First report of potato rot nematode, *Ditylenchus destructor* Thorne, 1945 infecting *Codonopsis pilosula* in Gansu province, China

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*Codonopsis pilosula* (Franch.) Nannf. (Campanulales: Campanulaceae) is a perennial herbaceous plant and its rhizomes are widely used in medicinal purpose. The acreage of *C. pilosula* is 2667 to 3333 hm2 annually planted in Gansu province, and the total output is 4000-5000 tons (Hou et al., 2019). During a survey for nematodes on *C. pilosula* in 2019 in Gansu province, China, diseased roots with wrinkled cuticles and tan or dark brown spots were observed in the fields in Tanchang county (N 34°23′82″, E 104°36′27″). The roots of diseased plants were collected and nematodes were extracted using a modified Baermann technique (Hooper, 1990). The results of morphological and morphometric characteristics of this nematode population were as following. The lip regions of females were plain with obscure constriction and stylets were 9.9 to 10.8 (μm) long with distinct knobs. Oval median bulbs were with valves, narrow isthmus and the posterior esophageal extended over intestines dorsally. Tail tips were rounded. The vulva of females at the back of the body were slightly protruding and the posterior uterine sac extended to the anus, which was about 3/4 of the distance from the vulva to the anus.

The morphometrics (mean±SD, n = 20) of females were as following: L = 980.8 ± 182.5 (779.1-1131.2) μm, a = 39.7 ± 6.5 (33.6-49.2), b = 6.7 ± 1.0 (5.3-7.6), c = 15.6 ± 2.0 (13.3-18.5), c′ = 3.8 ± 0.3 (3.4-4.2), V = 81.3 ± 2.4 (77.8-83.9), V′ = 106.9 ± 0.9 (105.7-108.1), stylet length: 11.3 ± 0.9 (9.8-12.3) μm, tail length: 62.8 ± 9.2 (55.6-78.5) μm, ABW = 16.5 ± 2.5 (13.4-20.1) μm, PUS = 65.5 ± 5.8 (61.7-78.3) μm.

Male bodies were similar to those of females and slightly bent spicules were strong with bursas encircling to 1/3 of the tail. The morphometrics (mean ± SD, n = 20) of males were as following: L = 772.0 ± 92.8 (679.8-876.6) μm, a = 40.3 ± 2.8 (37.3-43.0), b = 5.4 ± 0.4 (4.9-6.0), c = 12.8 ± 1.1 (11.5-14.5), c′ = 4.1 ± 0.3 (3.7-4.5), stylet length: 10.3 ± 0.4 (9.9-10.8) μm, tail length: 60.2 ± 5.0 (55.5-67.7) μm, ABW = 16.5 ± 2.5 (13.4-20.1) μm. These morphological characteristics matched with *Ditylenchus destructor* by Thorne. (Thorne, 1945).
DNA of single nematode \((n=5)\) was isolated using the Proteinase K method (Kumari and Subbotin, 2012) and amplification of rDNA-ITS region and D2/D3 fragments of the 28S rDNA sequencing were performed with the universal primers 18S \((5'-TTGATTACGTCCCTGCCCTTT-3')\) and 26S \((5'-TTTCACCTGCGCTTACTAAGG-3')\) (Vrain et al., 1992). D2A \((5'-ACAAGGTACCTGAGGGAAATTG-3')\) and 26S \((5'-TTTCACTCGGTTACTAAGG-3')\) (Vrain et al., 1992). The sequences of rDNA-ITS \((978\text{ bp};\text{ MT150860, MT150861)}\) and D2/D3 region of 28S \((735\text{ bp};\text{ MT672685, MT672686})\) were submitted to GenBank, and the BLAST result showed that rDNA-ITS sequences were 99.90%-100% identical to the \(D.\) destructor on potato from China \((FJ911551)\) and Russia \((AY987007)\), D2/D3 region of 28S sequences were 100% identical to the \(D.\) destructor on potato from Iran \((HQ235698)\) and on maize from China \((MT585824)\). Therefore, the nematode population was identified as \(D.\) destructor.

To confirm the pathogenicity of the population, the healthy \(C.\) pilosula seedlings (sterilized with 75% alcohol and 2.5% NaClO) were planted into sterilized substrates in a greenhouse at 25 to 30°C. After two weeks, every plant was inoculated with about 5000 mixed-stage nematodes near roots, repeated 5 plants and three plants served as control. After 60 days, symptoms on \(C.\) pilosula similar to those in the field were observed and \(D.\) destructor was isolated from inoculated plants, with population densities ranging from 52 to 101 mixed-stage nematode per 1g of fresh roots. The control plants remained healthy. To our knowledge, this is the first report that \(D.\) destructor on \(C.\) pilosula. By now, \(D.\) destructor damaged on angelica and potato in Gansu province (Wang et al., 1990; Li et al., 2016). Since \(C.\) pilosula is an important cash crop in Gansu province (Bi et al., 2008), more attentions should be paid to \(D.\) destructor on \(C.\) pilosula.

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References


Thorne, G. 1945. \(Ditylenchus destructor\) n. sp. the potato-rot nematode, and \(Ditylenchus dipsaci\) (Kuhn, 1857) Filipjev, 1936, the teasel nematode (Nematode: Tylenchidae). Proceedings of Helminthology of Society of Washington 12:27–33.
