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# FOUR NEW SPECIES OF NEMATODES (NEMATODA : DORYLAIMIDA AND ISOLAIMIDA) FROM RAJASTHAN, INDIA

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## INTRODUCTION

In the present paper four new species of Plant and Soil nematodes belonging to Order Dorylaimida and Isolaimida have been described and illustrated. During survey (2005-06) to districts of Rajasthan, large number of soil samples around roots of various host plants have been collected by the first author. These samples yielded wide variety of nematodes and few species have been found as new to science out of which *Dorylaimus murlii* sp. n., *Ischiodorylaimus baqrii* sp. n., *Nygolaimus shamimi* sp. n. and one species of very rare and curious genus (*Isolaimium*) of nematodes *Isolaimium rajasthanicus* sp. n. has been described and illustrated. This genus has been reported for the first time from India.

## MATERIAL AND METHOD

The nematodes were killed and fixed in hot 4% formalin and mounted on slides in anhydrous glycerine.

### *Dorylaimus murlii* sp. n.

(Fig. 1)

*Material examined* : 2 females, 2 males.

*Measurements* : *Holotype female* : L = 2.30 mm; a = 33; b = 4.9; c = 15.9; c' = 4.1; V = 44; odontostyle = 29 µm; odontophore = 35 µm; guiding ring = 18µm. pharynx = 465 µm; prerectum = 205 µm; rectum = 40 µm; tail = 145 µm; anal body width = 35 µm.

*Paratype female* (n = 1) : L = 2.37 mm; a = 45; b = 4.8; c = 14.7; c' = 6.4; V = 46; odontostyle = 30 µm; odontophore = 31 µm; guiding ring = 19 µm; pharynx = 485 µm; prerectum = 194 µm; rectum = 40 µm; tail = 161 µm; anal body width = 25 µm.

*Paratype males* (n = 2) : L = 2.40-281 mm; a = 35; b = 5; c = 109-122; c' = 4.1; T = 50-55; odontostyle = 32 µm; odontophore = 34-36 µm; guiding ring = 19-20 µm; pharynx = 465-550 µm; prerectum = 300-325 µm; spicules 54-58 µm; lateral guiding pieces = 18-20 µm; ventromedian supplements 24-28; tail = 22 µm; anal body width = 35-40 µm.

*Female* : Body slightly ventrally curved in posterior half upon fixation, tapering at both ends, more in the anterior region. Cuticle finely straited transversally, marked with 32-34 longitudinal lines, its thickness 4-8 µm (thickest at tail). Lateral hypodermal chords about 1/3rd-1/4th of body width near middle. Ventral body pores distinct 7-9 in oesophageal region and below oesophageal region 10-11 ventral body pores. Lip region narrower than body, marked with slight depression. Amphids stirrup shaped; their apertures 6-7 µm from anterior end and occupying 60-66% of corresponding body-width. Fussus 15 µm from amphidial slits. Odontostyle 2.1-2.4 of lip-region width; odontostyle aperture 6-9 µm or 20-25% of odontostyle length. Guiding ring located at 1.5-1.6 lip region width from anterior extremity. Odontophore 1.0-1.2 times odontostyle length. Nerve ring encircles slender part of pharynx at 150-155 µm or 34-36% of neck length from anterior end. Basal expanded part of pharynx occupying 42-55% of neck length. Cardia 12 × 12 µm, conoid with rounded tip. Oesophageal gland nuclei and their orifices are as given below :

DO = 58.43-58.95; DN = 59.00-59.50; DO-DN = 0.55-0.57; $S_1N_1$ = 62.23-63.50; $S_1N_2$ = 72.90-73.45; $S_2O$ = 79.43-80.51; $S_2N$ = 80.95-81.00.

Vulva a transverse slit; Vaigna 25-26 µm across the body or about 1/4th to 1/3rd of the body width, with moderately sclerotized distal region. Reproductive system amphidelphic, uterus and oviduct separated by sphincter; oocytes arranged first in single row then in double rows and in multiple rows in germinal region. Prerectum 5.8-6.0 and body-with long. Rectum 0.77-1.1 anal body-width long. Tail elongate conoid with rounded terminus, 4.1-5.3 anal body-width long; with 2 caudal pores on each side.

*Male* : Similar to female in general morphology except in tail shape and reproductive system. Spicules 2.1-2.4 anal body-width long medially. Lateral guiding pieces well developed, 18-20 µm long. Supplements consists of an adanal and 24-28 contiguous series of ventromedians. Copulatory muscles extending beyond supplement region. Prerectum 8.1-8.5 anal body-width long. Tail short, bluntly rounded, 0.88-0.92 anal body-width long, 2 caudal pores on each side.

*Type specimens* : Collected in September 2005. Holotype female along with one paratype male and one paratype female and male on slide no. IV/1944-45.

*Type habitat and Locality* : Collected from soil around roots of jowar (*Sorghum vulgare*) at district Alwar, Rajasthan, India.

*Discussion* : *Dorylaimus murlii* sp. n. differs from *Dorylaimus siddiqii* Ahmad & Jairajpuri, 1982 in having longer body length and spicules, shorter odontostyle, anteriorly situated vulva,

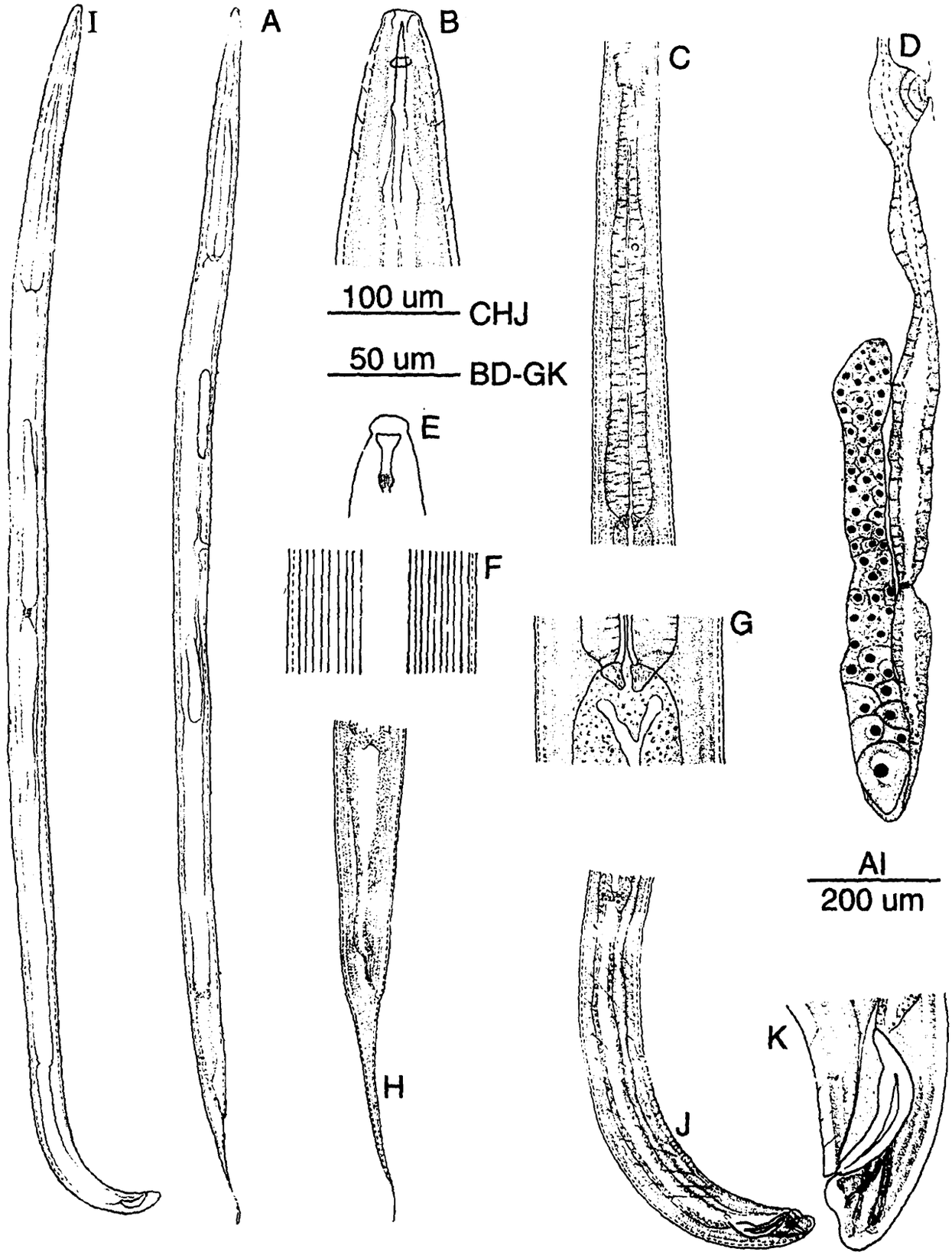


**Fig. 1.** *Dorylaimus murlii* sp.n. Female (A-H) A : Entire female, B : Anterior end, C : Pharynx, D : Posterior genital Branch of female, E : Amphid, F : Longitudinal Lines, G : Cardiac Region, H : Posterior end of tail. Male (I-K) I : Entire male J-K : Posterior end of Tail.

lesser number of ventromedian supplements in male (L = 2.17-2.23 mm; odontostyle = 37 µm; V = 49; spicules 50-51 µm; ventromedian supplements 31-34 (32) in *D. siddiqii*).

*Dorylaimus murlii* sp. n. differs from *Dorylaimus thornei* Andrassy, 1969 in having shorter body length, odontostyle and absence of vulval papillae (L = 2.7-2.8 mm; odontostyle 40 µm; a pair of vulval papillae on each side of vulva in *D. thornei*).

***Ischiodorylaimus baqrii*** sp. n.

(Fig. 2)

*Material examined* : 1 females, 2 males.

*Measurements* : *Holotype female* : L = 3.05 µm; a = 38; b = 4.3; c = 15; c' = 5.2; V = 45; odontostyle = 44µm; odontophore = 45 µm; guiding ring = 23 µm; pharynx = 705 µm; prerectum = 245 µm; rectum = 50 µm; tail = 228 µm; anal body width = 47 µm.

*Paratype male* (n = 2) : L = 2.70 mm; a = 37; b = 4.0; c = 77.2; c' = 0.81; T = 55; odontostyle = 44 µm; odontophore = 44 µm; guiding ring = 22 µm; pharynx = 674 µm; prerectum = 325 µm; spicules = 85 µm; lateral guiding pieces = 13 µm; ventromedian supplements = 21 + 5 + 15; tail = 35; anal body width = 43 µm.

*Female* : Body slightly ventrally curved in posterior half upon fixation, tapering more in posterior region. Cuticle finely striated transversely, marked with 42 longitudinal lines, its thickness 3-5 µm; (thickest at tail). Lateral hypodermal chords about 1/3rd of body-width in middle. Ventral and dorsal body pores 10-22 in pharyngeal region respectively. Lip region narrower, marked by depression. Amphids stirrup-shaped, their apertures 10 µm from anterior end and occupying 58% of corresponding body-with. Fussus 20 µm from amphidial slits. Odontostyle 2.4 lip region-width long; aperture 15 µm or 34% of odontostyle length. Guiding ring located at 1.2 lip region-width from anterior end. Odontophore 0.9-1.0 odontostyle length. Nerve ring encircles slender part of pharynx at 1% from anterior end. Basal expanded part of oesophagus occupies 49-52% of nect length. Cardia conoid with rounded tip 10 × 9 µm. Oesophageal gland nuclei and their orifices are as given below :

DO = 59.50-60.00; DN = 60.23-61.00; DO-DN = 0.73-1.00; $S_1N_1$ = 68.23-68.95; $S_1N_2$ = 73.90-74.10; $S_2O$ = 80.00-81.15; $S_2N$ = 81.95-82.00.

Vulva a transverse slit; 42 µm across or about 1/5th of corresponding body-width. Reproductive system amphidelphic. Uterus and oviduct separated by sphincter. Prerectum 5.2 anal body-width long. Rectum 1.0 anal body width long. Tail elongate conoid with rounded terminus 5.2 anal body width long, bent dorsally.

*Male* : Similar to female in general morphology except tail shape and reproductive system. Spicules 1.9 µm anal body-width long medially. Lateral guiding pieces well developed, 13 µm

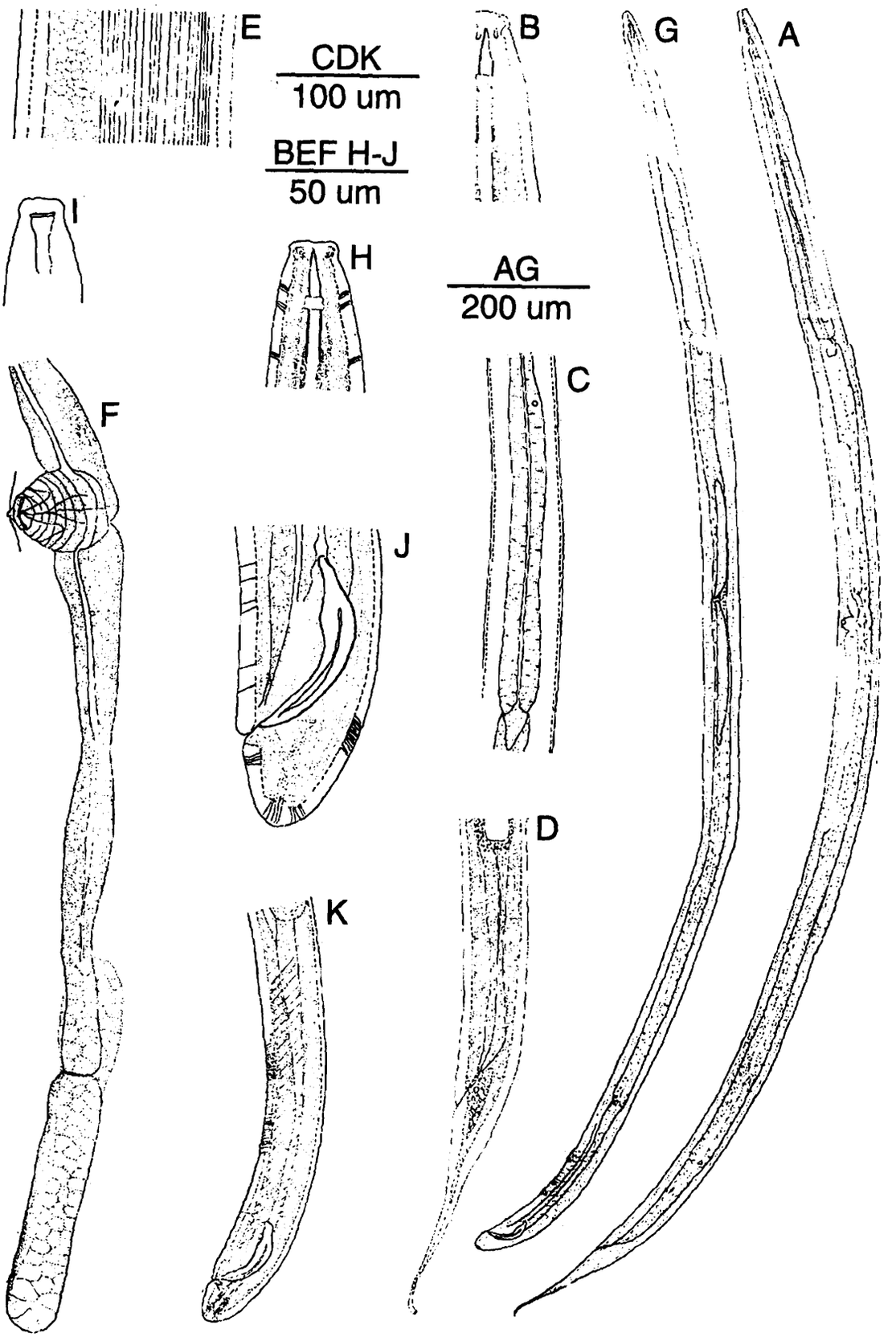


**Fig. 2.** *Ischiodorylaimus baqrii* sp.n. Female (A-F) A : Entire female, B : Anterior end, C : Pharynx, D : Posterior end of female, E : Posterior genital Branch of female.
Male (G-K) G : Entire male, H : Anterior end, I : Amphid, J-K : Posterior end of mail.

long. Supplements consist of an adanal and (21 + 5 + 15) ventromedians; arranged in two fassicles while five irregularly spaced supplements presents in between two fassicle. Subventral papillae arranged irregularly. Copulatory muscles in 69-70 bands, extending beyond supplements region. Prerectum 7.7 anal body-width long; begins before the region of ventromedian supplements. Tail short bluntly rounded, 0.81 anal body-widths long.

*Type specimens* : Collected during month of September, 2005 at Dholpur. Holotype female on slide no. IV/1943 and two paratype males on slide no. IV/1944.

*Type habitat and Locality* : Collected from soil around roots of Pearl millet. (*Pennisetum sativa*) at district Dholpur, Rājasthan, India.

*Discussion* : *Ischiodorylaimus baqrii* sp. n. differs from *Ischiodorylaimus rathori* Bohra & Baqri, 2005 in having longer odontostyle, tail and spicules and greater number of ventromedian supplements. Length of body is almost same (odontostyle 39-41 µm; tail 146-212 µm in females; spicules 65-75 µm and ventromedian supplements consisting of two groups 21-24 and 3-4 irregularly spaced supplements lying in between *Ischioddorylaimus rathori*).

From *Ischiodorylaimus paraugandanus* Khan & Ahmad, 1994 the new species differs in having shorter body length, odontostyle and spicules; greater number of ventromedian supplements (L = 4.91 mm; odontostyle 54-56 µm; female tail 321 µm; spicules 94-112 µm; lateral guiding pieces 20-22 µm; ventromedian supplements 36-38 in *Ischiodorylaimus paraugandanus*).

The new species also differs from *Ischiodorylaimus cognatus* Andrassy, 1983 in having shorter body length; tail and spicules and arrangement and number of ventromedian supplements (L = 4.0-4.3 mm; tail 70-80 µm in females; spicules 90-92 µm and ventromedian supplements consisting of two groups and eleven separated one lying in between in *T. cognatus*).

### ***Nygolaimus shamimi*** sp. n.

(Fig. 3)

*Material examined* : 5 females.

*Measurements* : *Holotype female* : L = 1.05 mm. a = 42; b = 3.8; c = 58; V = 40; tooth = 4 µm; pharynx = 275 µm; prerectum = 25 µm; rectum = 17 µm; tail = 18 µm; anal body-width = 18µm.

*Paratype female* (n = 4) : L = 1.09-1.13 mm; a = 42-43; b = 3.2-3.8; c = 54-68; V = 40-43; tooth 3-4.5; pharynx = 277-279 µm; prerectum = 25-27 µm; rectum = 15-16 µm; tail = 16-20 µm; anal body-width = 17-19 µm.

*Female* : Body almost straight upon fixation; tapering towards both extremities. Cuticle 2-4 µm thick (thickest at tail). Lateral hypodermal chords 1/3rd-1-4th of body diameter. Lip region distinctly set off from body contour. Lips rounded. Amphids cup-shaped; at 7 µm from anterior end, with slit like apertures occupying 46-47% of corresponding body width. Tooth 3-4.5 µm; deltoid type.

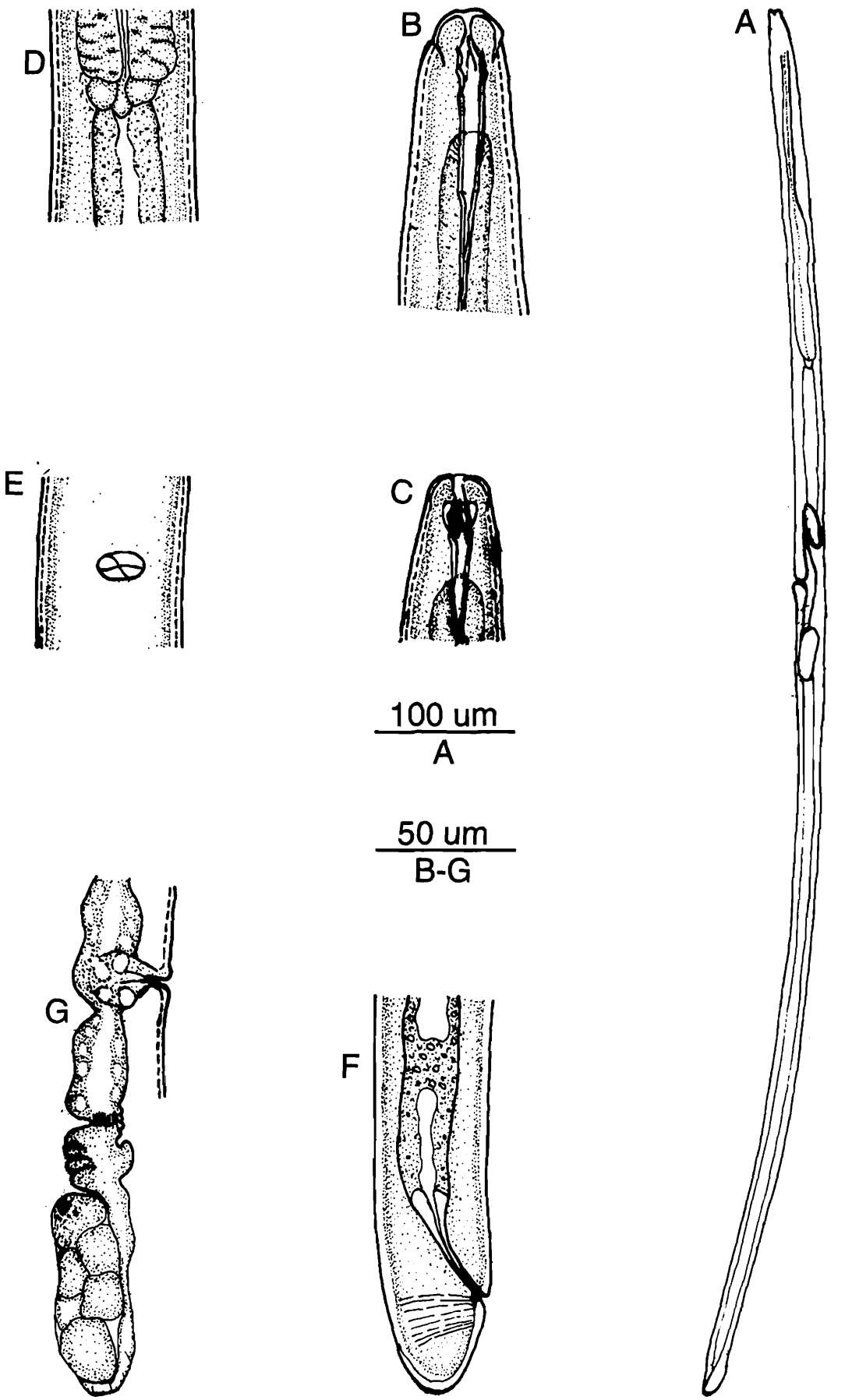


**Fig. 3.** *Nygolaimus shamimi* sp.n. A : Entire female, B : Anterior end, C : Amphid, D : Cardiac Region, E : Vulval Opening (Ventral View), F : Posterior end of tail, G : Posterior genital branch of female.

(Ventral arm longer). Nerve ring at 31-32% of neck length. Basal expanded part of pharynx occupying about 54-58% of neck length, with somewhat constriction near its middle. Cardia small, conoid, 5-6 × 10-11 µm long. Cardiac glands present at oesophago-intestinal junction.

Vulva a transverse slit. Vagina not distally sclerotized and 30% of corresponding body width. Female reproductive system amphidelphic, both genital branches are equally developed. Oviduct separated from uterus by a sphincture. Prerectum 1.3-1.4 and rectum 0.9 anal body width long. Tail rounded conoid 0.9-1.0 of anal body width.

*Male* : Not found.

*Type specimens* : Holotype female along with four paratype females mounted on slide No. IV/1942.

*Type habitat and Locality* : Collected from soil around roots of Sagwan at Chikani village, district Alwar, Rajasthan.

*Discussion* : The *Nygolaimus shamimi* sp. n. can be characterized in having lip region demarcated by constriction, lips rounded, labial papillae not elevated; tooth deltoid, 3-4.5 µm long, ventral arm longer; basal expanded part of oesophagus with somewhat constriction near its middle. Both genital branches are equally developed; vagina not distally sclerotized. Prerectum 1.3-1.4 anal body diameter. Tail conoid with rounded terminus, 0.9-1.0 anal body diameter long.

*Nygolaimus shamimi* sp. n. differs from very closely related *Nygolaimus captivitatis* (Heyns, 1968) Ahmad & Jairajpuri, 1982 in having smaller tooth; anteriorly situated vulva, tail conoid with rounded terminus (tooth 8 µm prerectum 1.2-1.3; tail bluntly convex-conoid in *Nygolaimus captivitatis*).

### ***Isolaimium rajasthanicus*** sp. n.

(Fig. 4)

*Material examined* : 1 male, 2 juvenile females.

*Measurements* : *Holotype male* (1) : L = 3.8 mm; a = 60; b = 15.5; c = 65.5; c' = 1.0; Stoma = 90 µm; pharynx = 245 µm; nerve ring = 157 µm; spicules = 52 µm; gubernaculum = 12 µm; anal body width = 54 µm; tail = 58 µm.

*Paratype (Juvenile) females* (2) : L = 2.4-3.5 mm; a = 43-61; b = 8.9-14.5; c = 75.7-76.9; nerve ring = 132-189 µm; rectum = 26-33 µm; anal body with = 33-39 µm; tail = 33-46 µm.

*Male* : Body slender, 63 µm wide at midbody, open c-shaped, ventrally curved upon fixation. Cuticle 3 µm thick at midbody, 6 µm thick at tail region, marked by about 65 fine longitudinal lines. Transverse lines indistinct. Body uniformly tapering towards anterior end. Lateral chords prominent, 6 µm wide. Lip region continuous with body contour. Lips closely amalgamated. Six prominent cuticularised tubes surround stomal aperture. Amphids funnel-shaped, aperture distinct.

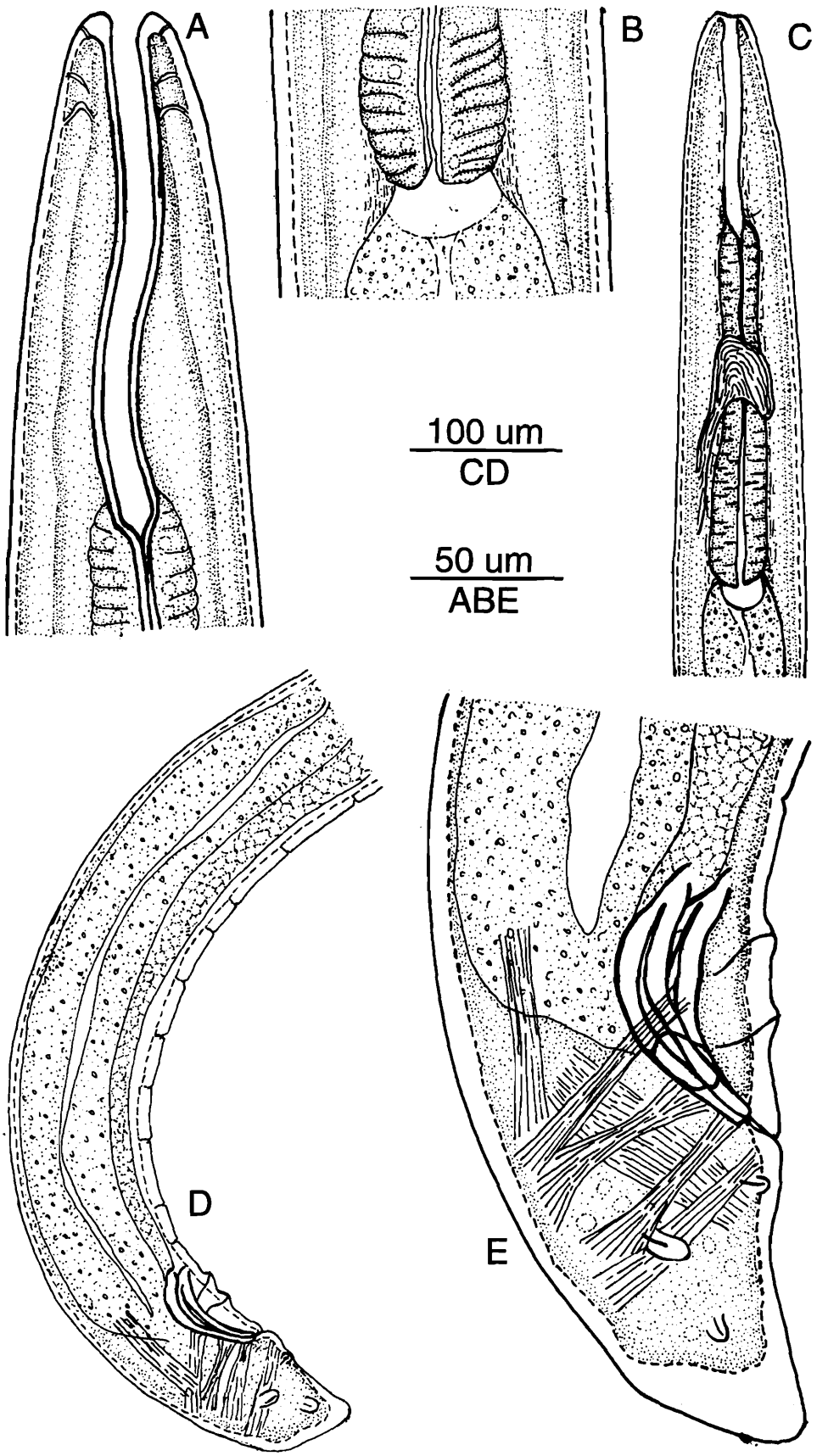


**Fig. 4.** *Isolaimium rajasthanicus* sp.n. A : Anterior end, B : Cardiac region, C : Pharynx D-E : Posterior end.

Stoma tubular with sclerotized walls more near anterior end, 6 µm wide, 36.7% of total pharynx length, 2.3% of entire body length. Posterior 7 µm parts of stoma surrounded by pharyngeal tissue. Body at pharyngeal base 3.3 times as wide as lip region diameter. Expanded part of pharynx occupies 63.2% of total pharyngeal length. Cardia 10 µm long. Intestine vacuolated with narrow lumen. Spicules cephalated, robust, ventrally arcuate, internally divided and 0.9 value smaller than anal body-width. Gubernaculum parallel to spicules, with posterior apophysis. Posterior end of body provided with seventeen midventral supplements with distinct innervations and irregularly spaced. Tail one anal body-width, long, with 2 pairs precloacal papillae and three pairs postcloacal papillae.

*Remarks* : The two juvenile females were collected but they are not completely mature hence it can not be said with certainty about their reproductive organ whether it is monodelphic or didelphic.

*Type Specimens* : Holotype male mounted on slide No. IV/1826. Two juvenile females mounted on Slides No. IV/1827-1829. Type specimens deposited in the National Zoological Collection at Zoological Survey of India, Jodhpur.

*Type habitat and Locality* : Collected from soil around roots of mausami (*Citrus* sp.) at Chikani, district Alwar, Rajasthan, India; collected by the first author during September, 2005.

*Discussion* : *Isolaimium rajasthanicus* sp. n. is characterized by having a 3.8 mm long body; cuticle wihout punctation, abount 65 longitudinal lines; 90 µm long stoma; male with 52 µm long, cephalated, internally divided spicules; presence of 17 midventral supplement, two pairs precloacal papillae and three pairs postcloacal papillae.

*Isolaimium rajasthanicus* sp. n. is close to *Isolaimium nigeriense* Timm, 1969 in body size but differs from it in having a greater b-value (15.5 *vs* 11.8-12.7), a greater c-value (65.5 *vs* 44-60), shorter spicules (52 *vs* 72-80 µm), cuticle without punctation (*vs* punctation distinct), smaller number of longitudinal lines (65 *vs* 100-120), greater number of midventral supplements (17 *vs* 6-7) and lesser number of caudal papillae (three *vs* four pairs postcloacal papillae).

*Isolaimium rajasthanicus* sp. n. differs from *Isolaimium collare* Andrassay, 2001 in having longer body size (3.8 *vs* 2.1 mm); greater b and c-value (b = 15.5 *vs* 10.0, c = 65.5 *vs* 63); longer stoma (90 *vs* 80 µm), absence of papilla on ventral side of neck (*vs* two large papilla on ventral side of neck region); longer spicules (52 *vs* 42-45 µm) and greater number of precloacal midventral supplements (17 *vs* 2). Andrassy (2001) also described *Isolaimium collare* on single holotype male in that case females were found juvenile.

The new species differs from *Isolaimium multipapillatum* Timm, 1969 in having smaller a-value (63 *vs* 70-78), absence of punctated cuticle (*vs* longitudinal and transverse striation froms large round distinct punctation); internally divided spicules (*vs* spicules without internal division, non-cephalated 54-56 µm long); and greater number of precloacal midventral supplements (17 *vs* 10-14).

The new species differs from *Isolaimium stictochroum* Timm, 1961 in having smaller body length (3.8 *vs* 4.1 mm); smaller c-values (65.5 *vs* 77.6-106); smaller stoma (90 *vs* 108-160 µm); cuticle smooth (*vs* presence of transverse striation and longitudinal lines consisting of rows of fine dots); longer spicules (52 *vs* 54-67 µm); smaller gubernaculum (12 *vs* 16-28 µm) and greater number of midventral supplements (17 *vs* 3 to 7).

The new species differs from *Isolaimium papillatum* Cobb, 1920 in having smaller body length (3.8 *vs* 4.7-4.9 mm); smaller a, b and c-value (60.3 *vs* 84-90, 15.5 *vs* 18.1-19.0 and 65.5 *vs* 87-99 respectively); smooth cuticle (*vs* prominent annulation with fine dots on tail); smaller spicules (52 *vs* 60-65 µm) and greater number of midventral supplements (17 *vs* 5).

*Remarks* : Isolaimium Cobb, 1920 is a rare genus of rather uncertain taxonomic position. Timm (1969) proposed a separate order, Isolaimiida, of it, which occupies a position between the orders Dorylaimida and Trichosyringida. Andrassy (1976) regarded it to belong to the order Dorylaimida, suborder Mermithina and superfamily Isolaimoidea. Swart and Henys (1991) retained Isolaimiida as a separate order, probably most closely related to Dorylaimida. The family Isolaimidae Timm, 1969 contains the only genus *Isolaimium.*

Although, together with the new member, 12 valid species have been described so far, they are uncommon and occur so scarcely that *Isolaimium* remains taxonomically one of the most problematic genera of the "Dorylaimida"

The *Isolaimium* species and their distribution are as follows :

| | |
|---|---|
| *I. africanum* | Hogewind & Heyns, 1967 (syn. *I. multistriatum* Hogewind & Heys, 1967)—Belgium, Ethiopia, South Africa. |
| *I. andrassyi* | Hogewind & Henys, 1967—Italy |
| *I. californicum* | Timm, 1969—United States (California) |
| *I. Collare* | Andrassy, 2001—Tanzania |
| *I. conicum* | Andrassy, 1970—Ivory Coast |
| *I. giganticum* | Nesterov, 1973—Hungary, Moldavia |
| *I. hamatispiculatum* | Bernard, 1985—United States (Tennessee) |
| *I. incus* | Hogewind & Heyns, 1967—Congo Republic, south Africa |
| *I. multipapillatum* | Timm, 1969—United States (?Alabama, Georgia, South Carolina, Maryland) |
| *I. nigeriense* | Timm, 1969—Nigeria |
| *I. papillatum* | Cobb, 1920—Hungary, United States (Virginia, Kansas) |
| *I. stictochroum* | Timm, 1961—Bangladesh. |

## SUMMARY

The present paper reports four new species of Plant and Soil nematodes belonging to Orders Dorylaimida and Isolaimida. *Dorylaimus murlii* sp. n. can be characterized in having 2.30-2.81 mm long body; lip region narrower than adjoining body, marked with slight depression; dorsal body pores in pharyngeal region; odontostyle 29-30 µm long; odontophore 34-36 µm long; guiding ring 18-20 µm from anterior end; amphidelphic reproductive system; prerectum 5.8-6.0 anal body widthh long; rectum 0.77-1.1 anal body width hlong; female tail elongate conoid with rounded terminus, 4.1-5.3 anal body width long with 2 caudal pores; spicules 54-58 µm long; lateral guiding pieces 18-20 µm; ventromedian supplements 24-28 contiguous; male tail short bluntly rounded, 0.88-0.92 anal body width long; 2 caudal pores on each pores. *Ischiodorylaimus baqrii* sp. n. can be characterized in having 2.70-3.05 mm long body; lip region narrower than adjoining body; dorsal and ventral body pores 10-12 in pharyngeal region respectively; odontostyle 44-45 µm long; odontophore 44-45 µm long; guiding ring 22-23 µm from anterior end; females amphidelphic; prerectum 5.2 anal body width long; rectum about one anal body width long; female tail elongate conoid with rounded terminus, 5.2 anal body width long; bent dorsally; spicules 85 µm long; lateral guiding pieces 13 µm long; ventromedian supplements arranged in two fassicles 21 + 5 + 15, five irregularly spaced ventromedian supplements between two fassicles; male tail short, bluntly rounded, 0.81 anal body width long. *Nygolainus shamimi* sp. n. can be differentiated in having 1.09-1.13 mm long body; lip region distinctly set off from body; tooth deltoid, 3-4.5 µm long; female reproductive system amphidelphic; prerectum 1.3-1.4 anal body width long; rectum 0.9 anal body width long; tail rounded conoid, 0.9-1.0 anal body width long. *Isolaimium rajasthanicus* sp. n. can be characterized in having 3.8 mm long body; lip region continuous with body contour; lips closely amalgamated; six prominent cuticularised tubes surrounds stomal aperture; stoma tubular; vacuolated intestine with narrow lumen; spicules 52 µm long, cephalated, robust, ventrally arcuate, medially divided; gubernaculum parallel to spicules with posterior apophysis; ventromedian supplements with distinct innvervations and irregularly spaced; tail one anal body width long; with 2 pairs precloacal papillae and three pairs of post cloacal papillae. The description of a recently described species *Isolaimium collare* Andrassy (2001) is also based on holotype male specimen because mature females in this genus is generally uncommon.



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