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NEMATODES FROM WEST BENGAL (INDIA)
XVIII. STUDIES ON THE SPECIES OF THE SUBFAMILY TYLENCHORHYNCHINAE (TYLENCHORHYNCHIDAE : TYLENCHIDA)

By

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ABSTRACT

Tylenchorhynchus mashhoodi Siddiqi & Basir, 1959 is being recorded from several localities of Burdwan, Birbhum, Murshidabad and West Dinajpur districts of West Bengal. *Tylenchorhynchus goldeni* Rashid & Singh, 1982 is being considered a synonym of *T. mashhoodi*. The study of the type specimens of *Tylenchorhynchus swarupi* Singh & Khera, 1978 reveals that it is a synonym of *T. goffarti* Sturhan, 1966. The paper also reports the morphometric variations in *T. goffarti*. *Quinisulcius capitatus* (Allen, 1955) Siddiqi, 1971 and *Merlinius affinis* (Allen, 1955) Siddiqi, 1970 are being reported for the first time from West Bengal.

INTRODUCTION

Singh & Khera (1978) and Chaturvedi & Khera (1979) have reported *T. mashhoodi* Siddiqi & Basir, 1959 from the rhizosphere of different hosts at Howrah, 24-Parganas, Hooghly, Nadia, Burdwan, Bankura and Murshidabad districts of West Bengal. Singh & Khera (1978) have also described a new species *Tylenchorhynchus swarupi* (=now *T. goffarti* Sturhan, 1966) from 24-Parganas and Hooghly districts. *Tylenchorhynchus nudus* Allen, 1955 has been reported by Baqri & Ahmad (1981) from district Jalpaiguri (West Bengal). Baqri & Ahmad (1.c.) have also studied the morphometric variations in *T. nudus*.

The recent extensive and intensive surveys of plant and soil nematodes conducted by the authors in several districts of West Bengal have revealed that *Tylenchorhynchus mashhoodi* is a widely distributed species.

The present study mainly deals with the morphometric variations in *T. goffarti* and concludes that *T. swarupi* Singh & Khera, 1978 is a synonym of the former. Our obsersations are based on the study of the type specimens of *T. swarupi*, available in the National Collection of Zoological Survey of India.

MATERIAL

All the specimens have been mounted in anhydrous glycerin, registered and deposited in the National Collection of Zoological

Survey of India. The type specimens (n=24 ♀♀ & 18 ♂♂) of *Tylenchorhynchus swarupi* Singh & Khera, 1978, available in the National Collection of Zoological Survey of India, have also been included in the present study.

Tylenchorhynchus mashhoodi Siddiqi & Basir, 1959

(Fig. 1, A—C)

Syn. 1959. *Tylenchorhynchus mashhoodi* Siddiqi & Basir, *Proc. 46th Indian Sci. Congr.* Part IV (Abs.), : 35.

1961. *Tylenchorhynchus mashhoodi* Siddiqi, *Z. Parasitenkunde*, **21** : 56-58.

1970. *Tylenchorhynchus mashhoodi* Baqri & Jairajpuri, *Rev. Brasil. Biol.*, **30** : 61-64.

1978. *Tylenchorhynchus mashhoodi* Singh & Khera, *Bull. zool Surv. India*, **1** : 27-28.

1979. *Tylenchorhynchus mashhoodi* Chaturvedi & Khera, *Zool. Surv. India, Tech. Mongr.* No. 2 : 8-9 pp.

1982. *Tylenchorhynchus goldeni* Rashid & Singh, *Indian J. Nematol.*, **12** : 193-195, new synonymy.

Dimensions :

Females (10) : L (mm)=0.53-0.64 (0.60) SD=0.04 ; a=25-29 (28) SD=1.20 ; b=4.8-5.5 (5.1) SD=0.37 ; c=12-18 (15) SD=1.89 ; c'=2.5-3.5 (3.2) SD=1.96 ; V=52-57 (55.7) SD=1.83 ; G_1=20-29 (23) SD=2.94 ; G_2=19-26 (21.6) SD=1.90 ; Stylet (μm)=15-19 (15.9) SD=1.20 ; Metenchium (μm)=8-10 (8.5) SD=0.66 ; m=50-56 (53.5) SD=1.20.

Males (10) : L (mm)=0.49-0.60 (0.55) SD=0.04 ; a=27-31 (28) SD=1.85 ; b=4.6-5.1 (4.9) SD=0.15 ; c=14-16 (14.8) SD=0.92 ; c'=2.5-3.0 (2.7) SD=0.23 ; T=39-52 (45.8) SD=4.36 ; Stylet (μm)=15-17 (15.8) SD=0.92 ; Metenchium (μm)=8-9 (8.3) SD=0.42 ; m=50-53(52) SD=1.41 ; Spicules (μm)=19-22 (19.4) SD=3.40 ; Gubernaculum (μm)=10-12 (10.5) SD=0.67.

Habitat and locality : Soil around roots of paddy (*Oryza sativa* L.) at Saldar, District Burdwan.

Other localities : Several localities in the districts of Burdwan, Birbhum, Murshidabad and West Dinajpur.

Discussion : Rashid & Singh (1982) described a new species *Tylenchorhynchus goldeni* from soil around roots of sugarcane hybrid, at Lucknow (U.P.) and differentiated it from *T. annulatus* (Cassidy, 1930) Golden, 1971 and *T. mashhoodi*. From *T. mashhoodi* they have differentiated *T. goldeni* in having a longer body, longer stylet, lower value of b and larger number of tail annules. While comparing with the dimensions and description provided by Allen (1955) and Baqri and Jairajpuri (1970) of *T. mashhoodi*, it is hereby noted that differential characters used by Rashid & Singh (1982) are either overlapping or insignificant. These are as follows : L= 0.57-0.82 mm against L=0.54-0.76 mm in *T. mashhoodi* ; stylet=16-19 μm against 16-19 μm in *T. mashhoodi* ; tail annules= 19-36 against 14-29 in *T. mashhoodi*.

This comparision reveals that the only character in which the description of *T. goldeni* differs from *T. mashhoodi* is the higher number of tail annules. However, we feel that 19-36 tail annules against 14-29 should not be treated as diagnostic character because this has been found highly variable character in *Tylenchorhynchus* species (Baqri and Ahmad, 1981 in *T. nudus* ; and the present study in *T. goffarti*). It is, therefore, proposd that *T goldeni* is a synonym of *T. mashhoodi*.

Tylenchorhynchus goffarti Sturhan, 1966
(Fig. 1, D-F)

Syn. 1970. *Tylenchorhynchus goffarti* Baqri and Jairajpuri, *Rev. Brasil. Biol.*, 30 : 64-65.

1978. *Tylenchorhynchus swarupi* Singh and Khera, *Bull. zool. Surv. India*, 1 : 25-28, new synonymy.

Dimensions :

Narendrapur population : Table I

Birbhum population :

Females (9) : L (mm) = 0.57-0.63 (0.61) SD = 0.03 ; a = 31-34(32.5) SD = 1.01 ; b = 4.8-5.3(5.1) SD = 0.17 ; c = 14-15(14.2) SD = 0.44 ; c' = 3.0-3.6(3.4) SD = 0.18 ; V = 52-60 (54) SD = 1.83 ; G_1 = 23-28(25) SD = 1.67 ; G_2 = 20-28(23) SD = 2.65 ; Stylet (μm) = 16-17(16.4) SD = 0.53 ; Metenchium (μm) = 8-9(8.6) SD = 0.49 ; m = 50-56(52) SD = 2.50.

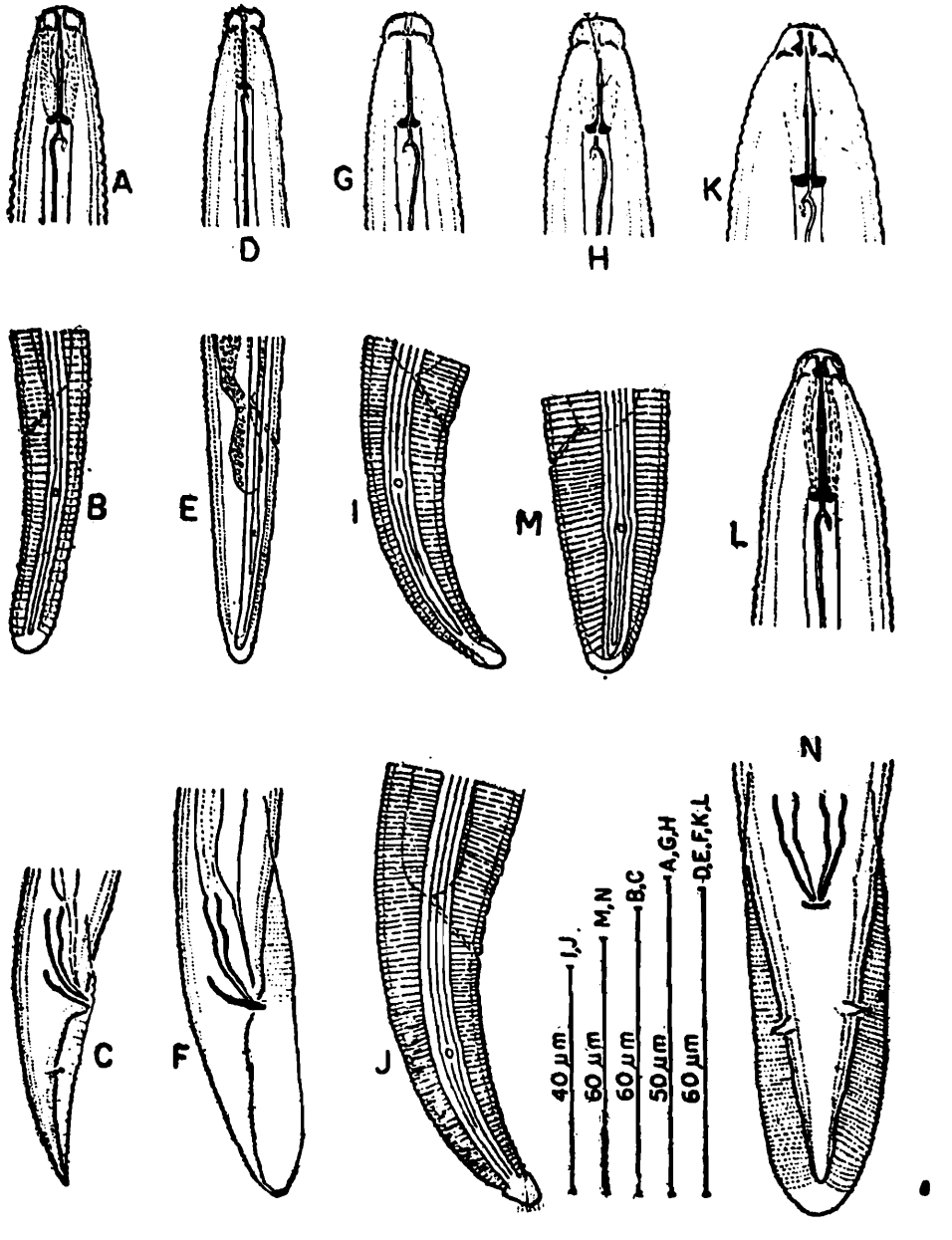

Fig. 1. *Tylenchorhynchus mashhoodi* (A-C) : A. Anterior end ; B. Female tail ; C. Male tail. *T. goffarti* (D-F) : D. Anterior end ; E. Female tail ; F. Male tail. *Quinisulcius capitatus* (G-J) : G. & H. Anterior end ; I & J : Female tails. *Merlinius affinis* (K-N) : K & L. Anterior end ; M. Female tail ; N. Male tail.

TABLE—I. Morphometric and Allometric Variations in Adults of *Tylenchorhynchus goffarti*.

Characters	Female (n=24, paratypes of *T. swarupi*)			Male (n=18, paratypes of *T. swarupi*)		
	Range	Mean ± S. D.	C. V. (%)	Range	Mean ± S. D.	C. V. (%)
Length (μm)	478-637	558±36.27	6.5	458-637	534±44.80	8.5
a	26-32	30± 1.84	6.1	28-35	33± 2.68	8.1
b	4.7-5.7	5.1 ± 0.28	5.5	4.5-5.8	5.0± 0.36	7.2
c	13-17	15± 1.28	8.5	13-22	16.5± 2.09	13.0
c′	2.6-3.2	2.9 ± 0.16	5.5	2.3-3.0	2.7± 0.24	8.9
V/T	52-58	53± 1.64	3.1	55-66	61± 3.56	5.8
G_1	24-30	27± 2.37	8.8	—	— —	—
G_2	20-30	25± 2.51	10.0	—	— —	—
m	50-57	53± 2.11	4.0	49-54	53± 2.53	4.8
Head height (μm)	3-4	3.3 ± 0.20	6.1	3-4	3.2± 0.20	6.4
Head width (μm)	6-8	6.8 ± 0.46	6.8	6-8	6.4± 0.62	9.7
Stylet (μm)	13-14	13.4 ± 0.39	2.9	13-14	13.2± 0.55	3.0
Stylet knobs (μm)	3-3.5	3.04± 0.14	4.6	3-3.5	3.03± 0.14	4.6
Metenchium (μm)	7-8	7.1 ± 0.42	5.9	7-8	7.2 ± 0.38	5.3
Oesophagus* (μm)	100-121	109 ± 5.27	4.8	100-115	107± 4.12	3.9
Median bulb* (μm)	49-58	54 ± 2.80	5.2	49-54	53± 2.53	4.8
Median oesophageal bulb length (μm)	10-13	12.4 ± 0.49	4.0	10-13	11.8 ±0.81	6.9
Median oesophageal bulb width (μm)	8-10	9.4 ± 0.65	6.9	7-10	8.6 ±0.78	9.1
Nerve ring* (μm)	66-76	71± 3.13	4.4	66-74	69±2.52	3.7
Excretory pore (μm)	80-95	88± 3.94	4.5	79-94	87±3 24	3.4
Vulva* (μm)	264-343	304±18.50	6.1	—	— —	—
Anterior gonad (μm)	126-195	154±17.50	11.0	—	— —	—
Posterior gonad (μm)	108-182	141±19.56	14.0	—	— —	—
Vagina (μm)	9-13	10.3± 1.17	14.0	—	— —	—
Vulva body width (μm)	16-22	19 ± 1.72	9.1	14-19	17±1.70	10.0
Anal body diameter (μm)	12-15	12.6± 1.01	8.0	11-13	11.9±0.73	6.1
Rectum (μm)	9-11	9.8± 0.64	6.5	—	— —	—
Tail (μm)	35-44	38 ± 3.16	8.3	25-39	32±3.38	11.0
Tail annules	24-43	35 ± 8.50	24.0	—	— —	—
Spicules (μm)	—	— —	—	18-24	21.3±1.28	6.0
Gubernaculum (μm)	—	— —	—	7-10	8.8±1.06	12.0

* Distances from anterior end

S. D.=Standard deviation

C. V.=Coefficient of variability

Male : L (mm) = 0.62 ; a = 31 ; b = 5.1 ; c = 15 ; c' = 3.0 ; T = 41 ; Stylet (μm) = 16.0 ; Metenchium (μm) = 8.0 ; m = 53.

Description : *Female* : Cuticle transversely striated 1-2 μm apart. Longitudinal striations absent. Lateral fields marked hy 4 incisures, 1/5th-1/4th the body-width near middle. Lip region set off from the body, bearing 5-6 indistinct striae, 6-8 μm wide and 3-4 μm high. Head framework slightly sclerotized. Stylet 1.6-2.3 hed-width long, its anterior part (metenchium) 50-57% of stylet length. Stylet knobs slopping downward, 3-5 μm wide. Orifice of dorsal oesophageal gland about 2μm from base of stylet. Median oesophageal bulb ovate, 46-54% of oesophageal length. Hemizonid prominent, 2-3 annules long, situated 0-5 annules from excretory pore. Vulva a transverse slit. Vagina about 1/2 the corresponding body-width. Gonads typical to the genus. Spermatheca functional, ovate or spherical in shape. Tail with a smooth rounded terminus, marked with 32-43 annules ventrally. Post intestinal

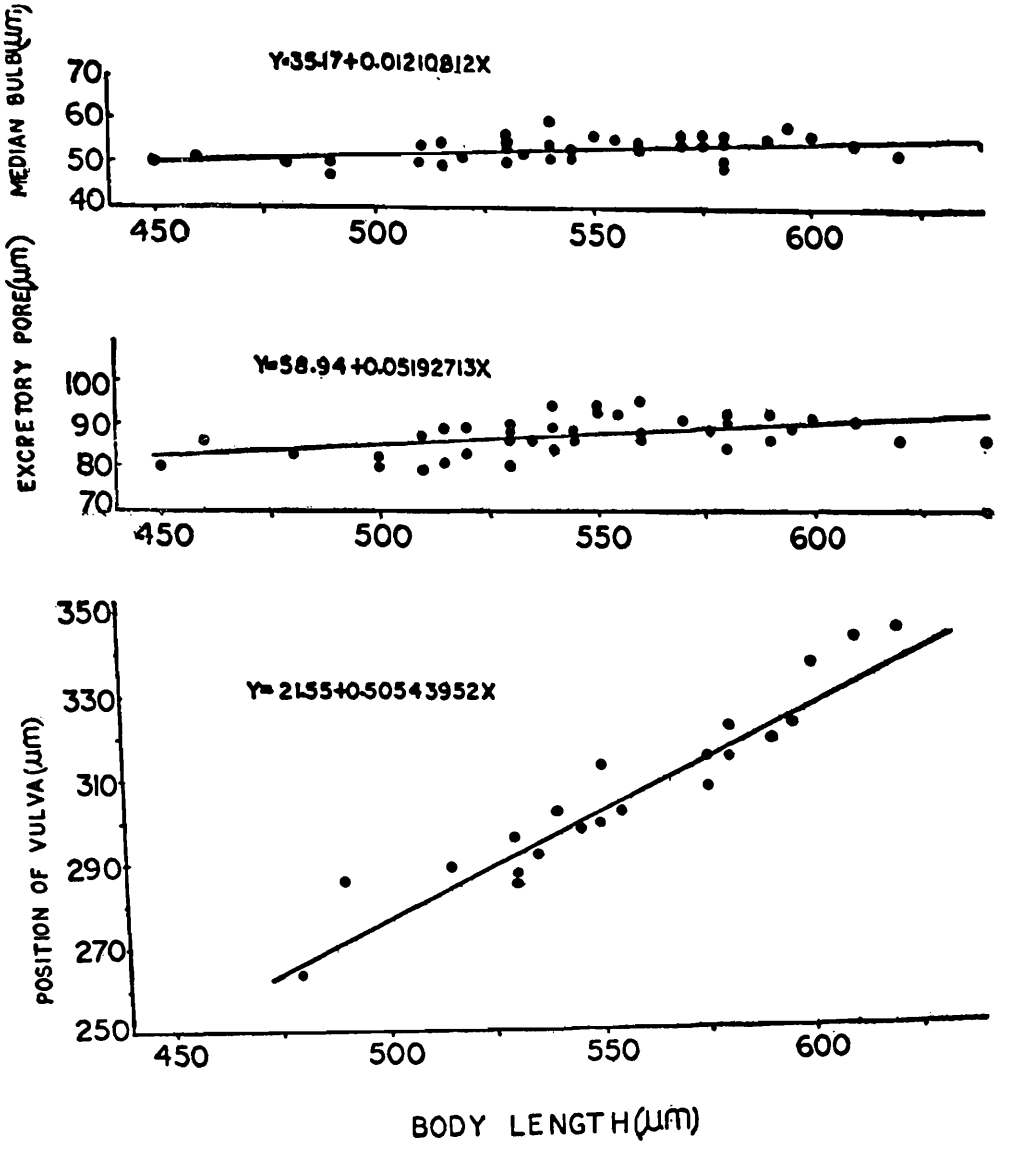

Fig. 2. *Tylenchorhynchus goffarti* : Body length in relation to position to median bulb, position of excretory pore and position of vulva.

sac about 1.1-1.3 anal body-width long. Phasmids in the anterior half, 36-40% of tail from anus.

Male : Male resembles females in general morphology. Spicules 18-24 (21.3) μm long medially. Gubernaculum trough shaped, 7-10 (8.8) μm long. Tail elongate conoid with acute terminus, 2.6-3.2 times the anal body diameter. Phasmids in the anterior half, 33-40% of the tail.

Morphometric and Allometric variations : The various morphometric and allometric characters analysed statistically for their variability in adults (Narendrapur population) are presented in Table I. This has been noted that the position of median oesophageal bulb, excretory pore and vulva are significantly correlated with body length (Fig. 2). The coefficient of correlations are respectively R=0.707, 0.728 and 0.929. The length of stylet (R=0.432), oesophagus (R=0.659), Gonads (R=0.802) and Tail (R=0.234 in females and 0.460 in males) are not significantly corre lated with the body length.

Among the various morphometric and allometric characters evaluated for their variability, the length of stylet and value of 'V' have been found least variable, their C.V. being 2.9-3.0% and 3.1% respectively. The highly variable characters (C.V.=>10%) are length of genital branches (C.V.=11-14%), vagina (C.V.=14%), value of c (C.V.=13%), and tail length (C.V.=11% in males only), length of gubernaculum (C.V.=12%), and tail annules (C.V.=24%). Remaining characters have been found either moderately variable (C.V.=4-6%) or markedly variable (C.V.=7-10%).

Remarks : The present description, based on 42 paratypes of *T. swarupi*, agrees with the description provided by Singh & Khera (1978) except the differences noted by us in the tail terminus and the fusion of the inner two incisures in tail region. Surprisingly they (l.c.) have reported and illustrated striated tail terminus whereas our study confirms that the tail terminus is smooth (Fig. 1,E). This is further being confirmed that inner two incisures fuse well below the phasmids in the tail region (after Singh & Khera, "the inner two incisures fuse at the phasmids).

Singh & Khera (1978) described *T. swarupi* from Narendrapur, district 24-Parganas (West Bengal) and separated it from *T. vulgaris* Upadhyay *et.al.* 1974, *T. brevilineatus* Williams, 1960 and *T. brassicae* Siddiqi, 1966. The present study reveals that their observations on tail terminus as striated instead of smooth, has led the misidentification of *T gofferti* as a new species. In fact, the specimens belong to *T. goffarti.* Hence, *T. swarupi* is hereby proposed a synonym of *T. goffarti.* Singh & Khera (1978) were having 42 paratypes of *T. swarupi* but they measured only 10 females and 10 males.

Quinisulcius capitatus (Allen, 1955)
Siddiqi, 1971
(Fig. 1, G—J)

1961. *Tylenchorhynchus capitatus* Siddiqi, *Z. parasitenkunde* **21** : 62-63.

1975. *Quinisulcius capitatus* Coomans & Saltakoglu, *Meded. Fac. Landbwel. Gent.*, **40** : 497-500.

Dimensions :

Female (7) : L (mm)=0.67-0.76 (0.72) SD=0.04 ; a=20-33 (30.6) SD=1.72 ; b=4.9-5.5 (5.2) SD=0.21 ; c=14-16 (15)

SD=0.90 ; c'=2.6-2.9 (2.7) SD=0.10 ; V=52-59 (55) SD=2.30 ; G_1=25-29 (27) SD=1.27 ; G_2=22-25 (24) SD=0.89 ; Stylet (μm)=17-18 (17.2) SD=0.39 ; Metenchium (μm)=8.5-9.6 (9.1) SD=0.19 ; m=50-53 (52) SD=1.46.

Description :

Female : Cuticle transversely striated, 1-2 μm apart. Longitudinal lines absent, lateral fields marked by five incisures, 1/5th-1/4th of the body-width near middle. Lip region set off from the body, bearing 5-6 annules, 4-5 μm high and about 8 μm wide. Head framework slightly sclerotized. Stylet 2.1-2.3 times the head-width, its anterior part (metenchium) 50-53% of the stylet length. Stylet knobs indented anteriorly, about 3.0-3.5 μm wide. Hemizonid about 2 annules long, situated at 1-5 annules above the excretory pore. Tail cylindrical ending in an acute smooth terminus, marked with 37-44 annules ventrally. Phasmids in the anterior half (23-37%) of the tail.

Male : Not found.

Habitat and locality : From soil around roots of *Citrus* sp. at Dalapchand basti, Kalimpong, Darjeeling, West Bengal.

Merlinius affinis (Allen, 1955) Siddiqi, 1970 (Fig. 1, K-N)

Dimensions :

Female (4) ; L (mm)=0.78-0.91(0.84) SD =0.06 ; a=20-21(20.9) SD=0.82 ; b=5.2-6.0(5.5) SD=0.36 ; c=13-16(15) SD=1.41 ; c'=1.41-2.41(1.87) SD=0.42 ; V=53-56(54) SD=1.50 ; G_1=20-21 (20.5) SD=0.58 ; G_2 =14-20(18.0) SD=2.83 ; Stylet (μm)=26-28 (27.1) SD=0.85 ; Metenchium (μm)=14-14.5 (14.4) SD=0.25 ; m=52-54(53) SD=0.96.

Male (2) : L (mm)=0.78-0.87(0.82) SD= 0.07 ; a=22-24(23) SD=1.41 b=5.4-5.6(5.5) SD=0.14 ; c=12-17(14.5) SD=3.54 ; c'= 1.93-2.5(2.3) SD=0.43 ; T=29-40(35.4) SD =7.78 ; Stylet (μm)=26-28(27.0) SD=1.42 ; Metenchium (μm)=13-15(14) SD=1.41.

Description :

Female : Cuticle transversely striated, 2 μm apart. Longitudinal lines absent, lateral fields $\frac{1}{5}$th-$\frac{1}{4}$th of the body near the middle. Lip region slightly set off from the body, flat at apex, bearing 6 annules, 3-4 μm high and 6.5-8.0 μm wide. Head framework heavily sclerotized. Stylet 2.6-2.8 times the head width, its anterior part (metenchium) about 50-54% of stylet length. Stylet knobs slightly indented anteriorly. Hemizonid 1-2 annules long, situated 0-1 annule above the excretory pore. Gonads typical to genus. Tail broadly rounded, marked with 28-34 annules ventrally. Phasmids in the anterior half (30-35%) of the tail.

Male : Similar to females in general morphology except the male genital system and tail shape. Spicules 24 μm medially. Gubernaculum stout, 6 μm long. Tail elongate conoid with acute terminus, 1.9-2.5 times the anal body diameter. Phasmids in the anterior half (37-45%) of the tail.

Habitat and locality : Form soil around roots of Tea (*Thea sinensis* L.) at Lebong, Darjeeling, Wast Bengal.

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