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Short communication

First Record of *Aphelenchoides nonveilleri* (Nematoda: Aphelenchoididae) from South Korea

Jiyeon Kim[1,2], Taeho Kim[3], Joong-Ki Park[1,*]

[1]Division of EcoScience, Ewha Womans University, Seoul 03760, Korea
[2]Freshwater Biodiversity Research Division, Nakdonggang National Institute of Biological Resources, Sangju 37242, Korea
[3]Division of Environmental Science and Ecological Engineering, College of Life Sciences and Biotechnology, Korea University, Seoul 02841, Korea

ABSTRACT

Aphelenchoides nonveilleri Andrássy, 1959, belonging to the family Aphelenchoididae Skarbilovich, 1947, is first reported from South Korea. The genus *Aphelenchoides* Fischer, 1894 includes about 200 species worldwide, but to date only nine *Aphelnechoides* species have been reported from South Korea. Specimens of *A. nonveilleri* were collected from the roots and shoot tips of chrysanthemum (*Chrysanthemum morifolium* Ramat, 1792) from a greenhouse. This species is distinguished from other *Aphelenchoides* species by its star-shaped mucro on the female tail tip, three lateral incisures, and the length of the post-vulvar uterine sac. Here we provide details of the morphological characters and morpometrics of *A. nonveilleri* based on optical microscopy.

Keywords: Nematoda, Aphelenchoididae, *Aphelenchoides nonveilleri*, South Korea

INTRODUCTION

Members of the genus *Aphelenchoides* Fischer, 1894 are known as plant pathogenic foliar nematodes. The major plant-parasitic species in this genus include *A. besseyi* Christie, 1942, which causes 'white tip' disease in rice, and *A. fragariae* (Ritzema Bos, 1891) Christie, 1923 and *A. ritzemabosi* (Schwartz, 1911) Steiner and Buhrer, 1932, which attack a wide variety of plants. About 200 species have been described in the genus *Aphelenchoides* worldwide, but only nine species have been reported thus far from South Korea: *A. besseyi*, *A. bicaudatus* (Imamura, 1931) Filipjev and Schuurmans Stekhoven, 1941, *A. fragariae*, *A. paradalianensis* Cui, Zhuo, Wnag & Liao, 2011, *A. parasaprophilus* Sanwal, 1965, *A. parietinus* (Bastian, 1865) Steiner, 1932, *A. ritzemabosi*, *A. rotundicaudatus* Fang, Wang, Gu & Li, 2014, and *A. subtenius* (Cobb, 1926) Steiner and Buhrer, 1932 (see Choi, 1996; Cui et al., 2011; Fang et al., 2014; Kim et al., 2016). In this study, we provide a detailed description and morphometrics of *A. nonveilleri* Andrássy, 1959 collected from chrysanthemum (*Chrysanthemum morifolium*, 1792) roots and shoot tips in South Korea.

Nematodes were isolated from roots and shoot tips of *C. morifolium* using sieving and the Baermann funnel method (Baermann, 1917), transferred into a 15 mL tube containing 2 mL water, and 4 mL of 80°C TAF (2% triethanolamine and 7% formaldehyde) solution was added for fixation. The fixed nematodes were then processed to glycerin (Seinhorst, 1959) and mounted in glycerin on HS-slides (Shirayama et al., 1993). Morphological observations were made under an optical microscope (Olympus BX-51) equipped with differential interference contrast (DIC). Morphometric characters were measured using QCapture Pro 5, from images taken with a digital camera (CoolSnap Photometrics color CCD).

SYSTEMATIC ACCOUNTS

Order Rhabditida Chitwood, 1933
Suborder Tylenchina Thorne, 1949
Infraorder Tylenchomorpha De Ley and Blaxter, 2002
Family Aphelenchoididae Skarbilovich, 1947

*To whom correspondence should be addressed
Tel: 82-2-3277-5948, Fax: 82-2-3277-2385
E-mail: jkpark@ewha.ac.kr

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Table 1. Morpometrics of *Aphelenchoides nonveilleri*

	Female (n=4)	Male (n=3)
L	787.4±40.2 (751.29–842.5)	697.6±23.9 (672.92–720.6)
Body width	22.8±1.1 (21.4–23.8)	19.3±1.6 (18.32–21.1)
Pharynx length	168.1±11.6 (159.54–185.3)	156.5±9.7 (150.32–167.8)
Tail length	40.7±2.5 (38.61–43.5)	42.3±6.0 (36.84–48.7)
Anal region body width	12.0±0.6 (11.47–12.9)	14.3±0.7 (13.48–15.0)
a	34.6±1.8 (31.96–35.7)	36.3±3.0 (33.11–39.0)
b	8.7±0.4 (8.27–9.1)	8.2±0.2 (8.02–8.3)
c	19.4±0.8 (18.17–20.0)	16.8±2.7 (13.81–19.0)
c′	3.4±0.1 (3.26–3.5)	3.0±0.6 (2.46–3.6)
Lip region width	7.2±0.1 (7.08–7.3)	6.7±0.2 (6.44–6.8)
Lip region height	3.2±0.2 (3.07–3.4)	2.7±0.2 (2.56–2.9)
Stylet	13.0±1.0 (11.88–14.2)	13.1±2.0 (11.84–15.3)
Corpus	58.6±3.0 (56.45–63.1)	55.9±2.5 (52.95–57.6)
Metacorpus length	16.7±1.1 (15.13–17.5)	14.2±1.7 (12.24–15.2)
Metacorpus width	12.5±1.0 (11.57–13.8)	10.9±0.7 (10.38–11.7)
Metacorpus width/body width	0.7±0.0 (0.69–0.8)	0.7±0.0 (0.7–0.72)
Isthmus	13.0±4.1 (8.96–17.7)	14.7±9.3 (4.35–22.2)
Nerve ring	81.0±3.3 (76.94–84.9)	83.2±1.9 (81.28–85.1)
Excretory pore	83.8±2.1 (81.22–86.2)	87.1±5.7 (80.82–91.9)
Nerve ring (% pharynx)	10.3±0.6 (9.75–11.1)	11.9±0.3 (11.55–12.2)
Excretory pore (% pharynx)	10.7±0.5 (10.24–11.3)	12.5±0.8 (11.56–13.2)
Vulva from anterior end	548.2±26.6 (525.96–584.5)	–
V (%)	69.6±0.3 (69.38–70.0)	–
Reproductive tract length	421.8±35.0 (371.69–448.8)	–
G (%)	53.8±6.6 (44.12–58.7)	–
Vagina	10.1±0.1 (9.99–10.1)	–
Post-vulvar sac	93.7±8.1 (84.48–103.0)	–
Post vulvar sac/body width	4.1±0.5 (3.55–4.8)	–
Uterus	57.3±13.8 (42.76–74.2)	–
Uterus/body width	2.5±0.5 (2.0–3.2)	–
Spermatheca	50.6±4.0 (46.66–55.5)	–
Rectum	17.2±3.1 (12.7–19.3)	–
Rectum/anal width	1.4±0.3 (0.98–1.7)	–
Spicule	–	18.8±1.0 (17.77–19.9)
Mucro	2.4±0.1 (2.24–2.5)	–
Cuticle thickness	0.6±0.1 (0.51–0.7)	0.6±0.1 (0.44–0.7)
Annuli width	0.9±0.3 (0.65–1.3)	1.0±0.2 (0.87–1.2)

All measurements are in μm and in the form mean±SD (range).
L, body length; a, body length/greatest bod diameter; b, body length/distance from anterior to base of esophageal glands; c, body length/tail length; c′, tail length/tail diameter at anus or cloaca; V, % distance of vulva from anterior; G, % length of female gonad in relation to body length.

Genus *Aphelenchoides* Fischer, 1894

[1]***Aphelenchoides nonveilleri* Andrássy, 1959**

Aphelenchus nonveilleri Andrássy, 1959: 265, fig. 3.

Material examined. 4 ♀♀, 3 ♂♂ South Korea: Chungcheongnam-do: Taean-gun, Taean-eup, Sangok-ri, 36° 46′67.9″N, 126°19′57.2″E, 27 Apr 2016. Voucher specimens are deposited in the National Institute of Biological Resources (slide nos. ZIIYIV0000001574 and ZIIYIV0000001575) and the Animal Phylogenomics Laboratory at Ewha Womans University (slide nos. 07010102001-07010102005), South Korea.

Measurements. See Table 1.

Description. Female: Body tapering slightly anteriorly, length 672.9–790.9 μm, width 18.3–22.5 μm; ventrally curved at tail region when relaxed by gentle heat (Fig. 1A). Cuticle annulated; annuli 1.04–1.3 μm wide and 0.62–0.7 μm thick at mid-body. Lateral fields with 3 incisures. Head region rounded, distinctly set off from body (Fig. 1B). Lip region 6.44–7.27 μm wide and 2.57–3.34 μm high. Stylet weak, slender with small basal swellings, length 12.03–15.32 μm. Oesophagus distinct but indistinct behind the median swelling. Median swelling large and rounded, occupying 72% of body width, and 12.24–16.88 μm long. Excretory pore located at level slightly posterior to nerve ring. Vulva a transverse slit, located about 3/4 of body length from anterior end; vagina one-third of body width at vagina region. Ovary extending almost to esophageal gland lobe; oocytes in a single row (Fig. 1C). Post-vulvar uterine sac approximately three times body

Korean name: [1]*별꼬리잎선충 (신칭)

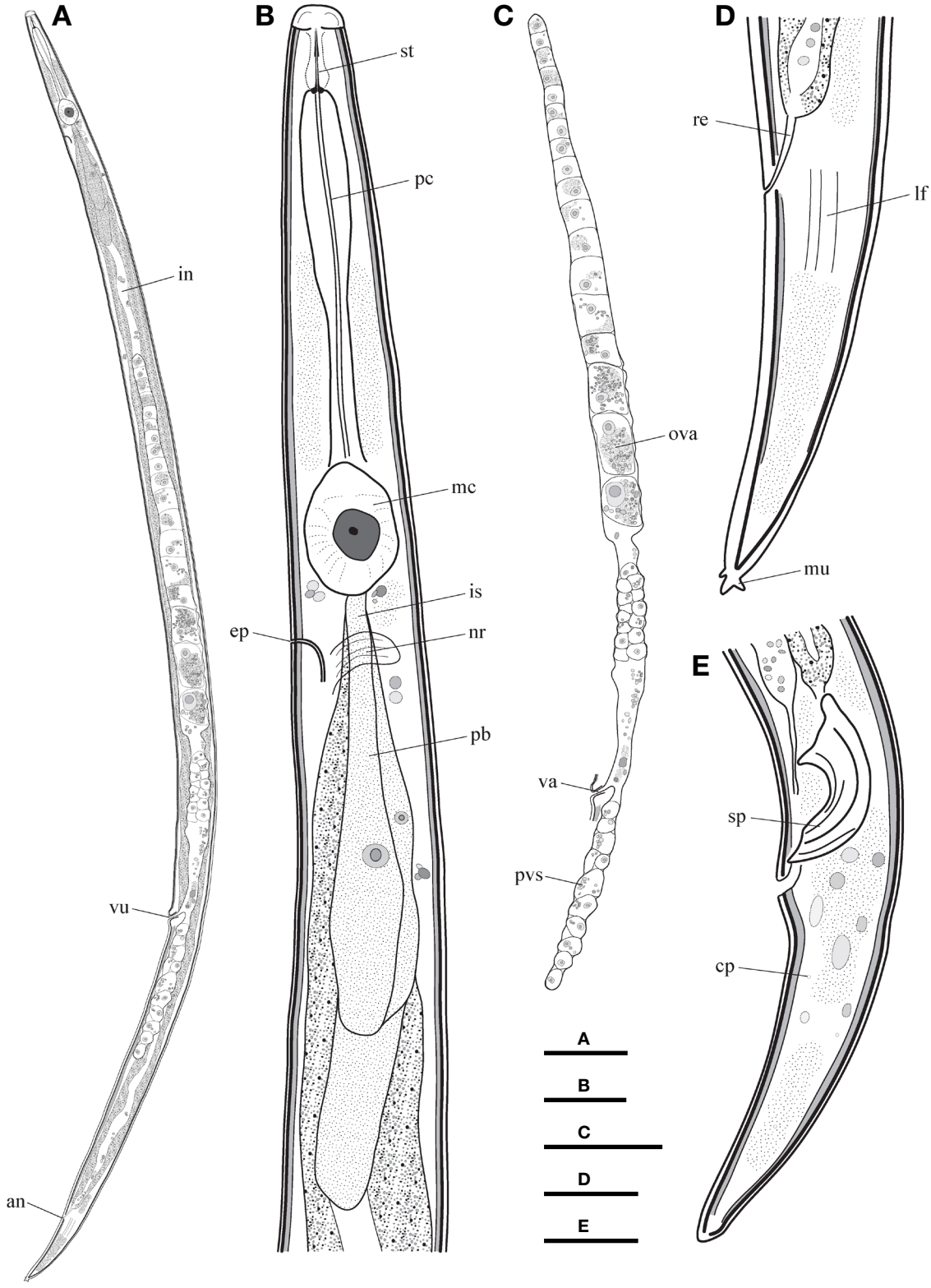

Fig. 1. *Aphelenchoides nonveilleri* Andrássy, 1959. A, Entire female; B, Female neck region; C, Female reproductive system; D, Female posterior region; E, Male posterior region. an, anus; cp, caudal papillae; ep, excretory pore; in, intestine; is, isthmus; lf, lateral field; mc, metacorpus; mu, mucro; nr, nerve ring; ova, ovary; pb, posterior bulb; pc, procorpus; pvs, post-vulval sac; re, rectum; sp, spicule; st, stylet; va, vagina; vu, vulva. Scale bars: A, C = 50 μm, B, D, E = 10 μm.

width in length. Tail gradually tapering to terminus with star-shaped mucro (Fig. 1D).

Male: Body size slightly smaller than female. Anterior portion of body similar to female. Testis single, outstretched, reaching to oesophageal glands. Spicules thorn-like in shape, length 17.77−18.68 μm. Gubernaculum absent. Tail with three caudal papillae: one subdorsal, one subventral and one lateral (Fig. 1E). Bursa absent.

Habitat. Roots and shoot tips of *Chrysanthemum morifolium*.

Remarks. Members of the genus *Aphelenchoides* Fischer, 1894 have variously shaped mucronate structures on the female tail tip, such as star-shaped, bifurcated, filiform, or chisel-shaped. *Aphelenchoides nonveilleri* is one of a group of species with star-shaped mucros, but this species is clearly distinguishable from the other species by the length of its post-vulvar uterine sac and its three lateral incisures.

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