

Four New Tylenchids (Tylenchina: Nematoda) for Nematode Fauna of Iran

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ABSTRACT

Four tylenchid species, namely, *Aglenchus agricola*, *Malenchus exiguus*, *Psilenchus curcumerus*, and *P. terextremus* are reported from Iran. The Iranian population of *A. agricola* is characterized by 542-659 μm long body, 10-12 μm long stylet, excretory pore at 70-87 μm distance from anterior end, prominent lateral fields, with four lines, tail of 170-198 long, and rare males with 15-20 μm long spicules. Iranian population of *M. exiguus* is characterized by 362-412 μm long body, 8-10 μm long stylet, lateral fields with two crenated lines, originating at mid-region of procorpus and ending at 1/3 of the tail length, PUS of 6-9 μm , tail 65-89 μm long and common males with 13-19 μm long spicules. The recovered population of *P. curcumerus* is characterized by having a smooth head region, 12-15 μm long stylet, presence of post-rectal sac and filiform tail with clavate terminus and the Iranian population of *P. terextremus* is characterized by lateral fields with crenate margins, appearing as a simple band, with two or three weakly developed bands in cross section and lateral view, respectively, median bulb anterior to the middle of the pharynx and filiform tail with rounded tip. The morphological and morphometric characters of the recovered populations and their differences and similarities with those given in the original descriptions are discussed.

Keywords: Morphology, Morphometrics, Sabalan grasslands.

INTRODUCTION

Andrássy (1954) revised the genus *Tylenchus* Bastian, 1865 and proposed to group its species in four subgenera. One of them was the subgenus *Tylenchus* (*Aglenchus* Andrásy, 1954). He designated *T. (Aglenchus) agricola* as its type species (Andrásy, 1980). Bello (1971), Golden *et al.* (1971) and Siddiqi (1971) regarded *Aglenchus* as a valid genus and distinguished it from the genus *Tylenchus* when dealing with the taxonomy of the family Tylenchidae Örley, 1880. The genus *Malenchus* Andrásy, 1968 was proposed by Andrásy (1968) for two species i.e. *Aglenchus machadoi* (Andrásy, 1963) Andrásy, 1968 from Angola and *Malenchus acarayensis*

Andrásy, 1968 from Paraguay (Andrásy, 1981). Golden *et al.* (1971) and Siddiqi (1971), accepted *Malenchus* as a good genus within the Tylenchidae (Andrásy, 1981). Geraert (2008) gave an excellent overview on the genera and species of the family Tylenchidae. He also discussed the history of two genera presented in this study, namely, *Aglenchus* Andrásy, 1954 (Meyl, 1961) and *Malenchus* in detail. There are currently eight well established species under *Aglenchus* according to Geraert (2008). The two other species, *A. agricola* var. *aquaticus* (Micoletzky, 1922) Ebsary, 1991 and *A. parvulus* Husain 1968 are regarded as *species inquirenda*. There are 35 well established species under genus *Malenchus*. The three species, namely, *M. kasolensis* Kapoor, 1982, *M. microlabiatius* Kapoor, 1982 and *M.*

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praecisus Kapoor, 1982 are considered as *nomina nuda* Geraert (2008). There are now 21 valid species under genus *Psilenchus* de Man, 1921 according to Geraert (2008). On the systematic position of *Psilenchus*, it is worth to mention that Ryss (1993) and Siddiqi (2000) placed it in Psilenchidae Paramonov, 1967 (Khan, 1969) under the superfamily Dolichodoridea Chitwood in Chitwood and Chitwood, 1950 but, Maggenti et al. (1987) placed it in Tylenchidae (superfamily Tylenchoidea Örley, 1880. Phylogenetic analyses showed a close relationship between the genus *Psilenchus* with members of Merliniinae Siddiqi, 1971 (Subbotin et al., 2006). In this paper, the morphology and occurrence of four tylenchid species are discussed.

MATERIALS AND METHODES

A total number of 80 soil samples were collected from grasslands of Sabalan region, northeast of Iran, during 2011-2012. Nematodes were extracted from soil by using sieve and centrifugation (De Grisse, 1969) and Whitehead tray (Whitehead and Hemming, 1965) methods. The collected specimens were killed in hot 4% formaldehyde solution, transferred to anhydrous glycerin according to De Grisse (1969), and mounted on permanent slides. Observations were made under a Nikon E600 light microscope and drawings and measurements were performed using a drawing tube attached to the microscope. The used morphometric indexes and abbreviations in morphometric tables (Tables 1-4) are according to Siddiqi (2000).

RESULTS AND DISCUSSION

Four species, namely, *Aglenchus agricola* (de Man, 1884) Andrassy, 1954, *Malenchus exiguus* (Massey, 1969) Andrassy, 1980, *Psilenchus curcumerus* Rahaman, Ahmad and Jairajpuri, 1994 and *P. terextremus* Hagemeyer and Allen, 1952 belonging to the family Tylenchidae were identified and

reported from Iran. To our knowledge, this is the first report on occurrence of the first two genera in Iran. and characters of two studied species of the genus *Psilenchus* are presented for the first time.

The morphological and morphometric characters of these four species as well as their comparisons with other reports worldwide are discussed.

Aglenchus agricola (De Man, 1884) Andrassy, 1954

(Figures 1-2)

Measurements: See Table 1.

Female: Body slender, straight, 542-659 μm long. Cuticle finely annulated, annuli 1.5-2.0 μm at mid-body. Lateral fields prominent, with four lines from which two inner lines usually weakly expressed, resulting in appearance of three lines, the outer ones slightly crenated. Head region continuous with the rest body, rounded, 5-7 μm wide and 3-4 μm high, without any definite striation. Spear delicate, conus almost half of the total length with rounded knobs. Amphidial opening slit-like. Median bulb rounded with conspicuous valve. Isthmus narrow and long, terminal bulb pyriform. Deirids located almost in the middle of isthmus. Excretory pore at the level of the junction of basal bulb with the intestine or located slightly anterior to it. Female genital organ comparatively short, comprising 16-23% of body length. Vulva conspicuously sunken in body contour, with visible outer and small inner lips, vulva flaps present. Vagina strongly swollen and oriented anteriorly. Spermatheca small and oval, filled with small, globular sperm. Post-vulval uterine sac absent. Tail longer than the distance between the vulva and anus, filiform, with pointed end.

Male: Rare and functional. General morphology similar to that of females, except sexual organs. Bursa well developed, with finely crenate margin. Cloacal lips form a protruding tube. Spicules tylenchoid,

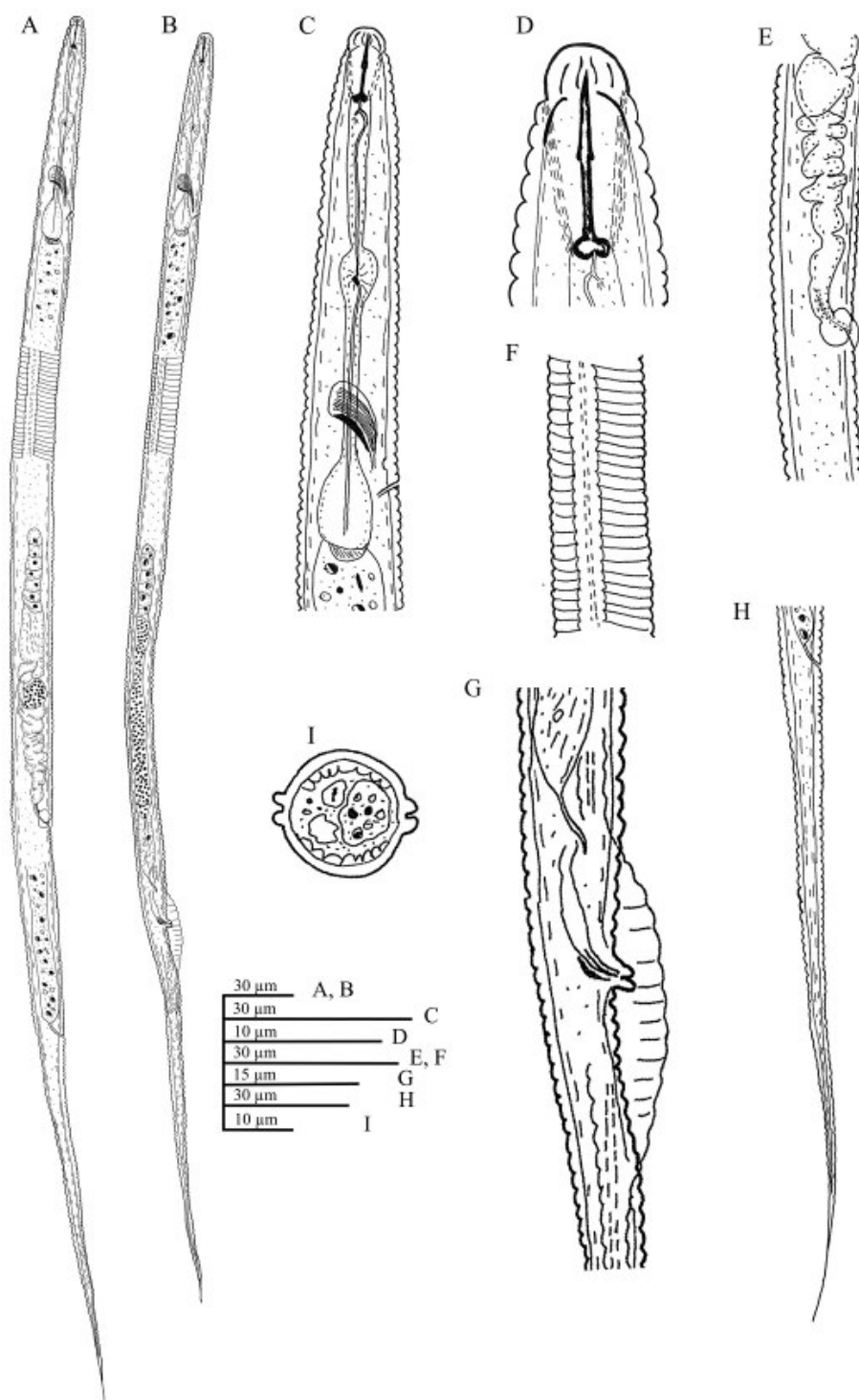


Figure 1. *Aglenchus agricola*. A: Entire female; B: Entire male; C: Female, anterior region; D: Female, head region; E: Female, vulva region; F: Female, lateral field; G: Male, posterior region; H: Female, tail; I: Female, midbody cross-section.

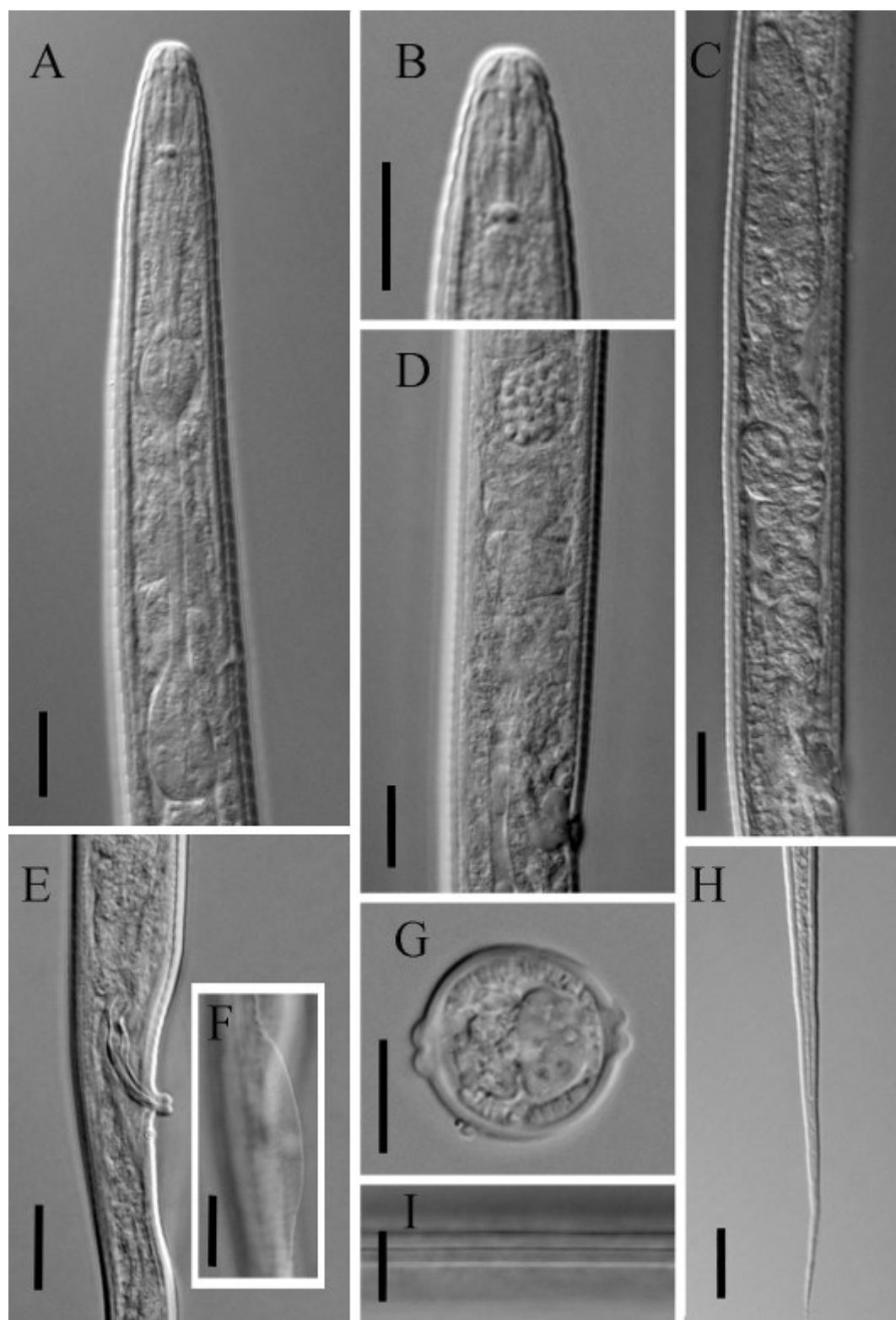


Figure 2. *Aglenchus agricola*. A: Female, oesophagus; B: Anterior end; C: Female, gonad; D: Part of gonad showing vulval flap, swollen vagina and spermatheca with rounded sperm; E: Male, spicule and cloacal tube; F: Bursa; G: Cross section of female; H: Female, tail tip; I: Female, lateral field. All scale bars = 10 µm.

Table 1. Morphometrics of *Aglencus agricola* adults recovered from grasslands of Sabalan region (All measurements in μm and in the form: Mean \pm sd range).

Origin	Sabalan		Geraert, 2008		Szczygiel, 1974		Paetold, 1958		Andrássy, 2007	
	Characters	Females	Males	Females	Males	Females	Males	Females	Females	Males
n		25	3	—	—	—	—	—	—	—
L		579 \pm 33 (542-659)	606 \pm 21 (591-631)	460-570	—	480-590	530-600	620-690	450-620	470-620
a		34.2 \pm 3.0(29.6-40.3)	40.5 \pm 3.1(36.9-42.6)	26-38	—	33-43	32-46	31-35	25-40	30-35
b		6.0 \pm 0.3(5.6-6.8)	6.5 \pm 0.2(6.3-6.8)	5-6	—	5.8-7.5	6.3-7.5	6-6.7	5.2-6.8	4.8-6.2
c		3.6 \pm 0.2(3.2-4.0)	3.2 \pm 0.2(3.0-3.4)	3-3.9	—	3.1-3.7	3.1-3.6	3.7-3.8	3.0-3.8	3.0-4.4
c'		15.2 \pm 1.6(12-18)	17.2 \pm 2(15.1-19.1)	13-19	—	—	—	—	15-20	14-15
V or T		56.8 \pm 1.4(53.8-58.8)	32.2 \pm 0.8(31.3-32.8)	52-60	—	53-59	—	57-58	53-59	—
V'		78.8 \pm 0.7(77.4-80.8)	—	75-81	—	—	—	—	—	—
Stylet		10.7 \pm 0.6(10-12)	10.7 \pm 0.6(10-11)	11-13	—	10-12	11-12	10.6-10.7	10-13	—
MB		46.4 \pm 2.0(43.2-52.4)	47.9 \pm 1.8(46.7-50.0)	44-49	—	—	—	—	—	—
Excretory pore		79.0 \pm 4.2(70-87)	76.0 \pm 6.1(69-80)	—	—	—	—	—	—	—
Oesophagus		96.3 \pm 4.8(82-105)	93.3 \pm 6.1(88-100)	—	—	—	—	—	—	—
Ant. end-vulva		329.0 \pm 15.9(299-364)	—	—	—	—	—	—	—	—
Body width		17.0 \pm 1.3(15-19)	15 \pm 1(14-16)	—	—	—	—	—	—	—
Annuli width		1.8 \pm 0.1(1.5-2.1)	1.7 \pm 0.2(1.5-1.8)	1.5-1.8	—	—	—	—	—	—
Tail		161.4 \pm 17.7(170-198)	189.0 \pm 18.5(175-210)	134-179	140-155	—	—	—	140-190	—
Tail/V-A		1.8 \pm 0.2(1.5-2.2)	—	1.0-2.3	—	—	—	—	1.6-2.4	—
G1		19.4 \pm 1.8(16.5-23.1)	—	22-26	—	—	—	—	—	—
Spicules		—	15.7 \pm 0.6(15-16)	—	13-15	—	—	—	—	13-15
Gubernaculum		—	5.3 \pm 0.6(5-6)	—	4-5	—	—	—	—	4-6
Bursa		—	43.7 \pm 4.2(39-47)	—	28-40	—	—	—	—	30



slightly arcuate. Gubernaculum thin. Tail filiform and pointed.

Discussion of *A. agricola*

Iranian population of *A. agricola* is in morphological and morphometric agreement with the description by Andrassy (1980) and other reports worldwide (see Table 1). This population is characterized by having prominent lateral fields with four lines from which two inner lines are usually weakly expressed, resulting in appearance of three lines with slightly crenate margins of outer ones, 10-12 μm long stylet, vulva conspicuously sunken in body contour, with visible outer and small inner lips and visible flaps, vagina strongly swollen and pyriform, post-vulval uterine sac absent, and filiform tail.

The species was originally described by de Man (1884) as *Tylenchus agricola* (de Man, 1884). In 1954, Andrassy established genus *Aglenchus* with *A. agricola* as the type species. Brzeski (Brzeski, 1999) synonymized *A. geraerti* Mizukubo, 1989, with this species, which was not followed by Geraert (2008).

Habitat and Locality

This species was recovered from the rhizosphere of grasses in grasslands of Aghamali and Agh masjed region in Sabalan, Ardebil province, northwestern Iran, during August 2012.

Malenchus exiguus (Massey, 1969) Andrassy, 1980

(Figures 3-4)

Measurements: See Table 2.

Female: Body small, 362-412 μm long and fusiform. Cuticular annuli prominent, 1.0-1.4 μm wide at mid-body. Lateral fields with two

lines, strongly crenate on margin, originating at mid-region of procorpus and ending at 1/4 tail length. Head region not offset, provided with 4-5 fine annuli, 5-6 μm wide at base, 3-4 μm high and dorso-ventrally compressed. Amphidial aperture long and S-shaped. Spear delicate with small knobs. Orifice of dorsal pharyngeal glands close to spear base. Median bulb oval to fusiform with small indistinct valve. Isthmus slender, terminal bulb small and pyriform. Excretory pore at the level with the basal bulb or slightly anterior to it. Vulva sunken in body with small lateral dikes in both sides. Female genital organ 23-37% of body length, postvulval uterine sac short, 6-9 μm long, spermatheca simple and round to oval in shape, filled with globular sperm. Tail filiform with pointed terminus.

Male: Similar to female in general morphology, but smaller. Spicules tylenchoid, slightly arcuate. Gubernaculum thin. Bursa smoothly bordered. Tail pointed.

Discussion of *M. exiguus*

Iranian population of *M. exiguus* is in full morphological and morphometric agreement with the data given by Geraert (2008) and two other reports (see Table 2). It is characterized by having two lines in lateral fields, strongly crenate on margin, originating at mid-region of procorpus and ending at 1/4 of tail length, head provided with 4-5 fine annuli, amphidial openings long and S-shaped, median bulb oval to fusiform with small, indistinct valve, vulva sunken with small lateral dikes in both sides and tail sharply pointed.

The species was originally described by Massey (1969), recovered from rhizosphere of *Picea engelmanni* (Massey, 1969). Geraert (2008) has synonymized *Malenchus sulcus* (Wu, 1970) Siddiqi, 1979 with this species (Geraert and Raski, 1986).

Habitat and Locality

Recovered from the rhizosphere of *Bromus* sp. in Arkh alti region, Sabalan,

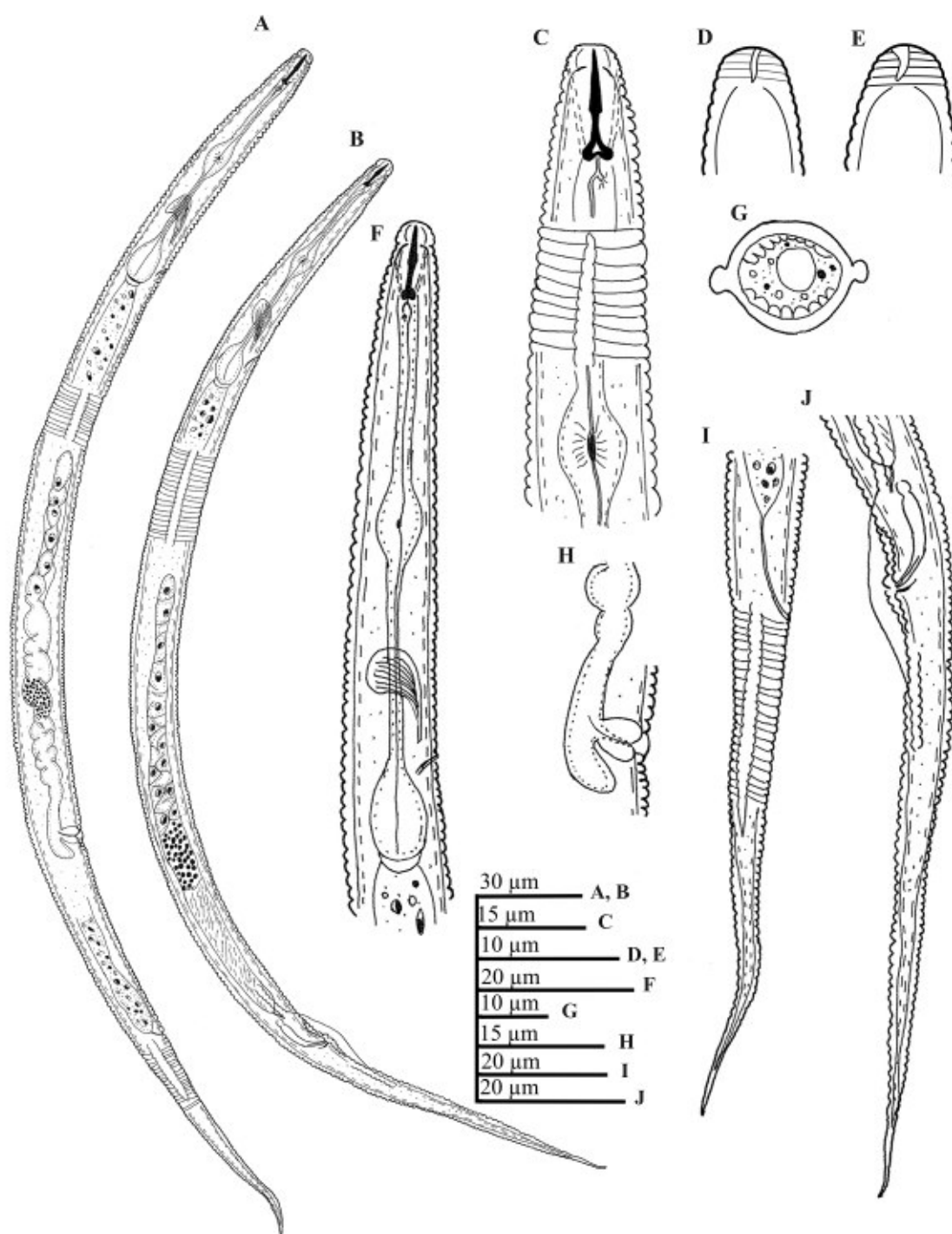


Figure 3. *Malenchus exiguus*. A: Entire female; B: Entire male; C: Female, lateral field in anterior region; D-E: Female, head region; F: Female, anterior region; G: Female, midbody cross-section; H: Female, vulva region; I: Female, tail; J: Male, posterior region.

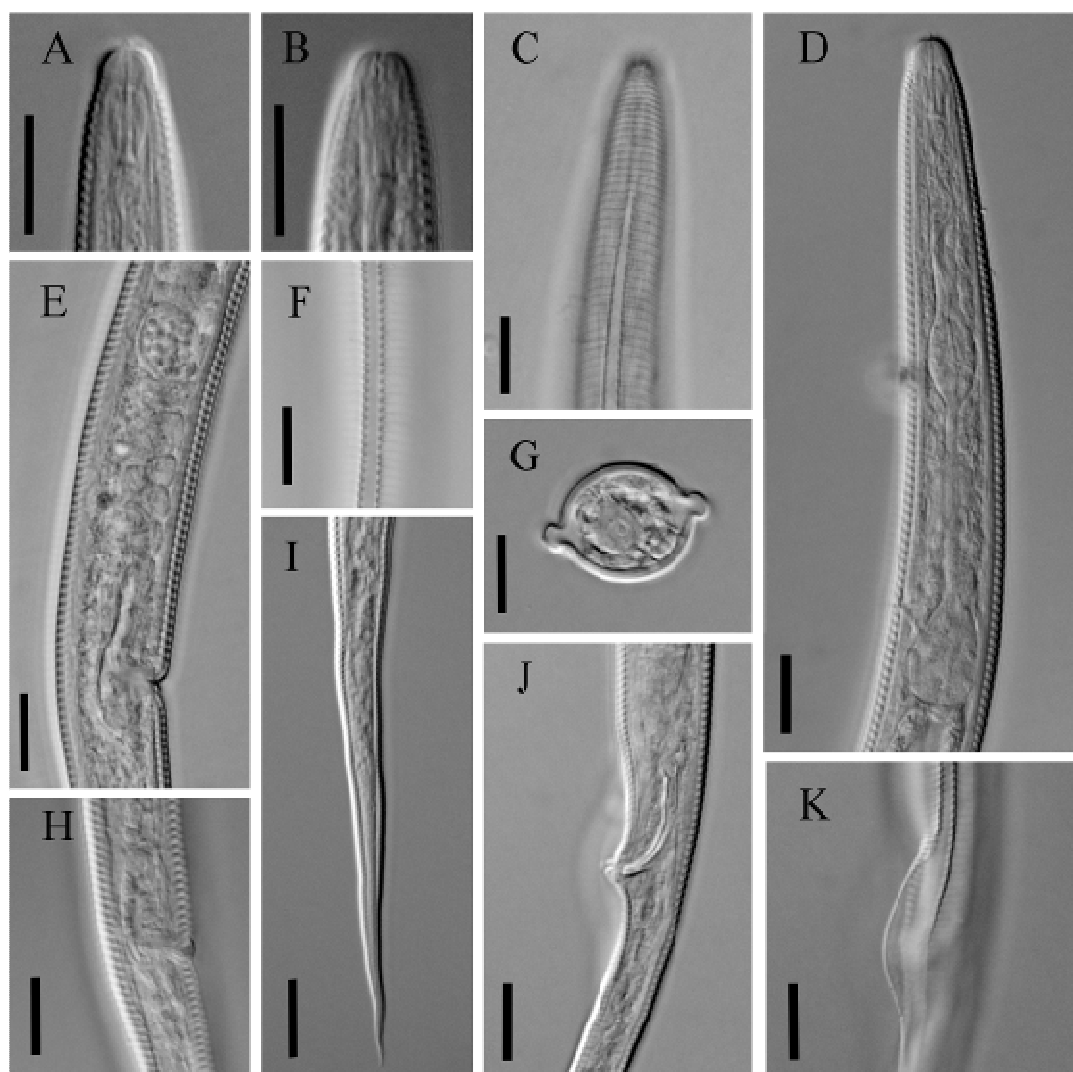


Figure 4. *Malenchus exiguus*. A: Anterior end; B: Amphidial slit; C: Lateral field beginning at mid-region of procorpus; D: Oesophagus; E: Part of female reproductive system; F: Lateral field at mid-body; G: Female, cross section; H: Vulval dik; I: Female, tail; J: Cloacal region; K: Bursa. All scale bars = 10 µm.

Ardebil province, northwestern Iran, during August 2012.

***Psilenchus curcumerus* Rahaman,
Ahmad and Jairajpuri, 1994**

(Figures 5-6)

Measurments: See Table 3.

Female: Body slender, straight, 884-1103 µm long. Cuticle finely striated striae about 1

µm wide at mid-body. Lateral fields with four incisures, the outer ones crenate. Head region truncate, continuous with the rest of the body, smooth, 3.0-4.5 µm wide and 6.5-8.0 µm high. Amphidial apertures oblique slits. Stylet delicate, without knobs, conus almost 1/3 total length. Orifice of dorsal gland 5-6 µm posterior to spear base. Median bulb oval, muscular with prominent valvular apparatus in the middle. Basal bulb pyriform and offset. Excretory pore near middle of isthmus. Hemizonid two or three annuli above excretory pore. Vulval opening a transverse

Table 2. Morphometrics of *Malenchus exiguus* adults recovered from grasslands of Sabalan region (All measurements in μm and in the form: Mean \pm sd range).

Origin Characters	Sabalan		Geraert and Raski (1986)		Szczygiel, (1974)		Geraert (2008)	
	Females	Males	Females	Males	Females	Males	Females	Males
n	13	8	4	2	—	—	—	—
L	387.5 \pm 15.4(362-412)	388 \pm 15.7(360-405)	389 \pm 13.1(370-400)	360-380	350-360	320-400	—	—
a	23.4 \pm 2.1(20.4-26.7)	26.9 \pm 1.9(23.1-28.9)	22.3 \pm 2.4(20-25)	22.5-26.2	24-26	20-26	—	—
b	4.5 \pm 0.2(4.1-4.8)	4.5 \pm 0.2(4.4-4.8)	4.9 \pm 0.3(4.5-5.2)	4.5-4.8	4.4-4.7	—	—	—
c	5.2 \pm 0.5(4.4-5.9)	4.2 \pm 0.3(3.8-4.8)	4.9 \pm 0.3(4.5-5.2)	3.8	4.1-4.7	3.8-5.2	—	—
c'	7.8 \pm 1.1(6.4-9.9)	7.9 \pm 0.5(7-8.6)	8.3 \pm 1.1(7.4-9.5)	8.9-9.0	10-12	7.4-12	—	—
V or T	64.4 \pm 2.3(58.2-66.7)	41.9 \pm 3.8(36.3-47.8)	64.9 \pm 1.1(63-66)	—	62-64	61-66	—	—
V'	80.1 \pm 3.1(70.1-82.0)	—	—	—	—	—	—	—
Stylet	9.4 \pm 1(8-10)	9.2 \pm 0.8(8-10)	9-10	9	9-10	9-10	—	—
MB	48.4 \pm 1.8(45.4-50.6)	47.2 \pm 1.0(44.9-48.2)	47	—	—	45-49	—	—
Excretory pore	75.1 \pm 2.7(71-80)	71.1 \pm 3.3(67-76)	68-75	69-73.5	—	—	—	—
Oesophagus	86.4 \pm 2.8(82-92)	85.5 \pm 3.8(79-92)	79.5 \pm 4(74-83)	74.5-83.5	—	64-68	—	—
Body width	16.5 \pm 1.7(14-19)	14.5 \pm 1.2(13-17)	17.5 \pm 1.3(16-19)	14.5-16	—	—	—	—
Vulva - anus	59.2 \pm 4.7(53-67)	—	52-60	—	51 ^a	—	—	—
Rex	59 \pm 3.3(55-65)	67 \pm 4.5(60-74)	—	—	—	—	—	—
Roes	67 \pm 3.5(62-72)	81.4 \pm 4.9(74-88)	—	—	—	—	—	—
Rvan	50.3 \pm 6.3(41-65)	—	—	—	—	—	—	—
Annulus width	1.2 \pm 0.1(1.1-1.4)	1 \pm 0(1.0-1.1)	1.5 \pm 0.2(1.2-1.6)	1.0-1.3	—	—	—	—
Tail	75.8 \pm 7.5(65-89)	92.5 \pm 6.7(84-100)	80.1 \pm 7.0(74-90)	95-98	80.7 ^a	71-88	—	—
Tail/V-A	1.3 \pm 0.2(1.1-1.6)	—	1.4 ^a	—	1.5 ^a	—	—	—
PUS	7.5 \pm 1.0(6-9)	—	—	—	—	—	—	—
Spicule	—	16.1 \pm 2.4(13-19)	—	—	—	—	—	14-16
Gubernaculum	—	3.9 \pm 0.8(3-5)	—	3-3.5	—	—	—	3-5
Bursa	—	34.1 \pm 6.5(23-42)	—	—	—	—	—	26-30

^a Calculated from the measurements

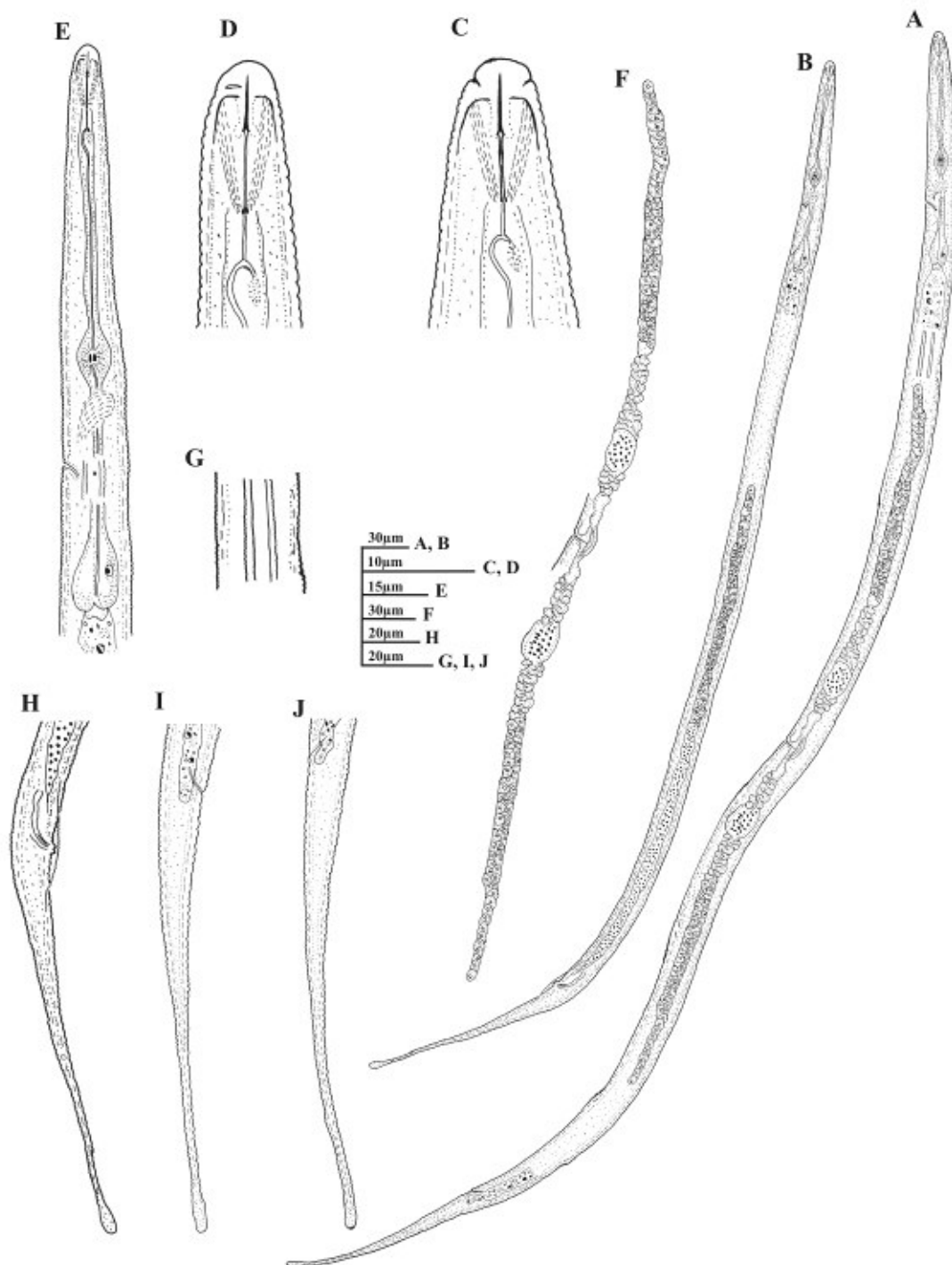


Figure 5. *Psilenchus curcumerus*. A: Entire female; B: Entire male; C, D: Female, head region; E: Female, anterior region; F: Female, reproductive system; G: Female, lateral field in mid-body; H: Male, tail; I, J: Female, tail.



Figure 6. *Psilenchus curcumerus*. A: Female, oesophagus; B&C: Anterior end showing smooth head; D: Amphidial slit; E&F: Anal region showing post intestinal sac; G: Part of female reproductive system; H: Female, lateral field in mid-body; I: Part of female tail showing phasmid; J: Female, tail tip; K: Cloacal region. All scale bars = 10 µm.

slit. Ovaries paired, outstretched in opposite directions. Spermatheca oval, axial and filled with rounded sperm. Post-rectal sac 7-10 µm long, extending behind the anus. Tail elongate, filiform with clavate terminus.

Male: General morphology similar to that of females, but body smaller (741-870 vs 884-1103 µm). Spicules tylenchoid, ventrally curved. Gubernaculum trough-shaped. Bursa adanal with finely crenate margins.

Habitat and Locality

Recovered from the rhizosphere of alfalfa in Meshkin Shahr, Ardebil province, northwestern Iran, during August 2012.



Table 3. Morphometrics of *Psilenchus curcumerus* adults recovered from grasslands of Sabalan region (All measurements in μm and in the form: Mean \pm sd range).

Origin	Sabalan		Rahman et al. (1994)	
Character	Females	Males	Females	Males
n	9	5	9	6
L	1004.8 \pm 79.9 (884-1103)	789.0 \pm 50.6 (741-870)	910 \pm 70 (830-1040)	840 \pm 20 (810-870)
a	43.6 \pm 3.8 (40.2-52.5)	42.3 \pm 5.6 (37.1-51.2)	50.7 \pm 2.4 (47.7-55.3)	51.3 \pm 1.3 (49.5-60.0)
b	6.9 \pm 0.4 (6.3-7.5)	5.9 \pm 0.4 (5.5-6.4)	7.0 \pm 0.4 (6.5-7.7)	6.7 \pm 0.4 (6.0-6.9)
c	7.3 \pm 0.4 (6.6-7.8)	6.1 \pm 0.4 (5.6-6.6)	6.5 \pm 0.3 (6.0-6.9)	5.4 \pm 0.3 (5.0-5.7)
c'	9.1 \pm 0.8 (7.7-10.4)	8.5 \pm 0.7 (7.4-9.3)	11.3 \pm 0.5 (10.2-12.0)	11.0 \pm 0.99 (10.0-12.5)
V or T	47.6 \pm 1.6 (44.5-50.0)	46.9 \pm 5.9 (39.7-55.3)	47 \pm 0.7 (46-48)	-
V'	55.2 \pm 2.0 (50.8-57.8)	-	-	-
Stylet	13.2 \pm 0.8 (12-14)	12.2 \pm 1.8 (11-15)	12.4 \pm 0.6 (12.0-13.5)	12.5 \pm 0.7 (12.0-13.5)
m	44.4 \pm 4.5 (37-50)	40.7 \pm 5.1 (33.3-45.5)	-	-
O	39.2 \pm 6.3 (30.8-50.0)	50.0 \pm 6.4 (45.5-54.5)	-	-
MB	56.8 \pm 1.3 (55.3-59.1)	55.9 \pm 1.4 (54.1-57.9)	54-58	-
Excretory pore	107.6 \pm 5.5 (102-118)	95.8 \pm 2.5 (93-99)	100.0 \pm 7.5 (90-108)	102.0 \pm 7.8 (92-113)
Oesophagus	145.7 \pm 3.9 (140-152)	134.6 \pm 0.9 (133-135)	128.0 \pm 5.3 (120-144)	127.3 \pm 7.7 (120-140)
Ant. end-vulva	477.7 \pm 33.8 (422-515)	-	348.0 \pm 31.5 (308-390)	-
Body width	23.1 \pm 1.6 (21-25)	18.8 \pm 1.6 (17-20)	-	-
Vulva - anus	388.3 \pm 43.6 (331-471)	-	-	-
Tail	138.8 \pm 11.9 (116-152)	130.4 \pm 7.5 (119-140)	138.8 \pm 6.8 (125-150)	158.0 \pm 7.0 (150-170)
Tail/V-A	0.4 \pm 0.0 (0.3-0.4)	-	0.39 \pm 0.01 (0.37-0.42)	-
Spicule	-	22.4 \pm 1.8 (20-25)	-	28.2 \pm 1.3 (27-30)
Gubernaculum	-	8.9 \pm 1.2 (7-10)	-	10.8 \pm 0.64 (10.5-12.0)

Discussion of *P. curcumerus*

Rahaman *et al.* (1994) from India. Iranian population of *P. curcumerus* is in morphological and morphomeric agreement with the original description (see Table 3) given by Rahaman *et al.* (1994). It is characterized by having a smooth head region, 12-15 μm long stylet, presence of post-rectal sac and filiform tail with clavate terminus.

Psilenchus terextremus Hagemeyer and Allen, 1952

(Figures 7-8)

Measurements: See Table 4.

Female: Body almost straight upon fixation, 642-874 μm long. Cuticle with distinct annuli 1.0-1.2 μm wide at mid-body. Lateral fields with visible crenate bands in margins, appearing as a simple band, with two bands in cross section (see Figure 8-E) or three weakly developed bands (see Figure 8-F) in lateral view. Head region truncate, not striated. Amphidial aperture slit-like, located below the contour of the lips. Spear delicate without knobs, conus less than half the total length. Orifice of dorsal gland 4-6 μm far from stylet base. Median bulb oval with prominent valve, anterior to the middle of the pharynx. Isthmus slender, basal bulb pyriform and offset with intestine. Excretory pore at the level with the basal bulb or slightly anterior to it. Hemizonid one annuli above excretory pore. Ovaries paired, outstretched, in opposite directions. Vulva a simple transverse slit without flap. Spermatheca elongate, oval, axial, filled with rounded sperm. Post anal

intestinal sac not observed. Tail filiform with rounded tip.

Male: Not found.

Habitat and Locality

Recovered from the rhizosphere of grasses in grasslands of Aghamali region in Sabalan, Ardebil province, northwestern Iran, during August 2012.

Discussion of *P. terextremus*

This species was originally recovered from the rhizosphere of strawberry, in Berkeley, California. Iranian population of *P. terextremus* is in morphological and morphometric agreement with the original description (Hagemeyer and Allen, 1952) and the data given by Brzeski, 1989 for a population from Poland (see Table 4). Compared to the data given in the latter references, the Iranian population has a lower range for c' (8.1-13.5 vs 11.6-19.5). It is characterized by having a slit shaped amphidial aperture, lateral fields with crenate margins, appearing as a simple band, with one or two weakly developed bands in cross section and lateral view, respectively, median bulb anterior to the middle of the pharynx and filiform tail with rounded tip.

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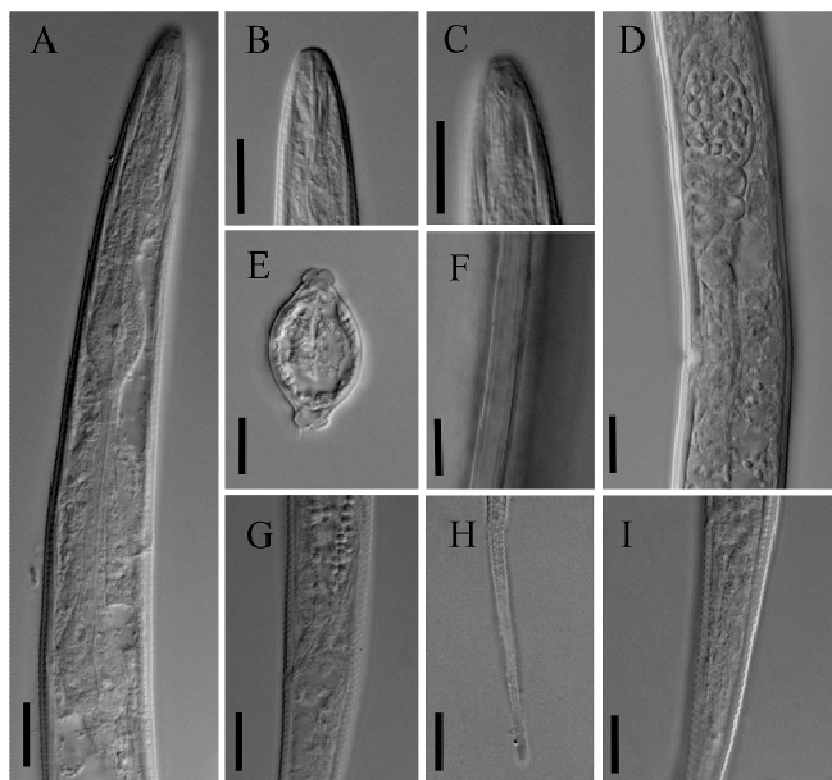


Figure 8. *Psilenchus terextremus*. A: Female, oesophagus; B: Female, anterior end; C: Amphidial slit; D: Part of female reproductive system; E: Female, cross section showing three lines in lateral field in mid-body; F: Lateral field in lateral view, showing four lines (with two weakly developed inner lines); G: Anal region in female lacking post intestinal sac; H: Tail end of female; I: Phasmid. All scale bars = 10 µm.

Table 4. Morphometrics of *Psilenchus terextremus* females recovered from grasslands of Sabalan region (All measurements in µm and in the form: Mean±sd range).

Origin	Sabalan	Brzeski (1989)	Hagemeyer and Allen (1952)
Character	Females	Females	Females
n	10	—	—
L	802±68.2 (642-874)	776±75.7 (693-912)	840-970
a	37.2±3.2 (31.2-40.6)	40±2.7 (36-45)	37-44
b	7.0±0.5 (5.9-7.5)	6.7±0.5 (6.1-7.8)	6.5-7.5
c	5.8±1.0 (4.9-7.7)	4.6±0.4 (4.1-5.2)	5.1-5.4
c'	11.2±1.7 (8.1-13.5)	15.2±2.4 (11.6-19.5)	—
V or T	47.6±1.0 (46.2-49.1)	46±1.9 (42-48)	45-46
V'	57.9±1.7 (54.8-60.8)	58±2.2 (54-60)	—
Stylet	11.8±1.1 (10.5-13.5)	—	11
St+dgo	16.9±1.3 (14.5-18.5)	14.6±1.1 (13-16)	—
m	40.2±3.2 (36.4-45.5)	—	—
O	43.1±6.8 (31.8-54.5)	—	—
MB	46.1±0.8 (44.4-47.5)	45±0.8 (44-46)	—
Excretory pore	94.2±6.1 (81-101)	88±4.8 (79-93)	—
Oesophagus	114.9±4.4 (108-120)	115±4.1 (111-123)	—
Ant. end-vulva	381.3±32.6 (309-414)	355±28.6 (314-383)	—
Body width	21.6±1.7 (19-25)	—	—
Vulva - anus	278.2±35.5 (210-325)	253±34.3 (215-325))	—
Tail	142.4±22.3 (105-163)	169±20.5 (146-199)	—
Tail/V-A	0.5±0.1 (0.3-0.6)	—	—

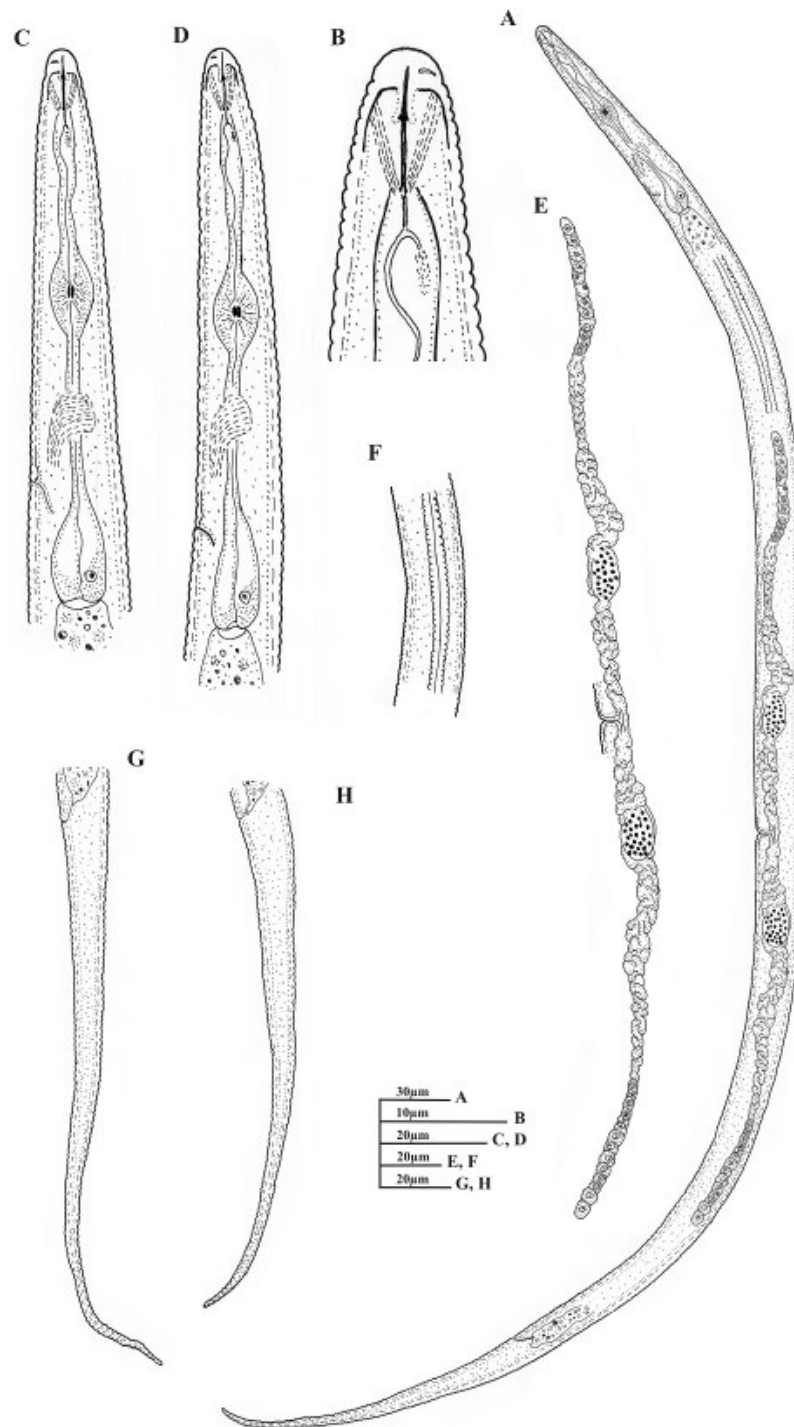


Figure 7. *Psilenchus terextremus*. A: Entire female; B: Female, head region; C, D: Female, anterior region; E: Female, reproductive system; F: Female, lateral field in mid-body; G, H: Female, tail.



REFERENCES

1. Andrassy, I. 1954. Revision der Gattung *Tylenchus* Bastian, 1865 (Tylenchidae: Nematoda). *Acta Zool. Acad. Scientiarum Hungaricae*, **1**: 5-42
2. Andrassy, I. 1968. Fauna Paraguayensis. 2. Nematoden aus der Galeriewaldem des. Acaray-flusses. *Opusc. Zool. Budapest.*, **8**, 167-315
3. Andrassy, I. 1980. The Genera and Species of the Family Tylenchidae Orley, 1880 (Nematoda). The genera *Aglenchus* (Andrassy, 1954) Meyl, 1961, *Michulenchus* Andrassy, 1959, and *Polenchus* gen. n. *Acta Zool. Acad. Scientiarum Hungaricae*, **26**: 1-20.
4. Andrassy, I. 1981. The Genera and Species of the Family Tylenchidae Orley, 1880 (Nematoda). The genus *Malenchus* Andrassy, 1968. *Acta Zool. Acad. Scientiarum Hungaricae*, **27**: 1-47.
5. Andrassy, I. 2007. *Free-living Nematodes of Hungar.* J. Pedozoologica Hungari-ca No.4, Hungarian Natural History Museum, 496 pp.
6. Bello, A. 1971. El género *Tylenchus* (Nematoda, Tylenchina). *Bol. r. Soc. Esp. Hist. Nat.*, **69**: 279-301.
7. Brzeski, M. 1989. Notes on the Genus *Psilenchus* de Man, 1921, with Description of *P. klingleri* sp. n. (Nematoda: Tylenchidae). *Annales Zool.*, **43**: 51-69.
8. Brzeski, M. 1999. Some Tylenchida (Nematoda) from Greenland. *J. Nematode Morph. Syst.*, **2**: 89-106.
9. De Grisse, A. T. 1969. Redescription et Modification de Quelques Techniques Utilisées Dans l'étude des Nematodes Phytoparasitaires. *Meded. Rijksfa. Gent*, **34**: 351-369.
10. De Man, J. G. 1884. Die, Frei in der Reinen Erde und im Süßen Wasser Lebenden Nematoden der Niederländischen Fauna: Eine Systematisch-faunistische Monographie. EJ Brill, Leiden, 206 pp.
11. Geraert, E. 2008. The Tylenchidae of the World: Identification of the Family Tylenchidae (Nematoda). Academia Press, Gent, Belgium, **(13-15)**: 360-400.
12. Geraert, E. and Raski, D. 1986. Unusual *Malenchus* Species (Nematoda: Tylenchidae). *Nematologica*, **32**: 27-55.
13. Golden, A., Zuckerman, B., Mai, W. and Rohde, R. 1971. Classification of the Genera and Higher Categories of the Order Tylenchida (Nematoda). *Plant Parasitic Nematodes Morphology Anatomy Taxonomy Ecology.*, **1**: 191-232.
14. Hagemeyer, W. and Allen, M. W. 1952. *Psilenchus Duplexus* n. sp. and *Psilenchus Terextremus* n. sp., Two Additions to the Nematode Genus *Psilenchus* de Man 1921. *Proc. Helm. Soc. Wash.*, **19**: 51-54.
15. Maggenti, A., Luc, M., Raski, D., Fortuner, R. and Geraert, E. 1987. A Reappraisal of Tylenchina (Nemata). XI: List of Generic and Supra-generic Taxa, with Their Junior Synonyms. *Revue de Nematol.*, **11**: 177-188.
16. Massey, C. 1969. New Species of *Tylenchus* Associated with Bark Beetles in New Mexico and Colorado. *Proc. Helm. Soc. Wash.*, **36**: 43-52.
17. Paetzold, D. 1958. Beiträge zur Nematoden Fauna Mitteldeutscher Salzstellen im Raum von Halle. *Wiss. Z. Martin-Luther-Univ. Halle-Wittenh.* **8**: 17-48
18. Rahaman, P. F., Ahmad, I. and Jairajpuri, M. 1994. One New and Two Known Species of the Family Tylenchidae. *Indian J. Nematol.*, **24**: 62-68.
19. Ryss, A. Y. 1993. Phylogeny of the Order Tylenchida (Nematoda). *Russian J. Nematol.*, **1**: 74-95.
20. Siddiqi, M. R. 1971. Structure of the Oesophagus in the Classification of the Subfamily Tylenchoidea. *Indian J. Nematol.*, **1**: 25-43.
21. Siddiqi, M. R. 2000. *Tylenchida Parasites of Plants and Insects*. 2nd Edition, CABI Publishing, Wallingford, UK, 833PP.
22. Subbotin, S. A., Sturhan, D., Chizhov, V.N., Vovlas, N. and Baldwin, J. G. 2006. Phylogenetic Analysis of Tylenchida Thorne, 1949 as Inferred from D2 and D3 Expansion Fragments of the 28S rRNA Gene Sequences. *Nematology*, **8**: 455-474.
23. Szczygieł, A. 1974. Plant Parasitic Nematodes Associated with Strawberry Plantation in Poland. *Zeszyty Probl. Post. Nauk Rol.*, **154**: 9-132
24. Whitehead, A. G. and Hemming, J. R. 1965. A Comparison of Some Quantitative Methods for Extracting Small Vermiform Nematodes from Soil. *Annals Applied Biol.*, **55**: 25-38.

چهار گونه جدید از نماتدهای (Tylenchid (Tylenchina: Nematoda برای فون نماتدهای ایران

ی. پناهنده، ا. پورجم و م. پدرام

چکیده

چهار گونه *Psilenchus curcumerus*, *Malenchus exiguus*, *Aglenchus agricola* و *P. terextremus* از ایران گزارش شده‌اند. جمعیت ایرانی گونه *A. agricola* با داشتن بدن به طول ۶۵۹-۵۴۲ میکرومتر، استایلت به طول ۱۰-۱۲ میکرومتر، منفذ دفعی در فاصله ۸۷-۷۰ میکرومتر از ابتدای بدن، باند جانبی مشخص با چهار شیار طولی، دم به طول ۱۷۰-۱۹۸ میکرومتر و وجود نر با اسپیکول به طول ۱۵-۱۶ میکرومتر از سایر گونه‌ها متمایز می‌گردد. جمعیت ایرانی گونه *M. exiguus* با داشتن اندازه بدن ۴۱۲-۳۶۲ میکرومتری، استایلت به طول ۸-۱۲ میکرومتر، دو شیار طولی مضرس در سطوح جانبی که از میانه ناحیه پروکرپوس آغاز و در ۱/۳ طول دم خاتمه می‌یابد، کیسه عقبی رحم به طول ۹-۶ میکرومتر، دم به طول ۸۹-۶۵ میکرومتر و وجود نر با اسپیکول به طول ۱۹-۱۳ میکرومتر در جمعیت مشخص می‌گردد. جمعیت ایرانی یافت شده از گونه *P. curcumerus* با داشتن ناحیه سر صاف و بدون شیار عرضی، استایلت به طول ۱۵-۱۲ میکرومتر، امتداد یافتگی روده بعد از مخرج و دم نخی شکل با انتهای چماقی شکل و جمعیت یافت شده از گونه *P. terextremus* با داشتن باند جانبی با حاشیه مضرس که در دید جانبی به شکل تک باند با سه باند داخلی ضعیف و یا دو باند در برش عرضی است، قرار گرفتن حباب میانی جلوتر از بخش میانی مری و دم نخی شکل با انتهای گرد از سایر گونه‌ها متمایز می‌گردد.