

A new species and a new record of Nematoda (Dorylaimida) with further observation on *Neoctinolaimus chitwoodi* (Moorthy, 1937) Thorne, 1967 from Uttar Pradesh, India

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Abstract

Miodorylaimus istvani sp. n. has been proposed and described with the first record of the genus from India in Pilibhit Tiger Reserve, Pilibhit district, Uttar Pradesh. The new species is characterized by medium and moderately slender body, thin cuticle, slender odontostyle with weak and straight odontophore, uncuticularised vulva in female, well developed dorylaimoid spicules and well-marked 8 spaced ventromedian supplements in male. *Allodorylaimus piracicabensis* (Lordello, 1955) Andr ssy, 1986 is being reported for the first time from India. *Neoctinolaimus chitwoodi* (Moorthy, 1937) Thorne, 1967 is reported with new distributional record from Pilibhit Tiger Reserve, India.

Keywords: Description, *Miodorylaimus istvani* sp. n., New species, New record, Taxonomy

Introduction

During a survey in Terai grassland of Gangetic plain zone of Uttar Pradesh, India few specimens of nematode were extracted from the soil samples collected from agro-ecosystem and grassland ecosystem of Pilibhit Tiger Reserve, Pilibhit district. Taxonomic investigation of some of these specimens revealed the presence of a species with new entity under the genus *Miodorylaimus* Andr ssy, 1986 among dorylaimid nematodes which is being proposed and described as new to science with the name *Miodorylaimus istvani* sp. n. Andr ssy (1986a) erected the new genus *Miodorylaimus* to describe and to accommodate two new species under this genus. These two species, *Miodorylaimus decens* Andr ssy, 1986 and *M. iucundus* Andr ssy, 1986 were described from Peru (South America). He separated this genus from *Mesodorylaimus* Andr ssy, 1986 on the basis of slender body, thin cuticle, unsclerotized vulval lips, long prerectum, short spicules

and few numbers of supplements in male. The new species is characterized by medium and moderately slender body, thin cuticle, and slender odontostyle with weak and straight odontophore, uncuticularised vulva in female, well developed dorylaimoid spicules and well marked 8 spaced ventromedian supplements in male. This is the first record of the genus from India with description of *Miodorylaimus istvani* sp. n.

Among the other specimens, some were identified as *Allodorylaimus piracicabensis* (Lordello, 1955) Andr ssy, 1986 with no record from India so far. So this species is considered as the new record from the country. Lordello (1955) described *Dorylaimus piracicabensis* from Sao Paulo, Brazil but Andr ssy (1959) transferred the species to the genus *Eudorylaimus* Andr ssy, 1959 due to its more affinity towards *Eudorylaimus* than the genus *Dorylaimus* Dujardin, 1845. Again, Andr ssy (1986b) erected a new genus *Allodorylaimus* to transfer and to accommodate

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some of the species of *Eudorylaimus* Andr ssy, 1959 on the basis of morphology and relationship and transferred *Dorylaimus piracicabensis* under the genus *Allodorylaimus* Andr ssy, 1989 after revision of the genus *Eudorylaimus*.

Only one specimen from Pilibhit Tiger Reserve was identified as *Neoactinolaimus chitwoodi* (Moorthy, 1937) Thorne, 1967 which was described under the genus *Actinolaimus* Cobb, 1913 from aquatic habitat of fresh water pond in Chitaldurg district, Karnataka (formerly Mysore state) in 1937 (Moorthy, 1937). The description and morphometrics given by Moorthy (1937) to establish this species were very brief. Even then it was accepted as a valid species by Thorne (1967) under the genus *Neoactinolaimus*. After that, in last 82 years, this species was not reported from elsewhere and this is the first distributional record of the species with single specimen from Pilibhit Tiger Reserve, Uttar Pradesh, India and the first report after 1937, proving its existence in nature.

Materials and Methods

The collected soil samples were processed by Cobb's sieving and decantation technique (Cobb, 1918) followed by modified Baermann funnel technique (Christie and Perry, 1951) for extraction of nematodes. The nematode specimens were fixed and preserved in their characteristic body posture in hot FA (formalin-acetic acid 4:1) solution and were mounted in anhydrous glycerin and sealing was done by paraffin wax (De Maeseneer and d'Herde, 1963) to make permanent slides. Then they were observed under a compound microscope (Nikon Eclipse Ni), measured, photographed by digital camera and was drawn by drawing tube attached to the same microscope.

Systematic Accounts

Phylum NEMATODA Rudolphi, 1808 (Lankester, 1877)

Order DORYLAIMIDA Pearse, 1942

Suborder DORYLAIMINA Pearse, 1936

Superfamily DORYLAIMOIDEA De Man, 1976

Family DORYLAIMIDAE De Man, 1976

Subfamily LAIMYDORINAE Andr ssy, 1969

Genus *Miodorylaimus* Andr ssy, 1986

1. *Miodorylaimus istvani* sp. n.

Family QUDSIANEMATIDAE Jairajpuri, 1965

Subfamily QUDSIANEMATINAE Jairajpuri, 1965

Genus *Allodorylaimus* Andr ssy, 1986

2. *Allodorylaimus piracicabensis* (Lordello, 1955) Andr ssy, 1986

Superfamily ACTINOLAIMOIDEA Thorne, 1939

Family ACTINOLAIMIDAE Thorne, 1939

Subfamily NEOACTINOLAIMINAE Thorne, 1967

Genus *Neoactinolaimus* Thorne, 1967

3. *Neoactinolaimus chitwoodi* (Moorthy, 1937) Thorne, 1967

Genus *Miodorylaimus* Andr ssy, 1986

1. *Miodorylaimus istvani* sp. n.

Measurements: See Table 1. The minimum-maximum ranges of measurements given hereafter are based on holotype and one female paratype.

Description of female: Body moderately slender, slightly ventrally curved on fixation, gradually tapering towards both extremities. Cuticle thin, 1-1.5 μ m thick at the level of odontostyle, 1.5-2 μ m at mid body, 2-2.5 μ m on tail. Body pores indistinct. Lip region rounded, confluent with the body contour or very minutely set off by depression, with same diameter or narrower than adjoining body, 4 μ m high, 10 μ m wide or 1/2.5 to one third of body width at neck base. Amphids cup-shaped, 6-6.5 μ m wide or about more than half (1/1.5-1/1.6) of the corresponding body width. Odontostyle slender, 12-13 μ m or about 1.2-1.3 lip region-widths long, its aperture about one-third of stylet length or occupying 33.3 - 38.4% of stylet. Odontophore weak, straight, 1.6-1.8 lip region-widths long. Guiding ring thin, not prominent, 7-8 μ m from anterior end. Nerve ring at 86-92 μ m from anterior end. Expanded portion of pharynx starts little posterior to the middle of the pharynx occupying 45.2-48.7% of the total pharyngeal length. Cardia 20 μ m long in holotype, conoid, terminally pointed. Vulva transverse, not cuticularised, slightly pre-equatorial. Vagina extending inward half of the corresponding body width. Reproductive system amphidelphic, posterior gonad slightly longer than anterior gonad in Holotype but both the gonads are almost same in length in Paratype. Both ovaries reflexed, posterior ovary longer than anterior ovary. Oocytes arranged in a single row except at tip. Prerectum 2.2-2.6, rectum 1.1-1.2 anal-body-width long. Tail 7.8 anal-body-widths long, attenuated, anteriorly convex and posteriorly

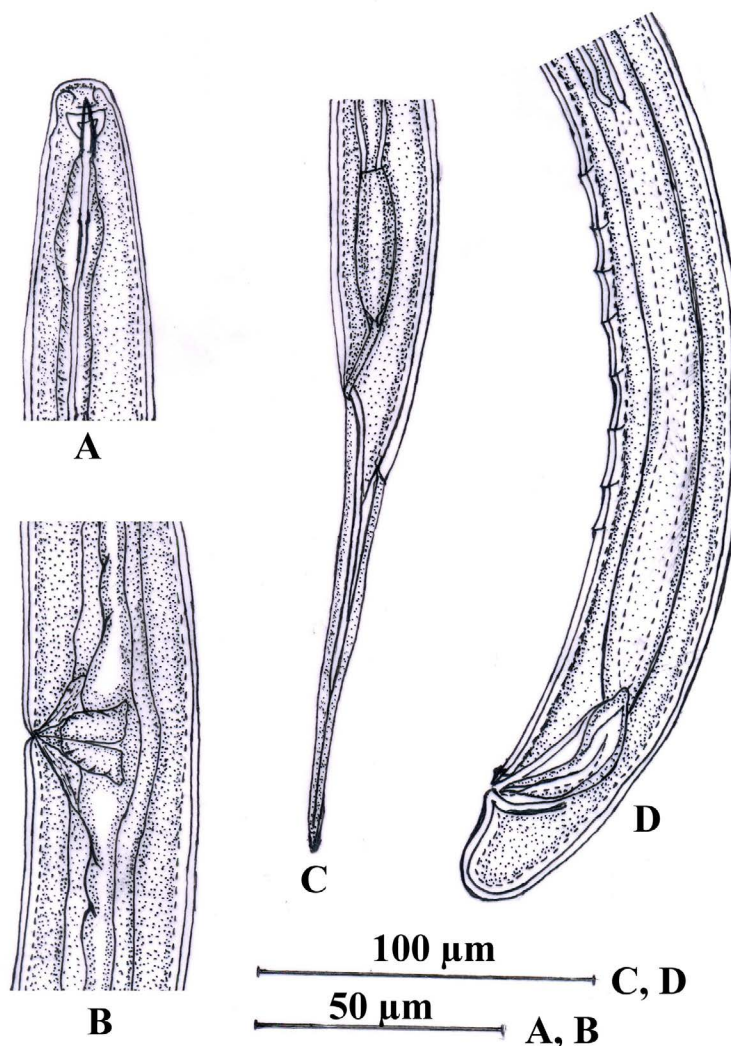


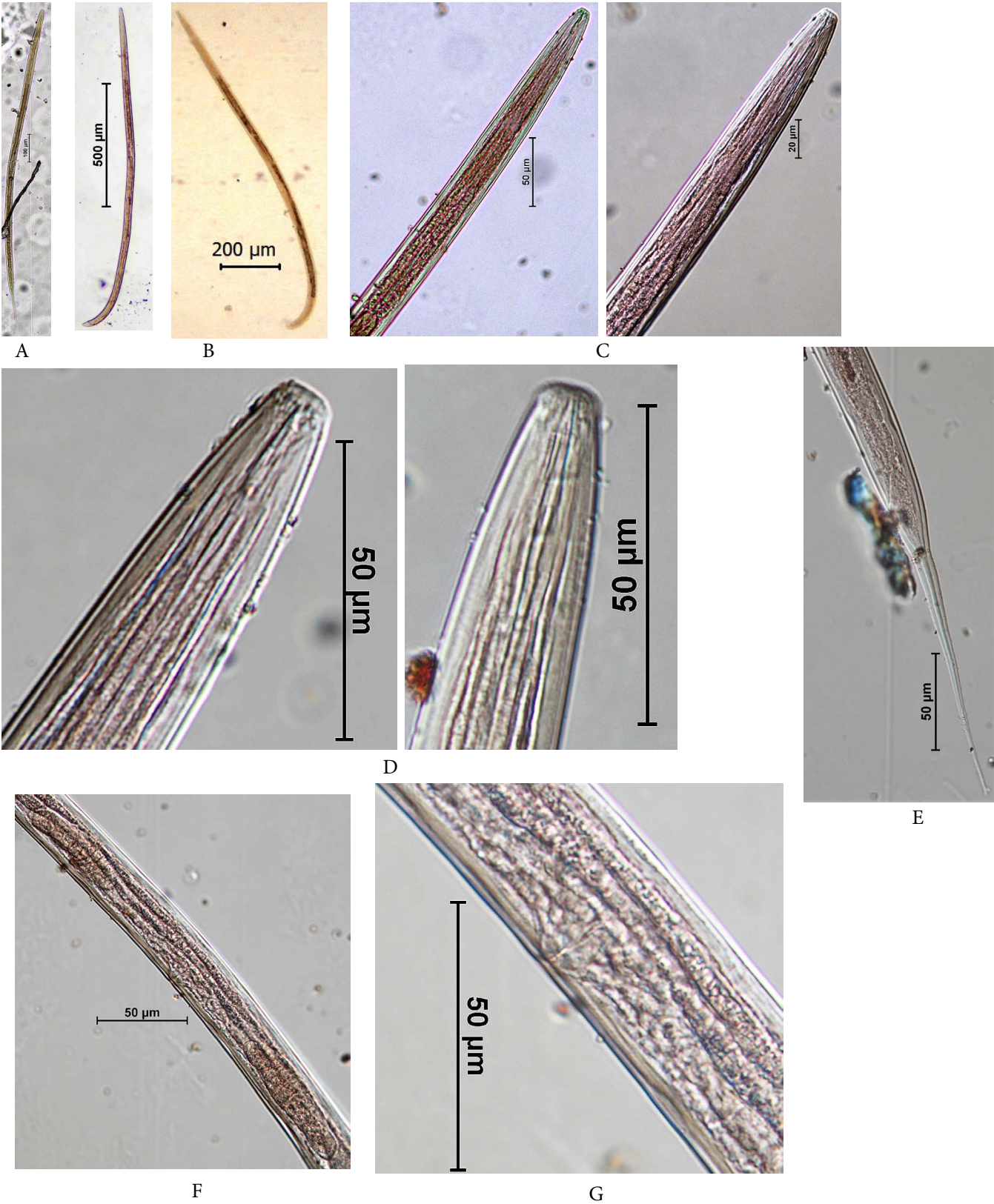
Figure 1. *Miodorylaimus istvani* sp. n. **Female:** A. Anterior end, B. Unsclerotised Vulva, C. Posterior body end showing tail. **Male:** D. Posterior body end showing ventromedian supplements, spicule and tail.

narrow, gradually tapering, ending in a pointed terminus.

Description of male: Similar to females in general morphology with the following exceptions. Posterior half of body more ventrally curved. Testes outstretched. Spicules well developed, cuticularised, 1.7-1.9 anal-body-widths long when measured through its median axis, dorylaimoid. Supplements conspicuous, distinct on the outer cuticular body wall, consists of 8 almost regularly spaced ventromedians and an adanal pair, the

space between supplements ranges between 7-11mm, the space being less towards the posterior-most supplement. Prerectum 2.7-3.0, rectum 1.6-1.8 anal-body-widths long. Tail short, little ventrally curved, terminally round, one anal-body-width long (1.0-1.05).

Diagnosis and characteristics: Body medium and moderately slender. Cuticle thin. Lip region continuous with body contour or minutely separate by little depression. Odontostyle slender with weak and straight odontophore.



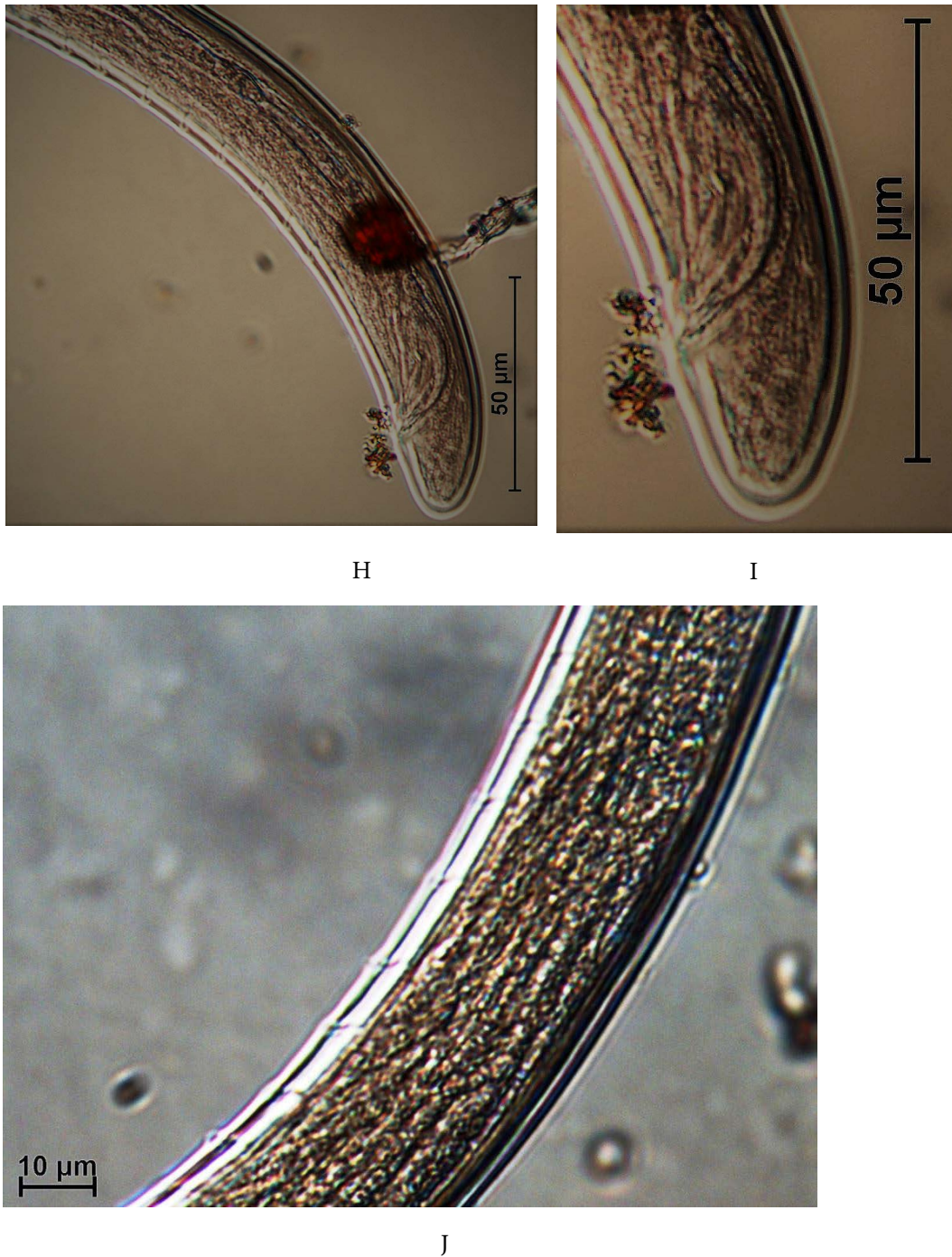


Figure 2. Photomicrographs of *Miodorylaimus istvani* sp. n. Female: A. Entire body, C. Anterior body end, D. Odontostyle, E. Posterior body end showing Tail, F. Reproductive System, G. Unsclerotised Vulva. Male: B. Entire body, H. Posterior Body End Showing Tail, Spicule & Ventromedian Supplements, I. Enlarged view of spicule, J. Enlarged view of Ventromedian Supplements.

Table 1. Morphometric data on *Miodorylaimus istvani* sp. n. (All measurements are in μm except L and body ratios, L in mm. Number of paratype given in parentheses)

Diagnostic Characters	Holotype female	Paratype female (1)	Paratype males (3)	
			Min	Max
L	1.23	1.17	1.05	1.35
<i>a</i>	41.0	41.7	36.2	40.9
<i>b</i>	4.5	4.3	4.1	4.9
<i>c</i>	7.8	7.1	52.5	64.2
<i>c'</i>	7.8	7.8	1.0	1.05
V %	47.7%	48.6%	53.8%	57.7%
G ₁ %	14.8	12.8	-	-
G ₂ %	16.8	12.7	-	-
Height of lip region	4.0	4.0	4.0	4.0
Width of lip region	10.0	10.0	10.0	10.0
Length of pharynx	272.0	266.0	251.0	271.0
Length of expanded part of pharynx	123.0	125.0	115.0	132.0
Length of odontostyle	12.0	13.0	12.0	13.0
Length of odontophore	18.0	17.0	16.0	17.0
Length of aperture in odontostyle	4.0	5.0	4.0	5.0
Width of odontostyle	2.0	1.5	1.5	1.5
Guiding ring from anterior end	8.0	7.0	7.0	8.0
Nerve ring from anterior end	92.0	89.0	86.0	97.0
Body width at neck base	29.0	26.0	26.0	30.0
Maximum body width	30.0	28.0	29.0	33.0
Body width at vulva	30.0	28.0	-	-
Vulva from anterior end	588.0	569.0	-	-
Length of vagina	15.0	14.0	-	-
Length of anterior gonad	183.0	150.0	-	-
Length of anterior ovary	61.0	45.0	-	-
Length of posterior gonad	208.0	149.0	-	-
Length of posterior ovary	78.0	46.0	-	-
Tail length	156.0	150.0	20.0	21.0
Anal-body diameter	20.0	19.0	20.0	20.0
Prerectum	44.0	51.0	54.0	60.0
Rectum	23.0	24.0	32.0	37.0
Thickness of cuticle at the level of odontostyle	1.0	1.5	1.5	1.5
Thickness of cuticle at mid body	1.5	2.0	2.0	2.0
Thickness of cuticle on tail	2.0	2.5	2.0	2.0
Length of testis	-	-	565.0	779.0
Length of Spicule	-	-	35.0	38.0
Number of ventromedian supplement	-	-	8	8

Expanded portion of pharynx starts posterior to the middle of pharynx. Vulva not cuticularised. Tail dissimilar in sexes as usual in the family Dorylaimidae. Female tail long with anterior convex portion and gradually narrow and attenuated posterior portion. Male tail short and rounded. Spicules well developed, dorylaimoid. Supplements well marked and consists of 8 spaced ventromedians.

Differential diagnosis and relationship: *Miodorylaimus istvani* sp. n. comes close to *M. decens* Andr ssy, 1986 and *M. iucundus* Andr ssy, 1986 in general morphology and in some morphometrics with some well marked differences leading towards its separate identity. The females of proposed new species differs from *M. decens* in having a comparatively less slender and wide body evident from 'a' value and maximum body width, anteriorly located vulva, shorter rectum and prerectum and longer tail (in female of *M. decens* $a = 50$; maximum body width = 22-25 μ m; $V = 52\%$; prerectum = 3.3 and rectum = 1.4 anal-body widths long; tail length = 123 μ m). The males of the new species differ by the possession of wider body as in females, shorter tail, well developed longer spicules and well marked 8 ventromedian supplements (in males of *M. decens* $a = 46-49$; tail length = 22-25 μ m; length of spicules = 24-25 μ m and number of ventromedian supplements = 4. *Miodorylaimus istvani* sp. n. differs from *M. iucundus* in having males, longer and comparatively more slender body evident from 'a' value, longer pharynx, shorter tail and longer prerectum in females (in females of *M. iucundus* total body length (L) = 0.88 -0.90mm; $a = 32-33$; length of pharynx = 192-195 μ m; tail length = 222-225 μ m; $c' = 14-15$ and prerectum = 1.8 anal-body width long; males unknown in *M. iucundus*)

Morphometrics of *M. decens* and *M. iucundus* after Andr ssy (1986a)

Key to the species of *Miodorylaimus* Andr ssy, 1986

1. Body shorter (L = 0.88 – 0.90mm), comparatively wider ($a = 33$). Males unknown.....
.....*Miodorylaimus iucundus* Andr ssy, 1986
Body longer (L = 1.17 – 1.23mm), comparatively slender ($a = 41 – 50$). Males present2
2. Vulva post-equatorial, tail shorter in female. Spicules short (24 - 25 μ m) and number of ventromedian supplements less (4) in males.....
.....*Miodorylaimus decens* Andr ssy, 1986

Vulva pre-equatorial, tail longer in female. Spicules long (35 – 38 μ m) and number of ventromedian supplements more (8) in males.....*M. istvani* sp. n.

Type locality: Lat 28°42.855N and long 079°56.486E, Dubaha village, Mahof Forest Range, Pilibhit Tiger Reserve, Pilibhit dist., Uttar Pradesh, India.

Type habitat: Collected from soil around the roots of wheat (*Triticum* sp.) from agro-ecosystem on 10-iii-2017, collected by the author.

Type specimens: Holotype: Female; 1 Paratype: Female; 3 Paratypes: Males. Z.S.I. Reg. No. WN1975 (Holotype female), WN 1975/1 (Paratype Male), WN 2014 (Paratype female and male). Deposited in National Zoological collection, Zoological Survey of India, Kolkata.

Etymology: The new species has been named after the author of the genus *Miodorylaimus* and eminent nematologist and Dr. (Prof.) Istvan Andr ssy.

2. *Allodorylaimus piracicabensis* (Lordello, 1955) Andr ssy, 1986

1955. *Dorylaimus piracicabensis* Lordello, L. G. E. Rev. Brasil. Biol., 15: 211 – 218.

1986. *Allodorylaimus piracicabensis* Andr ssy, I. Opusc. Zool. Budapest, 22: 3 – 42.

Measurements: See Table 2.

Diagnosis: Female: Body ventrally curved on fixation, specially the posterior end. Lip region set off from body by distinct constriction, lips angular, wider than adjoining body. Cuticle smooth. Expanded portion of pharynx starts almost near the middle or anterior, 49.1-55.4% of the total pharyngeal length. Cardia conoid, 14-16 μ m long. Odontostyle slender, needle-like, 1.2-1.4 labial width long, aperture occupying almost one-third (31.5 – 33.3%) or 1/3-1/3.1 of the stylet length. Odontophore 1.8-2.0 labial widths long. Vulva almost equatorial, *Pars refringens vaginae* well pronounced, vagina extending inward about half of the corresponding body width. Reproductive system amphidelphic. Both the gonads well developed, anterior gonad longer than posterior gonad. Pre-rectum 2.2 to 2.5 times as long as rectum or three anal-body diameter long, rectum 1.3-1.7 anal-body diameter long. Tail strongly ventrally curved, dorsally convex, conoid ending in a pointed terminus, 2.2-2.3

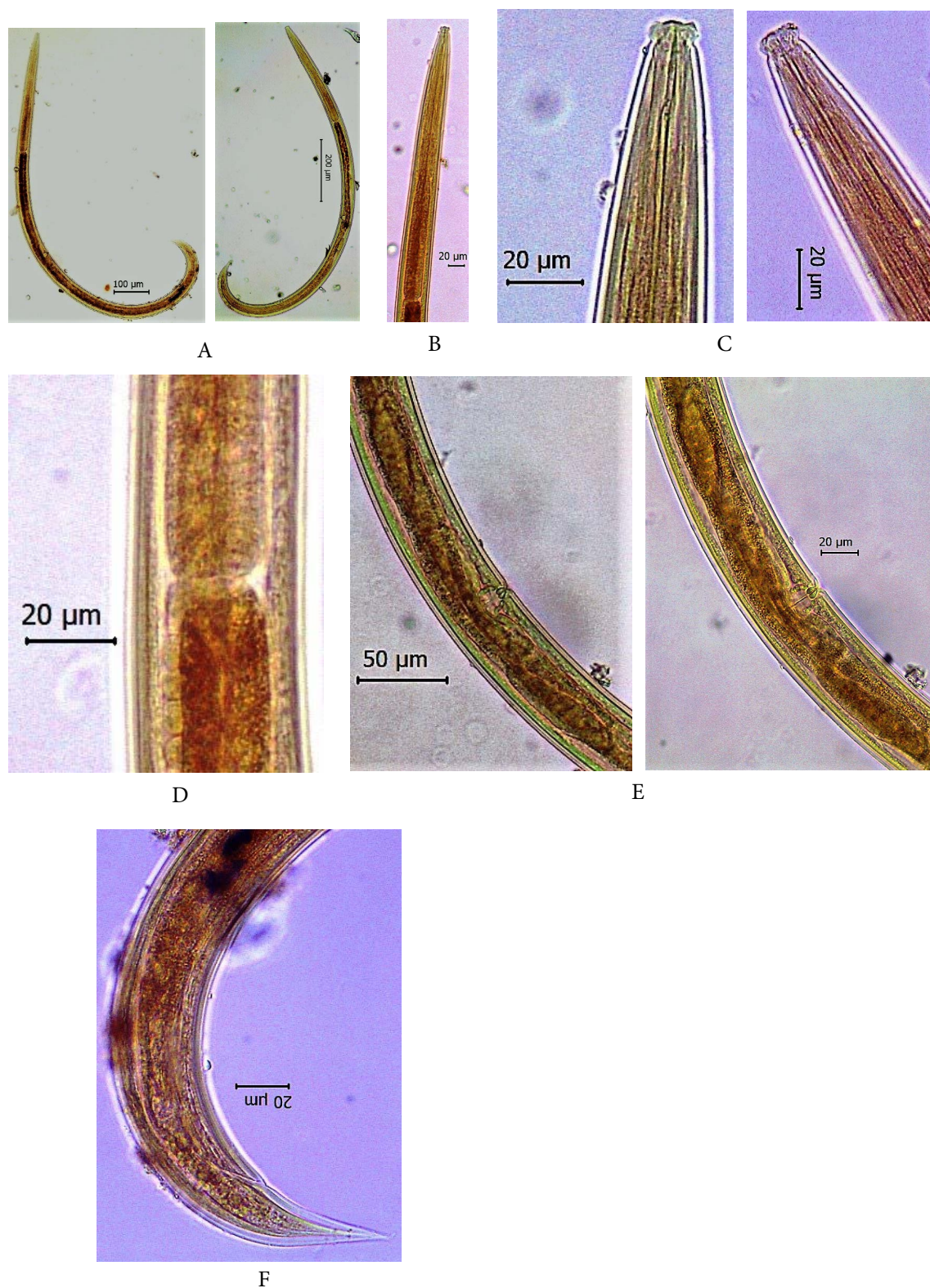


Figure 3. Photomicrographs of *Allodorylaimus piracicabensis* Female: A. Entire body showing difference in body shape, B. Pharynx, C. Lip region & Odontostyle, D. Pharyngo-intestinal junction, E. Entire reproductive system & vulva, F. Posterior body end showing tail.

anal-body diameter long,

Male: Not found.

Material examined: 6 Females collected on 08-iii-2017 by the author. Z.S.I. Reg. No. WN 1925, deposited in National Zoological Collection, Zoological Survey of India, Kolkata.

Locality: Lat 28°42.908N and long 079°59.466E, near

Veem tal, Mahof forest range, Pilibhit Tiger Reserve, Pilibhit dist, Uttar Pradesh.

Habitat: Collected from soil around the roots of unidentified grass near water body (Veem tal) from forest ecosystem.

Distribution: India: Uttar Pradesh. *Elsewhere*: Brazil, Lithuania

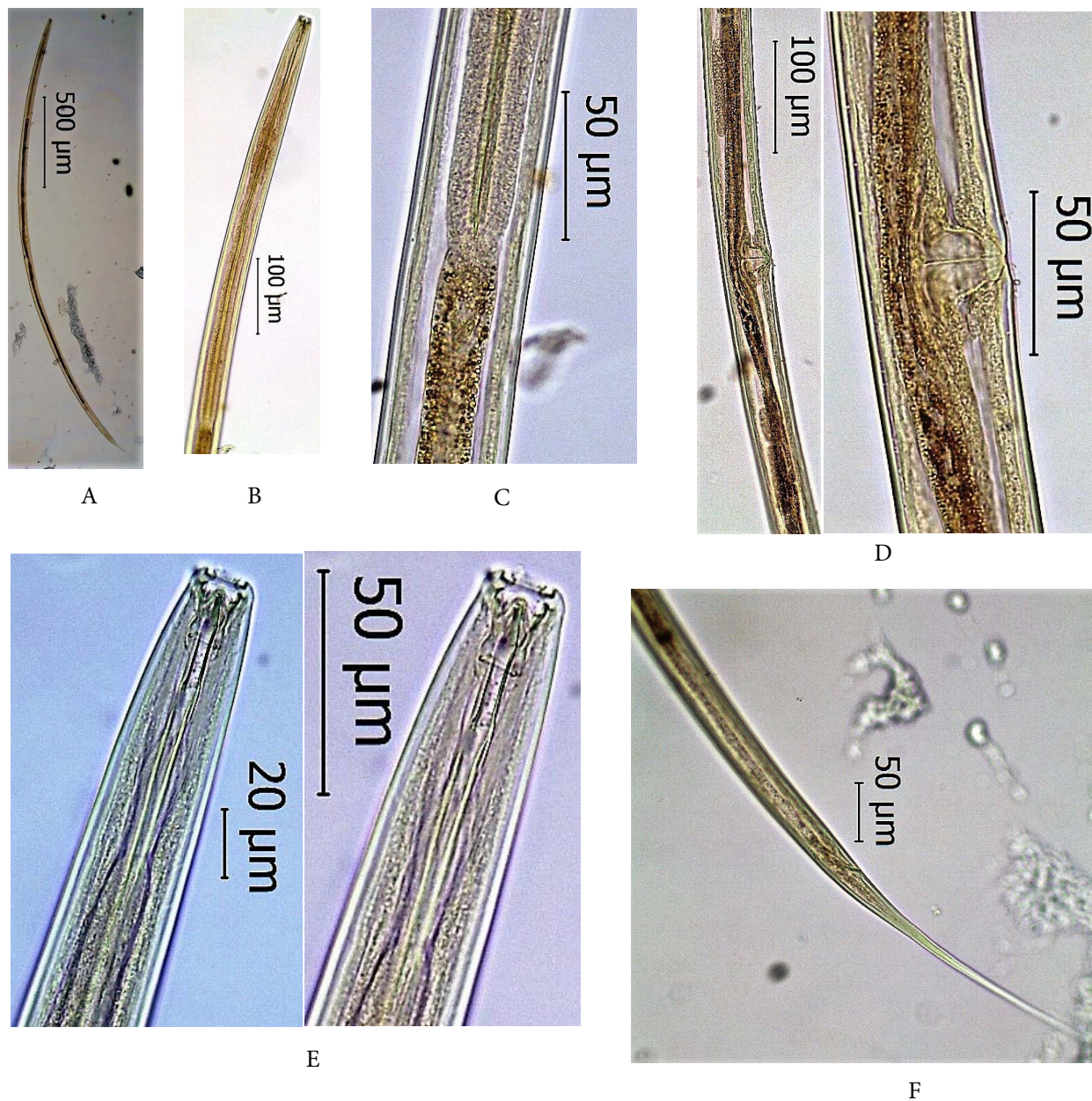


Figure 4. Photomicrographs of *Neactinolaimus chitwoodi* Female: A. Entire body, B. Pharynx, C. Pharyngo-intestinal junction, D. Entire reproductive system & Vulva, E. Lip region showing stoma, onchia & Odontostyle, F. Posterior body end showing tail.

Remark: Lordello (1955) described this species under the genus *Dorylaimus* Dujardin, 1845 from Sao Paulo, Brazil. This is the third record of the species from world and new record from India.

3. *Neoctinolaimus chitwoodi* (Moorthy, 1937) Thorne, 1967

1937. *Actinolaimus chitwoodi* Moorthy, V. N. *Proc. Helminth. Soc. Wash.*, 4(2): 61.

1967. *Neoctinolaimus chitwoodi* Thorne, G. *Univ. Puerto Rico Agr. Exp. Tech. Paper No. 43*: 1 – 48.

Measurements: See Table 3.

Diagnosis: Female: Body slightly ventrally curved on fixation. Lip almost continuous with body having slight depression. Stoma chitinized, vestibule with four onchia. Cuticle smooth. Expanded part of pharynx starts anterior to the middle of pharynx or 52.3% of the total pharyngeal length. Odontostyle strong, 1.5 labial width long, its aperture occupying about one-third of its length or 33.9% of odontostyle. Odontophore as long as odontostyle. Guiding ring prominent, 21µm from anterior end.

Vulva slightly anteriorly placed or pre-equatorial. vagina extending inward more than half or 54.3% of the corresponding body width, *Pars refringens vaginae* well marked. Reproductive system amphidelphic. Both the gonads well developed, posterior gonad longer than anterior gonad. Pre-rectum 4.7 times as long as rectum or 9.6 anal-body diameter long, rectum two anal-body diameter long. Tail long, attenuated, anterior portion convex and wide, posterior portion narrow, uniformly tapering to a finely rounded terminus, 11.6 anal-body diameter long.

Male: Not found.

Material examined: 1 Female collected on 10-iii-2017 by the author. Z.S.I. Reg. No. WN1974, deposited in National Zoological Collection, Zoological Survey of India, Kolkata.

Locality: Lat 28°42.855N and long 079°56.486E, Dubaha village, Mahof forest range, Pilibhit Tiger Reserve, Pilibhit dist., Uttar Pradesh.

Habitat: Collected from soil around the roots of wheat (*Triticum* sp.) from agro-ecosystem.

Table 2. Comparison of morphometrics and characters between *Miodorylaimus istvani* sp. n., *M. decens* and *M. iucundus* (All measurements are in µm except L and body ratios, L in mm)

Diagnostic characters	<i>M. istvani</i> sp. n.		<i>M. decens</i>		<i>M. iucundus</i>
	Female	Male	Female	Male	Female
Body Length (L)	1.17 - 1.23	1.05 - 1.35	1.23	1.08 - 1.12	0.88 - 0.90
<i>a</i>	41.0 - 41.7	36.2 - 40.9	50.0	46.0 - 49.0	32.0 - 33.0
<i>b</i>	4.3 - 4.5	4.1 - 4.9	4.5	4.2 - 5.0	4.3 - 4.6
<i>c</i>	7.1 - 7.8	52.5 - 64.2	10.0	44.0 - 50.0	4.0 - 4.1
<i>c'</i>	7.8	1.0 - 1.05	7.5	> 1.0	14.0 - 15.0
V %	47.7 -48.6%	-	52.0%	-	43.0%
Labial width	10.0	10.0	7.5 - 8.0	-	8.0
Pharynx	266.0 - 272.0	251.0 - 271.0	230.0 - 270.0	-	192.0 - 195.0
Odontostyle	12.0 - 13.0	12.0 - 13.0	12.0	-	11.0
Max. body width	28.0 - 30.0	29.0 - 33.0	22.0 - 25.0	-	27.2 - 27.5
Tail length	150.0 - 156.0	20.0 - 21.0	123.0	22.0 - 25.0	222.0 - 225.0
Length of Spicule	-	35.0 - 38.0	-	24.0 - 25.0	Male absent
Number of Supplements	-	8	-	4	Male absent

Table 3. Morphometric data on *Allodorylaimus piracicabensis* and *Neoctinolaimus chitwoodi* (All measurements are in μm except L and body ratios, L in mm, Number of examples (n) given in parentheses)

Diagnostic Characters	A. piracicabensis (n = 6)	N. chitwoodi (n = 1)
L	1.23 – 1.26	2.70
a	28.6 – 28.7	58.6
b	3.6 – 3.7	4.8
c	23.6 – 23.7	10.5
c'	2.2 – 2.3	11.6
V %	51.3%	45.4%
G ₁ %	15.7 – 16.5	10.3
G ₂ %	14.3 – 15.7	12.0
Height of lip region	5.5 – 6.0	6.0
Width of lip region	13.0 – 14.0	19.0
Length of pharynx	337.0 – 338.0	552.0
Length of expanded part of pharynx	166.0 – 187.0	289.0
Length of odontostyle	18.0 – 19.0	28.0
Length of odontophore	25.0 – 26.0	28.0
Width of odontostyle	2.0	4.0
Guiding ring from anterior end	8.0	21
Lip adjoining body width	12.5 – 13.0	18.5
Body width at neck base	40.0 – 41.0	43.0
Maximum body width	43.0 – 44.0	46.0
Body width at vulva	43.0 – 44.0	46.0
Vulva from anterior end	632.0 – 647.0	1228.0
Length of vagina	22.0 – 23.0	25.0
Length of <i>Pars proximalis vagina</i>	14.0 – 15.0	18.0
Length of <i>Pars refringens vagina</i> (with combined width)	5.0 – 6.5 x (5.0 – 6.0)	5.0 x (12.0)
Length of <i>Pars distalis vagina</i>	2.0 – 2.5	2.0
Length of anterior gonad	194.0 – 208.0	280.0
Length of anterior uterus	50.0 – 57.0	100.0
Length of anterior uterus	79.0 – 90.0	93.0
Length of anterior ovary	61.0 – 65.0	87.0
Length of posterior gonad	176.0 – 199.0	325.0
Length of posterior oviduct	62.0 – 83.0	101.0
Length of posterior oviduct	40.0 – 44.0	121.0
Length of posterior ovary	72.0 – 74.0	103.0
Tail length	52.0 – 53.0	256.0
Anal-body diameter	23.0	22.0
Prerectum	70.0 – 71.0	213.0
Rectum	27.0 – 32.0	45.0

cuticle at the level of odontostyle	2.0	2.5
Thickness of cuticle at mid body	2.5 – 3.0	2.5
Thickness of cuticle on tail	3.0 – 4.0	3.0

Distribution: India: Karnataka, Uttar Pradesh.

Remark: The present specimen of *Neoctinolaimus chitwoodi* fits accurately with all the measurements and morphology given by the descriptor of the species (Moorthy, 1937) indicating the existence of the species in soil habitat, except the shorter total body length (L = 3.4mm in original description) and presence of eggs in uteri. As the original description was on the basis of a single female specimen, the present data may be

considered as additional information for the species. This is the first distributional record of the species from Pilibhit Tiger Reserve, Uttar Pradesh and the first report after 1937, proving its existence in nature.

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