

Hemicriconemoides minor sp. n. with observations on four other species of the genus (Nematoda : Criconematidae)

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SUMMARY

Hemicriconemoides minor n. sp. is described from Australia. It is differentiated from *H. taiwanensis* Pinochet & Raski, 1975 by being smaller, with fewer annules, smaller stylet knobs and a slightly offset lip region. The male and two juveniles of *H. obtusus* Colbran 1962 are described. Additional information on *H. nitidus* Raski & Pinochet, 1975, *H. mangiferae* Siddiqi, 1961 and *H. insignis* Dasgupta, Raski & Van Gundy, 1969 is given. Variation in juvenile scales and the retrorse annules of *Hemicriconemoides* are discussed.

RÉSUMÉ

Hemicriconemoides minor n. sp. et observations sur quatre autres espèces du genre (Nematoda : Criconematidae)

Hemicriconemoides minor n. sp. est décrit, provenant d'Australie ; il se différencie de *H. taiwanensis* Pinochet & Raski, 1975 par la plus faible longueur du corps, le nombre moins élevé d'anneaux, les boutons du stylet moins développés et la région labiale quelque peu séparée du reste du corps. Le mâle et deux juvéniles appartenant à *H. obtusus* Colbran, 1962 sont décrits. Des données complémentaires sont fournies concernant *H. nitidus* Raski & Pinochet, 1975, *H. mangiferae* Siddiqi, 1961 et *H. insignis* Dasgupta, Raski & Van Gundy, 1969. Les variations concernant les écailles cuticulaires de juvéniles et la présence d'anneaux retrorses dans le genre *Hemicriconemoides* sont discutées.

The genus *Hemicriconemoides* occurs in most parts of the world, seven species having been recorded in Australia (Khair, 1978). *H. obtusus* Colbran, 1962, *H. insignis* Dasgupta, Raski & Van Gundy, 1967 and *H. minor* sp. n. occur in bushland soils and can be considered as being native rather than introduced species. These exhibit some of the variability within the genus. *H. obtusus* is considered to be the most aberrant species (Dasgupta, Raski & Van Gundy 1969) and *H. minor* sp. n. differs from most other species in having retrorse annules.

Materials and methods

Most of the nematode specimens were collected during a study of plant parasite nematodes occurring in bushland soils in South Australia (Reay & Wallace, 1982). Soil samples were collected using a 5 cm diameter auger to 40 cm depth. Nematodes were extracted by a modified Baerman's technique, relaxed

by gentle heat, then fixed with 2% formalin, or relaxed and fixed in hot FA 4:1. They were then processed to glycerol by Baker's method, or by a method of slow evaporation of glycerol-ethanol at 40°. Specimens were then mounted in pure glycerol.

Hemicriconemoides minor sp. n. (Fig. 1A-G)

MEASUREMENTS

Females (paratypes from Kuitpo Forest: n = 16): L = 0.32 (0.29-0.37) mm ; a = 14 (12-15) ; b = 3.4 (2.8-4.4) ; c = 23 (19-27) ; V = 92 (91-94) ; Stylet = 63 (56-68) μ m ; m = 90 (87-95) ; VL/VB = 1.3 (1.2-1.5) ; Rex = 37 (32-39) ; Rv = 12 (10-13) ; Rvan = 4 (2-5) ; Ran = 7 (6-8) ; R = 118 (112-125).

Holotype (female; Kuitpo Forest): L = 0.34 mm ; a = 15 ; b = 3.3 ; c = 26 ; V = 92 ; Stylet = 65 μ m ; m = 90 ; VL/VB = 1.5 ; Rex = 36 ; Rv = 13 ; Rvan = 5 ; Ran = 7 ; R = 117.

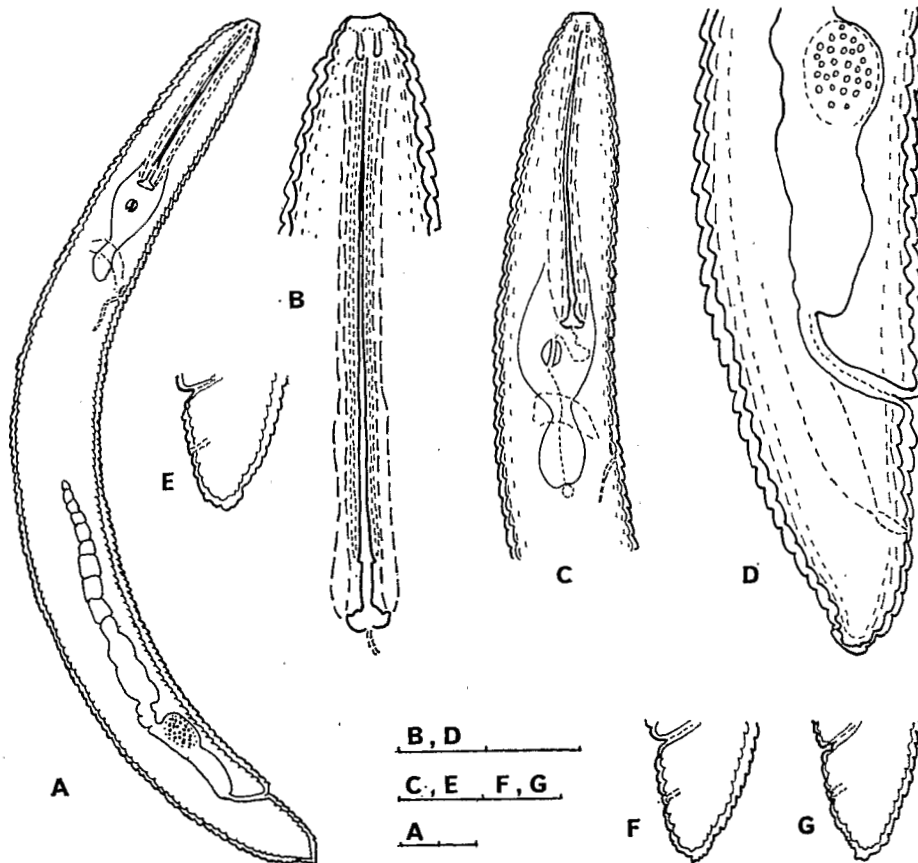


Fig. 1. *Hemicriconemoides minor* sp. n. A : female ; B : head and stylet ; C : oesophageal region ; D : posterior region of female ; E-G : variability of tail ; (Scale bars represent 20 μ m).

Females (paratypes from Kyeema; n = 16) : L = 0.36 (0.32-0.42) mm ; a = 15 (13-16) ; b = 2.9 (2.7-3.1) ; c = 25 (19-29) ; V = 92 (91-94) ; Stylet = 70 (62-75) μ m ; m = 89 (87-90) ; VL/VB = 1.4 (1.2-1.7) ; Rex = 39 (37-40) ; Rv = 12 (11-14) ; Rvan = 5 (4-7) ; Ran = 7 (5-9) ; R = 121 (113-128).

DESCRIPTION

Female : Body of young females slightly ventrally arcuate, older females horse-shoe shaped. Annules retrorse, margins sometimes slightly irregular, occasionally two annules on the dorsal side merge to form one annule on the ventral side. Head with three, occasionally two, rounded annules, narrower than the following neck region. Head rounded in outline. Stylet thin, straight or ventrally curved. Stylet knobs with small projections directed ante-

riorly ; in some paratypes these projections are barely discernible. Spermatheca filled with sperm. Gonad straight in most specimens seen, but sometimes recurved. Vulva open, no lateral vulval membranes. Tail end often dorsally curved, tail tip variable.

Males and juveniles : not found.

TYPE LOCALITY

Kuitpo Forest, adjacent to Meadows, 30 km south of Adelaide, South Australia. An established planting of *Eucalyptus maculata* Hook, composed of some mature trees, approximately 45 years old and numerous saplings. *E. maculata* has been introduced from the eastern states of Australia and does not occur in virgin South Australian forests. Shrub

layer absent. Ground species composed mostly of native orchid species, including *Pterostylis* spp., *Caladenia* spp., and *Acianthus caudatus* R. Br.

ADDITIONAL LOCALITY

Kyeema Conservation Park, east of Willunga, 18 km south of Adelaide, South Australia. This reserve is an area of dense natural bushland, with an average annual rainfall of 800-900 mm. Dominant species are: *Eucalyptus cosmophylla* FvM., *E. fasciculosa* FvM., and *E. obliqua* L'Herit. Understorey species include *Xanthorrhoea semiplana* FvM., *Hakea rostrata* FvM., ex Meisn., *H. ulicina* R. Br., *Acacia verticillata* (L'Herit) Willd., and *A. myrtifolia* (Sm.) Willd.

TYPE SPECIMENS

Holotype and seventeen paratypes in the Polish Collection of Nematodes, Instytut Zoologii PAN, ul. Wilcza 64, Warszawa, Poland; ten paratypes in Waite Agricultural Research Institute, Glen Osmond, South Australia 5064; six paratypes in Instytut Warzywnictwa, 96-100 Skierniewice, Poland; five paratypes in Plant Research Institute, Swan Street, Burnley, Victoria 3121, Australia; one paratype in each of the following collections: Laboratorium voor Nematologie, Binnenhaven 10, Wageningen, the Netherlands; Rijksuniversiteit Gent, Instituut voor Dierkunde, Ledeganckstraat 35, Gent, Belgium; Nematology Department, Rothamsted Experimental Station, Harpenden, England; Nematology Division, University of California, Davis, California 95616, U.S.A.; Nematology Division, Indian Agricultural Research Institute, New Delhi 12, India.

DIAGNOSIS

By having retrorse annules, *H. minor* sp. n., shows some similarity to *H. taiwanensis* Pinochet & Raski, 1975, but differs in being smaller, with fewer annules, a slightly offset head and smaller stylet knobs. (*H. taiwanensis*: L = 0.59-0.61 mm; R = 146-158; Rv = 13-16; Rvan = 7-10; VL/VB = 2.0-2.3; stylet knobs 9-11 μ m across). *H. minor* sp. n., differs from *H. californianus* Pinochet & Raski, 1975 and *H. gaddi* (Loos, 1949) Chitwood & Birchfield, 1957 in having a somewhat shorter stylet, retrorse annules and labial disc not elevated. Information regarding *H. gaddi* was taken from Dasgupta, Raski and Van Gundy (1969).

REMARKS

H. minor sp. n. was also recovered from other soils: i) forest soil, under *Eucalyptus fasciculosa*, near Cape Jervis, South Australia; ii) Virgin Karri Marri Forest (*Eucalyptus diversicolor* FvM., and *E. calophylla* R. Br.), south of Manjimup, Western Australia; iii) Tasmanian rainforest, (*Eucalyptus delegatensis* R.T. Bak.), near the Hellyer river, 64 km south of Burnie, Tasmania; iv) *Eucalyptus camaldulensis* woodland, adjacent to the Murray river, in Sunraysia district of Victoria. The Tasmanian females are similar to those from Kuitpo forest. The West Australian specimens are also similar, except for a slightly longer stylet (67-69 μ m; n = 3). The Victorian females are closest to those from Kyeema.

Hemicriconemoides obtusus Colbran, 1962

(Fig. 2 & 3)

A number of specimens of *H. obtusus* were recovered from South Australian soils, from several localities. They differ in various measurements, including being longer, with a longer stylet but generally fewer body annules. However, most characteristics agree with the original description and the redescription by Dasgupta, Raski and Van Gundy (1969). Two juveniles were also recovered from a South Australian locality, one J₄ with scaly annules and the other, J₂ with a smooth cuticle. This difference between juvenile stages is similar to that described for *H. chitwoodi* Esser, 1960, by Dasgupta, Raski and Van Gundy, (1969). Soil received from Western Australia contained a few females and also four male specimens which are described, being previously unrecorded.

MEASUREMENTS

Females (from South Australia; n = 16): L = 0.61 (0.51-0.68) mm; a = 17 (15.1-19.4); b = 4.8 (3.7-5.3); c = 18.7 (15.3-24.2); stylet = 69 (63-75) μ m; VL/VB = 2.3 (1.8-2.7); V = 88 (86-89); R = 99 (92-111); Rex = 25 (22-27); Rv = 14 (13-16); Rvan = 6 (5-7); Ran = 8 (7-9); m = 80 (78-81); stylet knobs = 8.8 (7.5-9.6) μ m in diameter.

Females (from Western Australia; n = 2): L = 0.46-0.51 mm; a = 14.9-16.6; b = 4.4-4.7; c = 19-20; stylet = 62-72 μ m; VL/VB = 1.7-2.0; V = 89-91; R = 92-99; Rex = 23-25; Rv = 12-13; Rvan = 5-6; Ran = 7; m = 79; stylet knobs = 7.8-8.9 μ m in diameter.

Males (from Western Australia; n = 4): L = 0.44 (0.41-0.47) mm; a = 22 (20.7-22.8); c = 10.2 (9.7-

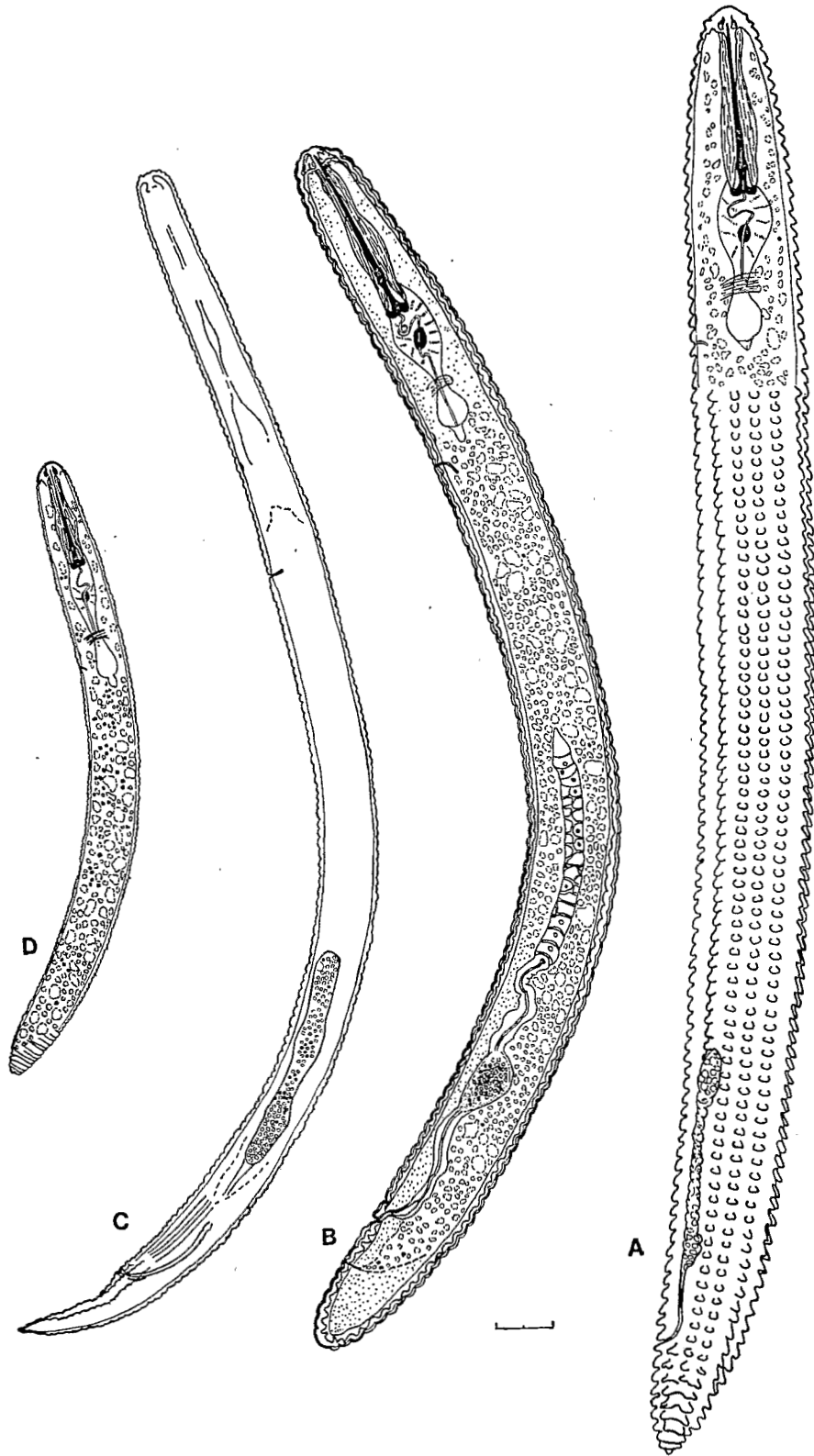


Fig. 2. *Hemicriconemoides obtusus* Colbran, 1962. In toto views. A : fourth stage juvenile ; B : female ; C : male ; D : second stage juvenile ; (Scale bar represents 20 μ m).

10.9); T = 34 (30-36); R = 186 (161-199); Rex = 54 (50-57); Ran = 18 (17-29); Tail length = 43.5 (41-48) μm .

Juvenile, st. 2 (from Myponga, South Australia; n = 1): L = 0.222 mm; a = 12.4; b = 2.9; c = 40.8; stylet = 35.7 μm ; R = 127; Rex = 40; Ran = 5.

Juvenile, st. 4 (from Myponga, South Australia) L = 0.50 mm; a = 12.5; b = 4.4; c = 31.0; stylet = 58.2 μm ; R = 110; Rex = 26; Rv = 11; Rvan = 5; Ran = 6.

DESCRIPTION

Females: The distinctive lip region is similar to that described previously (Colbran, 1962; Dasgupta, Raski & Van Gundy, 1969). Also as previously mentioned by the latter authors, the outer cuticle is thick and very close to the inner cuticle which is very thin. The annules are flattened, but may be somewhat retrorse on the post-vulval region. Conflicting comments by Dasgupta, Raski and Van Gundy (1969) and Siddiqi and Goodey (1963) can be resolved, as this appears to be an unreliable characteristic. Of the sixteen South Australian females, six show slightly retrorse annules on the post-vulval region, in one female they are only present on the tail, and the remaining nine females have post-vulval annules which are not retrorse, being similar to the rest of the body. The Western Australian females display a similar variability. Colbran described four projections across the tail terminus of the inner cuticle. Most of our specimens have one or two, occasionally three projections, but not four. Although no males have so far been recorded from South Australian soils, rounded sperm were present in the spermathecae of all but one female.

Males: Body ventrally curved when relaxed. Lip region somewhat truncate, continuous with the body and finely annulated. Seven lip annules are present which are narrower than the following body annules. Stylet absent, oesophagus reduced and degenerate. Hemizonid 4-15 annules anterior to the excretory pore. Lateral field with four lateral lines, the inner two sometimes less distinct. Spicules slightly curved, 27-35 μm long (measured along curvature). Gubernaculum curved, 5.4-6.8 μm long. Tail tapering to a bluntly rounded terminus. Caudal alae reduced, margins crenate, extending from four annules anterior to the cloaca to fourteen to sixteen annules posterior. Penial sheath 4.3-5.1 μm long. Testis packed with rounded sperm.

Juvenile, st. 2: Body smooth, slightly curved ventrally with fine annulations. Lip region smooth

and rounded, continuous with body. No lateral field visible.

Pre-adult female, juvenile st. 4: Body slightly curved ventrally, covered in scales. Scales retrorse, rounded on their edges, and arranged in twelve rows. The scales appear to be as twelve scales on each annule. Lip region similar to adult female.

LOCALITIES

The South Australian female specimens were recovered from soils of five reserves south of Adelaide and were most common at Myponga Conservation Park, an area of very low bushland with *Eucalyptus obliqua* and *E. cosmophylla* co-dominant. The low level of vegetation, only one metre high, is probably due to the extremely stony nature of the area. *H. obtusus* also occurs at: Cox's Scrub Conservation Park where *Eucalyptus cosmophylla* and *E. fasciculosa* are co-dominant; Deep Creek Conservation Park, bushland of *Eucalyptus obliqua*; and forest of *Eucalyptus Baxteri* (Benth.) Maiden & Blakely ex Black at Spring Mount Conservation Park. The Western Australian specimens (female and male) were recovered from virgin Karri forest (*Eucalyptus diversicolor*) south of Manjimup, Western Australia.

Hemicriconemoides nitidus

Raski & Pinochet, 1975

(Fig. 4A, B)

MEASUREMENTS

Females (n = 20). L = 0.43 (0.39-0.46) mm; a = 15-16; b = 4.3 (4.0-4.6); c = 20 (17-24); V = 90 (89-91); stylet = 57 (54-63) μm ; m = 83 (81-85); VL/VB = 1.9 (1.6-2.1); Rex = 27 (25-29); Rv = 11 (10-13); Rvan = 5 (4-6); Ran = 6 (5-7); R = 94 (88-99).

Males (n = 2): L = 0.34-0.39 mm; a = 17-19; b = 4.4-5.4; c = 10-13; spicules = 30-33 μm ; gubernaculum = 6 μm ; Rex = 34-49; Ran = 16-18; R = 107-181.

REMARKS

Studied specimens correspond to the description of Pinochet and Raski (1975), except for the rudimentary lateral vulval membrane seen on our specimens. The number of annules on males seems to be too variable to be used for taxonomic purposes.

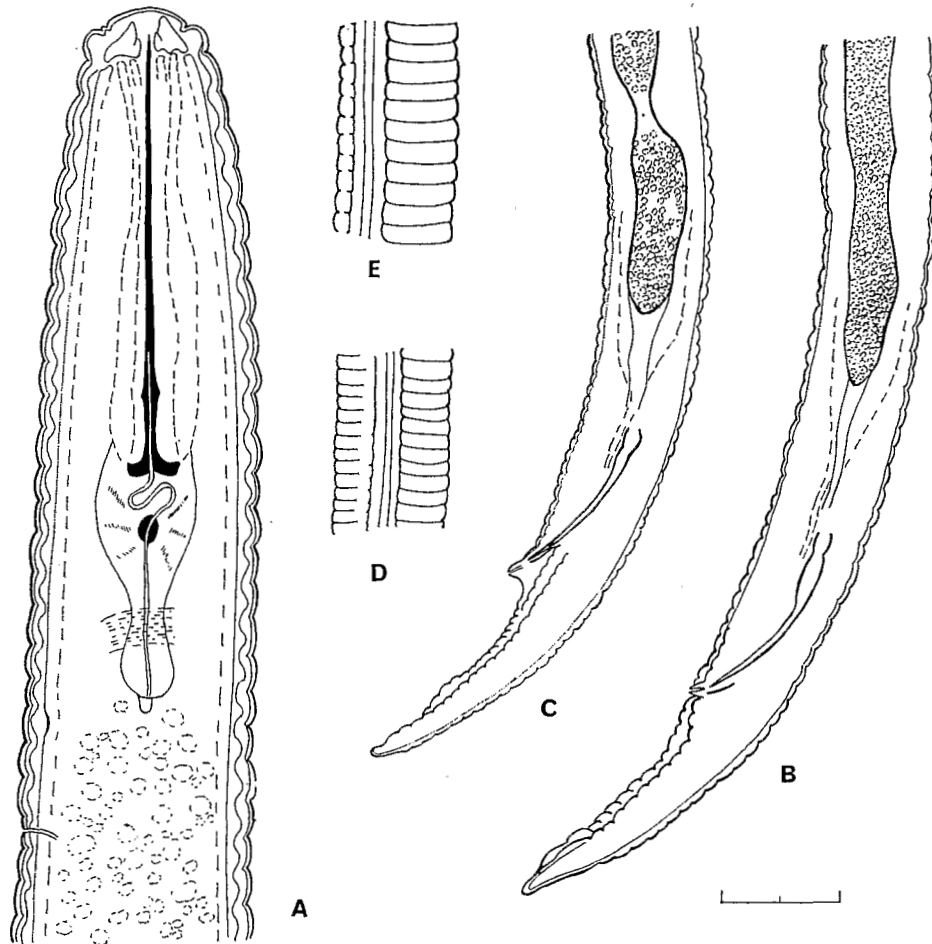


Fig. 3. *Hemicriconemoides obtusus* Colbran, 1962. A : anterior region of female ; B, C : posterior region of male ; D, E : lateral field of male ; (Scale bar represents 20 μ m).

H. nitidus was described from Minnesota, and the examined specimens were collected from an unknown locality in Indiana, U.S.A. by Dr. V.R. Ferris. This increases the known range of both variability and distribution of *H. nitidus*.

Hemicriconemoides mangiferae

Siddiqi, 1961
(Fig. 4C, D)

MEASUREMENTS

Females (n = 20) : L = 0.54 (0.46-0.63) mm ; a = 20 (17-22) ; b = 4.6 (3.6-5.9) ; c = 25 (21-31) ; V = 93 (92-94) ; stylet = 81 (74-90) μ m ; m = 89 (86-95) ; Rex = 36 (33-39) ; Rv = 12 (10-14) ; Rvan = 4 (2-6) ; Ran = 7 (6-9) ; R = 135 (127-142).

REMARKS

H. mangiferae was reported from Bowen, Queensland by Colbran in 1964, and since then from other Queensland localities, namely : Brisbane, Pialba, Pioneer, Stanley River Crossing, the Crater and Marlborough (Khair 1978). However, taxonomic studies by Dasgupta, Raski and Van Gundy (1969) Germani and Luc (1970) and Pinochet and Raski (1975) suggest the necessity for reconsideration of the distribution of this species. A population studied from New South Wales included males, with four lateral lines, and therefore it is concluded that they represent true *H. mangiferae*. Occurrence of this species in Australia confirms that it is a cosmopolitan species.

The population of *H. mangiferae* examined was collected from along the banks of the Ana Branch

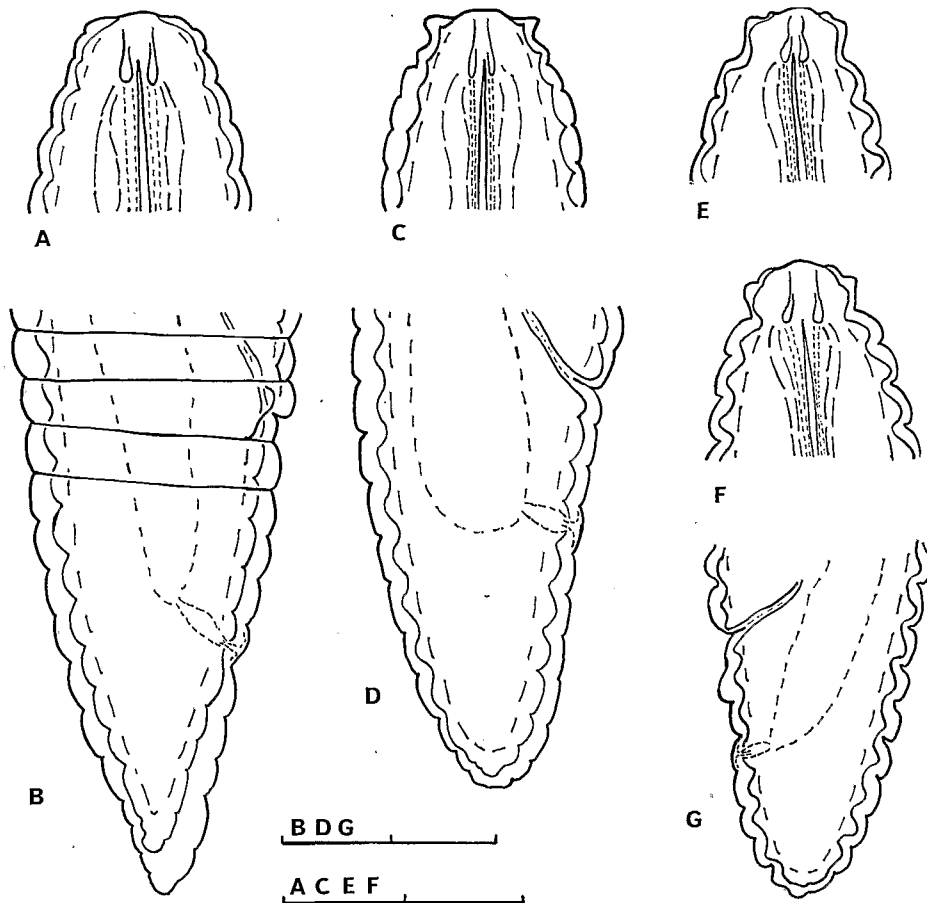


Fig. 4. *Hemicriconemoides nitidus* Raski & Pinochet, 1975, A : head and B : tail. *H. mangiferae* Siddiqi, 1961, C : head, and D : tail. *H. insignis* Dasgupta, Raski & Van Gundy, 1969, E, F : variability of lip region ; G : tail. (Scale bars represent 20 μ m).

River (Darling river system) beside the Silver City highway, about 25 km north of Wentworth, New South Wales. Vegetation in the sampling area includes *Eucalyptus camaldulensis* Denh., and *E. largiflorens* FvM., with occasional *Acacia stenophylla* A. Cunn. ex Benth.

***Hemicriconemoides insignis* Dasgupta,
Raski & Van Gundy, 1969
(Fig. 4E-G)**

MEASUREMENTS

Females (n = 14) : stylet = 73 (60-80) μ m ;
m = 90 (89-91) ; Rex = 31 (28-33) ; Rv = 9 (7-10) ; Rvan = 3-4 : Ran = 6 (4-7) ; R = 112 (99-119).

REMARKS

These specimens correspond well to those described by Dasgupta, Raski and Van Gundy (1969). The above measurements are given to report on the variability and distribution of this species.

Although *H. insignis* has only been reported from the type locality in New South Wales, it is so far, the most widely distributed species of the genus in South Australia. It was collected from five localities in South Australia, three south of Adelaide, Alligator Gorge in the lower Flinders Ranges and also Ferries-McDonald Conservation Park near Murray Bridge. Together with an additional locality at Nyngan, New South Wales, all are areas of *Eucalyptus* spp, varying from forest to mallee scrub.

The annulation in *Hemicriconemoides*

There are two characteristics of the annules of *Hemicriconemoides* described by Andrásy (1979) which do not agree with our observations. Despite a general lack of information for many species, a study of the literature shows that arrangement of the spines or scales is more variable than suggested by Andrásy (1979). Although in his definition of the subfamily Hemicriconemoidinae he stated: "Scales generally arranged in alternating rows" he also previously stated (concerning *Hemicriconemoides*) "Larvae have spines not arranged in continuous rows as in the *Ogma* group but being alternate". Fassuliotis (1962) showed that *H. chitwoodi* Esser, 1960 juveniles have spiny scales arranged in an imbricate manner. Those of *H. pseudobrachyurum* De Grisse, 1964 are described as six dentate scales on each annule, arranged as twelve rows. Juveniles of *H. mangiferae* Siddiqi, 1961 and *H. strictathecatus* Esser, 1960 are both described with twelve rows of spines. Studies of *H. cocophilus* (Loos, 1949) Chitwood & Birchfield 1957, by Germani and Luc (1970) clearly show the juveniles with ten spiny scales on each annule, arranged in ten continuous rows. They also describe *H. affinis* Germani & Luc, 1979 with apparently alternate scales, which are in rows of eleven or thirteen, in a spiral arrangement along the length of the body. Therefore we do not consider the arrangement of the juvenile scales to be a distinguishing characteristic for this genus.

Andrásy (1979) also described the annules of adult (female) *Hemicriconemoides* as "not retrorse". This does not agree with our observations, as all our specimens of *H. minor* sp. n. clearly show retrorse annules. Although most strongly developed in *H. minor* sp. n., the annules forming the outer layer of the double cuticle of *H. taiwanensis* are also retrorse, described by Pinochet and Raski (1975) as "posteriorly orientated body annulation". In addition the stylet knobs of *H. taiwanensis* are massive and rounded, without the anterior projections characteristic of most species. *H. obtusus* also does not fit well into the genus, with its distinctive lip region and unusual double cuticle. It might be suggested that these represent one or more new genera. However there are vast areas of Australia, particularly Western and Northern Australia where the endemic nematode species are unknown. Therefore we feel that until collections have been obtained from these areas, splitting of this genus into new genera would be premature.

Accepté pour publication le 8 mars 1982.

ACKNOWLEDGEMENTS

We thank Mr. D.E. Symon, Senior Lecturer and Botanist, Waite Agricultural Research Institute, University of Adelaide for identification of plant specimens. Also the South Australian section of the National Parks and Wildlife Service for permission to take soil samples in their reserves. Thanks are also due to Dr. J.W. Warcup, Waite Institute; Dr. F.D. Podger, of C.S.I.R.O., Hobart, Tasmania; and Dr. P. Christensen and Mr. A.R. Annels of the Forests Department (Manjimup) Western Australia for collection of some of the soil samples.

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