Bull. zool. Surv. India, 3 (3) : 239-247, 1981

NEMATODES FROM WEST BENGAL (INDIA) VII. MORPHOMETRIC AND ALLOMETRIC VARIATIONS IN *TYLENCHORHYNCHUS NUDUS* ALLEN, 1955 (TYLENCHORHYNCHIDAE : TYLENCHIDA)

QAISER H. BAQRI AND NASEEM AHMAD

Zoological Survey of India, Calcutta

ABSTRACT

The study of a single population of *Tylenchorhynchus nudus* Allen, 1955 from West Bengal (India) reveals that the length of stylet, the position of dorsal oesophageal gland orifice and the median oesophageal bulb, value of 'V', and lip height and width are less variable characters. The length of sexual branches, tail annules and the position of phasmids are highly variable characters.

MATERIAL

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

INTRODUCTION

Intraspecific variations occur frequently in nature within the same or different populations of a species. Several workers have studied the qualitative and quantitative variations in different species of nematodes (Goodey, 1952 ; Rhode & Jenkins, 1957 ; Triantaphyllou & Sasser, 1960 ; Bird & Mai, 1967 ; Baqri & Jairajpuri, 1970 ; and Roman & Hirschmann, (1969). Loof & Maas (1972), while studying the intraspecific variations among the different populations of *Xiphinema* species, observed that the qualitative characters are also important in distinguishing nematode species. Recently from India, the morphometric and allometric studies have been made by Azmi & Jairajpuri (1976) in *Helicotylenchus indicus* Siddiqi, 1963 ; Rashid & Khan (1976) in *Pratylenchus coffeae* (Zimmermann, 1898) Filipjev & Stekhoven, 1941 ; and Bajaj & Jairajpuri (1977) in *Xiphinema basiri* Siddiqi, 1959.

The present paper deals with the morphometric and allometric variations observed in *Tylenchorhynchus nudus* Allen, 1955 from Shaktigarh, district Jalpaiguri, West Bengal.

Tylenchorhynchus nudus Allen, 1955

(Figs. 1-5)

Dimensions : Table I.

Description : *Female* : Body curved in posterior half of its length upon fixation and tapering slightly towards both extremities. Cuticle marked with distinct transverse striae, 1-2 μm apart. Longitudinal striations absent. Lateral fields originate with two incisures below the base of stylet, become three near

TABLE—I

Morphometric and Allometric Variations in Adults of *Tylencorhynchus nudus*

	Female				Male			
Character	Range	Mean ± S. D.	S. E.	C. V. (%)	Range	Mean ± S. D.	S. E.	C. V. (%)
Length (μ)	602-863	688±45.0	4.96	6.5	516-726	645±46.0	7.10	7.0
a	26-35	29 ±2.1	0.24	7.4	25-35	30 ±2.6	0.41	8.7
b	5.1-6.4	5.6 ±0.3	0.04	6.0	4.3-6.0	5.3±0.4	0.06	8.0
c	12.5-16.4	12.9±1.3	0.15	10.5	11-17	14.6±1.4	0.23	10.0
V/T	53-57	55 ±1.2	0.13	2.0	43-59	51 ±5.5	0.88	10.9
G_1	13-28	22 ±3.2	0.37	15.0	—	—	—	—
G_2	16-26	22 ±2.3	0.26	11.0	—	—	—	—
Cuticle at mid body (μ)	1-2	1.8 ±0.3	0.04	19.0	1-2	1.8±0.2	0.04	15.0
Annules (μ)	2-2.5	2.0 ±0.08	0.01	4.4	1.8-2	1.99±0.03	0.0	1.5
Lateral fields(μ)	4-7	5.4 ±0.5	0.06	9.0	4.3-6.0	5.1±0.5	0.08	9.8
Incisures	4	4 ±0	0.0	0.0	4	4 ±0	0.0	0.0
Labial annules	0-2	—	—	—	0-2	—	—	—
Head height (μ)	3.5-4-0	3.41±0.09	0.09	2.8	3.4-4.0	3.41±0.09	0.01	2.7
Head width (μ)	6-8	7 ±0.3	0.08	4.5	6-7	6.8 ±0.3	0.06	5.3
Stylet (μ)	18-21	19 ±0.6	0.07	3.4	18-20	19 ±0.4	0.07	2.0
Stylet knobs (μ)	3.5-4.0	3.41±0.1	0.01	2.0	3.4-3.5	3.4 ±0.09	0.01	2.7
Metenchium (μ)	8.5-10.5	9.5 ±0.4	0.05	4.6	8.6-10	9.2±0.2	0.04	3.0
Dorsal oesophageal gland opening (μ)	2-3	2.4 ±0.1	0.01	4.0	2.0-2.5	2.4±0.1	0.04	5.0
oesophagus* (μ)	103-144	123±8.1	0.37	6.5	111-142	124±8.0	1.23	6.4
Median bulb* (μ)	54-75	64±4.5	0.05	7.0	56-71	64±4.2	0.68	6.7
Median oesophageal bulb length(μ)	13-15	14 ±0.7	0.08	5.3	12-14	13±0.5	0.08	4.0
Median oesophageal bulb width(μ)	9-12	9.7 ±0.6	0.07	7.0	9-10	9.2±0.4	0.04	4.3
Nerve ring* (μ)	69-94	81 ±4.9	0.54	6.0	73-91	83 ±5.3	0.18	6.4
Excretory pore*(μ)	87-124	101±7.0	0.77	7.0	85-115	102±6.6	1.02	6.4
Hemizonid	0-2 anules from excretory pore					0-2 annules from excretory pore		
Hemizonid width	1-2 annules					1-2 annules		
Vulva*	319-475	376±25.0	0.73	6.6	—	—	—	—
Anterior gonad (μ)	99-211	148±24.0	2.68	16.0	—	—	—	—
Posterior gonad (μ)	112-189	147±17.0	1.89	11.5	—	—	—	—
Vagina (μ)	8-11	9±0.6	0.07	6.7	—	—	—	—
Vulva body-width (μ)	20-26	23 ±1.6	0.19	7.0	17-23	22±1.6	0.26	7.7
Anal body diameter (μ)	10-15	14 ±0.9	0.11	7.0	14-18	16±1.0	0.16	7.7
Rectum (μ)	9-14	10 ±1.3	0.16	13.0	—	—	—	—
Tail (μ)	40-59	47 ±3.7	0.40	8.0	36-51	44±4.1	0.66	9.5
Tail annules	13-23	18 ±2.5	0.29	14.5	—	—	—	—
Phasmids (from terminus) (μ)	34-48	37 ±4.2	0.46	11.0	26-39	30±3.1	0.50	10.6
Spicules (μ)	—	—	—	—	22-27	25±1.4	0.24	6·0
Gubernaculum (μ)	—	—	—	—	11-14	12.8±0.99	0.16	7.7

*Distances from anterior end (μ)

S. D. = Standard deviation

S. E. = Standard error

C. V. = Coefficient of variability

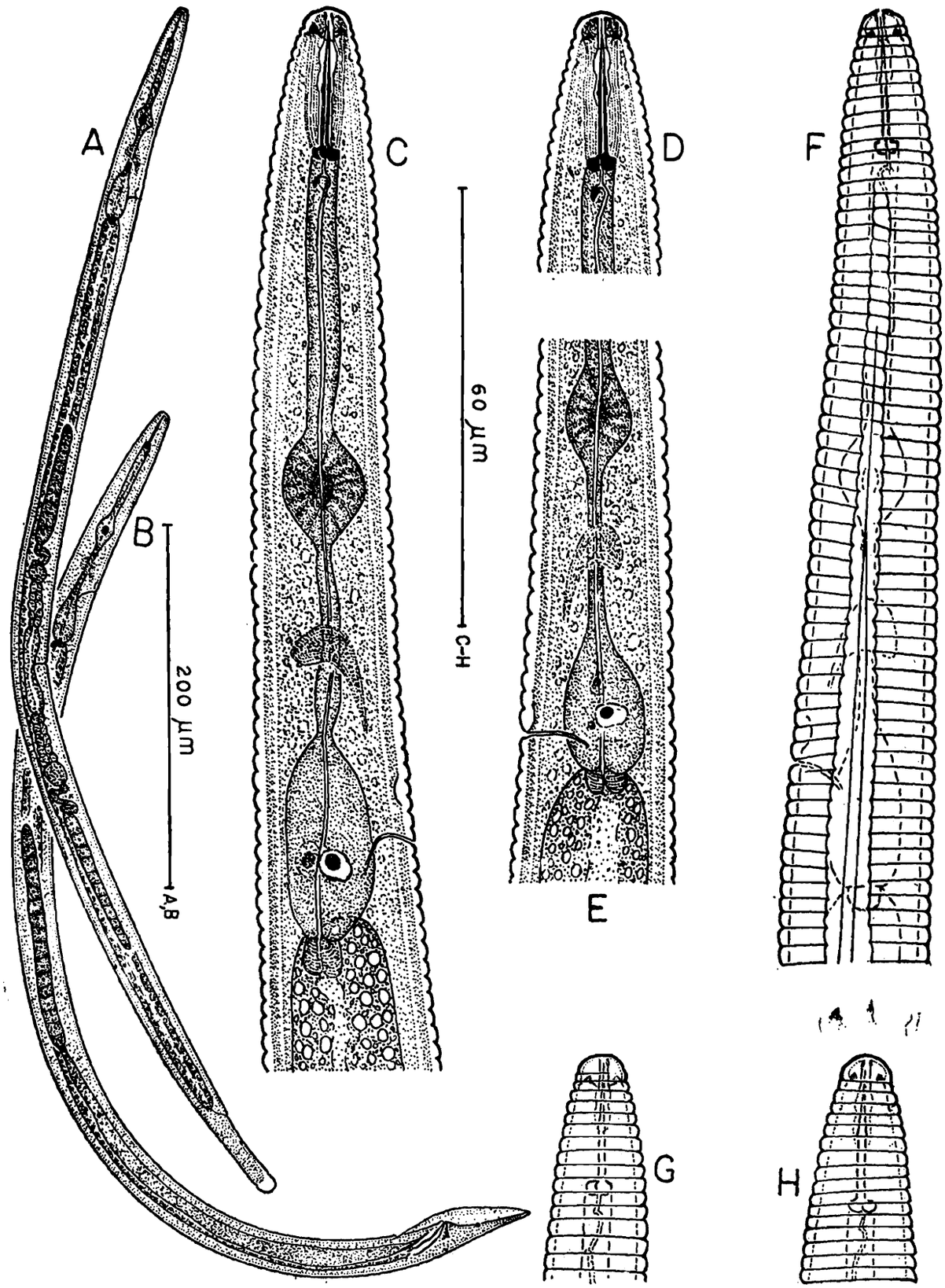

Fig. 1. *Tylenchorhynchus nudus* Allen, 1955 : A. Entire female ; B. Entire male ; C. Oesophageal region ; D. Anterior end ; E. Oesophageal region showing variation in position of hemizonid and excretory pore ; F. Anterior region, surface view ; G. Anterior end, lip region with incomplete stria ; H. Anterior end, lip region without stria.

middle of procorpus and four between median bulb and nerve ring (Fig. 1, F). The outer incisures are crenate. The four incisures extend up to the terminus (Fig. 2, D) but sometimes the inner two unite just below the phasmids (Fig. 2, F). Aerolations absent. Lateral fields 1/5th-1/4th of body-width near middle.

Lip region continuous with body, 6-8 μm wide and 3-4 μm high, generally bearing two annules (Fig. 1, F). Smooth lip region has also been noted in some specimens (Fig. 1, H). Sometimes the stria is incomplete and it appears from one side as if the lip region is smooth (Fig. 1, G). Head framework slightly sclerotized. Stylet 18-21 μm long, about 2.4-3.0 times the head-width ; its anterior part (metenchium) 9-11 μm long or 47-52% of the stylet length. The basal knobs rounded, 3-4 μm wide. Oesophagus typical to genus. Median oesophageal bulb at 45-57% of the oesophageal length from anterior end, 12-15 × 9-12 μm. Orifice of the dorsal oesophageal gland 2-3 μm from stylet base. Nerve ring 69-94 μm or 58-71% of the oesophageal length from anterior end. Excretory pore 85-124 μm or 65-94% of the oesophageal length from anterior extremity, position varies from anterior end to posterior end of oesophageal terminal bulb (Fig. 1, B & E). Hemizonid 1-2 annules long, situated 0-2 annules above the excretory pore (Fig. 1, C & E).

Vulva a transverse slit. Vagina 1/3rd—1/2 of corresponding body-width. Reproductive system amphidelphic, out streched. Each sexual branch consists of an ovary, oviduct, spermatheca and uterus. Spermatheca ovate or spherical and mostly filled with sperms. Oocytes arranged in a single row (Fig. 2, A & B), in one specimen in double rows with reflexed anterior part of ovary (Fig. 2, C). Tail cylindrical, ending in a clavate terminus, marked with 13-23 striae ventrally and 2.5-4.0 anal body-widths long. In one specimen, some apperent abnormal markings were noticed at the tail terminus (Fig. 2, E). Rectum 9-14 μm or about half to one anal body-width long. Phasmids 33-48 μm or 72-93% of the tail length from tail terminus. Generally both the phasmids occur at the same level but in some specimens noticed about one annule apart (Fig. 2, G & E).

Male : Similar to female in general shape and morphology except the reproductive system and tail shape. The two inner incisures of the lateral fields terminate before cloaca, the third one terminates before phasmids and outer most continues up to the tail terminus. Spicules 22-27 μm long medially. Gubernaculum stout, 11-14 μm long, proximal half slightly or distinctly curved with distinct spine-like structure near curvature. Tail with subacute terminus, 2.3-3.4 anal body-widths long, enveloped by bursa. Phasmids 26-39 μm or 58-83% of tail length from tail terminus.

Discussion

Table No. I, shows all the measurements and statistical calculations. The occurence of the lip region bearing two annules has been calculated in 77% specimens while for the smooth lip region or with incomplete stria in 23% specimens. The absence of stria or incomplete stria in the lip region have been observed for the first time in this species. The frequency of specimens having 18 μm long stylet has been noted in only 3%, maximum being 19 μm in 71%, with 20 μm in 21% and 21 μm in 5% (Fig. 3).

Among all the morphometric characters, the length of stylet and its metenchium, head width, head height, and position of dorsal oesophageal gland opening and median oesophageal bulb are found to be less variable

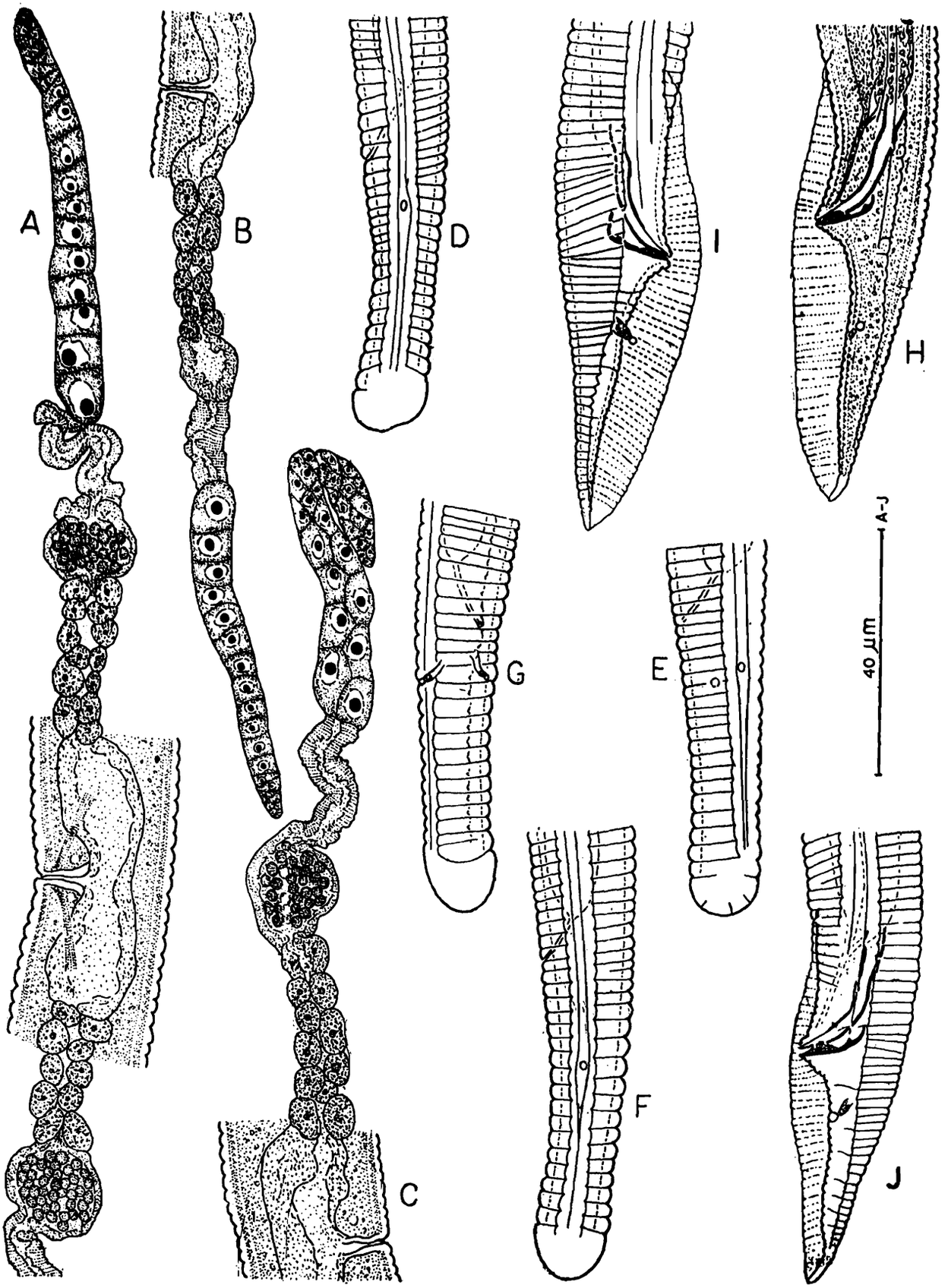

Fig. 2. *Tylenchorhynchus nudus* Allen, 1955 : A. Female reproductive system showing spermatheca filled with sperms ; B. Female reproductive system showing spermatheca without sperms ; C. Female anterior reproductive system with reflexed ovary and double rows of oocytes ; D-E. Female tails ; H-J. Male tails.

characters (C. V.=2–5%). Hence these characters can be used safely in the identification of this species. The highly variable characters are the length of sexual branches from 6–10%, are the lateral fields, length of oesophagus, position of nerve ring and excretory pore, tail length, length of vagina, and length of spicules and gubernaculum.

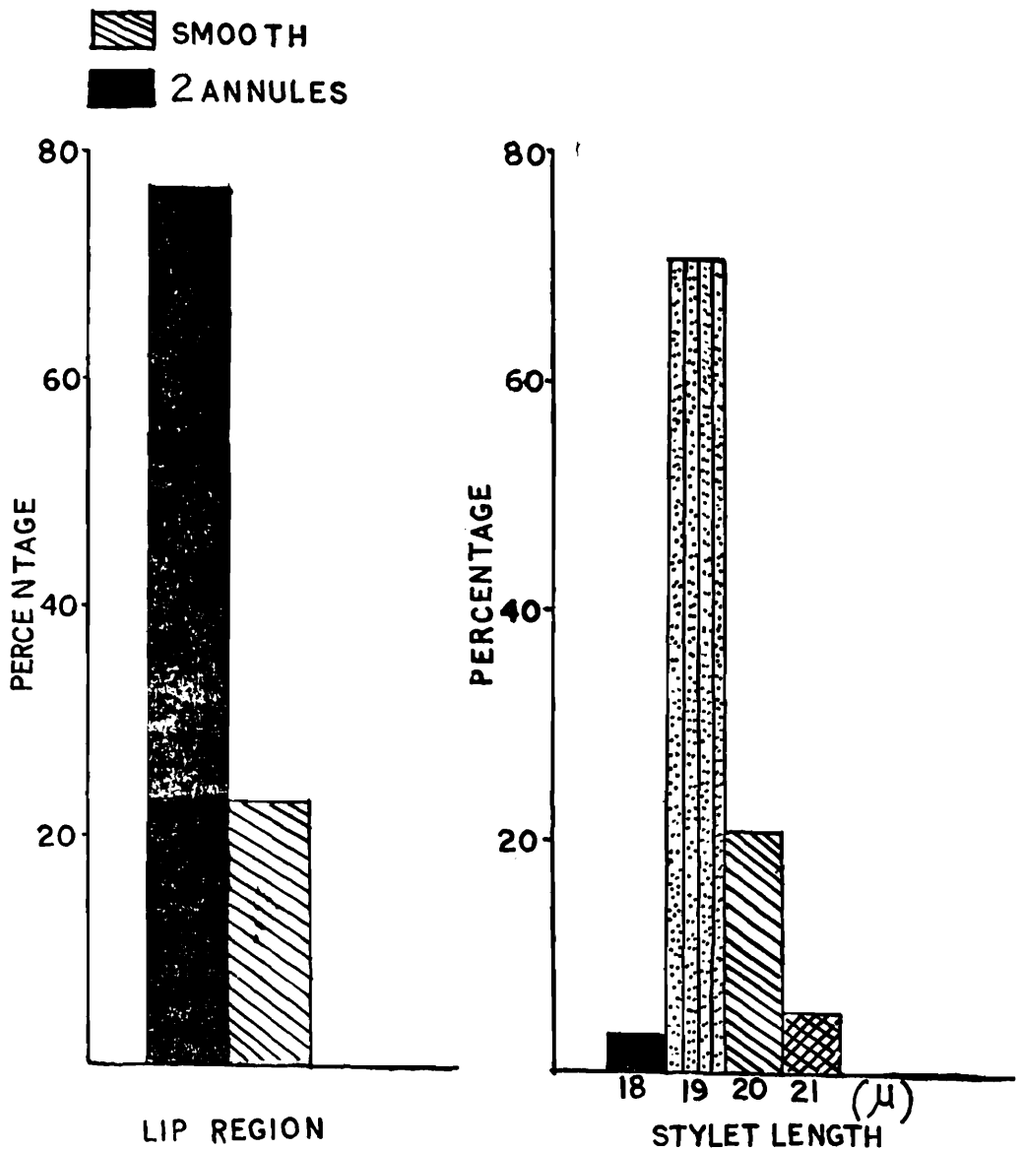

Fig. 3. Histograms showing the percentage of specimens having lip region with or without annules, and different stylet lengths.

(C. V.=11–16%), rectum (C. V.=13%), the number of tail annules (C. V=15%) and the position of phasmids from tail terminus (C. V.=11%). The characters which showed a moderate degree of variations, C. V. ranging

As far as allometric characters are concerned, it has been observed that position of vulva is positively correlated with the body length, while the length of tail and female sexual branches has been found negatively

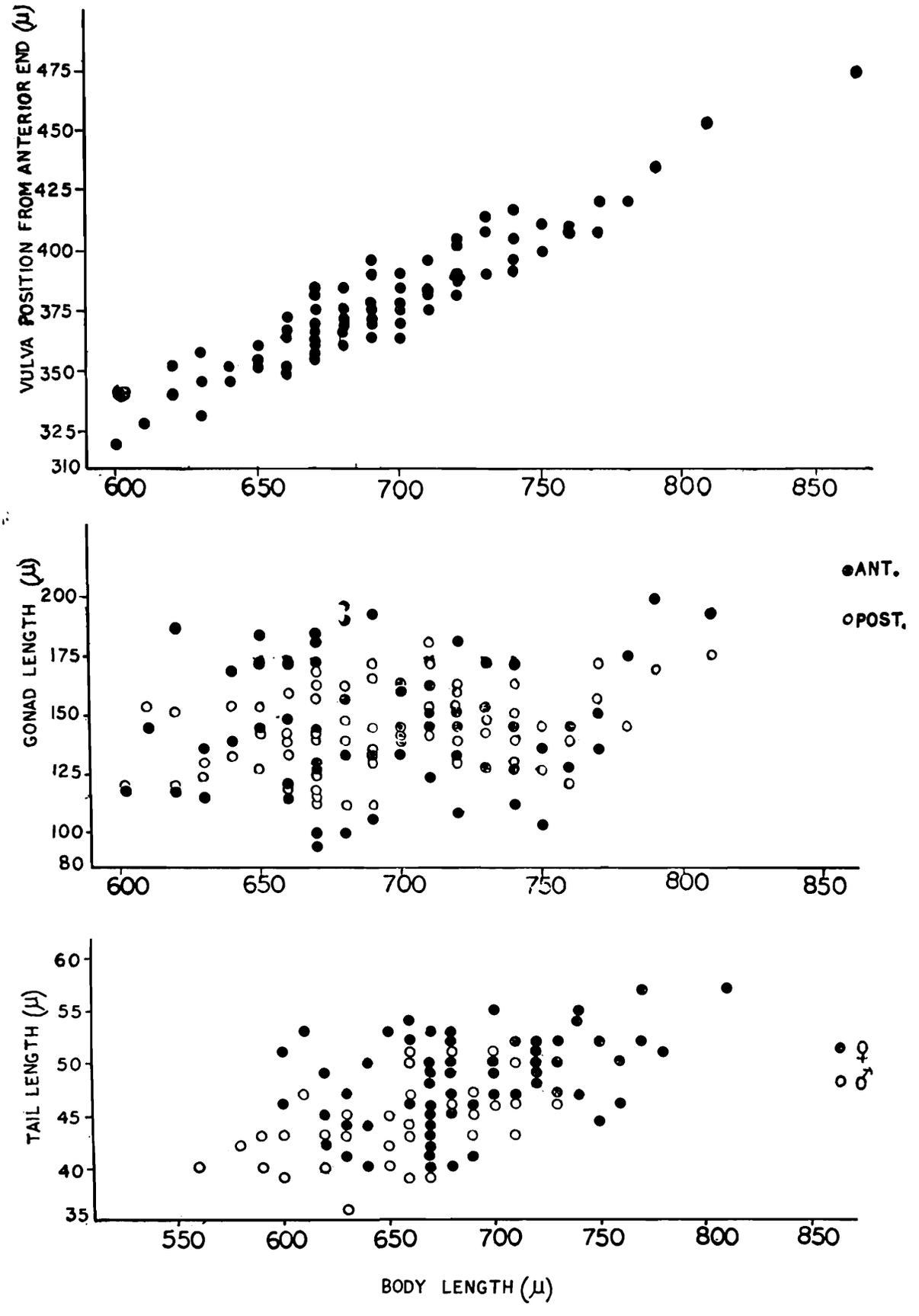

Fig. 4. Relation of body length with tail length, gonad length and vulva position.

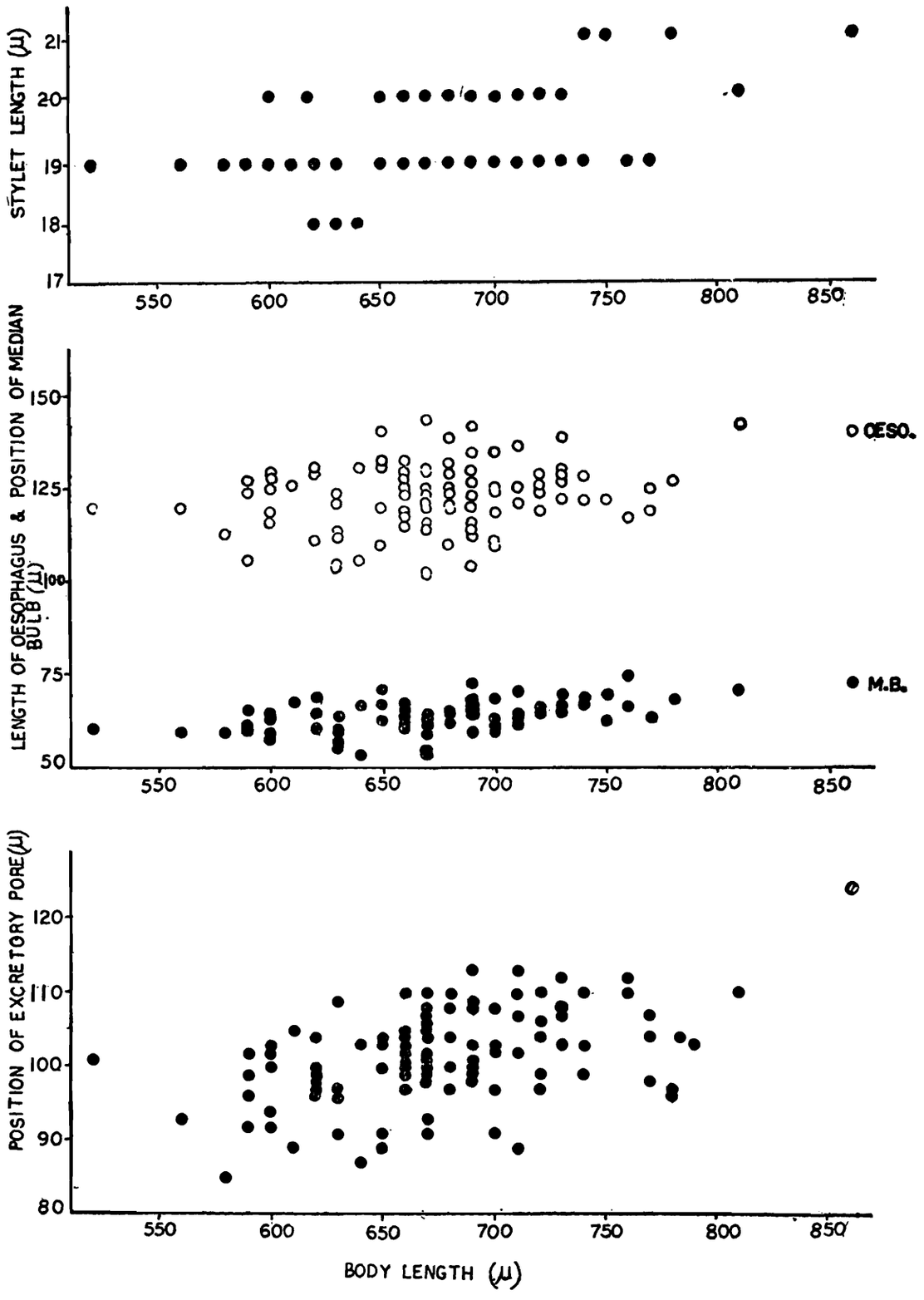

Fig. 5. Relation of body length with position of excretory pore, length of oesophagus and position of median oesophageal bulb, and stylet length.

correlated to the body length (Fig. 4). Among all the allometric characters, the value of 'V' is the least variable character (C. V. = 2%) while the G_1 and G_2 exhibit maximum variations (C. V. = 15% and 11% respectively). These results agree fully with the findings of Bird & Mai (1967) in *Trichodorus christei* Allen, 1957 = syn. of *Paratrichodorus minor* (Colbran, 1956) and partly with Mujib & Jairajpuri (1976) in *Helicotylenchus indicus* Siddiqi, 1963. The length of stylet and oesophagus, the position of median oesophageal bulb and excretory pore were also found independent of body length (Fig. 5), and thus can be used to differentiate this species from closely related species. These observations are also in accordance with Mujib & Jairajpuri (1976) and many others (Wu, 1960 ; Sturhan, 1963 ; Tarjan, 1969 ; and Bajaj & Jairajpuri, 1977).

REFERENCES

AZMI, M. I. and JAIRAJPURI, M. S. 1976. Morphometric and allometric variations in adults and juveniles of *Helicotylenchus indicus* Siddiqi, 1963. *Indian J. Nematol.*, **6** : 13-22.

BAJAJ, H. K. and JAIRAJPURI, M. S. 1977. Statistical analysis of variability in a population of *Xiphinema basiri* Siddiqi, 1963. *Nematol. Medit.*, **5** : 269-280.

BAQRI, Q. H. and JAIRAJPURI, M. S. 1970. On the intraspecific variations of *Tylenchorhynchus mashhoodi* Siddiqi and Basir, 1959 and an emended key to the species of *Tylenchorhynchus* Cobb, 1913 (Nematoda). *Rev. Brasil Biol.*, **30** : 61-68.

BIRD, G. W. and MAI, W. F. 1967. Morphometric and allometric variations of *Trichodorus christei*. *Nematologica*, **13** : 617-632.

GOODEY, J. B. 1952. The influence of the host of the dimensions of plant parasitic nematode *Ditylenchus destructor*. *Ann. appl. Biol.*, **39** : 468-474.

LOOF, P. A. A. and MAAS, P. W. TH. 1972. The genus *Xiphinema* (Dorylaimida) in Surinam. *Nematologica*, **18** : 92-119.

RASHID, A. and KHAN, A. M. Morphometric studies on *Pratylenchus coffeae* with description of *Pratylenchus typicus* Rashid, 1974. *Indian J. Nematol.*, **6** : 63-72.

RHODE, R. A. and JENKINS, W. R. 1957. Effect of temperature on the life cycle of stubby-root nematode (Abstr.). *Phytopathology*, **47** : 29.

ROMAN, J. and HIRSCHMANN, H. 1969. Morphology and Morphometrics of six species of *Pratylenchus*. *J. Nematol.*, **1** : 363-386.

STURHAN, D. 1963. Allometrische Untersuchungen an Longidoriden. *Z. Morph. Okol. Tiere.*, **53** : 39-60.

TARJAN, A. C. 1969. Variation within the *Xiphinema americanum* group (Nematoda : Longidoridae). *Nematologica*, **15** : 241-252.

TRIANTAPHYLLOU, A. C. and SASSER, J. N. 1960. Variations in perineal patterns and host specificity of *Meloidogyne incognita*. *Phytopathology*, **50** : 724-735.

WU, L. Y. 1960. Comparative study of *Ditylenchus destructor* Thorne, 1945 (Nematoda : Tylenchidae) from Potato, *Bulbous iris* and *dahlia*, with a discussion of de Man's ratios. *Can. J. Zool.*, **38** : 1175-1188.