Russian Journal of Nematology, 2007, 15 (1), 41 - 47

Iotonchus cuticaudatus sp. n., a new mononchid species from West Bengal, India with an unusual case of bivulvarity

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Accepted for publication 16 March 2007

Summary. A new species in the genus *Iotonchus* Cobb, 1916 from the district South 24-Parganas, West Bengal, India is described and illustrated herein. Fourteen female and seven male specimens of this species were collected. Body large (female: 2.8-3.0 mm; male: 2.3-3.1 mm), J-shaped after fixation, buccal cavity large but narrow (female: 56.6-66.6 x 33.3-36.6 µm; male: 50-56.6 x 26.4-30.0 µm), a small dorsal tooth at the base of the buccal cavity, females amphidelphic, ovary reflexed, sphincter at oviduct-uterus junction, advulval papillae present in female; long tail, caudal pore present, caudal glands conspicuous and spinneret terminal, cuticle at the tail terminus swollen. One female specimen was found possessing two vulva.

Key words: Bivulvarity, *Iotonchus*, Mononchida, new species, taxonomy.

The new species described here belongs to the genus *Iotonchus* Cobb, 1916, family Anatonchidae Jairajpuri, 1969 and subfamily Iotonchinae Jairajpuri, 1969. The new species is named *Iotonchus cuticaudatus* n. sp. During a survey of the district South 24-Parganas in the month of July, 2004 this species was collected from soil samples associated with guava plant (*Psidium guajava* L.).

MATERIALS AND METHODS

Nematodes were extracted from soil samples using a modified Baermann funnel technique (Christie & Perry, 1951), fixed in hot 4% FA (formalin-acetic acid mixture) (Seinhorst, 1966) and mounted in anhydrous glycerin and sealed. Preserved specimens were observed under different magnifications with an Olympus BX-51 trinocular light microscope. Figures were drawn with the aid of a Camera Lucida attached to the microscope. Images were captured with a CCD digital camera (CoolSnapPro) integrated with the microscope.

DESCRIPTION

Iotonchus cuticaudatus n. sp (Figs. 1, 2; Table I)

Female. Fourteen specimens were collected. Body long, J-shaped when heat relaxed; cuticle moderately thick all over the body but of variable thickness at lip region, mid-body and caudal region. Width of lip less than adjacent body width, lip region set off from body. Dorsal tooth situated at the base of buccal cavity, sub-ventral tooth absent, geusids prominent. Excretory pore situated behind the nerve ring; oesophageal glands prominent but openings not distinct; oesophagus cylindrical and muscular, cardia more than two times wider than its length. Gonads paired (amphidelphic), ovary opposed, reflexed, with tip of germinal zone often covering the entire body width and prominent due to presence of large oocytes in the ripening zones of both the anterior and posterior reproductive branch; posterior ovary large in all specimens, sphincter at oviduct-uterus junction. Many of the type specimens gravid; intra-uterine eggs found in holotype and five paratype females. Vagina transverse, *pars proximalis vaginae*, *pars refringens vaginae* and *pars distalis vaginae* prominent, vulval pore present, 2 (1-4) pre- and 1 (1-4) post-advulval papillae present. Length of rectum about half of its tail length but pre-rectum inconspicuous. Holotype bears 6 caudal pores; however, variation in its number (3-8) frequently observed in females. Tail elongated, tip rounded, cuticle at tail terminus swollen, caudal glands three

in number, spinneret opening terminal.

Bivulvarity in female. One female specimen had two vulvae. All the characters are similar to the rest of the female specimens except two vulvae and three gonads (anterior, fused and posterior). Middle gonad appears to connect with both the vulvae. Distance between two vulval openings has been considered as the length of fused gonad region, which is about one-sixth of anterior and posterior gonad branch either. Two vulval positions (vulval position 1 and vulval position 2) were observed in this specimen. Ovary highly lobed, reflexed, opposed, large oocyte absent, prominent sphincter at oviduct-uterus junction. Caudal pores four in number. Tip of the tail more swollen than that of the other female specimens. Mulvey (1963, 1967) previously reported bivulvarity in *Prionchulus muscorum* and *P. punctatus*.

Male. Highly developed gonads in all the seven specimens. Testes paired, opposed, outstretched; ejaculatory glands distinct in ventromedian supplementary region, rectal glands in caudal region much developed. Spicules paired, arcuate, spicule-head knobbed; gubernaculum distinct, lateral guiding pieces simple. Ventromedian supplements 15 (11-15), significantly developed and regularly spaced; copulatory muscles distinct in this region. Tail length smaller than females but caudal glands, spinneret opening, tail terminus similar to females. Caudal pore absent.

Etymology. Cuticle at the tail terminus notably swollen which has been considered as a special character; thus, the name *Iotonchus cuticaudatus* has been chosen for the proposed new species.

Type habitat and locality. Soil samples associated with guava tree collected from the district South 24-Parganas (22°22.64' N, 88°25.7' E), West Bengal, India, during the month of July, 2004.

Type specimens. All the slides containing holotype and paratypes of *Iotonchus cuticaudatus* deposited in National type Collection of Zoological Survey of India, Kolkata with following registration numbers: Holotype female - WN 958, Paratype females and males - WN 943, WN 944, WN 945 and WN 959.

Differential diagnosis and relationships. The proposed new species resembles *I. vulvapapillatus* (Andrássy, 1964) in possessing advulval papillae and in tail shape, but differs exhibiting smaller body length (*vs* female: L=3.8-4.3 mm; male: L=3.7-3.9 mm) and smaller tail length. It differs also in the values of 'a', 'c', 'V' and 'c''. The present species resembles *I. parabasidontus* (Mulvey & Jensen, 1967) but differs in having longer body length (*vs* female: 2.2-2.6 mm, male: 2.0-2.4 mm); different shape and size of buccal cavity; shape of dorsal tooth and shape of cardia. Lateral guiding pieces simple but never bifurcate in male; caudal pore present in female but absent in male; tail tip rounded with terminal opening but cuticle markedly swollen at the tail terminus. *I. risoceiae* (Carvalho, 1955) seems close to the newly described species, some measurements overlap but there are some significant differences. Shape of buccal cavity is different and dorsal tooth is of different shape; cuticle over the body much thicker; body pore in caudal region distinct (in holotype 6, in paratype females 3-8) but no caudal pore in male. Cuticle structure at tail tip markedly different, ejaculatory glands and rectal glands much developed in the present species. Although shape of the buccal cavity and tail has some similarities, overall measurements and other taxonomic characters show notable differences between the present species and *I. rayongensis* (Buangsuwon & Jensen, 1966) including longer body (*vs* 1.97 mm), presence of advulval papillae, terminal caudal spinneret (*vs* sub-terminal), different shape of tail terminus. The present species is close to *I. sagaensis* (Khan, Araki & Bilgrami, 2000) but differs in the measurements of 'a' and 'b'; higher anal body diameter (*vs* female: 44-52 µm; male: 45-55 µm); thicker cuticle (*vs* 3-4 µm) without striations; presence of advulval papillae. Shape and size of the vagina and tail (vs female: 225-265 µm, male: 164-223 µm) also different. In male, gubernaculum never notched; ventromedian supplements more in number (*vs* 10-12). The proposed new species has longer body length (*vs* female: 2.32-2.68 mm, male: 2.2-2.46 mm) and tail length (*vs* female: 190-230 µm, male: 150-180 µm) than *I. nayari* (Mohandas & Prabhoo, 1979), thus the measurements 'c' and 'c'' also different. No tooth-like projection at the anterior part of the sub-ventral wall; all the female specimens bear advulval papillae; prominent caudal glands and different tail terminus. The new one is different from *I. koupensis* (Siddiqi, 2001) in body length and all other measurements. The present species is also close to *I. aequatorialis* (Vinciguerra & Orselli, 2006) but differs in longer body length (*vs* 2.24-2.36 mm) and shorter tail length (*vs* 477-525 µm); absence of striations in cuticle; presence of advulval papillae and presence of sphincter between oviduct-uterus junction. Cuticle structure at tail terminus distinctly different.

Remarks. This is the first report of bivulvarity in genus *Iotonchus* as well as first report of bivulvarity from India in order Mononchida.

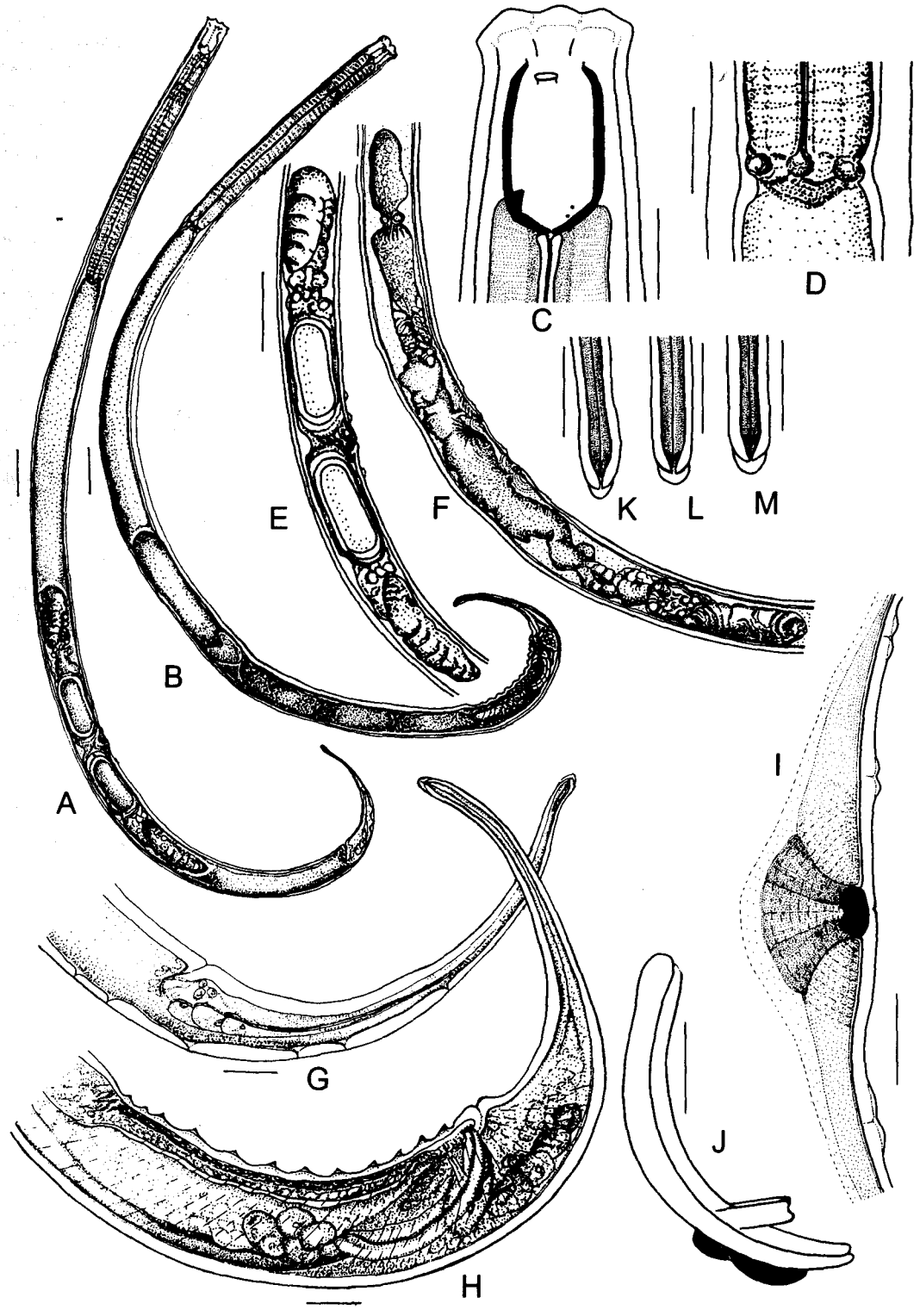

Fig. 1. *Iotonchus cuticaudatus* n. sp. (Camera lucida drawings) A: Entire body of female; B: Entire body of male; C: Head region; D: Oesophago-intestinal junction; E: Ovary (amphidelphic); F: Region with double vulva in unusual female; G: Caudal region of female; H: Hind part of male showing ejaculatory glands and spicules; I: Vulval region; J: Spicules with gubernaculum and lateral guiding pieces; K: Tail end of female possessing double vulva; L: Tail end of female; M: Tail end of male. Scale bars: A, B, E = 100 μm; F = 50 μm; C-D, G-M = 25 μm.

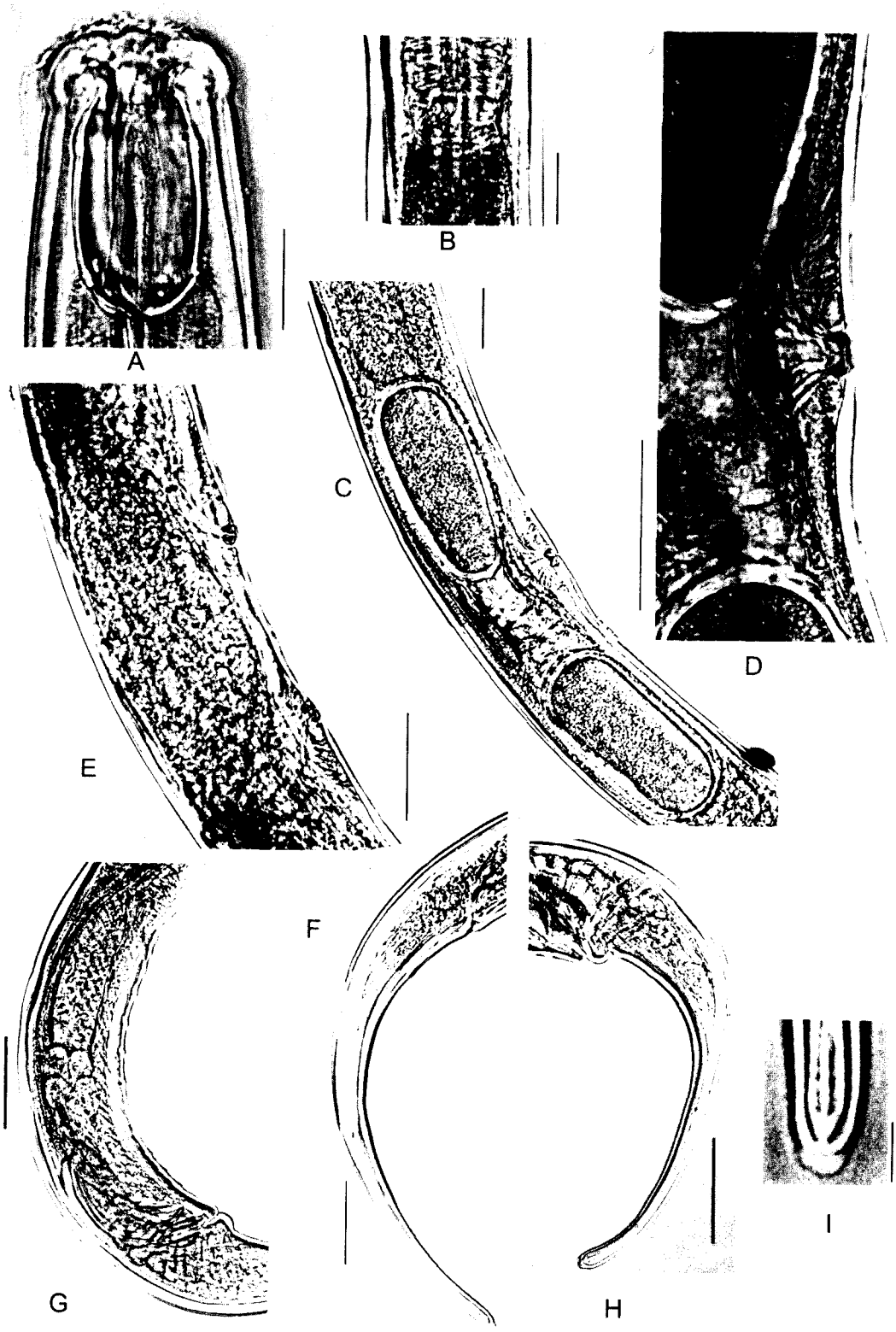

Fig. 2. *Iotonchus cuticaudatus n. sp.* (Photomicrographs) A: Head region; B: Oesophago-intestinal junction; C: Gonad (amphidelphic); D: Vulval region; E: Double vulval region; F: Female tail; G: Hind part of male showing ejaculatory glands and spicules; H: Male tail; I: Tail tip with swollen cuticle. Scale bars: A-B, D, F-H = 25 μm; C, E = 50 μm, I = 12.5 μm.

Table 1. Morphometric data on population of *Iotonchus cuticaudatus* n. sp. (n = numbers, all measurements are in µm, only 'L' in mm; values for paratypes are mean ± SD; * holotype and five paratype females have intra-uterine eggs).

	Holotype female	Paratype females (n = 12)	Paratype males (n = 7)	Female with double vulva
L	2.9	2.86 ± 0.04 (2.8-3.0)	2.56 ± 0.31 (2.3-3.1)	2.8
a	37.4	33.55 ± 2.20 (30.4-37.4)	33.76 ± 3.49 (30-39.3)	30.4
b	4.9	4.88 ± 0.35 (4.6-5.8)	4.72 ± 0.35 (4.4-5.4)	4.7
c	10.0	9.17 ± 0.79 (7.1-10.1)	11.31 ± 1.71 (9.6-14.5)	9.2
c'	5.7	6.28 ± 0.76 (5.47-7.8)	3.33 ± 0.15 (3.1-3.6)	5.5
V/T	63.9	63.60 ± 0.83 (62.0-64.5)	45.63 ± 4.00 (39.3-50.8)	–
V1	–	–	–	61.3
V2	–	–	–	64.6
G1	13.0	14.87 ± 0.84 (12.9-16.08)	–	18.7
G2	14.2	15.11 ± 0.59 (14.2-16.0)	–	20.9
Cuticle thickness at head region	4.1	4.15 ± 0.26 (3.4-4.4)	4.25 ± 0.09 (4.1-4.4)	4.1
Cuticle thickness at mid-body	8.9	8.85 ± 0.44 (7.7-9.5)	8.71 ± 0.55 (7.7-9.5)	8.9
Cuticle thickness at tail region	5.4	5.26 ± 0.45 (4.5-6.2)	5.37 ± 0.57 (4.5-6.2)	5.4
Lip height	12.7	13.31 ± 0.55 (12.7-14.2)	13.28 ± 0.51 (12.7-14.1)	12.7
Lip diameter	53.3	51.98 ± 1.52 (50-53.3)	48.05 ± 1.78 (46.6-50.0)	53.3
Mid-body diameter	76.6	87.83 ± 5.73 (76.4-93.2)	77.07 ± 3.00 (73.3-79.9)	93.2
Anal diameter	56.8	55.22 ± 1.53 (53.21-58.4)	68.02 ± 1.54 (66.6-69.9)	56.8
Length of buccal cavity	66.6	64.81 ± 3.50 (56.61-66.6)	54.49 ± 2.50 (50-56.6)	66.6
Diameter of buccal cavity	33.3	34.52 ± 1.60 (33.3-36.6)	27.56 ± 1.65 (26.4-30)	36.6
Position of dorsal tooth from buccal cavity base	14.1	14.10 ± 0 14.1	14.10 ± 0 (14.1)	14.1
% of dorsal tooth of buccal cavity length	21.2	21.82 ± 1.27 (21.2-24.9)	25.92 ± 1.23 (24.9-28.2)	21.2
Position of amphid from the anterior end	13.5	13.46 ± 0.75 (12.3-14.4)	13.63 ± 0.56 (12.9-14.2)	16.7
Diameter of amphidial aperture	4.9	5.00 ± 0.22 (4.6-5.4)	4.96 ± 0.23 (4.6-5.2)	7.1
Position of excretory pore from anterior end	190.6	207.11 ± 9.46 (89-215.5)	208.33 ± 9.46 (190.6-215.3)	210.3
Length of oesophagus	589.4	599.26 ± 9.64 (589.2-612.7)	535.65 ± 29.69 (492.8-582.8)	609.4
Length of cardia	17.2	16.45 ± 0.92 (15.2-18.0)	16.47 ± 1.04 (15.64-18.0)	11.8
Diameter of cardia	36.8	37.09 ± 1.67 (35.7-41.0)	36.30 ± 0.47 (35.7-36.8)	29.0
Position of nerve ring from anterior end	166.5	166.93 ± 23.09 (99.9-183.2)	157.11 ± 7.61 (149.9-166.5)	183.2
D	27.0	27.20 ± 0.93 (25.7-28.7)	27.01 ± 0.77 (25.7-27.9)	26.0
AS1	26.3	27.60 ± 0.82 (26.3-29.0)	27.60 ± 0.62 (26.7-28.3)	26.6
AS2	27.4	28.63 ± 0.88 (27.4-30.1)	28.63 ± 0.66 (27.68-29.8)	27.5
PS1	55.3	47.80 ± 4.07 (40-55.3)	46.61 ± 4.11 (40.0-51.34)	46.6
PS2	60.5	52.29 ± 3.66 (46.3-60.5)	51.76 ± 2.31 (49.6-55.6)	51
Glandulurum	465.5	468.94 ± 15.51 (444.4-498.7)	468.90 ± 19.45 (444.4-498.7)	456.5
Anterior gonad	377.8	425.18 ± 24.26 (377.8-466.2)	–	523.0

Table 1 (continued). Morphometric data on population of *Iotonchus cuticaudatus* n. sp. (n = numbers, all measurements are in µm, only 'L' in mm; values for paratypes are mean ± SD; * holotype and five paratype females have intra-uterine eggs).

	Holotype female	Paratype females (n = 12)	Paratype males (n = 7)	Female with double vulva
Uterus	122.2	144.20 ± 14.07 (122.2-165.3)	–	115.8
Oviduct	150.0	149.89 ± 6.08 (145-162.9)	–	297.3
Ovary	105.6	131.09 ± 13.42 (105.6-155.9)	–	110.1
Fused gonad	–	–	–	93.2
Length of intra-uterine egg*	118.2	131.37 ± 9.50 (118.0-145.6)	–	–
Diameter of intra-uterine egg*	54	57.54 ± 7.02 (48.6-67.3)	–	–
Posterior gonad	411.1	432.19 ± 18.70 (409.6-459.7)	–	586
Uterus	116.7	30.84 ± 13.35 (105.6-160)	–	137.3
Oviduct	155.6	127.51 ± 18.14 (110.6-162.2)	–	295.6
Ovary	138.9	173.89 ± 25.63 (131.7-198.1)	–	153.1
Length of intra-uterine egg	116.7	119.47 ± 14.65 (101.3-150.2)	–	–
Diameter of intra-uterine egg	61.0	63.83 ± 5.07 (54.4-70.1)	–	–
Vulval Length	1831.5	1792.42 ± 50.29 (1700-1860)	–	–
Vulval Length 1	–	–	–	1738.3
Vulval Length 2	–	–	–	1831.5
Total length of vagina	31.6	31.53 ± 1.03 (29.7-32.8)	–	–
Pars proximalis vagina	22.1	22.31 ± 0.88 (20.2-23.3)	–	–
Pars refringes vagina	6.9	6.53 ± 0.46 (5.8-6.9)	–	–
Pars distalis vagina	2.6	2.70 ± 0.09 (2.6-2.8)	–	–
cw	10.5	10.29 ± 0.47 (9.7-10.8)	–	–
Total length of vagina 1	–	–	–	30.6
Pars proximalis vagina 1	–	–	–	22.1
Pars refringes vagina 1	–	–	–	6.1
Pars distalis vagina 1	–	–	–	2.5
cw 1	–	–	–	12.4
Total length of vagina 2				37.6
Pars proximalis vagina 2	–	–	–	22.4
Pars refringes vagina 2	–	–	–	6.9
Pars distalis vagina 2	–	–	–	6.3
cw 2	–	–	–	15.11
Length of testes	–	–	1164.53 ± 117.24 (963.9-1297.3)	
Spicules	–	–	130.82 ± 4.17 (123.2-133.2)	–
Gubernaculum	–	–	30.68 ± 2.70 (26.6-33.3)	–
Ventro-median supplements	–	–	12.86 ± 1.35 (11-15)	–
Lateral guiding pieces	–	–	16.42 ± 0.60 (15.1-16.7)	–
Pre-rectum length	–	–	246.46 ± 14.97 (222.3-263.4)	–
Rectum length	25.7	25.50 ± 0.60 (24-26.1)	25.34 ± 0.74 (23.9-26.0)	36.8
Tail length	286.4	304.67 ± 32.18 (286.4-406.3)	226.96 ± 10.39 (216.5-243.1)	309.69
tail as % of body length	9.9	10.65 ± 1.10 (9.9-14.0)	8.97 ± 1.21 (6.9-10.4)	11.1

ACKNOWLEDGEMENT

We are indebted to Istvan Andrássy, Wasim Ahmad, Padma Bohra, Vlada Peneva and Q. H. Baqri for providing literature and continuous encouragement. We are also thankful to the Director, Zoological Survey of India for providing facilities for this work.

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T. Jana, A. Chatterjee, B. Manna. *Iotonchus cuticaudatus* sp. n., новый вид мононхид из Западной Бенгалии, Индия, и необычный случай обнаружения двух вульварных отверстий у самки.

Резюме. Из окрестностей Парганас в Западной Бенгалии описан новый вид рода *Iotonchus* Cobb, 1916. Всего собрано 14 самок и 7 самцов нового вида, отличающегося довольно крупными размерами тела (у самок 2,8-3,0 мм; у самцов 2,3-3,1 мм), J-образной формой тела, довольно длинной, но узкой стомой (у самок 56,6-66,6 x 33,3-36,6 мкм; у самцов 50-56,6 x 26,4-30,0 мкм) с небольшим дорсальным зубом у основания стомы, амфидельфной половой системой самок, загнутыми яичниками, наличием сфинктера между яйцеводом и маткой, наличием окловульварных папилл у самок, наличием каудальной поры и отчетливых каудальных желез, терминальной спиннеретой и утолщенной кутикулой на оконечности хвостового конца. У одной из самок отмечено формирование двух вульварных отверстий.