

MORPHOLOGICAL VARIATION AND DISTRIBUTION  
FREQUENCY OF HERMAPHRODITE *LONGIDORUS ELONGATUS*

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Hermaphroditism has only occasionally been recorded from dorylaimid nematodes (Luc, 1961; Jairajpuri & Siddiqi, 1964; Aboul-Eid & Coomans, 1966; Cohn & Mordechai, 1968 and Lamberti, Zacheo & Martelli, 1975) although it appears to be common in the family Rhabditidae (Triantaphyllou & Hirschmann, 1964). The reason for the occurrence of hermaphrodites or the variable sex ratio reported by Kozłowska and Seinhorst (1979) for *Longidorus elongatus* (De Man, 1876) Thorne & Swanger, 1936 is not known. During investigations into the effect of a range of crops on the population dynamics of plant parasitic nematodes at Invergowrie many *L. elongatus* were examined which allowed the following study to be made on the occurrence and morphology of male and hermaphrodite specimens.

The nematodes were extracted from 36, 200 g soil samples taken monthly between May 1976 and September 1979. During the investigation 65 860 female and 940 male nematodes were recovered giving a sex ratio of 1 : 0.014. This agrees with other populations from Great Britain but is at variance with some of those reported from Germany where males are quite common (Kozłowska & Seinhorst, 1979). Ten hermaphrodite nematodes were also found giving a female : intersex ratio of 1 : 0.00015.

The morphology of female, male and hermaphrodite *L. elongatus* was examined in specimens which had been heat killed and fixed in T.A.F. then mounted in glycerol (Tab. 1 & Fig. 1). The overall appearance of the hermaphrodite nematodes when heat killed resembled that of female nematodes (Fig. 1d & 1e).

Table 1  
Comparative measurements of normal females, normal males  
and hermaphrodites of *Longidorus elongatus*

	Female n = 199		Male n = 29		Hermaphrodite n = 10	
	$\bar{x}$ range	% coefficient of variation	$\bar{x}$ range	% coefficient of variation	$\bar{x}$ range	% coefficient of variation
Length (mm)	5.8 (4.6-7.1)	8.5	5.8 (5.1-6.9)	7.3	5.6 (4.6-6.5)	9.5
a	91.8 (69.2-119.1)	1.1	94.7 (74.5-111.9)	8.9	90.1 (77.7-104.4)	10.7
b	13.8 (10.0-20.3)	13.3	12.6 (10.7-14.7)	7.8	13.3 (11.1-15.1)	10.7
c	114.7 (89.6-156.3)	9.5	111.2 (93.1-139.4)	10.0	107.6 (84.0-121.2)	10.3
c'	1.3 (1.0-1.6)	9.1	—	—	—	—
v	47.6 (41.8-55.7)	5.2	—	—	49.3 (44.7-57.8)	7.7
Length of anterior female genital branch ( $\mu\text{m}$ )	413.1 (365.2-462.0)	6.2	—	—	396.7 (308.0-506)	19.0
Length of posterior female genital branch ( $\mu\text{m}$ )	408.1 (365.2-488.4)	7.8	—	—	357.0 (308.0-462.0)	20.9
Odontostyle ( $\mu\text{m}$ )	94.9 (72.0-109.8)	5.1	93.2 (86.7-102.0)	4.2	95.0 (87.7-106.2)	5.8
Odontophore ( $\mu\text{m}$ )	56.8 (40.6-69.4)	9.5	55.4 (42.2-62.5)	9.4	60.6 (47.1-73.7)	13.4
Spicule ( $\mu\text{m}$ )	—	—	59.3 (56.1-66.3)	3.4	43.0 (23.8-61.2)	31.1

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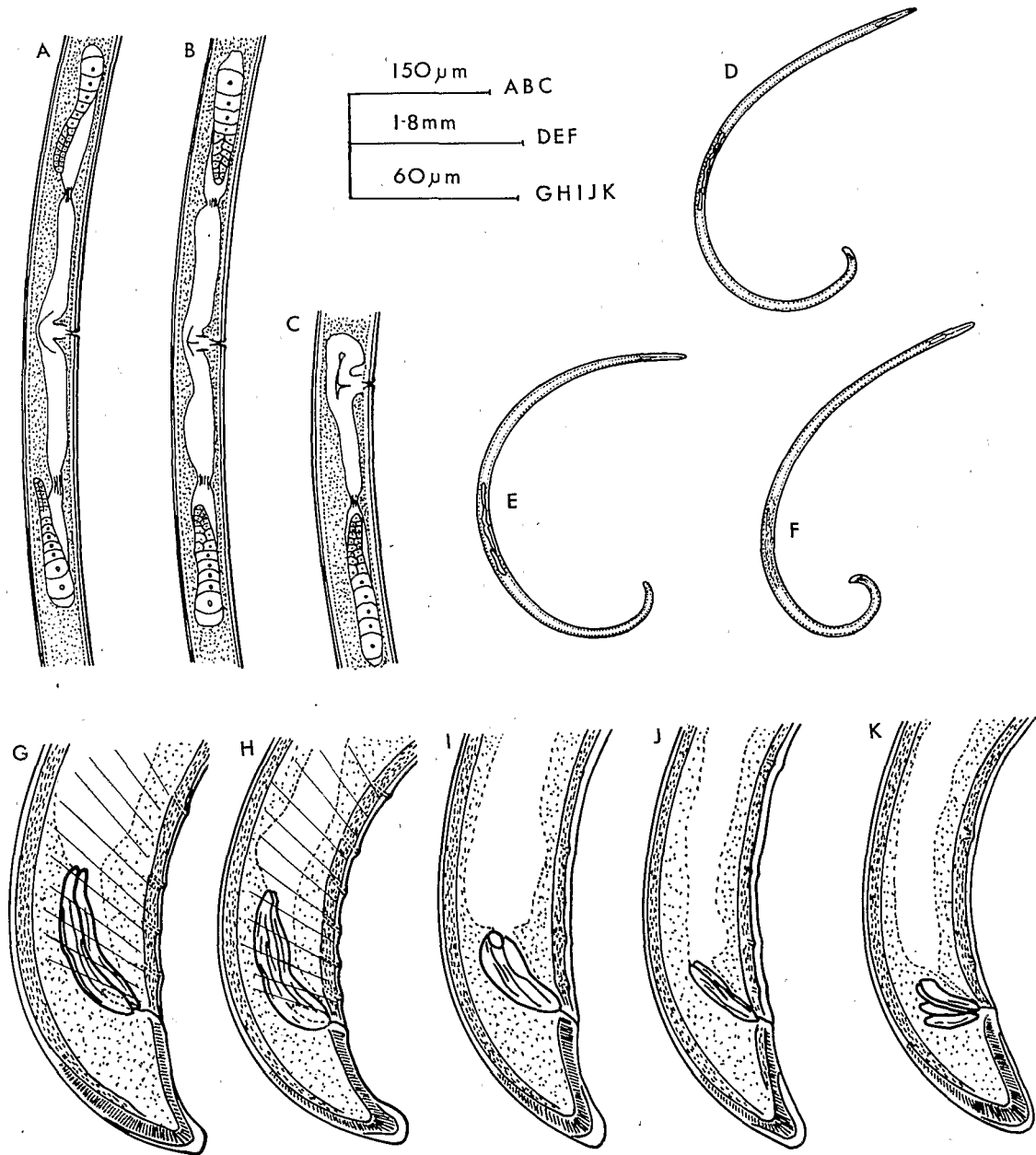


Fig. 1. *Longidorus elongatus*. A : Female gonads ; B : hermaphrodite, female gonads ; C : hermaphrodite with single posterior reproductive tract ; D, E & F : entire hermaphrodite, female and male nematodes ; G : male tail ; H-K : hermaphrodite tail showing range of spicule size and shape, note four rudimentary spicules in K.

The measurements and a, b, c ratios of the female specimens were similar to those recorded for other *L. elongatus* populations (Hooper, 1961; Williams, 1961 and Kozłowska & Seinhorst, 1979). The male specimens were slightly longer than those recorded by Hooper (1961) but resembled those given for the bisexual populations (Kozłowska & Seinhorst, 1979). Within the Invergowrie populations the hermaphrodite specimens morphologically resembled the female nematodes (a, b ratios; odontostyle and odontophore length) more than those of the male (c ratio only), but the range of measurements overlapped considerably. The position of the vulva was similar to that of normal females but the length of the posterior genital branches was marginally shorter (Tab. 1). The structure of the genital branches agreed with the description given by Williams (1961) with the exception of one specimen which possessed only a single posterior genital branch, the anterior branch was completely missing (Fig. 1c). The differences observed in the hermaphrodite specimens occurred in the size and shape of the spicules (Tab. 1 & Fig. 1g-k). Two specimens had spicule lengths within that recorded for the males, the other eight had smaller spicules between 54.4  $\mu\text{m}$  to 23.8  $\mu\text{m}$ . One specimen had two pairs of rudimentary small spicules (Fig. 1k). The supplements and the presence of oblique copulatory muscles were seen in hermaphrodite specimens which had large spicules but less obvious when the spicules were smaller. The number of supplements on the male and hermaphrodite nematodes were similar (male,  $x = 9.8$ ; range 8-12; hermaphrodite,  $x = 9.5$ ; range 7-12). Testes and *vas deferens* were observed in seven of the 29 males but neither testes or a rudimentary *vas deferens* was seen in any of the hermaphrodite specimens.

All the intersex specimens of *L. elongatus* resembled female nematodes with secondary male characters and were similar to the intersex specimens of *L. africanus*, *L. macrosoma* and *Xiphinema ingens* (Aboul-Eid & Coomans, 1966; Cohn & Mordechai, 1968 and Lamberti, Zacheo & Martelli, 1975). The mechanism by which both the female: male sex ratio is controlled and how hermaphrodite nematodes are produced in the Longidoridae is not known. As a necessary prerequisite to understanding both of these phenomena

this paper has quantified their occurrence in a population of *L. elongatus* which normally reproduces parthenogenically. It also describes for the first time the variability existing between hermaphrodite specimens.

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