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One new and two known species of tylenchida (Nematoda) from West Bengal, India

Debabrata Sen**Abstract**

Scutellonema bengalensis sp. n. was collected from soil around the roots of guava (*Psidium guajava* L.) and a small population of *Hirschmanniella gracilis* (de Man, 1880) Luc and Goodey, 1963 and *Hirschmanniella oryzae* (Van Breda de Hann, 1902) Luc and Goodey, 1963 were collected from the rhizosphere of guava in South 24-Parganas district, West Bengal, India. *Scutellonema bengalensis* sp. n. can be characterized and distinguished from all other species of the genus except *S. grande* Sher, 1964 by the position of its hemizonid which is located posterior to excretory pore. The present new species comes close to *S. grande* but it differs in having longer body, lesser number of cephalic and tail annules and in having longer spicules in males (L = 0.87 – 1.20 mm in females and 0.81 – 1.05 mm in males; number of cephalic annules = 6 – 9; number of tail annules = 15 – 21; length of spicules = 32.0 – 37.0µm in *S. grande* vs. L = 1.1 – 1.44 mm in females and 1.04 – 1.16mm in males; cephalic annules = 3 – 4; tail annules = 12 – 14; spicules = 45.0 – 51.0µm in *S. bengalensis* sp. n.). The present specimens of *Hirschmanniella gracilis* and *Hirschmanniella oryzae* agree well with morphology and measurements of their Topotypes with minor variations which may be considered as additional data for both of the species (Gubernaculum 9.0 – 14.0µm in male topotypes vs. 8 – 10µm in the present specimens of *H. gracilis*. Stylet length 15 – 19µm in female and 16 – 18µm in male topotypes vs. 14 – 17µm in females and stylet length = 14.5 – 17µm in males of present specimens of *H. oryzae*).

Keywords: New species, taxonomy, description *Scutellonema bengalensis* sp. n., *Hirschmanniella gracilis*, *Hirschmanniella oryzae*

Introduction

During a survey in the guava (*Psidium guajava* L.) orchards of South 24-Parganas (Geographical position, 21°26' – 22°38' North Latitude and 87°57' – 89°09' East Longitude), West Bengal, India, a population of tylenchid nematodes was collected. Examination of these specimens revealed that they seem to belong to an undescribed taxon of Tylenchida which is being proposed and described as *Scutellonema bengalensis* sp. n. under the family Hoplolaimidae Filipjev, 1934 along with two known species *Hirschmanniella gracilis* (de Man, 1880) Luc and Goodey, 1963 and *Hirschmanniella oryzae* (Van Breda de Hann, 1902) Luc and Goodey, 1963, belonging to the family Pratylenchidae Thorne, 1949.

The name of the genus *Scutellonema* was derived from the Latin terminology 'scutellum' which means enlarged shield-like phasmid^[1]. The genus was established to accommodate the species of the genus *Rotylenchus* Filipjev, 1936 having shield-like phasmids located in the anal region and five species of the genus *Rotylenchus* were transferred to the genus *Scutellonema* Andrassy, 1958^[1]. The genus was reviewed to provide a valid list of species and a key to species of the genus^[2, 3, 4]. All the species of *Scutellonema* are phytophagous (ecto- and partially endo-parasites) and they were found to be among hazardous parasites on various agricultural, horticultural and other crops^[5]. It was observed that most of the species of *Scutellonema* are distributed in the tropics and might have originated and radiated elsewhere in the world from Africa^[6]. A good number of new species of *Scutellonema* were described from the states of Karnataka, Manipur, Tamil Nadu, Kerala and Mizoram, India^[7, 8, 9, 10, 11, 12]. Some new species from India like *S. sheri* described from Sikkim^[13], *S. ramai* from Uttar Pradesh^[14], and *S. orientale* from Uttar Pradesh^[15]. were synonymized with *S. brachyurus* (Steiner, 1938) Andrassy, 1958. Similarly, *S. mangifera*, *S. eclipsi* described from Madhya Pradesh^[16, 17]. Were synonymized with *S. grande* Sher, 1964 and *S. naveenum* described from Tamil Nadu^[9]. was synonymized with *S. magniphasma* Sher, 1965. *Scutellonema bengalensis* sp. n. can be characterized and distinguished from all other species of the genus except *S. grande*

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Sher, 1964 by the position of its hemizonid which is located posterior to excretory pore.

The present specimens of *Hirschmanniella gracilis* and *Hirschmanniella oryzae* agree well with the morphology and measurements of their Topotypes^[18], and other reported specimens with some minor morphometric differences which may be considered as intra-specific variation. The distinguishing characters of *H. gracilis* and *H. oryzae* has been elaborated and it was elucidated that these two species can be differentiated by the difference in length of the stylet and spicules (Stylet length 21.0 -23.0µm; and spicules length and 28-35µm in *H. gracilis* against 17-19µm and 20-28µm respectively in *H. oryzae*)^[19], although both of the species show wide range of morphometric variation. A yield loss of about 12.05 – 19.22% of paddy in Hooghly district in West Bengal due to *Hirschmanniella gracilis* was estimated^[20]. *H. gracilis* was reported as a major and the key pest of paddy crop in West Bengal^[21], and it was observed that all the paddy growing districts of West Bengal are infested with *H. gracilis*^[22]. *Hirschmanniella oryzae* was found to occur at least in twelve states of India^[23], and it was reported as a potential pest of paddy in some localities of Northern districts of West Bengal^[24]. *H. oryzae* was recorded from the rhizosphere of jute (*Corchorus* spp.) from undivided 24-parganas district^[25]. This is the first distributional record of both the species from South 24-Parganas district.

Materials and Methods

Processing of soil samples

The soil samples were collected from the rhizosphere of guava plantation (*Psidium guajava* L.) with the help of an iron shovel from a depth of 2 – 15 centimeters from the surface. The samples were processed by Cobb's sieving and decantation technique^[26]. Soil sample of about 500gms was taken in a bucket of 10 liter capacity. The bucket was filled with clean water up to half of its capacity. The soil and water were thoroughly mixed by hand to make a homogeneous suspension. Stones and plant debris were removed. The muddy suspension were stirred very well and left undisturbed for 20 – 30 seconds allowing the heavier particles to settle down at the bottom of the bucket, while the nematodes and fine soil particles remained suspended in water. This suspension was passed through a coarse sieve of 2mm pore size and was caught in another bucket. The entire process was repeated thrice to get a muddy suspension quite free from stones, large soil particles and any other undesirable organic matters. This suspension was subjected to similar filtration through a fine sieve of 325 meshes with 43µm pore size. Most of the fine soil particles passed through this sieve but the nematodes and larger soil particles were retained on the surface of the sieve. This was again washed thoroughly with running water within the sieve to get rid of the soil particles as far as possible without losing the nematodes. Then the entire content of the sieve, containing nematodes was collected in a beaker by washing the sieve repeatedly with water.

Extraction of nematodes

The nematode specimens were extracted from the processed soil by modified Baermann funnel technique^[27]. A double layer of tissue paper was placed on aluminum net of 2 mm pore size and was made moist by applying water gently without leaving any air gap or bubble between the layers of the tissue paper. Now, the, previously collected water containing nematodes in the beaker, was poured gently on this

moist tissue paper and was suspended in clean water in a Petri dish in such a way that the lower surface of the tissue paper on aluminum net touches the upper surface of water in the Petri dish. The tissue paper with its contents was covered by another Petri dish to prevent from evaporation and desiccation. The whole arrangement was left undisturbed for at least 24 hours. The nematodes migrated downward through the porous tissue paper in the clear water of Petri dish. This clear water containing nematodes was taken in a big test tube with the help of a dropper by washing the Petri dish several times with clean water. The water in test tubes, along with nematodes, was kept undisturbed for 1 – 2 hours, so that the nematodes in the water could settle down at the bottom of the test tube. Then most of the water in the test tube was withdrawn by a dropper very carefully without disturbing the nematodes. Finally the entire nematode population along with 3 – 4 ml of water was taken after removal of water.

Fixation and Preservation of Nematodes

The nematodes, kept in 3 – 4 ml of water in the test tube, were killed and fixed instantly in their characteristic body posture by Seinhorst's method^[28], in hot FA (formalin-acetic acid 4:1) solution. The fixed nematode specimens were taken in a glass cavity block and the nematodes were picked up one by one from the fixative with the help of a single soft bristle of camel-hair brush under a stereo zoom binocular (Olympus). The picked nematodes were transferred to another glass cavity block containing 3 – 4 ml of glycerin-alcohol solution. A drop of copper sulphate (CuSO₄) was added to glycerin-alcohol solution in the cavity block to prevent the growth of fungi^[29]. The cavity block containing the nematodes in glycerin-alcohol solution was kept in an air tight glass desiccator for slow dehydration of nematodes at room temperature for 3 – 6 weeks.

Preparation of permanent slides

After 3 to 6 weeks, the nematodes were fully dehydrated in the desiccator and remained in pure anhydrous glycerin. Slides were prepared by taking a single droplet of anhydrous glycerin at the middle of a glass micro slide and by placing few dehydrated nematode specimens of same size and morphological shape, in that droplet. 3 – 4 minute blocks of paraffin wax were placed around the glycerin droplet on the slide. Now a cover glass was placed on the paraffin blocks and the slide was placed on a hot plate with 60 °C temperature. The paraffin blocks were melted and the slide was immediately removed and was allowed to come in normal temperature. In this case the paraffin itself acts as a supporting material of cover slip as well as a sealing material^[30]. Nematodes were observed under a compound microscope (Olympus BX 41), drawings were made with the help of a drawing tube attached to the microscope, and specimens were measured (Curved structures were measured through its median axis) and photographed by a digital camera attached to the same microscope.

Result and Discussion

Description

Scutellonema bengalensis sp. n. (Figure 1 and 2)

Measurements: Shown in Table 1 and 2. The measurements given hereafter are based on holotype. Minimum-maximum ranges of measurements of paratypes are given in parenthesis.

Females: Body cylindrical, slightly tapering at both

extremities, ventrally curved to assume 'C'-shape on fixation. Cuticle marked with distinct transverse striations, 1.5 – 2.0µm at mid-body. Lateral fields with four incisures, abruptly areolated and without any areolation at the level of scutellum. Cephalic region slightly set off, high arched, hemispherical with 4 (3 – 4) distinct annules, 8.5µm (7.5 – 8.5µm) high and 14.5µm wide. Basal lip annules without longitudinal striations. Stomatostylet 2.5 (2.3 – 2.7) head widths long, conus slightly less than to half of the total stylet length. Stylet knobs well developed, anteriorly cupped. Orifice of dorsal pharyngeal gland 9.5µm (8.5 – 9.5µm) below the stylet base. Median bulb almost round to oval with well-developed central vulvular apparatus, located slightly posterior to the middle of the pharynx. Pharyngeal glands overlap intestine dorsally. Nerve ring surrounding the isthmus just below the median bulb, 105.0µm (98.0 – 108.0µm) from anterior end. Excretory pore 127.5µm (120.0 – 135.0µm) from anterior end below the nerve ring, anterior to hemizonid. Hemizonid 137.0µm (122.5 – 137.0µm) from anterior end, 5 (4 – 6) annules posterior to excretory pore. Vulva transverse, slit-like, post-equatorial in position, epiptygma absent. Vaginal length about half of the corresponding body width. Reproductive system amphidelphic, both branches of gonad functional. Both ovaries outstretched, oocytes arranged in a single row. Spermathecae irregular-shaped or almost round. Tail short, 0.9 (0.8 – 0.9) anal body-width long, broadly rounded, terminally striated with 12 – 14 annules on ventral side. Phasmids scutellum-like, measuring 3.0µm (2.5 – 3.0µm) in diameter, located at the level of anus or 1 – 2 annules posterior to anus.

Males: Similar to females in general morphology except the following. Orifice of dorsal pharyngeal gland 7.0 – 8.0µm below the stylet base. Average length of stylet shorter than that of females. Testes 522.0 – 622.0µm long. Spicules slightly ventrally curved near middle, cephalated, 1.8 – 2.0 anal body-widths long. Gubernaculum straight, well developed, 0.5 – 0.8 anal body-width long. Bursa with crenate margins, completely enveloping tail. Tail terminally smooth

and pointed in lateral view, 1– 1.3 anal body-widths long.

Type habitat and locality

Holotype with some other paratypes collected from soil around the roots of guava (*Psidium guajava* L.) by the author at Baruipur block on 25. 08. 2006 and other paratypes from same habitat at Baruipur block, South 24-Parganas district, West Bengal, India on 27. 07. 2005.

Type specimens

Holotype registration No. WN1045 with one female paratypes on same slide. Paratype registration Nos. WN1046 (3♀ & 2♂), WN1047 (3♀ & 3♂), WN 1048 (1♀ & 2♂), WN1049 (2♀ & 4♂) and WN1050 (1♀ & 3♂). Deposited in National Zoological Collection, Zoological Survey of India, Kolkata, India.

Etymology

As this is the first report of the genus *Scutellonema* Andrassy, 1958 with the proposition of the present new species from the state of West Bengal, the new species has been named after the state.

Differential Diagnosis and Relationship

Scutellonema bengalensis sp. n. can be distinguished from all other species of the genus except *S. grande* Sher, 1964 by the position of its hemizonid which is posterior to excretory pore. The present new species shows very close resemblance with *S. grande* but it differs in having longer body, lesser number of cephalic and tail annules, non-areolated lateral field at the level of scutellum and in having longer spicules in males leading to its separate identity (L = 0.87 – 1.20 mm in females and 0.81 – 1.05 mm in males; cephalic annules = 6 – 9; tail annules = 15 – 21; lateral fields areolated at the level of scutellum; spicules = 32.0 – 37.0µm in males of *S. grande* against L = 1.1 – 1.44mm in females and 1.04 – 1.16mm in males; cephalic annules = 3 – 4; tail annules = 12 – 14; lateral fields not areolated at the level of scutellum; spicules = 45.0 – 51.0µm in *S. bengalensis* sp. n.).

Table 1: Morphometric data on female *Scutellonema bengalensis* sp. n. (All measurements are in µm except L and body ratios, L in mm. Number of paratypes examined given in the parenthesis)

Characters	Holotype female	Paratype females (11)				
		Min	Max	Mean	± SD	SE
L	1.39	1.1	1.44	1.26	0.15	0.06
<i>a</i>	31.6	27.5	36.9	32.1	4.02	1.79
<i>b</i>	9.0	7.5	8.8	8.1	0.52	0.23
<i>b'</i>	7.4	6.5	7.7	7.0	0.47	0.21
<i>c</i>	58.0	47.4	55.7	51.1	3.81	1.7
<i>c'</i>	0.9	0.8	0.9	0.8	0.03	0.02
V %	52.3	54.0	57.3	55.5	1.05	0.47
G ₁ %	19.8	19.9	20.6	20.2	0.34	0.19
G ₂ %	19.5	19.6	20.9	20.3	0.64	0.37
Head height	8.5	7.5	8.5	8.0	0.63	0.28
head width	14.5	14.5	14.5	14.5	0	0
Number of cephalic annules	4	3	4	3.8	0.45	0.2
Length of stomatostylet	38.0	35.0	40.0	37.8	1.92	0.86
Length of conus	19.5	16.5	19.5	18.4	1.3	0.58
m %	51.5	47.4	50.2	48.6	1.17	0.52
Stylet base to opening of dorsal gland	9.5	8.5	9.5	9.3	0.56	0.28
o %	24.5	22.6	26.4	24.2	1.71	0.86

Maximum body width	44.0	35.5	46.5	40.0	4.24	1.89
Body width at vulva	44.0	34.0	46.5	38.8	5.2	2.33
Pharyngeal length	154.5	147.0	164.0	156.2	6.87	3.07
Anterior end to posterior margin of pharyngeal gland	186.0	169.0	191.0	180.7	8.49	3.8
Anterior end to centre of median bulb	93.0	88.0	93.0	90.6	2.51	1.12
MB %	60.1	56.7	59.8	58.0	1.36	0.6
Anterior end to nerve ring	105.0	98.0	108.0	104.2	3.7	1.65
Anterior end to excretory pore	127.5	120.0	135.0	125.0	8.66	5.0
Anterior end to hemizonid	137.0	122.5	137.0	129.1	7.32	4.23
Length of anterior gonad	277.0	220.0	282.0	254.1	31.16	17.99
Length of posterior gonad	272.0	225.5	286.5	254.6	30.59	17.66
Anterior end to vulva	730.0	610.0	796.0	711.9	80.2	35.86
Length of vagina	19.5	17.0	22.0	19.0	2.09	0.94
Tail length	24.5	22.0	29.0	25.1	2.88	1.29
Anal body width	25.0	24.5	32.0	28.7	3.55	1.59
Diameter of scutellum	3.0	2.5	3.0	2.9	0.22	0.1
Number of tail annules	13	12	14	13.4	0.89	0.4

Table 2: Morphometric data on male *Scutellonema bengalensis* sp. n. (All measurements are in μm except L and body ratios, L in mm. Number of paratypes examined given in the parenthesis)

Characters	Paratype males (14)				
	Min	Max	Mean	\pm SD	SE
L	1.04	1.16	1.1	0.05	0.02
<i>a</i>	29.0	32.7	30.9	1.35	0.6
<i>b</i>	7.2	8.2	7.5	0.37	0.17
<i>b'</i>	6.1	7.4	6.6	0.54	0.24
<i>c</i>	35.3	41.8	38.7	2.44	1.09
<i>c'</i>	1.0	1.3	1.2	0.1	0.05
T%	44.9	55.2	49.6	3.92	1.75
Head height	7.5	8.5	8.0	0.63	0.28
Head width	12.0	14.5	12.8	1.15	0.51
Number of cephalic annules	3	4	3.7	0.5	0.25
Length of stomatostylet	29.5	36	33.3	2.77	1.24
Length of conus	13.5	17.5	16.2	1.63	0.73
m %	46.4	50.3	48.6	1.39	0.62
Stylet base to opening of dorsal gland	7.0	8.0	7.3	0.57	0.29
O %	20.7	24.5	22.5	1.64	0.82
Maximum body width	32.0	39.0	36.4	2.6	1.17
Pharyngeal length	137.0	159.0	148.3	8.89	3.97
Anterior end to posterior margin of pharyngeal gland	152.0	188.5	170.9	14.32	6.4
Anterior end to centre of median bulb	78.0	88.0	82.6	3.65	1.63
MB %	50.9	58.4	55.7	2.91	1.3
Anterior end to nerve ring	83.0	105.0	97.4	8.8	3.94
Anterior end to excretory pore	108.0	128.5	116.3	8.07	3.6
Anterior end to hemizonid	121.5	135.0	129.6	6.24	3.12
Tail length	25.0	32.0	29.1	2.6	1.17
Anal body width	22.0	25.5	23.8	1.35	0.6
Diameter of scutellum	2.5	3.0	2.6	0.25	0.13
Testis length	522.0	622.0	557.6	39.3	17.57
Length of Spicules	45.0	51.0	47.6	2.3	1.03
Length of gubernaculum	14.0	19.5	17.0	2	0.89
Length of bursa	54	61	57.2	2.77	1.24

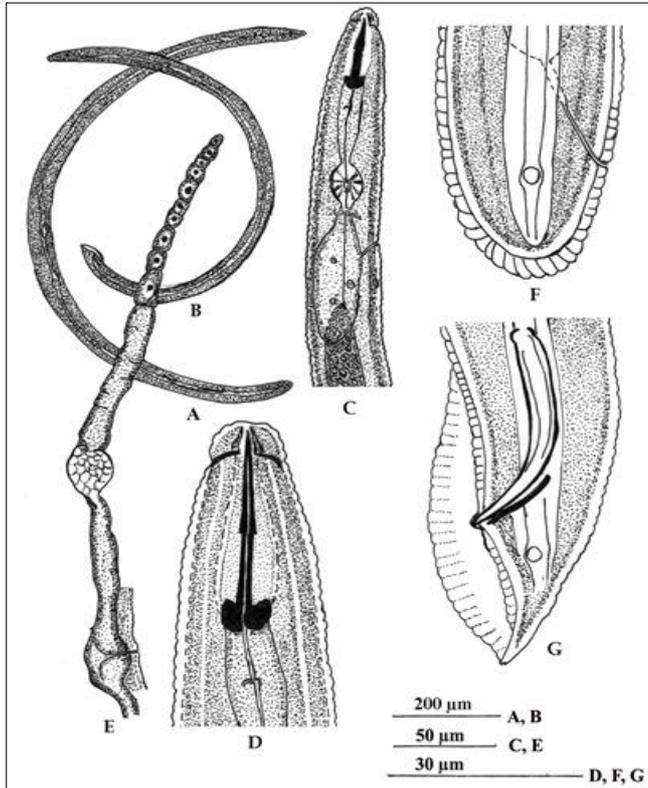


Fig 1: *Scutellonema benghalensis* sp. N. Female A. Entire body, C. Anterior portion of body, D. Anterior end showing cephalic region, stomatostylet, stylet knobs & opening of dorsal gland, E. Anterior branch of gonad, F. Posterior end showing scutellum and tail. Male: B. Entire body, G. posterior end showing spicule, gubernaculum & bursa.

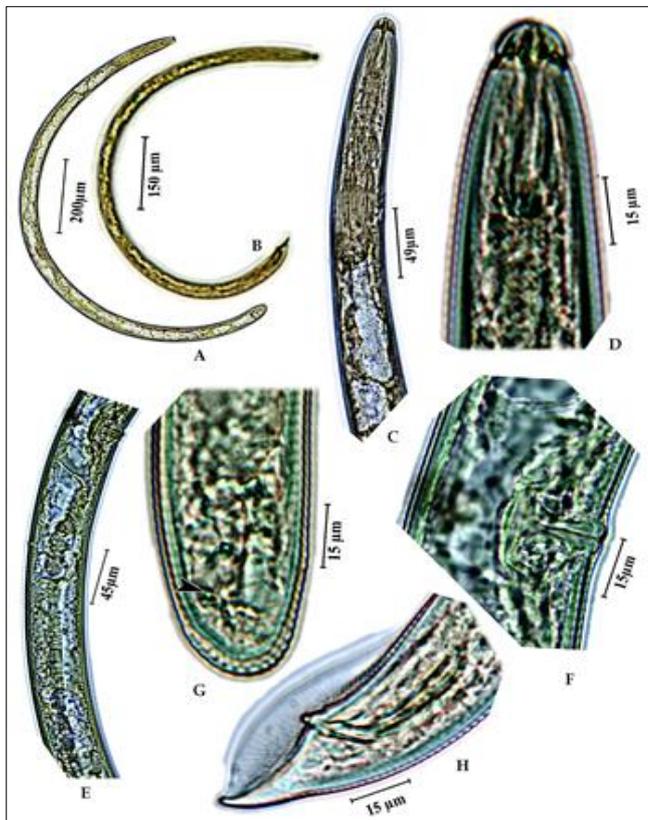


Fig 2: Photomicrographs of *Scutellonema benghalensis* sp. N. Female: A. Entire body, B. Anterior end, C. Anterior end showing stylet & knobs, D. Posterior branch of gonad, E. Vulva, F. Posterior end showing scutellum. Male: B. Entire body, H. Tail region showing spicules, gubernaculum & bursa.

Key to the species of the genus *Scutellonema* Andrassy, 1958 reported from India

1. Spermatheca functional, males present.....2
 - Spermatheca nonfunctional, males absent.....6
2. Hemizonid posterior to excretory pore.....3
 - Hemizonid anterior to excretory pore.....4
3. Body length 0.87 – 1.20mm in females; lateral field at the level of scutellum areolated.....*Scutellonema grande* Sher, 1964
 - Body length 1.10 – 1.44mm in females; lateral field at the level of scutellum not areolated.....*S. bengalensis* sp. n.
4. Head broadly rounded, deeply set off.....5
 - Head truncate, not set off.....*S. siamense* Timm, 1965
5. Head with 7 – 9 annules.....*S. bradys* (Steiner & Le Hew, 1933) Andrassy, 1958
 - Head with 2 – 3 annules.....*S. erectum* Sivakumar & Khan, 1981
6. Lateral field without areolation at the level of scutellum...7
 - Lateral field with areolation at the level of scutellum.....8
7. Basal lip annules with 4 striae; scutellum 4 – 5µm wide.....*S. imphalum* Sultan & Jairajpuri, 1978
 - Basal lip annules without striae; scutellum 6 – 7µm wide.....*S. scutellonema* Sen & Chatterjee, 2007
8. Basal lip annules without striae.....9
 - Basal lip annules with striae.....10
9. Lip region with 4 faint annules.....*S. sacchari* Rashid *et al.*, 1985
 - Lip region with 3 distinct annules.....*S. conocephalum* Sivakumar *et al.*, 1982
10. Basal lip annules with 6 striae.....*S. brachyurus* (Steiner, 1938) Andrassy, 1958
 - Basal lip annules with 10 or more striae.....11
11. Spear 29µm long.....*S. unum* Sher, 1964
 - Spear 34µm long.....*S. magniphasma* Sher, 1963

***Hirschmanniella gracilis* (de Man, 1880) Luc and Goodey, 1963 (Figure 3)**

Measurements

Females (N = 06): L = 1.56 – 1.72mm; a = 49.0 – 52.1; b = 10.3 – 14.0; b' = 4.5 – 6.8; c = 16.7 – 20.2; c' = 4.0 – 4.8; V = 51.8 – 54.5%; G₁ = 21.5 – 24.3%; G₂ = 13.1 – 21.2%; stylet length = 21.0 – 24.5µm; m = 42.8 – 48.0%; O = 12 – 18.6%; anterior end to centre of median bulb = 80.0 – 95.0µm; MB = 58.6 – 75.9%; maximum body width = 30.5 – 34.0µm; length of pharynx = 122.5 – 152.0µm; distance between anterior end and posterior margin of pharyngeal gland = 241.0 – 348.0µm; body width at vulva = 29.5 – 34.0µm; distance of vulva from anterior end = 830.5 – 904.0µm; length of vagina = 12.0 – 14.5µm; length of anterior branch of gonad = 343.0 – 421.0µm; length of posterior branch of gonad = 225.0 – 338.0µm; tail length = 81.0 – 103.0µm; anal body diameter = 19.5 – 22.0µm.

Males (N = 02): L = 1.59 – 1.63mm; a = 52.1 – 53.5; b = 12.9 – 15.0; b' = 6.2 – 6.5; c = 18.0 – 19.0; c' = 5.0 – 5.1; T = 53.5 – 55.8%; stylet length = 20.0 – 22.5µm; m = 45.0 – 47.9%; O = 17.4 – 24.5%; anterior end to centre of median bulb = 80.0 – 95.0µm; MB = 58.6 – 75.9%; maximum body width = 30.5µm; length of pharynx = 108.5 – 123.0µm; distance between anterior end and posterior margin of pharyngeal gland = 248.0 – 253.0µm; tail length = 86.0 – 88.0µm; anal

body diameter = 17.0 μ m.; length of testis = 874.5 – 889.0 μ m; spicule length = 30.5 – 31.5 μ m; gubernaculum = 8.0 – 10.0 μ m; length of bursa = 86.0 – 110.0 μ m.

Diagnosis

Females: Body slightly ventrally curved on fixation, long and slender. Cuticle marked with distinct transverse striae, 1.5 – 2.0 μ m apart at mid-body. Lateral fields with four incisures, not areolated. Cephalic region low arched, flattened to slightly hemispherical, continuous with body, annulations not prominent, 4.0 μ m high and 10.0 – 12.0 μ m wide. Cephalic frame work well developed. Stomatostylet robust, 1.8 – 2.2 head widths long, stylet knobs round, measuring 5 μ m across. Orifice of the dorsal pharyngeal gland 3.0 – 4.0 μ m below the base of stylet. Pharyngeal glands elongate, lobed, ventrally overlapping the intestine. Nerve ring at 103.0 – 116.5 μ m or at 74.1 – 88.1% of pharynx from anterior end. Median bulb oval with distinct valve plates. Hemizonid 131.0 – 151.0 μ m from anterior end, 1 – 2 annules long, located 3.0 – 5.0 μ m or 2 – 3 annules anterior to the excretory pore. Excretory pore at 135.0 – 159.0 μ m or at 98 – 113% of the pharyngeal length from anterior end. Vulva slightly post-equatorial. Vaginal length slightly more than half of the corresponding body width. Reproductive system amphidelphic. Each sexual branch consists of a uterus, a spermatheca, an oviduct and an ovary. Spermatheca oval, filled with sperms. Ovaries outstretched, oocytes arranged in a single row. Tail cylindrical, gradually tapering from anus, annulated up to anus bearing 43 – 68 annules, 4 – 4.8 anal body-width long, terminating in a pointed ventral projection. Phasmids located on middle to slightly posterior half of tail, at 46.5 – 51.8% of tail from anus.

Male: Similar to females in general morphology except the following. Excretory pore at 121.1 – 121.9% of the pharyngeal length from anterior end, being located posterior to pharyngo-intestinal junction. Spicules cephalated, 1.7 – 1.8 anal body-widths long. Gubernaculum developed, slightly curved, about one-third to one-fourth (1/3.1 – 1/3.8) of the spicule length. Bursa 5 – 6.4 anal body-widths long, arising a little anterior to the heads of spicules and ending sub-terminally. Tail similar as in females, 5 – 5.1 anal body-widths long with a pointed ventral projection.

Habitat and locality

Collected from soil around the roots of guava (*Psidium guajava* L.) by the author in Diamond Harbour block, South 24-Parganas district on 10. 08. 2008. ZSI registration No. WN1954 (6♀ & 2♂). Deposited in National Zoological Collection, Zoological Survey of India, Kolkata, India.

Remarks

A wide range of variation in measurements of *H. gracilis* was observed^[31]. The present specimens conform well to the morphology and measurements of the Topotypes of *Hirschmanniella gracilis*^[18]. Except slightly shorter gubernaculum in males (Gubernaculum = 9.0 – 14.0 μ m in topotypes vs. 8.0 - 10.0 μ m in the present specimens). The morphometric and allometric variations of *H. gracilis* were studied from soil around the roots of paddy (*Oryza sativa* L.) at West Dinajpur district, West Bengal, India^[19]. The present specimens agree with those except in having longer testis and insignificantly shorter gubernaculum (T = 25.0 – 44.0% and gubernaculum = 9.0 – 13.0 μ m vs. T = 53.5 – 55.8%,

gubernaculum = 8.0 - 10.0 μ m in the present specimens) which might be the intraspecific variation. This is the first distributional record of the species from South 24-parganas district.

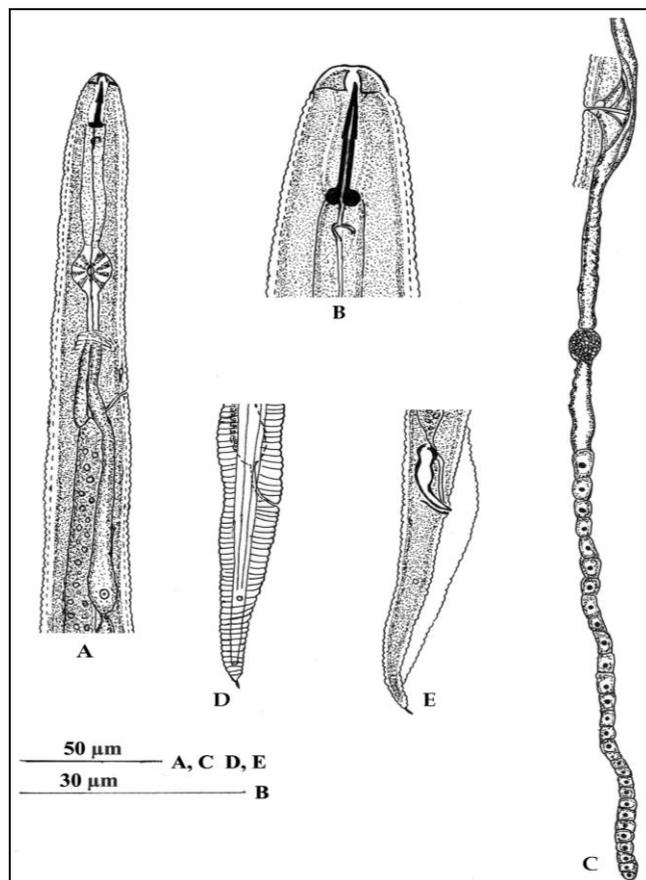


Fig 3: *Hirschmanniella gracilis*. Female. A. anterior end of the body, B. Cephalic region & stomatostylet, C. Posterior branch of reproductive system, D. Tail. Male: E. Posterior end showing spicule, gubernaculum, bursa & Tail terminus.

Hirschmanniella oryzae (Van Breda de Hann, 1902) Luc and Goodey, 1963 (Figure 4)

Measurements

Females (N = 08): L = 1.15 – 1.36 mm; *a* = 52.2 – 55.4; *b* = 8.3 – 10.8; *b'* = 4.4 – 5.7; *c* = 16.5 – 20.0; *c'* = 4.0 – 5.2; V = 51.2 – 54.9%; G₁ = 18.4 – 20.0%; G₂ = 15.9 – 19.5%; stylet length = 14.0 – 17.0 μ m; m = 44.8 – 47.0%; O = 14.5 – 20.0%; anterior end to centre of median bulb = 64.5 – 73.5 μ m, MB = 45.7 – 58.5%; maximum body width = 22.0 – 25.5 μ m, length of pharynx = 117.0 – 158.5 μ m; distance between anterior end and posterior margin of pharyngeal gland = 225.5 – 259.0 μ m; body width at vulva = 19.5 – 22.0 μ m; distance of vulva from anterior end = 612.5 – 747.0 μ m; length of vagina = 10.0 – 11.0 μ m; length of anterior branch of gonad = 186.0 – 254.5 μ m; length of posterior branch of gonad = 183.5 – 252.5 μ m; tail length = 61.0 – 73.5 μ m; anal body diameter = 12.0 – 17.0 μ m.

Males (N = 03): L = 1.2 – 1.22mm; *a* = 55.3 – 62.0; *b* = 9.6 – 10.2; *b'* = 4.6 – 5.7; *c* = 17.0 – 17.7; *c'* = 4.6 – 4.8; T = 46.9 – 57.4%; stylet length = 14.5 – 17.0 μ m; m = 40.0 – 47.0%; O = 15.0 – 23.5%; anterior end to centre of median bulb = 70.5 – 73.5 μ m; MB = 56.1 – 61.5%; maximum body width = 19.5 – 22.0 μ m, length of pharynx = 118.5 – 125.5 μ m; distance between anterior end and posterior margin of pharyngeal gland = 212.0 – 260.0 μ m; tail length = 68.5 – 71.0 μ m; anal

body diameter = 14.5µm.; length of testis = 568.5 – 700.0µm; spicule length = 22.5 – 25.5µm; gubernaculum = 7.5 – 10.0µm; length of bursa = 58.0 – 64.0µm.

Diagnosis

Females: Body almost straight or slightly ventrally curved on fixation, long and slender. Cuticle marked with distinct transverse striae, about 1.5 - 2.0µm apart near middle of the body. Lateral field with four incisures, not areolated. Cephalic region low arched, flattened with rounded edges, continuous with body, annules indistinct, 3.0µm high and 6.5 – 8.5µm wide. Cephalic frame well developed. Stomatostylet 1.7 – 2.3 head widths long, stylet knobs rounded, measuring 2.5 – 4.0µm across. Opening of dorsal pharyngeal gland 2.0 – 3.0µm below the stylet base. Median bulb oval with distinct valve plates. Oesophageal glands elongate, lobed, ventrally overlapping intestine. Hemizonid at 93.0 – 101.0µm from anterior end, 2 – 4 annules or 5.0 – 8.0µm anterior to excretory pore. Excretory pore distinct, at 101.0 – 116.5µm or at 86.2 – 97.5% of pharyngeal length from anterior end. Vulva slightly post-equatorial. Vaginal length 10.0 – 11.0µm or about half of the corresponding body width. Reproductive system amphidelphic. Ovaries long, outstretched, oocytes arranged in a single row. Spermatheca oval, filled with sperms. Tail cylindrical, elongate-conoid, gradually tapering behind anus, 4 – 5 anal body-widths long with a rounded terminus bearing a sharp terminal mucro. Tail annules extending almost up to terminus. Phasmids small, pore-like, located in posterior half of tail, 37.0 – 49.0µm from anus or at 60.6 – 69.2% of tail.

Male: Similar to those of females in general morphology except the following. Tail similar as in female, 4.6 – 4.8 anal body-widths long. Spicules cephalated, slightly arcuate, 1.5 – 1.7 anal body-widths long. Bursa with crenate margins, arising at the level of heads of spicules or a little posterior, ending sub terminally, not completely enveloping tail.

Habitat and locality

Collected from soil around the roots of guava (*Psidium guajava* L.) by the author at Dakshin Ghoshpara, Sonarpur block, South 24-Parganas district on 24. 07. 2005. ZSI Registration Number WN1927 (5♀ & 3♂) and WN2098 (3♀). Deposited in National Zoological Collection, Zoological Survey of India, Kolkata, India.

Remarks

Tylenchus oryzae van Breda de Hann, 1902 was described from soil around the roots of *Oryza sativa* in Java with a total length of 1.5 – 1.8 mm and stylet length 19.0µm [32]. Which was synonymised with *Hirschmanniella oryzae* [33]. The present specimens conform well to the morphology and measurements of the Topotypes of *H. oryzae* [18], except shorter stylet length (Stylet length = 16.0 – 19.0µm in female and 16.0 – 18.0µm in male topotypes; in Coimbatore population in India stylet = 17.0 – 20.0µm in female and 15.0 19.0µm in male vs. 14.0 - 17µm in females and 14.5 – 17.0µm in males of the present specimens). The present specimens also agree with the population of *H. oryzae*, reported from soil around the roots of *Corchorus capsularis* and *C. oltorios* in undivided 24-Parganas, Hooghly, Burdwan and Murshidabad districts, West Bengal [25]. Except in having shorter stylet, longer spicules and gubernaculum (Stylet length 17.0 – 21.0µm in females, 16.0 – 18.0µm in males;

spicule length 21.0 – 22.0µm; gubernaculum length 6.0 – 8.0 vs. stylet length 14.0 – 17.0µm in females and 14.5 – 17.0µm in males; spicule 22.5 – 25.5µm; gubernaculum 7.5 – 10.0 in the present specimens). The study on the distinguishing characters and morphometric and allometric variation in *H. oryzae* [24]. Strongly establishes the present specimen as *H. oryzae* and the deviation of stylet length and other minor variation in measurements might be considered as intraspecific variation. This is the first distributional record of the species from south 24-parganas after the division of the district.

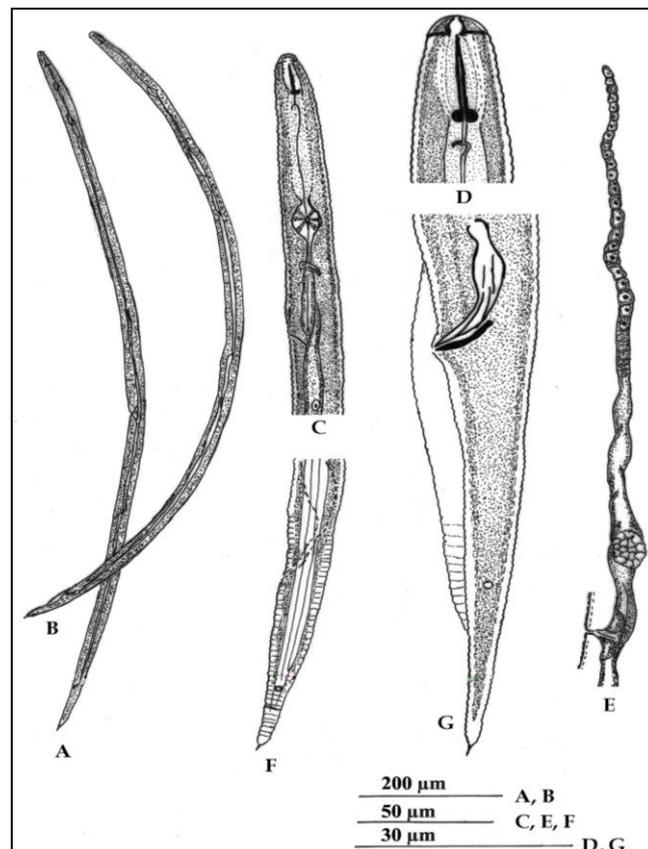


Fig 4: *Hirschmanniella oryzae*. Female: A. Entire body, C. Anterior portion, D. Cephalic region & stomatostylet, E. Anterior branch of gonad, F. Tail. Male: B. Entire body, G. Posterior end showing spicule, gubernaculum, bursa & tail.

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