Diseases Caused by Nematodes

First Report of *Globodera artemisiae* on *Artemisia japonica* from Guizhou and Yunnan Provinces, China

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The genus *Globodera* contains 14 valid species, including *Globodera artemisiae* Eroshenko and Kazachenko, 1972, which parasitizes *Artemisia vulgaris* L. and has been found in Russia, Armenia, China, Poland, Germany, and Sweden (Dobosz et al. 2006). During a survey for cyst nematodes in Guizhou and Yunnan provinces of China in 2018 to 2019, 10 plants of *Artemisia japonica* Thunb. and rhizosphere soil samples were collected from Hezhang County, Guizhou Province (N27 06.145, E104 39.153) and Xuanwei City, Yunnan Province (N35 10.796, E113 25.082). Many white females were observed on the roots in the field from Hezhang and Xuanwei sites. Two populations of cysts and second-stage juveniles (J2s) were extracted from soil samples using the sieving-decanting method, and specimens were identified by morphological, morphometric, and molecular studies. The cysts were rounded, light to dark brown in color, with a protruding neck and a nonprotruding terminal cone. The vulva cone was circumfenestrate, and the cyst wall pattern was prominent and tended to form wavy lines extending around the body. Morphometrics of cysts ($n = 15$) were as follows: length (with neck), 542 μm (462 to 675 μm); width, 425 μm (365 to 506 μm); length/width, 1.3 (1.1 to 1.7); fenestral diameter, 15.04 μm (11.9 to 18.9 μm); anus-fenestra distance, 38.1 μm (28.1 to 56.1 μm); and Granek's ratio, 2.59 (1.82 to 3.85). Morphometrics of J2s ($n = 25$) were as follows: body length, 534 μm (426 to 590 μm); maximum body width, 21.8 μm (19 to 27.8 μm); stylet length, 25.02 μm (23.1 to 26.4 μm); anterior end to median bulb valve, 78.08 μm (55.4 to 91.5 μm);

body width at anus, 14.1 μm (12.1 to 16.1 μm); tail length, 53.8 μm (41.1 to 67.9 μm); hyaline region, 25.2 μm (17.8 to 32.4 μm); values of a, c, and c' ratios, 24.6 (19.6 to 27.2), 9.9 (8.5 to 11.8), and 3.7 (2.9 to 5.1), respectively. Morphology and morphometrics of the cysts and J2s were consistent with those of *Globodera artemisiae* (Subbotin et al. 2010). The morphological identification was confirmed by molecular data. Sequencing was performed using primers rDNA1 (18S 5'-TGATTACGTCCTGCCCTTT-3') and rDNA2 (5'-TTTCACTCGCCGTTACTAAGG-3') for the ITS region (Vrain et al. 1992), D2A (5'-ACAAGTACCGTGGGAAAGTTG-3') and D3B (5'-TCGGAAGGAACCAGCTACTA-3') for the 28S D2-D3 region (Subbotin et al. 2010), and JB3 (5'-TTTTTTGGGCATCCTGAGGTTTAT-3') and JB5 (5'-AGCACCTAAACTTAAACATAATGAAAATG-3') for the mitochondrial COI gene (Derycke et al. 2010) and then submitted for registration in GenBank. Both the ITS (MT233311 and MT233312) and 28S D2-D3 region (MT233315 and MT233316) sequences were nearly identical to *G. artemisiae* reported in Poland (EU855121) (Dobosz et al. 2006), with a similarity of 99.58 and 99.62%, respectively. The COI sequences (MT233426 and MT233427) were found 99.52% identical to *G. artemisiae* from Germany (MN095894). The reproduction of *G. artemisiae* Hezhang population on *A. japonica* was evaluated by inoculating 1,000 eggs onto roots of healthy plants in 9-cm-diameter pots. Noninoculated plants served as controls (three replicates each). One hundred twenty days after inoculation, 41 ± 12 cysts were isolated from *A. japonica*. No white females or cysts were observed on the control plants. In conclusion, morphology, morphometrics, and molecular characterization confirmed that the two cyst nematode populations collected from fields in Hezhang County (Guizhou Province) and Xuanwei City (Yunnan Province) were identified as *G. artemisiae*. It has been reported on *Artemisia* spp. in Beijing (Chen et al. 1994). To our knowledge, this is the first report of *G. artemisiae* on *A. japonica* in Guizhou and Yunnan provinces in China.

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