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Short communication

First Record of *Eucephalobus iaculocaudatus* (Nematoda, Rhabditida, Cephalobidae) from South Korea

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ABSTRACT

The genus *Eucephalobus* Steiner, 1936, belonging to the family Cephalobidae Filipjev, 1934 (Cephalobomorpha), represents a group of bacterial feeding nematodes. Although this group is cosmopolitan and species-rich, only two species have been reported from South Korea. *Eucephalobus iaculocaudatus* Boström and Holovachov, 2011 was collected from natural forest in Chungcheongbuk-do, South Korea. This species shows typical morphological characters of the genus *Eucephalobus*, including a bicornuate labial probolae, cephalic probolae absent and three lateral incisures. However, *E. iaculocaudatus* is distinguished from other *Eucephalobus* species by conoid tail with a harpoon-shape mucro in female and ragged mucro in male. In this study, detailed morphological characters and morphometrics of *E. iaculocaudatus* are described and illustrated based on optical microscopy.

Keywords: Nematoda, Cephalobidae, *Eucephalobus iaculocaudatus*, new record, South Korea

INTRODUCTION

The genus *Eucephalobus* Steiner, 1936 belong to the family Cephalobidae (Cephalobomorpha) are bacterial-feeding nematodes that exist in almost all terrestrial environments, such as soils of natural environments (Abolafia and Peña-Santiago, 2002), agricultural lands (Boström, 1984) and highlands (Boström, 1990). Currently, only two species have been reported from South Korea (Kim et al., 2017, 2018): *E. oxyuroides* (de Man, 1876) Steiner, 1936 and *E. hooperi* Marinari-Palmisano, 1967.

Eucephalobus iaculocaudatus Boström and Holovachov, 2011 was collected from natural forest in Chungcheongbuk-do, South Korea. Herein, this species is described by detailed morphological characters and morphometrics.

Specimens were extracted from the soil sample by the Baermann funnel method (Baermann, 1917) and transferred to a 15 mL tube containing 2 mL water. Then, 4 mL of 80ºC TAF (2% triethanolamine and 7% formaldehyde) solution was added for fixation. Fixed specimens were dehydrated using Seinhorst (1959) method and mounted in pure glycerin on HS-slides (Shirayama et al., 1993). Morphological characters were observed and measured using an optical microscope (BX-51; Olympus, Tokyo, Japan) equipped with differential interference contrast (DIC), a CoolSnap Photometrics color CCD digital camera (MP5.0-RTV-R-CLR-10; Photometrics, Tucson, AZ, USA) and the program QCapture Pro 5 (QImaging, Surrey, Canada). The specimens (one female [NIBRIV0000862890] and one male [NIBRIV0000862891]) are deposited at the National Institute of Biological Resources, Republic of Korea.

SYSTEMATIC ACCOUNTS

Order Rhabditida Chitwood, 1933
Suborder Tylenchina Thorne, 1949
Infraorder Cephalobomorpha De Ley and Blaxter, 2002
Family Cephalobidae Filipjev, 1934
Genus *Eucephalobus* Steiner, 1936

[1]*_Eucephalobus iaculocaudatus_ Boström and Holovachov, 2011 (Table 1, Fig. 1)

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Table 1. Morphometrics of *Eucephalobus iaculocaudatus*

Character	*Eucephalobus iaculocaudatus*	
	Female (n=1)	Male (n=1)
L	428.8	449.6
a	24.4	23.2
b	3.2	3.5
c	8.3	11.2
c'	5.0	2.7
V	62.8	–
G or T	22.5	46.5
Body diameter	17.6	19.3
Pharynx length	136.1	130.1
Tail length	51.8	40.1
Anal body diameter	10.3	14.6
Lips region diameter	5.5	5.8
Stoma	9.8	10.9
Stoma diameter	2.2	2.5
Stoma/lips region diameter	1.8	1.9
Stoma/stoma diameter	4.4	4.4
Corpus	67.7	73.9
Isthmus	27.5	27.7
Basal bulb	17.0	15.6
Basal bulb diameter	11.5	11.0
Basal bulb length/diameter	1.5	1.4
Corpus:isthmus ratio	2.5	2.7
Nerve ring to anterior end	78.9	80.7
Excretory pore to anterior end	89.6	87.3
Deirid to anterior end	103.9	101.5
Nerve ring position (% pharynx)	58.0	62.0
Excretory pore position (% pharynx)	65.8	67.1
Deirid position (% pharynx)	76.4	78.0
Vulva from anterior end	269.2	–
Vulva to anus	104.2	–
Vulva to anus/tail length	2.0	–
Reproductive tract length	96.5	209.1
Vagina	7.4	–
Post-uterine sac	9.6	–
Uterus	30.6	–
Spermatheca	24.3	–
Oviduct	1.6	–
Ovary	81.2	–
Vagina/body diameter	0.4	–
Post-uterine sac/body diameter	0.5	–
Uterus/body diameter	1.7	–
Spermatheca/body diameter	1.4	–
Oviduct/body diameter	0.1	–
Ovary/body diameter	4.6	–
Spicules	–	17.5
Spicules/anal body diameter	–	1.2
Gubernaculum	–	10.5
Gubernaculum/anal body diameter	–	0.7
Gubernaculum/spicules (%)	–	0.6
Spicule/tail length	–	0.4
Rectum	18.5	–
Rectum/anal body diameter	1.8	–
Anus to phasmid	13.1	13.8
Phasmid position (% tail)	25.2	34.5
Mucro	4.8	2.3
Lateral field width	2.9	3.2
Lateral field width/body diameter (%)	16.8	16.6
Cuticle thickness	1.2	1.4
Annuli width	1.6	1.7

All measurements are in μm.
L, body length; a, body length/body diameter; b, body length/distance from anterior to base of esophageal glands; c, body length/tail length; c′, tail length/diameter at anus region; V, % distance of vulva from anterior end/body length; G, % length of female gonad in relation to body length; T, % length of male testis in relation to body length.

Material examined. 1♀ and 1♂, South Korea: Chungcheongbuk-do, Danyang-gun, Danyang-eup, Gosu-ri, 35° 22′22.5″N, 128°36′47.3″E, 10 Dec 2013, Kim T.

Measurements. See the Table 1.

Description. Adult: Body length of female 428.8 μm, ventrally curved after fixation (Fig. 1A). Male body length 449.6 μm, posterior region more curved than female (Fig. 1B). Cuticle annulated; annuli 1.6–1.7 μm wide and 1.2–1.4 μm thick at mid-body. Lateral field occupying 16.6–16.8% of width of body at mid-body. Three incisures in lateral field, fading out at phasmid region in female and extending to almost tail terminus in male (Figs. 1C–E). Head region continuous with neck. Lip region 5.5–5.8 μm diameter, six labial and four cephalic papillae present (Fig. 1F). Six lips conoid. Cephalic probolae absent. Three pairs bifurcated labia probolae, pointed terminus. Round- or transversal oval-shaped amphidial apertures present. Stoma cephaloboid 1.8–1.9 lip region diameter long, cheilorhabdions bar-shape, with dorsally small denticle on metastom (Fig. 1C). Pharyngeal corpus cylindrical, 2.5–2.7 times isthmus length. Isthmus narrower than corpus, distinctly demarcated from metacorpus. Basal bulb oval-shaped with well developed valves; 1.4–1.5 times as long as its width. Cardia conoid, surrounded by intestinal tissue. Nerve ring position at posterior corpus, at 58.0–62.0% of pharynx length. Excretory pore located at corpus-isthmus junction, at 65.9–67.1% of pharynx length. Position of deirids in lateral field at level of isthmus, at 76.4–78.0% of total neck length.

Female: Reproductive system monodelphic-prodelphic (Fig. 1G). Vulval lips no protruding. Vagina short, 0.4 body diameter long. Post-uterine sac 0.6 times of body diameter long. Uterus 1.7 body diameter long. Spermatheca 1.4 times the body width. Oviduct short. Ovary straight, with a single row of oocytes. Rectum 1.8 anal body diameter long (Fig. 1D). Tail elongated conoid; harpoon-shape mucro present, with a prominent dorsal spike, total 4.8 μm long. Phasmids located anteriorly middle of tail, at 25.2% of tail length.

Male: Reproductive system monorchic dextral (Fig. 1B). Testis reflexed ventrad anteriorly. Spicules curved ventrad (Fig. 1E), 17.5 μm long; manubrium rounded; calamus more swollen than manubrium; weakly velum; without hump; rounded terminus. Gubernaculum wedge-shape, 60% of spicules length. Three pairs of precloacal subventral papillae present (one pair very close to anus level). Five pairs of postcloacal papillae: one subventral at mid-tail, one lateral at anteriorly phasmid, three pairs close to tail end region (one dorsal, one lateral and one ventral). Tail conoid, arcuate ventrad, with spike shape with dorsal ragged mucro (2.3 μm long). Phasmids located before middle of tail, at 34.5% of tail length.

Distribution. Costa Rica (Boström and Holovachov, 2011),

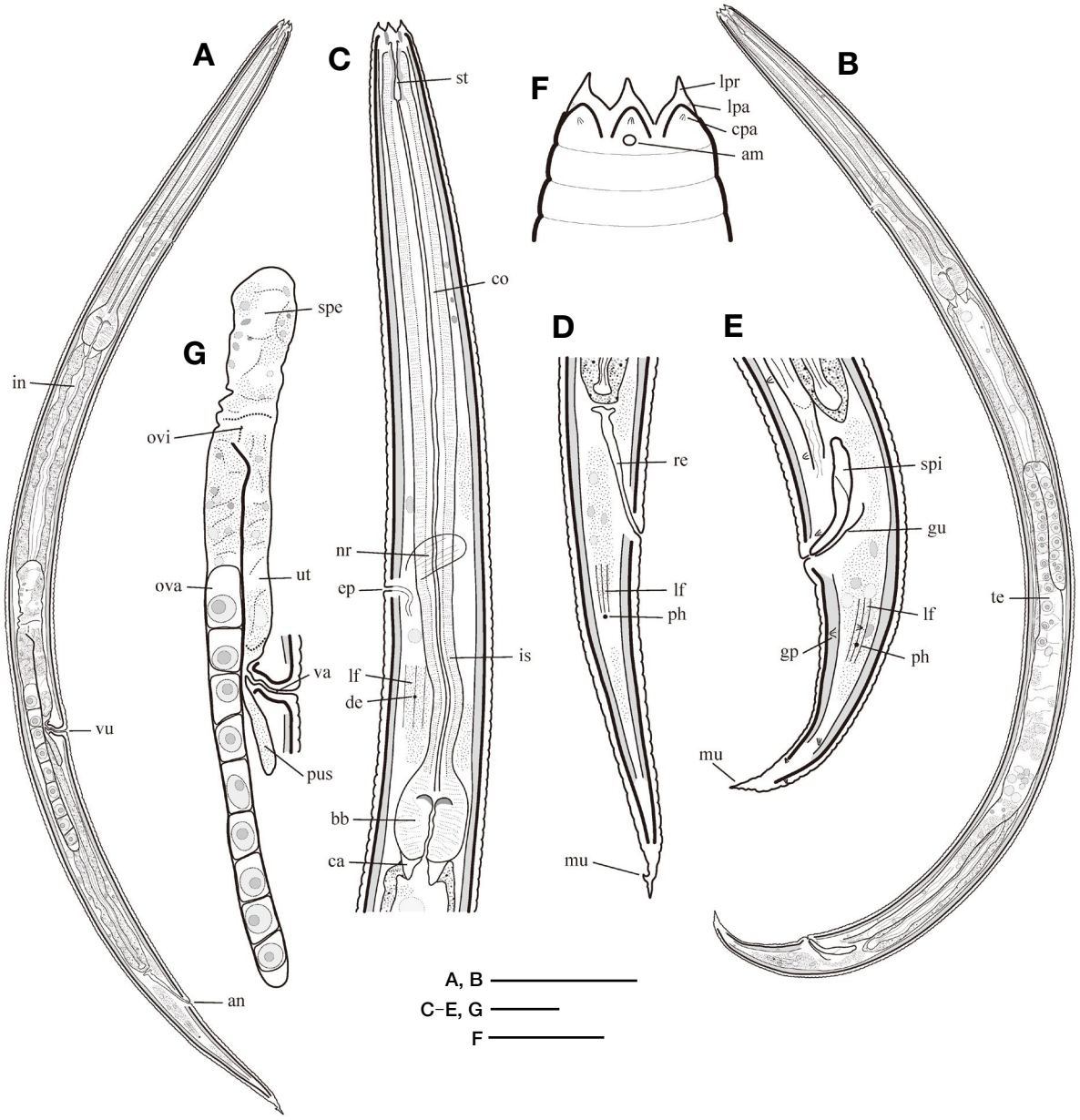

Fig. 1. *Eucephalobus iaculocaudatus* Boström and Holovachov, 2011. A, Entire female; B, Entire male; C, Male neck region; D, Female posterior region; E, Male posterior region; F, Male head region; G, Female reproductive system. am, amphid; an, anus; bb, basal bulb; ca, cardia; co, corpus; cpa, cephalic papilla; de, deirid; ep, excretory pore; gp, genital papilla; gu, gubernaculum; in, intestine; is, isthmus; lf, lateral field; lpa, labial papilla; lpr, labial probolae; mu, mucro; nr, nerve ring; ova, ovary; ovi, oviduct; ph, phasmid; pus, post-uterine sac; re, rectum; spe, spermatheca; spi, spicule; st, stoma; te, testis; ut, uterus; va, vagina; vu, vulva. Scale bars: A, B = 50 μm, C–E, G = 10 μm, F = 5 μm.

South Korea (this study).

Habitat. Soil below fallen leaves in a natural forest.

Remarks. Morphological characters of the specimen described in this study generally agree with the original description of *E. iaculocaudatus* (Boström and Holovachov, 2011), except for male body length (449.6 vs. 371–407 μm), tail length of female (c = 8.3 vs. 11.8–12.7 and c′ = 5.1 vs. 2.7–3.4) and male (c = 11.2 vs. 12.7–14.1 and c′ = 2.8 vs. 2.0–2.4), ratio of corpus and isthmus length of female (2.5 vs. 2.8–3.5) and position of genital papillae in male (three pairs of precloacal, two pairs at mid tail and three pairs close to tail end region vs two pairs of precloacal, one pair ad-cloacal, a sin-

gle on anterior cloacal lip, two pairs at mid-tail and two pairs close to tail terminus). However, these differences between present specimens and original description of *E. iaculocaudatus* have been regarded as intraspecific variations in the reports of other *Eucephalobus* species (Anderson and Hooper, 1971; Boström, 1984; Rashid et al., 1984; Abolafia and Peña-Santiago, 2002; Kim et al., 2017). *Eucephalobus iaculocaudatus* is reported for the first time from South Korea.

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CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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