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SUPPLEMENTARY FEMALE MORPHOLOGY AND MALE DESCRIPTION OF *HELICOTYLENCHUS VARIOCAUDATUS* FROM BANANA ROOTS

by

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Summary. The original description of *Helicotylenchus variocaudatus* (Luc, 1960) Fortuner, 1984, based on females only, is amplified and supplemented with the description of the male. All morphometric observations were of a bisexual population extracted from banana root tissues collected in São Tomè. This is a new geographical and host report of the species outside its type locality and the first record of the species with endoparasitic behaviour. All stages of nematode development were detected in the cortical tissues of banana roots in population densities 23-95 specimens/50 g of tissues with a female-male sex ratio 4:1. A compendium format key, referred to the eight *Helicotylenchus* species showing a regression of the posterior reproductive branch, is also presented to overcome difficulties in their identification.

The genus *Rotylenchoides* was proposed by Whitehead (1958) for *R. brevis* which was similar to *Helicotylenchus* spp. except for the presence of a postvulval uterine sac in place of a posterior reproductive branch with a functional ovary. Luc (1960) added three species to the genus (*R. affinis*, *R. intermedius* and *R. variocaudatus*). Siddiqi and Husain (1964) described *H. neoformis* which Sher (1966) transferred to *Rotylenchoides*. Fortuner (1984) studied the intraspecific variability and taxonomic value of several characters used in *Helicotylenchus* diagnoses and proposed *Rotylenchoides* Whitehead, 1958 as a junior synonym of *Helichotylenchus* Steiner, 1945, because the regression of the posterior genital branch in *Rotylenchoides* was not considered as a valid diagnostic character, and because of the existence of intermediate forms.

During an expedition to collect plant parasitic nematodes - by an EEC (European Economic Community) project – in coffee and banana plantations of the R. Democratica di São Tomè and Principe, *Hoplolaimus pararobustus* and *Meloidogyne javanica* were found associated with banana roots and also a large bisexual population of *Helicotylenchus variocaudatus* (Luc, 1960) Fortuner, 1984 was isolated from soil and roots of 3 "Banana prata" *Musa* sp. samples collected at S. Josè village.

The original description of *H.* (*Rotylenchoides*) *variocaudatus* was based only on females collected from the rhizosphere of black pepper (*Piper nigrum* L.) in Ono, Ivory Coast (Luc, 1960). This first record of the species outside its type locality and the endoparasitic habit of the present population presented an opportunity to expand its morphology and supplement the original data with a description of the male.

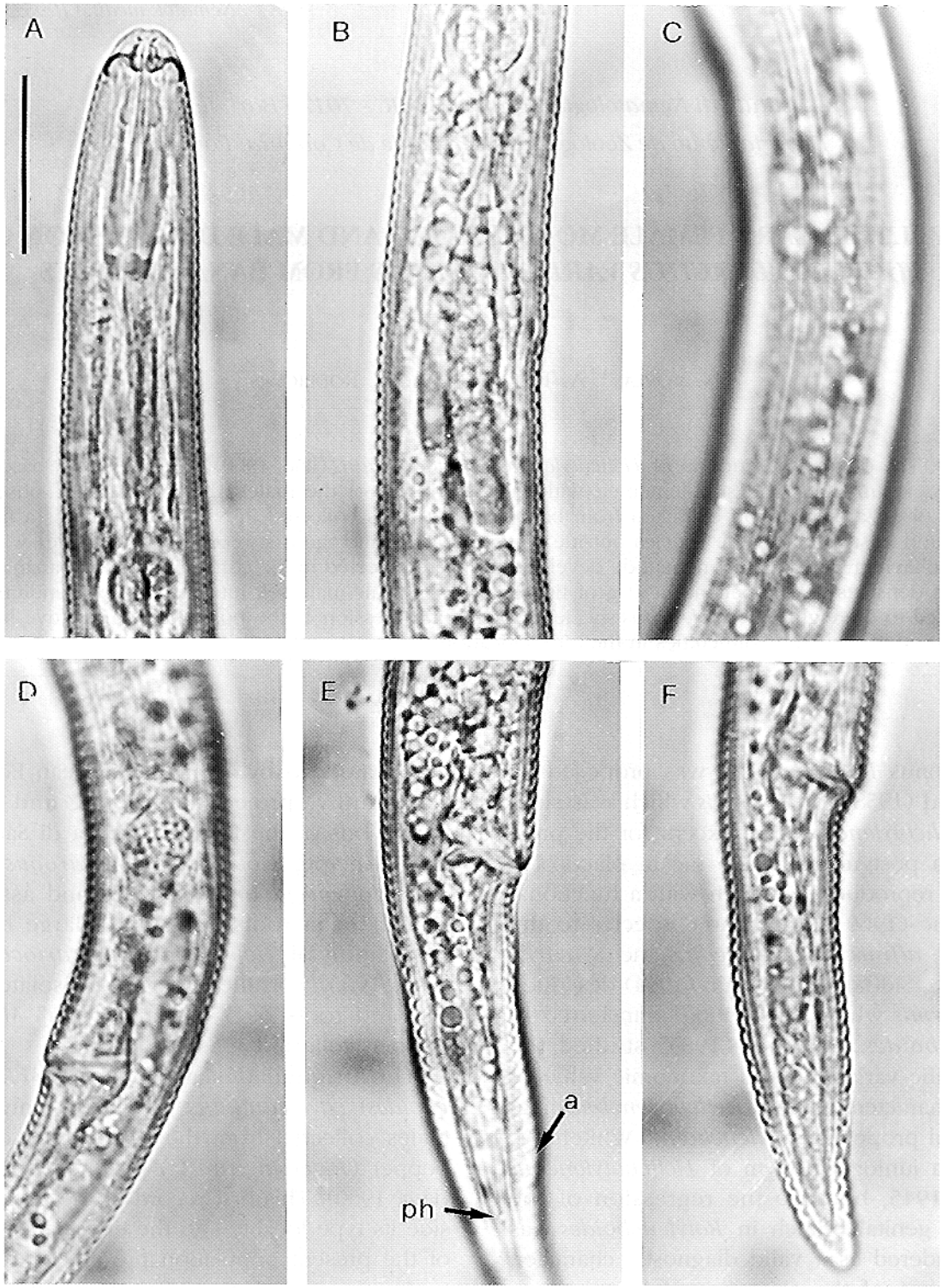

Fig. 1 - *Helicotylenchus variocaudatus* female: A, anterior end; B, oesophageal region; C, lateral fields; D and E, vulval regions; F, posterior body portion. (Scale bar = 20 µm). (Ph = phasmid, a = anus).

Materials and methods

Females and males were obtained from the roots and rhizosphere of banana *Musa* sp. cv. banana prata. Specimens used in this description were fixed in 4% formaldehyde + 1% propionic acid and transferred to dehydrated glycerine for making measurements and drawings and for preparing permanent glass slides. Also, glycerine infiltrated specimens were used for SEM observations of female tails.

Observations

DESCRIPTION OF *H. VARIOCAUDATUS* FROM SÃO TOME

Female (n = 16). L = 472±25 (431-500) µm; a = 25±1.8 (23-29); b = 4.0±0.2 (3.9-4.3); c = 28±2.3 (25-30); c' = 1.7±0.2 (1.3-2.0); V (%) = 88±1.5 (87-89); stylet = 25±0.8 (24-27) µm.

Habitus C-shaped in fixed specimens. Body tapering gradually anteriorly, from excretory pore and more posteriorly, from vulva to tail terminus. Lateral field 3.7±0.2 (3.5-4.0) µm, 1/5 of body width near middle. Annules 1.5±0.1 (1.4-1.6) µm apart at mid-body. Lip region hemispherical consisting of four annules. Labial framework highly developed. Stylet knobs project anteriorly. Dorsal oesophageal gland orifice 6-8 µm from base of stylet. Excretory pore 90±3.9 (86-96) µm from anterior end of body. Large rounded spermatheca 9±0.8 (8-10 µm diam) situated on the anterior gonad at 30±0.6 (29-32) µm from vulva. Non-functional posterior genital branch (6-10 µm). Tail 17±0.6 (15-22) µm in length, conical, with 10-12 annules on ventral side. Phasmid at the middle of tail (3-4 annules

TABLE I - *"Compendium format key to the* Helicotylenchus *species with retardation in the development of female genital branch" (females).*

Species:	H. a.*	H. b.	H. i.	H. m.	H. n.	H. vl.	H. vr. (1)	H. vr. (2)	H. w.
Habitus	OC	OC	OC	SA	OC	SA	OC	OC	OC
L (mm)	0.37-0.46	0.43-0.53	0.39-0.52	0.47-0.53	0.54-0.60	0.38-0.46	0.36-0.58	0.43-0.50	0.43-0.61
a	19-25	18-22	22-25	24-30	24-33	21-28	19-27	23-29	21-30
c	26-35	36-55	?	35-36	34-57	19-27	22-33	25-30	36-57
c'	1.3-1.7	?	0.8-1.0	0.3-1.0	?	1.4-2.3	1.8-2.6	1.3-2.0	0.7-0.9
V (%)	82-87	89-92	78-83	65-69	74-77	67-71	86-88	87-89	73-78
D.G.O. (µm)	7-9	?	7-9	?	9	?	8-10	6-8	3-5
Stylet (µm)	25-26.5	26-29	26-27	22-24	22-23	20-22	26-31	21-27	19-23
Head shape	H	T	H	H	H	H	H	H	T
N. head annules	4	3-4	4	3-4	4	?	4	4	4
Tail shape	CON	H	R	H	CON	CON	CON	CON	CON-R
N. tail annules	7	?	8-10	6-12	9-11	7-15	10-12	10-12	?
P./A. of males	P	P	P	P	A	P	P	P	A
P.u.s.	NF	NF	NF	F	NF	NF	NF	NF	NF

* Abbreviations: H. a. = *H. affinis* (Luc, 1960) Fortuner, 1984; H. b. = *H. brevis* (Whitehead, 1958) Fortuner, 1984; H. i. = *H. intermedius* (Luc, 1960) Fortuner, 1984; H. m. = *H. multicinctus* (Cobb, 1893) Golden, 1956; H. n. = *H. neoformis* (Siddiqi *et* Husain, 1964) Fortuner, 1984; H. vl. = *H. valdeclarus* (Orton Williams, 1983) Firoza and Maqbool, 1994; H. vr. (1) & (2) = *H. variocaudatus* (Luc, 1960) Fortuner, 1984 (1 = type population; 2 = S. Tomè population); H. w. = *H. whiteheadi* (Ganguly *et* Khan, 1987) Firoza and Maqbool, 1994.
Habitus (OC = open circle; SA = slightly arcuate). Head shape (H = hemispherical; T = truncate). Tail shape (CON = conoid; R = rounded). Males (P = present; A = absent). Post uterine sac (F = functional; NF = non functional).

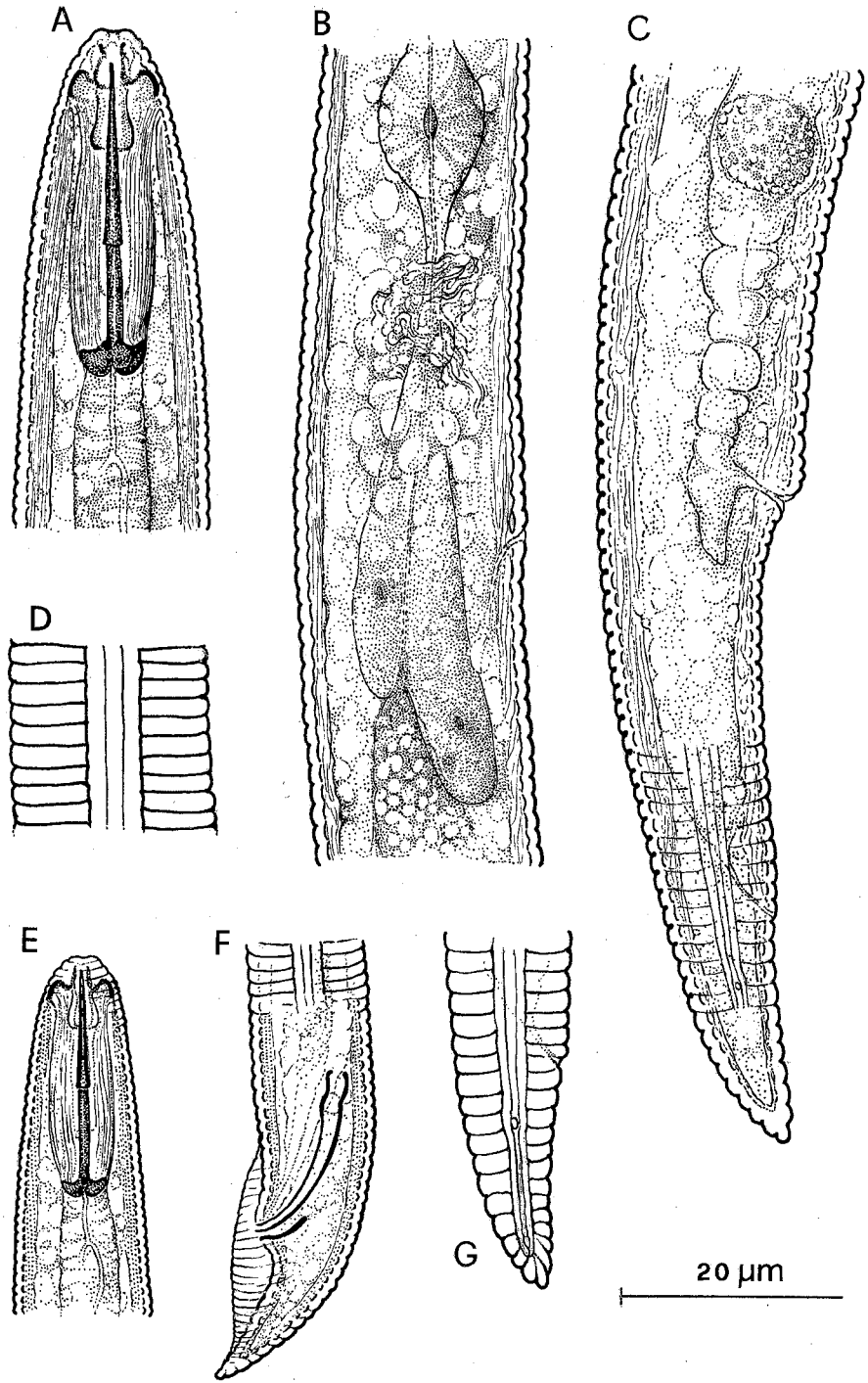

Fig. 2 - *H. variocaudatus* female: A and E, anterior end of female and male respectively; B and C, female oesophageal region and posterior end; D, female lateral field; F and G, posterior body portion of female and male respectively. (Scale bar = 20 µm).

posterior to anus), 13±1.5 (11-14) µm from tail terminus, while the inner incisures on tail region extend to the end of lateral field (Figs. 1, 4).

Male (n = 9). L = 417±49 (393-437) µm; a = 32±0.2 (29-36); b = 4.1±0.6 (3.7-5.2); c = 3.0±2.2 (27-33); c' = 1.6±0.2 (1.3-1.8); T% = 40±4.6 (32-48); stylet = 20±1.0 (19-22) µm; spicules = 16±1.0 (14-18) µm; gubernaculum = 5±0.5 (4.3-6) µm.

Ratio of 10-15 percent within the population. Habitus slightly curved. In general morphology of body resembles the female. Lateral field 1/4 of the corresponding body width. Annules 1.4±0.1 (1.4-1.6) µm apart at mid-body. Lip region hemispherical, consisting of four annules. Labial framework well developed. Dorsal oesophageal gland orifice 4.4±0.4 (3.7-4.6) µm from base of stylet. Excretory pore at 16-18% of the total body length, 73±4.6 (66-78) µm from anterior end. Spicules and gubernaculum anteriorly curved. Bursa enveloping tail. Tail 14±1.9 (12-18) µm, about twice [c' = 1.6±0.2 (1.3-1.8)] anal body width, regularly striated on dorsal and ventral side (Fig. 1).

Biology. Typical endoparasite of roots; all stages of its development were detected in the cortical tissues of banana with an approximately sex ratio female-male = 4:1.

Host plants and distribution: Luc (1960) reports this species as a parasite of pepper (*Piper nigrum* L.) and silten acacia (*Albizzia* sp.) in Ono, Ivory Coast. We detected a bisexual population of *H. variocaudatus* in three banana plantations at S. Josè village of São Tomè island, with a population density of 23-95 specimens per 50 g of root.

Specimens deposition. Eighteen females and six males mounted on 6-8 glass slides are depos-

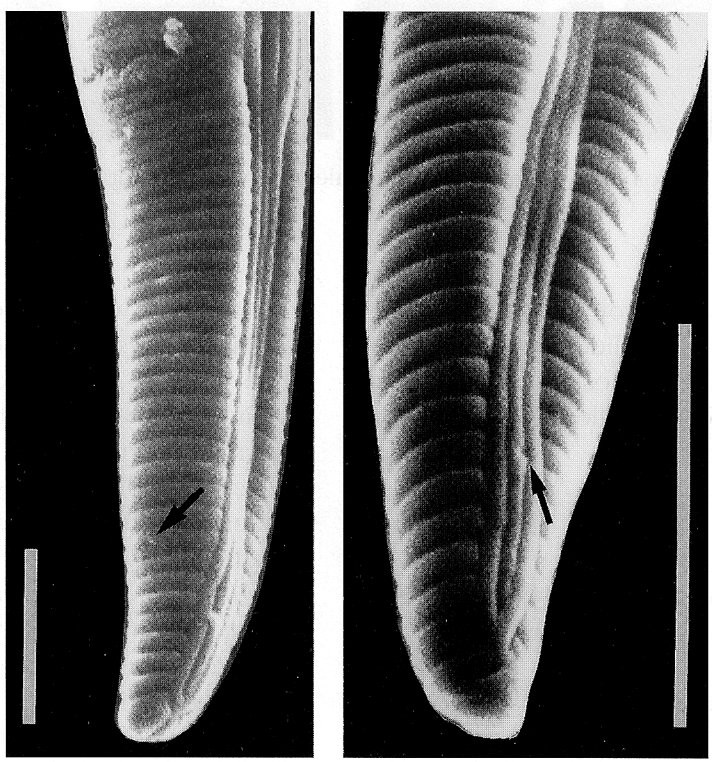

Fig. 3 - *H. variocaudatus*: SEM micrographs of posterior female body portion showing the characteristic structure of lateral field on tail, with distinct inner incisures and position of phasmid 3-4 annules posterior to the anus. (Scale bar = 20 µm).

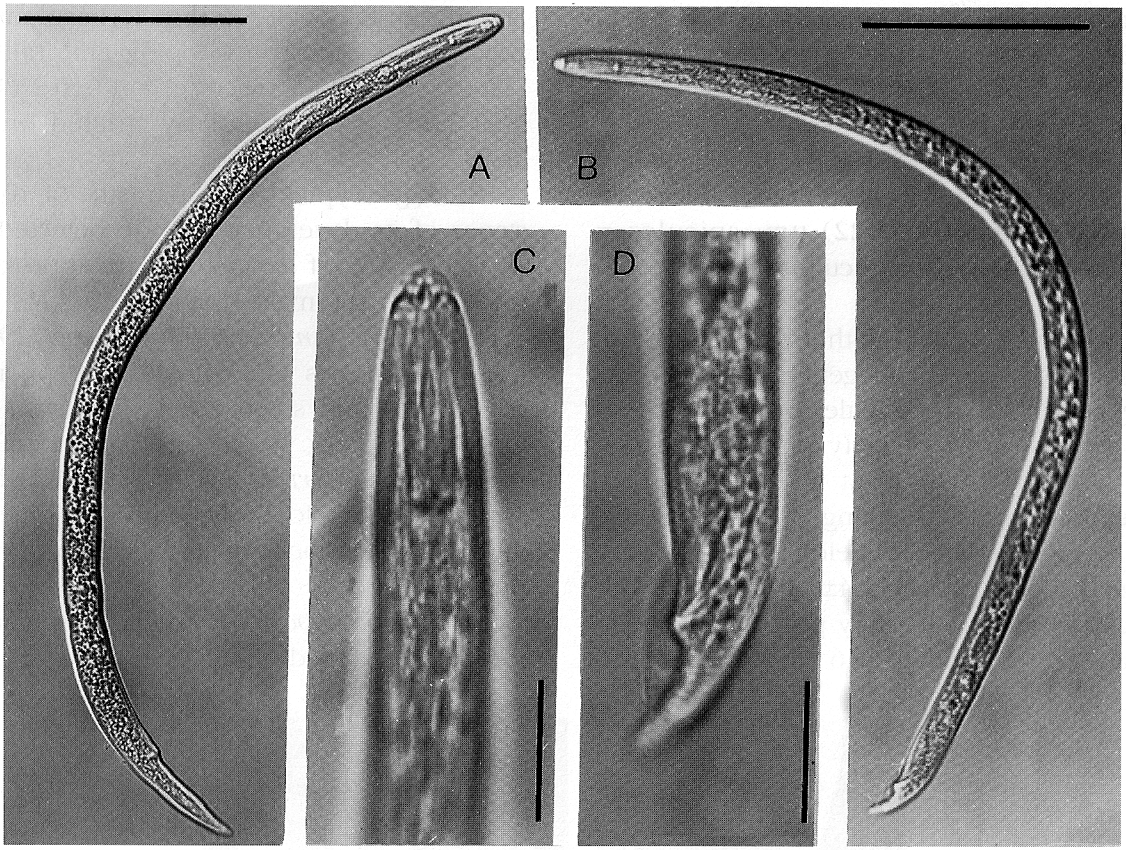

Fig. 4 - *H. variocaudatus*: entire body of female (A) and male (B); male anterior (C) and posterior (D) body portions. (Scale bar = 20 μm).

ited at the Istituto di Nematologia Agraria del CNR - Bari, Italy, and 2 glass slides with three females and two males are deposited at the Museum National d'Histoire Naturelle - Paris, France.

Remarks

The increasing number of members ascribed to the genus *Helicotylenchus* (more than 190 species) presents several difficulties in species differentiation, since many of them are poorly described and several characters show considerable variation. To overcome these difficulties "*partial compendium format keys*" (Table I) for groups of species can be defined within the genus, based on allometric and morphometric characters. A well-defined character, for example, that allows eight species of *Helicotylenchus* to be referred a defined group, is the retardation in the development of "the female posterior genital branch". The group contains *H. multicinctus* with the posterior branch slightly smaller than the anterior one but still functional; *H. affinis*, *H. brevis*, *H. valdeclarus*, *H. variocaudatus* and *H. whiteheadi* with a simple post-uterine sac; and two intermediate species, *H. intermedius* and *H. neoformis*, with a degenerate posterior branch.

All morphometrics are from the original description of the species and the authority placed on the abbreviations of the compendium key is also a reference list for the morphometrics used.

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