

## A NEW AND TWO FIRST RECORDED SPECIES OF MONONCHIDS (NEMATODA: MONONCHIDA) FROM JAPAN

Z. Khan and M. Araki

*Laboratory of Nematology and Soil Zoology, National Institute for Agro-Environmental Sciences, Tsukuba, Ibaraki 305-8604, Japan*

**Summary.** A new and two known species of mononchids are described and illustrated from Japan. *Iotonchus miamaensis* sp. n. has 3.2-3.5 mm long body;  $a = 44-50$ ;  $c = 7.6-8.4$ ; spicules = 127-138  $\mu\text{m}$ ; ventromedian supplements 12-13 in numbers, and is characterized by large and wide stoma with basal dorsal tooth, asymmetrical vaginal muscles, amphidelphic gonads and terminal spinneret. *Clarkus sheri* (Mulvey, 1967) Jairajpuri, 1970 and *Mylonchulus polonicus* (Stefanski, 1915) Cobb, 1917 are described and illustrated with additional information.

Mononchid nematodes in Japan have scarcely been studied, although a few preliminary reports on the occurrence of mononchids in Japan had been made by Imamura (1931), Kaburaki (1933), Yokoo and Koga (1966) and Shishida (1998). Very recently Khan *et al.* (2000a) have described *Iotonchus sagaensis*, *I. arcuatus* and *Miconchus japonicus* from a deciduous forest in the Saga prefecture, Japan.

For the better understanding of the nematode fauna in Japan, a survey was carried in various regions of the country.

Soil samples collected from Kyoto and Saga prefectures have yielded a new and two known species of mononchids, which are described and illustrated in this paper.

### MATERIALS AND METHODS

Nematodes were extracted from soil samples by Cobb's sieving methods and the centrifugal sugar-flotation technique. Nematodes obtained in clear water were killed in hot water (60 °C) and fixed in TAF. Fixed nematodes were transferred to glycerin by the method of Seinhorst (1959), and mounted on slides in anhydrous glycerin. Measurements and drawings were done using an Olympus BH2 research microscope, equipped with a drawing tube. Light microscope photographs were taken with an Olympus C-35 AD-4 photo micrographic camera with differential interference contrast.

### DESCRIPTIONS

#### *IOTONCHUS MIAMAENSIS* sp. n.

(Figs 1 and 2)

#### Measurements

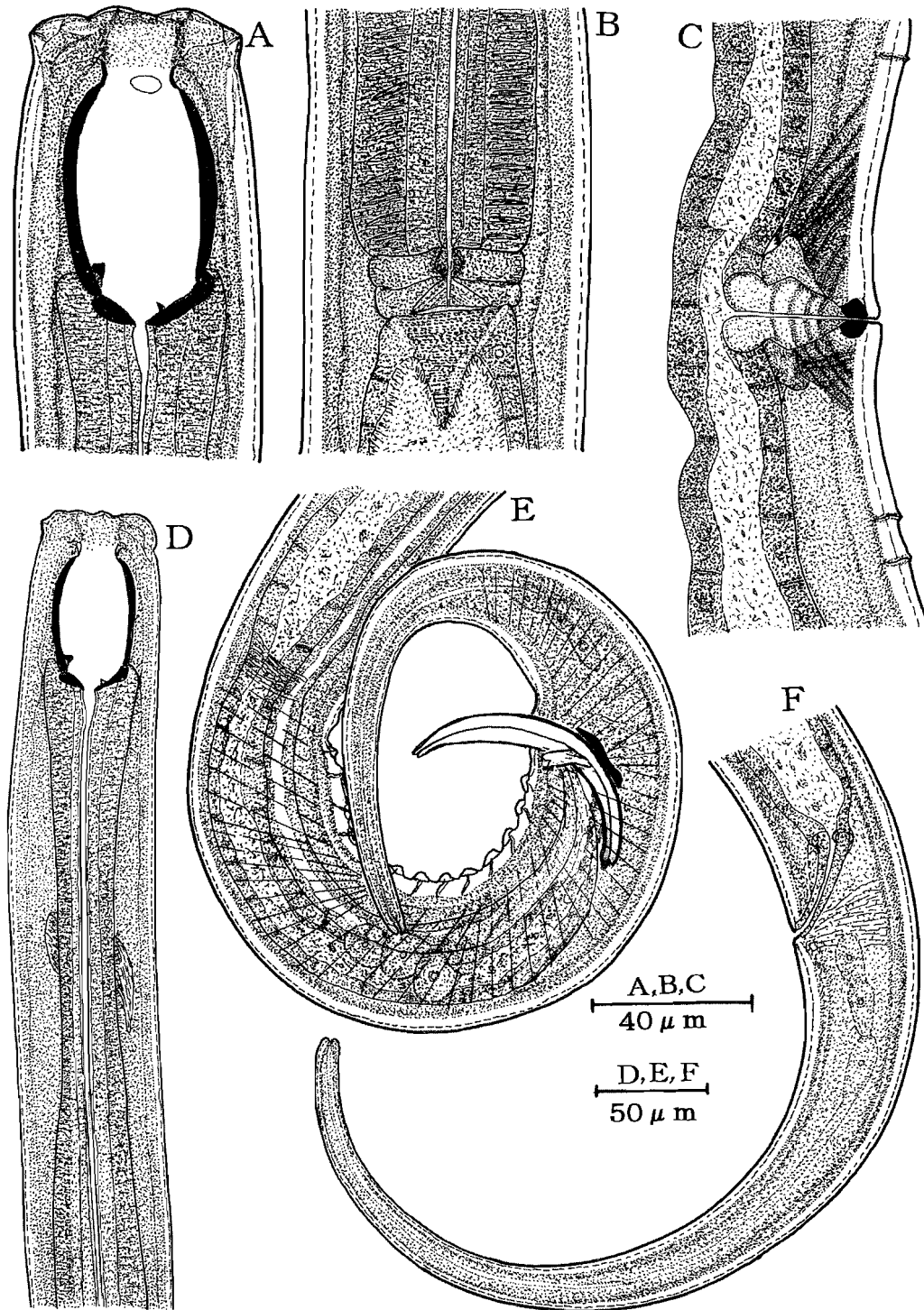
**Holotype female.** L = 3.4 mm;  $a = 46$ ;  $b = 4.7$ ;  $c = 8.1$ ;

$c' = 7.5$ ; V = 60; ABD = 55  $\mu\text{m}$ ; Tail = 414  $\mu\text{m}$ .

**Paratype females** (n = 8). L = 3.4±0.08 (3.2-3.5) mm;  $a = 46.8±2.2$  (44-50);  $b = 4.7±0.1$  (4.6-5.0);  $c = 8.0±0.2$  (7.6-8.4);  $c' = 7.9±0.3$  (7.5-8.3); V = 60.4±0.4 (60-61); ABD = 52.7±2.8 (48-57)  $\mu\text{m}$ ; Tail = 416.6±11.6 (396-432)  $\mu\text{m}$ .

**Paratype males** (n = 5). L = 3.0±0.09 (2.8-3.1) mm;  $a = 46.3±0.8$  (45-48);  $b = 4.6±0.07$  (4.5-4.7);  $c = 12.1±0.9$  (11.2-14.0);  $c' = 4.2±0.3$  (3.5-4.7); ABD = 59.3±3.1 (53-63)  $\mu\text{m}$ ; Tail = 245.3±11.2 (223-266)  $\mu\text{m}$ .

*Female.* Body large and robust, ventrally curved when fixed, more so in posterior region. Cuticle smooth, 3-4  $\mu\text{m}$  thick, striations indistinct. Internal striations discernable. Lip region set off by slight expansion, 53-57  $\mu\text{m}$  wide and 16-21  $\mu\text{m}$  high. Labial papillae prominent, protruded. Amphidial slit oval, 6-7  $\mu\text{m}$  wide, at 16-21  $\mu\text{m}$  from anterior end of head. Buccal cavity relatively large, thick-walled, begins at 16-18  $\mu\text{m}$  behind anterior end of body, 64-72  $\mu\text{m}$  long and 42-45  $\mu\text{m}$  wide or about 1.5 times as long as wide; vertical plates parallel, basal oblique plates flattened. Dorsal tooth rather small, nearly basal in position, apex pointing forward, at 16-18  $\mu\text{m}$  or 24-27% of buccal cavity length from its base. Two small but prominent foramina present at base of buccal cavity. About posterior fifth of stoma embedded in oesophageal tissues. Oesophagus 682-745  $\mu\text{m}$  long, narrowing to nerve ring at about one-quarter of its length, then expanding gradually to its base, where it occupies 3/5 of corresponding body width. Nerve ring and excretory pore at 158-184  $\mu\text{m}$  and 189-241  $\mu\text{m}$  from anterior end of body, respectively. Oesophago-intestinal junction tuberculate. Intestine with wide lumen, filled with dark granules. Reproductive system didelphic-amphidelphic. Both sexual branches almost equally developed. One pre- and two



**Fig. 1.** *Iotonchus miamaensis* sp. n.: A and D, anterior region; B, oesophago-intestinal junction; C, vulval region; E, male posterior region; F, female posterior region.

post-vulval papillae present. Vulva elevated, post-equatorial, transverse, provided with two cuticularized pieces. Vagina straight, muscular, extending inwards about two-fifths of corresponding body width deep; surrounded by asymmetrical muscles. Ovaries reflexed, oocytes arranged in a single row except near tip. Oviduct with narrow distal and dilated proximal parts. Sphincter present between uterus and oviduct. Rectum

straight, muscular, 48-56  $\mu\text{m}$  or almost equal to anal body width long. Tail 396-432  $\mu\text{m}$  long, proximally conoid then sub-cylindroid, ventrally arcuate. Three caudal glands arranged in tandem, spinneret terminal.

*Male.* Similar to female in general morphology, but more strongly curved to coiled in posterior region. Buccal cavity 57-62  $\mu\text{m}$  long and 34-40  $\mu\text{m}$  wide. Testes paired, opposed, outstretched. Spicules paired, slender,

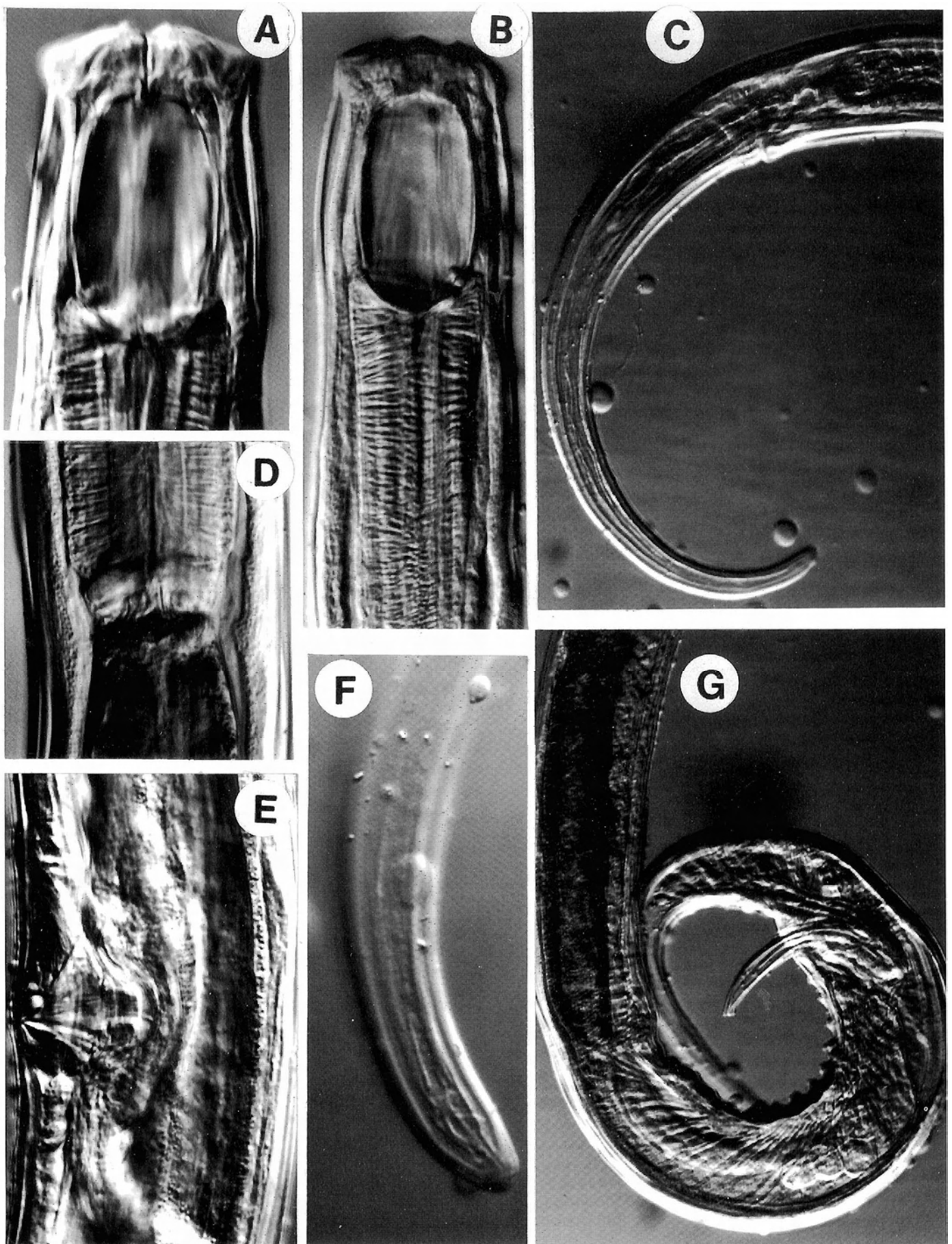


Fig. 2. Photomicrographs of *I. miamaensis* sp. n.: A and B, anterior region; C, female posterior region; D, oesophago-intestinal junction; E, vulval region; F, female tail terminus; G, male posterior region.

arcuate, 127-138  $\mu\text{m}$  or 2.0-2.4 times of anal body width long. Gubernaculum 32-39  $\mu\text{m}$  long, spoon shaped. Lateral guiding pieces bifid, 16-20  $\mu\text{m}$  long. Ventromedian supplements serially arranged, 12-13, almost equidistant. Copulatory muscles in paired bands. Accessory copulatory muscles not seen. Rectal glands present. Rectum 50-55  $\mu\text{m}$  long. Tail similar to that of female but smaller in size and coiled terminally. Caudal glands and spinneret as in females.

*Type habitat and locality.* Soil samples collected from rhizosphere of *Euonymus alata* Sieb from Kyoto University forest in Ashiu, near Miama town, Kitakuwata country, Kyoto prefecture, Japan.

*Type material.* Collected in November, 2000. Holotype female on slide No. 2000-N-10-001-K and paratype females and males on slides No. 2000-N10-002-K, deposited in the nematode collection of the laboratory of Nematology and soil Zoology, National Institute for Agro-Environmental Sciences, Tsukuba, Ibaraki 305, Japan. One each paratype female and male deposited at Instituut voor Dierkunde, Gent, Belgium.

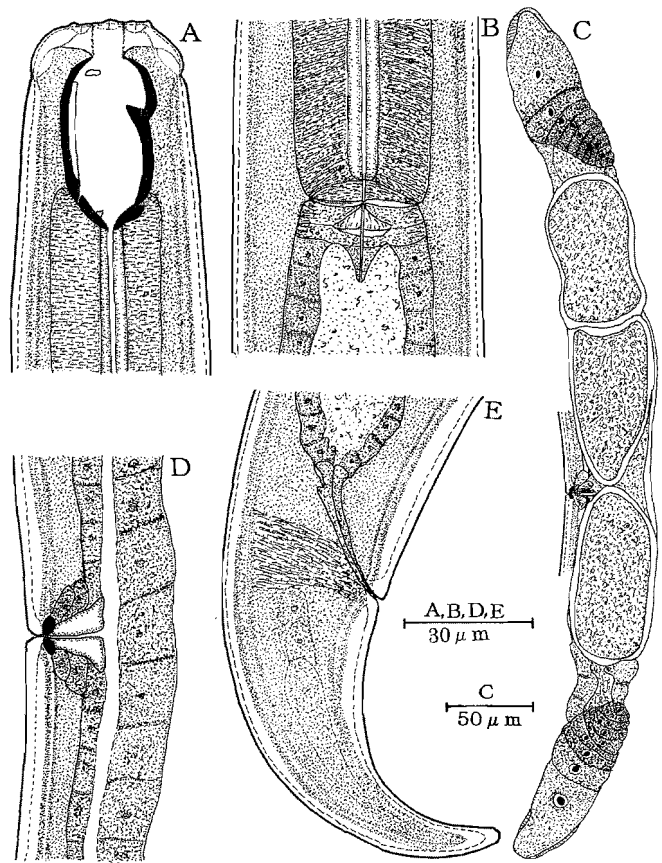
*Diagnosis and relationships.* The new species belongs to those groups of *Iotonchus* species which have caudal glands and a terminal spinneret. *I. miamaensis* sp. n. characterized by a large buccal cavity, basally located dorsal tooth, elongate ventrally curved tail, asymmetrical muscles around vagina and slender spicules. The new species is close to *I. risociae* Carvalho, 1955 and *I. apapillatus* Dhanam et Jairajpuri 1998. It differs from the former in having a narrow stoma, slender body and longer female tail (stoma 1.2 times longer than wide;  $a = 30-37$  and  $c = 10-11$  in *I. risociae*). From *I. apapillatus*, *I. miamaensis* differs in having a longer tail, presence of vulval papillae, lesser number of ventromedian supplements and shape of male tail ( $c = 10-13$  (female); ventromedian supplements 17-19; vulval papillae absent and mail tail arcuate not coiled in *I. apapillatus*).

**CLARKUS SHERI (Mulvey, 1967) Jairajpuri, 1970**  
(Figs 3 and 4)

**Measurements**

**Females (n = 8).** L =  $1.8 \pm 0.03$  (1.8-2.0) mm; a =  $33.6 \pm 0.7$  (32.4-34.8); b =  $4.3 \pm 0.1$  (4.1-4.5); c =  $19.9 \pm 0.8$  (17.9-21.4); c' =  $2.5 \pm 0.1$  (2.3-2.8); V =  $63.5 \pm 0.2$  (63-64); ABD =  $38 \pm 0.7$  (36-39)  $\mu\text{m}$ ; Tail =  $96.8 \pm 4.5$  (89-106)  $\mu\text{m}$ .

*Female.* Body large, ventrally curved when fixed, cylindrical, truncated anteriorly and gradually tapering towards posterior extremity into tail. Cuticle smooth, 3-4  $\mu\text{m}$  thick at mid-body. Lateral chords about 1/4 of corresponding body width wide at base of oesophagus. Lip region demarcated by slight constriction, rounded, 34-37  $\mu\text{m}$  wide and 13-16  $\mu\text{m}$  high. Labial papillae



**Fig. 3.** *Clarkus sheri*: A, anterior region; B, oesophago-intestinal junction; C, gonads; D, vulval region; E, posterior region.

weakly developed. Amphidial aperture slit-like, at 11-13  $\mu\text{m}$  from anterior end of body. Buccal cavity oblong, 41-43  $\mu\text{m}$  long and 22-23  $\mu\text{m}$  wide or about twice longer than wide. Dorsal tooth of medium size, forwardly directed, apex located at 70-75% of buccal cavity length from base of stoma. Longitudinal ridge present on ventrosublateral walls of buccal cavity, 24-27  $\mu\text{m}$  long, origin well above the level of dorsal tooth apex and extending to the base of vertical plate. Two prominent foramina present near the base of buccal cavity. Posterior quarter of stoma embedded in the fore end of oesophagus. Excretory pore conspicuous, located at 151-166  $\mu\text{m}$  from anterior end. Oesophagus cylindrical, 425-457  $\mu\text{m}$  long. Nerve ring encircles oesophagus at 128-131  $\mu\text{m}$  from anterior end of body. Oesophago-intestinal junction simple, non-tuberculate. Intestine with wide lumen, epithelium comprising of hexagonal/polygonal cells, filled with dark granules. Reproductive system didelphic-amphidelphic, both sexual branches equally developed. Ovaries reflexed, oocytes arranged in a single row except near the tip. Vulva post-equatorial, transverse with cone-shaped aperture. Vagina muscular, extending about 1/2 of corresponding body width deep, surrounded by glandular structures. Rectum 32-38  $\mu\text{m}$  long. Tail conoid, ventrally curved, terminus acutely rounded. Caudal glands weakly developed. Spinneret absent.

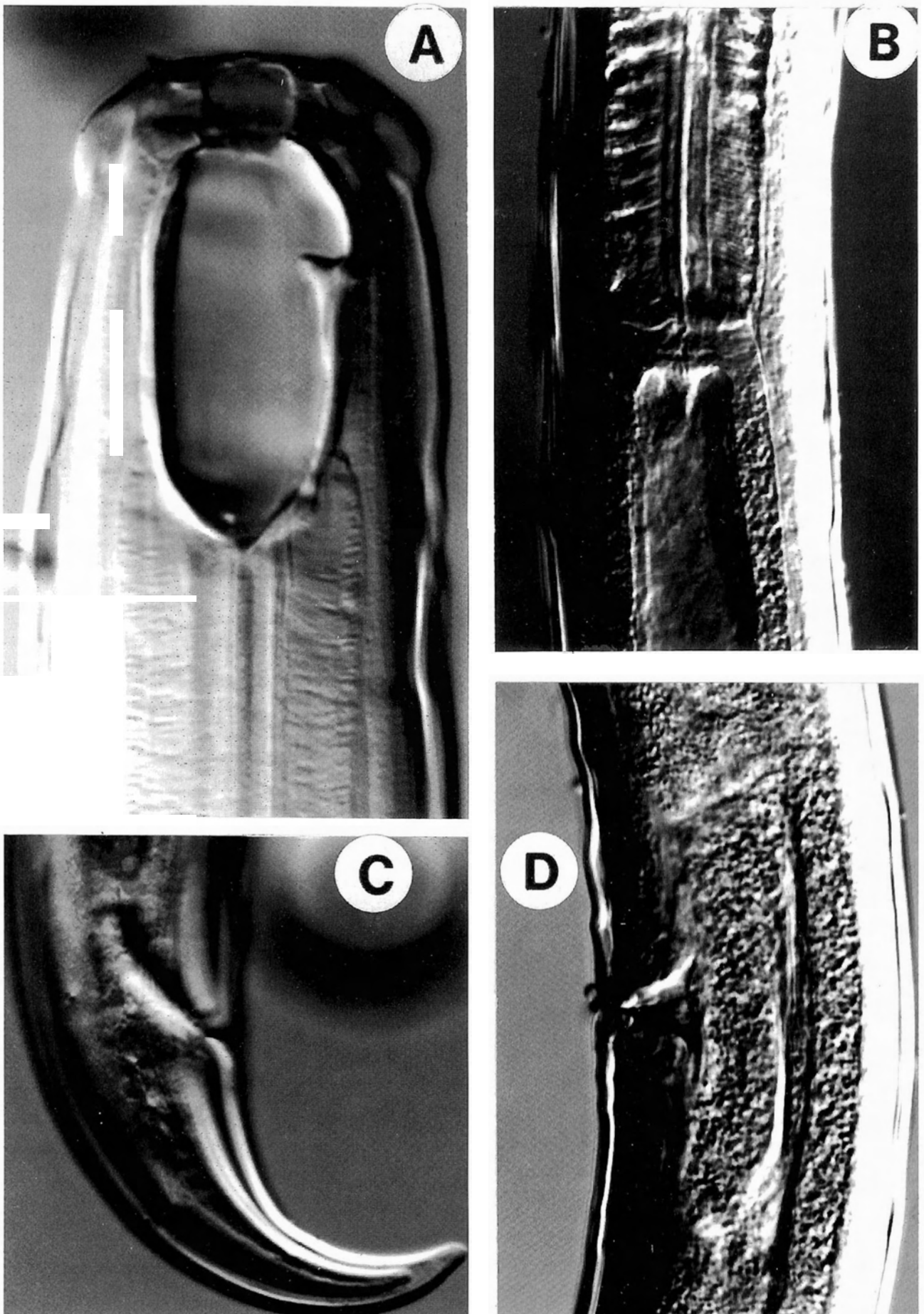


Fig. 4. Photomicrographs of *C. sheri*: A, anterior region; B, oesophago-intestinal junction; C, posterior region; D, vulval region.

*Male.* Not found.

*Habitat and locality.* Soil samples collected in August, 2000 from around the roots of *Salix japonica* in a deciduous forest, Hinokuma Mountain, near Kanzaki town, Saga prefecture, Japan.

*Remarks.* The buccal cavity of the present population is slightly longer than that originally description by Mulvey (1967) from California (stoma 41-43  $\mu\text{m}$  long *vs.* 32-38), but otherwise agree well with the original description. Vaginal glands and poorly developed caudal glands are newly illustrated here. This species is reported and described here for the first time from Japan.

***MYLONCHULUS POLONICUS* (Stefanski, 1915)**

Cobb, 1917

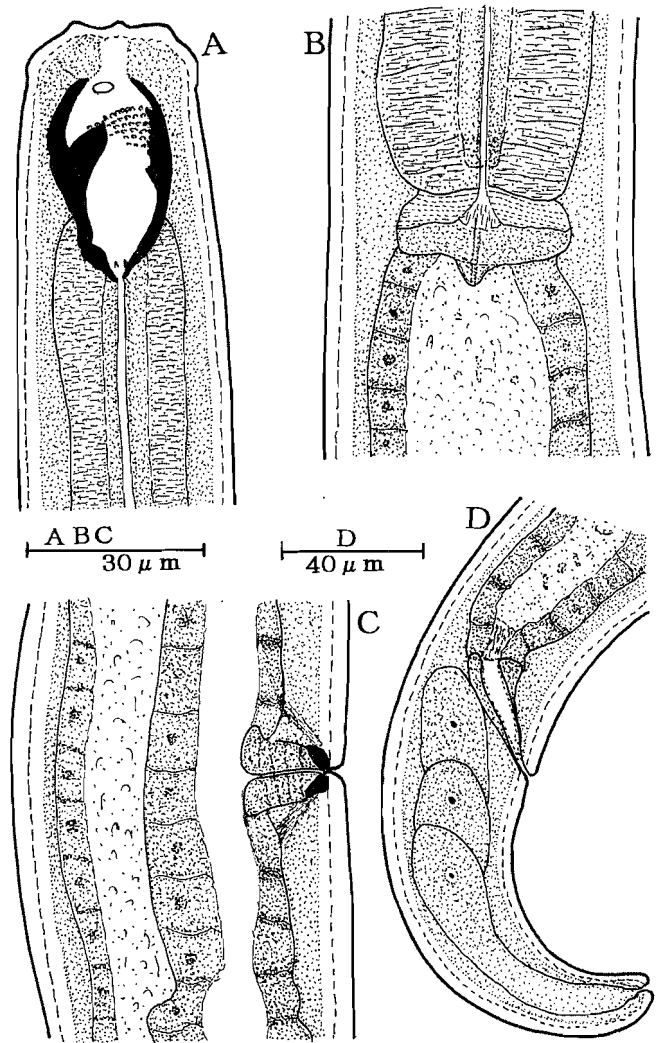
(Figs. 5 and 6)

**Measurements**

**Females** ( $n = 7$ ).  $L = 1.8 \pm 0.1$  (1.6-2.0) mm;  $a = 36.7 \pm 2.1$  (33-41);  $b = 3.8 \pm 0.2$  (3.6-4.3);  $c = 17.1 \pm 0.5$  (16-18);  $c' = 2.8 \pm 0.1$  (2.6-3.0);  $V = 63.5 \pm 1.3$  (61-66);  $ABD = 39.2 \pm 1.0$  (37-41)  $\mu\text{m}$ ; Tail =  $107.5 \pm 6.3$  (95-117)  $\mu\text{m}$ .

*Female.* Body medium sized, ventrally arcuate when relaxed. Cuticle smooth, about 3-4  $\mu\text{m}$  thick at mid-body. Internal striations faintly visible. Lip region demarcated by slight expansion, 29-31  $\mu\text{m}$  wide and 11-13  $\mu\text{m}$  high. Labial papillae distinctly raised above the head surface. Amphidial aperture oval, 3-4  $\mu\text{m}$  wide, at 9-11  $\mu\text{m}$  from anterior end of body. Buccal cavity 32-36  $\mu\text{m}$  long and 19-23  $\mu\text{m}$  wide. Dorsal tooth large sized, obliquely forward directed, its apex at 21-25% of stoma length from anterior end. Submedian teeth at 15-18  $\mu\text{m}$  or 47-50% from anterior end of buccal cavity. Subventral denticles fairly large, almost equal in size, arranged in 6-7 rows. Two minute foramina present at base of buccal cavity. Posterior fourth of stoma embedded in anterior region of oesophagus. Excretory pore distinct, at 155-165  $\mu\text{m}$  from anterior end. Oesophagus cylindrical, 453-536  $\mu\text{m}$  long. Nerve ring encircles oesophagus at 133-145  $\mu\text{m}$  from anterior end. Oesophago-intestinal junction simple, non-tuberculate. Intestine with wide lumen and filled with numerous granules. Reproductive system didelphic, amphidelphic, both sexual branches equally developed. Ovaris small, reflexed. Sphincter present between oviduct and uterus. Vagina extending inwards about  $\frac{1}{2}$  of corresponding body width deep, provided with two cuticularized pieces. Vulva post-equatorial, a transverse slit with wide opening. Rectum straight, almost equal to anal body width long. Tail conoid, ventrally arcuate with bluntly rounded terminus. Three caudal glands arranged in tandem, spinneret terminal.

*Male.* Not found.



**Fig. 5.** *Mylonchulus polonicus*: A, anterior region; B, oesophago-intestinal junction; C, vulval region; D, posterior region.

*Habitat and locality.* Soil samples collected in August 2000 from around the roots of *Pinus parviflora* in a deciduous forest, Hinokuma Mountain, near Kanzaki town, Saga prefecture, Japan.

*Remarks.* The Japanese specimens agree well with the morphology and measurements of *Mylonchulus montanus* given by Mulvey, 1961. In 1992 Andr assy synonymised this species with *M. polonicus*. We agree with Andr assy's opinion and considered the present specimens to be *M. polonicus*. However, it differs from those described by Khan *et al.* (2000b) from Korea in the absence of dorsal body pores. This species is described here for the first time from Japan.

**ACKNOWLEDGEMENT**

The first author is grateful to the Japan International Science and Technology Exchange Center (JISTEC) for providing STA Fellow to work at the National Institute for Agro-Environmental Sciences, Tsukuba, Japan.

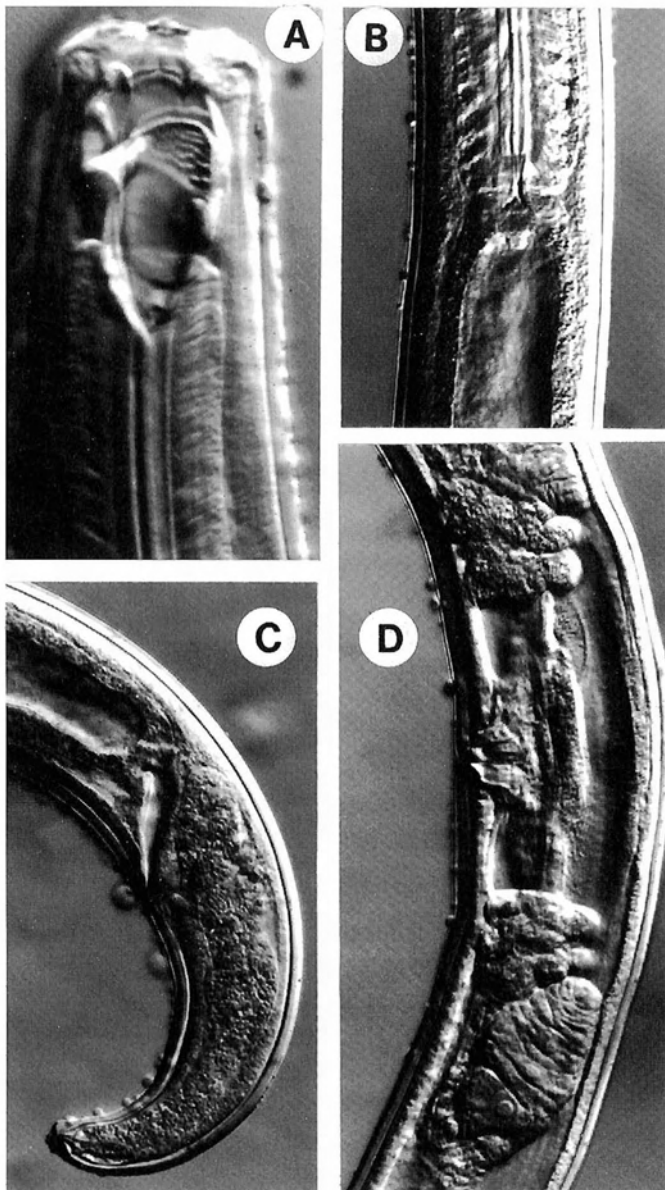


Fig. 6. Photomicrographs of *M. polonicus*: A, anterior region; B, oesophago-intestinal junction; C, posterior region; D, vulval region.

#### LITERATURE CITED

Andrássy I., 1992. A taxonomic survey of the family Mylonchulidae (Nematoda). *Opuscula Zoologica Budapestinensis*, 15: 11-35.

Carvalho J.C., 1955. *Mononchus risoceiae*, nova espécie (Nematoda, Mononchidae). *Revista do Instituto Adolfo Lutz*, 15: 129-134.

Cobb N.A., 1917. The Mononch (*Mononchus* Bastian, 1865), a genus of predatory nematodes. Contribution to a science of nematology, VI. *Soil Science*, 3: 431-486.

Dhanam M.D. and Jairajpuri M. S., 1998. Five new species of Mononchs from Malnad tracts of Karnataka, India. *Nematologica*, 44: 21-35.

Imamura S., 1931. Nematodes in the paddy field, with notes on their population before and after irrigation. *The Journal of the College of Agriculture, Imperial University of Tokyo*, 11: 193-240.

Jairajpuri M.S., 1970. Studies on Mononchida of India. II. The genera *Mononchus*, *Clarkus* n. gen. and *Prionchulus* (Family Mononchidae Chitwood, 1937). *Nematologica*, 16: 213-221.

Kaburaki T., 1933. Notes on the fauna of the Oze district. Pp. 70-94. In: "Oze ten-nen kinenbutsu chosa hokoku" (Census Report of Oze, the natural monument), Ministry of Education, Tokyo (in Japanese).

Khan Z., Araki M. and Bilgrami A.L., 2000a. *Iotonchus sagaensis* sp. n., *I. arcuatus* sp. n. and *Miconchus japonicus* sp. n. (Nematoda: Mononchida) from Japan. *International Journal of Nematology*, 10: 143-152.

Khan Z., Choi Y.E., Lee S.M. and Choi J. S., 2000b. Descriptions of four new and an unknown species of predatory nematodes (Mononchida) from Korea. *Korean Journal of Soil Zoology*, 5: 71-83.

Mulvey R.H., 1961. The mononchidae: a family of predaceous nematodes. I. Genus *Mylonchulus* (Enoplida: Mononchidae). *Canadian Journal of Zoology*, 39: 665-696.

Mulvey R.H., 1967. The Mononchidae: A family of predaceous nematodes VI. Genus *Mononchus* (Nematoda: Mononchidae). *Canadian Journal of Zoology*, 45: 915-940.

Seinhorst J.W., 1959. A rapid method for the transfer of nematodes from fixative to anhydrous glycerin. *Nematologica*, 4: 67-69.

Shishida Y., 1998. Pp. 295-296. In: The 1st general research report of the Ibaraki Nature Museum. Ibaraki, Japan: Ibaraki Nature Museum (in Japanese).

Stefanski W., 1915. Nouvelles espèces de Nématodes provenant de Pologne. *Zoologischer Anzeiger Leipzig*, 45: 363-368.

Yokoo T. and Koga S., 1966. On the nematodes found from the soils dug around the roots of Azalea nurseries for sale: One sample of the propagation of the more important plant parasitic nematodes by the selling of the nurseries. *Agricultural Bulletin of Saga University, Saga, Japan*, 23: 7-15.