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Laimaphelenchus hyrcanus n. sp. (Nematoda: Aphelenchoididae), a new species from northern Iran

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Abstract

Laimaphalenchus hyrcanus **n. sp.**, from bark samples of cypress (*Cupressus* sp.) and jujube (*Ziziphus jujube* Miller) from Gorgan, Golestan province in northern Iran, is described and illustrated based on morphological and molecular characters. The new species is characterized by females with 670–870 µm body length, slender stylet of 11–12 µm, six-lobed cephalic region not divided by ribs, three incisures in the lateral field with slightly areolated outer lines in the posterior region, cuticular vulval flap, males with two pairs of caudal papillae, and subcylindrical tail in both sexes ending in a single stalk-like terminus with four pedunculate tubercles bearing 9–10 finger-like projections. The new species most closely resembles *L. persicus* and *L. penardi* but it can be differentiated by its having three incisures in the lateral field and two pairs of caudal papillae in males. Molecular analysis of the D2/D3 region of the 28S ribosomal RNA gene indicates a sister-taxon relationship with *L. penardi* (Steiner, 1914) Filipjev & Schuurmans Stekhoven, 1941 and *L. deconincki* Elmiligy & Geraert, 1972.

Key words: Aphelenchoididae, Gorgan, LSU rRNA, new species, SEM

Introduction

Members of the genus *Laimaphelenchus* Fuchs, 1937 are usually recovered from moss, algae and lichens on trees, particularly conifers, or in the tunnels of wood-boring beetles (Hunt 1993). According to Hunt (2008), this genus belongs to the family Aphelenchoididae Skarbilovich, 1947. He considered 13 species as valid nominal species, three species as *species inquirendae* (*L. corticilis* Truskova & Eroshenko, 1977, *L. exilis* Truskova & Eroshenko, 1977, and *L. sapinus* Truskova & Eroshenko, 1977), and the remaining one, *L. lichni* Hirling, 1979 as *nomen nudum*. Subsequently, two other species, namely *L. simlaensis* Negi, Kalia, Walia & Bajaj, 2009 and *L. persicus* Asghari, Pourjam, Heydari & Zhao, 2012 have been added to this genus.

In a nematological survey conducted in northern Iran, a population of *Laimaphelenchus* was recovered from bark samples collected from cypress and jujube trees which did not match any of the species of this genus that have so far been described. This species is illustrated and described here as *L. hyrcanus* **n. sp.**

Material and methods

*Nematode extraction***.** Bark samples were collected from some cypress trees (*Cupressus* sp.) in Naharkhoran National Park in the south of Gorgan, Golestan province, northern Iran and subsequently from some jujube trees (*Ziziphus jujube* Miller*)* in Heidar Abad, a village in the west of Gorgan. Nematodes were extracted by soaking small pieces of bark samples in tap water for 48–72 h using the tray method (Whitehead & Hemming 1965) and recovered using a 37 µm aperture sieve.

Light and scanning electron microscopy. For light microscopy, extracted nematodes were killed using gently

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species available in the GenBank; these species are: *L. penardi, L. deconincki, L. persicus, L. australis, L. preissii* and *L. heidelbergi* Zhao, Davies, Riley & Nobbs, 2007. According to our molecular analysis *L. hyrcanus* sp. n. is sister taxon to a clade containing *L. deconincki* (KF998578.) and *L. penardi* (KJ472144). *L. heidelbergi* shows a distinct position from other *Laimaphelenchus* species in the phylogenetic tree (Fig 4). It is morphologically different from all other *Laimaphelenchus* species based on its characteristic tail shape with a single offset terminal tubercle covered by 20–30 tiny knob-like appendages. *L. hyrcanus* **sp. n.** is molecularly most similar to *L. deconincki* but differs in 84 (*ca* 11.8%) positions including 5 insertions/deletions, it differs from *L. penardi* in 86 (*ca* 12.2%) positions including 5 insertions/deletions. Our phylogenetic analyses indicate that *Laimaphelenchus* species form a polyphyletic group.

Discussion

The genus *Laimaphelenchus* presently contains fifteen species and has a world-wide distribution. Members of this genus have been recorded in Antarctica, Argentina, Australia, Europe, India, North America, South Africa and the Middle East (Hunt 1993, Swart 1997, Peneva & Chipev 1999, Zhao *et al*. 2006a, 2006b, 2007, Negi *et al*. 2009, Asghari *et al*. 2012). *Laimaphelenchus persicus* was reported as a new species from Iran with a dichotomous morphological key for valid species of the genus (Asghari *et al*. 2012). *Laimaphelenchus hyrcanus* **n. sp.** is the second new species of *Laimaphelenchus* from Iran to be described.

Males in most of the described valid species of *Laimaphelenchus* have three pairs of caudal papillae in three positions: a preanal pair, an adanal pair and a pair at the middle of the tail tip. In *L. hyrcanus* **n. sp.** there are only two pairs of caudal papillae located subventrally: an adanal pair, and a second pair at about 54–60% of the distance between the cloacal aperture and tail tip; a feature that has also been reported in *L. preissii* (Zhao *et al*. 2006a).

Scanning electron microscopy (SEM) has been performed for recently described species of *Laimaphelenchus, i.e. L. cocuccii, L. patulus, L. preissii, L. australis, L. heidelbergi,* and *L. persicus.* As detailed morphology of the body such as the structure of the cephalic region (presence or absence of labial disc and ribs) and morphology of the tail tip are some of the main features in characterization of *Laimaphelenchus* species, SEM studies for other known species of the genus could support the characterization and discrimination of similar and newly described species.

Hunt (1993) pointed out that *Laimaphelenchus* has a conoid tail tapering to a distinctive, offset terminus bearing four pedunculate tubercles with fringed margins. Some species now in this genus do not show this typical character *e.g. L. heidelbergi*, *L. preissii* and *L. unituberculus*. In our molecular analysis, species with four clear tubercles group closely together in one clade (Fig 4). Several DNA sequence analyses based on 28S and 18S rDNA revealed the paraphyly of the genus, although the genera *Laimaphelenchu*s, *Aphelenchoides* Fischer, 1894 and *Schistonchus* Cobb, 1927 (Fuchs, 1937) always group together (Ryss, *et al*. 2013, Asghari *et al*. 2012, Zeng *et al*. 2010, Davies *et al*. 2010). Further molecular data from known species of these genera is needed to clarify the exact position of *Laimaphelenchu*s spp.

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