

Plant nematodes from Australia: Studies on Hemicycliophoridae (Nematoda: Tylenchida)

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SUMMARY

Four new species of *Hemicycliophora* de Man, 1921 and one new species of *Loofia* Siddiqi, 1980, are described from areas of naturally occurring vegetation in South Australia. The new species are *H. wallacei* sp. n. and *H. litoralis* sp. n. both from a coastal locality, also *H. eucalypti* sp. n., *H. charlestoni* sp. n. and *Loofia acuta* sp. n. from bushland soils. Additional information is given for four other species of *Hemicycliophora*, including previously undescribed males of *H. biloculata* Colbran, 1969, *H. iwia* Brzeski, 1974 and *H. halophila* Yeates, 1967 together with comments on *H. brevicauda* Sauer, 1958.

RÉSUMÉ

Nématodes phytoparasites d'Australie :
études sur les Hemicycliophoridae (Nematoda : Tylenchida)

Quatre nouvelles espèces d'*Hemicycliophora* de Man, 1921 et une nouvelle espèce de *Loofia* Siddiqi, 1980 sont décrites sur des spécimens associés à la végétation naturelle de l'Australie du Sud. Il s'agit de : *H. wallacei* n. sp. et *H. litoralis* n. sp., récoltés près de la côte, et *H. eucalypti* n. sp., *H. charlestoni* n. sp. et *Loofia acuta* n. sp., provenant de sol de brousse. Des données supplémentaires sont apportées concernant quatre autres espèces d'*Hemicycliophora*, et en particulier les mâles, jusque-là inconnus, de *H. biloculata* Colbran, 1969, *H. iwia* Brzeski, 1974 et *H. halophila* Yeates, 1967 ; des observations sont également faites sur *H. brevicauda* Sauer, 1958.

Four new species of *Hemicycliophora* de Man, 1921 and one new species of *Loofia* Siddiqi, 1980 were collected by the author from areas of naturally occurring vegetation in South Australia. In addition to South Australia, soil samples were collected from the Sunraysia district of Victoria and New South Wales and various parts of Queensland. Four other species of *Hemicycliophora* are studied here. Seven other species of Hemicycliophoroidea were also collected from Australian soils, namely *H. saueri* Brzeski, 1974, *H. natalensis* Loof & Heyns, 1969, *H. ovata* Colbran, 1962, *H. arenaria* Raski 1958, *H. tessellata* Sauer, 1958, *Colbranium truncatum* (Colbran, 1956) Andrassy, 1979 and *Hemicaloosia nudata* (Colbran, 1963) Reay & Das, 1978. Some of these are new records for South Australia (Reay, 1984).

Methods

The nematodes were extracted by a modified Baerman technique. Specimens of *Loofia* were fixed in hot F.A. 4 : 1. *Hemicycliophora* specimens were relaxed by gentle heat, fixed in 2% formalin and processed by means of slow evaporation of alcohol to glycerol.

Measurements were made on specimens mounted

in glycerol, from which ethanol had been evaporated, rather than dehydrated glycerol. Females were measured along inner cuticle. Male spicules were measured along their curvature and the penial sheath along the mid-line. The ratio "a" has been omitted. The author considers that it is of relatively little value when comparing species and in addition it is greatly affected if specimens are at all flattened.

Hemicycliophora wallacei * sp. n.

(Fig. 1 D, E ; Fig. 2)

Five collections of adults were made from within Clinton Conservation Park.

MEASUREMENTS

Holotype (female) and females : see Table 1.

Allotype (male) and males : see Table 2.

Juveniles : see Table 3.

* This species is named in honour of Professor H. R. Wallace of the Waite Agricultural Research Institute.

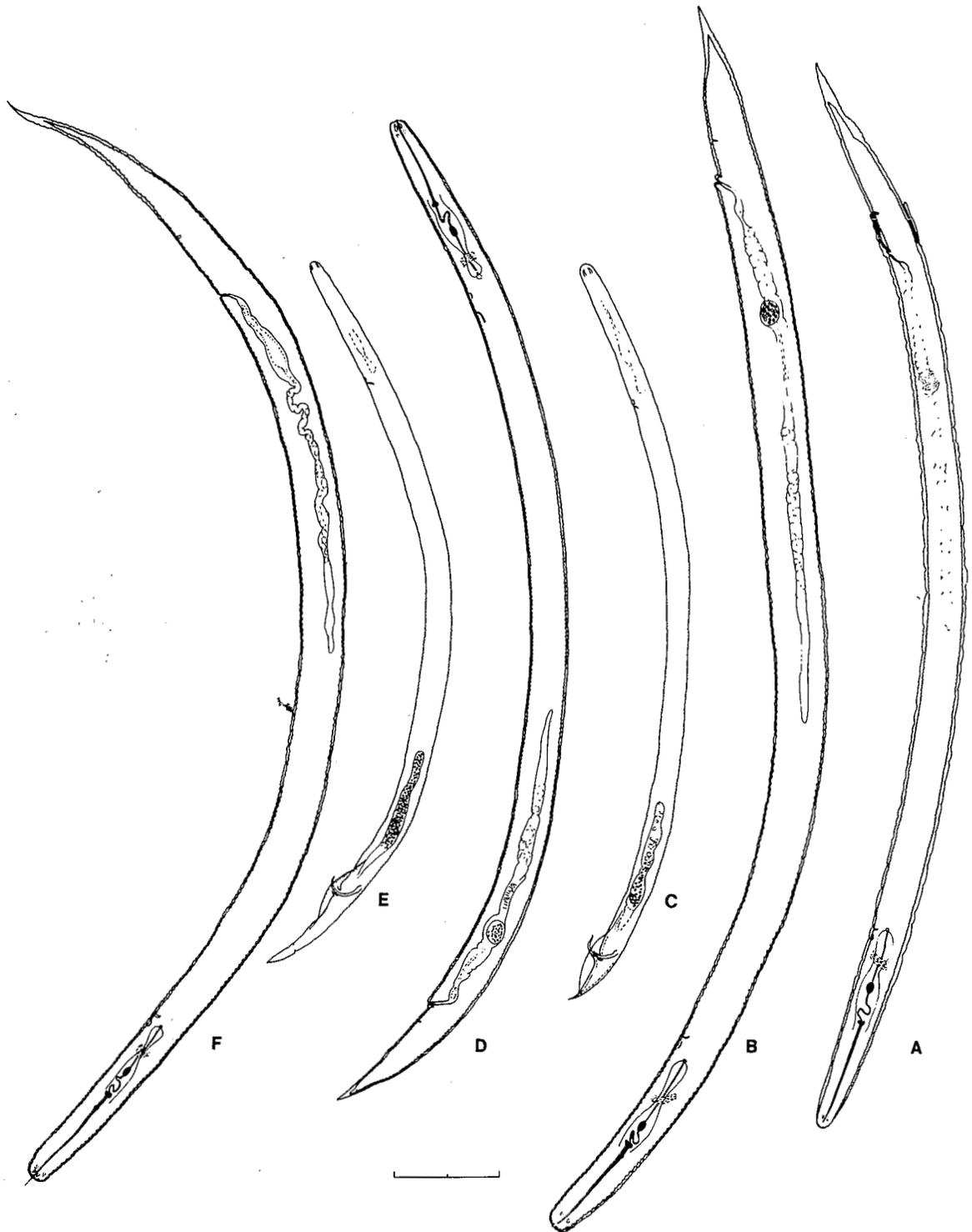


Fig. 1. *In toto* views : A : ♀ *H. litoralis* ; B : ♀ *H. eucalypti* ; C : ♂ *H. eucalypti* ; D : ♀ *H. wallacei* ; E : ♂ *H. wallacei* ; F : ♀ *Loofta acuta*. (Bar scale represents 100 μ m.)

DESCRIPTION

Females (type population) : Body straight to curved when relaxed, outer cuticle close fitting. Annules of outer cuticle flatter than body annules. Lateral field marked by an irregularity rather than break in the annules, with occasional anastomoses. Sometimes one lateral line may be seen, which is frequently incomplete. In four of all type females collected, a second less distinct line is visible, and does not extend over the full length of the body. Irregular longitudinal striae often present, more frequently located in the region of the lateral field. Lip region rounded to conoid, submedian lips distinct in most specimens, higher than lateral lips. Lip annules two,

often indistinct on inner cuticle, and smaller than following body annules. Spear slender, straight to slightly curved. Basal knobs rather variable, usually rounded, slightly posteriorly sloped with small posterior cavity. Median bulb moderately large, with large valve plates. Isthmus short. Hemizonid usually two annules long. Excretory pore opposite to posterior to terminal bulb, at level of, to four annules posterior to hemizonid. Genital branch single, outstretched. Spermatheca large rounded, some sperm usually present. Vulval lips modified, body recessed posterior to vulva. Post-vulval region ventrally curved along dorsal surface, but otherwise evenly tapered to tail terminus. Tail conoid, pointed, annulated along most of its length to terminus which

Table 1
Measurements of *Hemicycliophora wallacei* n. sp. Females

	<i>Female holotype</i>	<i>Paratypes</i>	<i>Pop. 178 B</i>	<i>Pop. 132 D, E</i>	<i>Pop. 131 G</i>
n	1	27	7	18	16
L (mm)	1.06	1.007 (0.87-1.13)	1.08 (1.03-1.17)	0.960 (0.86-1.04)	0.846 (0.79-0.89)
b	6.2	5.9 (5.1-6.3)	6.1 (5.8-6.7)	6.1 (4.3-6.6)	5.7 (5.4-6.1)
c	9.9	11.0 (9.5-12.0)	11.0 (10.0-12.0)	11.0 (10-13)	10.5 (8-12)
V%	88.0	89.0 (87.5-90)	88.0 (86-90)	88.5 (86-90)	88.0 (87-89)
VL/VB	3.6	3.5 (3.1-3.9)	3.7 (3.2-4.2)	3.3 (2.9-3.8)	3.2 (2.6-3.7)
Stylet (µm)	85.0	82.5 (77-88)	84.0 (80-90)	79.0 (72-84)	74.0 (70-81)
m	85.0	83.5 (79-85)	82.5 (81-83)	85.0 (82-88)	84.0 (80-88)
R	299	285 (267-305)	292 (270-312)	269 (235-286)	260 (243-273)
Rex	52	53 (49-57)	55 (51-59)	52 (49-58)	51 (47-54)
RV	45	36 (31-44)	37 (34-41)	36 (34-40)	34 (31-37)
RVan	7	6 (5-9)	8 (6-10)	7 (4.9)-12)	6 (4-7)
Ran	38	30 (23-37)	29 (27-32)	29 (26-34)	28 (24-31)
Tail (µm)	107.5	93.0 (74-110)	97.5 (89-104)	86.5 (73-92)-105)	80.5 (71-99)

Table 2
Measurements of *Hemicycliophora wallacei* n. sp. males

	<i>Allotype</i>	<i>Paratypes</i>	<i>Pop.</i> <i>132 D, E</i>	<i>Pop.</i> <i>131 G</i>
n	1	1	2	5
L (mm)	0.76	0.738	0.781-0.783	0.719 (0.69-0.75)
c	8.0	7.6	7.8-9.1	8.3 (7.5-9.5)
T	22.0	20.7	14.4-18.3	20.0 (17-26)
R	282	287	277-282	265 (251-282)
Rex	54	56	53-58	51 (49-54)
Ran	30	43	22-34	35 (26-44)
Tail (μm)	95.0	97.5	86.1-100	87.2 (72-101)
Spicules (μm)	43.5	37.5	33-37.5	35.0 (31-37)
Gubernaculum (μm)	5.0	7.0	5.1-5.5	4.9 (4.8-5.1)
Penial sheath (μm)	4.0	7.0	4.8-5.4	5.5 (5.0-6.0)

Table 3
Measurements of *Hemicycliophora wallacei* n. sp. juveniles

	<i>Pop.</i> <i>178 C</i>	<i>Pop.</i> <i>132 D</i>	<i>Pop.</i> <i>131 G</i>	<i>Pop.</i> <i>130 D & 100 D</i>
J 2				
n	1	—	4	—
L (mm)	0.385	—	0.43 (0.35-0.49)	—
Stylet (μm)	47.0	—	47.5 (43-49)	—
Rex	73	—	61-67 *	—
J 3				
n	4	4	2	—
L (mm)	0.53 (0.49-0.54)	0.51 (0.48-0.53)	0.50-0.52	—
Stylet (μm)	58.5 (56-61)	57.0 (54-59)	55-58	—
Rex	63 (62-65)	62 (60-66)	62-64	—
J 4				
n	3	1	6	3
L (mm)	0.73 (0.68-0.76)	0.79	0.65 (0.61-0.70)	0.69 (0.66-0.71)
Stylet (μm)	70.5 (68-72)	69.5	63.5 (60-67)	69.0 (63-73)
Rex	57 (56-58)	53	54 (53-58)	56 (53-59)

* n = 2.

is conoid to pointed. Terminal portion of tail with annules usually too indistinct to be counted, but which are not smooth.

Males (type population) : Body ventrally curved when relaxed. Lip region rounded to conoid, continuous with body contour, but not annulated, "oval

organs" (de Man, 1921) not visible. Stylet absent, oesophagus reduced and degenerate. Hemizonid extending over two annules, one annule anterior to the excretory pore. Lateral field with two, slightly crenate lateral lines. Spicules semicircular; gubernaculum curved. Caudal alae with crenate margins, extending fifteen annules anterior to the cloacal

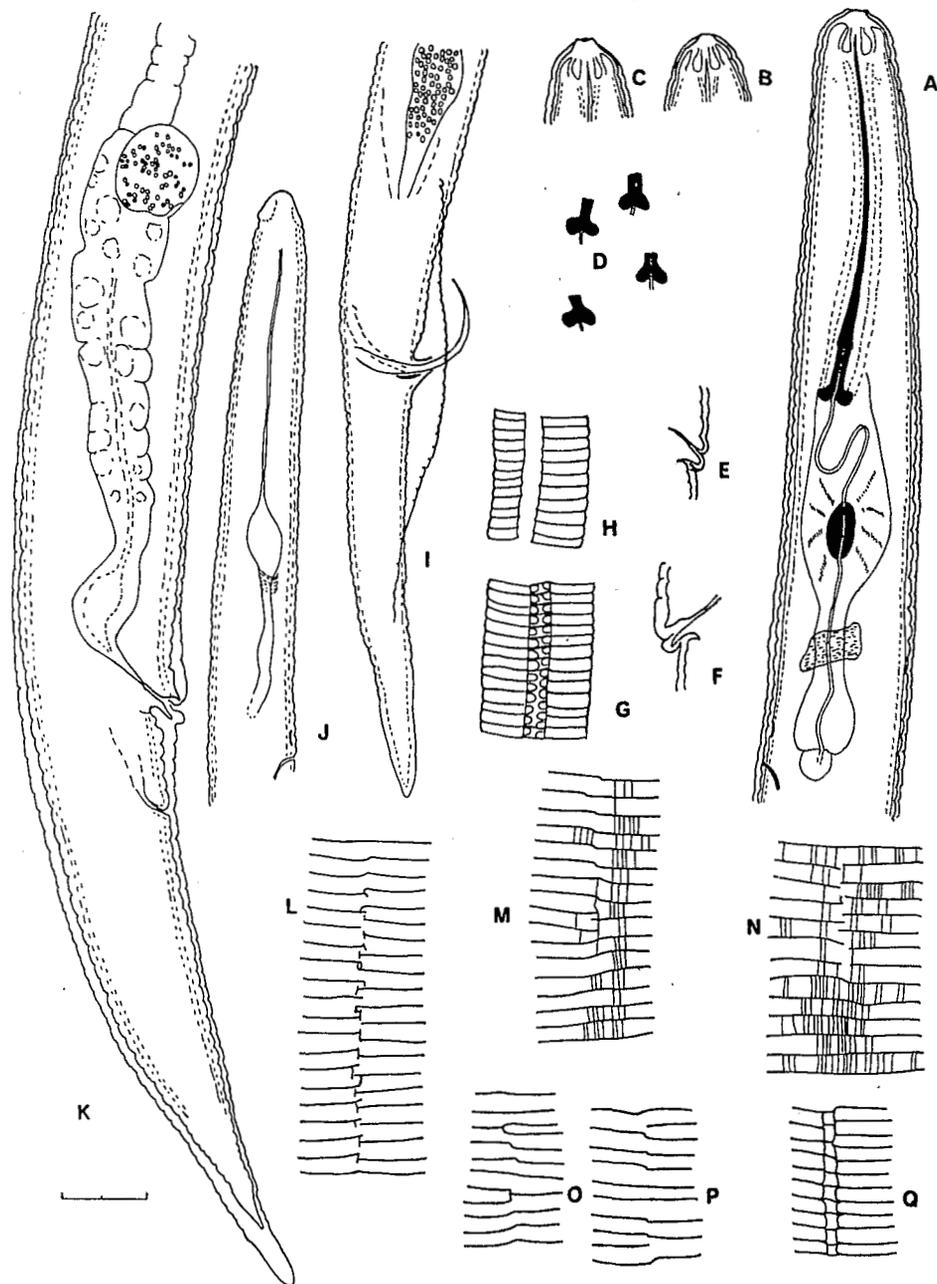


Fig. 2. *H. wallacei* n. sp. Female. A : anterior ; B, C : lip region ; D : variation in stylet knobs ; E, F : vulval lips ; K : post-vulval region ; L-Q : variation in lateral field (L and Q are atypical). Male H : lateral field ; I : posterior region ; J : anterior region (atypical) ; G : juvenile lateral field. (Bar scale represents 20 μ m).

aperture, to 28-34 annules posterior. Body just anterior to cloaca deeply recessed. Testis packed with rounded sperm. Tail tapering to a conoid terminus. Tail terminus smooth, not annulated the smooth portion being 30-51% of total tail length.

Juveniles (all populations) : Juveniles of all stages (J2, J3 and J4) are similar in most respects to the adult females. In specimens where the lateral field was visible, all J2 and J3 and some J4, exhibited a difference in the lateral field. The lateral field shows a distinct break in the annules, with ornamentations as illustrated. Two J4 specimens have an intermediate ornamentation, partly as for younger stages and partly as in adult females. Another three J4 specimens are similar to the adult females, without the ornamentations of younger stages. No size difference could be determined between J4 in the gradation from juvenile to adult markings. The differences described were observed in all populations studied. For reasons unknown, four J3 and four J4 from 131G and 132D & E had broken stylets.

TYPE SPECIMENS

Holotype (female) and **allotype** (male) deposited in Nematode Collection, South Australian Museum, North Terrace, Adelaide, South Australia, 5000. (No. 178C (m) and 178C (f), respectively).

Paratypes : Females, one male, and juveniles deposited at Waite Agricultural Research Institute, Glen Osmond, South Australia, 5064. Three females at each of the following nematode collections : Dept of Primary Industry, Indooroopilly, Qld., 4068, Australia ; Commonwealth Institute of Parasitology, St. Albans, Herts, England ; Muséum national d'Histoire naturelle, Laboratoire des Vers, Paris, France ; Laboratorium voor Nematologie, Landbouwhogeschool, Wageningen, Netherlands ; University of California Davis Nematode Collection, Davis, Ca 95616, U.S.A.

TYPE HABITAT AND LOCALITY

Collected by author in December 1981 from beach sand, near tide line, Clinton Conservation Park, north-west of Pt. Wakefield, South Australia. This locality is a coastal reserve at the northern end of St. Vincents gulf. Host plant, *Threkeldia diffusa* R. Br. (Chenopodiaceae).

DIAGNOSIS AND RELATIONSHIPS

Hemicycliophora wallacei sp. n. resembles *H. natalensis* Loof & Heyns, 1969, but differs in several characters. *H. natalensis* is more coarsely annulated, with fewer body annules and lower Rex and Ran

values than *H. wallacei* sp. n. *H. natalensis* also differs in the lip region, where the lateral lips are higher than the submedian lips, and also the two lip annules are large, very distinct and similar in size to the following body annules. The stylet of *H. wallacei* sp. n. is more slender, but with larger, stout basal knobs, less posteriorly sloped than *H. natalensis*. The vulval lips of *H. wallacei* sp. n. are shorter, and less projected, with a longer post-vulval region which is more attenuated. South Australian juveniles of *H. natalensis* have lateral field markings similar to those of adult females, and not the ornamentations to be found in J2 and J3 of *H. wallacei* sp. n. *H. wallacei* sp. n. may also be distinguished from Australian specimens of *H. natalensis* by their longer stylet, more slender median bulb and smaller terminal bulb. *H. wallacei* sp. n. may be distinguished from *H. conida* Thorne, 1955, by the shape of the lip region and absence of ovate markings on the cuticle. Also, *H. wallacei* has a greater number of body annules and higher values for Rex and RVan.

OTHER POPULATIONS

Pop. 178B Sand, close to tide line of beach. Sand collected from beneath plants of *Halosarcia halocnemoides* (Nees) P. G. Wilson, December 1981.

Pop. 132D, E. Sand from sand dunes about 20 m inland from 178C and 178B. Sand collected from beneath old plant of *Halosarcia halocnemoides*, August, 1980.

Pop. 131G. Muddy sand from low lying marshy area, with predominantly *Arthrocnemum* (2 spp.). Site is about 1 km from the coast (5.6 km west of site 178) and constantly saturated with saline water. Collected August 1980.

Pop. 130D and 100D. (Juveniles) Sandy area 1.5 km from coast, and 8 km west of site 178. *Arthrocnemum* sp. and *Atriplex* sp. Collected November 1975 and August 1980.

Females : A few differences were noted between some of the populations collected, and the type population. The longitudinal striae of the lateral field were visible in only a proportion of specimens from 132D, 132E and 178B, and were absent from 131G females. The submedian lips are less distinct in 131G specimens. In two females, from 132D and 132E, there are three lip annules. Reproductive system similar to type population except the spermatheca which is smaller and less well developed in 131G females and in other specimens without sperm. None of the spermathecae of 131G females contained sperm, despite the presence of males. Only one female from 178B had sperm present in the spermatheca. Overall, including the type population, 21 spermathecae were

full, 22 contained some sperm and 29 were empty. The vulva and post-vulval region are similar to the type population. In a few specimens the tail is annulated to the terminus.

Males: Males from 131G, in common with the females, are in poor condition. The lateral field in most of the 131G males was obscure, and in one specimen the annulations too indistinct at mid body to permit a total annule count. 'Oval organs' visible in one specimen. Oesophagus less degenerate than type population. The proportion of the smooth tail terminus is quite variable, being greatest in the type populations, up to 51% of the posterior region being smooth, to other populations where as little as 8% is smooth (from 131G).

Hemicyclophora eucalypti sp. n.

(Fig. 1B, C; Fig. 3A-L.)

MEASUREMENTS

Female (paratypes; $n = 11$): $L = 1.056$ mm (0.87-1.20); $b = 6.2$ (5.4-6.7); $c = 10.5$ (9-12); $V = 87.5$ (86-89); $VL/VB = 3.7$ (3.2-4.2); stylet = 104.0 μ m (97-113); $m = 84.3$ (83-87); $R = 206$ (190-221); $Rex = 41$ (39-44); $RV = 33$ (30-37); $RVan = 8$ (7-10); $Ran = 24$ (21-28); tail = 100.0 μ m (80-127).

Male (paratype, in J4 cuticle): $L = 0.733$ mm; $c = 13.1$; $T = 22.4$; $R = 414$; $Rex = 94$; $Ran = 21$; tail = 56 μ m; spicules = 41.5 μ m; gubernaculum = 6 μ m; penial sheath = 5 μ m.

Juveniles (type population): J2 ($n = 1$): $L = 0.362$ mm; stylet = 53.5 μ m; $Rex = 58$. — J3 ($n = 7$): $L = 0.56$ mm (0.50-0.59); stylet = 70.5 μ m (61-75); $Rex = 51$ (49-54). — J4 ($n = 1$): $L = 0.829$ mm; stylet = 95.5 μ m; $Rex = 45$.

Holotype (female): $L = 1.183$ mm; $b = 6.3$; $c = 11.3$; $V = 88.5$; $VL/VB = 3.2$; stylet = 103.0 μ m; $m = 83.5$; $R = 207$; $Rex = 40$; $RV = 33$; $RVan = 7$; $Ran = 26$; tail = 104.5 μ m.

Allotype (male): $L = 0.757$ mm; $c = 14.3$; $T = 22.2$; $R = 383$; $Rex = 80$; $Ran = 23$; tail = 53.0 μ m; spicules = 43 μ m; gubernaculum = 8.5 μ m; penial sheath = 8 μ m.

DESCRIPTION

Females: Body straight to slightly curved when relaxed, outer cuticle close fitting. Outer cuticle annules less rounded than body annules. Lateral field marked by a discontinuity rather than break in the annules, with some anastomoses and usually no lateral line visible. Where several anastomoses occur together, one lateral line may be visible. Numer-

ous longitudinal striae are visible in some but not all specimens, or may be present only on the posterior region of the body. Lip region continuous with body annules, in some specimens a slight constriction is present. Labial disc distinct and somewhat elevated. Lip annules four, distinct on inner cuticle, less clearly defined on outer cuticle, smaller than following body annules. Stylet long and slender, basal knobs rounded, posteriorly sloped with posterior cavity. Median bulb typical for genus; isthmus medium to long; terminal bulb oval in shape. Hemizonid two annules long. Excretory pore usually well posterior to terminal bulb and at level of, or one annule posterior to hemizonid. Genital branch single, outstretched. Spermatheca small to moderately sized, rounded, sperm present in 66% of the specimens. Vulval lips modified, the posterior lip rather bulbous and usually posteriorly directed. Body usually not recessed posterior to vulva, sometimes a slight recess visible, but first post-vulval annule usually smaller than the following annules. Post-vulval region straight to slightly ventrally curved, evenly tapered to tail terminus. Tail pointed, not quite annulated to terminus which is smooth or with very indistinct annulation.

Males: Body slightly ventrally curved when relaxed. Lip region continuous with body contour, with seven to eight lip annules. "Oval organs" not visible. Stylet absent, oesophagus reduced and degenerate. Hemizonid extending over two annules, immediately anterior to excretory pore. Lateral field with two, indistinct lateral lines. Spicules semi-circular (in allotype tips slightly reflexed). Gubernaculum curved, body just anterior to cloaca recessed. Testis packed with rounded sperm. Caudal alae with finely crenate margins, extending 31-33 annules anterior to the cloacal aperture to 36 annules posterior. Tail slightly ventrally curved, finely annulated, tapering to finely pointed, smooth terminus.

Juveniles: Juvenile stages are similar in most respects to adult females. Tail often more acutely pointed. Lateral field with longitudinal striae in most specimens, and no lateral line visible. In some specimens there is an incomplete break in the annules, or a break where several anastomoses occur together.

TYPE SPECIMENS

Holotype (female) and *allotype* (male) deposited in Nematode Collection, South Australian Museum, North Terrace, Adelaide, South Australia, 5000, No. 105E (c) and 105E (I) respectively.

Paratypes: Females, one male in J4 cuticle, and juveniles at Waite Agricultural Research Institute, Glen Osmond, South Australia, 5064. One female

at each of the following nematode collections : Dept. of Primary Industry, Indooroopilly, Qld. 4068, Australia ; Commonwealth Institute of Parasitology, St. Albans, Herts, England ; Laboratorium voor Nematologie, Landbouwhogeschool Wageningen, Netherlands ; University of California Davis Nematode Collection, Davis, Ca 95616, U.S.A.

TYPE HABITAT AND LOCALITY :

Collected by the author in November 1975 and again in December 1976 from Deep Creek Conservation Park, near the southern tip of the Fleurieu Peninsula, north-west of Victor Harbor, South Australia. The type locality is an area of tall eucalypt

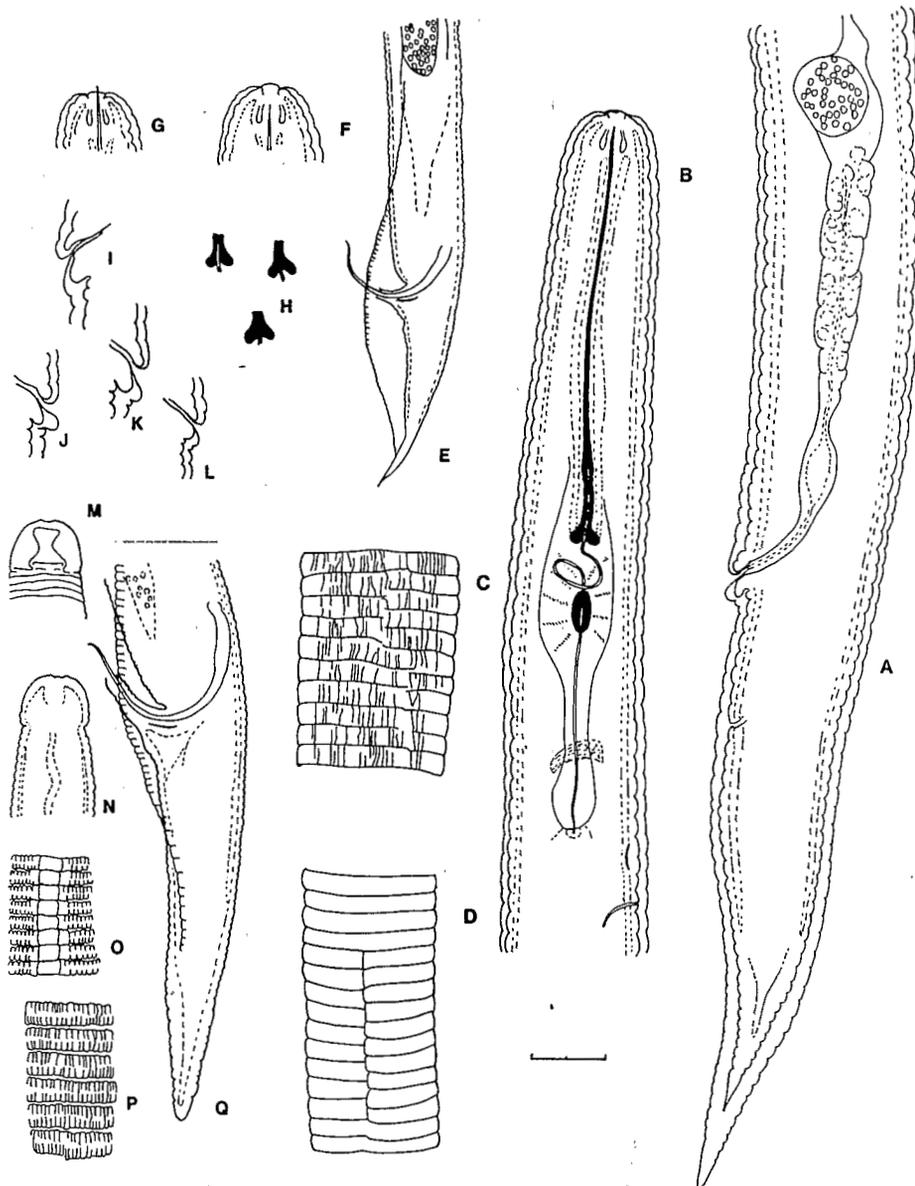


Fig. 3. *H. eucalypti* n. sp. Female. A : post-vulval region ; B : anterior region ; C, D : lateral field ; F, G : lip region ; H : stylet knobs ; I, L : vulval lips. Male. E : posterior region. *H. halophila* Yeates, 1967. Female. P : cuticular pattern. Male. M, N : lip region ; Q : posterior region. Juvenile. O : cuticular pattern. (Bar scale represents 20 μ m.)

forest, surrounded by mallee bushland, 0.6 km from reserve boundary. *Eucalyptus fasciculosa* F. Muell. and *E. obliqua* L'Her. are co-dominant trees. Associated understorey plant species include *Banksia*, *Casuarina*, *Acacia*, *Hakea*, *Pultenaea* and *Xanthorrhoea*.

DIAGNOSIS AND RELATIONSHIPS

Hemicycliophora eucalypti sp. n. resembles *H. saueri* Brzeski, 1974, and to a lesser extent *H. conida* Thorne, 1955. *H. eucalypti* sp. n. is most readily distinguished from *H. saueri* by the lack of ornamentations in the lateral field, shape of the vulval lips, and the longer stylet. It also differs from *H. saueri* in the stylet knobs which are stouter and less conspicuously posteriorly sloped, the more posterior position of the anus, fewer body annules and more acutely pointed tail. From *Hemicycliophora conida*, *H. eucalypti* sp. n. may be distinguished by the four lip annules (as compared to two for *H. conida*), and lack of ornamentation in the lateral field. It may also be distinguished from *H. conida* by the longer stylet, with more robust knobs and thicker more bulbous vulval lips.

Hemicycliophora litoralis sp. n.

(Fig. 1A; Fig. 4)

MEASUREMENTS

Females (paratypes; n = 52) : L = 1.114 mm (0.85-1.38); b = 5.5 (4.7-6.6); c = 9.1 (7.6-10.9); V = 84.5 (82-86); VL/VB = 5.7 (4.8-7.3); stylet = 109.0 μ m (94-118); m = 84.0 (82-85); R = 326 (299-380); Rex = 66 (60-73); RV = 55 (48-69); RVan = 14 (10-19); Ran = 41 (34-50); tail = 121.5 μ m (95-150).

Juveniles J2 (n = 1) : L = 0.401 mm; stylet = 63.5 μ m; Rex = 76. — J3 (n = 12) : L = 0.569 mm (0.503-0.631); stylet = 80.5 μ m (72.5-85.5); Rex = 75 (70-79). — J4 (n = 18) : L = 0.792 mm (0.681-1.074); stylet = 96.0 μ m (89.5-105.0); Rex = 69 (66-73).

Holotype (female) : L = 1.098 mm; b = 5.2; c = 9.4; V = 84.2; VL/VB = 6.1; stylet = 111.0 μ m; m = 83.8; R = 327; Rex = 71; RV = 56; RVan = 15; Ran = 41; Tail = 117.0 μ m.

DESCRIPTION

Females : Body ventrally curved when relaxed, outer cuticle frequently very loose fitting and usually with one fold. In the majority of the specimens the fold is at the vulva, less frequently at the anterior

end of the body. From the total female population, 68% have a fold at the vulva; 11% with a fold anterior to the median bulb, 5.5% two folds are present, and 5.5% there is no fold at all in the outer cuticle. The annulation of the outer cuticle becomes indistinct along much of the body, being annulated at the anterior end to about the level of the median bulb, and at the posterior end, only on the tail. Much of the outer cuticle has an irregular 'bubbled' appearance, and annular markings may only be distinguished in lateral view on the inner surface of the outer cuticle. This smoothness of much of the outer cuticle was observed in all specimens, including those few where the outer cuticle is relatively close fitting. Lateral field marked by two crenate lateral lines which form a distinct break in the annulation. In some specimens one line is more conspicuous than the other, and also occasionally they are very close together and without careful observation may appear as one line. Longitudinal striae are rare, and were observed on only two females. Lip region continuous with body, sometimes slightly offset, with two lip annules, occasionally two to three, or three lip annules are present, which are more distinct on the outer cuticle. Labial disc truncate, elevated and prominent. Stylet long, usually straight. Stylet knobs rounded, posteriorly sloped with moderate posterior cavity. Median bulb large to very large, isthmus rather wide, terminal bulb bulbous. Hemizonid two (36%) or three (64%) annules long opposite bulge in cuticle. Excretory pore at level of, to four annules posterior to hemizonid. Genital branch single, outstretched. Spermatheca rounded to oval in shape, moderate to very large with small sperm, present in all but three females. Vulval lips modified, anterior lip wider than posterior lip which is relatively small and often reflexed towards the body. Body with small recess after vulva, post-vulval region tapered to tail terminus. Anus often obscure and difficult to determine. Tail long, tapering, more sharply tapered towards distal portion, not quite annulated to terminus. Tail terminus conoid to pointed.

Male : not found.

Juveniles : Juvenile stages similar to adult females in most respects. Outer cuticle loose, similarly smooth between the region of the median bulb and tail, all stages with a fold on the tail. Lateral field with two lateral lines, similar to adults, longitudinal striae not observed. Tail distinctly annulated to terminus.

TYPE SPECIMENS

Holotype (female) : No. 178C (J) deposited in Nematode Collection, South Australian Museum, North Terrace, Adelaide, South Australia, 5000.

Paratypes : Females and juveniles at Waite Agricultural Research Institute, Glen Osmond, South Australia, 5064. Four females and two juveniles at each of the following nematode collections : Dept. of Primary Industry, Indooroopilly, Qld., 4068, Australia ; Commonwealth Institute of Parasitology, St. Albans, Herts, England ; Muséum national d'Histoire naturelle, Laboratoire des Vers, Paris, France ; Laboratorium voor Nematologie, Landbouwhoges-

chool, Wageningen, Netherlands ; University of California Davis Nematode Collection, Davis, Ca 95616, U.S.A.

TYPE HABITAT AND LOCALITY :

Specimens collected by B. J. and F. Reay in December 1981 from beach sand, near high-tide line of small beach at Clinton Conservation Park, north-

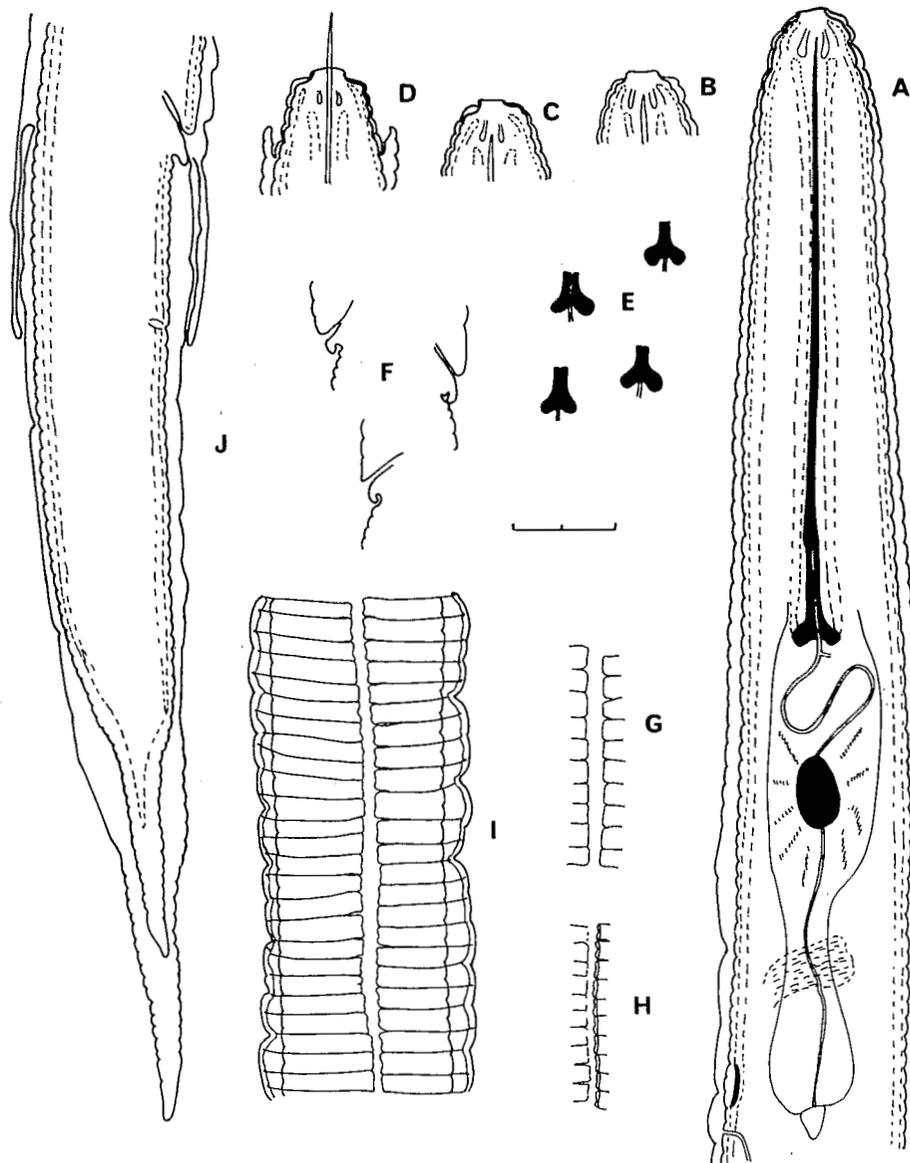


Fig. 4. *H. litoralis* n. sp. Female. A : anterior region ; B-D : lip region ; E : stylet knobs ; F : vulval lips ; G, H : lateral field ; I : cuticular pattern ; J : post-vulval region. (Bar scale represents 20 μ m.)

west of Port Wakefield, South Australia. This locality is a coastal reserve at the northern end of St. Vincent's gulf. Host plant *Threkeldia diffusa* R. Br. (Chenopodiaceae). *H. litoralis* sp. n. and *H. wallacei* sp. n. (type population) were collected from the same sand sample.

DIAGNOSIS AND RELATIONSHIPS

Hemicycliophora litoralis sp. n. may be distinguished from seven similar species as follows. To avoid repetition of the descriptive information, characters by which these seven species may be distinguished are given, rather than those of the new species. *i*) *H. chathamii* ssp. *chathamii* Yeates, 1978, has evenly developed vulval lips, fewer total body annules, lower Rex value, and no lateral lines in the lateral field; *ii*) *H. vidua* Raski, 1958 has a more anterior vulva, longer post-vulval region with higher RVan value, small spermatheca and lateral field without lateral lines; *iii*) *H. sheri* Brzeski, 1974 has a rounded labial disc, three lip annules, lower Rex value, higher RVan value, tight fitting outer cuticle and no lateral lines in the lateral field; *iv*) *H. shepherdii* Wu, 1966 has stylet knobs with a small cavity, different vulval lips, fewer total body annules, lower Rex and Ran values and no lateral lines in the lateral field; *v*) *H. lutosa* Loof & Heyns, 1969 has a rounded labial disc which is not elevated, lower Rex value and a higher number of post-vulval annules; *vi*) *H. gracilis* Thorne, 1955 has a large, rounded labial disc, rather longer stylet, higher number of post-vulval annules and close fitting outer cuticle; *vii*) *H. poranga* Monteiro & Lordello, 1978 has three lip annules, a smaller VL/VB ratio, and fewer annules in the post-vulval region.

Hemicycliophora charlestoni sp. n.

(Fig. 5)

MEASUREMENTS

Female (paratypes; $n = 12$): L = 1.222 mm (1.0-1.42); $b = 6.0$ (5.3-6.5); $c = 9.7$ (8.2-12.4); $V = 84.5$ (82-87); VL/VB = 5.2 (4.5-6.3); stylet = 112.5 μm (100-120); $m = 83.5$ (82-84.5); $R = 297$ (277-316); Rex = 53 (49-58); RV = 60 (54-65); RVan = 18 (15-22); Ran = 42 (37-48); tail = 127.0 μm (101-152).

Male (paratypes; $n = 4$): L = 1.04 mm (0.91-1.13); $c = 6.7$ (6.2-7.3); $T = 21.5$ (18-25); $R = 539$ (499-557); Rex = 99 (73-112); Ran = 78 (67-88); tail = 155.0 μm (136-178); spicules = 56.0 μm (51-60); gubernaculum = 10.0 μm (8.5-12.5); penial sheath = 17.5 μm (16-21).

Juveniles: J2 ($n = 5$): L = 0.44 mm (0.386-0.469); stylet = 70.5 μm (68-74); Rex = 66-69 ($n = 2$). — J3 ($n = 13$): L = 0.645 mm (0.58-0.72); stylet = 80.5 μm (70.5-88.5); Rex = 59 (55-61). — J4 ($n = 10$): L = 0.930 mm (0.82-1.01); stylet = 100.5 μm (93.5-111.0); Rex = 58 (55-61).

Holotype (female): L = 1.173 mm; $b = 6.0$; $c = 8.3$; $V = 82$; VL/VB = 5.7; stylet = 111.5 μm ; $m = 84.0$; $R = 284$; Rex = 49; RV = 65; RVan = 17; Ran = 48; tail = 140.5 μm .

Allotype (male): L = 1.096 mm; $c = 6.2$; $T = 24.8$; $R = 556$; Rex = 112; Ran = 88; tail = 177.5 μm ; spicules = 58.5 μm ; gubernaculum = 10 μm ; penial sheath = 21 μm .

DESCRIPTION

Females: Body ventrally curved when relaxed, outer cuticle loose fitting. Outer cuticle covered with fine tessellate markings, present in two rows on each annule. Lateral field without other markings, discernible as a discontinuity where anastomoses occur. Lip region continuous with body annules or may be slightly offset. Labial disc distinct, rounded. Lip annules three, the first two smaller than the third. Stylet long, basal knobs strongly posteriorly sloped, rounded, with large posterior cavity. Median bulb and isthmus typical for genus. Hemizonid usually two (occasionally three) annules long, one annule anterior to excretory pore which is usually posterior to the terminal bulb. Genital branch single, outstretched. Spermatheca of moderate size, oval, filled with sperm in all but one female. Vulval lips modified. Post-vulval region cylindrical to slightly tapered, abruptly tapering towards terminus. Tail annulated almost to terminus which is conoid to pointed.

Males: Body straight to ventrally curved when relaxed, finely annulated. Head region offset, smooth or with two to four annules in the posterior region only. Large "oval organs" appearing as a dorso-ventral cap on the head region. Stylet absent, oesophagus reduced and degenerate. Hemizonid extending over three annules, three to six annules anterior to excretory pore. Lateral field with three lateral lines, irregularly areolated, the outer lines crenate. Spicules semicircular, gubernaculum curved. Body just anterior to cloaca recessed, often with indistinct annulation. Testis packed with rounded sperm. Caudal alae with finely crenate margins, extending 33-46 annules anterior to the cloacal aperture to 2135 annules posterior, the post-anal stretch being less than the preanal portion. Tail straight to ventrally curved, annulation somewhat irregular, terminus conoid to pointed.

Juveniles : Juvenile stages similar to adult females. In all but one J4, the outer cuticle is folded at the tail region. Most specimens of J3 and J4 show a difference from the females in the cuticular pattern. In these juveniles the outer cuticle is tessellated, the tessellations stopping in the region of the lateral field so that two lateral lines are visible. The tessellated pattern extends across each annule, and is not separated into two rows as in adult females. In stage J3, ten specimens have two lateral lines and a tessellate pattern outside the lateral field. In the remaining

three specimens only the two lateral lines may be distinguished. With stage J4, eight individuals have broad tessellated markings, as in other juveniles, and two individuals have a double tessellation as in adult females. No cuticular markings of any kind are visible on the five J2 specimens.

TYPE SPECIMENS

Holotype (female) (with one J4) and *allotype* (male, with two J3) deposited in Nematode Collection, South

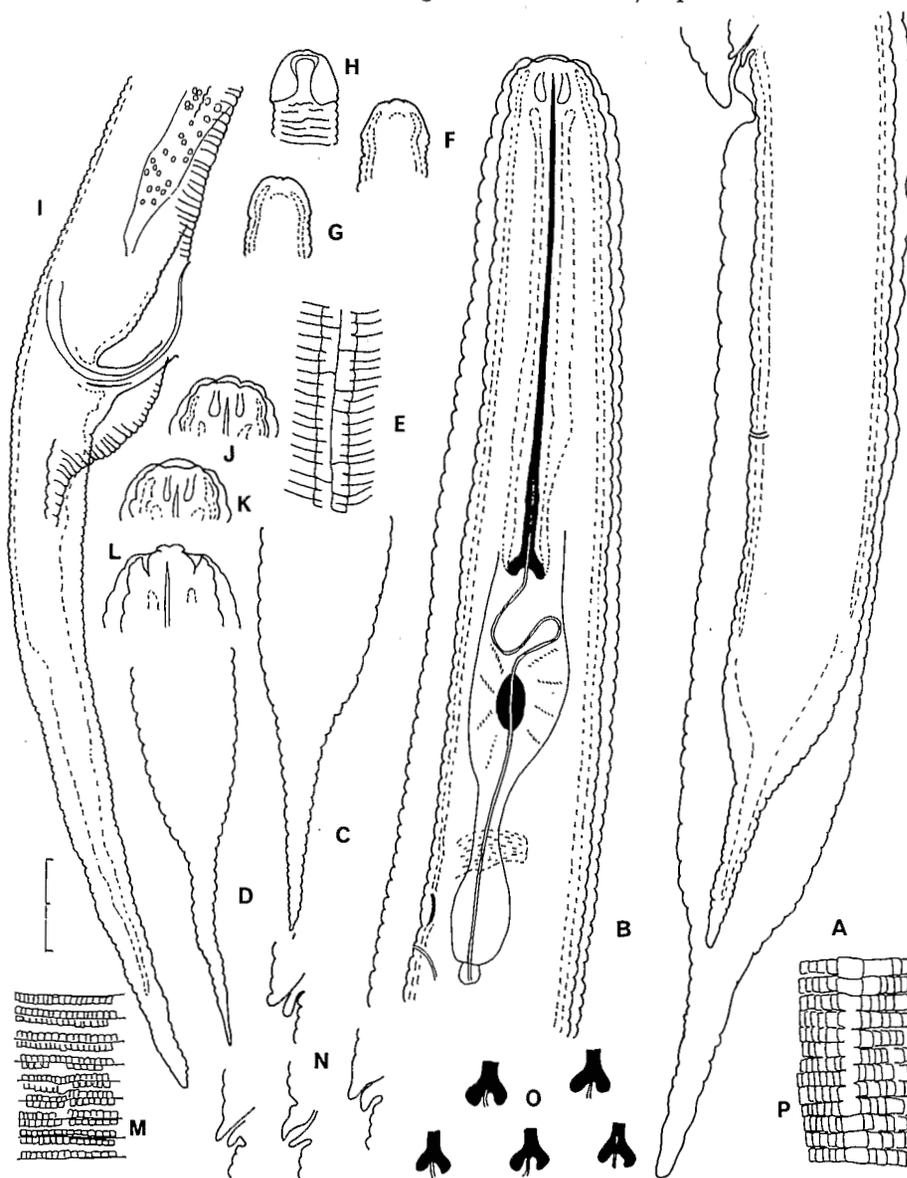


Fig. 5. *H. charlestoni* n. sp. Female. A : post-vulval region ; B : anterior region ; C, D : variation in tail ; J, K : lateral view of lip region ; L : dorso-ventral view of lip region ; M : cuticular pattern ; N : vulval lips ; O : stylet knobs. Male. E : lateral field ; F-H : lip region ; I : posterior region. Juvenile. P : cuticular pattern. (Bar scale represents 20 μ m.)

Australian Museum, North Terrace, Adelaide, South Australia 5000. (No. 168A (L) and 168A (V), respectively).

Paratypes : Females, males and juveniles at Waite Agricultural Research Institute, Glen Osmond, South Australia, 5064 ; also one female and one juvenile at each of the following nematode collections : Dept of Primary Industry, Indooroopilly, Qld, 4068, Australia ; Commonwealth Institute of Parasitology, St. Albans, Herts., England ; Laboratorium voor Nematologie, Landbouwhogeschool, Wageningen, Netherlands ; University of California Davis Nematode Collection, Davis, Ca 95616, U.S.A.

TYPE HABITAT AND LOCALITY

Specimens collected by the author, in November 1981, from Charleston Conservation Park, near Charleston, in the Mount Lofty Ranges, east of Adelaide, South Australia. Specimens obtained from soil collected beneath *Acacia pycnantha* Benth., in an area of mixed bushland where *Eucalyptus camaldulensis* Dehn (River Red Gum) is the dominant tree species. Associated plant species include *Banksia marginata* Cav., and *Allocasuarina verticillata* (Lam) L. Johnson.

DIAGNOSIS AND RELATIONSHIPS

Hemicyclophora charlestoni sp. n. shows some resemblance to *H. ripa* van den Berg, 1981, *H. macristhmus* Loof, 1968 and *H. aquatica* (Micoletsky, 1913) Loos, 1948. Characters distinguishing these species are the following : *i*) *H. ripa* has a broader and more elevated labial disc than *H. charlestoni* sp. n. ; the stylet is shorter than *H. charlestoni* sp. n. with noticeably smaller basal knobs which are less strongly sloped ; also the tail is evenly tapered and more acutely pointed than *H. charlestoni* sp. n. ; *ii*) the labial disc in *H. macristhmus* is broader and more protruding than *H. charlestoni* sp. n. ; the nematode is also shorter, and has fewer body annules ; there are also differences in the cuticular pattern of both females and juveniles ; *iii*) *H. aquatica* has a longer stylet, with less posteriorly sloped basal knobs and a barely discernible posterior cavity ; it also differs in the more protruding labial disc and cuticular markings (information taken from Loof, 1968).

Loofia acuta sp. n.

(Fig. 1F ; Fig. 6A-K)

MEASUREMENTS

Females (n = 4) : L = 1.10 mm (0.97-1.3) ; b = 6.3 (6.1-6.7) ; c = 6.9 (6.4-7.3) ; V = 78.5 (77-81) ; VL/

VB = 6.4 (6.2-6.6) ; stylet = 110.0 μ m (105-122) ; m = 85.5 (84-87) ; R = 242 (218-273) ; Rex = 42 (40-45) ; RV = 47 (42-53) ; RVan = 13 (12-15) ; Ran = 33 (29-38) ; tail = 160.5 μ m (132-189).

Holotype (female) : L = 0.967 mm ; b = 6.2 ; c = 7.3 ; V = 80.5 ; VL/VB = 6.2 ; stylet = 105.0 μ m ; m = 86.1 ; R = 218 ; Rex = 43 ; RV = 42 ; RVan = 13 ; Ran = 29 ; tail = 132.0 μ m.

DESCRIPTION

Females : Body strongly annulated, ventrally curved when relaxed, outer cuticle close fitting. Outer cuticle annules flatter than body annules. Lateral field marked by a groove like irregularity of the annules. Breaks in the annulation only where anastomoses occur. Lateral lines and longitudinal striae not observed. Head rather blunt in outline, with low domed lip region. Labial disc truncate to slightly domed. Two lip annules, with submedian lips present. First lip annule smaller than second lip annule which is similar to and only slightly smaller than following body annules. Stylet long, straight to slightly curved. Stylet knobs rounded, slightly posteriorly sloping, with distinct posterior cavity. Median bulb slender, terminal bulb small, continuous with narrow isthmus. Hemizonid one to two annules long, at level of or one annule anterior to excretory pore which is situated posterior to terminal bulb. Genital branch outstretched or slightly convoluted. Spermatheca small, oval, with sperm or indistinct and without sperm. Vulval lips not modified, posterior lip with small fold or cleft. Post-vulval region slender, without post-vulval recess, and evenly tapered to acutely pointed tail. Tail terminus very finely pointed, with less distinct annulation.

Male and juveniles not found

TYPE SPECIMENS

Holotype : Female No. 71C (a) deposited in Nematode Collection, South Australian Museum, North Terrace, Adelaide, South Australia, 5000.

Paratypes : Females at Waite Agricultural Research Institute, Glen Osmond, South Australia, 5064. One female at each of the following nematode collections : Commonwealth Institute of Parasitology, St. Albans, Herts., England and University of California Davis Nematode Collection, Davis, Ca 95616, U.S.A.

TYPE HABITAT AND LOCALITY

Mallee scrub at Cox's Scrub Conservation Park, south of Ashbourne, South Australia. *Eucalyptus*

cosmophylla F. Muell., is the dominant tree species. Associated trees and shrubs include *Banksia marginata* Cav., *Allocasuarina striata* (Macklin) L. Johnson, *Hakea rostrata* F. Muell. ex Meissner, *Callistemon macropunctatus* (Dum.-Cours.) Court, *Leptospermum myrsinoides* Schldl. and *Xanthorrhoea semiplana* F. Muell.

DIAGNOSIS AND RELATIONSHIPS

With its distinctly separated lip annules and submedian lips, *Looftia acuta* sp. n. shows some resemblance to *Hemicycliophora hesperis* Raski, 1958. Within the genus *Looftia*, *L. acuta* sp. n. shows some similarity to *L. vaccinium* (Reed & Jenkins, 1963)

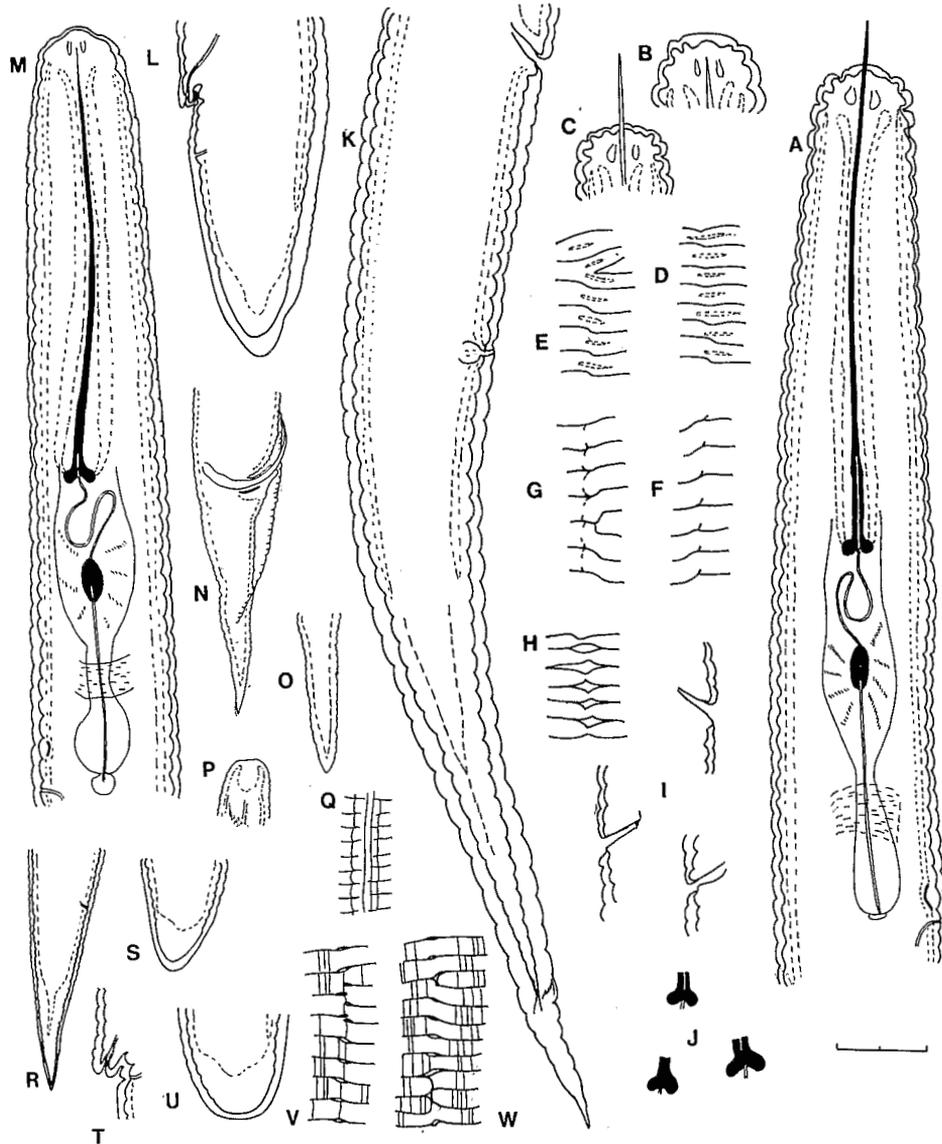


Fig. 6. *Looftia acuta* n. sp. Female. A : anterior region ; B; C : lip region ; D-H : variation in lateral field ; I : vulval lips ; J : stylet knobs ; K : post-vulval region. *Hemicycliophora biloculata* Colbran, 1969. Female. L : post-vulval region ; M : anterior region ; T : vulval lips ; U : tail. V, W : lateral field. Male. N : posterior region ; O : tail ; P : lip region ; Q : lateral field. Juveniles. R : J3 tail ; S : J4 tail. (Bar scale represents 20 μ m.)

Siddiqi, 1980. *L. acuta* sp. n. may be distinguished by its narrower labial disc, more prominent submedian lips, and distinctly separated lip annules. In addition, *L. acuta* sp. n. has fewer body annules, and lower values for Rex, RVan and Ran.

Hemicycliophora iwia Brzeski, 1974

(Fig. 7A-K)

The male of this species was not described and some differences were observed from the original description of females. *H. iwia* has only been recorded from the type locality, at Boeill Creek, New South Wales.

MEASUREMENTS

Females: L = 0.906 mm (0.83-0.97); b = 5.2 (4.9-5.4); c = 14.4 (12-15.4); V = 88 (86-89); VL/VB = 3.5 (3.1-4.0); stylet: 102.0 μ m (98-110); R = 226 (211-245); Rex 47 (43-50); RV = 35 (30-38); RVan = 13 (10-15); Ran = 22 (20-24); tail = 63.5 μ m (55-74).

Male: L = 0.654 mm; c = 10.5; T = 33.1; R = 353; Rex = 82; Ran = 18; anal body width = 14.5 μ m; tail = 62.0 μ m; spicules = 48.0 μ m; gubernaculum = 6.0 μ m; penial sheath = 12.0 μ m.

DESCRIPTION

Females: Body straight to slightly ventrally curved when relaxed. Outer cuticle moderately close fitting, less so in the post-vulval region. Lateral field with irregular break in annules, without any lateral line, but often with irregular longitudinal striae. Lip region rounded, with slightly domed labial disc. Lip annules three, more distinct on inner cuticle, first annule smaller than the following lip annules. Stylet knobs rounded, posteriorly sloped, sometimes irregular, with large posterior cavity. Hemizonid two annules long, at level of or one annule anterior to the excretory pore. Spermatheca small to moderately sized, sperm present in most specimens. Body recessed posterior to vulva, vulval lips modified and elongated. Post-vulval region more or less cylindrical, tapering towards the conoid, distal portion. Tail annulated to rounded terminus.

Male: Body ventrally curved, finely annulated. Lip region continuous with body contour, not annulated. 'Oval organs' appearing as an extension of the cuticle from the 'neck', rather than as a head cap as in *H. charlestoni* sp. n. Stylet absent, oesophagus reduced and degenerate. Hemizonid extending over three annules, and three annules anterior to the

excretory pore. Lateral field with two, crenate lateral lines. Spicules strongly curved, semicircular. Gubernaculum curved. Body immediately anterior to cloaca recessed. Body smooth immediately anterior and posterior to cloaca. Caudal alae with crenate margins. Penial sheath fairly well developed. Tail slightly ventrally curved, annulation irregular, tapering to conoid terminus.

DISCUSSION

Measurements of female *H. iwia* were generally similar to those of the original description except for a slightly higher total annule count. All the female specimens studied have three lip annules, as opposed to two originally described. Although smaller than the following lip annules, the first lip annule is distinct on the inner cuticle. All three lip annules are less distinct on the outer cuticle. The lateral field was originally described as "marked by anastomoses or breaks of striae". Longitudinal striae were not mentioned or illustrated. Four of the seven females studied have irregular longitudinal striae marking the cuticle. *H. iwia* is closely related to *H. halophila* Yeates, 1967. It may only be distinguished by the cuticular ornamentations of females and juveniles and also the slightly longer tail of *H. halophila*. The latter species has two lip annules on the inner cuticle and three on the outer one. This character seems therefore to be a rather unreliable means of distinguishing between these two species.

Hemicycliophora brevicauda Sauer, 1958

(Fig. 7L-U)

Female and juvenile specimens of this species were collected from five localities in Northern Queensland and exhibit some variation from the original description.

MEASUREMENTS

Females (n = 9): L = 0.74 mm (0.66-0.84); b = 5.1 (5.0-5.3); c = 48.5 (36-68); V = 96.5 (96-98); VL/VB = 0.85 (0.7-1.1); stylet = 76.5 μ m (71-85); R = 193 (186-202); Rex = 43 (41-45); RV = 8 (5-12); RVan = 1-3; Ran = 6 (3-10); tail = 15.5 μ m (10-20).

DISCUSSION

Females from northern Queensland have a shorter stylet, but greater number of total body annules than type specimens. Lip region domed, with two lip

annules. Stylet knobs rather small, with small posterior cavity. Tail more or less rounded, sometimes conoid rounded, with hyaline region at terminus, which is usually smooth and not annulated. Lateral field with one or two lateral lines, infrequently a single line as described by Brzeski (1974). Lines may be continuous along the length of the body or interrupted. Fine longitudinal striae occasionally observed. Males were not recovered, and spermathecae of females did not contain sperm. Juveniles generally similar to females, with two lip annules and similar lateral field markings. Tail not rounded, but conoid to pointed, finely annulated to terminus.

LOCALITIES

Specimens of this species were obtained from five localities in Northern Queensland : Bellenden Ker National Park (south of Cairns), at the edge of tropical rainforest ; Davies Creek National Park (west of Cairns) in *Eucalyptus* (*E. polycarpa* F. Muell. and *E. creba* F. Muell.) woodland ; Mossman River National Park (north-west of Mossman) in tropical rainforest ; 31 km west of Mt. Garnett, in *Eucalyptus alba* Reinw. ex Blume and *Melaleuca* woodland ; Mt. Elliot National Park (south of Townsville) in *Eucalyptus alba* woodland.

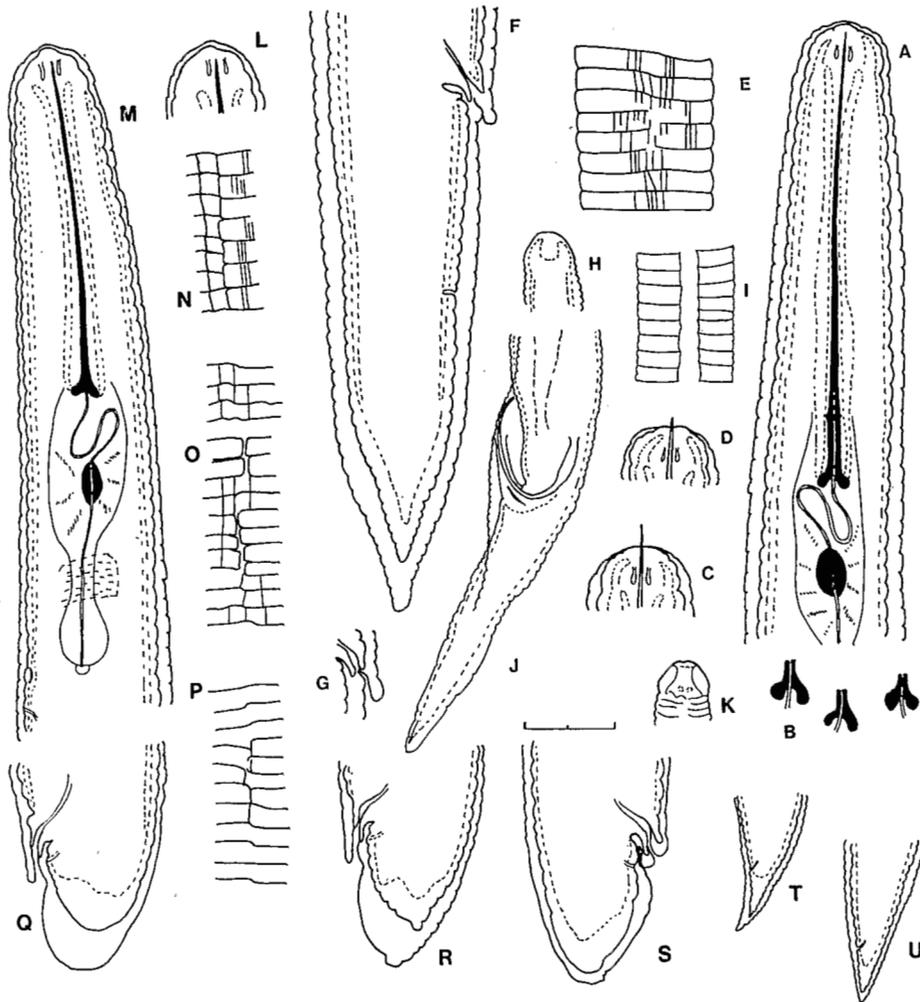


Fig. 7. *H. iwia* Brzeski, 1974. Female. A : anterior region ; B : stylet knobs ; C, D : lip region ; E : lateral field ; F : post-vulval region ; G : vulval lips. Male. H. K : lip region ; I : lateral field ; J : posterior region. *H. brevicauda* Sauer, 1958. Female. L : anterior region ; M : lip region ; N-P : lateral field ; Q-S : post-vulval region. Juveniles. T, U : tails. (Bar scale represents 20 μ m.)

Hemicycliophora biloculata Colbran, 1969

(Fig. 6L-W)

A few specimens of this species, including males which were previously unrecorded, were collected from Northern Queensland.

MEASUREMENTS

Females (n = 5) : L = 0.80 mm (0.68-0.87) ; b = 4.6 (4.1-4.9) ; c = 23.4 (19-27) ; V = 94 (93-95) ; VL/VB = 1.5 (1.3-1.8) ; stylet = 94.5 μ m (88-98) ; R = 199 (176-220) ; Rex = 43 (40-46) ; RV = 12-14 ; RVan = 2-4 ; Ran = 9-11 ; tail = 34.5 μ m (27-40).

Males (n = 2) : L = 0.57, 0.58 mm ; c' = 10, 11 ; T = 22, 24 ; R = 273, 393 ; Rex = 73, 88 ; Ran = 38 ; tail = 52, 56 μ m ; spicules = 24, 28.5 μ m ; Penial sheath = 6, 6.5 μ m.

DESCRIPTION

Male : Body ventrally curved when relaxed, and finely annulated. Lip region continuous with body, smooth at first then finely annulated. "Oval organs" not visible. Stylet absent, oesophagus reduced and degenerate. Spicules almost semicircular, body deeply recessed anterior to cloaca. Tail conoid to pointed, finely annulated to terminus. Caudal alae finely crenate. Lateral field rather indistinct, appearing as four lateral lines which are areolated.

DISCUSSION

Female measurements similar to those for the type population, but with lower range in annule values for total body annules, Rex and RV. Female lip region similar, with two lip annules and somewhat elevated labial disc. Stylet knobs rounded, with moderately large cavity. Lateral field without lateral lines, or one or two lines visible, but small ornamentations as originally described. Fine longitudinal striae are also visible, so that the lateral field as a whole does not appear as illustrated by Brzeski (1974). Spermatheca ovoid and offset as first described, but full with sperm. Tail rounded or conoid, smooth at terminus, and with haline region.

Juveniles generally similar to females, with similar lip region and lateral field pattern. The tail shape differs, being pointed in J3 becoming conoid in J4.

LOCALITY

Specimens were collected from two sites in tropical rainforest, at Eungella National Park (west of Mackay) north Queensland.

Hemicycliophora halophila Yeates, 1967

(Fig. 3M-Q)

Specimens of this species were collected by the author from three localities in South Australia, all of which are areas with sandy soil. A single male specimen was also recovered, and being previously unrecorded, is described here.

MEASUREMENTS

Females (n = 8) from Sandy Creek : L = 1.079 mm (0.93-1.27) ; b = 5.4 (4.7-5.9) ; c = 10.5 (9.8-11.8) ; V = 86.5 (85-88) ; stylet = 117.5 μ m (96.0-145.0) ; R = 215 (190-238) ; Rex = 41 (33-45) ; RV = 40 (34-44) ; RVan = 10 (8-13) ; Ran = 29 (26-34) ; tail = 103.0 μ m (89-123).

Female (n = 1) from Cox's Scrub : L = 1.275 mm ; b = 5.9 ; c = 11.3 ; V = 86.9 ; VL/VB = 3.8 ; stylet = 130.0 μ m ; R = 234 ; Rex = 42 ; RV = 41 ; RVan = 12 ; Ran = 29 ; tail = 117.0 μ m.

Females (n = 5) from Aldinga Scrub : L = 1.10 mm (0.85-1.31) ; b = 5.2 (4.7-5.4) ; c = 12 (10-14) ; V = 87.5 (86-90) ; VL/VB = 3.3 (2.5-4.2) ; stylet = 130.0 μ m (113-143) ; R = 203 (193-217) ; Rex = 38 (36-41) ; RV = 39 (35-42) ; RVan = 11 (10-12) ; Ran = 27 (25-29) ; tail = 100.0 μ m (95-106), (1 ♀ : tail = 62.0 μ m).

Male (n = 1) from Aldinga Scrub : L = 0.912 mm ; c = 8.6 ; T = 23.6 ; R = 372 ; Rex = 76 ; Ran = 42 ; tail = 106.5 μ m ; spicules = 68.0 μ m ; gubernaculum = 9.0 μ m ; penial sheath = 22.0 μ m.

DESCRIPTION

Females : Lip region with two lip annules and submedian lips, labial disc moderately large. Stylet knobs rounded strongly posteriorly sloped and divergent with large posterior cavity. Oesophagus well developed. Cuticle with numerous longitudinal striae, which occasionally appear as regular block-like tessellations in some specimens. Lateral field usually marked by a break or discontinuity in annulation, occasionally two lateral lines are visible, similar to those of juveniles, but less distinct. Spermatheca oval, offset, of moderate size, with or without sperm. Vulval lips moderately elongated. Post-vulval region at first cylindrical, then tapering. Tail more abruptly tapered towards terminus, which is conoid. Annulations extend to tail terminus.

Male : Body ventrally curved when relaxed. Lip region conoid, offset from rest of body, smooth at anterior part, with two to three annules towards posterior region. "Oval organs" visible as dorso-ventral cap over head region. Oesophagus reduced

and degenerate. Hemizonid three annules long, opposite bulge in cuticle and two annules anterior to excretory pore. Lateral field very indistinct — three lateral lines visible which are areolated — the presence of a fourth line could not be determined. Body recessed anterior to cloaca. Caudal alae crenate, extending 31 annules anterior to 32 annules posterior to cloacal aperture. Spicules semicircular, slightly recurved at tip. Tail almost straight, tapered, and annulated to conoid terminus.

Juveniles: Juveniles from Aldinga Scrub were studied, and comprised five J2, seventeen J3 and seven J4. These are generally similar in many respects to adult females. The tail shape is similar to females, but the outer cuticle is folded at the tail in most juveniles, less frequently in J2. The lateral field is marked by two conspicuous lateral lines, which are areolated in J3 and J4 and may be less distinct in some J4. The cuticle is covered in longitudinal striae in all juvenile stages, as illustrated. A single J3 male was recovered from Sandy Creek.

DISCUSSION

Although the original descriptions of *H. halophila* and *H. koreana* Choi & Geraert, 1971 are quite similar, measurements given by Brzeski (1974) indicate that *H. koreana* may be larger than *H. halophila*, and with a longer stylet. The South Australian specimens of *H. halophila* are longer, and with a longer stylet than those given by Brzeski (1974). *H. koreana* may be distinguished by the more elevated labial disc, sub-median lips rarely visible in lateral view, stylet knobs larger and less posteriorly sloped and cuticular markings. Also the vulval lips are somewhat longer and thicker than those of *H. halophila* and the tail of *H. koreana* is less abruptly tapered and more attenuated towards the terminus. The twisting of the base of the conical part of the stylet was visible in most of the specimens examined of *H. koreana*. This peculiarity was also observed in most specimens of *H. halophila*, but seems less strongly developed than in *H. koreana*.

Accepté pour publication le 22 février 1984.

LOCALITIES

H. halophila was most abundant at Sandy Creek Conservation Park, being recovered from five sites within the reserve. Dominant trees include *Allocasuarina verticillata* (Lam) L. Johnson, *Eucalyptus fasciculosa* F. Muell., and *Banksia marginata* Cav. It was also recovered from Aldinga Scrub Reserve from soil beneath *Acacia pycnantha* Benth., and *Isolepis nodosa* (Rottb.) R. Br., and from Cox's Scrub Conservation Park — mixed bushland including *Eucalyptus cosmophylla* F. Muell., and *Banksia marginata*.

ACKNOWLEDGEMENTS

Sincere thanks are due to my husband, Brian Reay, for his continued assistance with collection of soil samples. Thanks are also due to M. R. Sauer for kindly providing specimens of *H. saueri* and *H. iwia* and to Y. E. Choi for specimens of *H. koreana*. Loan of specimens by R. C. Colbran, Queensland, Mae Noffsinger (UCDNC) California, U.S.A., and Esther van den Berg, South Africa, is gratefully acknowledged. Thanks also to the South Australian and Queensland Sections of the National Parks and Wildlife Service, and to the State Planning Authority of South Australia, for their co-operation with soil sampling in their reserves. Plant species were identified by D. E. Symon, Senior Botanist, Waite Agricultural Research Institute (University of Adelaide), and R. W. Johnson and L. Pedley, Queensland Herbarium, Indooroopilly.

REFERENCES

- BRZESKI, M. W. (1974). Taxonomy of Hemicycliophorinae (Nematoda, Tylenchida). *Zesz. probl. Postep. Nauk. roln.*, 154 : 237-330.
- LOOF, P. A. A. (1968). Taxonomy of *Hemicycliophora* species from west and central Europe (Nematoda : Criconematoidea). *Meded. Landb Hoogesch. Wageningen*, 68 : 1-43.
- de MAN, J. G. (1921). Nouvelles recherches sur les nématodes libres terricoles de la Hollande. *Capita Zool.*, 1 : 3-62.
- REAY, F. (1984). Plant nematodes from Australia : New records of Hemicycliophoridae (Nematoda : Tylenchida). *Austral. Pl. Pathol.*, 13 : 8-11.