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SEM OBSERVATIONS ON TWO SPECIES OF *HOPLOLAIMUS* DADAY, 1905 (NEMATODA: HOPLOLAIMIDAE)

by
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Summary. The main morphometrical characteristics of *Hoplolaimus galeatus* (Cobb 1913) Thorne 1935 and *H. stephanus* Sher, 1963 are amplified and supplemented with scanning electron microscope (SEM) observations, made on two bisexual American populations collected in natural habitats from Pensacola, Florida and Raleigh, North Carolina, respectively. In both species lip region is hemispherical in profile, set off from the body by a distinct constriction, having 4-6 annuli and an oral disc. Anterior cephalic annuli are marked by six longitudinal striae (two deep dorsal and ventral grooves and 4 shallower lateral), but the basal annulus is divided into (26-36 in *H. galeatus*; 30-36 in *H. stephanus*) irregular blocks. The lateral fields in both species have 4 incisures with outer and inner bands areolated. The main diagnostic features and measurements of both species are compared with all previous data.

The description and morphology for most of the 24 species assigned to the genus *Hoplolaimus* Daday, 1905 are based on light microscope (LM) observations with the exception of *H. aerolaimoides* Siddiqi, 1972 (Abrantes *et al.*, 1987; Siddiqi, 1986), *H. capensis* Van den Berg *et* Heyns, 1970 (Van den Berg and Buckley, 1987), *H. magnistylus* Robbins, 1982 (Robbins, 1982), *H. pararobustus* (Schuurmans Stekhoven *et* Teunissen, 1938) Sher in Coomans, 1963 (Baujard *et al.*, 1989; Sauer, 1985; Vovlas and Lamberti, 1985) and *H. seinhorsti* Luc, 1958 (Vovlas, 1983; Sauer, 1985; Van de Berg and Buckley, 1987), on which many morphological characters have been clarified by SEM studies regarding the variability of external structures.

In this paper additional LM and SEM observations are presented, with supplementary descriptive data, on two populations of *Hoplolaimus*: *H. galeatus* (Cobb, 1913) Thorne, 1935 and *H. stephanus* Sher, 1963, recently collected in two American natural habitats from Florida and Nort Carolina, respectively. All morphometrical data are compared with those previously reported.

Materials and methods

Specimens were extracted from soil by centrifugation, fixed in hot 4% formaldehyde + 1% propionic acid, and processed to glycerine by Seinhorst's (1962) rapid method. Wergin's method (Wergin, 1981) was used for the preparation of nematodes from scanning electron microscopy (SEM). These specimens were coated with gold and observed with a JEOL 50A stereoscan at 5-10 kV accelerating voltage.

Abbreviations used are defined in Siddiqi, 1986. All measurements are in micrometers (μm) unless otherwise stated.

HOPLOLAIMUS GALEATUS (Cobb, 1913) Thorne, 1935 (Fig. 1)

Females (n = 4): L = 1560 ± 66.6 (1474-1634); a = 29.9 ± 1.2 (28.7-31.4); b = 6.7 ± 0.4 (6.3-7.1); b' = 8.8 ± 0.7 (8.1-9.6); V = 56.2 ± 3.1 (52-59); c = 66.7 ± 6.7 (56.7-71.0); c' = 0.65 ± 0.1 (0.6-0.7); stylet = 53.5 ± 1.0 (52-54); m = 56.7 ± 0.5 (56-57); O = 9.8 ± 0.9 (9.2-10.2).

Description. Body ventrally arcuate. Lip region hemispherical, squared en face view (Fig. 1B) with 4-6 annuli measuring 17 (16-19) wide × 9 (8-10) high, basal annulus with 26-36 longitudinal striations (Fig. 1 A-D). First annulus divided into six labial sectors (four submedians and two smaller lateral) clearly separated by longitudinal incisures that continue in the lip annuli (Fig. 1B). Oral disc oval, well developed, raised above the first annulus, with ovoid oral aperture (Fig. 1 A-D). Amphidial aperture distinct on lateral sides of oral disc (Fig. 1 A-D). Lateral fields with four distinct incisures, regularly areaolated along

body, beginning at 9-12 annuli behind constriction of lip region (Fig. 1D) and ending at 4-8 annuli posterior to anus level (Fig. 1J, K). Vulval opening transverse, with a single epiptygma (Fig. 1E, I). Anal opening pit-like, at 12 (10-15) annuli from terminus. Tail rounded, annuli at terminus mostly wider than that of mid-body (Fig. 1J, L). Phasmids scutellum-like (Fig. 1F, H) located at 29% (26-31) and 86% (83-88) of body length, respectively.

Males (n = 2): L = 1246-1252; a = 30.3-33.8; b = 6.1-6.5; b' = 7.5-8.4; T = 41-50; c = 31.1-33.8; c' = 1.5-1.7; stylet = 43-45; m = 56-57; anterior phasmid = 33-36%; poserior phasmid = 86-87 %; spicules = 37-40; gubernaculum = 20-23.

Morphological characters are generally similar to those described for the females, except for a slightly higher lip region, 10.5 (10-11). Caudal alae well developed; 76 (75-77) long.

Habitat and locality: Specimens collected around roots of pine (*Pinus* sp.) at Pensacola, Florida, USA.

Remarks: Measurements as well as general morphology closely conforms with original description and those reported by Orton Williams (1973) except for a slight difference in spicules and gubernaculum length (37-40 vs 40-52, 20-23 vs 20-28 respectively). SEM observations (Fig. 1) show a wider variability in longitudinal striations on basal annulus and number of lip annuli than those reported by Orton Williams (26-36 vs 32-36 and 4-6 vs 5 respectively). SEM observations of male tail are similar to those presented by Hogger and Bird, 1974.

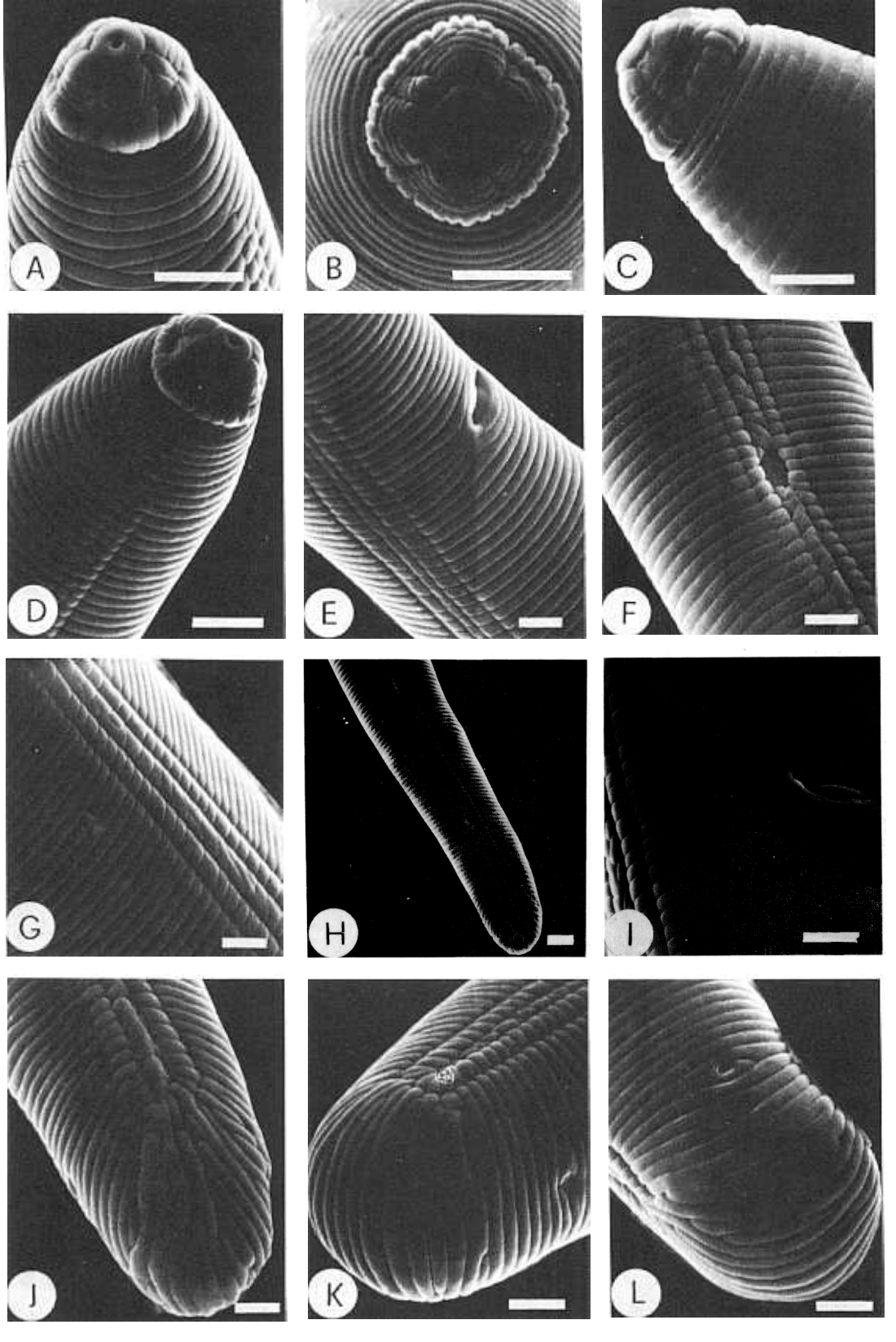
HOPLOLAIMUS STEPHANUS Sher, 1963
(Table I, Fig. 2)

Female. Body cylindroid, tapering to anterior end. Lip region hemispherical, squared en face view (Fig. 2A, C), with four annuli (Fig. 2 A-D), measuring 15 (14-16) wide × 7 (6-9) high. First annulus divided into six labial sectors (four submedians and two smaller lateral) clearly separated by six longitudinal incisures that continue in the lip annuli.

TABLE I - *Morphometric data of* Hoplolaimus stephanus *from Raleigh, North Carolina.*

	n = 10 females			n = 4 males		
	$\bar{X}$	SD	Range	$\bar{X}$	SD	Range
		Measurements in μm				
Body length	1226	118.2	1008-1429	1282	55.2	1219-1352
Vulval body width	40	3.7	35-47	37	2.1	35-39
Anal body width	29	3.1	24-34	22	1.1	21-23
Lateral field width	10	1.9	8-12	10	1.0	9-11
Oesophagus length	206	15.9	172-221	203	4.2	200-209
Nerve ring anterior end distance	122	8.4	109-131	132	5.2	124-136
Excretory pore anterior end distance	148	12.5	124-159	167	17.1	152-184
Stylet length	45	2.3	41-48	44	0.9	43-45
Tail length	20	2.7	16-23	32	1.9	31-35
Spicules	—	—	—	38	3.1	35-42
Gubenaculum	—	—	—	19	2.2	16-21
		Percentages				
V or T	55	2.3	53-58	31	6.5	25-38
m	55	2.2	52-59	55	1.0	54-56
O	15	2.1	12-17	16	2.4	14-19
G_1	28	10.3	20-43	—	—	—
G_2	28	9.0	19-40	—	—	—
		Ratios				
a	30.9	3.1	25.8-34.0	34.6	0.5	33.9-35.2
b	6.0	0.5	5.1-6.8	6.3	0.2	6.1-6.5
b'	7.5	0.6	6.8-8.2	8.0	0.3	7.8-8.3
c	62.4	6.0	53.0-69.9	39.8	3.0	36.2-43.6
c'	0.7	0.1	0.5-0.8	1.5	0.2	1.3-1.7

Fig. 1 (*Front page*) - SEM micrographs of *Hoplolaimus galeatus*: A-D, anterior body portions; E, I, vulval region; F, posterior phasmid; G, areolated lateral fields at mid-body; H, posterior body portion; J-L, female tails. Scale bars = 10 μm.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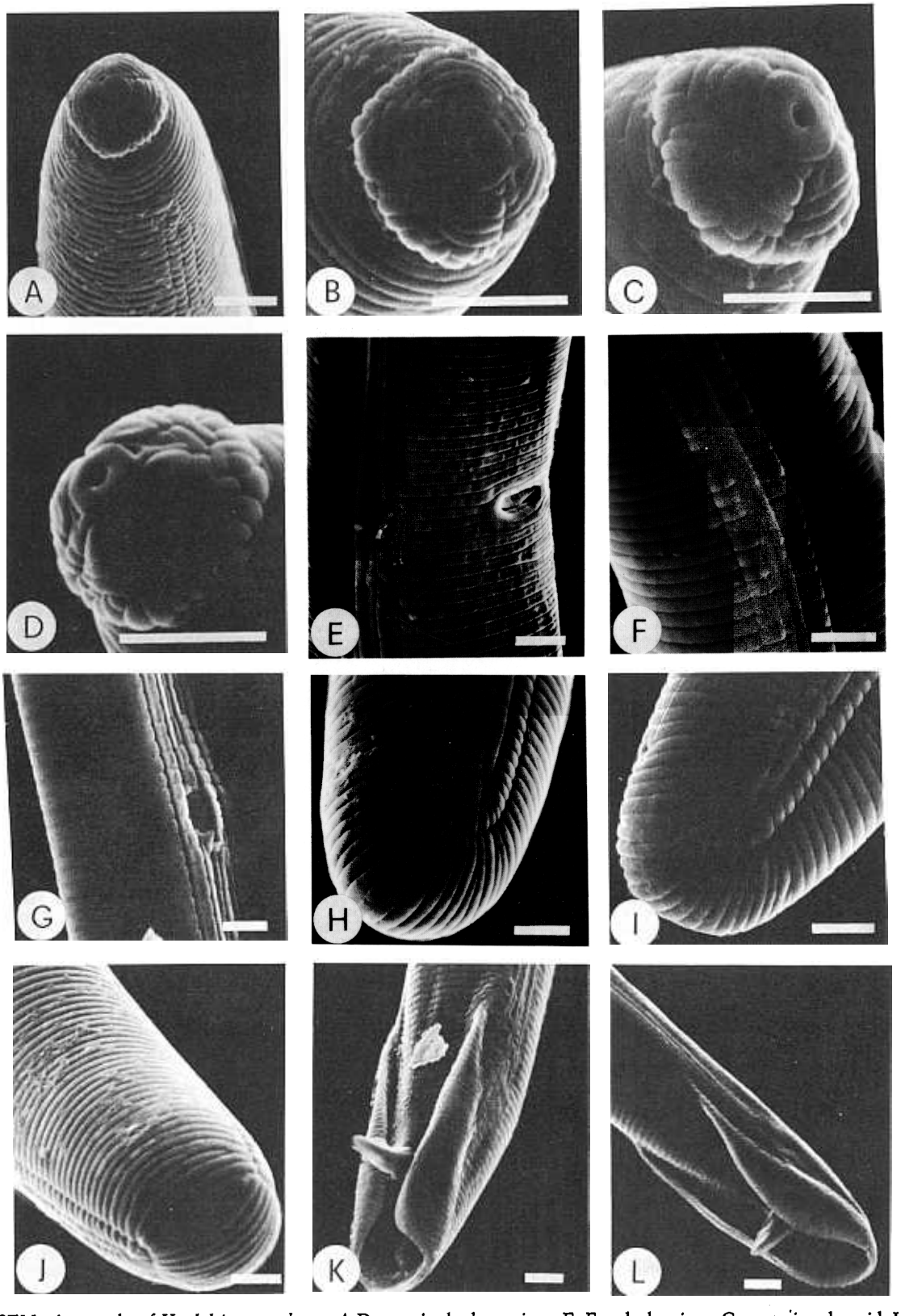

Fig. 2 - SEM micrographs of *Hoplolaimus stephanus*: A-D, anterior body portions; E, F, vulval regions; G, posterior phasmid; H tail regions; K, L, male tail regions. Scale bars = 10 µm.

Oral disc rounded (Fig. 2B), well developed, raised above the first annulus. Basal lip annulus divided into 30-36 irregular longitudinal striations; some of the blocks formed by this striations are subdivided horizontally (Fig. 2B, C) that in lateral view with the light microscope (LM) can be confused with two lip annuli. Lateral fields with four incisures, regularly areolated along most of body, sometimes with irregular areaolations at mid-body (Fig. 2E, F), beginning at 8-10 annuli behind constriction of lip region (Fig. 2A) and ending at 6-8 annuli posterior to anus level (Fig. 2 H-J). Vulval opening transverse, with a well developed single epiptygma (Fig. 2E). Anal opening pit-like, at 13 (11-15) annuli from terminus. Tail rounded, annuli at terminus as wider as those of mid-body (Fig. 2 H-J). Phasmids scutellum-like (Fig. 2G), located at 34% (31-42) and 86% (83-88) of body length, respectively.

Male. Similar morphology to that of female, except for the slightly higher lip region, 8 (7-9). Caudal alae well developed envolving the tail completely, 89 (77-115) long.

Remarks: This is the first record of the species for North Carolina since the original description from material collected in South Carolina and later recorded in New Jersey (Sher, 1963). Our specimens are morphologically similar to the original description. Small differences in numerical dimensions of «b» value of females and males (5.1-6.8 vs 7.3-9.8, 6.1-6.5 vs 7.3-8.9), respectively and spicules length (35-42 vs 30-38), have been noted in this study which extends the known range of variability for this species.

SEM observations show that lip annuli are very constant in this species, as has been reported in the original description. However, we found a wider variability in the longitudinal striations on basal lip annulus than reported by Sher (1963) because of resolution limits at LM observations (30-36 vs 24-28) respectively. Fig. 2 E shows the single epitygma reported as inconspicuous on a few specimens or not seen by Sher (1963).

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