

**NEMATODES FROM WEST BENGAL (INDIA). XXII.  
MORPHOMETRIC AND ALLOMETRIC VARIATIONS IN  
HIRSCHMANNIELLA ORYZAE (V. BREDA DE HAAN, 1902) LUC &  
GOODEY, 1963 (PRAITYLENCHIDAE : TYLENCHIDA)**

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INTRODUCTION

Though *Hirschmanniella gracilis* (de Man, 1880) Luc & Goodey, 1963 has been found a key pest of paddy by Baqri et. al (1983) in West Bengal, *H. oryzae* (V Breda de Haan, 1902) Luc & Goodey 1963 has also been encountered as a potential pest of paddy in some localities of North Bengal Districts of West Bengal. Since *H. gracilis* has been confused with *H. oryzae* in West Bengal, it was felt necessary to study the intra-specific variations with special reference to allometric and morphometric characters of the two species so that these may be identified correctly. Dey & Baqri (1985) have already discussed the allometric and morphometric variations in *H. gracilis*. Waliullah (1985) has also studied allometric variations in *H. oryzae* from Indonesia. However, he has taken into consideration only the linear relationships of a few sets of characters by using the logarithmic regression equation. This paper reports the variations in single population of *H. oryzae* from West Bengal, India.

MATERIAL AND METHOD

The nematodes were fixed in hot 4% formalin, dehydrated in the desiccator and mounted in anhydrous glycerine. The specimens have been registered and deposited with the National Zoological Collection, Zoological Survey of India, Calcutta.

*Hirschmanniella oryzae* (V Breda de Haan, 1902) Luc & Goodey, 1963  
(Figs. 1 - 3)

*Dimensions* : TABLE I.

*Description* :

*Female* : Body slightly curved upon fixation. Body annules 1.2-2.0  $\mu\text{m}$  apart in the middle region. Lateral fields 5-7  $\mu\text{m}$  or 1/4th-1/3rd of body-width near middle, marked with four incisures of which the outer ones are crenate. In some specimens incomplete aerolations have been found in the posterior region of the body. Head continuous with body, flat at apex, marked with 3-4 annules, with well developed cephalic framework. Stylet robust, 17-19  $\mu\text{m}$  or about 1.8-2.2 times the head-width. The metanchium (anterior part of the stylet) 7-8  $\mu\text{m}$  long or 41-42 % of the stylet length. The stylet knobs are rounded, 3.5-4.2  $\mu\text{m}$  wide.

TABLE 1  
**Morphometric and Allometric Variations in Adults**  
 in *Hirschmanniella Oryzae* (V. Breda de Haan, 1902) Luc & Goodey, 1963 (40 Females, 40 Males)

Characters	♀						♂							
	Range		Mean	±	S. D.	S. E.	C.V.(%)	Range		Mean	±	S. D.	S. E.	C.V.(%)
Length (mm)	1.20 –	1.58	1.40	±	0.09	0.02	6.83	1.09 –	1.44	1.28	±	0.09	0.01	7.0
a	59.30 –	75	68.05	±	3.38	0.53	4.97	55.50 –	73.94	63.71	±	5.05	0.80	7.92
b	10.50 –	12.70	11.53	±	0.60	0.09	5.20	9.01 –	11.68	10.53	±	0.67	0.11	6.39
b'	3.9 –	5.0	4.32	±	0.24	0.04	5.55	3.57 –	5.02	4.19	±	0.25	0.04	6.03
c	14.30 –	18.30	16.29	±	0.98	0.15	6.02	14.34 –	18.21	16.60	±	1.01	0.16	6.11
c'	5.20 –	7.0	5.82	±	0.47	0.07	8.07	4.5 –	6.15	5.31	±	0.35	0.06	6.64
V/T	51 –	57	53.42	±	1.41	0.22	2.64	23 –	35	28.97	±	3.35	0.53	11.55
G <sub>1</sub>	18 –	23	20.02	±	1.73	0.27	8.64	–	–	–	–	–	–	–
G <sub>2</sub>	15 –	25	18.85	±	1.98	0.31	10.5	–	–	–	–	–	–	–
O	13.51 –	18.42	15.57	±	1.13	0.17	7.26	11.11 –	17.65	15.06	±	1.12	0.17	7.44
m	55.30 –	66.10	61.82	±	2.80	0.44	4.53	56.0 –	66.94	62.82	±	2.12	0.34	3.38
Cut. at mid body (µm)	0.80 –	1.20	0.95	±	0.10	0.02	10.50	0.8 –	1.2	0.94	±	0.11	0.02	11.68
Annules (µm)	1.20 –	2.0	1.56	±	0.23	0.04	14.68	1.1 –	1.7	1.47	±	0.16	0.03	10.77
Lateral fields (µm)	5 –	7	5.87	±	0.85	0.13	14.47	5 –	7	5.47	±	0.60	0.09	10.92
Head width (µm)	7 –	9	8.47	±	0.55	0.09	6.49	8 –	9	8.42	±	0.50	0.08	5.93
Stylet (µm)	17 –	19	17.78	±	0.48	0.08	2.69	17 –	19	17.50	±	0.52	0.08	2.96
Head height (µm)	3 –	5	3.87	±	0.40	0.06	10.32	3 –	5	3.75	±	0.44	0.07	11.68
Stylet knobs (µm)	3.5 –	4.2	3.81	±	0.10	0.01	2.62	3 –	4	3.51	±	0.09	0.01	2.56
Metenchium (µm)	7 –	8	7.47	±	0.19	0.02	2.54	7 –	8	7.52	±	0.21	0.03	2.79

Characters	♀							♂						
	Range	Mean	±	S. D.	S. E.	C.V.(%)	Range	Mean	±	S. D.	S. E.	C.V.(%)		
D. Oesc.gl.opening (µm)	2.5 - 3.5	3.14	±	0.23	0.03	7.32	2 - 3	2.84	±	0.20	0.03	7.04		
Oesophagus* (µm)	116 - 136	124.90	±	4.34	0.69	3.47	113 - 135	123.35	±	4.85	0.77	3.93		
Oeso. overlap** (µm)	150 - 240	203.27	±	19.78	3.13	9.73	140 - 205	185.20	±	21.27	3.36	11.48		
Median bulb (µm)	16-20 × 9-12	18.07×	±	1.11×	0.18×	6.19×	17-20 × 8-11	18.10×	±	1.17×	0.19×	6.48×		
		10.97	±	0.89	0.14	8.12		9.87		0.65	0.10	6.55		
Median bulb* (µm)	70 - 81	75.20	±	2.32	0.37	3.09	70 - 84	76.50	±	3.49	0.55	4.57		
Nerve ring* (µm)	89 - 102	96.42	±	3.07	0.49	3.18	90 - 104	97.62	±	3.58	0.57	3.67		
Excretory pore* (µm)	112 - 131	121.45	±	4.92	0.78	4.05	109 - 129	120.52	±	5.01	0.79	4.16		
Hemizonid (from excr.pore)	0 - 5 annules.													
Hemizonid width	2 - 4 annules.													
Vulva* (µm)	668 - 830	751.07	±	46.0	7.27	6.12	-	-		-	-	-		
Vagina (µm)	8 - 10	8.82	±	0.81	0.13	9.18	-	-		-	-	-		
Vulva body width (µm)	17 - 25	20.70	±	1.80	0.28	8.7	-	-		-	-	-		
Anterior gonad (µm)	222 - 380	279.15	±	37.32	5.90	13.37	-	-		-	-	-		
Posterior gonad (µm)	210 - 358	266.32	±	37.34	5.90	14.02	-	-		-	-	-		
Anal body width (µm)	12 - 18	14.87	±	1.53	0.24	10.35	13 - 17	14.53	±	2.54	0.40	17.78		
Rectum (µm)	8 - 15	10.32	±	2.16	0.34	20.96	-	-		-	-	-		
Tail annules (no.)	54 - 75	65.27	±	6.10	0.96	9.35	-	-		-	-	-		
Tail length (µm)	70 - 105	86.47	±	6.98	1.10	8.08	63 - 90	77.67	±	5.34	0.84	6.88		
Spicules (µm)	-	-		-	-	-	20 - 28	23.8	±	1.65	0.26	6.94		
Gubernaculum (µm)	-	-		-	-	-	5 - 10	7.7	±	1.24	0.20	16.16		
Phasmids (µm)	20 - 45	28.65	±	5.65	0.89	9.72	21 - 35	27.67	±	2.90	0.46	10.49		

\* Distance from anterior end.

\*\* Distance from Oesophagus-intestinal junction.

Oesophagus typical of the genus. Median oesophageal bulb at 56-60 % of the oesophageal length from anterior end,  $16-20 \times 9-12 \mu\text{m}$ . Oesophageal glands lobed, overlapping intestine ventrally. Orifice of the dorsal oesophageal gland  $2.5-3.5 \mu\text{m}$  below the base of the stylet. The nerve ring situated at  $89-102 \mu\text{m}$  or 72-80 % of the oesophageal length from anterior extremity. Excretory pore at  $112-131 \mu\text{m}$  or 91-94 % of the oesophageal length from anterior end, located slightly anterior to the oesophago-intestinal junction (Fig. 1). Hemizonid 2-4 annules long, situated 0-5 annules anterior to the excretory pore. Vulva post-equatorial in position. Vagina about 1/2 of the corresponding body-width. Reproductive system amphidelphic. Each sexual branch consists of an uterus, a spermatheca, an oviduct and an ovary. Spermatheca filled with sperms. Oocytes arranged in a single row except in the growth region. Tail cylindrical, with mucronate terminus,  $70-105 \mu\text{m}$  or 5.5-6.5 anal body-widths long. Phasmids located in posterior half of the tail, 26.4-42.8 % of the tail length from tail terminus.

♂ : Similar to female in general shape and morphology except the reproductive system and the tail shape. Bursa subterminal (Fig. 1. I, J). Gubernaculum slightly curved. Spicules  $20-28 \mu\text{m}$  long when measured along the median line. Tail slightly curved,  $63-90 \mu\text{m}$  or 4.5-6 anal body-widths long, with a pointed ventral mucro.

#### MORPHOMETRIC AND ALLOMETRIC CHARACTERS

The measurements and statistical analyses of various morphometric and allometric characters of adult females and males have been furnished in Table-I. The position of the vulva and the length of the tail are significantly correlated with the body length, the correlation of which are 0.922 and 0.629 respectively (fig. 2). The position of the excretory pore has moderate correlation with body-length as its 'r' value is 0.502. The length of oesophagus and the position of the median bulb from anterior end is less correlated with the body-length, the 'r' value are 0.268 and 0.159 respectively. The length of the stylet and gonads have no correlation with the body-length.

The statistical analysis shows that the stylet length and the 'V' value are the least variable characters ( $CV \geq 3$ ). Though the 'V' value is least variable, the length of anterior and posterior sexual branches exhibit high degree of variability ( $CV = 8.64$  and  $10.5$  respectively). The length of body, tail and oesophagus; distance of dorsal oesophageal gland opening from the base of stylet; position of median bulb, nerve ring, and excretory pore from anterior end; and the value of a, b, b', c, O, and m are moderately variable characters ( $CV = 4-8$ ). In case of male, the length of the spicules varies moderately ( $CV = 6.94$ ) while the length of the gubernaculum and the position of phasmids show a high degree of variability ( $CV = 10.49 - 16.16$ ).

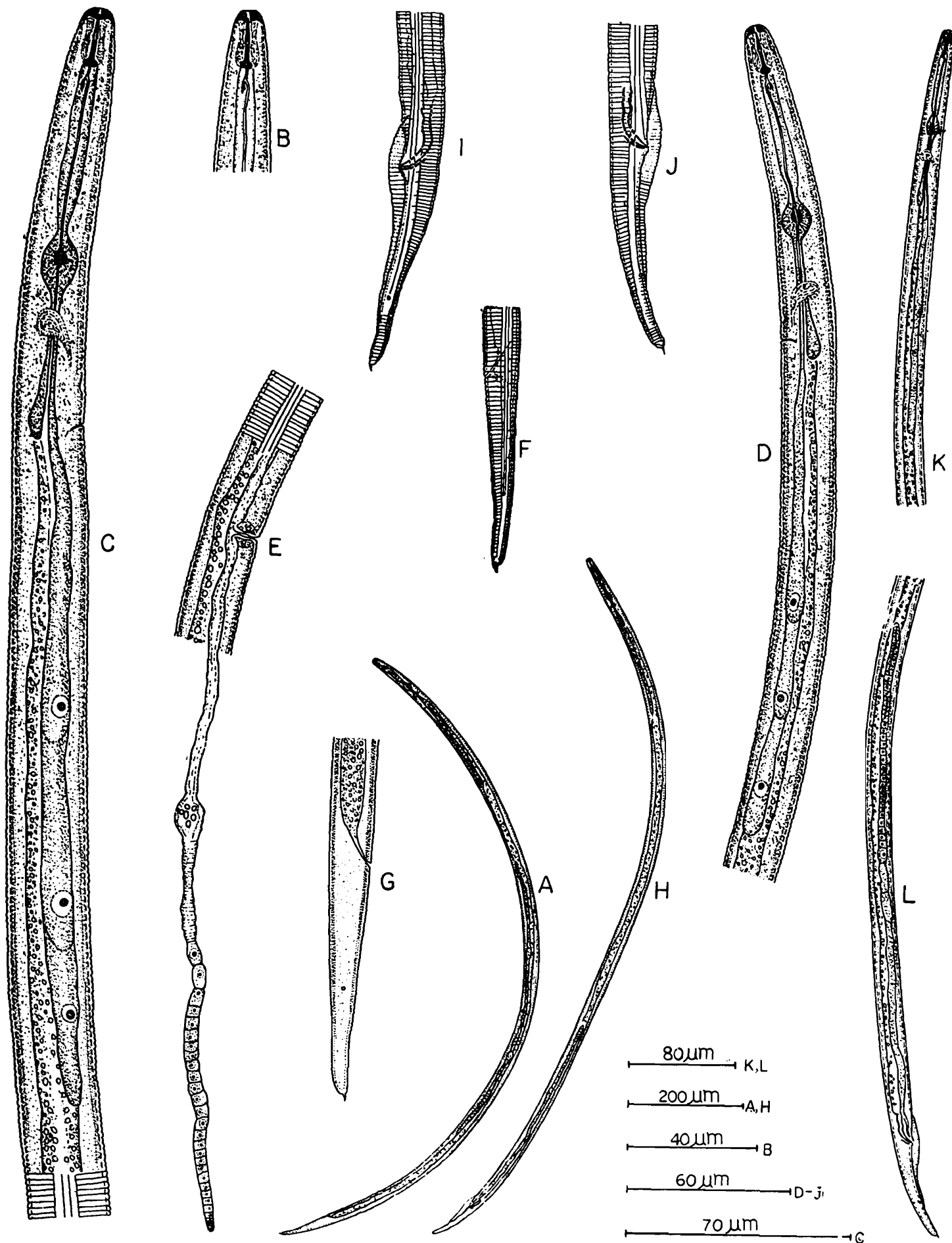


Fig. 1. *Hirschmanniella oryzae* (V. Breda de Haan, 1902) Luc & Goodey, 1963. A-G : Female. A-Entire Female, B-D-Anterior region, E-Female reproductive system, F & G-Female tails. H-L Male. H-Entire male, I & J-Male tails, K-Anterior region, L-Posterior region.

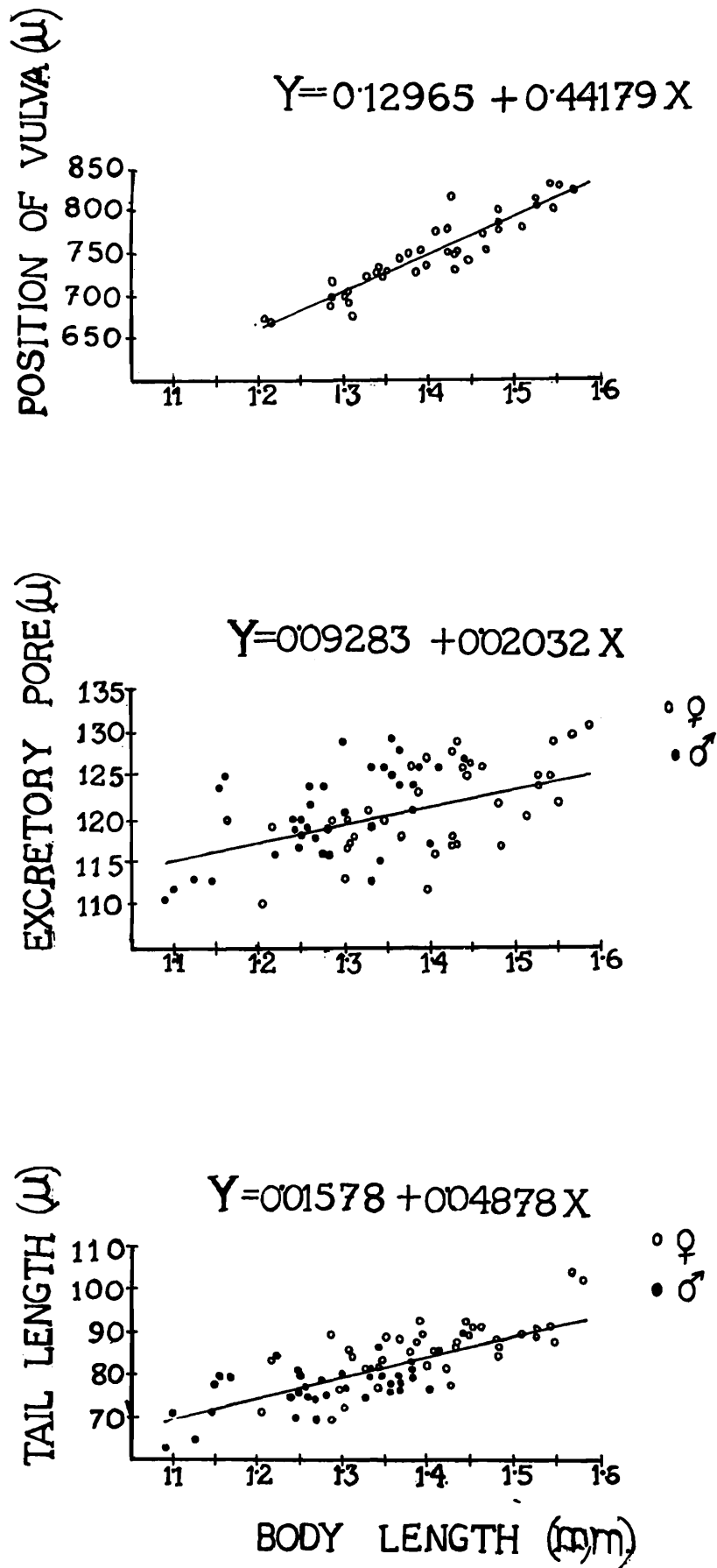


Fig. 2. Correlation between body length versus vulva, excretory pore and tail length respectively with regression lines.

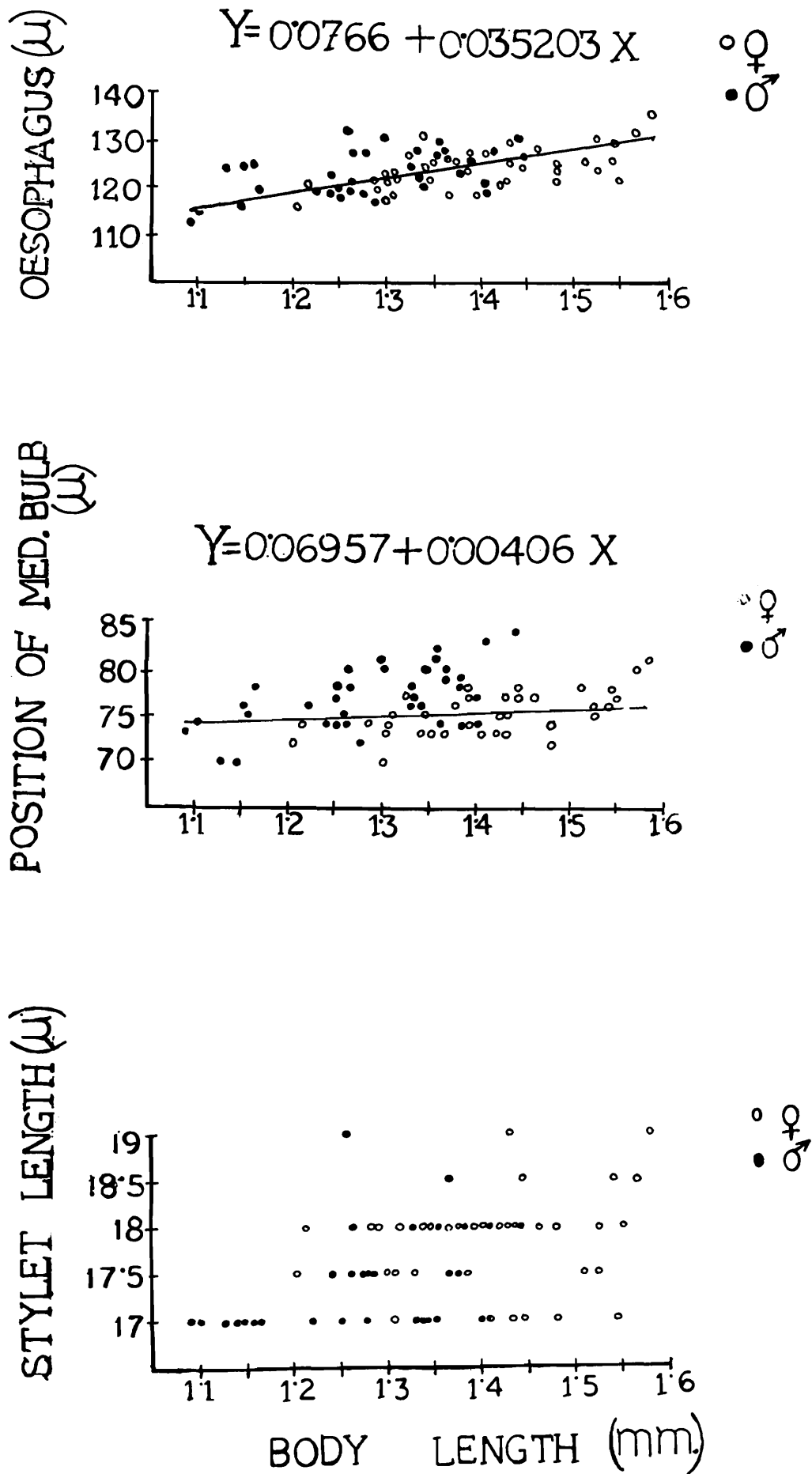


Fig. 3. Correlation between body length versus oesophagus, position of median bulb and stylet length respectively with regression lines.

In some respects these results have been found similar to Waliullah's (1985) findings on *H. oryzae*, viz., total oesophageal length, position of vulva and spicule length show consistent positive correlation with body length. Our observations are similar to Bird and Mai (1967) who found that the stylet length and the position of vulva were least variable than other allometric characters in *Trichodorus christei* Allen, 1957. Azmi and Jairajpuri (1976) also found that the position of vulva and the length of the stylet are least variable characters in *Helicotylenchus indicus* Siddiqi, 1963. Similar results have been found by Baqri & Ahmad (1981, 1984) in *Tylrnhorhynchus nudus* Allen, 1955 and *Helicotylenchus crenacauda* Sher, 1966.

*Remarks* : Dey and Baqri (1985) while discussing the distinguishing characters of *H. gracilis* and *H. oryzae* have already reported that the length of the stylet and spicules can be used to differentiate these two species (stylet and spicules = 21-23  $\mu\text{m}$  and 28-35  $\mu\text{m}$  in *H. gracilis* against 17-19  $\mu\text{m}$  and 20-28  $\mu\text{m}$  respectively in *H. oryzae* ).

Sher (1968) in his illustrations (fig. 3,A) and Shivakumar & Khan (1982) in their key to species of *Hirschmanniella* have reported that the excretory pore in *H. oryzae* is situated posterior to oesophago-intestinal junction. However, the West Bengal population shows that the position of excretory pore varies from opposite to slightly anterior to the oesophago intestinal junction.

*Locality and habitat* : From soil around roots of paddy, *Oryza sativa* at Salbari, District Darjeeling, West Bengal.

### SUMMARY

The statistical analysis of the measurements of a single population of *Hirschmanniella oryzae* (V. Breda de Haan, 1902) Luc & Goodey, 1963 reveals that the length of the stylet and the position of vulva are the least variable characters ( $CV \geq 3$ ). The length of the body, oesophagus, tail and spicules; the position of the dorsal oesophageal gland opening, median oesophageal bulb, nerve ring, excretory pore and the values of a, b, b', c, 0 and m are moderately variable characters ( $CV \geq 8$ ). The values of G1 and G2, length of the oesophageal overlap and the position of the phasmids show a high degree of variability ( $CV < 8$ ).

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