

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

Chunhui Ni¹, Shuling Zhang¹,
Huixia Li^{1*}, Yonggang Liu²,
Wenhao Li¹, Xuefen Xu¹
and Zhipeng Xu¹

¹College of Plant Protection, Gansu Agricultural University/Biocontrol Engineering Laboratory of Crop Diseases and Pests of Gansu Province, Lanzhou, 730070, Gansu Province, China.

²Institute of Plant Protection, Gansu Academy of Agricultural Sciences, Lanzhou, 730070, Gansu Province, China.

*E-mail: lihx@gsau.edu.cn

This paper was edited by Zafar Ahmad Handoo.

Received for publication
May 19, 2020.

Abstract

In November 2019, stem nematode was found on *Codonopsis pilosula* in Tanchang county, Gansu province, China. The population of stem nematode was identified on the basis of both molecular and morphological methods. The morphological and morphometric characteristics of this nematode population matched with *Ditylenchus destructor* Thorne, 1945. The sequences of rDNA-ITS and D2/D3 region of 28S-rRNA similarity with the *D. destructor*. The pathogenicity results revealed the symptom of dry rot on *C. pilosula* was caused by this nematode. To our knowledge, this is the first report that *D. destructor* on *C. pilosula* in China.

Keywords

Chinese herbal medicine, *Ditylenchus destructor*, Molecular biology, Morphology, New host.

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. Lip regions were plain with obscure constriction and stylets are tiny with 9.9 to 10.8 (μm) long and distinct knobs. Oval median bulbs were with valves, narrow isthmus and the posterior esophageal extended over intestines from the dorsad. Lateral fields marked by six incisures and tail tips were rounded. The vulvas 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. 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 \pm SD) of the nematodes were as following. Females ($n=20$): $L=980.8 \pm 182.5$ (779.1-1,131.2) μm , $a=39.7 \pm 6.5$ (33.6-49.2), $b=6.7 \pm 1.0$ (5.3-7.6), $c=15.6 \pm 2.0$ (13.3-18.5), $c'=3.8 \pm 0.3$ (3.4-4.2),

$V=81.3 \pm 2.4$ (77.8-83.9), $V'=106.9 \pm 0.9$ (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 .

Males ($n=20$): $L=772.0 \pm 92.8$ (679.8-876.6) μm , $a=40.3 \pm 2.8$ (37.3-43.0), $b=5.4 \pm 0.4$ (4.9-6.0), $c=12.8 \pm 1.1$ (11.5-14.5), $c'=4.1 \pm 0.3$ (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* (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 sequencing were performed with the universal primers 18S (5'-TTG ATT ACG TCC CTG CCC TTT-3') and 26S (5'-TTT CAC TCG CCG TTA CTA AGG-3') (Vrain et al., 1992). The sequence of rDNA-ITS (978bp; MT150860, MT150861) were submitted to GenBank, and the BLAST result showed that these sequences were 99.90% identical to the *D. destructor* on potato from

Hebei Province in China (FJ911551) and on sweet potato from Shandong Province in China (EF208212). Therefore, the nematode population was identified as *D. destructor*.

To confirm the pathogenicity of the population, the healthy *C. pilosula* seedlings which were sterilized with alcohol (75%) and NaClO (2.5%) were planted into sterilized substrates in a greenhouse. After two weeks, every plant was inoculated with about 5,000 *D. destructor* near roots, repeated five 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. The control plants remained healthy. The results revealed the symptom of dry rot on *C. pilosula* was caused by this nematode. To our knowledge, this is the first report that *D. destructor* could infect *C. pilosula* and *C. pilosula* is a new host of it. 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, more attentions should be paid to *D. destructor* on *C. pilosula*.

Acknowledgments

This research was supported by the National Natural Science Foundation of China (31760507) and National Key Research and Development Plan (2018YFC1706301).

References

- Hooper, D. J. 1990. "Extraction and processing of plant and soil nematodes", In Luc, M., Sikora, R. A. and Bridge, J. (Eds), Plant Parasitic Nematodes in Subtropical and Tropical Agriculture. Wallingford: CAB International, pp. 45–68.
- Kumari, S. and Subbotin, S. A. 2012. Molecular characterization and diagnostics of stubby root and virus vector nematodes of the family Trichodoridae (Nematoda: Triplonchida) using ribosomal RNA genes. *Plant Pathology* 61:1021–31.
- Li, H. X., Xu, P. G., Li, J. R., Jian, J. Z. H., Zhao, P. and Peng, D. L. 2016. Identification of the pathogenic nematodes from potatoes in Dingxi of Gansu Province. *Journal of Plant Protection* 43:580–7.
- 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.
- Vrain, T. C., Wakarchuk, D., Lévesque, A. C. and Hamilton, R. I. 1992. Intraspecific rDNA restriction fragment length polymorphisms in the *Xiphinema americanum* group. *Fundamental and Applied Nematology* 15:563–73.
- Wang, Y. J., Liu, F. Z. H., Sheng, X. L., Sun, Z. H., Huo, K. C., Jin, X. and Land Miao, X. C. H. 1990. On the causal nematode of angelica "Makou Bing" disease and its control. *Acta Phytopathologica Sinica* 20:13–9.