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Research Article

Description of four species of Tylenchidae Örley, 1880 (Nematoda: Tylenchomorpha) with two new records from Iran

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Abstract: During a nematological survey, nineteen known species of plant-parasitic nematodes belonging to the family Tylenchidae (Tylenchomorpha: Tylenchoidea) were collected and identified from different localities of West Azerbayjan and Kermanshah provinces, Iran. Among them two species, namely *Discotylenchus attenuatus* and *Tylenchus bhitaii*, are new records for Iranian nematode fauna, the male of *T. bhitaii* is recorded for the first time. Also, two previously reported species *Filenchus quartus* and *Tylenchus stachys* are illustrated and described. Descriptions, morphometric data, line drawings and microscopic photographs are provided.

Keywords: Description, *Discotylenchus*, *Filenchus*, Nematode, New record, *Tylenchus*

Introduction

The family Tylenchidae was established by Örley (1880), the members of Tylenchidae are cosmopolitan and weak parasites of plants. On the evolutionary ladder of Tylenchida Thorne, 1949, they represent the first rung in being both weak plant parasites and as a conservative group with many ancestral characters (*e.g.*, weak feeding apparatus, undifferentiated non-muscular corpus, filiform tails, etc.) (Siddiqi, 2000). Several genera (*Tylenchus* Bastian, 1865*, Filenchus* Andràssy, 1954*, Ottolenchus* Husain & Khan, 1967) feed on soil and freshwater algae and parasitize lichens and mosses. According to Geraert (2008), this family includes five subfamilies, namely Atylenchinae Skarbilovich, 1959, Boleodorinae Khan, 1964, Ecphyadophorinae Skarbilovich, 1959, Tylenchinae Örley, 1880 and Tylodorinae Paramonov, 1967.

To date, more than 64 species of the family Tylenchidae have been reported from different regions of Iran, some with full illustration and some as short reports without any additional taxonomic information (Ghaderi *et al.*, 2012). The taxonomic studies of Tylenchidae members in Iran has received attention in recent years, *e. g.,* Ghaemi *et al*., 2012; Atighi *et al.,* 2013; Panahandeh *et al*., 2015 and Mirbabaei Karani *et al*., 2015.

In a nematode survey conducted in western and northwestern Iran, several species were recovered and four species belonging to three genera, *Filenchus* Andrassy, 1954, *Discotylenchus* Siddiqi, 1980 and *Tylenchus* Bastian,1865 were identified and we provided descriptions, morphometric data, line drawings and light microscopic photographs for them. *Discotylenchus attenuatus* siddiqi, 1980 and *Tylenchus bhitaii* Maqbool & Shahina, 1987 are new for Iran. In addition, the male of *T. bhitaii* was described and characterised for the first time.

Materials and Methods

150 soil samples were randomly collected from the rhizosphere of the plants in different fields,

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orchards, forests, and grasslands in West Azerbayjan and Kermanshah provinces during September to December 2013. The nematodes were extracted by a modified, combined sieving and centrifugation flotation method (Jenkins, 1964) and Whitehead tray (Whitehead & Hemming, 1965). The nematodes were hand-picked, killed, fixed and transferred to anhydrous glycerin (De Grisse, 1969). Permanent slides were prepared and studied by a light microscope (Nikon E200). Drawings were made using a drawing tube attached to the same microscope. Photographs were taken by a digital camera attached to the microscope. Species were identified using available identification key (Geraert, 2008) and original descriptions.

Results

Nineteen species (Table 1) belonging to the family Tylenchidae were identified. *Discotylenchus attenuatus* and *Tylenchus bhitaii* are new records from Iran, and two previously reported species, namely *Filenchus quartus* and *Tylenchus stachys* are also described here.

Discotylenchus attenuatus siddiqi, 1980 (Figures 1 and 2; Table 2)

***Female*:** Body straight to slightly curved when heat killed. Cuticle weakly annulated. Lateral field occupying three to four µm diameter at mid-body, hardly visible \, four incisures at vulval region, not areolated. Lip region continuous and smooth, tapering to an offset prominent labial disc, *ca* 2.2 µm high and 3.8 µm broad. Stylet slender with minute rounded basal knobs, 6-7 µm long; conus occupying *ca* 29-50% of its total length. The dorsal gland orifice (DGO) 2 µm behind spear base. Median bulb oval, valvate, located *ca* 32–48 µm from the anterior end and isthmus elongate-slender, surrounded by the nerve ring which is located *ca* 45-64 µm from anterior end. Basal bulb saccate or pyriform, with flat base. Excretory pore slightly posterior to nerve ring position, 55-72 µm from lip region. Hemizonid distinct, 2-3 annuli anterior to excretory pore. Deirids not observed. Reproductive tract is monodelphic-prodelphic. Oocytes arranged in a single row even in the germinal zone; spermatheca offset, rounded, with sperm. Post uterine sac (PUS) occupying 8-18% of distance from vulva to anus and *ca* 0.4-0.8 times the corresponding body diameter long. Tail attenuate, filiform, with extremely thin end.

Table 1 Nematode species identified in the present study.

Species	Locality (provinces)	Associated plants
Atetylenchus abulbosus (Thorn, 1949) Khan, 1973	West Azerbayjan	Artemisia
Basiria duplexa (Hagemeyer & Allen, 1952) Geraert, 1968	West Azerbayjan	Millet
Boleodorus thylactus Thorn, 1941	Kermanshah & West Azerbayjan	Clover & Millet
Coslenchus assamensis (Phukan & Sanwal, 1980) Andrassy, 1981	West Azerbayjan	Astragalus & Oat
*Discotylenchus attenuatus** Siddiqi, 1980	West Azerbayjan	Apple
Discotylenchus discretus Siddiqi, 1980	West Azerbayjan	Apple
Filenchus afghanicus (Khan and Khan, 1978) Siddiqi, 1986	Kermanshah & West Azerbayjan	Alfalfa & Savory
Filenchus butteus (Thorne & Malek, 1968) Raski & Geraert, 1987	Kermanshah	Palm
Filenchus cylindricaudatus (Wu, 1969) Siddiqi, 1986	Kermanshah	Grapevine
Filenchus quartus(Szczygiel, 1969) Lownsbery & Lownsbery, 1985	Kermanshah	Olive
Filenchus vulgaris (Brzeski, 1963) Lownsbery & Lownsbery, 1985	West Azerbayjan	Bromus & Alfalfa
Irantylenchus vicinus(Szczygiel, 1970) Sumenkova, 1984	Kermanshah & West Azerbayjan	Palm & Clover
Neopsilenchus magnidens (Thorne, 1949) Thorne & Malek, 1968	Kermanshah & West Azerbayjan	Grapevine & Alfalfa
Psilenchus curcumerus Rahaman, Ahmad & Jairajpuri, 1994	Kermanshah	Olive
Psilenchus hilarulus de Man, 1921	Kermanshah & West Azerbayjan	Tomato & Acer
Psilenchus iranicus Kheiri, 1970	Kermanshah	Oak
*Tylenchus bhitaii** Maqbool & Shahina, 1987	West Azerbayjan	Agropyron
Tylenchus naranensis Maqbool, Zarina & Ghazala, 1986	West Azerbayjan	Thymes
Tylenchus stachys Brzeski, 1996	West Azerbayjan	Almond

* New records for Iranian nematode fauna.

***Male*:** Similar to females in the general characteristics, except in sexual organs. Testis outstretched, spermatocytes in one single column, 110-150 µm long. Spicules tylenchoid. Gubernaculum simple. Caudal alae adanal, 18-20 µm long. Tail similar in shape to that of female.

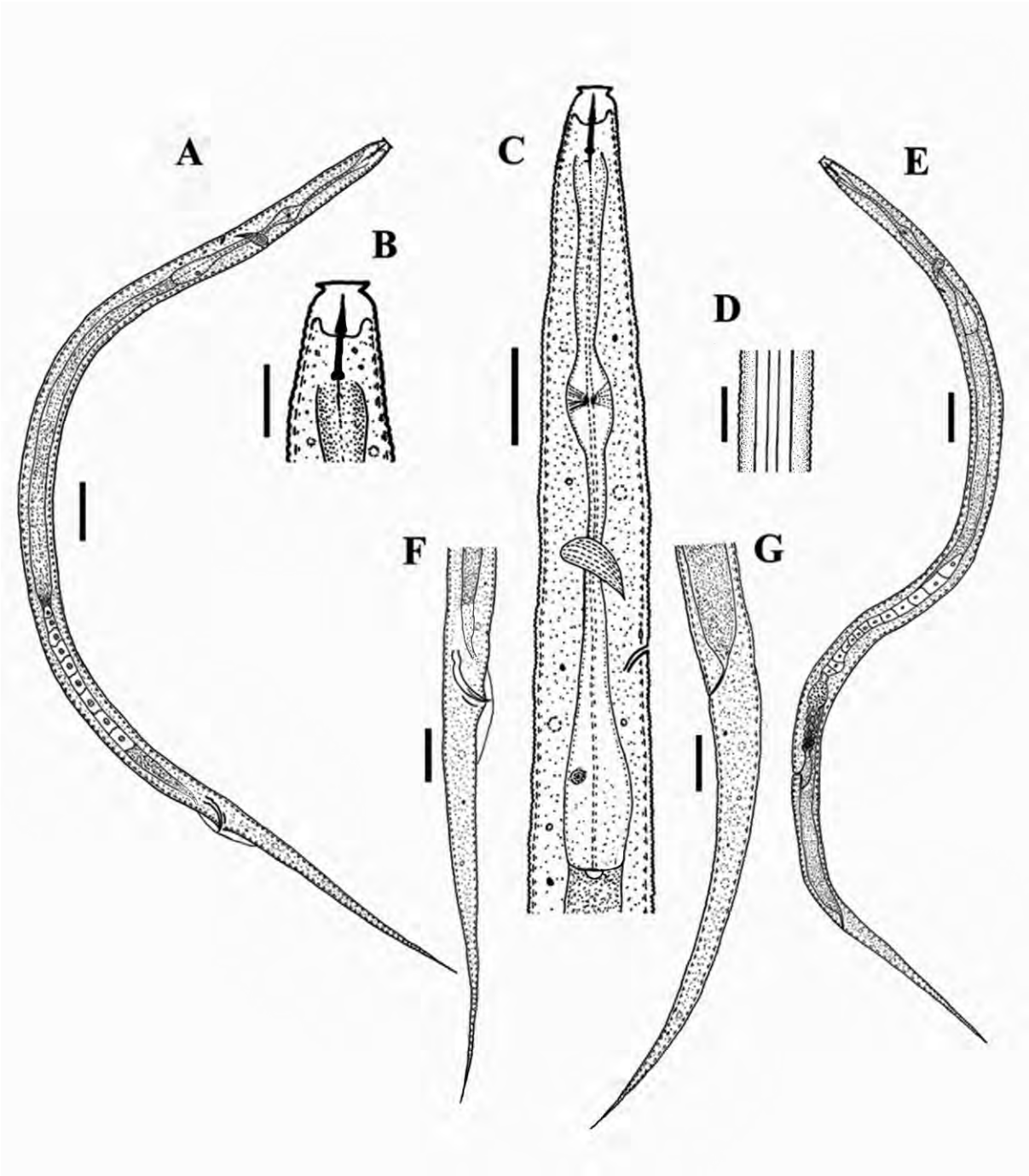

Figure 1 *Discotylenchus attenuates.* A: Male entire body; B: Anterior end; C: Female pharyngeal region; D: Lateral field at mid-body; E: Female entire body; F: Male tail and cloacal region; G: Female tail. (Scale bars: A, E = 20 μm; C, D, F, G = 10 μm; B = 5 μm).

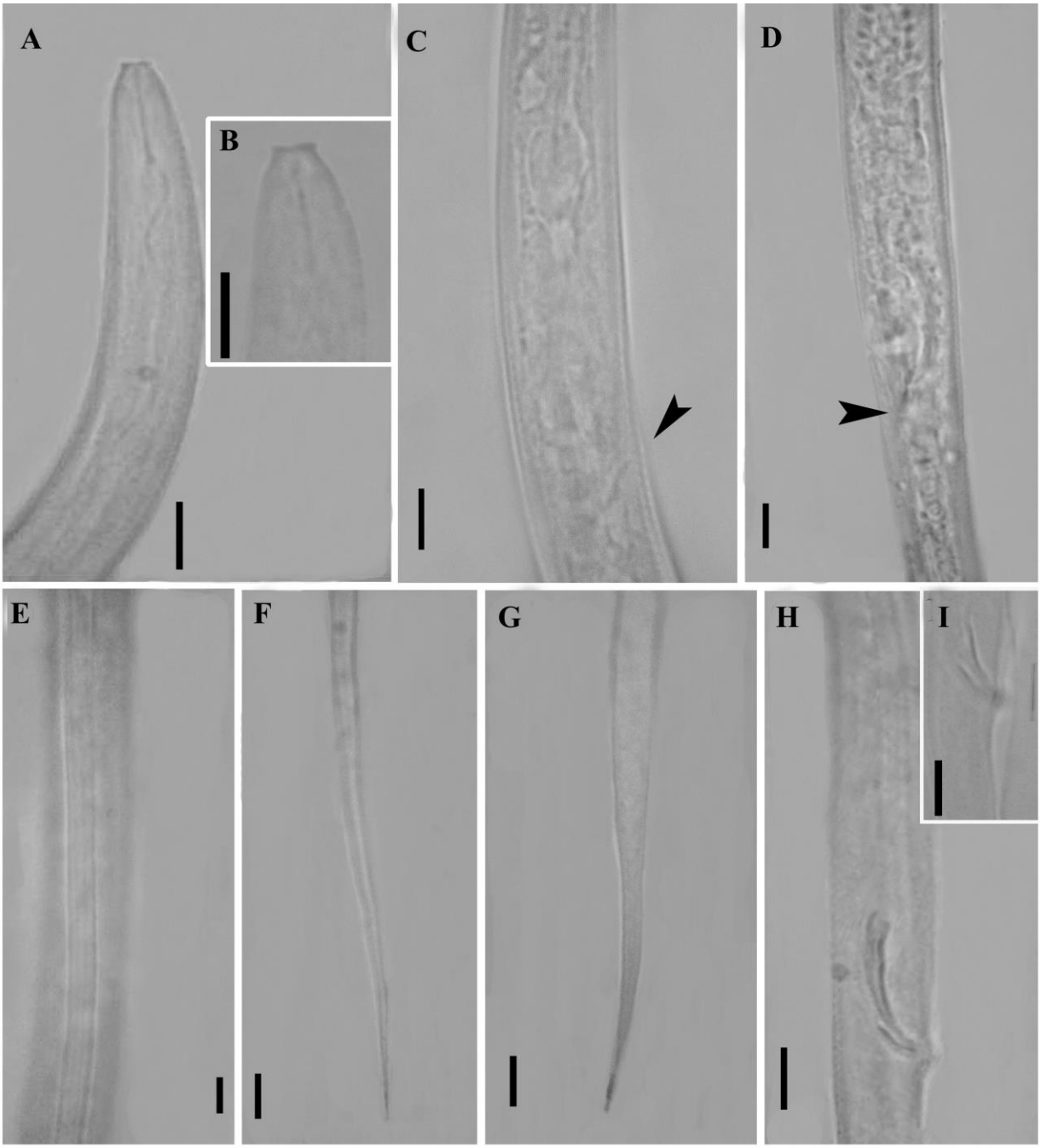

Figure 2 *Discotylenchus attenuates.* A: Anterior end; B: Female head end C: Female pharyngeal region showing excretory pore (arrowhead); D: Vulval region showing post uterine sac (PUS, arrowhead); E: Lateral field at mid-body; F: Male tail; G: Female tail; H: Male posterior end showing spicule; I: Male caudal alae. (all scale bars = 5 μm; except in B = 10 µm).

Table 2 Morphometric data of *Discotylenchus attenuatus* from West Azarbayjan province, northwestern Iran and its comparison with original description.

Characters\Origin	Present study		Sidddiqi, 1980	
	Female	Male	Female	Male
n	10	4	15	10
L	423 ± 34.4 (371-477)	377 ± 21 (353-397)	330-400	340-370
a	34 ± 3.7 (26.4-38.4)	34.4 ± 2.6 (30-36)	25-33	31-37
b	5.0 ± 0.3 (4.4-5.2)	4.3 ± 0.3 (3.9-4.5)	4.1-5.4	4.6-5.2
c	5.3 ± 0.6 (4.3-6.5)	5.0 ± 0.2 (4.7-5.2)	4.1-5	3.7-4.8
c'	9.3 ± 1.4 (7.7-12.3)	8.7 ± 1 (7.7-10.0)	9-12	8.3-10.3
V or T	66.0 ± 2 (63.0-68.0)	34 ± 5.4 (30.1-37.8)	60-64	30-38
V'	81.0 ± 1.8 (78.0-83.0)	-	76	-
Stylet	6.7 ± 0.4 (6.0-7.0)	6.8 ± 0.5 (6.0-7.0)	6-6.5	6-6.5
Conus	2.6 ± 0.5 (2.0-3.0)	2.6 ± 0.5 (2.0-3.0)	-	-
MB	48.0± 2.0 (44.0-51.0)	50.0 ± 2.0 (47.0-51.0)	43-46	41-46
Excretory Pore	62.0 ± 5.6 (55.0-72.0)	60.0 ± 4.5 (55.0-66.0)	50-55	-
Max. Body width	12.6 ± 1.5 (11.0-16.0)	11.0 ± 0.8 (10.0-12.0)	-	-
Post uterine sac length	7.1 ± 1.7 (5.0-10.0)	-	-	-
Vulva-Anus	63.0 ± 11.0 (52.0-85.0)	-	50-62	-
Anal /cloacal body diam.	8.7 ± 0.8 (7.0-10.0)	8.8 ± 1.3 (7.0-10.0)		-
Tail	80.4 ± 8.1 (70.0-90.0)	75.3 ± 3.5 (70.0-87.0)	68-96	72-90
Spicules	-	13.0 ± 0.8 (12.0-14.0)	-	11-12
Gubernaculum	-	4.3 ± 0.5 (4.0-5.0)	-	3-4.5

Measurements are in µm.

Remarks

According to Siddiqi (2000), *Discotylenchus* contains six known species besides, *D. iranicus* has been added by Ghaemi *et al.* (2012) (totally seven species till now). Based on Geraert (2008), species of *Discotylenchus* can be assigned in two groups based on number (two or four) of incisures in lateral field. Dimensions and morphological characters of the present specimens conform to those descriptions of *D. attenuatus* given by Siddiqi (1980) from Bush soil at Oyo Road, Ibadan, Nigeria except for some variations in spicules length (spicule = 11-12 µm in Siddiqi, 1980). Iranian population of *D. attenuatus* is close to *D. discretus* Sidddiqi, 1980. It differs from *D. discretus* by shorter body length (371-477 *vs* 440-610 μm), shorter stylet (6-7 *vs* 7-7.5 μm) and shorter tail length (70-90 *vs* 80-115 μm). The present population was recovered from soil samples associated with the rhizosphere of apple trees in Naqadeh, West Azerbayjan province, and is reported from Iran for the first time.

***Filenchus quartus* (Szczygiel, 1969) Lownsbery & Lownsbery, 1985**
(Figures 3 and 4; Table 3)

Female. Body straight to slightly curved when heat killed. Cuticle weakly annulated. Lateral field 3.0-3.5 µm wide at mid-body, with four incisures at vulval region, not areolated. Lip region continuous with body contour, *ca* 3.0-3.5 µm high and 5.5-6.0 µm broad. Stylet with distinct rounded basal knobs, conus occupying *ca* 25-44% of its total length. The dorsal gland orifice (DGO) 2.0-2.5 µm just behind spear base. Median bulb oval, valvate, located *ca* 46–50 µm from the anterior end and isthmus elongate-slender, surrounded by the nerve ring which is located *ca* 48-63 µm from anterior end. Basal bulb saccate or pyriform, with flat base. Excretory pore slightly posterior to nerve ring position or at beginning of pharyngeal basal bulb level. Hemizonid just anterior to excretory pore. Deirids not observed. Reproductive tract is monodelphic-prodelphic. Oocytes are arranged in a single row even in the germinal zone; spermatheca offset, rounded, often with sperm. Post-uterine sac short, occupying 8-14% of distance from vulva to anus and *ca* 0.6-0.7 times the corresponding body diameter long. Tail slightly tapers evenly, posterior part usually pointed, but not filiform.

***Male*:** Not found.

Remarks

Filenchus quartus was originally described from Poland in the rhizosphere of strawberry by Szczgiel (1969). Morphological and morphometric characters of the Iranian population of *F. quartus* fit well with the original description. Several populations of this species have been reported from Afghanistan, the Netherlands, Japan, Spain, Greenland and Belgium (Geraert, 2008). The population recovered from Iran is close to *F. discrepans* (Andrássy, 1954) Andrássy, 1972 and *F. spiculatus* Sultan, 1986. It differs from the former species by having a longer stylet (9-10 *vs* 7-7.4 µm) and the tail shape (posterior part often pointed, but not filiform *vs* filamentous) and from *F. spiculatus* by having a longer stylet (9-10 *vs* 6-7 µm) and anteriorly located vulva (V = 54-60 *vs* 60-64). This species was previously reported from Iran, from the rhizosphere of Cotton in Tehran province (Qhanbarnia *et al*., 1998), with no morphological and morphometric data. The material of present study was collected from the rhizosphere of Olive in Gilan-e-Gharb, Kermanshah province.

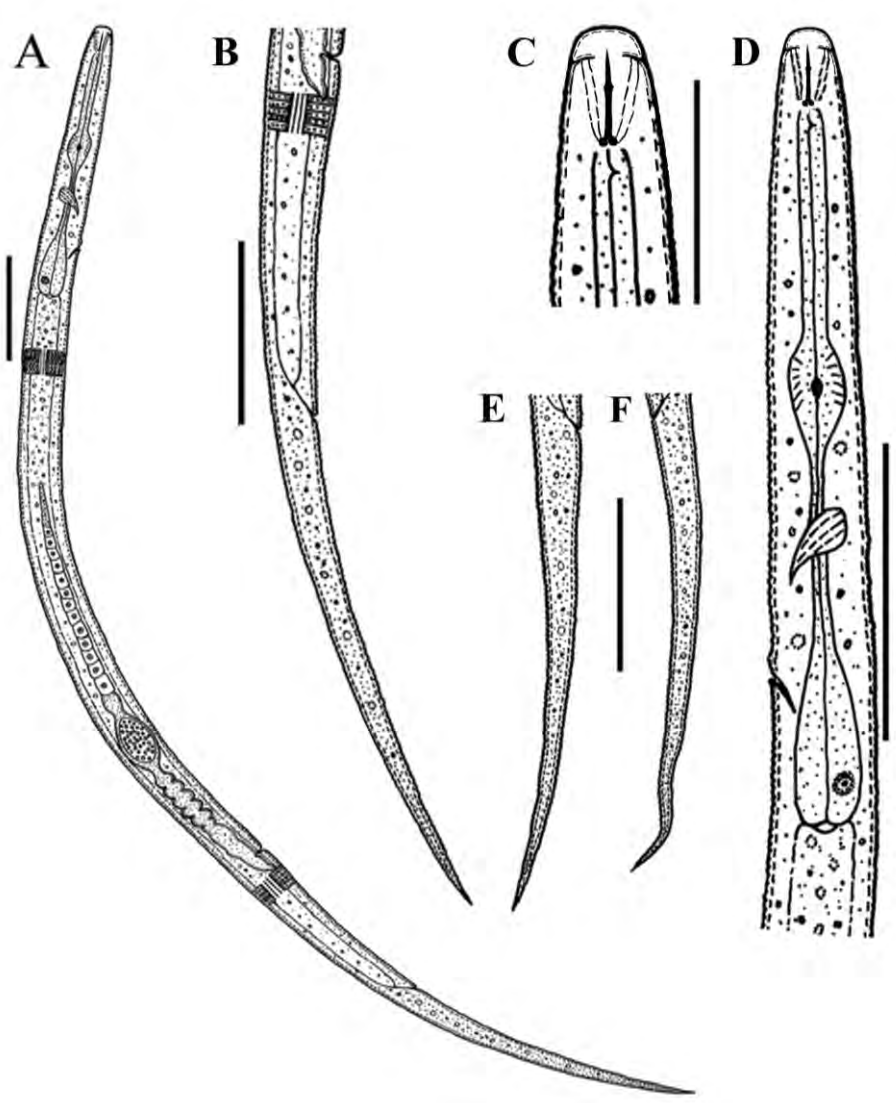

Figure 3 *Filenchus quartus*. A: Female entire body; B: Vulva region and posterior end; C: Anterior end; D: Female pharyngeal region; E: Female tail. (all scale bars = 30 μm).

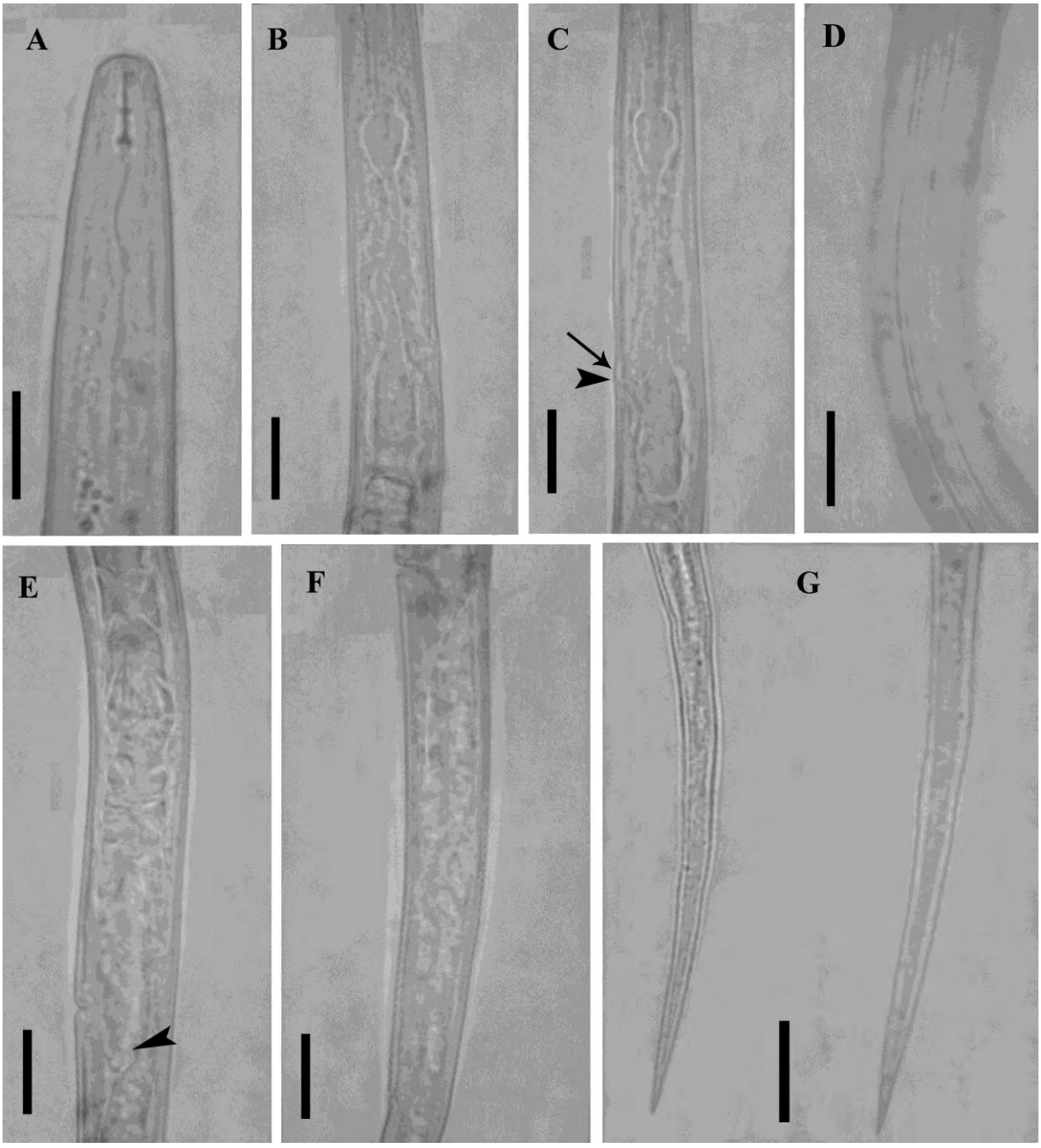

Figure 4 *Filenchus quartus.* A: Anterior end; B & C: Female pharyngeal region showing excretory pore and Hemizonid (arrowhead); D: Lateral field at mid-body; E: Vulval region showing post uterine sac (PUS, arrowhead); F: Vulva to anus; G: Female tail. (all scale bars = 10 μm).

Table 3 Morphometric data of females of *Filenchus quartus* from Kermanshah province, western Iran and its comparison with other populations.

Characters\Origin	Present study	Szczygiel, 1969	Lownsbery & Lownsbery, 1985	Castillo *et al*., 1991
	Female	Female	Female	Female
n	10	9	?	15
L	674.5 ± 10.6 (640-655)	410-560	560-700	375-556
a	30.1 ± 1.5 (29.7-31.2)	37-46	30-39	29.8-35.6
b	6.5 ± 1.7 (5.3-7.7)	4.4-5.3	-	4.2-6.0
c	4.7 ± 0.9 (4.1-5.3)	4.2-5.3	3.7-5.3	3.8-6.6
c'	12.6 ± 4.8 (9.2-16.0)	-	12-16	9.2-16.6
V or T	57.1 ± 2.5 (54.3-60.0)	60- 66	57-65	59-66
V'	78.4 ± 4.3 (71.7-79.0)	-	76-80	-
Stylet	9.5 ± 0.7 (9.0-10.0)	9.4-11.8	11.5-12.5	8-11
Conus	3.3 ± 1.1 (2.5-4.0)	-	-	-
MB	48.6 ± 14.5 (38.3-58.8)	-	42-43	37-45
Excretory Pore	67.5 ± 3.5 (65.0-70.0)	-	-	46-79
Max. body width	21.5 ± 0.7 (21.0-22.0)	-	-	11.5-17
Post uterine sac length	12.0 ± 1.4 (11.0-13.0)	-	-	-
Vulva-Anus	128.5 ± 26.2 (110.0-147.0)	-	50-62	61-86
Anal /cloacal body diam.	11.5 ± 2.1 (10.0-13.0)	-	-	-
Tail	140 ± 28.3 (120-160)	-	68-96	74-146

Measurements are in µm.

***Tylenchus bhitaii* Maqbool & Shahina, 1987 (Figures 5 and 6, Table 4)**

Female: Body ventrally curved upon fixation. Cuticle finely annulated, 1-1.2 µm thick at mid-body. Lateral field four to five µm wide at mid-body, with Four incisures at vulval region, outer incisures weakly crenate and inner ones smooth. Lip region continuous with body contour, with 4-5 fine annules, *ca* 2.4 µm high and 5.3 µm broad. Stylet small with distinct rounded basal knobs, 8-9 µm long; conus occupying *ca* 45-50% of its total length. The dorsal gland orifice just posterior to stylet knobs. Median bulb well developed, oval, valvate, located *ca* 30–41 µm from the anterior end. Nerve ring encircling middle of isthmus. Basal bulb cylindroid elongate. Excretory pore slightly posterior to nerve ring position, 56-77 µm from the anterior end, its opening at level of anterior terminal bulb. Hemizonid invisible. Deirids not observed. Female reproductive system monodelphic prodelphic, outstretched, with oocytes in single file. Spermatheca rounded, filled with rounded Sperm. Post uterine sac occupying 12-24% of distance from vulva to anus and *ca* 0.6-1 times the corresponding body diameter long. Tail slender, almost cylindrical, with hooked, tapering to rounded smooth tip.

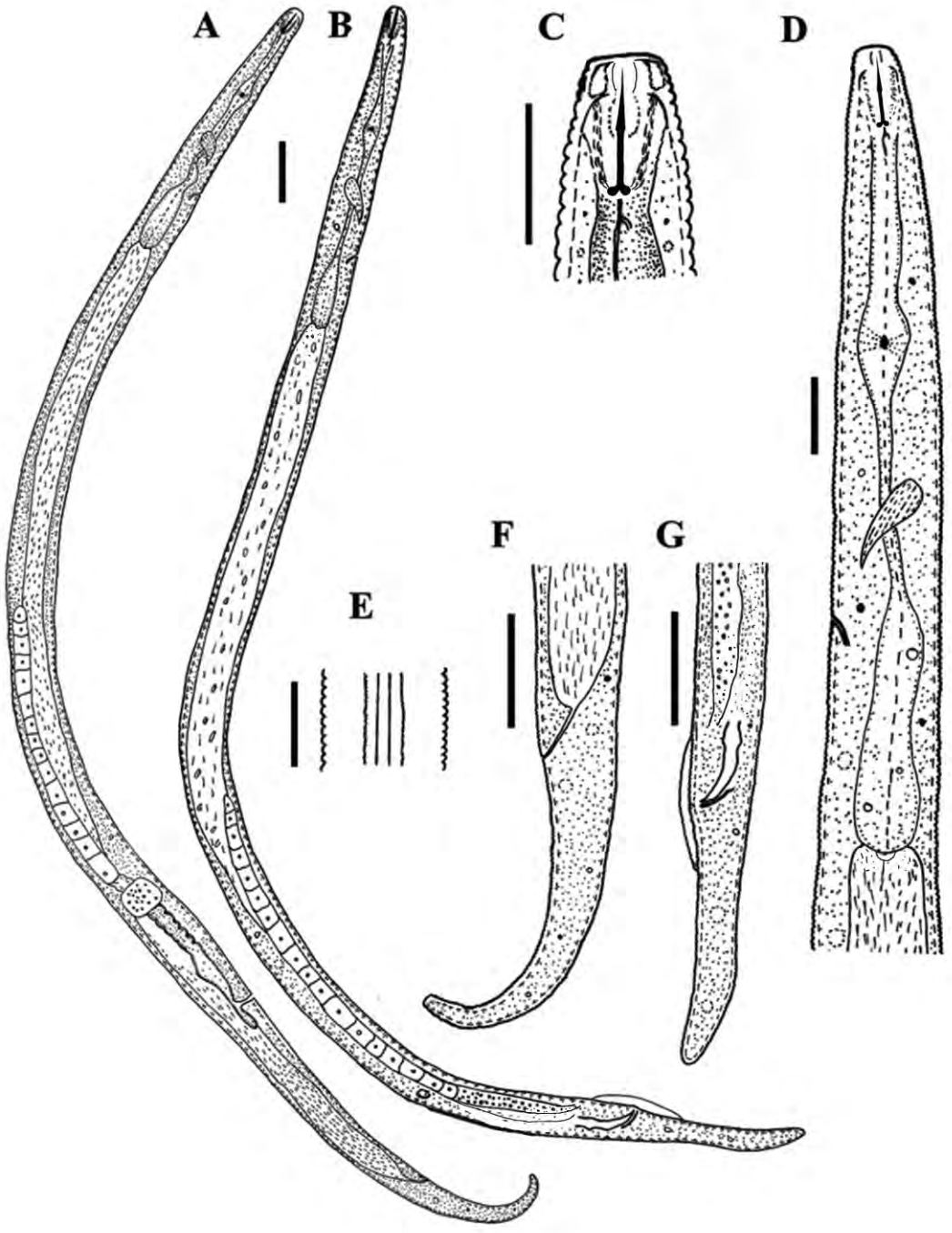

Figure 5 *Tylenchus bhitaii.* A: Female entire body; B: Male entire body; C: Anterior end; D: Female pharyngeal region; E: Lateral field at mid-body; F: Female tail; G; Male tail and cloacal region. (scale bars:A, B, F, G = 20 μm; C-E = 10 μm).

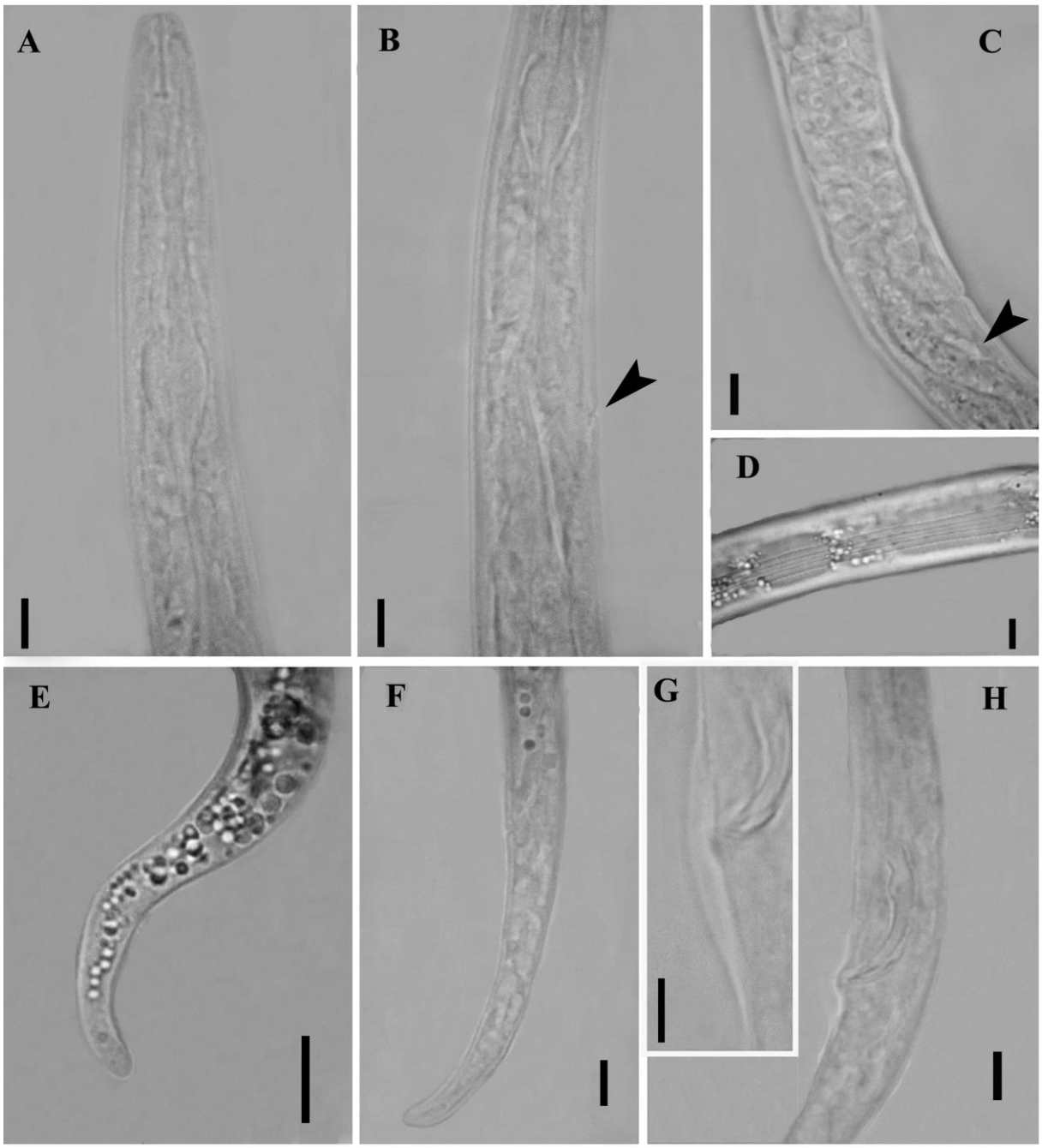

Figure 6 *Tylenchus bhitaii.* A: Anterior end; B: Stylet in deital; C: Female pharyngeal region showing excretory pore (arrowhead); D: Vulval region showing post uterine sac (PUS, arrowhead); E: Lateral field at mid-body; F & G: Female tail; H: Male caudal alae; I: Male posterior end showing spicule. (all scale bars = 5 μm).

Table 4 Morphometric data of *Tylenchus bhitaii* from West Azarbayjan province, Northwestern Iran and its comparison with original description.

Characters\Origin	Present study		Maqbool & Shahina, 1987
	Female	Male	Female
n	10	3	12
L	460 ± 59 (385-581)	431 ± 3.5 (428-435)	650 (600-670)
a	30 ± 2.8 (25.7-34)	32.4 ± 1.4 (31-33.5)	34 (34-35)
b	5.0± 0.3 (4.6-5.3)	4.8 ± 0.2 (4.7-5.0)	6 (5.7-6.5)
c	10.0 ± 1.2 (8.4-12.1)	9.0 ± 0.1 (8.7-9.5)	10 (9.8-10.4)
c'	4.9 ± 0.9 (3.7-6.1)	5.0± 0.5 (4.5-5.4)	5.2 (5.2-5.4)
V or T	73.0 ± 1.2 (71.4-75.5)	35.0 ± 0.8 (34.0-36.0)	72 (70-72)
V'	82.0 ± 1.5 (78.0-83.5)	-	-
Stylet	8.2 ± 0.4 (8.0-9.0)	8.3 ± 0.6 (8.0-9.0)	10.4 (10-11)
Conus	4.0 ± 0.2 (3.5-4.0)	4.2 ± 0.3 (4.0-4.5)	-
MB	36.0 ± 2.1 (34.0-40.0)	39.0 ± 1.0 (38.0-40.0)	36
Excretory Pore	68.5 ± 6.3 (56.0-77.0)	65.0 ± 3.0 (62.0-68.0)	74-80
Max. body width	15.5 ± 2 (13.0-18.0)	13.3 ± 0.6 (13.0-14.0)	
Post uterine sac length	14.0 ± 2.0 (12.0-18.0)	--	-
Anal /cloacal body diam.	9.7 ± 1.2 (8.0-12.0)		
Tail	47.5 ± 9.4 (33.0-64.0)	50.0 ± 0.6 (49.0-51.0)	60-68
Spicules	-	17.7 ± 0.6 (17.0-18.0)	-
Gubernaculum	-	6.5 ± 0.6 (6.0-7.0)	-

Measurements are in µm.

***Male*:** common, less than female (ratio of 3:10 females). Similar to females in the general characteristics, except in sexual organs. Testis single, located along ventral side of body. spermatocytes arranged in one row. Spicules tylenchoid. Gubernaculum simple. Caudal alae adanal, 26-28 µm long. Tail similar in shape to that of female.

Remarks

Dimensions and morphological characters of the present specimens conform to descriptions of *T. bhitaii* given by Maqbool & Shahina (1987) reported from the rhizosphere of wheat (*Triticum aestivum* L.) at Tandojam, Sind, Pakistan except for some variations in body length and stylet length (L = 0.46–0.65 mm, stylet = 9.2–10.4 µm in Maqbool & Shahina, 1987). Iranian population of *T.bhitaii* is clos to *T. naranensis* Maqbool, Zarina & Ghazala, 1986 but differs from it by shorter body length (385-581 *vs* 730-870 µm) and greater c ratio (8.4-12 *vs* 6-7). The species is very similar to *Filenchus sandneri* (Wasilewska, 1965) Raski & Geraert, 1987, but differs from it by having longer stylet conus (about 1/2 *vs* 1/3 stylet length). The present specimen was collected from the rhizosphere of *Agropyron cristatum* (L.) Gaertn. in Naqadeh West Azerbayjan province, northwestern Iran. This is the first report of the presence of *T. bhitaii* in Iran The males of this species are described for the first time.

***Tylenchus stachys* Brzeski, 1996**
(Figures 7 and 8, Table 5)

Female: Body slightly ventrally curved upon fixation. Cuticle coarsely annulated, annuli 1.4-1.7 µm wide at mid-body. Lateral field six to seven µm wide at mid-body, with Four incisures at vulval region, outer incisures completely areolated on entire body. (*i.e.*, Three ridges). Lip region continuous with body contour, *ca* 4 µm high and 7 µm broad. Stylet slender with distinct rounded basal knobs, 15-16 µm long; conus occupying *ca* 47-50% of its total length. The dorsal gland orifice just posterior to stylet knobs. Median bulb oval to almost rounded in outline, located *ca* 51–65 µm from the anterior end. Nerve ring encircling middle of isthmus. Excretory pore slightly posterior to nerve ring position, 106-120 µm from the anterior end. Basal bulb elongate pyriform. Hemizonid just anterior to excretory pore. Deirids at the centre of lateral field, shortly posterior to excretory pore. Female reproductive system monodelphic

prodelphic, outstretched, with oocytes in single file. Spermatheca rounded, filled with rounded sperm. Post uterine sac occupying 13-17% of distance from vulva to anus and *ca* 0.6-0.8 times the corresponding body diameter in length. Tail ventrally arcuate with pointed tip.

***Male*:** Similar to female in general characteristics, except in sexual organs. Testis outstretched, spermatocytes in one single column, 437- 466 µm long. Spicules tylenchoid. Gubernaculum simple. Caudal alae crenate, adanal, 40-60 µm long. Tail similar in shape to that of female.

Remarks

This species has originally been described from Victoria, Australia (Brzeski, 1996). Morphological and morphometric characters of Iranian population completely fit with those given in the original description. Iranian population of *T. stachys* is closest to *T. skarduensis* Maqbool & Shahina, 1987 and *T. safroni* (Fotedar & Handoo, 1979) Siddiqi, 1986. It differs from *T. skarduensis* by longer spicules (25-27 *vs* 18-20 μm) and from *T. safroni* by longer stylet (15-16 *vs* 12-14 μm). This species has previously been reported from Iran, recovered from Kohgiluyeh and Boyer-Ahmad province (Ghaemi & Pourjam, 2012), with no morphological and morphometric data, in this study it was collected from the rhizosphere of almond tree in Mohammadyar, West Azerbayjan province, northwestern Iran.

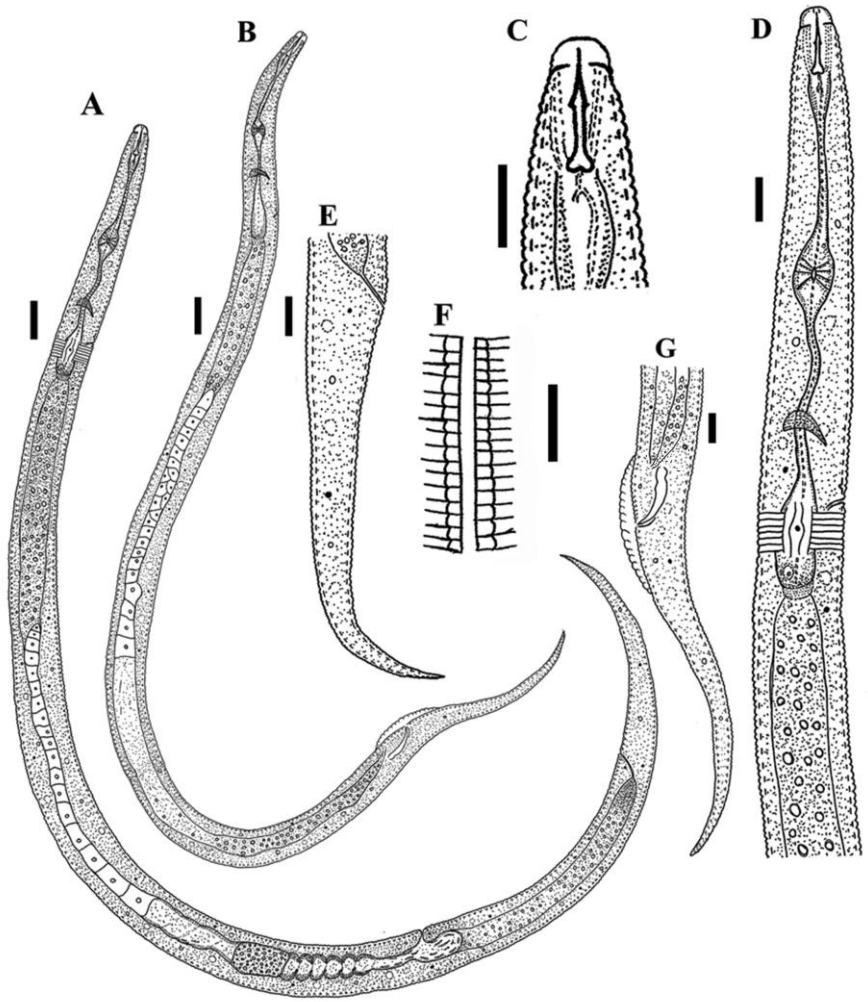

Figure 7 A: Female entire body; B: Male entire body; C: Anterior end; D: Female pharyngeal region; E: Female tail; F: Lateral field at mid-body; G: Male tail and cloacal region. (A & B = 20 μm; C-G = 10 μm).

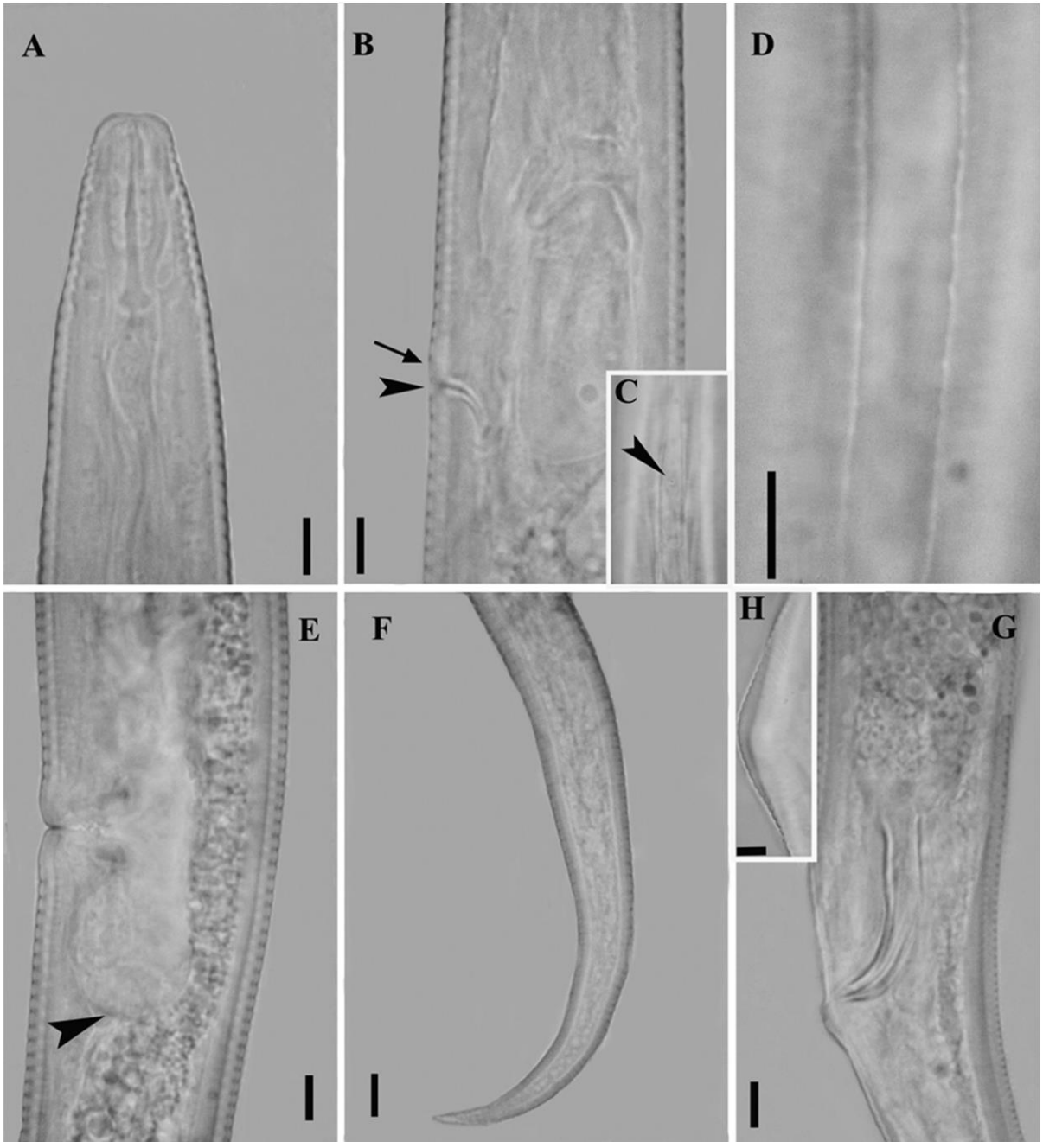

Figure 8 *Tylenchus stachys*. A: Anterior end; B: Female pharyngeal region showing excretory pore and Hemizonid (arrowhead); C: Dierid; D: Lateral field at mid-body; E: Vulval region showing post uterine sac (PUS, arrowhead); F: Female tail; G: Male posterior end showing spicule; H: Male caudal alae. (all scale bars = 5 μm).

Table 5 Morphometric data of *Tylenchus stachys* from West Azarbayjan province, Northwestern Iran and its comparison with original description.

Characters	Present study		Brzeski, 1996	
	Female	Male	Female	Male
n	9	3	26	25
L	830 ± 45 (756-885)	782 ± 41.3 (736-816)	1005 ± 72.6 (826-1113)	946 ± 47.3 (859-1045)
a	28.0 ± 1.7 (25.0-30.0)	31.0 ± 1.2 (30.0-32.0)	41 ± 4.2 (35-53)	42.5 ± 4.8 (37-56)
b	6.3 ± 0.3 (6-6.7)	6.1 ± 0.1 (6.4-6.6)	7.3 ± 0.4 (6.4-8)	7 ± 0.3 (6.6-7.7)
c	6.8 ± 0.5 (5.7-7.4)	6.0 ± 0.4 (5.8-6.5)	6.4 ± 0.3 (5.8-7.4)	6 ± 0.3 (5.4-6.7)
c'	6.3 ± 0.6 (5.5-7.3)	7.4 ± 0.7 (7.0-8.1)	10.0 ± 0.9 (8.1-11.8)	9.3 ± 0.6 (8-10.7)
V or T	67.0 ± 2.0 (62.0-69.0)	58.0 ± 1.2 (57.0-59.0)	61.5 ± 0.9 (59.0-63.0)	-
V'	79.0 ± 1.3 (76.0-80.0)	-	73.0 ± 0.8 (71.0-74.0)	-
Stylet	15.1 ± 0.4 (15.0-16.0)	14.3 ± 0.6 (14.0-15.0)	15.4 ± 0.4 (14.5-16.5)	15.3 ± 0.4 (14.5-15)
Conus	7.2 ± 0.4 (7.0-8.0)	7.3 ± 0.6 (7.0-8.0)	-	-
MB	45.0 ± 1.6 (43.0-48.4)	47.0 ± 2.4 (45.0-49.6)	45.5 ± 1.5 (42.0-48.0)	46.0 ± 1.1 (44.0-48.0)
Excretory Pore	114 ± 5.5 (106-120)	111 ± 1 (110-112)	124 ± 10 (101-137)	118 ± 6.9 (108-135)
Max. body width	30.0 ± 1.8 (28.0-33.0)	25.3 ± 0.6 (25.0-26.0)	-	-
Post uterine sac length	21 ± 1.4 (19.0-23.0)	-	13.0 (9.0-19.0)	-
Vulva-Anus	149 ± 15.0 (132-176)	-	232 ± 23.3 (181-297)	-
Anal /cloacal body diam.	19.6 ± 1.1 (18.0-21.0)	17.3 ± 1.2 (16.0-18.0)	-	-
Tail	123 ± 11.6 (110-145)	127 ± 2.5 (125-130)	157 ± 9.5 (133-174)	157 ± 9.2 (142-176)
Spicules	-	25.7 ± 1.2 (25.0-27.0)	-	25.5 ± 1 (24.0-28.0)
Gubernaculum	-	5.3 ± 0.6 (5.0-6.0)	-	-

Measurements are in μm.

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توصیف چهار گونه نماتد از خانواده Tylenchidae Örley, 1880 (Nematoda: Tylenchomorpha) شامل دو گزارش جدید برای ایران

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چکیده: نوزده گونه از نماتدهای انگل گیاهی متعلق به خانواده Tylenchidae (Tylenchomorpha: Tylenchoidea) از مناطق مختلف استان‌های آذربایجان غربی و کرمانشاه جمع‌آوری و شناسایی شدند. از بین آن‌ها دو گونه *Discotylenchus attenuatus* و *Tylenchus bhitaii* گزارش‌های جدیدی برای فون نماتدهای ایران بوده و افراد نر گونه *Tylenchus bhitaii* برای اولین بار گزارش می‌شود. دو گونه *Filenchus quartus* و *Tylenchus stachys* که قبلا گزارش آنها موجود بود، توصیف می‌شوند. توصیف کامل، داده‌های ریخت‌سنجی، ترسیم‌ها و عکس‌های میکروسکوپ نوری برای این چهار گونه ارائه شده است.

واژگان کلیدی: توصیف، نماتد، گزارش جدید، *Discotylenchus*، *Filenchus*، *Tylenchus*