

New records of plant parasitic nematodes *Nothotylenchus ferepolitor* and *Neopsilenchus paragracilis* from rhizosphere of *Allium cepa* in Iran

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Abstract

In this study, 42 soil samples from onion fields of Razavi and Northern Khorasan provinces resulted 16 species of nematodes viz., *Psilenchus curcumerus*, *Ditylenchus apus*, *D. medians*, *Basiria gracilis*, *B. graminophila*, *Aphelenchus isomerus*, *A. avenae*, *Boleodorus thylactus*, *Zygotylenchus guevarai*, *Pratylenchus thornei*, *P. neglectus*, *Irantylenchus clavidorus*, *Neopsilenchus magnidens*, *Neopsilenchus paragracilis*, *Nothotylenchus ferepolitor*, *Filenchus pratensis*. Among these species *Neopsilenchus paragracilis* and *Nothotylenchus ferepolitor* are new records in Iran.

Keywords: Nematode new records, *Neopsilenchus paragracilis*, *Nothotylenchus ferepolitor*, onion, Iran

Onion *Allium cepa* L., is from Liliaceae family and consumed for their putative nutritional and health benefits (Munday *et al.*, 2003) and cultivated for food, such as the Japanese bunching onion *A. fistulosum*, the Egyptian onion *A. xproliferum* and the Canada onion *A. canadense*. Onions are cultivated and used around the world and widely cultivated in Iran. In Iran onion cultivated on an area about 71 thousand hectares, average 2,260,000 t/year production and sixth producer in the world (FAO, 2012). The Khorasan province in Iran is one of the main onion production area specially in Neyshabour and Torbat heydarie cities. *Ditylenchus dipsaci* (Kühn, 1857) Filipjev, 1936 is the most important pathogenic nematode that primarily infects onion and garlic but other nematodes also can cause reduce quantity and quality of product. The most published work on onion is from management of sting and stem-bulb nematodes. In addition, *Tylenchus* sp., *Rotylenchulus reniformis* Linford & Oliveira, 1940; *Meloidogyne javanica* (Trueb, 1885) Chitwood, 1949; *Hemicycliophora oostenbrinki* Luc, 1958 and *Helicotylenchus multincinctus* (Cobb, 1893) Golden, 1956 are reported from onion field of Ghana (Addoh,

1971). Recorded nematode species from onion fields in New York were *Meloidogyne hapla* Chitwood, 1949, *Pratylenchus penetrans* (Cobb, 1917) Filipjev & Schuurmans Stekhoven, 1941, *Paratrichodorus allium* (Jensen, 1963) Siddiqi 1974, *P. minor* (Colbran, 1956) Siddiqi, 1974 and *Tylenchus* sp. (Abawi *et al.*, 2006). In this study survey of nematodes of onion fields of Razavi and Northern Khorasan provinces of Iran are presented.

Materials and Methods

Soil sampling: Soil samples were collected from the rhizospheres of only onion cultivated fields in Northern and Razavi Khorasan provinces in East of Iran. Soil samples (42) were taken from the depth of 20-30 cm, put in polyethylene bags with necessary labeling and brought to the laboratory and processed.

Processing of samples: Nematodes were extracted from soil samples by using the Jenkins (1964) method, killed and fixed according to De Grisse (1969). Genera and species were identified based on morphological and morphometric characters (Siddiqi, 2000).

Measurements and drawings: Measurements were taken with an ocular micrometer of "Olympus BH2" model microscope. Drawings were made by a drawing tube attached to the compound microscope.

Results and Discussion

A total of 16 species of nematodes were identified from which two species *Nothotylenchus ferepolitor* Kazachenko, 1980 and *Neopsilenchus paragracilis* (Geraert & Raski, 1986) Siddiqi, 2000 are recorded for the first time in Iran (Table 1).

***Neopsilenchus paragracilis* (Geraert & Raski, 1986) Siddiqi, 2000
(Fig. 1 A-G; Table 2)**

Female: Body length about 630-870 μm long, body annuli weakly developed, 1.6-2.0 μm wide at mid-body. Lateral field a plain band marked by

two involutions, two distinct outer lines. Head about 2.4 μm high and 5.5 μm wide. Amphidial aperture has shape of an inverted "V"; starts between cephalic papillae, continuous on lateral side of head. One or two indistinct annuli posterior to amphidial apertures. Stylet delicate, no knobs; dorsal pharyngeal gland opens at 4-6 μm posterior to stylet. Vagina straight; posterior uterine sac short (9-12 μm); about 30 to 58% of vulva body diameter; spermatheca elongated, filled with large, rounded sperm (2.5-2.9 μm dia.). Tail elongated, conical; tail tip finely rounded to pointed.

Male: Similar to female in shape. Spicule about 14-15.5 μm long. Bursa near to cloacal region.

Remarks: General description and morphometric measurements of this species closely fit to the redescription of Geraert (2008). The species represents a new record for Iranian nematode fauna.

Table 1. Nematode species collected from Razavi and Northern Khorasan provinces of Iran.

Nematode species	Collection area
<i>Aphelenchus avenae</i> Bastian, 1865	Nobahar and Esmaeel abad
<i>A. isomerus</i> Anderson & Hooper, 1980 (Ebsary, 1991)	Nobahar, Esmaeel abad and Chenaran
<i>Basiria gracilis</i> (Thorne, 1949) Siddiqi, 1963	Shirvan, Bojnourd and Ash khaneh
<i>B. graminophila</i> Siddiqi, 1959	Bojnourd and Shirvan
<i>Boleodorus thylactus</i> Thorne, 1941	Mashhad
<i>Ditylenchus apus</i> Brzeski, 1991	Shirvan
<i>D. medians</i> (Thorne & Malek, 1968) Fortuner & Maggenti, 1987	Shirvan and Bojnourd
<i>Filenchus pratensis</i> (Sumenkova, 1987) Ebsary, 1991	Taybad and Kashmar
<i>Irantylenchus clavidorus</i> Kheiri, 1972	Shirvan and Bojnourd
<i>Neopsilenchus magnidens</i> (Thorne, 1949) Thorne & Malek, 1968	Mashhad and Toos
<i>Neopsilenchus paragracilis</i> (Geraert & Raski, 1986) Siddiqi, 2000*	Shirvan
<i>Nothotylenchus ferepolitor</i> Kazachenko, 1980*	Toos and Firoozeh
<i>Pratylenchus thornei</i> Sher & Allen, 1953	Shirvan, Neyshabour and Esmaeel abad
<i>P. neglectus</i> (Rensch, 1924) Filipjev & Schuurmans Stekhoven, 1941	Toos, ghoochan and Esmaeel abad
<i>Psilenchus curcumerus</i> Rahaman, Ahmad & Jairajpuri, 1994	Mashhad and Chenaran
<i>Zygotylenchus guevarai</i> (Tobar Jiménez, 1963) Braun & Loof, 1966	Taybad and Akhلامad

* = New records in Iran

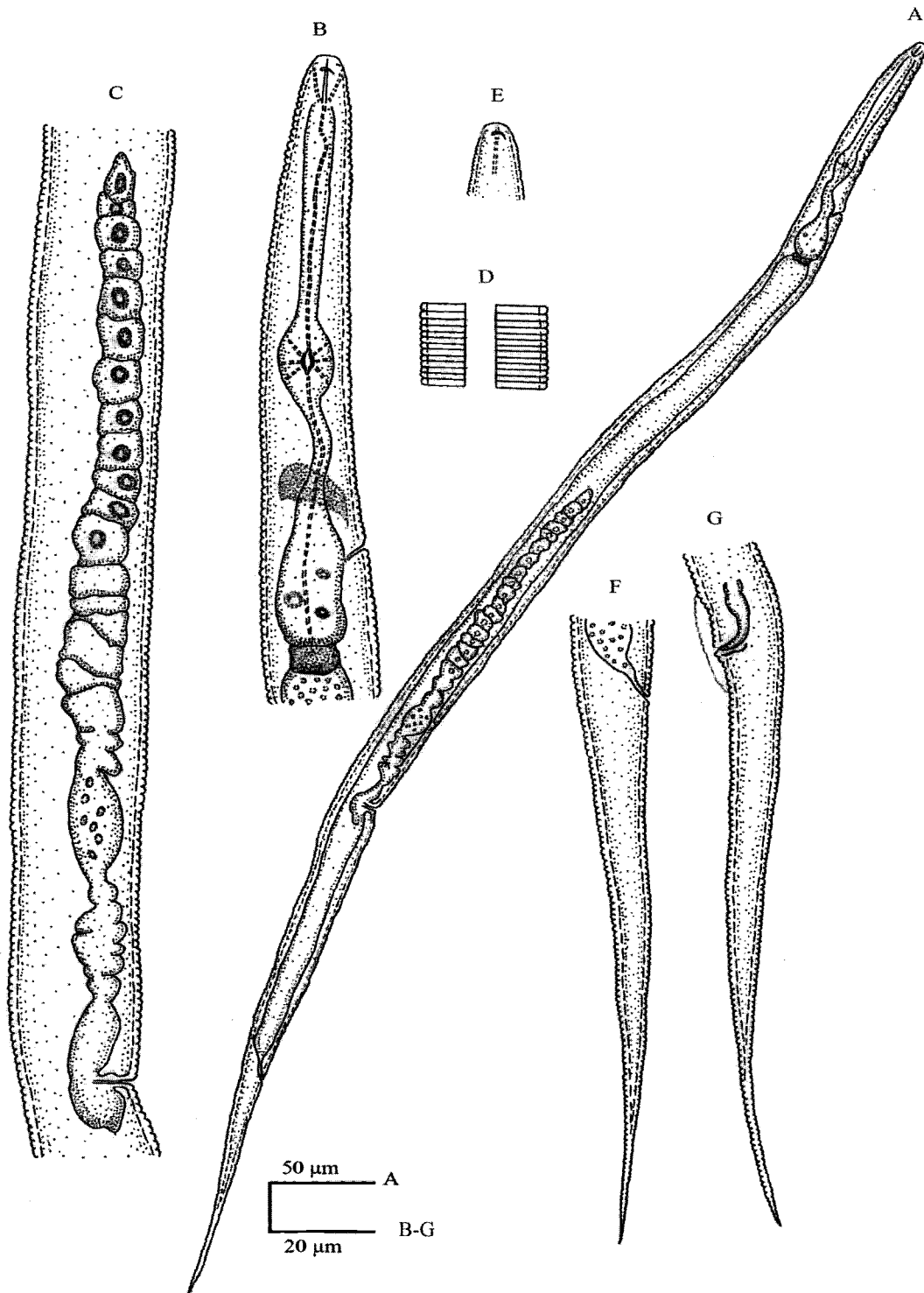


Fig. 1 (A-G). *Neopsilenchus paragracilis*. A. Whole body; B. Head region with oesophagus; C. Ovary; D. Lateral field with transversal striae; E. Amphidial aperture with inverted of V shape; F. Tail of female; G. Tail of male with cloacal region.

Table 2. Morphometric characters of the Iranian population of *Neopsilenchus paragracilis* and their comparison with type population (measurements are in μm).

Origin Characters	Northern Khorasan region		Geraert & Raski, 1986
	Female (n=8)	Male (n=3)	Female
L	760±72.30 (630-870)	616.66±15.27 (600-630)	630-850
a	36.57±1.15 (35-38.09)	35.58±0.77 (35-36.47)	37-48
b	6.18±0.42 (5.33-6.83)	5.58±0.11 (5.48-5.71)	-
c	5.87±0.58 (5.18-6.75)	5.41±0.17 (5.25-5.6)	5.6-6.1
c'	9.39±0.21 (9.14-9.75)	8.8±0.71 (8.23-9.6)	9-13
V or T	65.94±4.14 (59.15-72.5)	49.05±1.39 (47.61-50.4)	65-71
V'	79.76±7.16 (68.49-89.15)	-	78-85
Stylet	10.5±1.06 (9-12)	9.66±0.57 (9-10)	8-11
Pharynx length	122.68±7.95 (115-137.5)	110.33±4.61 (105-113)	121-139
S.E-pore	100.43±7.24 (84-108)	79.66±2.08 (78-82)	-
Orifice	5±0.53 (4-6)	4.33±0.57 (4-5)	5-6
Mb	48.95±4.87 (39.13-55.93)	40.24±3.48 (36.28-42.85)	47-52
Head-vulva	502.5±69.02 (400-600)	-	-
Vulva-anus	127.75±51.93 (73-230)	-	-
PVS	10.75±1.28 (9-12)	-	5-11
Width in vulva	20.75±1.48 (18-23)	-	-
Tail length	129.75±10.15 (120-144)	114±6.55 (107-120)	120-145
Width in anus	13.81±1.06 (13-15)	13±1 (12-14)	-
G	28.8±6.10 (19.01-38.49)	-	-
Gubernaculum	-	4.83±0.28 (4.5-5)	-
Bursa of tail (%)	-	28.1±3.39 (24.3-30.84)	-
Spicule length	-	14.83±0.76 (14-15.5)	-

***Nothotylenchus ferepolitor* Kazachenko, 1980
(Fig. 2 A-F; Table 3)**

Female: Body straight when relaxed. Cuticle less than 1 μm thick, annules 1-1.1 μm . Lateral field with six incisures, 5 μm wide. Head continuous with body about 1.5-2 μm high and 5 μm wide. Stylet delicate, conus about one-third stylet length. Median oesophageal bulb fusiform. Thickenings of lumen indistinct, about 1 μm long. Spermatheca 1.4-3.2 body width long. Posterior part of uterine sac 1.9-2.1 vulval body width long or 22.85- 42.02% of vulva anus

distance. Vaginal walls slightly thicker than cuticle, vagina length 0.3-0.42 vulval body width. Elongated conical tail with pointed tip.

Male: Similar to females. Caudal alae surrounded 33% (28.16-36.61) of tail length. Spicule length 13 (12-14).

Remarks: General description and morphometric measurements of this species closely fit to the redescription of Brzeski (1983; 1991). The species represents a new country record for Iranian nematode fauna.

Table 3. Morphometric characters of the Iranian population of *Nothotylenchus ferepolitor* and their comparison with type population (measurements are in μm).

Origin Characters	Razavi Khorasan region		Brzeski, 1991		Brzeski, 1983	
	Female (n=5)	Male (n=3)	Female (n=5)	Male (n=4)	Female (n=8)	Male (n=6)
L	762±197.40 (600-1100)	656.66±25.16 (630-680)	754-977	641-710	560-850	570-630
a	43.99±8.62(36.11-57.89)	41.91±0.62(41.25-42.5)	50-63	49-59	34-68	36-55
b	6.30±0.42 (5.85-6.84)	4.88±0.30 (4.53-5.11)	6.4-8.3	5.6-6.2	5.1-7.0	4.6-6.1
c	9.20±1.48(7.14-10.75)	9.38±0.13(9.29-9.54)	7.8-8.9	7.7-8.2	9.2-10.4	7.9-10.6
c'	6.82±1.28(5.07-8.09)	6.57±0.55(6-7.1)	8.5-10.1	7.6-9.2	6-9	-
V or T	75.51±1.61(74.54-78.33)	47.03±6.97(42-55)	71-72	-	71-75	35-52
V'	83.48±2.79(80.34-87.65)	-	80-81	-	80-83	-
Stylet	6.8±1.09 (6-8)	6.1±0.28 (6-6.5)	6-6.5	5.5-6	6-7	6-7
Pharynx length	128.6±8.82 (120-140)	135±13.07 (126-150)	111-123	113-116	-	-
S.E-pore	87.4±9.86(72-99)	83.33±6.65(76-89)	84-92	78-84	-	-
Orifice	0.8±0.27(0.5-1)	0.5±0.1(0.4-0.6)	-	-	-	-
Mb	42.04±2.42(39.53-51)	36.52±4.54(32-41.08)	34-39	36-39	34-37	34-41
Head-vulva	574±141.88 (470-820)	-	-	-	-	-
Vulva-anus	114.8±38.44 (69-175)	-	-	-	-	-
PVS	32.6±4.27 (29-40)	-	-	-	-	-
Width in vulva	17.2±1.30 (16-19)	-	-	-	-	-
Tail length	83.2±17.29 (65-105)	70±3.60 (66-73)	88-113	78-91	-	-
Width in anus	12.2±1.30(11-14)	10.66±0.57(10-11)	-	-	-	-
G	36.77±8.83(29.33-51.53)	-	-	-	24-56	-
Gubernaculum	-	4.5±0.5(4-5)	-	-	-	4
Bursa of tail (%)	-	33±4.35(28.16-36.61)	-	14-35	-	14-35
Spicule length	-	13±1(12-14)	-	11-13	-	13-14

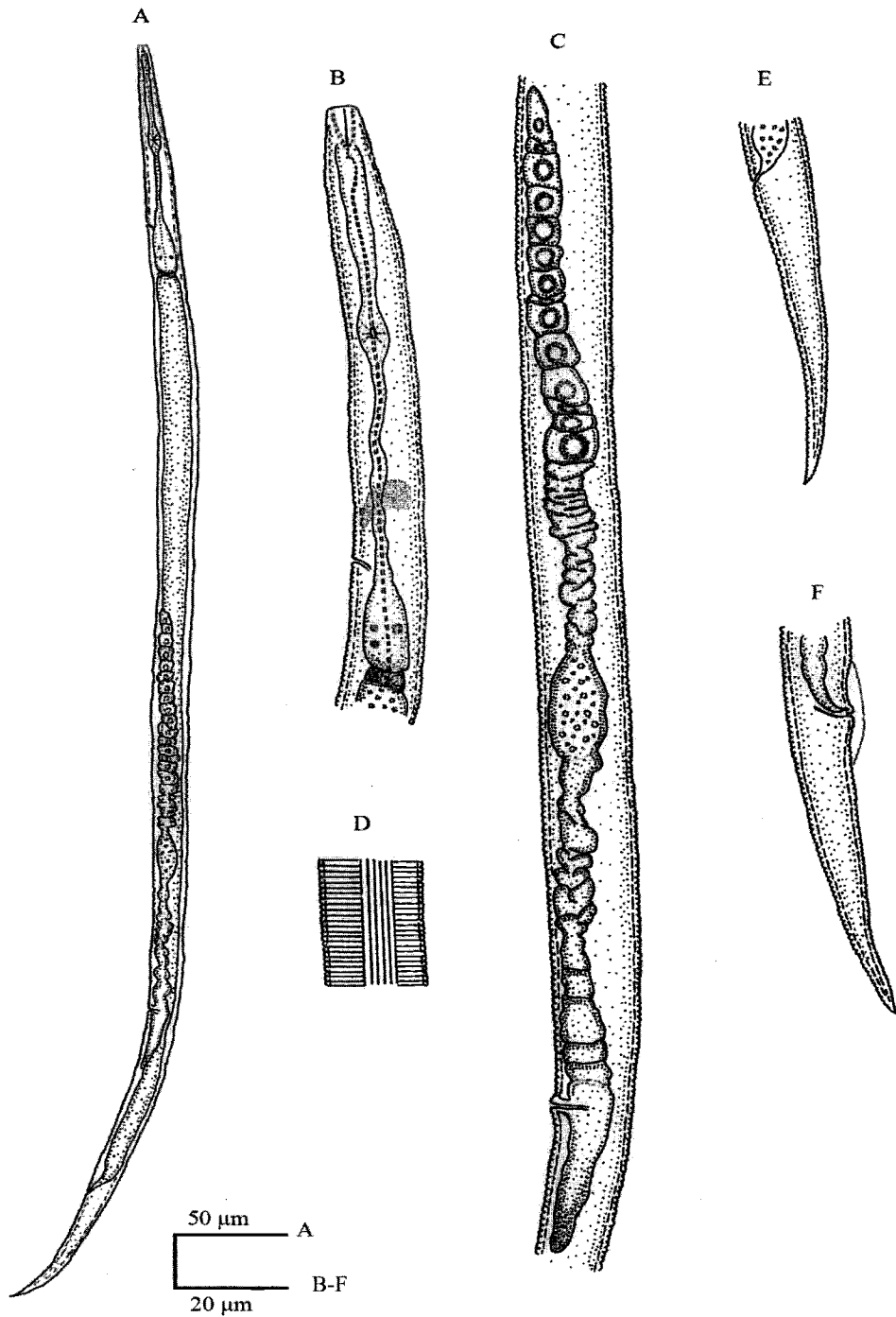


Fig. 2 (A-F). *Nothotylenchus ferepolitor*. A. Whole body; B. Head region with oesophagus; C. Ovary; D. Lateral field with transversal striae; E. Tail of female; F. Tail of male with cloacal region.

Acknowledgments

The authors thank Mr. Pooria Ensafi and Mrs. Somaye Alvani for their technical helps.

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(Received: December 28, 2013)