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NEW DATA OF TWO *Mylonchulus* SPECIES (Mononchida: Mylonchulidae) AND AN UPDATED KEY TO SPECIES FROM VIETNAM

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ABSTRACT: Two species of *Mylonchulus*, *M. kermaniensis* and *M. oceanicus*, were recorded, described and illustrated for the first time from Vietnam. *Mylonchulus kermaniensis* was collected from Nghe An province, their measurements and description correspond well with the type population from Kerma, Iran except for the absence of vulval papilla(e). *Mylonchulus oceanicus* was found in Cao Loc, Lang Son province. Measurements and description of the Vietnamese specimens fit well the type population from Hawaii, USA as well as another population from Japan except for a slightly shorter tail (c = 47-56 *vs* 39-49 in type and other population). In addition, an updated key to twenty already known species in Vietnam is also given in this paper.

Keywords: Mylonchulidae, *Mylonchulus*, new records, nematode, Vietnam.

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INTRODUCTION

In Vietnam, up to now, the studies on predaceous nematodes of the order Mononchida have revealed 18 species on a total of 77 species of the genus *Mylonchulus* (Mylonchulidae) [4]. In the present paper, two additional *Mylonchulus* species were identified from Nghe An and Cao Bang provinces; they represent new records for the nematode fauna in Vietnam. *M. kermaniensis* was collected from soil around the base of banana at Nghe An province. This species was originally described from Kerman and Iran [6].

Andrassy (1986) [3] first reported *M. oceanicus* from Hawaii, USA and Ahmad et al. (2010) [2] recorded this species from Okinawa, Japan though with a slightly shorter tail than in the type population. In present paper, *M. oceanicus* is recorded from Cao Loc (Lang Son province).

MATERIALS AND METHODS

Soil samples were collected from natural forest areas in Nghe An and Lang Son provinces (Vietnam). Nematodes were extracted from soil samples by modified Baermann funnel technique [7], killed by heat, fixed in formaldehyde 4%, transferred to anhydrous glycerol according to Seinhorst (1959) [5], and mounted on glass slides for microscopic observation. Permanent slides were stored at the Department of Nematology, IEBR. Figures were drawn using an Olympus microscope CH40 with drawing tube and illustrations were edited by Adobe Illustrator CS6.

IEBR stands for Institute of Ecology and Biological Resources; VAST stands for Vietnam Academy of Science and Technology.

RESULTS AND DISCUSSION

Mylonchulus kermaniensis Shokoohi, Mehrabi-Nasab, Mirzaei & Peneva, 2013 (Figs. 1A-C)

Material: 6 females in good condition. Measurements: see table 1.

Female: Moderately slender nematodes of medium size, 1.2-1.5 mm long. Habitus after fixation ventrally arcuate, particularly toward posterior end. Under light microscope: cuticle smooth, 2-3 µm thick at the base of oesophagus. Lip region offset from the body contour by slight depression, its width 22-25 µm. Buccal cavity medium size, 24-26.5 µm long by 14-15.8 µm wide, funnel shaped, tapering at base; its wall

strongly sclerotized,. Amphideal fovea cup-shaped. Dorsal tooth massive, with sharp apex, pointing forward. Apex of dorsal tooth situated at 77-84% of buccal cavity length from its base. Small rasp-like denticles arranged in six transverse rows, without teeth in ventral wall.

Oesophagus cylindroid, 336-391 µm long, nerve ring at 40-42% of its length from anterior end; secretory-excretory pore and system not seen. Oesophago-intestinal junction non-tuberculate. Cardia projecting into intestinal lumen.

Table 1. Morphometric data of *Mylonchulus kermaniensis* Shokoohi, Mehrabi-Nasab, Mirzaei & Peneva, 2013

Local	*Mylonchulus kermaniensis*	
	Types Kerman, Iran	Nghe An, Vietnam
	Shokoohi et al. (2013)	Present paper
n	6 ♀♀	6 ♀♀
L (mm)	1.28-1.49	1.2-1.5
a	23.7-34.5	29-35.5
b	3.4-3.7	3.5-3.9
c	27.9-38.9	35-41
c’	1.3-1.7	1.3-1.6
V (%)	61-66	60-64
Buccal cavity length (µm)	24-27	24-26.5
Buccal cavity width (µm)	15-18	14-15.8
Apex of dorsal tooth position from base of buccal cavity (%)	66-82	77-84
Lip region width (µm)	21.5-25	22-24.6
Neck length (µm)	357-407	336-391
Body width (µm)	41-57	40.5-45
Anal body width (µm)	28-32	25.5-31
Tail length (µm)	37-49	35-39.5
Rectum (µm)	19-25	16.7-24.6

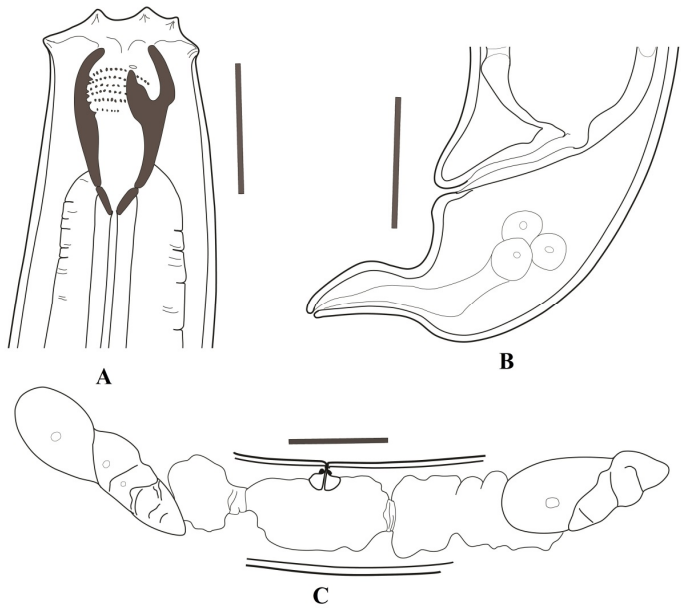

Figure 1. Mylonchulus kermaniensis Shokoohi, Mehrabi-Nasab, Mirzaei & Peneva, 2013

A. Head region;
B. Female tail region; C. Female reproductive system
(Scale bars: A, B = 20 µm; C = 40 µm)

Reproductive system didelphic-amphidelphic, both branches equally developed with ovary reflexed. Oocytes arranged in single row. Sphincter present between oviduct and uterus. Vulva, a transverse slit in ventral view, not protruding. Vagina short with *pars refringens vaginae* sclerotized, visible as 2 pieces in optical section. Advulval papilla(e) absent. Rectum straight, thick-walled and muscular, 17-25 µm, prerectum not seen. Tail sigmoid, sharply bend ventrad with digital posterior portion clearly bend dorsal side; 35-40 µm long or 1.3-1.6 anal body diameter. Caudal gland moderately developed and spinneret opening prominent, terminal.

Male: Not found.

Remark: The measurements and description of Vietnamese specimens correspond well with holotype and paratype specimens from type population from Kerma, Iran [6] with the exception of the absence of advulval papilla(e) in all specimens.

Locality: Nghe An.

***Mylonchulus oceanicus* Adrassy, 1986 (Figs. 2A-C)**

Material: 10 females in good condition. Measurements: see table 2.

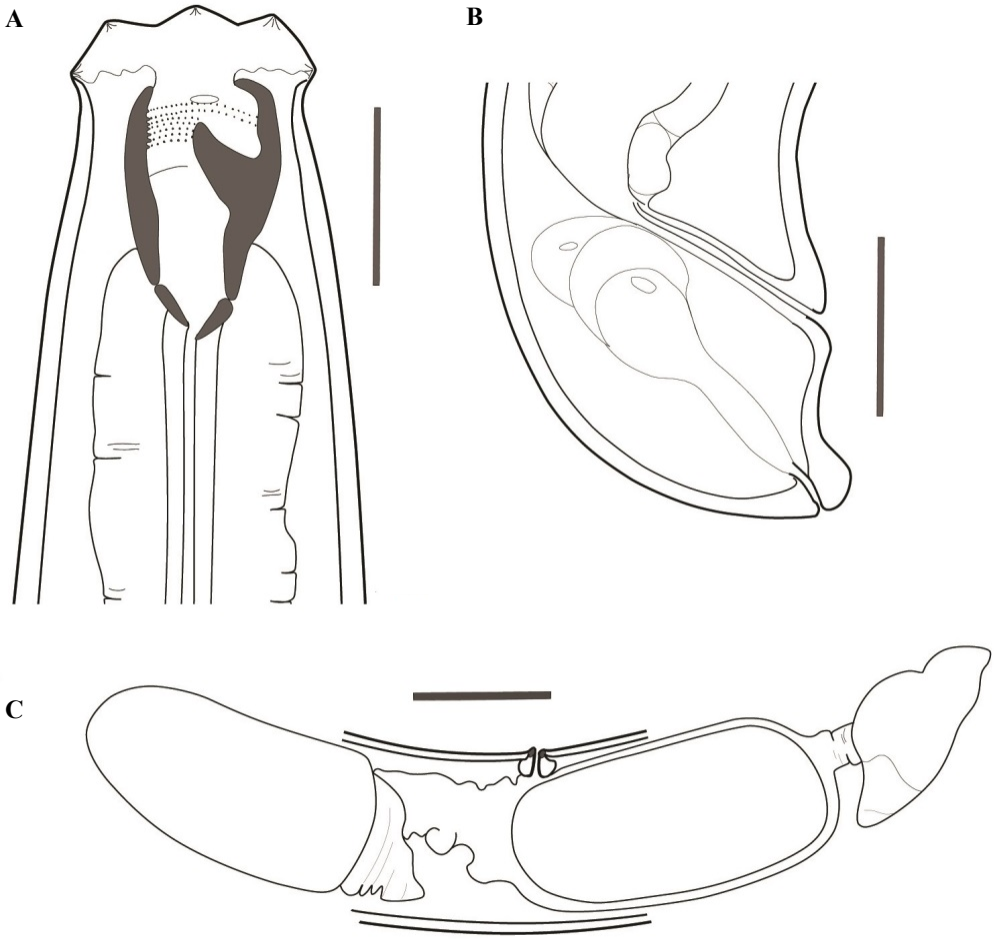

Figure 2. Mylonchulus oceanicus Andrassy, 1986
A. Head region; B. Female tail region; C. Female reproductive system
(Scale bars: A, B = 20 µm; C = 40 µm)

Female: Moderately stout nematodes of small size, 1.0-1.2 mm long. Habitus after fixation ventrally curved, particularly towards posterior end or C-shaped. Cuticle smooth, 1.5-2 μm thick. Lip region 24-28 μm wide, slightly offset from the body contour by a depression. Buccal cavity medium size, 25.5-29 μm long and 15-17.5 μm wide, funnel shaped, tapering at base; strongly sclerotized. Amphideal fovea cup-shaped. Dorsal tooth very large, claw-like with sharp apex, pointing forward and situated at 80-86% of buccal cavity length from its base. Small rasp-like denticles arranged in seven transverse rows in ventrosublateral wall. Ventrosublateral teeth absent. Oesophagus cylindrical, 333-369 μm long, surrounding base of buccal cavity. Secretory-excretory pore not observed. Oesophago-intestinal junction non-tuberculate. Rectum straight, thick-walled and muscular, 21-24 μm, shorter than anal body width. Reproductive system didelphic-amphidelphic, both branches equally developed with ovary reflexed. Sphincter between oviduct and uterus absent. Vulva a transverse slit in ventral view, not protruding. Vagina short with *pars refringens vaginae* sclerotized, visible as 2 pieces in optical section. A large egg in posterior branch, 48x90 μm large. Tail short, plump, ventrally bent, nearly semicircular in its dorsal contour, 19-24 μm or 0.65-0.75 anal body width. Tail terminus slightly but distinctly dorsal curved, round or obtuse. Three large caudal glands prominent, spinneret present in subdorsal terminus with cuticularized valvular apparatus.

Male: Not found.

Remark: The measurements and description of Vietnamese specimens correspond well with the type population from Hawaii, USA (Andrassy, 1986) [3] and other population from Okinawa, Japan [2] except for slightly shorter tail (c = 47-56 *vs* 39-49).

Locality: Lang Son.

Table 2. Morphometric data of *Mylonchulus oceanicus* Andrassy, 1986

	Mylonchulus oceanicus		
	Type population Hawaii (USA)	Okinawa (Japan)	Lang Son (Vietnam)
	Andrassy (1986)	Ahmad et al. (2010)	Present paper
n	? ♀	6 ♀	10 ♀
L (mm)	1.06-1.23	0.99-1.44	1.04-1.18
a	24-26	24.6-29.7	20.6-25.4
b	3-3.2	2.9-3.7	3-3.3
c	34-35	39-49	47.5-56
c’	1-1.2	0.7-0.9	0.65-0.75
V (%)	63-64	61-66	61.6-66
Buccal cavity length (μm)	26-29	26-30	25.5-29
Buccal cavity width (μm)	16-17	17-19	15-17.5
Apex of dorsal tooth position from base of buccal cavity (%)	80-82	-	80-86
Lip region width (μm)	25-26	24-30	24.6-28.2
Lip region height (μm)	-	9-10	-
Neck length (μm)	350-410	340-444	333-369
Body diameter at vulva (μm)	43-49	-	44-53
Anal body diameter (μm)	-	-	28-34
Tail length (μm)	31-35	25-34	19-24
Rectum (μm)	-	21-27	21-24

?. no information.

Currently, 20 species of *Mylonchulus* genus were recorded and an updated key to species of *Mylonchulus* genus in Vietnam (based on Ahmad & Jairajpuri, 2010 [1]) was present as bellow:

1a) Female reproductive system paired, amphidelphic..... 2
1b) Female reproductive system unpaired, prodelphic. Post-uterine sac shorter than vulval body diameter or completely absent …..... 18
2a) Spinneret situated on dorsal side of tail tip 3
2b) Spinneret terminal, situated at center of tail tip …..... 8
3a) Tail tip dorsally bent; ventro-sublateral teeth absent ..... *M. oceanicus*
3b) Tail tip not dorsally bent; ventro-sublateral teeth mostly present……..... 4
4a) Buccal cavity 30 µm length or longer; body length ca 1.5 mm……..…....*M. brevicaudatus*
4b) Buccal cavity 20 µm length or less than; body length shorter 1.5 mm ……..…..... 5
5a) Body length very small, about 0.6-0.7 mm; buccal cavity broad, barrel shaped……... ..*M. doliolarius*
5b) Body longer; buccal cavity as usual, strongly tapering toward its base……..... 6
6a) Ventro-sublateral teeth present, prominent. Tail longer, 35-46 µm ....*M. brachyuris*
6b) Tail shorter, 15-25 µm ……..... 7
7a) Intestine characteristically narrowed at genital region……..... *M. contractus*
7b) Intestine not strikingly narrowed at genital region, tail tip round …….…..... ..*M. nainitalensis*
8a) Tail sigmoid, sharply bent ventrad with digitate posterior part inclining slightly dorsally and making dorsal contour somewhat concave 9
8b) Tail not sigmoid, either more or less arcuate or if subdigitate, showing no concave dorsal contour or not sharply bent ventrad 11
9a) Ventro-sublateral denticles rasp-like numerous (ca 10-15 irregular rows)…… ..*M. dentatus*
9b) Ventro-sublateral denticles rasp-like, less than 10 rows 10
10a) Ventro-sublateral denticles rasp-like in 6 rows; no advulval papillae …… .*M. kermaniensis*
10b) Ventro-sublateral denticles rasp-like in 7-8 rows. Advulval papillae absent ..... *M. sigmaturus*
11a) Tail longer, 2-4 anal body width 12
11b) Tail shorter, less than 2 anal body width 13
12a) Ventro-sublateral denticles densely arranged, in ca 10 irregular rows ……... ..*M. apapillatus*
12b) Ventro-sublateral denticles not so dense, in 5-7 rows ……..…….. *M. polonicus*
13a) Ventro-sublateral teeth absent ……..…….…..... *M. amurus*
13b) Ventro-sublateral teeth present ..…… ……..... 14
14a) Tail longer, 1.5-1.8 anal body width ……..……..…..….. 15
14b) Tail shorter, as long as anal body width ……..……...……..... 16
15a) Tail arcuate, cylindrical for almost entire length. Advulva papillae present ……..... *M. lacustris*
15b) Tail sharply bent ventrad, consisting of an anterior wider and a posterior slender. Rasp-like denticles in 6-7 rows……...…..……...……..... ..*M. hawaiiensis*
16a) Tail obtuse with bluntly rounded tip ……...…..……..... *M. orbitus*
16b) Tail conoid with narrowly rounded tip ……..…….. ..17
17a) Tail 30 µm long or shorter ……..……...….. *M. curvicaudatus*
17b) Tail longer, 40-50 µm long ……..……....… *M. minor*

18a) Tail longer, 1.5-2 anal body width. Post uterine sac completely absent ……..... *M. mulveyi*
18b) Tail short, 1 anal body width. Ventro-sublateral denticles in 5-6 transverse rows ..……..... 19
19a) Caudal spinneret subdorsal ……..……..... *M. orientalis*
19b) Caudal spinneret terminal ……..…….……... *M. index*

Remarks: Of the total 20 species of the genus *Mylonchulus* found in Vietnam, eight species are cosmopolitan, viz. *M. apapillatus* was recorded in India and Korea; *M. kermaniensis*, from Iran; *M. amurus* and *M. dentatus*, from India, and two species as *M. doliolarus* and *M. orientalis* from Vietnam.

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GHI NHẬN MỚI HAI LOÀI TUYẾN TRÙNG GIỐNG *Mylonchulus* (Mononchida: Mylonchulidae) VÀ KHÓA ĐỊNH LOẠI CÁC LOÀI CỦA GIỐNG NÀY Ở VIỆT NAM

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TÓM TẮT

Hai loài tuyến trùng, *Mylonchulus kermaniensis* và *M. oceanicus*, được ghi nhận lần đầu tiên và được mô tả cho khu hệ tuyến trùng Việt Nam. *M. kermaniensis* được ghi nhận từ Nghệ An có số đo và mô tả hoàn toàn phù hợp với số đo và mô tả gốc của loài này từ Iran. Tuy nhiên, không quan sát thấy nhú vulva ở tất cả cá thể từ quần thể ở Việt Nam trong khi đó, có 2 trong số 6 cá thể của quần thể loài này từ Iran có nhú vulva. *M. oceanicus* được ghi nhận từ Lạng Sơn có số đo và mô tả phù hợp với số đo và mô tả gốc của loài này từ Hawaii, Hoa Kỳ cũng như quần thể từ Nhật Bản ngoại trừ đuôi hơi ngắn hơn (c = 47-56 so với c = 34-35 ở quần thể gốc và c = 39-49 ở quần thể Nhật Bản).

Như vậy, cho đến nay đã có 20 loài thuộc giống *Mylonchulus* được ghi nhận ở Việt Nam và lần đầu tiên đưa ra khóa định loại cho tất cả các loài của giống này được ghi nhận ở Việt Nam.

Từ khóa: *Mylonchulus*, ghi nhận mới, tuyến trùng, Việt Nam.

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