

# Australian plant nematodes : two new species of *Hemicriconemoides* Chitwood & Birchfield, 1957 with notes on *H. minor* Brzeski & Reay, 1982 and *H. gabrici* (Yeates, 1973) Raski, 1975 (Nematoda : Criconematidae)

Françoise REAY and Robert C. COLBRAN

Plant Pathology Department, Waite Agricultural Research Institute,  
University of Adelaide, Glen Osmond, South Australia 5064  
and Plant Pathology Branch, Department of Primary Industries,  
Indooroopilly, Queensland 4068, Australia.

## SUMMARY

Two new species of *Hemicriconemoides* from north Queensland are described. *H. digitatus* n. sp. is characterised by its offset lip region, truncate first annule, cylindrical tail with subdigitate terminus and juveniles without rows of scales; this species shows some resemblance to *H. mangiferae* Siddiqi, 1961 and *H. kanayaensis* Nakasono & Ichinohe, 1961. In addition to the characters already mentioned, *H. digitatus* n. sp. may be distinguished from *H. mangiferae* by the larger number of body annules, higher RV value and lower V value. *H. digitatus* n. sp. may be distinguished from *H. kanayaensis* by the second annule (narrower than the first and set off from the body annules *vs* wider and continuous with the body annules), tail shape and longer stylet. *H. coronatus* n. sp. is characterized by the crown-like lip region, and first annule disc-like, retrorse annules of the outer cuticle and hemispherical tail. *H. coronatus* n. sp. may be distinguished from *H. parvus* Dasgupta, Raski & Van Gundy, 1969 by the retrorse annules, set off second annule, rounded tail and juveniles without rows of scales. *H. coronatus* n. sp. may be distinguished from *H. minor* Brzeski & Reay, 1982 and *H. taiwanensis* Pinochet & Raski, 1975 by its disc-like first annule and hemispherical tail. New information is given for males and juveniles of *H. minor*. *H. minor* and *H. coronatus* n. sp. have retrorse annules of the outer cuticle and juveniles (J4) without scales on the annules. Annules of juveniles of *H. coronatus* n. sp. are slightly scalloped and those of *H. minor* are crenate. The taxonomic position of these species is discussed and the diagnosis of *Hemicriconemoides* amended. Additional information is also given for *H. gabrici* (Yeates, 1973) Raski, 1975.

## RÉSUMÉ

Nématodes phytoparasites d'Australie : deux nouvelles espèces du genre *Hemicriconemoides*  
Chitwood & Birchfield, 1957 et notes sur *H. minor* Brzeski & Reay, 1982 et *H. gabrici*  
(Yeates, 1973) Raski, 1975 (Nematoda : Criconematidae)

Deux nouvelles espèces du genre *Hemicriconemoides* provenant du nord du Queensland sont décrites. *H. digitatus* sp. est caractérisé par une région labiale en relief, un premier anneau tronqué, une queue cylindrique à extrémité subdigitée et des juvéniles dépourvus de rangées d'écaïlles; cette espèce ressemble à *H. mangiferae* Siddiqi, 1961 et *H. kanayaensis* Nakasono & Ichinohe, 1961. En sus des caractères mentionnés ci-dessus, *H. digitatus* n. sp. peut être séparé de *H. mangiferae* par le nombre plus grand d'anneaux, un coefficient RV plus élevé et un coefficient V plus faible; il se distingue de *H. kanayaensis* par la forme du deuxième anneau (plus étroit que le premier et en relief *vs* plus large que le premier et en continuité avec les anneaux du corps), la forme de la queue et le stylet plus long. *H. coronatus* n. sp. est caractérisé par une région labiale en forme de couronne, un premier anneau disciforme, une cuticule externe pourvue d'anneaux retrorses et une queue hémisphérique. *H. coronatus* n. sp. peut être séparé de *H. parvus* Dasgupta, Raski & Van Gundy, 1969 par ses anneaux de corps retrorses, un deuxième anneau en relief, une queue arrondie et des juvéniles dépourvus de rangées d'écaïlles. Cette espèce se distingue de *H. minor* Brzeski & Reay, 1982 et de *H. taiwanensis* Pinochet & Raski, 1975 par son premier anneau disciforme et sa queue hémisphérique. Des données nouvelles sont apportées sur les mâles et les juvéniles de *H. minor*. Cette dernière espèce et *H. coronatus* n. sp. présentent une cuticule externe avec des anneaux retrorses et des juvéniles de même stade dépourvus d'écaïlles. Les anneaux des juvéniles de *H. coronatus* n. sp. sont légèrement festonnés et ceux de *H. minor* crénelés. La position taxinomique de ces espèces est discutée et la diagnose du genre *Hemicriconemoides* amendée. Des données supplémentaires sont rapportées concernant *H. gabrici* (Yeates, 1973) Raski, 1975.

Two new species of *Hemicriconemoides* were collected independently by the authors from areas of tropical rainforest and two other localities in north Queensland. One of these species, *H. coronatus* n. sp. has retrorse annules of the outer cuticle. With *H. taiwanensis* Pinochet & Raski 1975 and *H. minor* Brzeski & Reay 1982, there are now three known species with retrorse annules of the outer cuticle. The diagnosis of the genus *Hemicriconemoides* is amended, for reasons given in the discussion.

## Methods

Nematodes were relaxed by gentle heat, then fixed with 2% formalin or F.P.4 : 1. They were processed by a method of slow evaporation of glycerol-ethanol at 40° and mounted in glycerol. Females were measured along their inner cuticle. Male spicules and penial sheath were measured along the mid-line. The ratio "a" has been omitted, as it is of little value when comparing species. Instead the body width is given, measured two to four annules posterior to the excretory pore, not at mid-body as has been customary. There appears to be some confusion as to the use of the annule value RV which was proposed by De Grisse (1964) for the "annule number from terminus, on which the vulva occurs". RV has since been used for the number of annules from the anterior end of the body to the vulva. We consider that RV should be used as first proposed by de Grisse. In this paper we are using two new symbols. RZ = number of annules of female between excretory pore and vulva. RA = number of annules of males and juveniles between excretory pore and cloaca or anus respectively.

### *Hemicriconemoides digitatus* n. sp.

(Fig. 1)

Eight populations containing adults were collected from north Queensland.

## MEASUREMENTS

*Holotype* (female) and *females* : see Table 1.

*Allotype* (male) and *males* : see Table 2.

*Juveniles, 4th stage*

(type population; n = 1) L = 0.348 mm; b = 3.6; c = 16.1; stylet = 65.7 µm; R = 168; Rex = 42; RA = 112; Ran = 14, body width = 19.6 µm; tail length = 21.7 µm.

(Palmerston pop.; n = 1) L = 0.391 mm; b = 3.5; stylet = 65.5 µm; R = 168; Rex = 41; body width = 20.4 µm.

## DESCRIPTION

*Females* (type population)

Body slightly curved when relaxed, with two closely appressed cuticles. Body annules rounded, outer cuticle annules somewhat flattened. Lip region truncate, oral disc depressed. Two subequal lip annules present, the first wider than and separated from the second by a deep constriction. Both lip annules distinctly narrower than following body annules. Stylet long, knobs directed anteriorly. Excretory pore opposite base of oesophagus, sometimes at or anterior to hemizonid, which is one to two annules long. Genital branch rather short, single, prodelphic, with oocytes in single file. Spermatheca round to oval, usually packed with sperm. Vulva not usually modified, occasionally anterior lip may be slightly overhanging. Rudimentary vulval flaps visible on some but not all specimens. Body narrower, and cylindrical posterior to vulva, tapering close to tail terminus. Tail annulated to terminus which is rounded to conoid, subdigitate.

### *Males* (type population)

Body slender, ventrally or dorsally curved when relaxed. First annule offset, expanded outwards and separated from second by a deep constriction. Body annules very fine in anterior region where they may be difficult to distinguish, becoming coarser at mid-body. Stylet absent, oesophagus reduced and degenerate. Hemizonid extending over three annules, just anterior to excretory pore which is opposite swelling of cuticle. Lateral field with four incisures, the inner pair less distinct than outer. Caudal alae reduced, crenate, extending six to fourteen annules anteriorly and fifteen to twenty four annules posteriorly. Gonad packed with rounded sperm. Spicules slightly curved, penial sheath short. Tail tapering, terminus conoid, smooth or finely annulated and may be dorsally curved.

### *Juveniles* (type population)

Body ventrally curved when relaxed. First annule truncate, narrower than second annule which is retrorse. Body annules retrorse, ornamented with rounded scales arranged in eighteen rows at level of excretory pore and twenty rows at mid-body. Rows of scales becoming irregular and the scales less distinct towards posterior region of body. Excretory pore opposite isthmus and anterior to hemizonid, which is two annules long. Tail conoid, terminus dorsally directed.

## TYPE SPECIMENS

*Holotype* (female) and *allotype* (male) in the Queensland Museum, Brisbane, Q1d, 4006, Australia. [No. 191D (s) and 191DII, respectively].

*Paratypes* : Females, males and juvenile at the Waite Agricultural Research Institute, Glen Osmond, South Australia 5064. Three females at Department of Primary Industries, Indooroopilly, Q1d 4068, Australia, two

Table 1  
Measurements of *Hemicriconemoides digitatus* n. sp. (females)

n	Female holotype	Paratypes 29	El Arish 15	Kurrimine 19	Mossman 10	Palmerston 5	Tully 5	Babinda 1	Gowrie 1
L (mm)	0.527	0.534 (0.44-0.62)	0.505 (0.44-0.54)	0.574 (0.52-0.65)	0.555 (0.48-0.59)	0.489 (0.35-0.59)	0.584 (0.57-0.62)	0.593	0.58
b	4.0	3.9 (3.4-4.7)	4.0 (3.5-4.3)	4.1 (3.7-4.5)	3.9 (3.5-4.4)	3.7 (3.2-4.1)	4.1 (3.9-4.3)	4.2	4.1
c	13.2	15.4 (13.1-19.4)	17.9 (13-27)	16.4 (14-20)	17.0 (14-19)	15 (12-19)	17.3 (16-19)	16.9	14.8
V	88.1	88.0 (86-91)	88.0 (86-89)	88.2 (86-91)	88.5 (87-89)	88 (87-89)	87.2 (84-90)	89.5	86.2
VL/VB	2.8	3.0 (2.4-3.5)	2.9 (2.5-3.5)	2.7 (1.8-3.4)	3.1 (2.8-3.5)	3.0 (2.7-3.3)	3.5 (2.7-4.3)	3.1	3.8
Styilet (µm)	90.1	87.8 (78-98)	83.4 (77-87)	97.2 (87-105)	90.8 (78-105)	87.5 (71-95)	93 (89-97)	89.5	93.9
Styilet knobs (µm)	6.8	7.0 (6.0-8.2)	6.6 (5.6-7.7)	7.6 (6.8-8.5)	6.7 (6-7.8)	7.3 (6.5-8.2)	7.3 (6.8-8.5)	7.7	7.7
R	166	169 (149-182)	157 (144-170)	170 (159-181)	169 (161-172)	163 (157-171)	165 (156-173)	175	165
Rex	40	42 (36-44)	40 (34-44)	42 (39-46)	41 (40-43)	40 (38-41)	41 (38-43)	45	43
RZ	107	108 (95-119)	98 (85-106)	107 (97-115)	107 (102-111)	103 (97-112)	102 (97-108)	111	100
RV	19	20 (15-24)	19 (16-22)	21 (17-25)	20 (18-22)	20 (18-21)	22 (19-26)	19	22
RVan	5	7 (4-9)	7.5 (6-9)	8 (7-10)	8 (7-9)	7 (6-9)	10 (7-12)	7	10
Ran	14	13 (11-16)	11 (9-14)	13 (10-17)	12 (10-14)	13 (12-15)	12 (12-14)	12	12
Tail (µm)	40.0	35.3 (23-45)	29.3 (19-37)	35.3 (29-44)	33.0 (25-40)	33.1 (23-40)	34.0 (31-39)	35.1	39.1
Body width (µm)	23.8	24.7 (21-31)	24.2 (22-26)	28.3 (25-31)	24.2 (22-27)	23.1 (19-25)	26.1 (25-27)	25.1	23.8

females at each of the following nematode collections : Commonwealth Institute of Parasitology, St. Albans, Herts, England; University of California Davis Nematode Collection, Davis, Calif. USA; Muséum National d'Histoire naturelle, Laboratoire des Vers, Paris, France.

#### TYPE HABITAT AND LOCALITY

Collected by B. J. and F. Reay in May 1982 in Bellenden Ker National Park, south of Cairns, Queensland. This locality is alongside a river, in tropical rainforest.

#### DIAGNOSIS AND RELATIONSHIPS

*H. digitatus* n. sp. shows resemblance to *H. mangiferae* Siddiqi, 1961. *H. digitatus* n. sp. may be distinguished by the lip annules which are distinctly offset from the body, the disc-like first annule and shorter second annule. Although the tail shape of *H. mangiferae* is very variable (pointed to conoid), *H. digitatus* n. sp. may be distinguished by its cylindrical tail shape and subdigitate terminus. *H. digitatus* n. sp. also differs in some measurements; with more body annules (*H. mangiferae* : R = 127-148); higher RV value (*H. mangiferae* : RV = 10-14); and lower V %

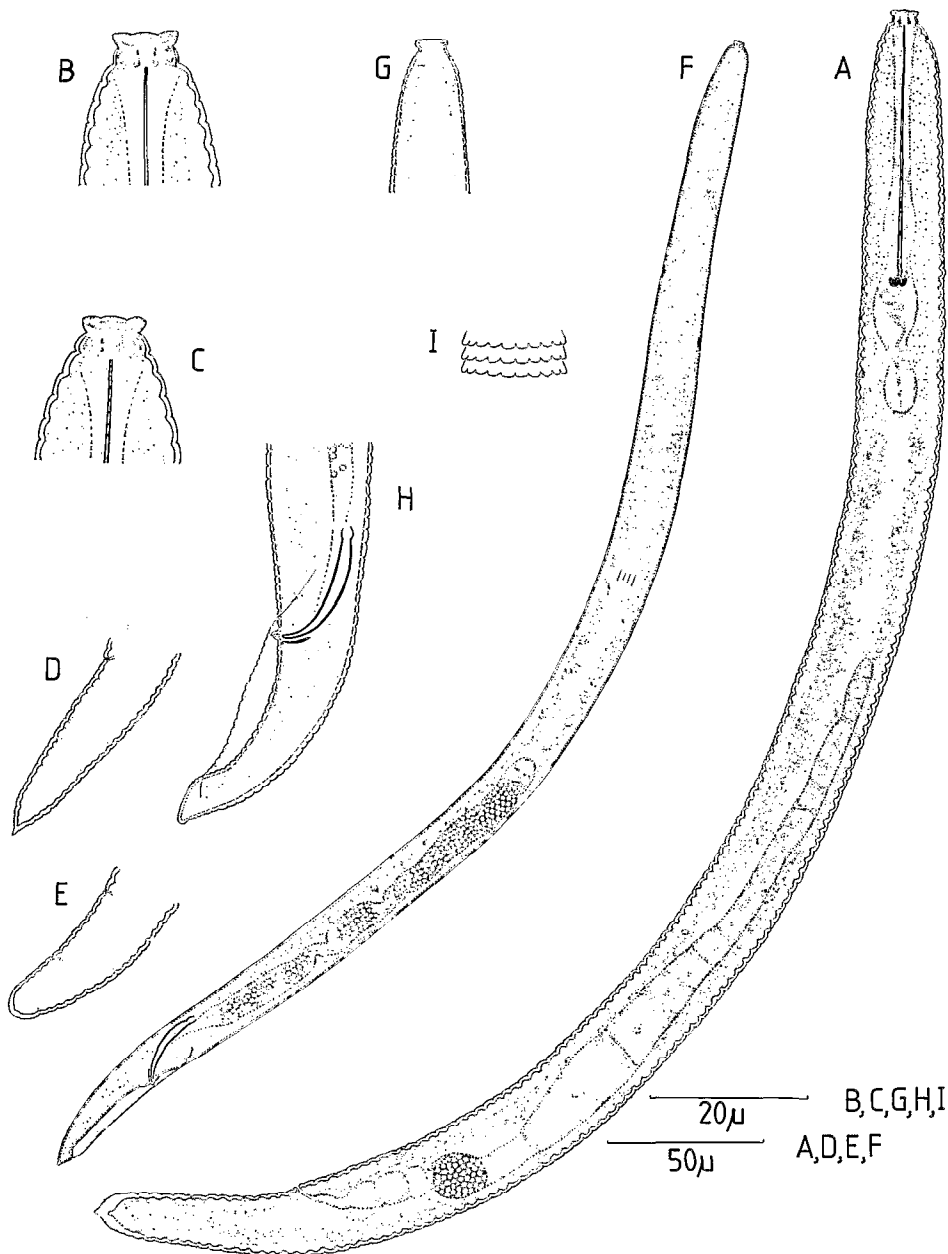


Fig. 1. *H. digitatus* n. sp. Female. A : " in toto "; B, C : head region; D, E : atypical tails. Male. F : " in toto "; G : head region; H : tail. Juvenile (J4). I : scales on cuticle.

(*H. mangiferae* : V % = 91-94). *H. digitatus* n. sp. also shows some resemblance to *H. kanayaensis* Nakasono & Ichinohe, 1961. It may be distinguished from the latter by the second annule which is narrower than the first and set off from the following body annules. In

*H. kanayaensis* the second annule is continuous with the body annules, and also wider than the first annule. *H. digitatus* n. sp. also differs from *H. kanayaensis* in the subdigitate tail terminus, and longer stylet (78-98 vs 66-78 µm).

Table 2

Measurements of *Hemicriconemoides digitatus* n. sp. (males)

n	Male (allotype)	Paratypes 4	Mossman 1	El Arish 1
L (mm)	0.476	0.407 (0.37-0.45)	0.517	0.484
c	15.1	12.6 (11.7-14)	14.4	14.4
T	36	30.1 (28-36)	33.4	34.7
R	310	271 (226-328)	247	304
Rex	80	71 (62-85)	—	76
RA	204	177 (145-214)	—	203
Ran	26	24 (18-29)	25	25
Tail ( $\mu$ m)	31.6	32.2 (30-35)	35.9	33.6
Spicules ( $\mu$ m)	28.1	24.1 (21-27)	29.8	33.2
Gubernaculum ( $\mu$ m)	3.8	4.8 (3.6-5.1)	5.1	4.1
Penial sheath ( $\mu$ m)	3.4	2.5 (2.1-3.1)	2.1	2.6
Body width ( $\mu$ m)	14.5	13.8 (13.2-14.3)	14.7	14.5

## OTHER POPULATIONS

*Localities*

*El Arish* : Collected from tropical rainforest (CSIRO 1 - Queensland Department of Forestry [QDF]) at El Arish, south of Innisfail, Queensland, in October 1978.

*Kurrimine* : Collected from tropical rainforest (CSIRO 55 QDF) from Kurrimine National Park, 8 km from Kurrimine, south of Innisfail, Queensland, in October 1978.

*Mossman* : Collected by FR from two localities in tropical rainforest, at Mossman River National Park, north-west of Mossman, Queensland in May 1982.

*Palmerston* : Collected by FR from tropical rainforest in Palmerston National Park, west of Innisfail, Queensland in May 1982.

*Tully* : Collected from cleared vine forest, dominated by *Acacia cincinnata* F. Muell., *A. mangium* Willd.,

and *Eucalyptus pellita* F. Muell., since planted with *Pinus caribaea* Mor., (CSIRO 150 - QDF) 2 km from Tully, south of Innisfail, Queensland in October 1978.

*Babinda* : Collected from logged tropical rainforest (SF 310 - QDF, Gold Field), 145° 48' E, 17° 18' S, 14 km from Babinda, north of Innisfail, Queensland, in September 1977.

*Gowrie Creek* : Collected from tropical rainforest at Gowrie Creek, 10-12 km from Abergowrie, north-west of Ingham, Queensland, in September 1976.

*Morphometric data*

Females from other localities are similar in many respects to the type population. There is some variation in stylet length (Tab. 1), except for El Arish, other populations have longer stylets. In 30 % of specimens from El Arish, the digitate tail terminus is either absent or poorly developed. Where it is absent, the tail terminus is rather unevenly rounded.

A single male from Mossman is longer than type specimens, but similar in other respects.

A 4th stage juvenile was collected from Palmerston. The body is C-shaped when relaxed and covered in rows of rounded scales. There appear to be eighteen rows at the level of the excretory pore and twenty at mid-body. The first head annule is truncate, narrower than the second which is retrorse and similar to the body annules which are also retrorse. Anus obscure, tail conoid, dorsally curved.

*Hemicriconemoides coronatus* n. sp.

(Figs 2, 3)

Five populations of another new species of *Hemicriconemoides* were collected from north Queensland.

## MEASUREMENTS

*Holotype* (female) and *females* : see Table 3.

*Juveniles* : see Table 4.

## DESCRIPTION

*Females* (type population)

Body short, plump, forming an open C when relaxed. Outer cuticle attached closely to body in oesophageal and post-vulval regions, slightly separated on ventral side of remainder of body. Annules of outer cuticle somewhat flattened, retrorse, no lateral field visible, anastomoses present on some specimens. Body annules

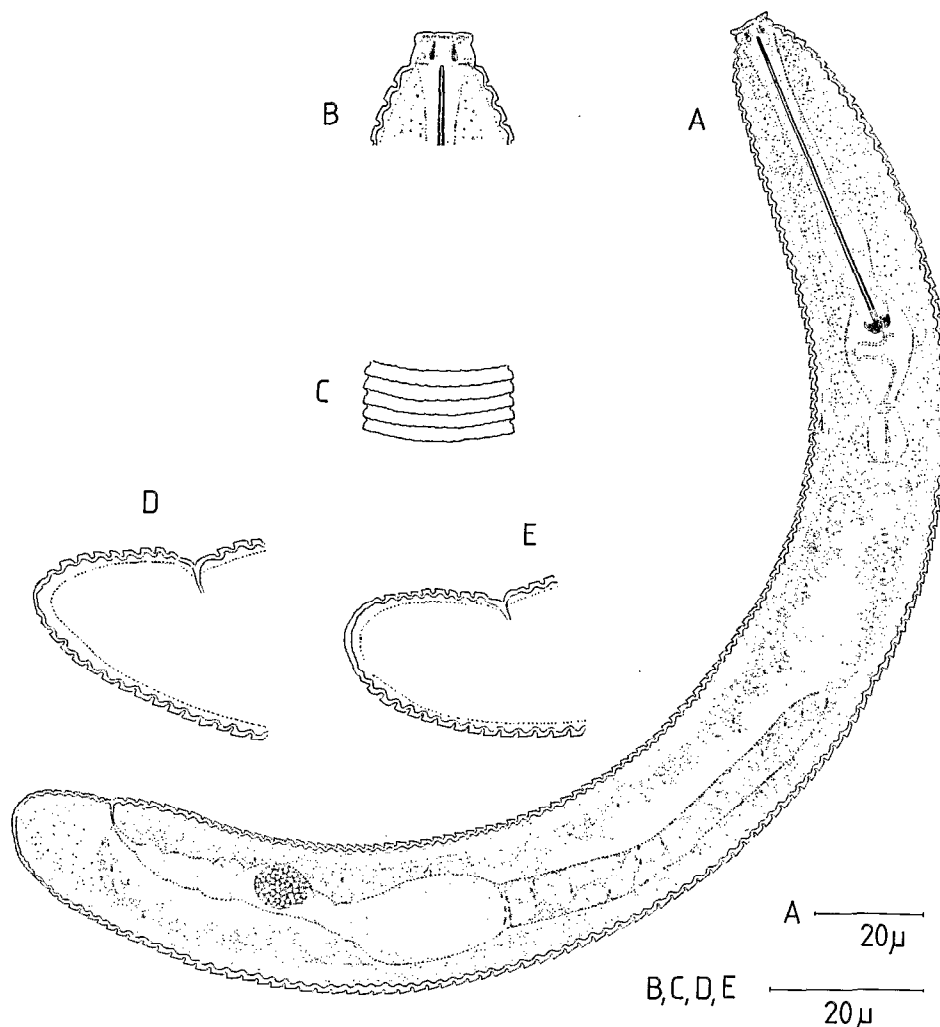


Fig. 2. *H. coronatus* n. sp. Female. A : " in toto "; B : head region; D, E : tails. Juvenile (J4). C : ornamentation of annules.

directed outwards on the ventral surface, retrorse on dorsal surface. Lip region crown-like, with two annules, the first more prominent and wider than the second. The first annule is disc-like, with two dorsal and two ventral lobes, each pair separated by an indentation. The second annule is directed outwards, offset from the body annules. Labial disc small, not protruding beyond margin of anterior labial annule. Stylet slender, knobs usually anchor shaped. Hemizonid two annules long, often obscure. Excretory pore close to hemizonid, sometimes opening at or anterior to the hemizonid. Vulva marked by a slight body depression, usually without vulval flaps — in a few specimens rudimentary flaps are visible. Vulval lips often rather broad in lateral view, the anterior lip may be somewhat bulbous or slightly

projecting. Spermatheca oval to round, usually packed with sperm. Body may be slightly depressed at anus, which is situated on the annule following the vulva, sometimes on the posterior vulva lip. In 5 % of specimens, the post-vulval region is longer and the anus is two to four annules posterior to the vulva. Tail usually hemispherical, sometimes broadly conoid, annulated to terminus.

*Males Unknown.*

*Juveniles (type population)*

Juveniles somewhat similar to adult females. First annule similar to adult females, second annule retrorse

in most specimens. Body annules also retrorse, without ornamentations in J2 and J3. The posterior edges of the annules of J4 are slightly scalloped in all but one specimen, but without rows of scales. The scalloping is often indistinct and more readily visible on the posterior region of the body. Tail conoid.

TYPE SPECIMENS

*Holotype* : Female [Slide No. 191E(0)] in the Queensland Museum, Brisbane, Qld, 4006, Australia.

*Paratypes* : Females and juveniles at Waite Agricultural Research Institute, Glen Osmond, South

Australia, 5064. Five females and two juveniles at Department of Primary Industries, Indooroopilly, Qld, 4068, Australia. Five females at each of the following nematode collections : Commonwealth Institute of Parasitology, St. Albans, Herts, England; University of California, Davis Nematode Collection, Davis, California, USA; Muséum National d'Histoire naturelle, Laboratoire des Vers, Paris, France.

TYPE HABITAT AND LOCALITY

Collected by B. J. and F. Reay in May 1982, from tropical rainforest in Bellenden Ker National Park, south of Cairns, Queensland.

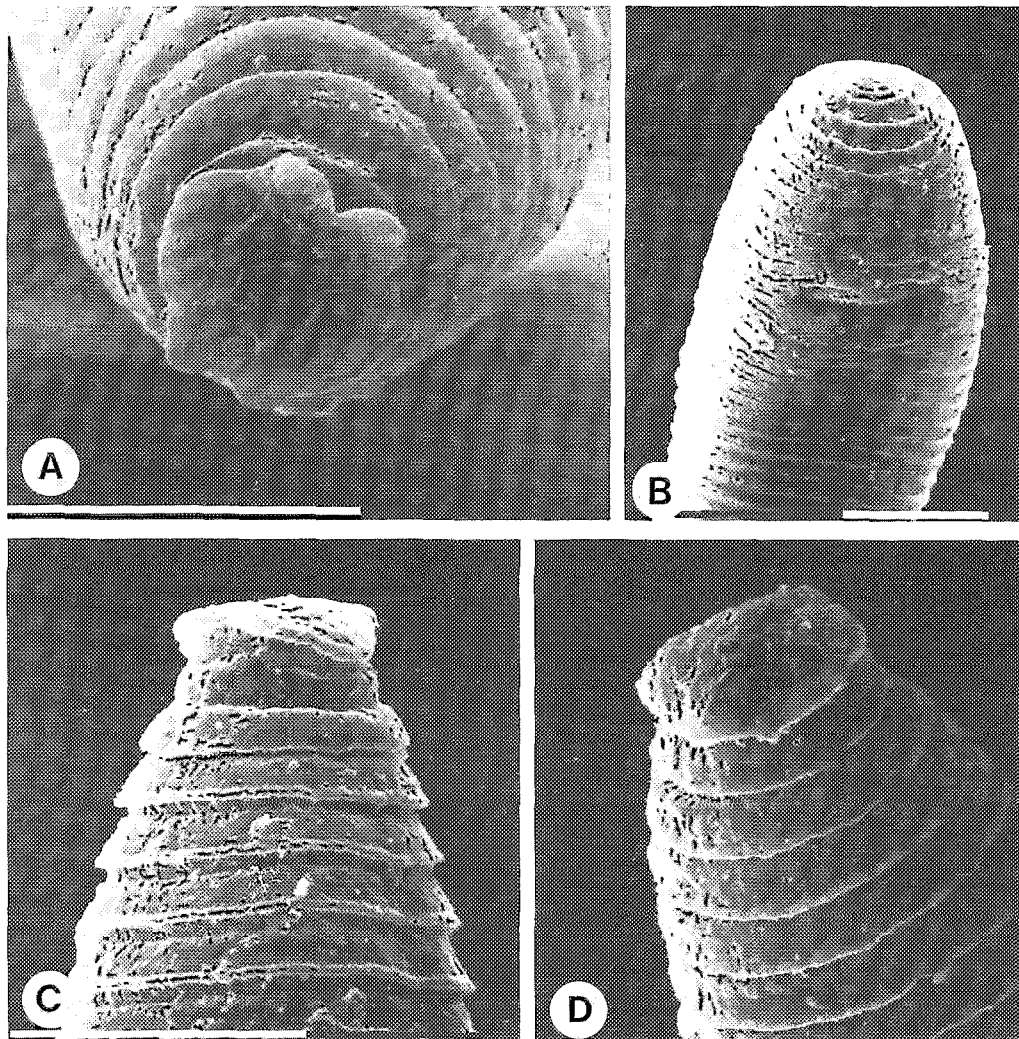


Fig. 3. *H. coronatus* n. sp. SEM studies. Female. A : "en face"; B : posterior region showing vulva and tail; C, D : views of anterior region (Bar scales represent 10  $\mu$ m).

Table 3  
Measurements of *Hemicriconemoides coronatus* n. sp. (females)

<i>n</i>	Female (holotype)	Paratypes 143	Palmerston 20	Mossman (site 194) 25	Mossman (sites 195-197) 17	Bundaberg 6
L (mm)	0.312	0.309 (0.25-0.34)	0.310 (0.25-0.35)	0.321 (0.29-0.37)	0.313 (0.29-0.36)	0.309 (0.28-0.33)
b	3.1	3.0 (2.5-4.0)	3.1 (2.9-3.4)	3.1 (2.6-3.6)	2.8 (2.6-3.2)	3.1 (2.8-3.4)
c	23.7	19.9 (15-28)	20.2 (18-25)	17.1 (14-20)	17.6 (15-21)	19.6 (17-22)
V	94	93.0 (91-94)	93.3 (92-95)	92.4 (91-94)	93.0 (92-94)	92.8 (92-94)
VL/VB	0.8	0.9 (0.7-1.2)	0.9 (0.7-1.0)	1.1 (0.9-1.3)	1.1 (0.9-1.3)	0.9 (0.8-1.0)
Stylet (µm)	68.9	67.3 (59-74)	66.9 (63-70)	67.0 (63-80)	73.9 (68-78)	68.2 (66-72)
Stylet knobs (µm)	6.0	6.2 (4.7-7.3)	6.3 (5.8-7.3)	6.4 (4.7-7.0)	6.3 (4.9-7.6)	6.7 (6-7.5)
R	125	124 (112-135)	119 (113-126)	122 (111-136)	142 (125-152)	119 (114-126)
Rex	35	34 (30-40)	34 (32-37)	35 (32-39)	39 (34-43)	34 (32-38)
RZ	81	78 (70-91)	75 (71-80)	77 (68-86)	92 (80-100)	74 (70-78)
RV	9	10 (8-13)	10 (8-11)	11 (9-12)	11 (9-12)	10 (9-11)
RVan	0	0 (0-4)	0 (0-1)	0 (0-1)	0 (0-1)	1 (0-1)
Ran	9	10 (8-12)	10 (8-11)	11 (9-12)	11 (9-12)	9 (8-11)
Tail (µm)	13.2	15.8 (10-23)	15.6 (12-18)	19.0 (15-24)	17.9 (14-21)	16.0 (14-19)
Body width (µm)	25.8	26.0 (23-31)	26.4 (23-29)	26.5 (20-35)	24.1 (22-27)	27.3 (24-32)

## DIAGNOSIS AND RELATIONSHIPS

*Hemicriconemoides coronatus* n. sp. is distinguished by its crown-like lip region, retrorse annules of the outer cuticle and hemispherical tail. Two other species, *H. minor* Brzeski & Reay, 1982 and *H. taiwanensis* Pinochet & Raski, 1975 also have retrorse annules of the outer cuticle. The lip region of *H. minor* is not offset and crown like, and the tail is not hemispherical. In *H. taiwanensis* the first annule is narrower than the second, the stylet knobs are large and rounded and the tail terminus is pointed. *H. parvus* Dasgupta, Raski &

Van Gundy, 1969 does not have retrorse annules, the second annule is less clearly offset from the body annules, and the tail is conoid.

## OTHER POPULATIONS

*Localities*

*Palmerston*: Collected by FR from tropical rainforest in Palmerston National Park, west of Innisfail, Queensland in May 1982.



Table 4  
Measurements of *Hemicriconemoides coronatus* n. sp. (juveniles)

	J4			J3			J2
	Type pop. 19	Mossman site 194 5	Mossman site 196-197 3	Type pop. 2	Mossman (site 194) 5	Mossman (site 196-197) 1	Type pop. 1
L (mm)	0.219 (0.19-0.25)	0.255 (0.22-0.28)	0.206 (0.19-0.22)	0.136-0.159	0.174 (0.16-0.19)	0.183	0.173
b	2.7 (2.3-3.0)	3.0 (2.8-3.3)	2.6 (2.5-2.7)	2.1-2.2	2.4 (2.3-2.4)	2.3	2.4
c	15.1 (12.3-17.9)	20.3 (20.1-20.5)	12-14		17.4 (14.-22)		15.7
Stylet (µm)	51.0 (43-57)	49.6 (47-53)	47.4 (45-50)	37.6-40.8	42.1 (39-46)	40.2	—
R	140 (118-150)	160 (146-169)	129 (124-136)	146-148	161 (155-171)	162	162
Rex	43 (37-48)	47 (45-48)	39 (37-42)	47-48	52 (50-57)	48	44
RA	87 (73-98)	105 (100-110)	78-80		100 (99-101)		106
Ran	12 (8-14)	11.5 (11-12)	12-14		11 (9-13)		12
Tail (µm)	14.8 (11.7-18.5)	12.4 (11.9-12.8)	15-18		9.1 (7.8-10.2)		11

*Mossman* : Collected by FR from four localities in tropical rainforest, at Mossman River National Park, north-west of Mossman, Queensland in May 1982.

*Bundaberg* : Collected by FR from sandy soil at Elliott River Forest (QDF) south-west of Bundaberg, Queensland in May 1982. This is an area of wallum, co-dominant plants include *Melaleuca quinquenervia* (Car.) S. T. Blake, *Banksia oblongifolia* Cav., and *B. aemula* R. Br with occasional *Eucalyptus umbra* R. T. Baker and *Xanthorrhoea* sp. This is the only record of this species outside rainforest.

*Other records* : This species has also been collected from tropical rainforest at : The Crater (12 km south of Atherton); Garrawalt; Eungella; and Cathin, in Queensland.

#### Morphometric data

Females of these populations are generally similar to the type population. Females from three of four sites (195-197) at Mossman have more body annules, with

somewhat higher values for Rex and RZ. These females also include some specimens with rounded rather than anchor-shaped stylet knobs. All females have the anus on the first annule after the vulva or on the posterior vulval lip.

Juveniles were not collected from Palmerston, Bundaberg or Mossman site 195. J2 were not collected outside the type locality.

Juveniles generally similar to those from the type locality. There is some variation in measurements (Tab. 4). One J4 of live studied has plain annules, not scalloped as in other specimens.

#### *Hemicriconemoides minor*

Brzeski & Reay, 1982

(Fig. 4)

Since *Hemicriconemoides minor* was first described, additional specimens have been obtained from central Victoria. One population includes males and juveniles, not previously recorded, which are described here.

MEASUREMENTS

*Females* (n = 8) : L = 0.39 (0.34-0.42) mm; b = 3.1 (2.8-3.4); c = 21.7 (19-25); stylet = 67.3 (63-71)  $\mu$ m; V = 91.3 (91-92);  $\frac{VL}{VB}$  = 1.4 (1.3-1.5); R = 125 (120-132); Rex = 37 (35-39); RZ = 77 (73-82); RV = 12-13; RVan = 3-4; Ran = 9-10; tail = 18.2 (13-22)  $\mu$ m; body width = 23.5 (19-26)  $\mu$ m.

*Female in J4 cuticle* (n = 1) : L = 0.29 mm; b = 2.8; c = 26.3; stylet = 60.7  $\mu$ m; V = 93.4;  $\frac{VL}{VB}$  = 1.4; R = 118; Rex = 36; RZ = 70; RV = 12; RVan = 4; Ran = 8; tail = 11.1  $\mu$ m; body width = 19.1  $\mu$ m.

*Males* (n = 10) : L = 0.32 (0.28-0.36) mm; c = 17.7 (14-21); T = 33 (25-45); R = 242 (228-256); Rex = 75 (71-80); RA = 153 (142-158); Ran = 14 (12-16); tail = 18.3 (15-20)  $\mu$ m; spicules = 21.7 (19-24)  $\mu$ m; gubernaculum = 4.5 (3.6-5.1)  $\mu$ m; penial sheath 2.8 (2.4-3.4)  $\mu$ m.

*Male in J4 cuticle* (n = 1) : L = 0.33 mm; c = 17.5; T = 39.1; R = 239; Rex = 76; RA = 147; Ran = 16; tail = 18.7  $\mu$ m; spicules 22.5  $\mu$ m; gubernaculum = 3.8  $\mu$ m. (J4) : stylet cone = 42.1  $\mu$ m; R = 126; Rex 42; RA = 74; Ran = 10.

*Juveniles 4th stage* (n = 13) : L = 0.25 (0.22-0.28) mm; b = 2.6 (2.5-2.9); c = 21.4 (15-27); stylet = 51.2 (47-55)  $\mu$ m; R = 128 (125-134); Rex = 40 (37-41); RA = 79 (76-83); Ran = 10 (8-12); tail = 12.3 (9-17)  $\mu$ m.

*Juvenile, 3rd stage* (n = 7) : L = 0.198 (0.16-0.21) mm; b = 2.4 (2.0-2.6); c = 18.0 (15-21); stylet = 46.0 (42-48)  $\mu$ m; R = 130 (125-136); Rex = 41 (39-44); RA = 79 (75-84); Ran = 10 (9-12); tail = 10.9 (9-13)  $\mu$ m.

DESCRIPTION

*Females*

Specimens generally similar to type population from Kyeema. Outer cuticle annules retrorse as first described. Body annules directed outwards at mid-body, rather than retrorse as in type specimens. Body annules at anterior and posterior regions moderately retrorse.

*Female in J4 cuticle*

A female was recovered still within the J4 cuticle. The posterior margins of the annules of the J4 cuticle are finely crenate.

*Males*

Body may be straight, ventrally or dorsally curved, when relaxed. Cuticle finely annulated, annules very fine in anterior region, becoming coarser towards mid-body.

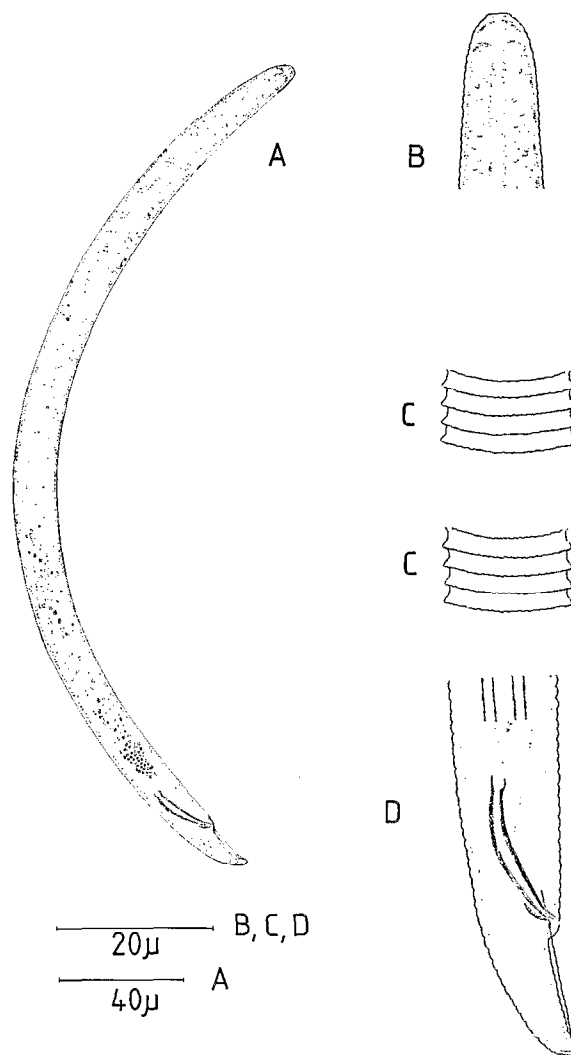


Fig. 4. *H. minor*. Male. A : " in toto " ; B : head region ; D : tail. Juvenile (J4); C : crenate margins of annules.

Lip region domed, rounded, indistinctly annulated and slightly offset. Hemizonid two to three annules long, opposite slight bulge in cuticle. Excretory pore often obscure, two to four annules posterior to hemizonid. Spicules arcuate, gubernaculum slightly curved. Penial sheath short. Caudal alae reduced, extending two to four annules anterior to cloaca and posteriorly to tail terminus. Tail ventrally curved, conoid, annulated to rounded terminus. Lateral lines often indistinct, usually four visible, the outer pair slightly crenate, the inner often obscure.

*Male in J4 cuticle*

Body slightly ventrally curved, similar to mature

males. J4 stylet cone present between male and juvenile cuticles. J4 cuticle annules with crenate margins. Penial sheath not visible, spicules contained within male body.

#### *Juvenile, 4th stage*

Juveniles C-shaped when relaxed. Annules at first retrorse, soon directed outwards for much of body length, becoming somewhat retrorse on tail. Posterior margins of annules crenate, varying from moderately coarse and irregular crenations, to fine, regular crenations. The rows of scales usual for J4 of this genus are not present. Lip region domed, lip annules not offset, but continuous with body. Hemizonid two annules long, excretory pore opening at or close to hemizonid. Tail conoid, often dorsally curved at terminus.

#### *Juveniles, 3rd stage*

Juveniles similar to J4. Posterior edge of annules varying from smooth to coarsely crenate. Of seven specimens studied, the three smallest specimens have smooth annules except for slight irregularity on the tail. The other four specimens have annules with crenate posterior margins and show variation similar to that of J4 juveniles.

#### LOCALITY

Collected by Dr. J. H. Warcup in 1982 from slopes of Mt. William, the Grampians, Victoria. Dominant vegetation is *Eucalyptus obliqua* L'Herit with a thick understory of *Acacia* spp.

### ***Hemicriconemoides gabrici***

(Yeates, 1973) Raski, 1975

This species was originally described as *Paratylenchus gabrici* Yeates, 1973. Eight female specimens (from the type locality) held in the Queensland Department of Primary Industries nematode collection were available for study. Additional measurements and description are included here.

#### MEASUREMENTS

Females (paratypes; n = 8) : L = 0.50 (0.44-0.55) mm; stylet = 71.6 (67-74)  $\mu$ m; V = 87.5 (86-89);  $\frac{VL}{VB}$  = 2.8 (2.2-3.7); R = 154 (148-157); Rex = 37.5 (36-39); RZ = 96 (93-102); RV = 21 (19-23); RVan = 5-6; Ran 15 (14-17); tail = 44.1 (35-51)  $\mu$ m.

#### DESCRIPTION

##### *Females*

Outer cuticle moderately close fitting. Body annules rounded, outer cuticle annules flattened. Lip region

domed, usually two, sometimes three annules. Oral disc more or less truncate, slightly elevated. First annule usually longer, but narrower than second. Hemizonid two to three annules anterior to excretory pore. Vulval flaps rudimentary, not visible in all specimens. First post-vulval annule usually flattened. Tail tapering to knob-like or pointed terminus.

This species is characterised by its domed lip region and long tapering tail with pointed terminus.

#### Discussion

There are three described species of *Hemicriconemoides* (*H. taiwanensis*, *H. minor*, *H. coronatus* n. sp.) with retrorse annules of the outer cuticle. Although *H. minor* was first described with retrorse annules of both cuticles, females from Victoria have body annules which are directed outwards between the excretory pore and vulva. In the other two species only the outer cuticle annules are retrorse. Juveniles were collected with females of *H. coronatus* n. sp. and the 4th stage juveniles were found to have annules which are slightly scalloped instead of scaled as in other known juveniles of *Hemicriconemoides*. This led to the study of juveniles of *H. minor* from Victoria. These have crenate margins of the annules. The juveniles of *H. taiwanensis* are unknown. As discussed by Brzeski and Reay (1982) there are several aberrant species of *Hemicriconemoides* which might be considered worthy of separation into a new genus. The only character held in common by females of the three species mentioned here is the retrorse annulation of the outer cuticle. In other respects they are quite dissimilar, differing in the shape of the lip region, stylet knobs and post-vulval region. The juveniles of one species are unknown and differ in the other two.

Concerning *H. coronatus* n. sp., two well known taxonomists have independently made the comment that "this species resembles a *Discocriconemella* with a double cuticle of aberrant cuticular character". In view of these comments, SEM studies were made of *H. coronatus* n. sp. The lip region does resemble *Discocriconemella* s.l. and shows a strong similarity in shape to a study of *Acrozostron caudaventer* (Orton Williams, 1979) Orton Williams, 1981, but without the large, conspicuous amphid apertures. We do not feel that this species should be placed in *Discocriconemella* s.l., as it would introduce an additional character to the group, which is not normally present, as well as creating confusion amongst non-taxonomists.

There are a number of species of *Hemicriconemoides* which are atypical of the genus, several of these from Australia. We recognise that the three species mentioned here sit uneasily in *Hemicriconemoides*. Because of their dissimilarity they would not fit well into one genus and we do not consider that nematology would be well served

by the erection of several new monotypic genera. The plant nematodes associated with native vegetation are still virtually unknown in many areas of Australia. It is to be hoped that future collections will uncover other species and lead to a better understanding of this group of nematodes. Thus the diagnosis of *Hemicriconemoides* has been emended.

**Genus *Hemicriconemoides***  
Chitwood & Birchfield, 1957

DIAGNOSIS (emend.) : *Females* straight or ventrally curved, with two cuticles. Annules of inner cuticle usually rounded, rarely retrorse (*H. minor*). Outer cuticle annules usually flattened or somewhat rounded, sometimes retrorse (*H. taiwanensis*, *H. minor*, *H. coronatus*). Lip annules usually two, sometimes one or three, offset or continuous with body annules. Stylet usually with anchor-shaped basal knobs, rarely rounded (*H. taiwanensis*) but not posteriorly sloping. Vulva with or without vulval flaps. Tail variable, often conoid but may be pointed or hemispherical. *Juveniles* (J4) Annules usually ornamented with scales, variously arranged, rarely scalloped (*H. coronatus*) or crenate (*H. minor*).

ACKNOWLEDGEMENTS

Sincere thanks to Ms Kate Couper for preparing the drawings. We also wish to thank Brian Reay, and Dr. J. H. Warcup of the Waite Institute for collection of soil samples; also officers of the Queensland Department of Forestry for supplying soil samples from their *Phytophthora* survey (including those collected for them by CSIRO officers). Thanks are also due to Dr. K. Nakasono of Kyushu National Agricultural Experimental Station, Japan, for specimens of *H. kanayaensis*. We are grateful to the Queensland National Parks and Wildlife Service and the Queensland Department

*Accepté pour publication le 17 février 1986.*

of Forestry for their co-operation with soil sampling in their reserves. Plant specimens were identified by Dr. R. W. Johnson and L. Pedley, Queensland Herbarium, Indooroopilly, Queensland. SEM studies were prepared by D. Gowanlock, Department of Primary Industries, Indooroopilly. This work was partially funded by two grants from the Bureau of Flora and Fauna (Australian Biological Resources Study).

REFERENCES

- BRZESKI, M. W. & REAY, F. (1982). *Hemicriconemoides minor* sp. n. with observations on four other species of the genus. (Nematoda : Criconematidae). *Revue Nématol.*, 5 : 327-334.
- DASGUPTA, D. R., RASKI, D. J. & VAN GUNDY, S. D. (1969). Revision of the genus *Hemicriconemoides* Chitwood & Birchfield, 1957 (Nematoda : Criconematidae). *J. Nematol.*, 1 : 126-145.
- DE GRISSE, A. (1964). Morphological observations on *Criconemoides*, with a description of four new species found in Belgium. (Nematoda). *Meded. Landbouwhogeschool OpzoekingsStns Gent*, 29 : 734-761.
- NAKASONO, K. & ICHINOHE, M. (1961). *Hemicriconemoides kanayaensis* n. sp. associated with tea root in Japan (Nematoda : Criconematidae). *Jap. J. appl. Ent. & Zool.*, 5 : 273-276.
- ORTON WILLIAMS, K. J. (1981). Revision of the genus *Discocriconemella* de Grisse & Loof, 1965 (Nematoda : Criconematoidea). *Syst. Parasitol.*, 2 : 133-138.
- PINOCHE, J. & RASKI, D. J. (1975). Four new species of the genus *Hemicriconemoides* (Nematoda : Criconematidae). *J. Nematol.*, 7 : 263-270.
- RASKI, D. J. (1975). Revision of the genus *Paratylenchus* Micolczky, 1922 and descriptions of new species. Part I of 3 parts. *J. Nematol.*, 7 : 15-34.
- YEATES, G. W. (1973). Taxonomy of some soil nematodes from the New Hebrides. *N.Z.J. Sci.*, 15 : 673-697.