Diseases Caused by Nematodes

First Report of *Meloidogyne incognita* on *Cardamine violifolia* in China

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Cardamine violifolia is an economically important medicinal plant and is also valuable for its strong ability to accumulate selenium (Both et al. 2020). It is not only used to extract selenium proteins and selenium polysaccharides, but it is also widely used to develop selenium-supplement reagents. In September 2020, root-knot nematode (*Meloidogyne* spp.) infection experiments found galls and egg masses on the roots of many *C. violifolia* plants in Enshi (30°32'25.67" N; 109°48'48.46" E), Hubei Province, China. The above-ground parts of these plants were stunted, and the leaves were yellow. Almost 5% of *C. violifolia* plants were affected by the disease. The roots with galls were collected, and nematodes were dissected and extracted. Based on phytopathological examination, the number of galls on each plant was 91.87 ± 19.01 , and the number of egg masses was 15.27 ± 5.36 ($n = 15$). Nematodes and galls were collected from the soil and infected roots (Barker 1985). The morphological characteristics of the nematode species were measured as follows. Measurements of adult females ($n = 20$): body length = 628.15 ± 73.69 μm , width = 356.77 ± 36.72 μm , and stylet length = 15.58 ± 0.93 μm . A high, trapezoidal dorsal arch with thick striations was observed in the perineal region of females. Second-stage juveniles (J2s) ($n = 20$): body length = 377.09 ± 18.19 μm , body width = 15.64 ± 1.24 μm , stylet length = 13.31 ± 1.04 μm , tail length = 42.49 ± 4.64 μm , and hyaline tail terminus = 12.35 ± 2.02 μm . J2s presented well developed esophageal glands. Eggs ($n = 20$):

length = 80.81 ± 3.47 μm and width = 37.09 ± 2.98 μm . All the morphological characteristics of the identified species were consistent with the descriptions of *Meloidogyne incognita* (Kofoid & White, 1919) Chitwood, 1949 (Whitehead 1968). Molecular identification was carried out by PCR with the *M. incognita*-specific primers Mi-F/Mi-R (Meng et al. 2004) and 28S rDNA D2/D3 region primers MF/MR (Hu et al. 2011). The target fragments of 955 bp and 478 bp amplified by the primer pairs Mi-F/Mi-R and MF/MR were observed under a UV light, which confirmed that these nematodes collected from *C. violifolia* were *M. incognita*. The fragments were sequenced (MZ596342 and MZ566843, respectively) and aligned with available sequences on the NCBI, which were 100% identical to the MK410954 and MN728679 and MK410953 and MF177882 *M. incognita* sequences, respectively. Pathogenicity testing was conducted to confirm Koch's postulates in a greenhouse by the inoculation of 500 J2s from the original population into *C. violifolia* seedlings ($n = 30$, five- to six-leaf stage). After 7 weeks, all inoculated plants exhibited the same symptoms that were observed in the field initially. Different life stages of *M. incognita* were observed in the dissected galled tissues. The average reproductive factor was 37.30 ± 6.13 , which is considered as the pathogenicity of *M. incognita* to *C. violifolia*. Therefore, *C. violifolia* is a suitable host for *M. incognita* in China. Growers should be informed of the current findings to avoid serious economic losses that might be caused by this pathogenic nematode and to prepare for proper management action. To our knowledge, this is the first report of *M. incognita* infecting *C. violifolia* in China.

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