Khan, 1974
H. goldeni Sultan & Jairajpuri, 1979
H. goodi Tikyani, Khera & Bhatnagar, 1969
H. graminophilus Fotedar & Mahajan, 1974
H. gratus Patil & Khan, 1983
H. gulabi Jain, Siddiqui & Parihar, 2000
H. haki Fotedar & Mahajan, 1974
H. handooi Khan, Ghazi & Soomro, 2008
H. hazratbalensis Fotedar & Handoo, 1974
H. holguinensis Sagitov, Sampetro, Santos & Paneke, 1978
H. hoplocaudus Manjrekar, 1972
H. hydrophilus Sher, 1966
H. impar Prasad, Khan & Chawla, 1965
H. imperialis Rashid & Khan, 1972
H. incisus Darekar & Khan, 1978
H. indentatus Chaturvedi & Khera, 1979
H. indenticaudatus Mulk & Jairajpuri, 1975
H. indicus Siddiqi, 1963
H. inifatis Fernandez, Razjivin, Ortega & Quincosa, 1980
H. insignis Khan & Basir, 1964
H. intermedius (Luc, 1960) Fortuner, 1984
= *Rotylenchoides intermedius* Luc, 1960
H. interrogativus Eroshenko, 1981
H. issykkulensis Sultanalieva, 1983
H. jammuensis Fotedar & Mahajan, 1974
H. jasmirii Jain, Siddiqui & Parihar, 2000
H. jojutlensis Zavaleta-Mejia & Sosa Moss, 1979
H. kashmirensis Fotedar & Handoo, 1974
H. kermarreci Marais, Berg, Queneherve & Tiedt, 2000
H. kherai Kumar, 1982
H. krugeri Van den Berg & Heyns, 1975
H. labiatus Roman, 1965
H. labiodiscinus Sher, 1966
H. laevicaudatus Eroshenko & Nguen Vu Thanh, 1981
H. leiocephalus Sher, 1966
H. lemoni Firoza & Maqbool, 1996
H. limarius Eroshenko, Nguen Ngok Tyan, Nguen Vu Thank & Doan Kan, 1985
H. limatus Siddiqi, 1995
H. lissocaudatus Fernandez, Razjivin, Ortega & Quincosa, 1980

- H. lobus* Sher, 1966
H. longicaudatus Sher, 1966
H. macronatus Mulk & Jairajpuri, 1975
H. macrostylus Marias & Queneherve, 1996
H. magnicephalus Phukan & Sanwal, 1981
H. marethae Marais, Queneherve, Tiedt & Meyer, 2013
H. martini Sher, 1966
H. meloni Firoza & Maqbool, 1994
H. microcephalus Sher, 1966
= *H. mangiferensis* Elmiligy, 1970
H. microdorus Prasad, Khan & Chawla, 1965
H. microtylus Firoza & Maqbool, 1993
H. minutus van den Berg & Cadet, 1984
H. minzi Sher, 1966
H. monstruosus Eroshenko, 1984
H. montanus Teben'kova, 1983
H. morasii Darekar & Khan, 1980
H. mucrogaleatus Fernandez, Razjivin, Ortega & Quincosa, 1980
H. mucronatus Siddiqi, 1964
H. multicinctus (Cobb, 1893) Golden, 1956
H. iperoiguensis (Carvalho, 1956) Andrassy, 1958
H. mundus Siddiqi, 1995
H. neoformis (Siddiqi & Husain, 1964) Fortuner, 1984
= *Rotylenchoides neoformis* Siddiqi & Husain, 1964
H. neopaxilli Inserra, Vovlas & Golden, 1979
H. nigeriensis Sher, 1966
H. nitens Siddiqi, 1995
H. notabilis Eroshenko & Nguen Vu Thanh, 1981
H. obliquus Maqbool & Shahina, 1986
H. obtusicaudatus Darekar & Khan, 1978
H. oleae Inserra, Vovlas & Golden, 1979
H. orthosomaticus Siddiqi, 1972
H. oryzae Fernandez, Razjivin, Ortega & Quincosa, 1980
H. oscephalus Anderson, 1979
H. parabelli Volkova, 1987
H. paracanalisis Sauer & Winoto, 1975
= *H. trivandranus* Mohandas, 1976
H. paraconcaus Rashid & Khan, 1972
H. paracrenacauda Phukan & Sanwal, 1981
H. paradihysteroides Darekar & Khan, 1979
H. paragirus Saha, Chawla & Khan, 1974

- H. paraplatyurus* Siddiqi, 1972
H. parapteracercus Sultan, 1981
H. pasohi Sauer & Winoto, 1975
H. paxilli Yuen, 1964
H. persiaensis Kashi & Karegar, 2014
H. persici Saxena, Chhabra & Joshi, 1972
H. pisi Swarup & Sethi, 1968
H. planquettei Marais & Queneherve, 1999
H. platyurus Perry in Perry, Darling & Thorne, 1959
H. plumariae Khan & Basir, 1964
H. pricei Siddiqi, 1995
H. pseudodigonicus Szczygiel, 1970
H. pseudopaxilli Fernandez, Razjivin, Ortega & Quincosa, 1980
H. pseudorobustus (Steiner, 1914) Golden, 1956
= *H. microlobus* Perry in Perry, Darling & Thorne, 1959
= *H. bradys* Thorne & Malek, 1968
= *H. phalerus* Anderson, 1974
H. pteracercus Singh, 1971
H. rajcolagri Jain, Siddiqui & Parihar, 2000
H. raskii Naraynaswamy, 1987
H. retusus Siddiqi & Brown, 1964
H. reversus Sultan, 1985
H. reynosus Razjivin, O'Relly & Milian, 1973
H. rohtangus Jairajpuri & Baqri, 1973
H. ryzhikovi Kulinich, 1986
H. sacchari Razjivin, O'Relly & Milian, 1973
H. saccharumi Jam, Upadhyay & Singh, 1986
H. sagitovi Fortuner, Merny & Roux, 1981
= *H. orientalis* Saqitov, Sanpedro, Santos & Paneke, 1978
H. samorensis Jain, Siddiqui & Parihar, 2000
H. sandersae Ali & Loof, 1975
H. saxeus Siddiqi, 1995
H. scoticus Boag & Jairajpuri, 1985
H. serenus Siddiqi, 1963
H. seshadrii Singh & Khera, 1979
H. shakili Sultan, 1981
H. sharafati Mulk & Jairajpuri, 1975
H. sheri Jam, Upadhyay & Singh, 1975
H. shervarayensis Giribabu & Saba, 2002
H. sieversii Razjivin, 1971
H. silvaticus Lal & Khan, 1989
H. similis Fernandez, Razjivin, Ortega & Quincosa, 1980

- H. solani* Rashid, 1972
H. sparsus Fernandez, Razjivin, Ortega & Quincosa, 1980
H. spitsbergensis Loof, 1971
H. steineri Fotedar & Mahajan, 1974
H. striatus Firoza & Maqbool, 1994
H. stylocercus Siddiqi & Pinochet, 1979
H. subterminalis Siddiqi, 1995
= *Rotylenchoides subterminalis* Siddiqi, 1995
H. subtropicalis Fernandez, Razjivin, Ortega & Quincosa, 1980
H. tangericus Sultan, 1981
H. teres Gaur & Prasad, 1972
= *H. thornei* Gupta & Chhabra, 1967
= *H. bakeri* Gupta & Chhabra, 1975
H. thornei Roman, 1965
H. trapezoidicaudatus Fotedar & Kaul, 1985
H. tropicus Roman, 1965
H. truncatus Roman, 1965
H. tumidicaudatus Phillips, 1971
H. tunisiensis Siddiqi, 1964
H. unicum Fernandez, Razjivin, Ortega & Quincosa, 1980
H. urobelus Anderson, 1978
H. ussuriensis Eroshenko, 1981
H. valdeclarus (Orton Williams, 1983) Ebsary, 1991
= *Rotylenchoides valdeclarus* Orton Williams, 1983
H. valecus Sultan, 1981
H. variabilis Phillips, 1971
H. varicaudatus Yuen, 1964
H. variocaudatus (Luc, 1960) Fortuner, 1984
= *Rotylenchoides variocaudatus* Luc, 1960
H. ventroprojectus Patil & Khan, 1983
H. verecundus Zarina & Maqbool, 1991
H. verrucosus Fernandez, Razjivin, Ortega & Quincosa, 1980
H. vindex Siddiqi, 1995
H. vulgaris Yuen, 1964
H. wajihi Sultan, 1981
H. whiteheadi (Ganguly & Khan, 1987) Firoza & Maqbool, 1994
= *Rotylenchoides whiteheadi* Ganguly & Khan, 1987
H. willmottae Siddiqi, 1972
H. wilmae Marais, Gaidashova & Tiedt, 2008
H. zeidani Elbadri, Moon, Wani, Bukhari, Lee & Choo, 2009

Species inquirendae

- H. borinquensis* Roman, 1965 (by Fortuner *et al.*, 1981)



1. *H. abuharazi*



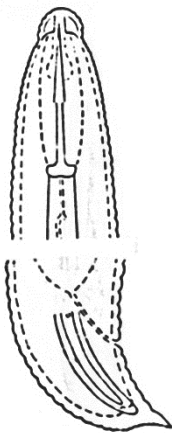
2. *H. abunaamai*



3. *H. acunae*



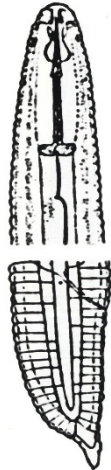
4. *H. acuticaudatus*



5. *H. acutus*



6. *H. affinis*



7. *H. africanus*



8. *H. agricola*



9. *H. alinae*



10. *H. amabilis*



11. *H. amplius*



12. *H. angularis*



13. *H. anhelicus*



14. *H. annobonensis*



15. *H. apiculus*



16. *H. aquili*



17. *H. arachisi*



18. *H. areolatus*



19. *H. arliani*



20. *H. assamensis*



21. *H. astriatus*



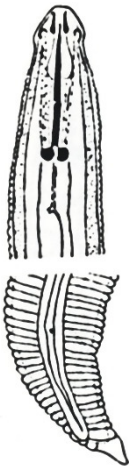
22. *H. atlanticus*



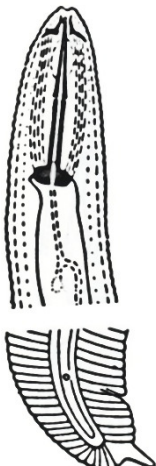
23. *H. attenuatus*



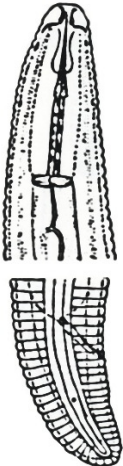
24. *H. australis*



25. *H. babikeri*



26. *H. bambesae*



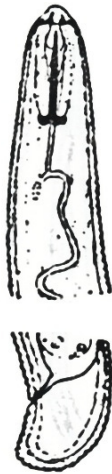
27. *H. belli*



28. *H. belurensis*



29. *H. bifurcatus*



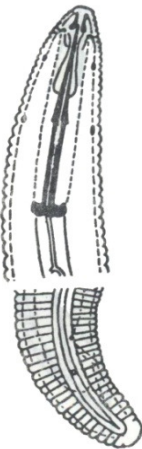
30. *H. bihari*



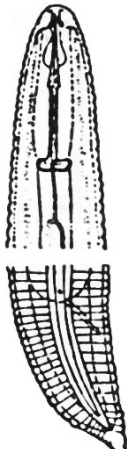
31. *H. brevis*



32. *H. brevicaudatus*



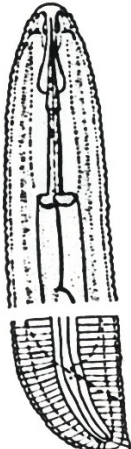
33. *H. caipora*



34. *H. californicus*



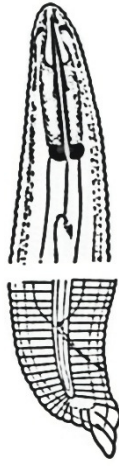
35. *H. canadensis*



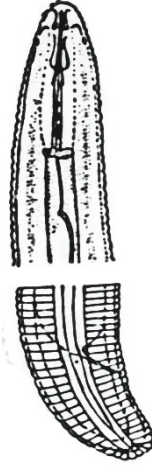
36. *H. canalis*



37. *H. caroliniensis*



38. *H. caudatus*



39. *H. cavenessi*



40. *H. cedreus*



41. *H. certus*



42. *H. clarkei*



43. *H. coffae*



44. *H. concavus*



45. *H. conicephalus*



46. *H. conicus*



47. *H. constrictus*



48. *H. coomansi*



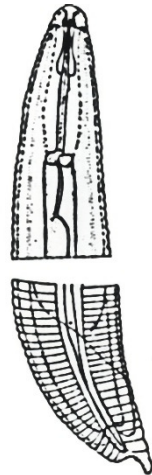
49. *H. cornurus*



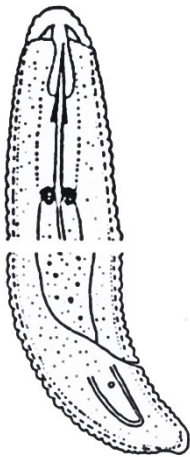
50. *H. craigi*



51. *H. crassatus*



52. *H. crenacauda*



53. *H. crotonii*



54. *H. curatus*



55. *H. curvatus*



56. *H. curvicaudatus*



57. *H. cuspidata*



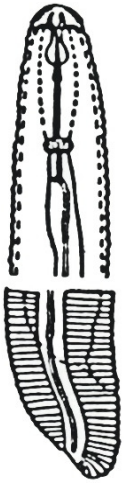
58. *H. delanus*



59. *H. delhiensis*



60. *H. densibullatus*



61. *H. depressus*



62. *H. digitatus*



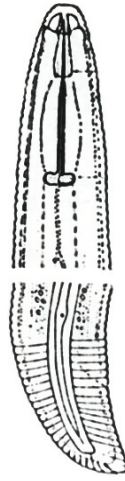
63. *H. digitiformis*



64. *H. dingus*



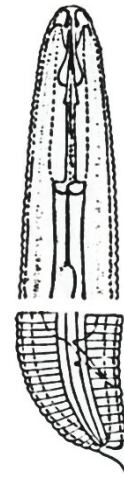
65. *H. digonicus*



66. *H. dihystra*



67. *H. discocephalus*



68. *H. dolichodoryphorus*



69. *H. dunicola*



70. *H. egyptiensis*



71. *H. elegans*



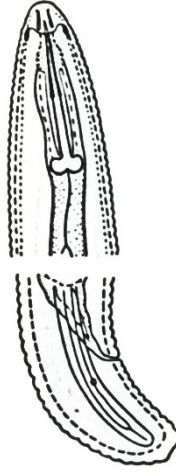
72. *H. eletropicus*



73. *H. erythrinae*



74. *H. exallus*



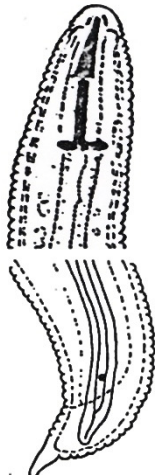
75. *H. falcatus*



76. *H. fericulus*



77. *H. ferus*



78. *H. gerti*



79. *H. girus*



80. *H. goldeni*



81. *H. goodi*



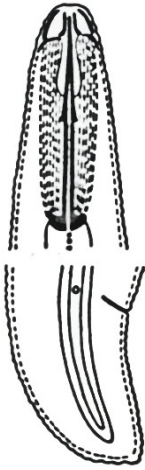
82. *H. graminophilus*



83. *H. gratus*



84. *H. gulabi*



85. *H. haki*



86. *H. handooi*



87. *H. hazratbalensis*



88. *H. holguinensis*



89. *H. hydrophilus*



90. *H. impar*



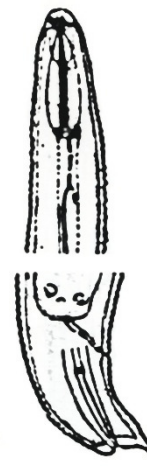
91. *H. imperialis*



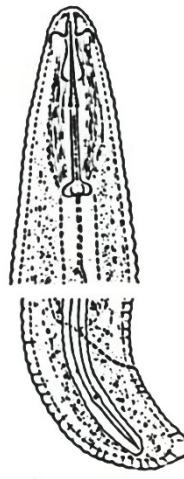
92. *H. incisus*



93. *H. indentatus*



94. *H. indenticaudatus*



95. *H. indicus*



96. *H. inifatis*



97. *H. insignis*



98. *H. intermedius*



99. *H. interrogativus*



100. *H. issykkulensis*



101. *H. jammuensis*



102. *H. jasmirii*



103. *H. jojutlensis*



104. *H. kashmirensis*



105. *H. kermarreci*



106. *H. kherai*



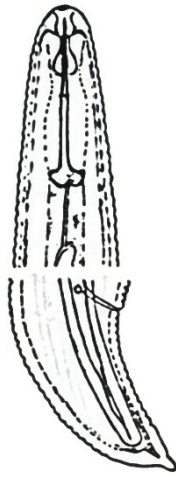
107. *H. krugeri*



108. *H. labiatus*



109. *H. labiodiscinus*



110. *H. laevicaudatus*



111. *H. leiocephalus*



112. *H. lemoni*



113. *H. limarius*



114. *H. limatus*



115. *H. lissocaudatus*



116. *H. lobus*



117. *H. longicaudatus*



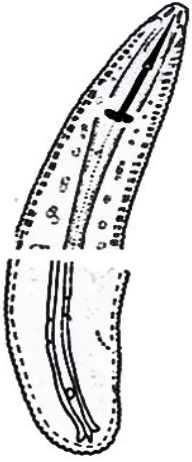
118. *H. macronatus*



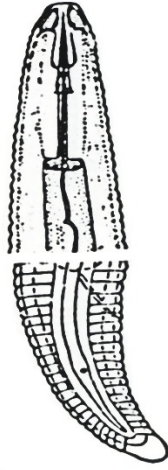
119. *H. macrostylus*



120. *H. magnicephalus*



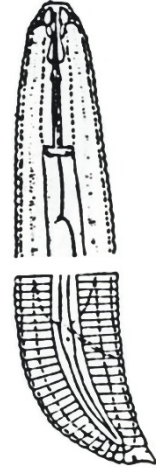
121. *H. marethae*



122. *H. martini*



123. *H. meloni*



124. *H. microcephalus*



125. *H. microdorus*



126. *H. microtylus*



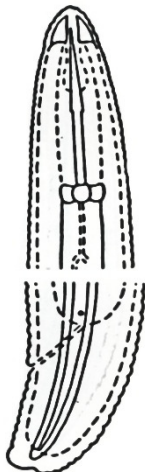
127. *H. minutus*



128. *H. minzi*



129. *H. monstruosus*



130. *H. montanus*



131. *H. morasii*



132. *H. mucrogaleatus*



133. *H. mucronatus*



134. *H. multicinctus*



135. *H. mundus*



136. *H. neoformis*



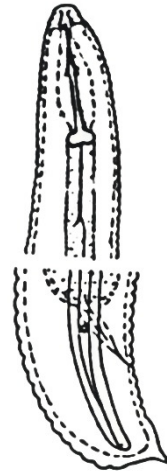
137. *H. neopaxilli*



138. *H. nigeriensis*



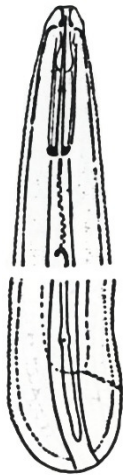
139. *H. nitens*



140. *H. notabilis*



141. *H. obliquus*



142. *H. obtusicaudatus*



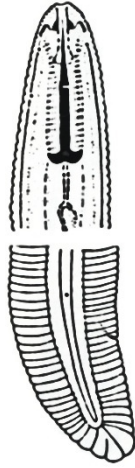
143. *H. oleae*



144. *H. orthosomaticus*



145. *H. oryzae*



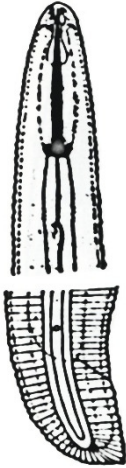
146. *H. oscephalus*



147. *H. parabelli*



148. *H. paracanalii*



149. *H. paraconcaus*



150. *H. paracrenacauda*



151. *H. paradihysteroides*



152. *H. paragirus*



153. *H. paraplatyurus*



154. *H. parapteracercus*



155. *H. pasohi*



156. *H. paxilli*



157. *H. persiaensis*



158. *H. persici*



159. *H. pisi*



160. *H. planquettei*



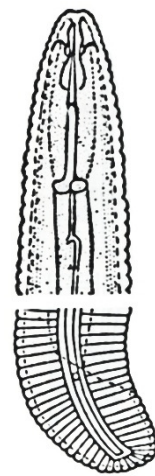
161. *H. platyurus*



162. *H. plumariae*



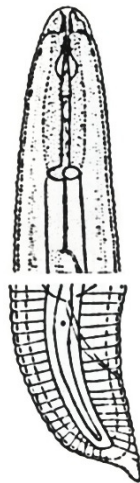
163. *H. pricei*



164. *H. pseudodigonicus*



165. *H. pseudopaxilli*



166. *H. pseudorobustus*



167. *H. pteracercus*



168. *H. rajcolagri*



169. *H. retusus*



170. *H. reversus*



171. *H. reynosus*



172. *H. rohtangus*



173. *H. ryzhikovi*



174. *H. sacchari*



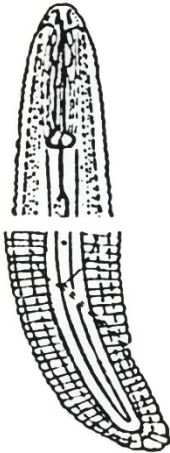
175. *H. saccharumi*



176. *H. sagitovi*



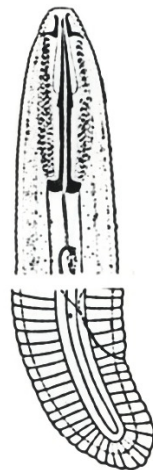
177. *H. samorensis*



178. *H. sandersae*



179. *H. saxeus*



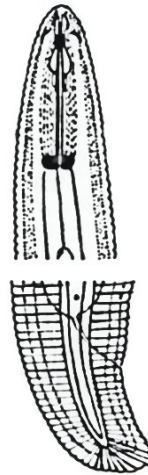
180. *H. scoticus*



181. *H. serenus*



182. *H. seshadrii*



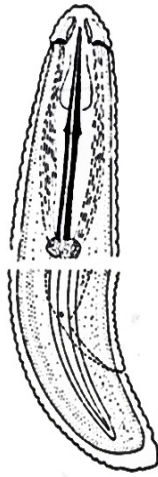
183. *H. shakili*



184. *H. sharafati*



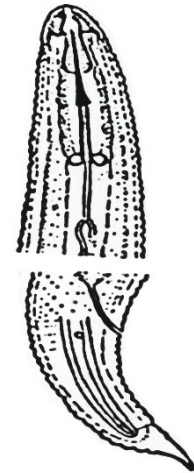
185. *H. sheri*



186. *H. shervarayensis*



187. *H. sieversii*



188. *H. silvaticus*



189. *H. similis*



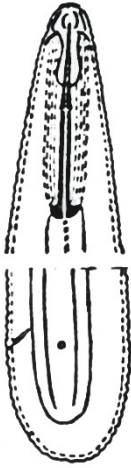
190. *H. solani*



191. *H. sparsus*



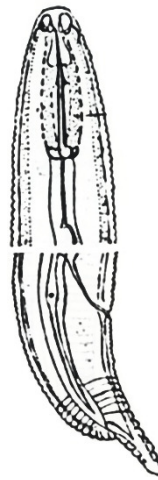
192. *H. spitsbergensis*



193. *H. steineri*



194. *H. striatus*



195. *H. stylocercus*



196. *H. subterminalis*



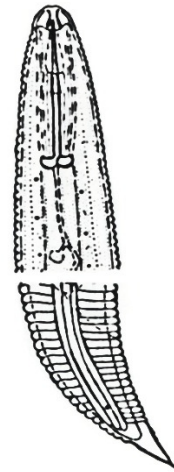
197. *H. subtropicalis*



198. *H. tangericus*



199. *H. teres*



200. *H. thornei*



201. *H. trapezoidicaudatus*



202. *H. tropicus*



203. *H. truncatus*



204. *H. tumidicaudatus*



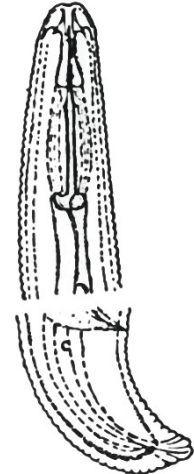
205. *H. tunisiensis*



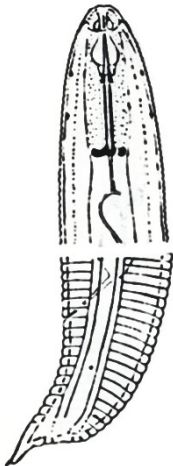
206. *H. unicum*



207. *H. urobelus*



208. *H. ussuriensis*



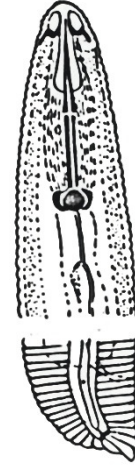
209. *H. valdeclarus*



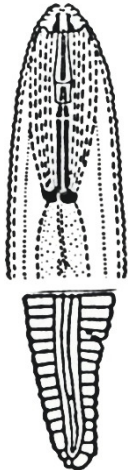
210. *H. valecus*



211. *H. variabilis*



212. *H. varicaudatus*



213. *H. variocaudatus*



214. *H. ventroprojectus*



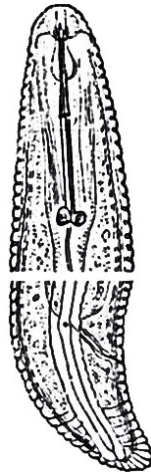
215. *H. verecundus*



216. *H. verrucosus*



217. *H. vietnamiensis*



218. *H. vindex*



219. *H. vulgaris*



220. *H. wajihi*



221. *H. whiteheadi*



222. *H. willmottae*



223. *H. wilmae*



224. *H. zeidani*

Table 2. A diagnostic data on species of the genus *Helicotylenchus* females (Measurements provided from original description).

Species name	Habitus	Body length (mm)	a	c	c'	V	DGO (µm)	Stylet length (µm)	Stylet knobs shape	Head shape	Head ann	Tail shape	Tail ann	Phas post. ant/post	Male PGB	Female PGB	Fig.No. Head & tail
<i>H. abuharazi</i>	S	0.52-0.63	25-33	38-52	0.9-1.1	61-64	9-14	21-24	R-FA	H	3-4	CC SH-VP	6-9	8-1/	ABS	F	1
<i>H. abunaamai</i>	S	0.52-0.63	25-29	33-44	1.1-1.4	59-65	?	21-22	F-C	H	4	CC SH-VP	7-11	5-1/	ABS	F	2
<i>H. acunae</i>	LS	0.63-0.65	22.3-24.2	37.2-39.7	?	60.5-62.4	?	28.9-30.6	AI	H	4-5	CON-R SH-VP	10-11	7-6/	ABS	F	3
<i>H. acuticaudatus</i>	LS	0.83-0.86	28.5-29.1	30.7-32.5	?	64.8-65.8	?	33.1-33.9	AI	H	4-5	CONI PT-VP	9-10	5-4/	ABS	F	4
<i>H. acutus</i>	?	0.73-0.85	26-28	51-61	0.8-0.9	57-62	6-8	29-31	FA	H	4-5	CON SH-VP	6-10	4-3/	ABS	F	5
<i>H. affinis</i>	OC	0.37-0.46	19.5-25.2	26.4-35.6	1.3-1.7	82.5-87.8	7-9	25-26.5	I-FA	H	4	CONI	?	1-2	PRS	NF, PUS	6
<i>H. africanus</i>	SA	0.62-0.98	33-41	25-36	1.6-2.3	58-64	?	27-31	R-FA	H	4-5	TAP PT-VP	11-18	8-3/	PRS	F	7
<i>H. agricola</i>	S	0.48-0.61	21.5-27	27-39	1-1.3	62-65	7-8	22-25	R	T/H	4-5	CON SH-VP	7-10	7-4/	ABS	F	8
<i>H. alinae</i>	S	0.8-1.05	25-38.7	37-57.2	0.7-1.2	57-62	10-15	30-35	R-FA	R	3-4	CC	12-15	9-5/	ABS	NF	9
<i>H. amabilis</i>	S	0.48-0.6	20-25.7	26.3-34.1	1.1-1.4	59.2-63.1	?	23.1-25.9	?	?	?	?	10-13	3-4	ABS	F	10
<i>H. amplius</i>	S	0.69-0.89	23-31	30-42	0.9-1.5	59-62	12-18	27-29	AI	H	4-5	MUC	8-14	10-1/	ABS	F	11
<i>H. angularis</i>	S	0.48-7.1	25-35	36-62	1-1.4	57-69	10-11	23-26	F-C	T/H	2-4	CC-L-VP	7-12	6-3/	ABS	F	12
<i>H. anhelicus</i>	SA	0.57-0.78	26-32	33-46	1-1.9	57-64	?	29-32	AI	H	5	H	11	5-4/	PRS	F	13
<i>H. annobonensis</i>	S	0.75	28	35	?	65	?	?	?	?	?	L-VP	?	?	ABS	F	14
<i>H. apiculatus</i>	?	0.5-0.6	21-29	30-41	?	61-66	9-11	24	CUP	H	5-7	SP-VP	?	5/	PRS	F	15
<i>H. aquili</i>	S	0.55-0.7	21-33	55-61	1	60-68	?	23-24	AC	H	4	R	9	11-8/	ABS	F	16
<i>H. arachnisi</i>	S	0.47-0.6	26-29	39-46	1-1.4	60-65	8-10	21-23	FA	H	4-5	BR	?	6-2/	ABS	F	17
<i>H. areolatus</i>	S	0.4-0.6	20.4-29.6	32.5-64.2	0.6-1.2	63-66	?	22.5-25.7	FA	H	4	CON-RT	8-11	7-0/	PRS	F	18
<i>H. arliani</i>	LS	1.1-1.3	30-39.3	35.5-41.7	1-1.9	61.4-64.9	10-12	36-40	AD	H	5-6	CC	21	11/	PRS	F	19
<i>H. assamensis</i>	LS	0.55-0.71	25-32	27-42	1.2-1.8	59-65	10-13	24-28	OR	T	3	CC	13-16	7-4/	ABS	NF	20
<i>H. astratus</i>	S	0.56-0.65	28-32	38.5-45.5	0.8	61-64	6	20-22	AC	T	SM	CON-SRT	4-6	4-3/	ABS	F	21

Species name	Habitus	Body length (mm)	a	c	c'	V	DGO (µm)	Stylet length (µm)	Stylet knobs shape	Head shape	Head ann	Tail shape	Tail ann	Phas. post. ant/post	Male	Female PGB	Fig No. Head & tail
<i>H. atlanticus</i>	OC	0.62-0.71	20.1-26.4	42.5-46	?	65-66	?	25.9-27.4	AI	H	4-5	CON SH-VP	7	4/	ABS	F	22
<i>H. attenuatus</i>	SA	0.42-0.52	24-29	19-28	1.7-2.8	77-84.5	6-9	25-26.5	ANC	H	3-4	AT-EC	10-15	/0-5	PRS	NF	23
<i>H. australis</i>	OC	0.6-0.8	27-37	41-69	0.9-1.6	58-61	?	20-24	R	T	SM	H	8-20	11-1/	PRS	F	24
<i>H. babikeri</i>	S	0.40-0.51	21-30	29-39	1.3-1.6	62-69	5.5-7	16-17.5	R-AI	T	3-5	CONI	8-12	5/1	ABS	F	25
<i>H. bajortensis</i>	C	0.61-0.9	31-38	38-60	0.75-1.2	57-63	12-16	22-28	AD	CON	3	CYL-R	-	-	-	-	NA
<i>H. bambescae</i>	S	0.55-0.59	21-22	34-42	1-1.3	62-63	12	22-24	R	H	5-6	VP	7-9	7-2/	ABS	F	26
<i>H. belli</i>	S	0.71-0.98	27-33	27-48	1.2-1.6	57-62	?	27-29	FA	T	SM	H	16	/7	ABS	F	27
<i>H. belurensis</i>	S	0.57-0.67	27-29	44-48	0.9-1.2	60-67	10-11	23-26	AI	T	5-6	CON-VP	10-15	5-2/	PRS	F	28
<i>H. bifurcatus</i>	S	0.76-0.8	20.4-22.7	37.1-40.1	?	64.8-67	?	28.4-30.1	R-FA	H	4-5	VP	8-9	0/	ABS	F	29
<i>H. bihari</i>	S	0.54-0.62	26-30	43-60	0.8-1.2	60-64	8-11	20-21	F-C	T	5-6	SCY-T	6-8	9-3/	ABS	F	30
<i>H. brassicae</i>	?	0.80	30	44.4	?	63.1	?	29-31	?	H	?	H	?	0/	ABS	F	NA
<i>H. brevis</i>	OC	0.43-0.53	18-22	36-55	?	89.7-92.1	?	26-29	FA	T	3-4	H	?	0/	PRS	NF-PUS	31
<i>H. brevicaudatus</i>	SC	0.46-0.6	18-26	29.1-38.9	0.68-1.5	61-64.2	15	20-23.5	R	CONI	4	H-BC	6-7	/2	ABS	F	32
<i>H. caipora</i>	S	0.61-0.73	27.9-35.4	32.6-51.3	1.3-2	57.3-63.3	?	24.3-27.1	FA	H	4-5	CC-SRT	6-11	7/2-3	PRS	F	33
<i>H. californicus</i>	S	0.58-0.78	27-32	32-50	0.8-1.3	59-64	?	24-27	FA	H	4	L-VP	8	2/	PRS	F	34
<i>H. canadensis</i>	S	0.68-0.97	20-30.4	48.7-65	?	61-66	6-9	28-30	AC	T	4-5	CC	10-12	12-3/	ABS	F	35
<i>H. canalis</i>	LS	0.67-0.9	22-30	38-61	0.7-1	56-62	?	32-36	AI	H	5	L-VP	6	4-3/	ABS	F	36
<i>H. carolinensis</i>	LS	0.68-0.82	27-32	35-49	0.9-1.3	61-64	?	25-28	AI	H	4	IR-H	12	6/	ABS	F	37
<i>H. caudatus</i>	S	0.52-0.61	23-25	32-36	0.8-1.5	63-66	?	25-28	R-AI	H	3-4	IR-VP	8-14	7-0/	ABS	F	38
<i>H. cannesi</i>	S	0.56-0.7	24-32	33-64	1-1.3	56-62	?	24-27	AI	H	4	IR-H	13	6/	ABS	F	39
<i>H. cedreus</i>	?	0.53-0.61	20.9-26.5	25.6-38.9	1.1-1.6	58.3-63.4	?	22.4-26.5	?	?	?	CONI	?	?	PRS	F	40
<i>H. certus</i>	S	0.59-0.65	23-31	36-45	?	61-65	8.4-10.5	23-25	FA	H	4-5	CON PT-VP	7-10	4-1/	ABS	F	41
<i>H. cheni</i>									NA								NA
<i>H. clarkei</i>	S	0.56-0.69	25-32	35-53	0.9-1.4	59-64	?	23-27	FA	T	SM	H	12	8-7/	PRS	F	42

Species name	Habitus	Body length (mm)	a	c	c'	V	DGO (µm)	Stylet length (µm)	Stylet knobs shape	Head shape	Head ann	Tail shape	Tail ann	Phas post. ant/post	Male	Female PGB	Fig.No. Head & tail
<i>H. coffae</i>	S	0.38-0.59	18-22	35-53	0.9-1.4	59-64	?	24-25	FA	H	4-5	VP	10-12	2/3	ABS	F	43
<i>H. concavus</i>	SA	0.64-0.86	26-33	42-51	0.8-1	61-65	?	29-32	AI	H	SM	H	6-12	18-11/	ABS	F	44
<i>H. conicephalus</i>	LS	0.46-0.64	28-32	36-51	0.7-1.4	60-63	?	21-24	FA	T	SM	R-VP	7-9	6-1/	ABS	F	45
<i>H. conicus</i>	S	0.62-0.73	26-35	40.4-55	0.9-1.2	60-63	8-10	24-25	AI	T	SM	CONI	7-12	2-1/1-2	ABS	F	46
<i>H. constrictus</i>	OS	0.61-0.62	23.7-24.2	34.9-36.2	1.37-1.49	62.6-62.8	8-12.8	20.9-22.5	R	H	IN	VC	7-8	8-6/	ABS	NF	47
<i>H. coomansi</i>	SA	1.17-1.3	35-40	43-67	0.7-1.1	58-60	?	39-42	FA	T/H	4-5	H	10-13	8-5/	PRS	F	48
<i>H. cornutus</i>	LS	0.67-0.84	25-32	37-59	0.65-1.15	61-65	7-12	24-27	AI	H	4-5	IR-VP	5-11	10-2/	PRS	F	49
<i>H. craigi</i>	LS	0.52-0.65	23-30	23-33	1-1.2	56-61	?	22-24	AI	H	4	PT-VP	7-9	6/2	ABS	F	50
<i>H. crassatus</i>	OC	0.64-0.77	27-34	45-71	0.63-1	61-64	?	26-30	AC	T	4	IR-VP	3-9	6/2	ABS	F	51
<i>H. crenatauda</i>	S	0.57-0.77	24-29	31-52	1-1.3	59-64	?	24-28	FA	H	4	IND-VP	8	6-4/	ABS	F	52
<i>H. eroinii</i>	LS	0.49-0.6	20.4-26	20.8-36	1.1-1.8	59-66.6	14	20-24	R	T/H	3	CON	6-7	0-1	ABS	F	53
<i>H. curtatus</i>	S	0.83-1.26	17.5-27.5	38.1-52	0.8-1.2	58-64	3-9	42-46	F-I	T	6-7	DC	13-18	0-5	PRS	F	54
<i>H. curvatus</i>	?	0.6	26-28	38-44	?	59-60	8-10	22	CUP	T	4	SH-VP	?	0/2	ABS	F	55
<i>H. curvicaudatus</i>	S	0.59-0.63	27.1-29.1	28.9-30.1	?	60.4-62.8	?	30.4-31.7	AI	H	4	CUR-VP	14	6/	ABS	F	56
<i>H. cuspicaudatus</i>	LS	0.58-0.72	23-30	26-33	1.6-2.5	60-67	11-13	25-28	R-FA	H	4	CON-VA	19-23	5/	ABS	NF	57
<i>H. delanus</i>	C	0.46-0.62	22.5-33	35.8-56.5	0.7-1.2	73-76	5-8	25-28	F-I	T	5-6	DC	6-11	5	PRS	F	58
<i>H. delhiensis</i>	S	0.54-0.7	21-30	43-54	?	59-65	8	21-22	AC	H	2-3	CON-R	7	9/	ABS	F	59
<i>H. densiballatus</i>	S	0.43-0.58	24-31	41-51	0.9-1.2	62-65	?	22-23	AMA	H	3	CC SH-VP	7-10	8-1/	ABS	F	60
<i>H. depressus</i>	S	0.66-0.8	30.2-35.7	41.2-70.8	0.76-1.28	63.2-67.7	?	23-27	R	H	3-4	CON	10-13	11-6/	ABS	F	61
<i>H. digitatus</i>	S	0.52-0.61	21-30	21-26	?	59-66	8.5	20-21	R	H	4	DIGI	13-16	2/5	ABS	F	62
<i>H. digitiformis</i>	S	0.7-0.8	26-31	30-39	1.1-1.4	60-62	?	27-30	AC	H	5	DIGI	14-16	4-1/	ABS	F	63
<i>H. dignus</i>	OC	0.51-0.58	20-27	42-69	0.9-1.1	63-70	?	25-27.6	AC	H	3-5	BR	?	3-5	ABS	F	64
<i>H. digonicus</i>	S	0.5-0.79	23-33	41-63	0.7-0.9	58-64	?	24-28	FA	T	4-5	H SH-VP	4-10	5-1/	ABS	F	65
<i>H. dihystrera</i>	S	0.59-0.79	27-35	35-49	0.8-1.2	60-65	?	24-29	AI	H	4-5	CON- SH-VP	6-12	11-5/	PRS	F	66
<i>H. discocephalus</i>	S	0.47-0.6	22.4-28	26.4-45.5	1-1.6	56.9-62.8	9.6-12	20.8-23.2	AI	T	4-5	L-VP	6-10	IN	ABS	F	67

Species name	Habitus	Body length (mm)	a	c	c'	V	DGO (µm)	Stylet length (µm)	Stylet knobs shape	Head shape	Head ann	Tail shape	Tail ann	Phas post. ant/post	Male	Female PGB	Fig No. Head & tail
<i>H. distinctus</i>																	
<i>H. dolichodoryphorus</i>	S	0.71-0.92	28-34	37-67	0.8-1.1	61-66	?	34-38	AI	H	5	MUC	5	3-2/	PRS	F	68
<i>H. dumicola</i>	S	0.64-0.77	26-31	46-66	0.74-0.9	59-62	10.5-15	36-40	AI	H	4-5	CC	9-15	8-2/	ABS	NF	69
<i>H. egyptiensis</i>	S	0.69-0.85	26-32	25-33	1.4-1.9	59-62	9-13	24-28	R	T	4-6	MUC	8-15	5/2	ABS	F	70
<i>H. elegans</i>	LS	0.43-0.45	28-30	27-37	?	60-62	9-10	21-24	CUP	H	5-6	CON	?	2/2	ABS	F	71
<i>H. electropicus</i>	S	0.53-0.68	26-31	35-45	1-1.4	60-65	9	23-25	CUP	T	4	CC SH-VP	12-15	8-5/	ABS	F	72
<i>H. erythrinae</i>	LS	0.48-0.61	23-26	27-34	1-1.6	60-65	?	23-26	AI	H	4-5	MUC	6-12	4/2	PRS	F	73
<i>H. exaltus</i>	LS	0.61-0.78	26-32	30-52	0.7-1.2	59-63	?	25-28	FA	H	4	CON SH-VP	12	5-3/	PRS	F	74
<i>H. faicatus</i>	OC	0.53-0.61	25-31	34-47	?	58-63	8-10.5	21-22	FA	T	IN	BL-R CONI	8-10	0/	ABS	F	75
<i>H. fericitus</i>	S	0.71-0.85	29-35	39-53	0.9-1.4	59-65	13-15	27-29.5	R	H	4-5	CYL-H	12-16	14-7/	PRS	F	76
<i>H. ferus</i>	S	0.47-0.49	21-23	43-45	?	65-66	9-12.6	22-23	F-C	T	SM	H	?	/3-5	ABS	F	77
<i>H. gerti</i>	S	0.52-0.69	24.9-28.7	32.7-44.3	1.1-1.8	63-66	8-12	22-24	F-AI	H	3-4	DC-VP	4-7	8-3/	ABS	F	78
<i>H. girus</i>	SA	0.7-0.8	28-32	56-67	0.6-0.8	60-64	?	23-25	AI	H	SM	H-CLA	IN	4/	ABS	F	79
<i>H. goldeni</i>	S	0.78-0.9	27-32	42-44	0.9-1.2	65-71	6-9	31-36	AI	H	5-7	BLC-R	12-15	8-4/	PRS	F	80
<i>H. goodi</i>	S	0.64-0.84	21-28	70-80	?	58-62	?	23-25	FA	T	SM	H	8	13/	ABS	F	81
<i>H. graminophilus</i>	LS	0.70-0.84	25-32	32-40	?	64-68	?	25-29	FA	T	IN	BLC	8-12	/2-4	ABS	F	82
<i>H. gratus</i>	SA	0.75-0.9	34-41	52-63	0.7-1	58-65	?	25-27	AI	T	SM	H	14-18	12-3/	ABS	F	83
<i>H. gulabi</i>	S	0.4-0.58	21.7-26	22.3-47	0.58-1.58	61-66.3	10	21-24	R	T	IN	CON	7-8	0/0	ABS	F	84
<i>H. haki</i>	S	0.86-0.95	26-31	24-28	1.5	51-52	?	30-31	AC	T	5-6	BLC	20	5-4/	ABS	F	85
<i>H. hanidooi</i>	S	0.43-0.55	27-30.7	30.7-40.3	0.75-1.3	59.2-74.6	?	21-22	F-C	T	4-5	CON-VP	12-14	5-2/	ABS	NF	86
<i>H. hazratbalensis</i>	LS	0.52-0.65	20-25	40-50	1.1-1.3	59-61	?	22-24	ANC	T	4-5	CON-VP	12	/1-3	ABS	F	87
<i>H. holguinensis</i>	OC	0.64-0.67	20-25.6	48-51.5	?	65-67.8	16-16.5	26-27.5	FA	H	4-5	NOT-T	12-13	7-6/	PRS	F	88
<i>H. hoplocanthus</i>	?	0.76-0.96	25-34	58-65	0.6-0.8	58-61	?	29-30	?	?	?	H	?	?	ABS	?	NA
<i>H. hydrophilus</i>	S	0.70-0.92	26-31	35-55	0.8-1.2	59-65	?	28-32	R	H	4	L-VP	?	5-4/	PRS	F	89
<i>H. impar</i>	S	0.65-0.59	24-37.5	36-47	1.2-1.6	65-71	11	27-29	?	H	4-5	BR	12-17	12-10/	ABS	F	90
<i>H. imperialis</i>	OC	0.48-0.59	25-33	36-43	?	65-71	11	27-29	AI	T	4-5	R	8-12	10-4/	PRS	F	91

Species name	Habitus	Body length (mm)	a	c	c'	V	DGO (µm)	Stylet length (µm)	Stylet knobs shape	Head shape	Head ann shape	Tail shape	Tail ann	Phas post. ant/post	Male PGB	Female PGB	Fig. No. Head & tail
<i>H. incisus</i>	OC	0.76-0.85	29-32	58-68	0.67-0.73	61-63	?	24-26	CUP	T	SM	CLA-H	IN	19-15/	ABS	F	92
<i>H. indentatus</i>	S	0.52-0.64	22-24	33-41	1-1.2	62-65	?	23-29	FA	H	4-5	IND-VP	6-10	8-4/	PRS	F	93
<i>H. indenticanolatus</i>	S	0.58-0.75	21-33	36-43	1.1-1.4	60-64	10-12	22-24	AI	H	5-6	NOT-VP	12-17	7-2-6	ABS	F	94
<i>H. incitcus</i>	S	0.45-0.63	23-32	33-47	?	60-65	9	21-23	R-SD	T	4	CCBL-T	11	6/6	ABS	F	95
<i>H. infatus</i>	S	0.71-0.75	27-28	31-35.1	?	62-64	?	29.1-31.2	AI	H	4-5	VP	8-9	9-7/	ABS	F	96
<i>H. insignis</i>	S	0.6-0.87	30.5-31.7	52-66.7	?	60-63	13-16	23-25	AI	H	4	CON SH-VP	7-11	5-3/	ABS	F	97
<i>H. intermedius</i>	OC	0.39-0.52	22.4-25.5	41.4-59.7	0.8-1	78-83	7-9	26-27	AI	H	4	R	8-10	0/	PRS	NFD	98
<i>H. interrogativus</i>	S	0.62-0.7	25-30	21-30	?	60-68	10-11	27-28	AC	H	4-5	CONI	12-18	3-2/	ABS	F	99
<i>H. isykhulensis</i>	OC	0.72-0.81	21-26.8	24-32.3	?	53-56	?	25	FA	T	5	CONI	?	5	PRS	F	100
<i>H. jammuisensis</i>	S	0.93-1.3	24-27	39-43	?	56-59	?	31-33	AC	T	5	BLC	13	12/	PRS	F	101
<i>H. jasmintii</i>	S	0.45-0.55	22.7-31.6	26.2-40.8	1-1.7	56-65.3	11	19-23	R	H	4	CC	9-10	7-1-2	ABS	F	102
<i>H. jojuatensis</i>	S	0.64-0.9	19.6-26.6	36.5-54.7	0.9-1.2	58.7-63.7	?	27.4-28.9	FA	H	4	H	11	8/	ABS	F	103
<i>H. kazhimirensis</i>	S	0.84-1	30-36	33-38	?	55-62	?	34-36	AI	H	7	CYL-H	14-18	10/	ABS	F	104
<i>H. kernarracti</i>	C	0.49-0.7	26.1-36.6	34.4-49.8	0.9-1.3	59-65	6-9	20-22	R-FA	H	3-4	D-SF	7-12	7-2/	PRS	F	105
<i>H. kherai</i>	S	0.53-0.68	18.4-28.5	31.8-59.3	?	64-69	?	23.3	AI	H	3	H	10-12	7/	PRS	F	106
<i>H. krugeri</i>	S	0.5-0.7	19.8-30.7	20-36.1	1.2-2.1	55-58	?	22.1-27.9	FA	T	SM	R	10-19	11-1/	ABS	F	107
<i>H. labiatus</i>	?	0.5-0.6	21-24	35-48	?	61-64	10-11	25	CUP	T	3-4	CC	?	8/	ABS	F	108
<i>H. labiodiscimus</i>	LS	0.48-0.66	22-29	27-42	1-1.4	58-63	?	23-27	FA	T	SM	IR-H	15	8-7/	ABS	F	109
<i>H. laevicanolatus</i>	S	0.49-0.54	23-27	30-35	?	63-64	9-10	21-23	AC	H	IN	CON-VP	8-9	0/	ABS	F	110
<i>H. leiocephalus</i>	S	0.68-0.86	25-31	31-61	0.9-1.5	55-63	?	24-29	AI	H	SM	H	12	2/	ABS	F	111
<i>H. lemoni</i>	S	0.57-0.62	32.6-35.7	44.9-46.2	1-1.3	58.6-61.5	8-10	20.8-21.6	AD	T	4-5	SL-C	9-14	1-0/	ABS	F	112
<i>H. limarius</i>	?	0.7	30	47	?	62	?	26	R	H	4	H	7-8	4/	ABS	F	113
<i>H. limatus</i>	C	0.58-0.8	26-32	39-53	1-1.4	61-67	13.5-18	31-34	ANC	CR-H	3-4	CC	9-14	4-1/	PRS	F	114
<i>H. lisocaulatus</i>	S	0.64-0.65	21-23.1	27.9-29.4	?	65.9-68.3	?	30.5-31.2	AI	H	4-5	CONI	9-10	3-2/	ABS	F	115
<i>H. lobus</i>	S	0.74-0.95	30-34	34-46	1-1.6	57-65	?	28-31	R	H	5	SH-VP	9	3/2	ABS	F	116
<i>H. longicaulatus</i>	S	0.53-0.76	27-31	25-35	1.4-2	60-66	?	25-29	AI	H	SM	L-VP	12	10-8/	ABS	F	117

Species name	Habitus	Body length (mm)	a	c	c'	V	DGO (µm)	Stylet length (µm)	Stylet knobs shape	Head shape	Head ann shape	Tail ann shape	Tail ann	Phas post. ant/post	Male PGB	Female PGB	Fig No. Head & tail
<i>H. macronotatus</i>	S	0.51-0.59	2.5-3.0	41-43	?	60-64	8-10	20-22	FA	T	4-5	CC-VP	?	3-0/	ABS	F	118
<i>H. macrostylus</i>	S	0.94-1.12	20.4-28.9	43.9-71.3	0.6-0.9	63-65	11.2	42-45	AI	AF	7-8	R-SH-VP	7-11	7/5	PRS	F	119
<i>H. magnicephalus</i>	S	0.57-0.72	28-36	27-34	?	62-65	10-12	21-24	R	T	SM	CON	7-10	9-3/	ABS	F	120
<i>H. marethae</i>	S	0.52-0.64	20-28.6	25.3-39.7	1.1-1.6	57-60	8-9	24-27	F	CF	SM	DC	13-19	/3-10	ABS	F	121
<i>H. martini</i>	S	0.45-0.58	25-31	21-31	1.5-2.5	54-60	?	22-25	R	T	SM	H-SRT	10	/3-12	PRS	F	122
<i>H. meloni</i>	VA	0.62-0.78	28.1-31.9	37.9-59.9	0.83-1.25	61-66	8.1-13.6	24-25	R-SD	H	4-5	DC	8-11	7-2/	ABS	F	123
<i>H. microcephalus</i>	LS	0.55-0.71	27-32	30-42	1.2-1.5	61-66	?	23-27	AI	T	IN	TAP-VP	10	5-3/	ABS	F	124
<i>H. microdorus</i>	SA	0.65-0.74	32.5-35	36-44	1.1-1.3	60-66	8	18-21	AI	H	3-4	BL-R	9-12	?	ABS	F	125
<i>H. microstylus</i>	SA	0.54-0.59	25.8-27.5	55.6-62	0.8-0.85	61.7-67.2	8-10	22.4-23.2	FA	H	3-4	CC	4-5	0/	PRS	F	126
<i>H. minutus</i>	S	0.35-0.43	21.7-34	120.8-26.4	1.7-2	65-68	9.2-11.4	19.5-22.4	FA	H	4	MUC	10-15	8-0/	ABS	F	127
<i>H. minzi</i>	S	0.68-0.8	27-34	46-71	0.5-1	59-64	?	26-29	AI	T	5	IR-H	11	4-2/	PRS	F	128
<i>H. monstruosus</i>	S	0.5-0.6	20-25	25-30	?	60-64	?	24.5	AI	H	5-7	CON-H	14-20	6-0/	ABS	F	129
<i>H. montanus</i>	?	0.72-0.89	26-32	37-53	0.9-1.3	59-64	?	30-31	AI	H	4-5	BLC	?	?	ABS	F	130
<i>H. morasi</i>	S	0.45-0.64	27.5-33	27-39	1.2-1.7	61-64	9	18-20	CUP	H	5-6	CC-TAP	10-15	10-5/	ABS	F	131
<i>H. mucrogaleatus</i>	S	0.53-0.59	22.4-25.7	30.4-32.9	?	64.9-65.2	?	26.4-27.1	AI	H	4-5	L-VP	6-7	6-5/	ABS	F	132
<i>H. mucronatus</i>	LS	0.49-0.59	25-28	26-33	?	58-63	13	21-23	CUP	H	4	MUC	?	3/	PRS	F	133
<i>H. multisetus</i>	SA	0.47-0.53	24-30	35-46	0.8-1	65-69	?	22-24	R-FA	H	3-4	H	6-12	6-2/	PRS	F	134
<i>H. mundus</i>	A-C	0.41-0.51	24.5-31	23-37	1.2-1.7	57-69	8-9.5	20-22.5	R-SE	H	3-4	CON-R	9-12	3-0/	PRS	F	135
<i>H. neoformis</i>	OC	0.54-0.6	24-33	34-57	?	74-77	9.5	22-23	AI	H	4	CON	9-11	8-5/	ABS	NF-D	136
<i>H. neopaxilli</i>	S	0.61-0.75	28-37	32-42	1.2-1.9	55-64	?	23-26	R	T	4-5	CON-VP	10-14	5-3/	ABS	F	137
<i>H. nigritiensis</i>	S	0.69-0.86	25-32	40-63	0.6-0.9	59-66	?	30-33	FA	H	5	DIGI	4	2-1/	PRS	F	138
<i>H. nitens</i>	A-C	0.4-0.5	22-28	25-34	1.2-1.7	64-69.5	7.5-8	19-21	R	CR	2-3	CC	11-14	6-3/	PRS	F	139
<i>H. notobils</i>	S	0.55-0.65	21-30	42-48	?	62-66	11-12	21-23	FA	H	3	CON	?	4-3/	ABS	F	140
<i>H. obliquus</i>	S	0.63-0.69	27-31	48-50	0.8-0.9	61-64	?	22-23	FA	H	4-5	CYL-H	9-12	5-1/	ABS	F	141
<i>H. obtusicaudatus</i>	OC	0.67-0.88	24-32	46-63	0.7-1.2	59-64	?	23-25	FA	T	SM	CLA-H	IN	15-10/	ABS	F	142
<i>H. oleae</i>	S	0.67-0.93	33-36	37-45	1.1-1.7	58-65	?	29-31	FA	T	4-5	BLC	16-21	7-4/	ABS	F	143

Species name	Habitus	Body length (mm)	a	c	c'	V	DGO (µm)	Stylet length (µm)	Stylet knobs shape	Head shape	Head ann	Tail shape	Tail ann	Phas post. ano/post	Male	Female PGB	Fig.No. Head & tail
<i>H. orthosomarticus</i>	SA	0.89-1.3	34-39	53-64	0.7-0.9	52-55	?	34-36	R	H	SM	H	15-19	19-11/	ABS	F	144
<i>H. onyzae</i>	OC	0.49-0.62	27-30.1	33.2-36.3	?	66.5-69.3	?	22.4-25.3	AI	H	5	CC	7-8	6-5/	ABS	F	145
<i>H. osephalus</i>	S	0.78-0.92	28-35	27-39	1.1-1.7	58-63	6-9	25-28	AI	H	6-8	CC-BR	13-24	14-3/	ABS	F	146
<i>H. parabelli</i>	?	0.65-0.72	23-23.9	26.4-27.1	1.7	59.8-61.4	?	26.6-28	?	?	?	BLC	16-17	3-4	ABS	F	147
<i>H. paracanalis</i>	OC	0.64-0.92	22-31	36-62	0.7-1.1	58-63	?	31-37	AI	H	6-7	VP	6-9	10-0/	PRS	F	148
<i>H. paraconcavus</i>	S	0.62-0.71	24-42	39-52	?	64-68	?	26-29	AI	H	SM	CON-R	12	10-8/	ABS	F	149
<i>H. paracrenacauda</i>	S	0.58-0.67	26-31.4	33-52	?	58-65	8-11	26.7-28	AI	H	3-4	CONI-L-VP	6-10	10-6/	ABS	F	150
<i>H. paradihystreroides</i>	LS	0.7-0.8	31-37	16-25	1.4-1.5	62-70	?	23-25	CUP	T	4-5	BR SH-VP	11-13	5-4/	ABS	F	151
<i>H. paragirus</i>	OC	0.8-1	30-37	53-79	0.5-1	59-63	?	24-26	ANC	T	3	H	6-10	17-11/	ABS	F	152
<i>H. paraplatyurus</i>	S	0.68-0.85	28-34	40-48	1-1.3	59-65	?	24-27	R	H	4-5	SCY-BR	13-20	4/1	ABS	F	153
<i>H. parapteracercus</i>	S	0.5-0.8	20-32	24-52	0.8-1.5	61-68	5.6-7	27-28	AI	H	5-6	IND-VP	8-13	10-5/	ABS	F	154
<i>H. pasohi</i>	S	0.59-0.7	22-33	45-63	0.7-0.9	62-71	?	26-31	FA	H	5-6	IND SH-VP	6-10	3-1/	PRS	F	155
<i>H. paxilli</i>	S	0.57-0.75	22-28	27-39	?	59-64	7-8	29-32	AC	H	6	DIGI	9-14	3/3	ABS	F	156
<i>H. persiaensis</i>	S	0.57-0.73	25.2-31.4	54.2-79	0.6-1.2	58.8-64.2	8.9-10.9	22-26	FA	CT	4-5	CC	6-9	3-1/	ABS	F	157
<i>H. persici</i>	S	0.5-0.7	16-18.5	18-21	?	55-62	?	20-22	R	H	4-5	CON	?	0/	ABS	F	158
<i>H. pisi</i>	LS	0.7-0.87	17-29	28-41	?	60-65	13.5	26-29	FA	T	3-4	VP	12	3	ABS	F	159
<i>H. planguetiei</i>	C	0.52-0.67	18-24.2	27.2-50.6	0.8-1.3	67-73	9-12	28-31	R-FA	AF	4-5	CON-VP	4-8	6-3/	PRS	F	160
<i>H. platyurus</i>	S	0.8-0.93	27-32	32-46	1-1.6	57-60	?	28-32	R	H	4-5	H	9-17	6/2	ABS	F	161
<i>H. plumaritas</i>	S	0.49-0.6	23-24	34-42	?	61-63	8-10	22-26	AC	H	4	CON-SH-VP	10	4-3/	ABS	F	162
<i>H. pricei</i>	SA	0.51-0.64	25-32	32-43	1-1.4	66-74	8.2-10	28-30.5	ANC	H	4-5	SCY	11-14	2/3	PRS	F	163
<i>H. pseudodigonicus</i>	S	0.72-0.94	21.7-31.2	52.1-62.5	?	58-61.8	?	27-30	FA	T	5	H	8-12	7-2/	PRS	F	164
<i>H. pseudopaxilli</i>	S	0.62-0.66	23.8-29	27.1-29	?	64-65.1	?	22.9-24.1	AI	H	4-5	MUC	9-10	5-2/	ABS	F	165
<i>H. pseudorobustus</i>	S	0.6-0.82	27-34	32-52	0.9-1.4	59-64	?	26-30	FA	H	4-5	L-VP	7-12	7-2/	ABS	F	166

Species name	Habitus	Body length (mm)	a	c	c'	V	DO (µm)	Sty/let length (µm)	Sty/let knobs shape	Head shape	Head ann	Tail shape	Tail ann	Phas post. ant/post	Male	Female PGB	Fig No. Head & tail
<i>H. pteracervus</i>	S	0.62-0.73	2.5-2.9	41-68	0.6-1.08	57.1-65	?	23.5-25.2	AC	H	5	VP	10-15	16/3	ABS	F	167
<i>H. rajcolagri</i>	S	0.46-0.62	20.25	26-35.6	1-1.3	59-67	15	20-23	R	CON	4	CON	9	/0-	ABS	F	168
<i>H. raskii</i>									NA								NA
<i>H. retusus</i>	LS	0.73-0.77	33-36	48.5-53	?	61-64	13	26-27	CUP	T	4	OBT-R	11	13/	ABS	F	169
<i>H. reversus</i>	LS	0.64-0.69	29-31	39-41	0.9-1.1	62-68	?	24-28	AI	T	4-5	BLC	8-14	10-3/	ABS	F	170
<i>H. reynosus</i>	S	0.58-0.7	24.7-26.4	41.2-42	?	62.1-65.3	?	25.2-26.2	FA	T	4-5	CON-DIGI	7-9	6-5/	ABS	F	171
<i>H. rohtangus</i>	S	0.89-1.12	30-37	28-44	1.2-1.9	61-67	11-14	36-38	AI	H	5-6	CYL-IR-IND	16-30	12-1/	ABS	F	172
<i>H. ryzhikovi</i>	?	0.81-0.94	29-35	40-67	0.7-1.1	51-57	?	33.3-36.3	R	H	?	?	?	?	ABS	F	173
<i>H. sacchari</i>	S	0.57-0.69	20.5-26.7	26-30.7	?	65-67.3	?	22-24	FA	T	5-6	CYL-SRT	9-11	2-0/	PRS	F	174
<i>H. saccharumi</i>	S	0.57-0.69	23.7-30.2	38.3-47.7	1-1.5	60.5-64.2	?	22-24	R-FA	H	3-4	CC-SH-VP	7-8	7-5/	ABS	F	175
<i>H. sagitovi</i>	S	0.48-0.5	20-22	34-37	?	64-66	13.1-13.6	25-27	AC	H	3-4	IND-R	10-12	/2-3	ABS	F	176
<i>H. samorensis</i>	SC	0.43-0.52	21-26.3	22.6-32.8	1.1-1.8	58-66.3	10	19-20.5	R	T	4-5	CON	7	3/	ABS	F	177
<i>H. sandersae</i>	S	0.76	30	38	1.4	61	?	22	SD	H	5	CON-BR	11	11/	PRS	F	178
<i>H. saxeus</i>	A	0.77	31	32	1.7	66.4	13.5	33	R	H	6	CON	15	4/	PRS	F	179
<i>H. scoticus</i>	S	0.91-1.11	30-38	39-67	0.8-1.4	53.6-61.8	?	33-35	FA	T	4-5	CON-BR	6-15	9/2	ABS	F	180
<i>H. serenus</i>	S	0.68-0.78	27-32	32-43	?	54-63	9	28-30	AI	H	4-5	CC-TAP	13	3/	ABS	F	181
<i>H. seshadrii</i>	OC	0.58-0.72	28-33	40-51	1-1.2	60-66	?	22-25	ANC	H	4-5	CYL-H	12-18	4-2/2	ABS	F	182
<i>H. shakili</i>	S	0.5-0.7	22-27	26-34	1.2-1.5	56-63	?	25-27	FA	H	4-5	TAP-PT	15-16	8-2/	ABS	F	183
<i>H. sharafati</i>	S	0.71-0.84	27-31	40-50	1.1-1.4	59-64	8-13	24-25	ANG-SD	T	2-3	DIGI	8-16	7-2/	ABS	F	184
<i>H. sheri</i>	S	0.48-0.66	21.8-25.9	40-50	0.85-1.1	61-66	8-12	20-24	AI	H	3-4	CC-IR-R	?	11-6/	ABS	F	185
<i>H. shervaravensis</i>	S	0.52-0.67	26-33	27.4-54.9	0.9-1.6	63-66	12-14	25-28	R	CT	4	CC	7-10	12-9/	ABS	F	186
<i>H. sieversii</i>	SA	0.72-0.82	22.3-25.6	38.1-42.1	?	62-65	?	32-34	R	H	5	BL-R	9-10	2-1/	PRS	F	187
<i>H. silvaticus</i>	LS	0.55-0.6	32.5-38	35.5-37.5	1.8-2.4	63-66.5	5-7	19.5-21.5	R	H	SM	CONI-VP	10-16	0/	PRS	F	188

Species name	Habitus	Body length (mm)	a	c	c'	V	DGO (µm)	Stylet length (µm)	Stylet knobs shape	Head shape	Head ann	Tail shape	Tail ann	Phas post. ant/post	Male	Female PGB	Fig.No. Head & tail
<i>H. similis</i>	S	0.53-0.57	23.5-27.1	30-40.1	?	62.2-65.9	?	20.7-21.4	AI	H	4	L-VP	6-7	6-5/	ABS	F	189
<i>H. solani</i>	S	0.60-0.74	25-28	25-30	?	58-62	?	25-28	FA	H	6	L-VP	13-16	0/	ABS	F	190
<i>H. sparsus</i>	S	0.62	23.9	45	?	66.8	?	25.6	FA	H	4-5	BL-SH-VP	7	5/	ABS	F	191
<i>H. spitsbergensis</i>	S	0.79-1.08	28-38	36-42	?	56-68	8-9	27-31	AI	H	4-5	TRAP-CON	13	2/3	ABS	F	192
<i>H. steineri</i>	C	0.75-0.84	31-39	29-38	?	61-63	?	22-26	AI	H	4	BR	18-21	0/	ABS	F	193
<i>H. striatus</i>	SC	0.66-0.82	26.7-31.5	40.3-60.6	0.75-1	59.7-64.9	8-12	22.4-24	AD	H	4-5	DC	8-15	8-0/	ABS	F	194
<i>H. stylocercus</i>	S	0.65-0.91	27-38	22-34	1.6-2.7	58-67	11-13.5	24-27	AC	H	4-5	IND-VP	14-30	14/4	PRS	F	195
<i>H. subterminalis</i>	SA	0.41-0.5	24-30	30-42	1-1.6	88.5-91	7-8	24.5-25.5	ANC	H	3	CON-R	7-9	0-3	PRS	NF	196
<i>H. subtropicalis</i>	S	0.49-0.58	22.3-26.4	32.6-35.8	?	64-65.1	?	22-23.8	AI	H	4-5	L-VP	7-8	6-3/	ABS	F	197
<i>H. tangericus</i>	S	0.63-0.73	23-27	42-53	0.7-1	56-64	?	27-31	R-SD	T	5-6	BH	7-11	7-5/	ABS	F	198
<i>H. tenes</i>	OC	0.50-0.55	28-31	44-47	?	60-66	10	20-21	AC	T	4	R	10-11	0/	ABS	F	199
<i>H. thornei</i>	?	0.50-0.6	19-27	21-36	?	61-63	10-12	24-25	CUP	H	SM	SP	?	?	PRS	F	200
<i>H. trapezoidicaudatus</i>	OC	0.64-0.79	24.5-28.3	33-37	0.53-0.62	61-65	9.5	26-29	AI	T	4	TRAP-H	8	3/	ABS	F	201
<i>H. tropicus</i>	?	0.50-0.7	25-29	35-57	?	59-64	10	24-25	CUP	T	3-4	VP	?	8/	ABS	F	202
<i>H. truncatus</i>	?	0.43-0.5	20-32	34-50	?	60-65	7-9	20-22	CUP	T	3-4	T	?	7/1	ABS	F	203
<i>H. tunidicaudatus</i>	OC	0.71-0.89	24-31	38-76	0.5-1	60-67	12	25-28	R	H	IN	H	12	11/	PRS	F	204
<i>H. tunisiensis</i>	S	0.88-1.1	28-33	45-55	?	56-58	9	32-36	AI	T	4	OBT-R	?	7/	ABS	F	205
<i>H. unicum</i>	OC	0.84-1.07	39.1-42.4	53-57	?	64-65.7	?	29.4-32	AI	H	4-5	VP	7-8	8-7/	ABS	F	206
<i>H. urobelus</i>	LS	0.66-0.81	25-33	30-42	1.1-1.6	59-66	7-10	24-28	FA	H	3-4	MUC	7-13	14-4/	PRS	F	207
<i>H. ussurpiensis</i>	S	0.75-0.89	22-30	30-39	?	57-63	10.5-11	28-31	R	H	6-7	CONI	13-18	3/4	ABS	F	208
<i>H. valdeclarus</i>	SA	0.38-0.46	21-28	19-27.1	1.4-2.3	67.1-71.8	?	20-22	AI	H	SM	CONI-PT	7-15	8-3/	PRS	NF	209

Species name	Habitus	Body length (mm)	a	c	c'	V	DGO (mm)	Sxlet length (mm)	Sxlet knobs shape	Head shape	Head ann	Tail shape	Tail ann	Phas. post. ant/post	Male	Female PCB	Fig No. Head & tail
<i>H. villosa</i>	S	0.66-0.74	24-52	32-55	1-1.3	60-63	?	31-33	AI	H	3-4	IR-H	10-12	3-0/	ABS	F	210
<i>H. varabilis</i>	LS	0.50-0.72	23-29	35-53	0.8-1.4	56-66	14	23-26	AI	T	SM	BR	12	10/	PRS	F	211
<i>H. varicaudatus</i>	OC	0.58-0.6/	18-26	39-50	?	60-63	8-10	29-35	FA	T	5	IK-H	6-11	2-0/	ABS	F	212
<i>H. varicaudatus</i>	OC	0.36-0.58	19.3-27.5	22.7-53.6	1.8-2.6	86.3-88.9	8-10	26-31	R	II	4	CONI	10-12	/5-3	PRS	NF PUS	213
<i>H. venenosus</i>	S	0.60-0.7	29-37	24-31	1.8-3.1	57-66	?	26-28	AI	T	SM	IND-VP	12-15	0/	ABS	F	214
<i>H. venosus</i>	S	0.50-0.6/	24.1-52.4	27.7-53.5	0.8-1.5	54.3-69.2	8-10.4	18.4-22.4	AI	H	5-7	CC SH-VP	8-15	5-5/	PKS	F	215
<i>H. verrucosus</i>	S	0.70-0.73	21.2-23.9	45.9-48.1	?	53.1-64	?	31.8-32.6	AI	H	4-5	CUR- VP	5-6	8-7/	ABS	F	216
<i>H. vietnamensis</i>	?	0.59	26	65	?	68	?	23	AI	H	3-4	H-IND	?	?	ABS	F	217
<i>H. viridex</i>	S	0.58-0.65	26-32	30-45	0.96-1.4	51-64.5	11-15	21-22	R-FA	H	4-5	CC	16-21	6-2/	PRS	F	218
<i>H. vulgaris</i>	S	0.78-1.1	25-31	63-116	?	56-62	9-12	30-34	AC	T	5	IR-H	4-10	18-6/	ABS	F	219
<i>H. waijii</i>	LS	0.56-0.58	26-28	45-49	0.8-1	62-63	?	23-24	AI	H	5-6	BH	6-10	7-5/1	ABS	F	220
<i>H. whiteheadi</i>	OC	0.43-0.61	21.7-30.5	36.3-57	0.7-1.09	73-78.7	3-5	19-23	AC	T	4	CON-R	?	2-1/	ABS	NF PUS	221
<i>H. vultuatae</i>	S	0.6-0.75	28-33	40-60	0.9-1.2	59-67	13.5-17	24.5-28	AI	H	5-6	SCY	12-17	8-1/	ABS	F	222
<i>H. vulvae</i>	C	0.5-0.67	15-26.4	31.3-53.8	0.7-1.7	57-61	10-12	23-29	AI	R	10-11	TC	11-17	11-6/	PRS	F	223
<i>H. zeidani</i>	S	0.62-0.81	25.6-36.6	29.2-53.1	0.9-1.7	57.8-71.2	4-12	21.5-26.5	F-SC	II	SM	CON	10-13	2-1/	ADS	F	224

Abbreviations

Habitus

A	= Arcuate
A-C	= Arcuate to C-shaped
C	= C-shaped
LS	= Loose spiral
OC	= Open circle
OS	= Open spiral
S	= Spiral
SA	= Slightly arcuate
SC	= Spirally curved
VA	= Ventrally arcuate

Shape of stylet knobs

AC	= Anteriorly concave
AD	= Anteriorly directed
AI	= Anteriorly indented
AMA	= Amalgamated
ANC	= Anchor shaped
ANG	= Angular shaped
CUP	= Cup shaped
F	= Flattened
FA	= Flattened anteriorly
F-C	= Flattened to concave
F-I	= Flattened to indented
F-SC	= Flattened to slightly curved
I	= Indented
OR	= Outwardly rounded
R	= Rounded
R-FA	= Rounded to flattened anteriorly
R-SD	= Rounded to sloping downwards
R-SE	= Rounded to slightly elongated
SD	= Sloping downwards

Head shape and annulations

AF	= Anteriorly flattened
CF	= Conically flattened
CON	= Conoid
CONI	= Conical
CR	= Conoid rounded
CT	= Conical truncate
H	= Hemispherical
IN	= Indistinct
R	= Rounded
SM	= Smooth or no annulation
T	= Truncate

Tail shape and annulations

AT-EC	= Attenuated-elongate conoid
BC	= Broadly conoid
BH	= Broadly hemispherical
BLC	= Bluntly conoid
BL-R	= Bluntly rounded

BR	= Broadly rounded
CC	= Convex-conoid
CLA	= Clavate
CON	= Conoid
CONI	= Conical
CON-VA	= Conoid ventrally arcuate
CUR	= Curved
CYL	= Cylindrical
DC	= Dorsally curved
DIGI	= Digitate
D-SF	= Dorsally slightly flattened
H	= Hemispherical
IND	= Indented
IR	= Irregular
L	= Large
MUC	= Mucronate
NOT	= Notched
OBT	= Obtusely
PT	= Pointed
R	= Rounded
RT	= Rounded terminus
SCY	= Sub-cylindrical
SH	= Short
SL-C	= Slightly convex
SP	= Spicate
SRT	= Smooth rounded terminus
SYM	= Symmetrical
T	= Truncate
TAP	= Tapering
TC	= Tapering conical
TRAP	= Trapezoid
VP	= Ventral projection

Phasmid

IN	= Indistinct
/	= Number of annules anterior to the anus on the left of the oblique and those posterior to the right.

Males

ABS	= Absent
PRS	= Present

Females

D	= Degenerate
F	= Functional
FEMALE	= Female post genital branch
PGB	
NF	= Non-functional
PUS	= Post uterine sac

Fig. No.

NA	= Not available
----	-----------------

References

- Anderson, R.V. 1979. A supplemental key to species of *Helicotylenchus* Steiner, 1945 (Nematoda: Hoplolaimidae) described since 1972 and a description of *H. oscephalus* n. sp. *Canadian Journal of Zoology* 57, 337-342.
- Andrássy, I. 2007. Free-living nematodes of Hungary (Nematoda errantia), II. In: C. Csuzdi & S. Mahunka (Eds.), *Pedozoologica Hungarica No. 4*. Hungarian Natural History Museum. Budapest, Hungary, 496 pp.
- Anwar, S.A. & Chaudhary, N.A. 1976. Nematodes associated with mango in the Punjab. *Pakistan Journal of Zoology* 8, 230-231.
- Azmi, M.I. & Jairajpuri, M.S. 1978. Morphometric and allometric variations in the adults and juveniles of *Helicotylenchus indicus*, 1963. *Indian Journal of Nematology* 6, 13-22.
- Boag, B. & Jairajpuri, M.S. 1985. *Helicotylenchus scoticus* n. sp. and a conspectus of the genus *Helicotylenchus* Steiner, 1945 (Tylenchida: Nematoda). *Systematic Parasitology* 7, 47-58.
- Cobb, N.A. 1893. Nematodes, mostly Australian and Fijian. *Macleay Memorial Volume Linnean Society of New South Wales*, 252-308.
- De Ley, P. & Blaxter, M.L. 2004. A new system for Nematoda: combining morphological characters with molecular trees, and translating clades into ranks and taxa. In: Cook, R. and Hunt, D.J. (Eds.) *Proceedings of the Fourth International Congress of Nematology, 8-13 June 2002, Tenerife, Spain. Nematology Monographs and Perspectives* 2. Brill, Leiden, the Netherlands, 633-653 pp.
- Decraemer, W. & Hunt, D.J. 2006. Structure and classification. In: Perry, R.N. & Mones, M. (Eds.). *Plant Nematology*. CABI Publishing, Wallingford, UK, 3-32 pp.
- Filipjev, I.N. 1934. The classification of the free-living nematodes and their relation to the parasitic nematodes. *Smithsonian Miscellaneous Collections* 89, 1-63.
- Firoza, K. 1996. *Taxonomic studies on the plant parasitic nematodes belonging to the family Hoplolaimidae with special reference to genus Helicotylenchus*. Ph. D. Thesis, University of Karachi, Karachi, Pakistan, 329 pp.
- Firoza, K. & Maqbool, M.A. 1991. Description of *Rotylenchus capsicumi* n. sp., and morphometric data on five known species of the genus *Helicotylenchus* Steiner, 1945 (Nematoda: Hoplolaimidae) recorded from Pakistan. *Pakistan Journal of Nematology* 9, 71-78.
- Firoza, K. & Maqbool, M.A. 1992. Observations on five known species of spiral nematodes from Pakistan. *Pakistan Journal of Nematology* 10, 15-22.
- Firoza, K. & Maqbool, M.A. 1993. Three new species of the subfamily Hoplolaiminae (Nematoda: Hoplolaimidae) from Pakistan. *Pakistan Journal of Nematology* 11, 69-78.
- Firoza, K. & Maqbool, M.A. 1994. Descriptions of *Helicotylenchus meloni* and *H. striatus* n. sp. (Nematoda: Hoplolaimidae) from Pakistan. *Pakistan Journal of Nematology* 12, 109-116.
- Firoza, K. & Maqbool, M.A. 1996. Description of *Helicotylenchus lemoni* n. sp. (Nematoda: Hoplolaimidae) with a key to species of Pakistan. *Pakistan Journal of Nematology* 14, 83-88.
- Fortuner, R. 1979. Morphometrical variability in *Helicotylenchus* Steiner, 1945, 1. The progeny of a single female. *Revue de Nematologie* 2, 197-202.
- Fortuner, R. 1984. Morphometrical variability in *Helicotylenchus* Steiner, 1945, 6. Value of the characters used for specific identification. *Revue de Nematologie* 7, 245-264.
- Fotedar, D.N. & Kaul, V. 1985. A revised key to the species of the genus *Helicotylenchus* Steiner, 1945 (Nematoda: Rotylenchoidinae). *Indian Journal of Nematology* 15, 138-147.

- Golden, A.M. 1956. Taxonomy of the spiral nematodes (*Rotylenchus* and *Helicotylenchus*), and the developmental stages and host-parasitic relationships of *R. buxophilus* n. sp., attacking boxwood. *Maryland Agricultural Experiment Station Bulletin A-85*, 28 pp.
- Kafi, A. 1963. Plant parasitic nematodes in Pakistan. *FAO Technical Bulletin No 32*, 12 pp.
- Khan, A., Ghazi, R.R. & Soomro, M.H. 2008. A new species of the genus *Helicotylenchus* Steiner, 1945 (Nematoda: Hoplolaiminae) from Balochistan, Pakistan. *Proceedings of Parasitology* 46, 87-91.
- Khan, A., Khanzada, A.K. & Aslam, M. 1987. Plant parasitic nematodes associated with date palm in Balochistan. *Pakistan Journal of Nematology* 5, 15-17.
- Khan, S.A., Khan, H.A., Qamar, F. & Seema, N. 1992. Nematodes associated with coconut nurseries in Karachi and adjoining areas, Part-I. *Pakistan Journal of Science and Industrial Research* 35, 342-344.
- Krall, E.L. 1978. *Root parasitic nematodes: Family Hoplolaimidae*. Academy of Sciences of the USSR, Leningrad, Nauka Publishers, Leningrad, 580 pp.
- Malik, R. & Yasmeen, Z. 1978. Nematodes in paddy fields of Pakistan. *International Rice Research Newsletter* 3, 16-17.
- Maqbool, M.A. & Shahina, F. 1986. Four new species of the family Hoplolaimidae (Nematoda) with notes on *Rotylenchus cypriensis* Antoniou, 1980 from Pakistan. *Nematologia Mediterranea* 14, 117-128.
- Maqbool, M.A. & Shahina, F. 2001. *Systematics and distribution: Biodiversity of nematode fauna in Pakistan*. National Nematological Research Centre, University of Karachi, Karachi-75270, Pakistan, 179 pp.
- Maqbool, M.A. 1986. *Classification and distribution of plant parasitic nematodes in Pakistan*. National Nematological Research Centre, University of Karachi, Karachi, Pakistan. 58 pp.
- Maqbool, M.A., Ghazala, P., Fatima, N. & Qasim, M. 1985. *Pararotylenchus microstylus* n. sp. and *Scutylenchus baluchiensis* n. sp. with observations on some new records from Pakistan. *Pakistan Journal of Nematology* 3, 61-67.
- Maqbool, M.A., Zain, A. & Shama, N. 1975. Studies on parasitic nematodes associated with sugar cane (*Saccharum officinarum* L.) in Sindh region. *Research Bulletin No.1*, Nematological Research Centre, University of Karachi, Karachi, Pakistan, 26 pp.
- Marais, M. 2001. *A monograph of the genus Helicotylenchus Steiner, 1945 (Nemata: Hoplolaimidae)*. Ph. D. Dissertation, University of Stellenbosch, Stellenbosch, South Africa.
- Perry, V.G., Darling, M.H. & Throne, G. 1959. Anatomy, taxonomy and control of certain spiral nematodes attacking blue grass in Wisconsin. *University of Wisconsin Research Bulletin* 207, 1-24.
- Saeed, M. & Ashrafi, S.H. 1973. On the occurrence of some plant parasitic nematodes with special reference to new hosts in West Pakistan. *Pakistan Journal of Scientific and Industrial Research* 16, 128-129.
- Saeed, M., Khan, H.A., Khan, S.A. and Qamar, F. 1986. A survey of the nematode problem of tobacco in Pakistan. (A) Nurseries. *Pakistan Journal of Scientific and Industrial Research* 29, 279-283.
- Sher, S.A. 1961. Revision of the Hoplolaiminae (Nematoda). I. Classification of nominal genera and nominal species. *Nematologica* 6, 155-169.
- Siddiqi, M.R. 1986. *Tylenchida: Parasites of plants and insects*. Commonwealth Agricultural Bureaux, Farnham Royal, London, 645 pp.
- Siddiqi, M.R. 1995. Nematodes of tropical rainforests. 6. Ten new species of Rotylenchoidinae. *Afro-Asian Journal of Nematology* 5, 186-197.
- Steiner, G. 1945. *Helicotylenchus*, a new genus of plant-parasitic nematodes and its relationship to *Rotylenchus* Filipjev.

- Proceedings of Helminthological Society of Washington* 12, 34-38.
- Subbotin, S.A., Inserra, R.N., Marais, M., Mullin, P., Powers, T.O., Roberts, P.A., Berg, E.V.D., Yeates, G.W. & Baldwin, J.G. 2011. Diversity and phylogenetic relationships within the spiral nematodes of *Helicotylenchus* Steiner, 1945 (Tylenchida: Hoplolaimidae) as inferred from analysis of the D2-D3 expansion segments of 28S rRNA gene sequences. *Nematology* 13, 333-345.
- Subbotin, S.A., Volvas, N., Yeates, G.W., Hallmann, J., Kiewnich, S., Chizhov, V.N., Manzanilla-Lopez, R.H., Inserra, R.N. and Castaillo, P. 2015. Morphological and molecular characterization of *Helicotylenchus pseudorobustus* (Steiner, 1914) Golden, 1956 and related species (Tylenchida: Hoplolaimidae) with a phylogeny of the genus. *Nematology* 17, 27-52.
- Whitehead, A.G. 1958. *Rotylenchoides brevis* n. g., n. sp. (Rotylenchoidinae n. subfam: Tylenchida). *Nematologica* 3, 327-331.
- Zarina, B. & Maqbool, M.A. 1991. Description of *Helicotylenchus verecundus* n. sp., and *Tylenchorhynchus rosei* n. sp., (Nematoda: Tylenchida) from Pakistan. *Pakistan Journal of Nematology* 9, 79-86.

(Accepted: January 5, 2015)