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

KAN ZHUO¹²⁴, HONGHONG WANG¹²⁴, HONGLING ZHANG¹ & JINLING LIAO¹²³⁵
¹Laboratory of Plant Nematology, South China Agricultural University, Guangzhou 510642, China
²Guangdong Province Key Laboratory of Microbial Signals and Disease Control, South China Agricultural University, Guangzhou 510642, China
³Guangdong Vocational College of Ecological Engineering, Guangzhou 510520, China
⁴These authors contributed equally to this work
⁵Corresponding author. E-mail: jlliao@scau.edu.cn

**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 μm 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 characterized 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 from 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.
(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.

Acknowledgements

This research was supported by the Planning Project for Science and Technology in Guangzhou City (grant no. 11A62100574), National Key Basic Research Program of China (973 Program) (grant number 2013CB127501) and the Special Fund for Agro-scientific Research in the Public Interest of China (grant no. 200903040).

References

Krall, E.L. & Krall, K.A. (1978) Revision of the plant nematodes of the family Heteroderidae on the basis of trophic
specialization of these parasites and their co-evolution with their host plants. *In: Fitogel'mintologicheskie isledovaniya*. Moscow, USSR, pp. 39–56.


http://dx.doi.org/10.1163/156854108785787190


http://dx.doi.org/10.1163/187529278x00461


http://dx.doi.org/10.1163/109086906778493420


http://dx.doi.org/10.1006/mpev.2001.0998


http://dx.doi.org/10.1163/109086900750042


http://dx.doi.org/10.1163/109086903771025831


http://dx.doi.org/10.11646/zootaxa.3652.1.7


http://dx.doi.org/10.1163/15685411-00002678