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Heterodera guangdongensis n. sp. (Nematoda: Heteroderinae) from bamboo in Guangdong Province, China—a new cyst nematode in the *Cyperi* group

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Abstract

Heterodera guangdongensis n. sp. is described from bamboo (*Phyllostachys pubescens* Mazel) based on morphology and molecular analyses of rRNA D2D3 expansion domains of large subunit (LSU D2D3) and internal transcribed spacer (ITS) sequences. This new species can be classified in the *Cyperi* group. Cysts are characterized by a prominent, ambifenestrate vulval cone with weak underbridge, a vulva-anus distance of 28.9–35.9 µm and a vulval slit of 31.1–41.0 µm, but without bullae. Females are characterized by a 25.1–27.6 µm stylet with rounded knobs sloping slightly posteriorly. Males are characterized by a 21.5–23.0 µm stylet with knobs slightly projecting or flat anteriorly, lateral field with four lines, and a 22.0–26.0 µm spicule with bifurcate tip. Second-stage juveniles are characterized by a 19.3–21.3 stylet with slightly projecting or anteriorly flattened knobs, lateral field with three lines, a 41.7–61.3 µm tail with finely rounded terminus and hyaline portion forming 43.0–57.1% of the tail length. Molecular analyses show that the species has unique D2D3 and ITS rRNA sequences and RFLP-ITS-rRNA profiles.

Key words: cyst nematode, new species, morphology, molecular, *Phyllostachys pubescens*, phylogeny

Introduction

Heterodera Schmidt, 1871, a cyst-forming nematode genus containing about 80 species (Subbotin *et al.*, 2010a), includes some of the most economically damaging plant-parasitic nematodes. Currently, four *Heterodera* species have been recorded from bamboo. *H. bamboosi* (Kaushal & Swarup, 1988) Wouts & Baldwin, 1998 was the first *Heterodera* species to be reported on bamboo (*Bambusa* sp.) in India (Kaushal & Swarup 1988). Afterwards, another *Heterodera* species, *H. koreana* (Vovlas, Lamberti & Choo, 1992) Mundo-Ocampo, Troccoli, Subbotin, Cid, Baldwin & Inserra, 2008, was isolated from moso bamboo (*Phyllostachys pubescens* Mazel) in the South Korean peninsula (Vovlas *et al*. 1992). Subsequently, this species was also detected from fishpole bamboo (*P. aurea* Carriere *ex* A. Riviere & C. Riviere) in the USA, unidentified bamboo in Thailand and moso bamboo in China (Inserra *et al*. 1999, Sturhan 2010, Wang *et al*. 2012). More recently, two additional species of *Heterodera*: *H. hainanensis* Zhuo, Wang, Ye, Peng & Liao, 2013 and *H. fengi* Wang, Zhuo, Ye, Zhang, Peng & Liao, 2013, were found on moso bamboo in China (Zhuo *et al.* 2013, Wang *et al.*, 2013). In 2009, an unknown *Heterodera* species was recovered from moso bamboo in Guangzhou City, Guangdong Province, China. Later, the same undescribed *Heterodera* species was found again in moso bamboo from two other cities, Hechi and Nanning, of Guangxi Province, China. Here, this species is described and illustrated as *Heterodera guangdongensis* n. sp. Phylogenies based on rRNA D2D3 expansion domains of large subunit (LSU D2D3) and internal transcribed spacer (ITS) sequences were constructed to analyze the relationships of *H. guangdongensis* n. sp. with other cyst nematodes. An RFLP-ITS-rRNA profile of this new species is also provided.

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(Ding *et al*. 2012, Zhuo *et al*., 2014), *H. koreana* from Jiangxi (Wang *et al.* 2012), *H. hainanensis* from Hainan (Zhuo *et al*. 2013) and *H. fengi* from Guangdong (Wang *et al*. 2013). Besides these nematodes, two other cyst-forming nematodes, *H. oryzicola* and *Cactodera cacti* (Filipjev & Schuurmans Stekhoven, 1941) Krall & Krall, 1978, have been reported in China's subtropical zones in the early years (Li *et al*. 1985, Pan *et al*. 1997). Of the five *Heterodera* species in China's tropical and subtropical regions, two (*H. elachista* and *H. oryzicola*) were reported on rice (Li *et al*. 1985, Ding *et al*. 2012, Zhuo *et al*. 2014), the other three (*H. koreana*, *H. hainanensis* and *H. fengi*) were from bamboo (Wang *et al.* 2012, Zhuo *et al.* 2013, Wang *et al*. 2013). *H. guangdongensis* n. sp. represents another species of the genus *Heterodera* on bamboo in this region.

Recently, it has been proposed to arrange the genus *Heterodera* in seven groups: *Afenestrata*, *Avenae*, *Cyperi*, *Goettingiana*, *Humuli*, *Sacchari* and *Schachtii* (Subbotin *et al.* 2010a). All morphological characters of *H. guangdongensis* n. sp. are in accord with the diagnostic characterizations of the *Cyperi* group suggested by Subbotin *et al.* (2010a). Furthermore, the current phylogenies inferred from LSU D2D3 and ITS both showed that the new species is closely related to some members of the *Cyperi* group. We therefore conclude that *H. guangdongensis* n. sp. should belong to the *Cyperi* group. Presently, among the four *Heterodera* recorded from bamboo, only *H. fengi* belongs to the *Cyperi* group, the other three all belong to the *Afenestrata* group. *H. guangdongensis* n. sp. is the second member of the *Cyperi* group found on bamboo.

In summary, the finding of *H. guangdongensis* n. sp. in combination with other *Heterodera* species reported previously indicates that China's tropical and subtropical regions have a rich cyst nematode fauna, especially on bamboo. Therefore, it would be valuable to investigate further the distribution of cyst nematode in bamboo from China's tropical and subtropical zones.

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