Diseases Caused by Nematodes

First Report of Southern Root-Knot Nematode, *Meloidogyne incognita*, Infecting *Isatis indigotica* Fortune in Anhui Province, China

Zhijiao Zhao, Xuebing Zhao, Yaxing Feng, Xiaofeng Zhu, Yuanyuan Wang, Xiaoyu Liu, Haiyan Fan, Lijie Chen, and Yuxi Duan[†]

College of Plant Protection, Nematology Institute of Northern China, Shenyang Agricultural University, Shenyang, China

Funding: This research was supported by a fund from the Ability Establishment of Sustainable Use for Valuable Chinese Medicine Resources (2060302). Plant Dis. 106:1074, 2022; published online as <https://doi.org/10.1094/PDIS-05-21-1005-PDN>. Accepted for publication 6 September 2021.

Isatis indigotica Fortune, widely cultivated in China, is an important Chinese herbal medicine, mainly used to treat cold and fever. In October 2020, as many as 65 galls per root were observed on the roots of *I. indigotica* in Taihe, Anhui Province, China (117°21'19.5"N, 32°57'59.5"E), and samples were taken. The infected plants were weak, and the leaves were wilting. Second-stage juveniles (J2s) were dissected from the egg masses released by females. Excretory pores of females were located nearby median bulb. The dorsal arch of the perineal pattern ($n = 10$) of the female was elliptical, and the dorsal arch was relatively high with smooth to wavy lines. Morphometrics of females ($n = 10$): body length (L) = 595.5 ± 24.0 (570.0 to 620.5) μm , body width (W) = 350.5 ± 30.0 (320.0 to 390.5) μm , stylet length = 13.6 ± 0.7 (12.1 to 15.4) μm , and the distance from dorsal esophageal gland orifice to base of stylet (DGO) = 3.5 ± 0.2 (2.8 to 4.0) μm . J2s ($n = 20$) had the following characteristics: L = 383.2 ± 12.5 (337 to 430) μm , a = 22.0 ± 1.1 (20.3 to 24.4) μm , c = 8.4 ± 0.5 (7.5 to 10.5) μm , stylet length = 12.4 ± 1.5 (10.1 to 14.6) μm , DGO = 2.9 ± 0.6 (2.0 to 3.6) μm , tail length = 39.5 ± 3.4 (32.0 to 48.5) μm and hyaline tail terminus = 10.5 ± 0.5 (9.5 to 11.2) μm . There were four lines on the lateral field of J2s. Females and J2s obtained from galls had uniform morphological and molecular characteristics and were confirmed to be *Meloidogyne incognita*. Live J2s were detected in all soil samples with a mean of 120 ± 15 J2s/100 ml of soil. Five 4-week-old *I. indigotica* plantlets, grown in pots (500 cm³) with sterilized soil were inoculated with 1,000 J2s from egg masses per pot and 5 noninoculated pots were used as control. Plants were well maintained under $25 \pm 3^\circ\text{C}$ in the

greenhouse. Three plants were gently removed from the pots 30 days after inoculation, and an average of 50 galls per root was observed on the roots, and the resulting nematode reproduction factors (RF = final egg density / 1,000, initial egg density) of 3.2, suggested that *I. indigotica* is a good host for *M. incognita* (Mojtahedi et al. 1988). There were no significant differences in main measurements and morphological characteristics between the Taihe population of *M. incognita* and that represented in Orton Williams (1973). DNA was extracted from five single J2s, and ITS and 18S rDNA gene was amplified using the primer pair 18S/26S and 18s1.2a/18sr2b (Bernard et al. 2010; Vrain et al. 1992). The sequence of 18S rDNA (MW875892) was submitted to GenBank. Comparisons showed a sequence identity of >99.8% for *M. incognita* (MF177719.1). The rDNA sequences of *M. incognita*, *M. hapla*, *M. javanica*, and *M. arenaria* are so homologous that rDNA-based differentiation is difficult. The SCAR primers can successfully distinguish *M. incognita*, *M. hapla*, *M. javanica*, and *M. arenaria*. Five species-specific primer sets (Finc/Rinc; MORF-F/MTHIS-R; Jmv-F/Jmv-R; Far/Rar and Fjav/Rjav, Stanton et al. 1997; Wishart et al. 2002; Zijlstra et al. 2000) were used to species-specifically distinguish within the genus. The results (+, +, -, -, -) proved that the Taihe population belonging to *M. incognita*. To our knowledge, this is the first report of *M. incognita* parasitizing *I. indigotica*. This finding may be important to medicinal plant industry, since *M. incognita* is one of the most harmful nematode pests in the world and would cause severe damage to *I. indigotica*.

References:

- Bernard, E. C., et al. 2010. J. Nematol. 42:139.
- Mojtahedi, H., et al. 1988. J. Nematol. 20:468.
- Orton Williams, K. 1973. *Meloidogyne incognita*. In: CIH Descriptions of Plant-Parasitic Nematodes. Set 2, No. 18. Commonwealth Agricultural Bureaux, Farnham Royal, UK.
- Stanton, J., et al. 1997. Fundam. Appl. Nematol. 20:261.
- Vrain, T. C., et al. 1992. Fundam. Appl. Nematol. 15:563.
- Wishart, J., et al. 2002. Phytopathology 92:884.
- Zijlstra, C., et al. 2000. Nematology 2:847.

The author(s) declare no conflict of interest.

e-Xtra

Keywords: *Meloidogyne incognita*, *Isatis indigotica*, identification

[†]Indicates the corresponding author.
Y. Duan; duanyx@syaueu.edu.cn