

## DESCRIPTION OF TWO NEW MONHYSTERID SPECIES (NEMATODA) FROM KEOLADEO NATIONAL PARK, RAJASTHAN, INDIA

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**Summary.** Two new monhysterid species collected from a ditch, rich in wet humus and organic matter, in Keoladeo National Park, Rajasthan, India, have been described and illustrated. *Monhystrella kerryi* sp. n. is characterised by small-sized females (L = 440-510  $\mu$ m, a = 21-26, b = 5.52-6.41, c = 3.49-4.32, c' = 7.86-10, V = 57-63), smooth cuticle, funnel-shaped stoma with a small dorsal tooth, posterior vulva and presence of an ovoid glandular body opening distally into vaginal lumen. The other species, *Hofmaenneria keoladeoensis* sp. n., is characterised by a large-sized body (L = 1008-1243  $\mu$ m; a = 43-47; b = 6.09-6.40; c = 5.94-6.12; c' = 10.2-10.27; V = 69-71), distinctly annulated cuticle, large and well developed labial setae, sexual dimorphism not found in amphidial apertures, relatively posterior vulva, presence of three glandular bodies opening into vaginal lumen distally and males with 23-25  $\mu$ m long spicules.

The monhysterid genera *Monhystrella* Cobb, 1918 and *Hofmaenneria* Schneider, 1940 belong to the super-families Monhysteroidea de Man, 1876 and Sphaerolaimoidea Filipjev, 1918, and the families Monhysteridae de Man, 1876 and Sphaerolaimidae Filipjev, 1918, respectively. Among the known species of *Monhystrella*, *M. gracilis* Khera, 1966, *M. stewarti* (Khera, 1971) Andr assy, 1981 and *M. longistoma* (Khera, 1971) Andr assy, 1981 have been described from India. The genus *Hofmaenneria* Schneider, 1940 with type species *H. branchystoma* (Hofm anner in Hofm anner and Manzel, 1914) Schneider, 1940 lacks any record from the Indian subcontinent. This is the first report of the genus from India.

During a survey of nematodes from Keoladeo National Park (Rajasthan), a Ramsar site, *Monhystrella kerryi* sp. n. and *Hofmaenneria keoladeoensis* sp. n. were found and are described and illustrated herein.

### MATERIALS AND METHODS

The nematodes were extracted from the soil samples using sieving and decantation and modified Baerman's funnel techniques. For light microscopy (LM), nematodes were fixed in 4% formaldehyde, processed to anhydrous glycerine and mounted on slides. They were later measured with an ocular micrometer. Drawings were made using a drawing tube mounted on an Olympus Trinocular DIC Microscope BX51 and photographs were taken using an Olympus digital camera, Camedia C-3030.

### DESCRIPTIONS

#### *MONHYSTRELLA KERRYI* sp. n.

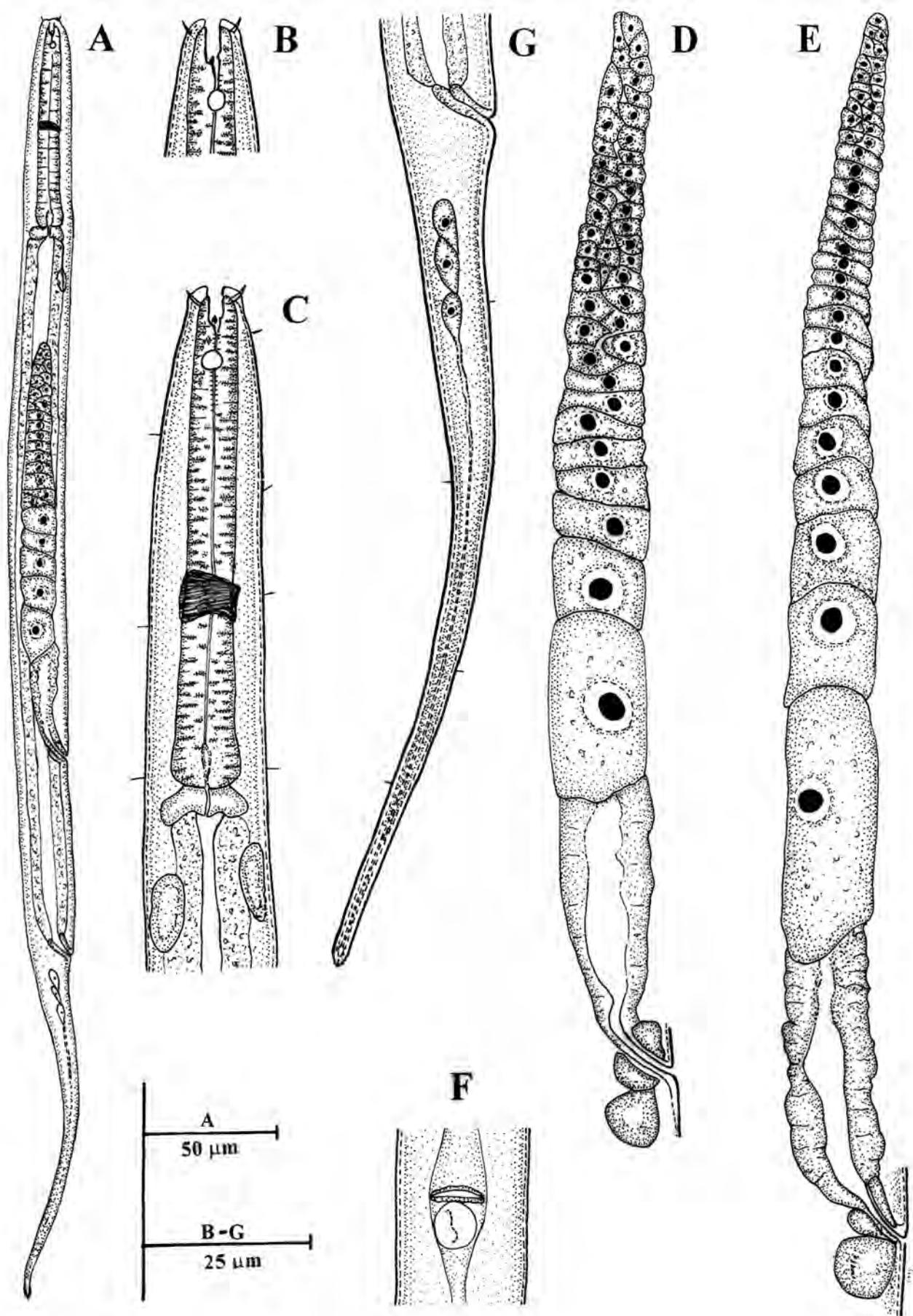
(Figs. 1 and 2)

*Holotype female.* L = 0.44 mm; a = 22.20; b = 5.76; c = 3.79; c' = 8.35; V = 59.45.

*Paratype females* (n = 7). L = 0.47 $\pm$ 0.23 (0.44-0.51) mm; a = 23.04 $\pm$ 1.78 (21-26); b = 5.99 $\pm$ 0.34 (5.52-6.41); c = 3.83 $\pm$ 0.28 (3.49-4.32); c' = 8.76 $\pm$ 0.83 (7.86-10.01); V = 59.42 $\pm$ 2.08 (57.20-63.13); G1 = 34.60 $\pm$ 1.94 (32-37); stoma length = 6.14 $\pm$ 0.89 (5-7)  $\mu$ m; pharyngeal length = 80 $\pm$ 6.58 (73-90)  $\mu$ m; tail length = 124.70 $\pm$ 7.08 (118-133)  $\mu$ m.

*Female.* Body small-sized, slender, tapering at both extremities, more towards posterior end, straight to slightly curved ventrally upon fixation. Cuticle smooth without striations as observed in LM. Somatic setae present; cervical setae 8-10, about 3  $\mu$ m long. Lip region continuous with adjoining body. Lips amalgamated, low with papilliform inner labial sensilla. Outer labial sensilla small, setose; cephalic sensilla setose, post-labial, 2.5-3  $\mu$ m long or 1/3<sup>rd</sup> of lip region diameter. Amphidial apertures circular, 2.5-3.0  $\mu$ m across or 1/3<sup>rd</sup> of corresponding body diameter, located 12-15  $\mu$ m or 1.7-1.8 lip diameters from anterior end. Cheilostom prominent, rest of stoma funnel-shaped with a very small tooth at the base of dorsal wall, surrounded by pharyngeal tissue. Pharynx almost cylindroid ending in an ovoid, non-valvate basal bulb of 12-13 x 11-12  $\mu$ m dimension. Nerve ring at 57%-72% of pharyngeal length. Body at pharyngeal base about 2.0-2.5 times lip diameter. Excretory pore 10-15  $\mu$ m posterior to nerve ring. Cardia 4-6  $\mu$ m long, flanked by glandular cells. Paired pseudo-coelomocytes of 10-12  $\mu$ m length, located 12-14  $\mu$ m

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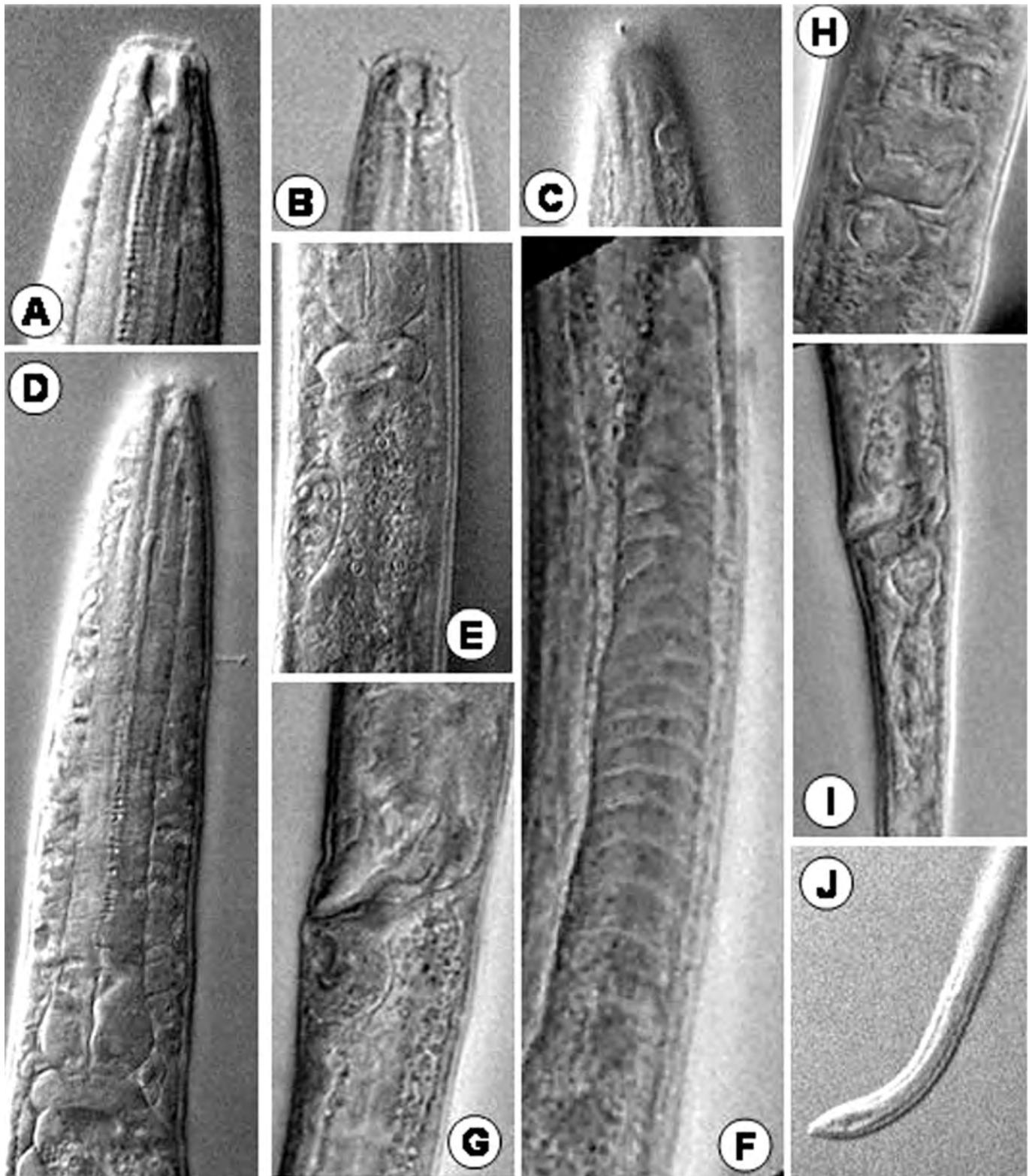


**Fig. 1.** *Monbystrella kerryi* sp. n. A: Entire female; B: Anterior end; C: Pharyngeal region; D, E: Female reproductive system; F: Vulval region (ventral); G: Tail region.

posterior to base of cardia. Intestine thin-walled, transparent, granular with wide lumen. Rectum 10-12  $\mu\text{m}$  long or 0.7-0.8 times anal body diameter. Anal opening crescent-shaped.

Reproductive system monodelphic, prodelphic. Ovary outstretched, at right side of intestine, distal end

reaching close to pseudocoelomocytes. Oocytes arranged in two rows in germinal zone. Intra-uterine eggs 30-40  $\times$  12-15  $\mu\text{m}$  in dimension, usually one present at a time. Vagina 12  $\mu\text{m}$  long or 1.5 times corresponding body diameter, sclerotized with thickened walls. Vulva post-equatorial, transverse slit. Posteriorly placed ovoid glan-



**Fig. 2.** *M. kerryi* sp. n. A-C: Anterior end; D: Pharyngeal region; E: Posterior pharyngeal region with pseudocoelomocyte; F: Distal end of ovary; G: Vulval region (lateral); H: Vulval region (ventral); I: Anal region; J: Tail tip.

dular body (5-6  $\mu\text{m}$ ) opening into vaginal lumen distally. Tail elongate conoid, ventrally curved, tapering gradually to narrow terminus, about 1.6-2.1 times longer than vulva-anus distance. Three linearly arranged caudal glands with defined nuclei, opening terminally through a long lancet-shaped spinneret (5-6  $\mu\text{m}$ ). Caudal setae 3-4.

*Male.* Not found.

*Type habitat and locality.* Soil samples rich in organic manure collected from a ditch near 'Man Sarovar', Keoladeo National Park, Bharatpur, Rajasthan, India.

*Type Specimens.* Holotype and seven paratype females on slide *Monhystrella kerryi* sp. n. No. 1B/1-4 deposited in the 'Nematode Collection' of the Department of Zoology, Aligarh Muslim University, Aligarh, India. Two paratype females on slide '*Monhystrella kerryi* sp. n. No. 1B/5' deposited at the Laboratory of Nematology, Wageningen University and Research Center (WUR), 6700 ES Wageningen, The Netherlands.

*Diagnosis and Relationships.* *Monhystrella kerryi* sp. n. is characterised by a small-sized body, smooth cuticle, continuous lip region, 8-10 cervical setae, funnel-shaped stoma armed with a small dorsal tooth, circular amphids placed at posterior level of stoma, a pair of pseudocoelomocytes posterior to cardia, relatively posterior vulva, sclerotized, thickened vaginal walls, an ovoid glandular body opening distally into vaginal lumen and a long tail 7-10 times anal body diameter long.

*Monhystrella kerryi* sp. n. most closely resembles *M. iranica* Schiemer, 1965 but differs in having considerably more posterior vulva, smaller stoma, larger amphids in relation to corresponding body diameter and shorter terminal spinneret ( $V = 48-52\%$ , stoma 7-9  $\mu\text{m}$ , amphids 1/5th of corresponding body diameter, spinneret 7-10  $\mu\text{m}$  long in *M. iranica* Schiemer, 1965).

The new species also comes close to *M. longistoma* (Khera, 1971) Andr ssy, 1981 but can be differentiated in having greater 'V' value, smaller stoma, sclerotized, thickened vaginal walls, post-vulval glandular body opening distally into vaginal lumen and longer tail/vulva-anus distance ratio [ $V = 47-50\%$ , stoma 12-14  $\mu\text{m}$  long, vaginal walls not thickened, post-vulval glandular body not reported and tail/vulva-anus distance = 1 in *M. longistoma* (Khera, 1970) Andr ssy, 1981].

*Monhystrella kerryi* sp. n. differs from *M. gracilis* Khera, 1966 in having greater body length, smaller 'a' value, greater 'V' value, presence of tooth in stoma, a longer vagina with sclerotized, thickened walls, post-vulval glandular body opening distally into vaginal lumen and considerably longer rectum ( $L = 0.38-0.44$  mm,  $a = 37-42$ ,  $V = 52-54\%$ , tooth absent in stoma, vagina 5  $\mu\text{m}$  without thickened walls, post-vulval glandular body not reported and rectum 5  $\mu\text{m}$  long in *M. gracilis* Khera, 1966).

From *M. paramacrura* (Meyl, 1953) Andr ssy, 1968, the new species differs in having greater 'V' value, smaller 'c' value, longer cephalic setae, relatively anterior amphids, thick vaginal walls, post-vulval glandular body opening distally into vaginal lumen and absence of

males [ $V = 47-52\%$ ,  $c' = 10-14$ , cephalic setae 1  $\mu\text{m}$  long, amphids 2-2.5 times lip diameter from anterior end, vagina thin-walled, glandular body not reported and males found in *M. paramacrura* (Meyl, 1953) Andr ssy, 1968].

*Etymology.* The species is named in honour of the Nematologist, Prof. Brian Kerry, Rothamsted Research, Harpenden, Herts, England.

#### *HOFMAENNERIA KEOLADEOENSIS* sp. n.

(Figs. 3 and 4)

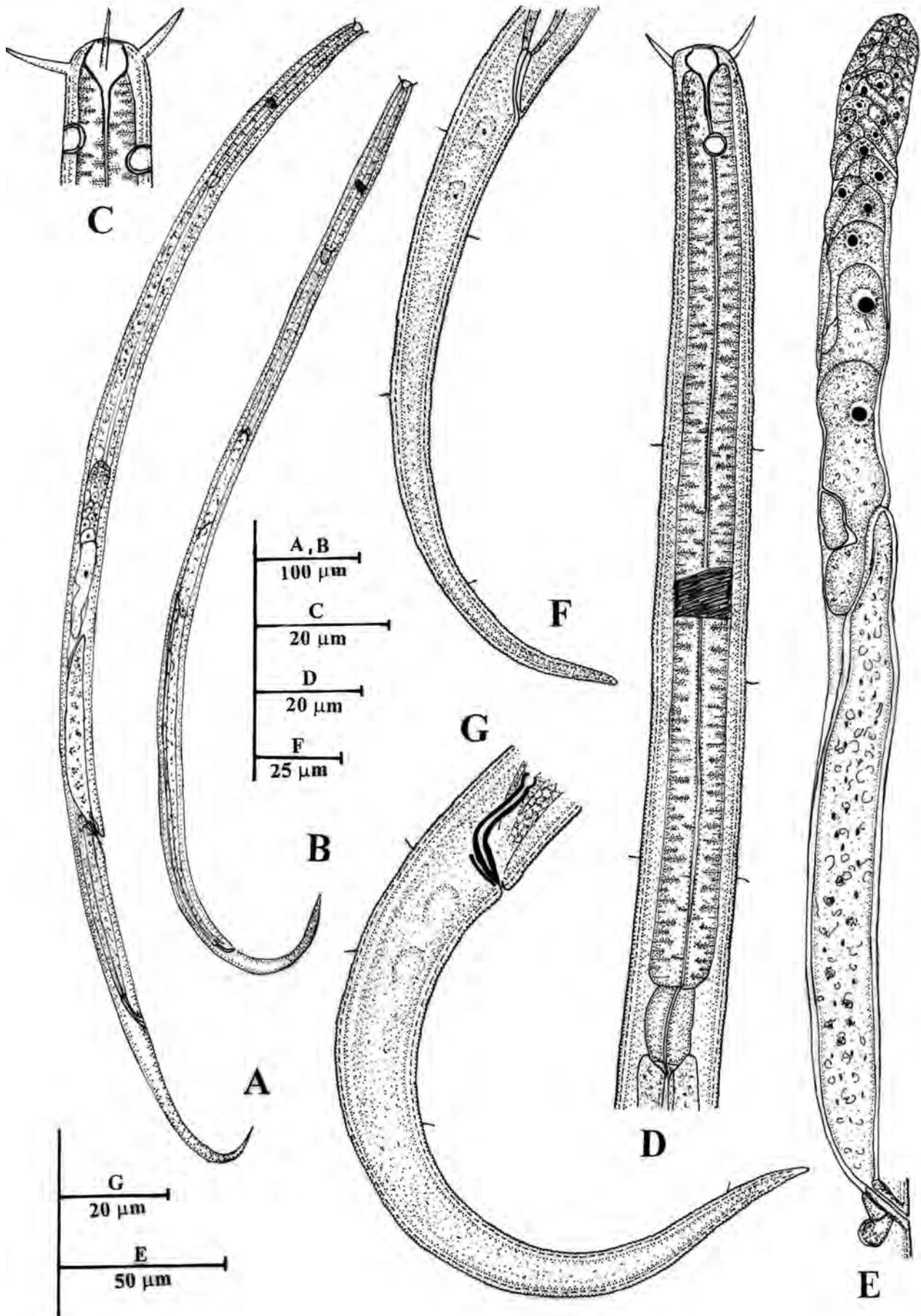
*Holotype female.*  $L = 1.16$  mm;  $a = 48.54$ ;  $b = 6.19$ ;  $c = 5.73$ ;  $c' = 11.27$ ;  $V = 69.52$ .

*Paratype females* ( $n = 2$ ).  $L = 1.17 \pm 0.56$  (1.13-1.21) mm;  $a = 45.27 \pm 2.82$  (43-47);  $b = 6.23 \pm 0.21$  (6.09-6.40);  $c = 6.03 \pm 0.12$  (5.94-6.12);  $c' = 10.23 \pm 0.04$  (10.23-10.27);  $V = 70.48 \pm 0.96$  (69-71);  $G1 = 35.33 \pm 7.38$  (30.11-40.56); stoma length =  $10.51 \pm 2.12$  (9-12)  $\mu\text{m}$ ; pharyngeal length =  $186.52 \pm 13.43$  (177-196)  $\mu\text{m}$ ; tail length =  $195.54 \pm 1.34$  (185-204)  $\mu\text{m}$ .

*Paratype males* ( $n = 5$ ).  $L = 1.12 \pm 0.92$  (1.00-1.24) mm;  $a = 53.01 \pm 3.36$  (47-57);  $b = 6.31 \pm 0.23$  (6.11-6.71);  $c = 7.99 \pm 0.23$  (7.73-8.28);  $c' = 6.88 \pm 0.40$  (6.50-7.35);  $T = 65.21 \pm 1.23$  (64-69); stoma length =  $8.24 \pm 1.09$  (7-10)  $\mu\text{m}$ ; pharyngeal length =  $179.24 \pm 9.85$  (167-187)  $\mu\text{m}$ ; tail length =  $140.43 \pm 9.65$  (130-150)  $\mu\text{m}$ .

*Female.* Body large-sized, slender, tapering at both extremities, more towards posterior end, straight to ventrally curved upon fixation. Cuticle 0.5-1.0  $\mu\text{m}$  thick at mid body, finely annulated, annules 0.5  $\mu\text{m}$  wide. Lateral field with two closely placed alae. Lip region continuous with adjoining body, lips amalgamated. Inner labial sensilla papilliform, outer labial sensilla setose, cephalic sensilla elongate, setose, 9-10  $\mu\text{m}$  long or about lip diameter. Amphidial apertures circular, 5  $\mu\text{m}$  in diameter or about 40-50% of corresponding body diameter, located 16-20  $\mu\text{m}$  or 1.5-2.0 times lip region diameter from anterior end. Stoma barrel-shaped, 9-12  $\mu\text{m}$  long and 7.5-9  $\mu\text{m}$  wide. Pharyngeal tissue surrounding 1/4<sup>th</sup> of stomal length. Pharynx cylindroid, muscular with basal part widened. Nerve-ring at 105-120  $\mu\text{m}$  from anterior end or 59-61% of pharyngeal length. Excretory pore obscure. Cardia tongue-shaped, 10-15  $\mu\text{m}$  long. Paired pseudocoelomocytes of 10-14  $\mu\text{m}$  length, located 15-20  $\mu\text{m}$  posterior to cardia. Intestine granular with wide lumen. Rectum 0.7-1.3 times anal body diameter, thick-walled, provided with sphincter muscles.

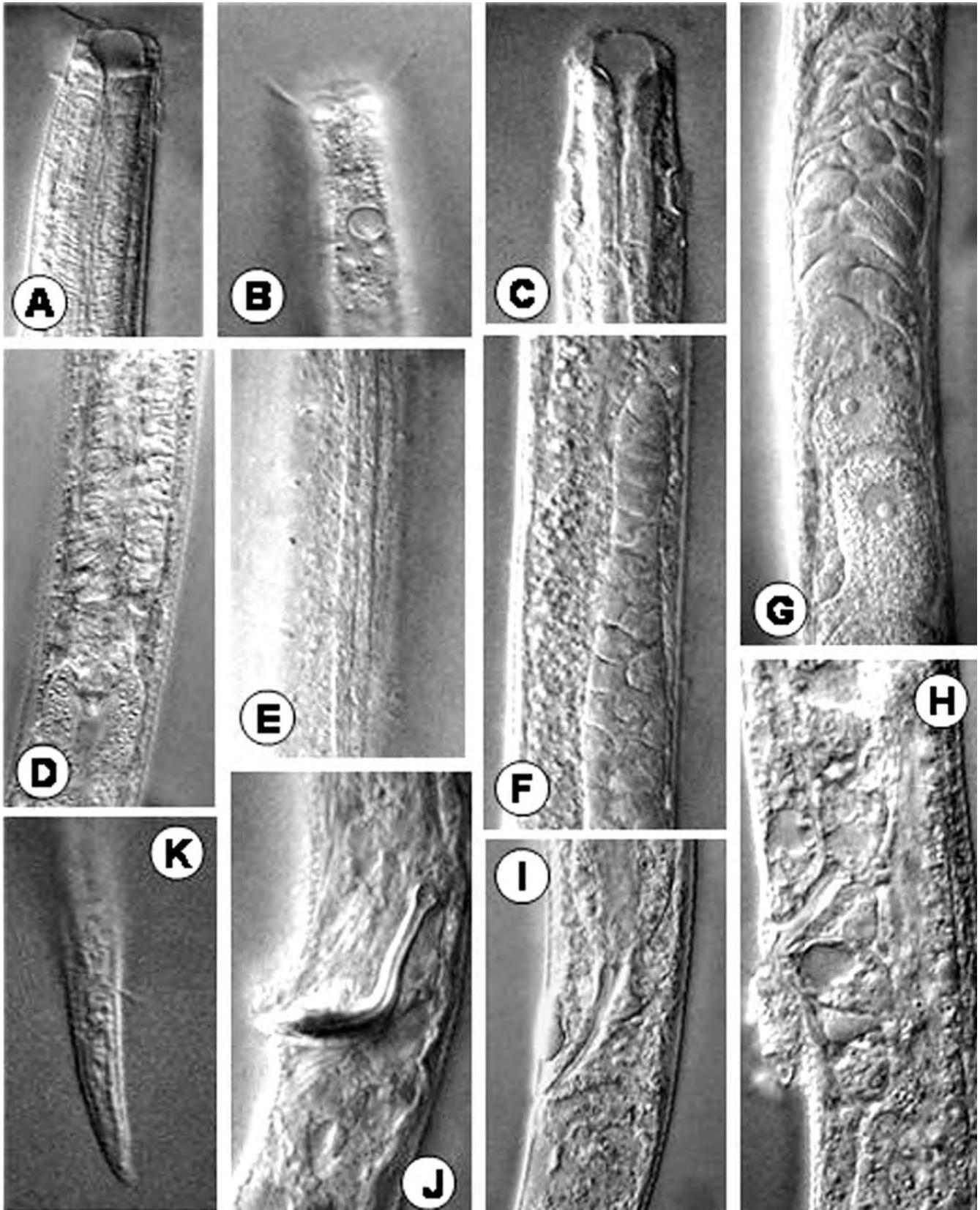
Reproductive system monodelphic, prodelphic. Ovary outstretched, located at right side of intestine. Distal end of ovary broad and thick with oocytes arranged in single row in one specimen. In other specimens oocytes arranged in multiple rows. Mature oocyte 50-75 x 19-23  $\mu\text{m}$  in dimension. Oviduct attached with genital tract adaxially on the dorsal side. Uterus thick-walled, usually filled with sperms. Vagina anteriorly directed, thick-walled, about 14-16  $\mu\text{m}$  long, more than half of corresponding body diameter. Three glandular



**Fig. 3.** *Hofmaenneria keoladeoensis* sp. n. A: Entire female; B: Entire male; C: Anterior end; D: Pharyngeal region; E: Female reproductive system; F: Female tail; G: Male tail.

bodies of 10-12 x 10-11  $\mu\text{m}$  dimension opening into vaginal lumen distally. Vulva post-equatorial, a broad transverse slit. Vulva-anus distance 142-175  $\mu\text{m}$ . Tail

elongate conoid, ventrally curved, tapering gradually into beak-like tip, about 1.2-1.4 times longer than vulva-anus distance. Three linearly arranged caudal glands,



**Fig. 4.** *H. keoladeoensis* sp. n. A-C: Anterior end; D: Posterior pharyngeal region; E: Lateral field; F,G: Distal end of ovary; H: Vulval region; I: Anal region; J: Cloacal region; K: Tail end.

opening through terminal pore. Caudal setae 4-5.

*Male.* Body curved ventrally, more sharply in the posterior region. Similar to female in general morphology. Testis single, outstretched. Spicules 23-25  $\mu\text{m}$  long, slender, capitate, 1-1.3 times anal body diameter long, bent ventrally at right angle, distal half slightly thicker than proximal. Gubernaculum simple, 7-9  $\mu\text{m}$  long. Anterior cloacal lip prominently protruded. Tail similar in shape but slightly shorter than that of female.

*Type habitat and locality.* Soil samples rich in humus and organic matter collected from a ditch at Mrig Tal location of Keoladeo National Park, Bharatpur city, state of Rajasthan, India.

*Type Specimens.* Holotype, two paratype females and five paratype males on slide 'Hofmaenneria keoladeoensis' sp. n. No. 1A/1-5' deposited in 'Nematode Collection' of the Department of Zoology, Aligarh Muslim University, Aligarh, India. One paratype female and one paratype male on slide 'Hofmaenneria keoladeoensis' sp. n. 1A/6' deposited at the Laboratory of Nematology, Wageningen University and Research Center (WUR), 6700 ES Wageningen, The Netherlands.

*Diagnosis and Relationships.* *Hofmaenneria keoladeoensis* sp. n. is characterised by a large-sized body; fine annulated cuticle; large and well developed labial setae; barrel-shaped stoma; circular amphids not showing sexual dimorphism; paired pseudocoelomocytes posterior to cardia; relatively posterior vulva; three glandular bodies opening into vaginal lumen distally; a long conoid tail and males with short spicules.

*Hofmaenneria keoladeoensis* sp. n. most closely resembles *H. branchystoma* (Hofmänner in Hofmänner and Menzel, 1914) Schneider, 1940 but differs in having greater 'a', 'c' and 'V' values; shorter spicules and elongate conoid tail with beak-like terminus [a = 30-40, c' = 7-8, V = 60-67%, spicules 40  $\mu\text{m}$  long and tail conical with swollen terminus in *H. branchystoma* (Hofmänner in Hofmänner and Menzel, 1914) Schneider, 1940].

The new species differs from *H. niddensis* (Skwarra, 1921) Schneider, 1940 in having greater 'a' and 'V' values, shorter cardia, similar amphids in both sexes, body cuticle of uniform thickness in male, shorter spicules and elongate conoid tail with acute terminus [a = 35-41, V = 61-64%, cardia = 20  $\mu\text{m}$  long, sexual dimorphism in amphids (smaller in females), cuticle thickened in the region of pre-anal organ in male, spicules 30-35  $\mu\text{m}$  long and elongate conoid tail with club-shaped terminus in *H. niddensis* (Skwarra, 1921) Schneider, 1940].

*Hofmaenneria keoladeoensis* sp. n. differs from *H. hazanensis* Mulvey, 1969 in having greater body length; greater 'b', 'c', 'c' and 'V' values and presence of males (L = 0.3-0.4, b = 4.2-4.4, c = 4.0-4.6, c' = 15, V = 59-60%, males not reported in *H. hazanensis* Mulvey, 1969).

*Etymology.* The species name is based on its locality, the Keoladeo National Park.

## ACKNOWLEDGEMENT

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