Brazilian *Peltamigratus* Sher, 1964 (Nematoda : Hoplolaimidae), with descriptions of six new species [1]

Cláudio BITTENCOURT* and Chaw Shung HUANG

Laboratório de Fitopatologia, Dept. de Biologia Vegetal, Universidade de Brasília, DF 70910, Brasil.

SUMMARY

Peltamigratus christiei (Golden & Taylor, 1956) Sher, 1964, *P. holdemani* Sher, 1964, *P. ibiboca* Monteiro & Choudhury, 1978, *P. nigeriensis* Sher, 1964 and six new species of the genus were found in the 1 100 soil samples collected from diverse localities of Brazil between 1975 and 1981. *P. areolatus* sp. n. is characterized by L = 0.67 ± 0.04 mm, stylet = 26 ± 0.59 µm, V = 57.8 ± 1.18, without epiptygma, lateral fields areolated in the esophageal and phasmid regions, and hemispherical tail terminus with annules separated by deep cuticular striae. *P. levicaudatus* sp. n. females and males are respectively 0.77 ± 0.04 mm and 0.68 ± 0.03 mm long, stylet = 30.8 ± 0.7 µm, V = 56.2 ± 1.8 with double, well developed epiptygma, lateral fields not arcolated and the conical tail terminal carries markedly thickened cuticle. *P. amazonensis* sp. n. is about 0.66 ± 0.05 mm long for both sexes, stylet = 27.8 ± 1.3 µm, lip region annulated and off set, V = 54.3 ± 1.8 without epiptygma and the conical tail carries distal annules significantly wider than the other tail annules. *P. cerradoensis* sp. n. measures 0.86 ± 0.04 mm (female) and 0.79 ± 0.02 mm (male) long, stylet = 31.6 ± 0.6 µm, V = 57.7 ± 1.2 with double, well developed epiptygma, lateral fields with two incisures, female tail conical with distal annules wider than the other tail annules. *P. raskii* sp. n. has hemispherical, smooth, continuous lip region; L = 0.78 ± 0.04 mm, stylet = 30.4 ± 0.7 µm, V = 56.3 ± 1.0 with simple, poorly developed epiptygma, lateral fields with two incisures, and the conical tail with distal annules wider than the other body annules. *P. paraensis* sp. n. females are 0.94 ± 0.07 mm and the males 0.86 ± 0.06 mm long, stylet = 29 ± 1.1 (female) or 27.2 ± 1.1 µm (male), V = 54.9 ± 1.3 with simple, poorly developed epiptygma, lateral fields with two incisures and tail hemispherical with distal annules not wider than the other body annules. A key is given for the species of *Peltamigratus.*

RÉSUMÉ

Peltamigratus *Sher, 1964 (Nematoda : Hoplolaimidae) récoltés au Brésil, comprenant la description de six nouvelles espèces*

Peltamigratus christiei (Golden & Taylor, 1956) Sher, 1964, *P. holdemani* Sher, 1964, *P. ibiboca* Monteiro & Choudhury, 1978, *P. nigeriensis* Sher, 1964 et six nouvelles espèces de *Peltamigratus* Sher, 1964 ont été déterminés dans les 1 100 échantillons de sol récoltés en divers endroits du Brésil entre 1975 et 1981. *P. areolatus* n. sp. est caractérisé par : L = 0,67 ± 0,04 mm; stylet = 26 ± 0,59 µm; V = 57,8 ± 1.18; absence d'épiptygmes; champs latéraux aréolés au niveau de l'œsophage et des phasmides; queue hémisphérique avec anneaux de l'extrémité séparés par des incisures profondes. *P. levicaudatus* sp. n. est caractérisé par : L = 0,68 ± 0,03 mm (mâle) et 0,77 ± 0,04 mm (femelle); stylet = 30,8 ± 0,7 µm; V = 56,2 ± 1,8; épiptygme double, proéminent; champ latéral non aréolé; queue conique, cuticule de l'extrémité épaissie. Chez *P. amazonensis* sp. n., les individus des deux sexes ont une longueur de 0.66 ± 0,05 mm, stylet = 27,8 ± 1.3 µm; région labiale annelée et en relief; V = 54,3 ± 1,8; épiptygmes absents; queue conique avec anneaux terminaux nettement élargis. *P. cerradoensis* sp. n. mesure 0,86 ± 0,04 mm (femelles) et 0,79 ± 0,02 mm (mâles); stylet = 31,6 ± 0,6 µm; V = 57.7 ± 1,2; épiptygme double, proéminent; champ latéral comportant deux incisures; queue de la femelle conique à anneaux terminaux élargis. *P. raskii* sp. n. est caractérisé par : région labiale hémisphérique, non annelée, non en relief; L = 0,78 ± 0,04 mm; stylet = 30,4 ± 0,7 µm; V = 56,3 ± 1,0; un seul épiptygme, peu développé; champ latéral comportant deux incisures; queue conique à anneaux terminaux élargis. Chez *P. paraensis* sp. n., les femelles mesurent 0,94 ± 0,07 mm, et les mâles 0,86 ± 0,06 mm; stylet = 29 ± 1,1 (femelles) et 27,2 ± 1,1 µm (mâles); V = 54,9 ± 1,3; un seul épiptygme, peu développé; champ latéral comportant deux incisures; queue hémisphérique à anneaux terminaux identiques à ceux du corps. Une clé pour la détermination des espèces du genre est proposée.

(1) Part of the MS thesis of the senior author.

* Present address : CNPH-EMBRAPA, Km 9, Rod. Brasília-Anápolis, Caixa Postal 07.0218, Brasília, Brazil.

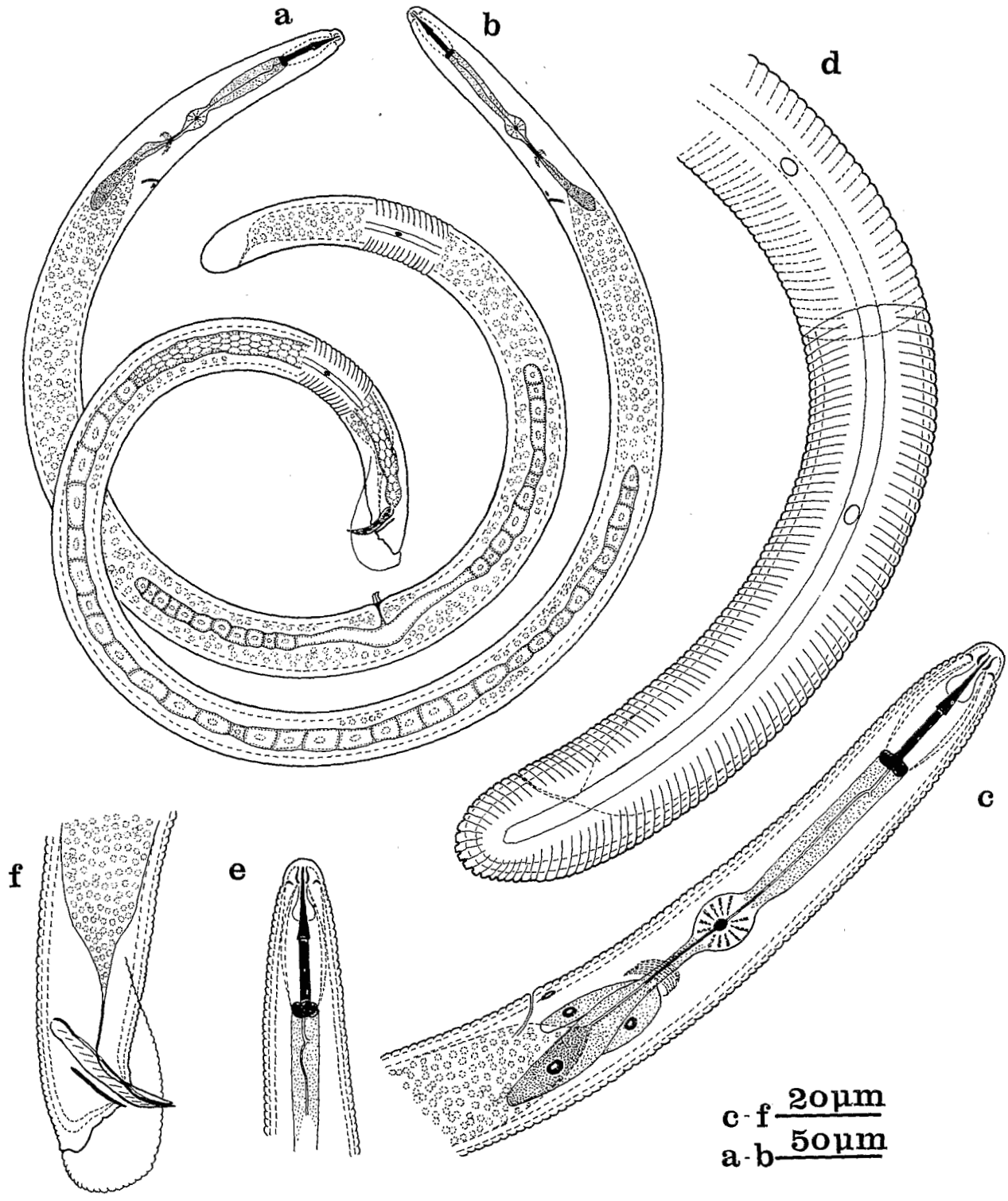

Fig. 1. *Peltamigratus christiei* Sher, 1964 : a : Female; b : Male; c : Female, anterior region; d : Female, posterior region; e : Male, anterior region; f : Male, posterior region.

A preliminary survey in the Nematology Collection of University of Brasília (UnB), showed that members of the family Hoplolaimidae Filipjev, 1934 are extremely common in Brazilian soils. *Peltamigratus* Sher, 1964 was one of the most common genera in the samples.

A review of literature showed that seventeen species of *Peltamigratus* had been described up to March 1984. Of the known species, only *P. holdemani* (Sharma & Loof, 1972; Sharma & Loof, 1974; Sharma, 1976, 1977, 1978) and *P. ibiboca* (Monteiro & Choudhury, 1978; Lopes & Lordello, 1980) have been registered for Brazilian territory.

This paper describes the species of *Peltamigratus* identified from Brazilian soils, collected between September, 1975 and December, 1981.

Materials and methods

Nematodes studied were extracted from 1 100 soil samples, collected from diverse localities of Brazil. They were killed by gentle heat (60°/1 min.) soon after extraction and fixed in the formalin-glycerine-water mixture formulated by Golden (Hooper, 1970). Specimens mounted permanently in glycerine by Seinhorst's method (Hooper, 1970) were used for all morphological observations and measurements.

Peltamigratus christiei (Golden & Taylor, 1936) Sher, 1964

(Fig. 1)

DIMENSIONS (see Tab. 1)

DESCRIPTION

Females : Body open spiral to C-shaped. Lip region not or slightly set off from body. Spear knobs oval, slightly flattened anteriorly. Body annules in the region between the phasmids measure 1.3-1.4 µm. Excretory pore at level of esophageal-intestinal junction. Hemizonid at level of excretory pore or 1-2 annules anterior to it. Spermatheca not observed. Epiptygma double, well developed. Lateral fields usually with two incisures, sometimes four. Intestine not overlapping rectum. Tail rounded, 10-12 annules, with constrictions between annules.

Males : Similar to females, except in sexual characteristics.

HABITAT

Found in the rhizosphere of *Hevea braziliensis;* municipality of Belém, State of Pará.

DISCUSSION

The Belém population (CNUB no. 1709) of *P. christiei* fits well the description given by Sher (1964), with slight variations in body length and " a " ratio. Specimens are deposited in the Nematode Collection of the University of Brasília, slide numbers 1709/1 and 1709/2.

Peltamigratus holdemani Sher, 1964

(Fig. 2)

DIMENSIONS (see Tab. 2)

DESCRIPTIONS

Females : Assumed spiral form after fixation. Lip region hemispherical, elevated, slightly set off or not, with 4-5 distinct annules. Stylet knobs oval, slightly concave anteriorly. Body annules in the region between two phasmids measure 1.3-1.6 µm. Excretory pore located in the region between esophageal-intestinal junction and end of posterior esophageal glands. Hemizonid simple, two body annules long, 1-3 annules posterior to excretory pore. Spermatheca rounded, filled with sperms in some but not all specimens examined. Epiptygma simple, inconspicuous. Lateral field with four distinct incisures down to anus level, from where sometimes the outer lines fade away. Anterior phasmid at right-hand or left-hand side of the body. Intestine not overlapping rectum. Tail with 6-10 ventral annules, the distal annules being 2-5 times wider than other body annules. Terminus of the tail rounded.

Males : Similar to females except in sexual characters.

HABITAT

Found in the rhizospheres of banana (*Musa* sp.), dryland rice *(Oryza sativa), Anacardium* sp., " Jurema preta " *(Pityrocarpa* sp.), okra *(Abelmoschus esculentus),* " Murici " *(Byrsonima crassifolia),* tomato *(Lycopersicon esculentum), Hibiscus sabdariffa,* sugar-cane, citrus, papaya, *Cassia* sp. and *Eugenia malaccensis.* States of Maranhão, Goiás, Rio Grande do Norte and Ceará.

Specimens are deposited in the Nematode Collection of the University of Brasília.

DISCUSSION

P. holdemani is very common in Brazilian soils. It was reported for Brazil by Sharma and Loof (1972, 1974) and Sharma (1976, 1977, 1978). The populations studied differ from those described by Sher (1964) in that : *i)* the lip region has distinct annules, *ii)* distal annules of tail are wider than the other body annules, *iii)* the hemizonid is simple and *iv)* the two outer incisures in the lateral fields fade away after the posterior phasmid.

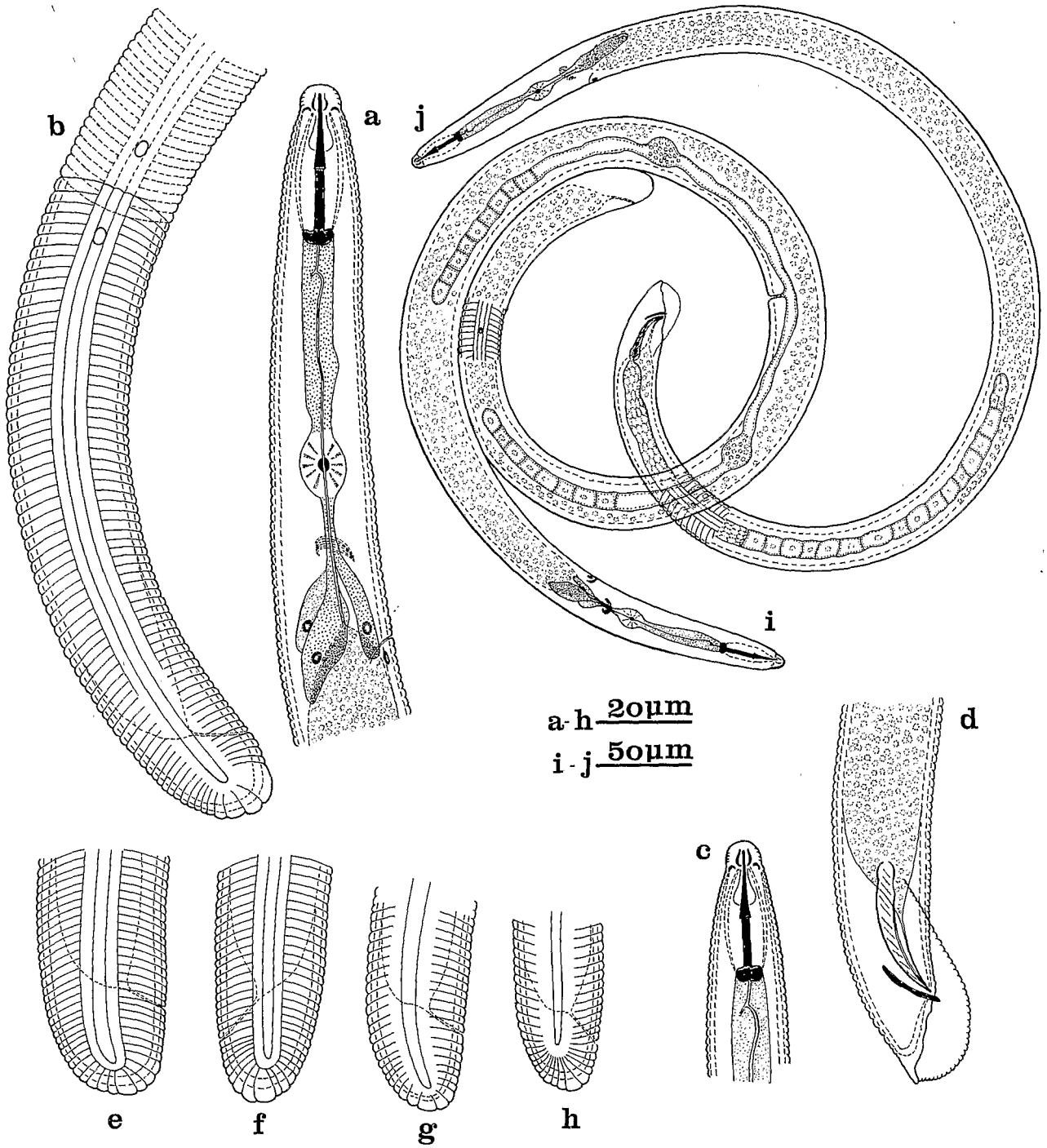

Fig. 2. *Peltamigratus holdemani* Sher, 1964 : a : Female, anterior region; b : Female, posterior region; c : Male, anterior region; d : Male, posterior region; e-h : Female tails; i : Female, whole nematode; j : Male, whole nematode.

Table 1

Measurements of *Peltamigratus christiei* in Sher (1964) and of a Brazilian population.

Females *Measurements*	*Paratypes (Sher, 1964)*		*Brazilian population*				
	Males		*Females (5)*			*Male (2)*	
	20	*10*	*Range*	*Average*	*Standard Deviation*	*Range*	*Average*
L (mm)	0.67-0.87	0.66-0.81	0.81-0.99	0.88	0.08	0.83-0.91	0.87
Stylet (µm)	30-34	29-33	28.5-31	29.6	1	28	28
a	25-31	26-33	28.3-35.5	31.5	2.7	34.7-39	36.8
b	6.4-8.3	6.7-8.6	7.5-9.4	8.7	0.9	9.1	9.1
b′	5.3-7.3	5.3-6.7	5.6-7.7	6.7	0.9	7.1-7.9	7.5
c	45-80	39-58	49.3-56	53.8	2.6	56.2-61.3	58.7
o	11-18	11-18	15.2-23.9	19.9	3.4	16.3-18.6	17.4
V	53-58	—	54.3-59.8	57.3	2.3	—	—
Ant. phasmid (%)	76-85	76-84	79.3-82.8	80.4	1.4	85.2-85.4	85.3
Post. phasmid (%)	82-90	85-89	87.1-89.8	88.1	1	90.2-91.6	90.9
Spicules (µm)	—	27-31	—	—	—	26-29	27.5
Gubernaculum (µm)	—	11-15	—	—	—	11-12	11.5

Table 2

Measurements of *Peltamigratus holdemani* Sher (1964) and of a Brazilian population.

Measurements	*Types (Sher, 1964)*		*Brazilian population*					
	Female	*Male*	*Female (35)*			*Male (13)*		
			Range	*Average*	*Standard Deviation*	*Range*	*Average*	*Standard Deviation*
L (mm)	0.87	0.77	0.83-1.01	0.92	0.06	0.69-0.89	0.81	0.05
Stylet (µm)	30	28	28.5-34	30.8	1.1	27.5-29.5	28.6	0.5
a	30	36.9	28.6-37	32.3	2	30.2-39.3	34.6	2.6
b	8.7	7.7	8-10.3	9.1	0.5	7.1-9.7	8.4	0.7
b′	6.4	5.9	6.1-7.8	6.9	0.4	5.5-7	6.4	0.4
c	81	39.4	49.3-81	61.8	7.8	36.1-50.6	41.2	4.1
o	17	18.6	8-22	16.2	2.9	13-23	18.4	3
V	55	—	53-57	55.3	1	—	—	—
Ant. phasmid (%)	82	82.8	79.7-85.1	82.3	1.4	79.6-86	83.3	1.8
Post. phasmid (%)	85	86.3	79.8-87.2	84	1.6	82.1-87.6	85	1.6
Spicules (µm)	—	32.5	—	—	—	28-32	30	1.3
Gubernaculum (µm)	—	13.5	—	—	—	13-15	13.5	0.6

The differences, however, are not considered sufficient to establish a new species. Similar intraspecific variations were also reported by Golden and Taylor (1956) and Loof (1964).

Peltamigratus ibiboca Monteiro & Choudhury, 1978

(Fig. 3)

DIMENSIONS (see Tab. 3)

DESCRIPTION

Females : Body C-shaped after killing. Labial disc slightly set off from body. Spear knobs rounded, slightly flattened anteriorly. Body annules in the region between the phasmids measure 1.3-2.1 µm. Excretory pore opposite to posterior portion of esophageal glands. Hemizonid 2 annules long, about 1-2 annules anterior to excretory pore. Spermatheca oval, filled with sperms. Epiptygma double, well developed. Lateral fields with two incisures. Anterior phasmid located at right-hand or left-hand side of the body. Intestine not overlapping rectum. Tail conical with 7-12 annules ventrally. Tail annules wider than other body annules.

Males : Similar to female, except in sexual characteristics.

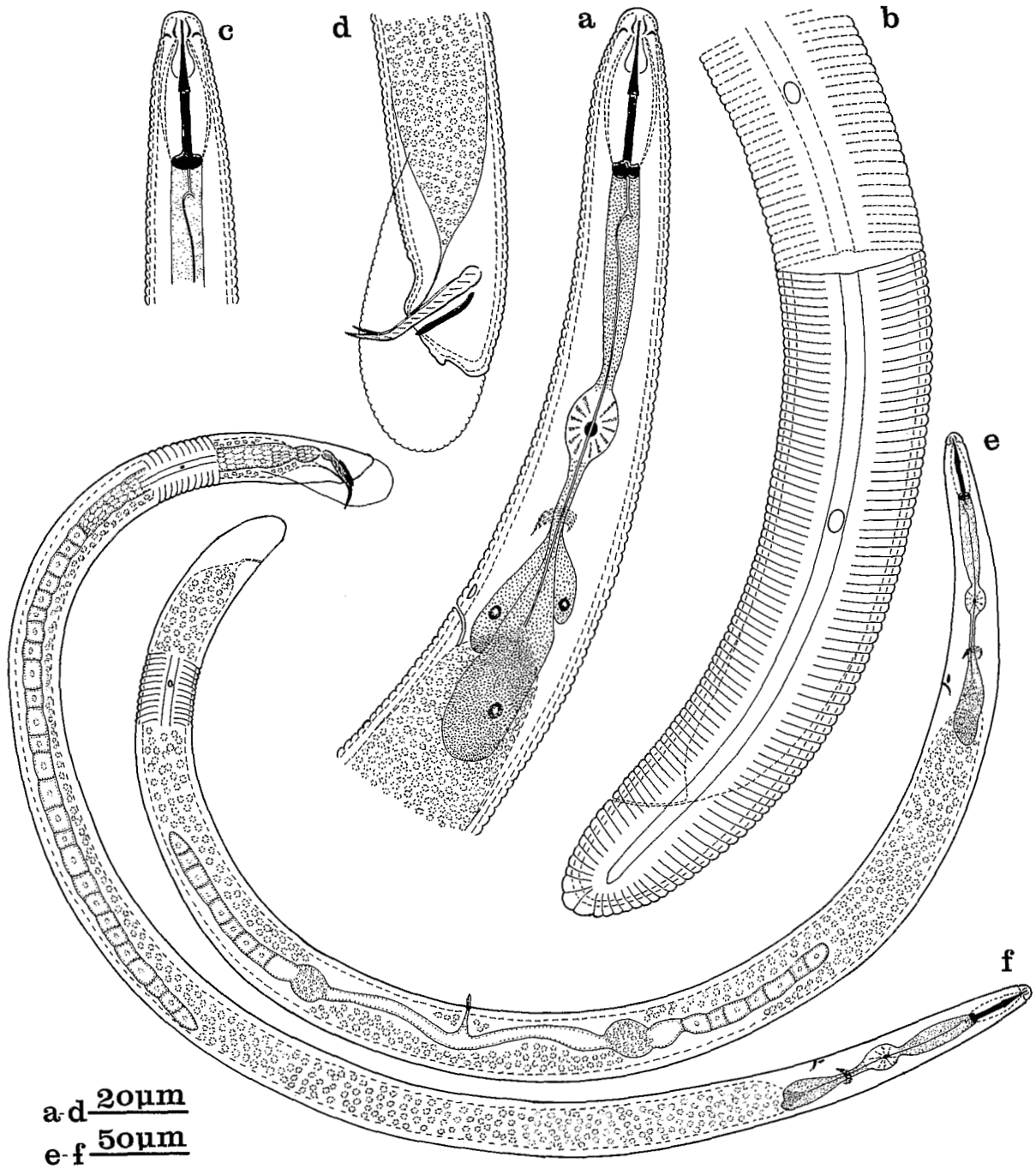

Fig. 3. *Peltamigratus ibiboca* Monteiro & Choudhury, 1978 : a : Female, anterior region; b : Female, posterior region; c : Male, anterior region; d : Male, posterior region; e : Female, whole nematode; f : Male, whole nematode.

Table 3

Measurements of *Peltamigratus ibiboca* in Monteiro & Choudhury, 1978 and of a Brazilian population.

Measurements	*Types (Monteiro & Choudhury, 1978)*		*Population studied in this work*					
	Female	*Male*	*Females (13)*			*Male (5)*		
			Range	*Average*	*Standard Deviation*	*Range*	*Average*	*Standard Deviation*
L (mm)	0.84	0.71	0.83-0.99	0.91	0.05	0.82-0.92	0.87	0.03
Stylet (µm)	31	30	30.5-33	31.5	0.9	29.5-30.5	30.2	0.4
a	27	30	25.4-32	28.8	2.2	27.3-34.2	31.4	2.5
b	7.4	5.8	8.1-9.6	8.6	0.4	7.7-8.8	8.3	0.5
b′	5.8	4.8	5.5-6.7	6.1	0.3	5.3-6.5	6.1	0.5
c	53	35	35.7-64.6	50.8	8.7	43.8-63.5	54.8	8.7
o	—	—	14-22	17.8	2.2	14.6-17	15.8	1.1
V	54	—	54.4-59.3	56.4	1.4	—	—	—
Ant. phasmid (%)	—	—	71.6-82.3	75.3	2.8	76.6-79.7	78.2	1.1
Post. phasmid (%)	—	—	83.1-93.9	87.3	3.1	88.3-89.5	88.8	0.5
Spicules (µm)	—	—	—	—	—	31-31.5	31.2	0.2
Gubernaculum (µm)	—	—	—	—	—	12-14	13.4	0.8

HABITAT

Found in the rhizosphere of avocado *(Persea americana), Andropogon bicornis,* tomato and sweet peper. States of Pernambuco, Goiás, Rio Grande do Norte and Ceará.

DISCUSSION

The descriptions given above were based on a population collected by Mr. Jaime Maia dos Santos in the Municipality of Petrolina, State of Pernambuco, from where Monteiro and Choudhury (1978) obtained type specimens of the species.

The permanent mounts studied are deposited in the Nematode Collection of the University of Brasília.

Peltamigratus nigeriensis Sher, 1964

(Fig. 4)

DIMENSIONS (see Tab. 4)

DESCRIPTION

Females : Body assumed spiral to open circle form after killing. Lip region slightly set off from body. Spear knobs rounded, slightly flattened anteriorly. Body annules in the region between the phasmids measure 1.6-2.1 µm. Excretory pore opposite the posterior esophageal glands. Hemizonid at level of excretory pore or 1-2 annules posterior to it. Spermatheca rounded, filled with sperms in most of the specimens. Epiptygma double, well developed. Lateral fields with two or four incisures. Where four incisures are present, the external two fade away after anus. Intestine not overlapping rectum. Tail conoid with 6-8 annules, the distal ones twice as wide as the others.

Males : Similar to females, except in sexual characteristics.

HABITAT

Found in the rhizosphere of mixed native " Cerrado " vegetation; campus of the University of Brasília, Distrito Federal.

DISCUSSION

The population studied showed practically all of the characteristics of *P. nigeriensis* described by Sher (1964) except the longer stylet and higher " c " ratio. In addition, the number of incisures in the lateral fields was found to be variable in the population. Some individuals had four distinct lines while in others two external lines were either vague or invisible. This variation was not reported by Sher (1964) in his description of the species.

Peltamigratus areolatus sp. n.

(Fig. 5)

DIMENSIONS (see Tab. 5)

DESCRIPTION

Females (n = 8) : Body assumes open C-shape after fixation. Lip region slightly set off with 1-2 smooth

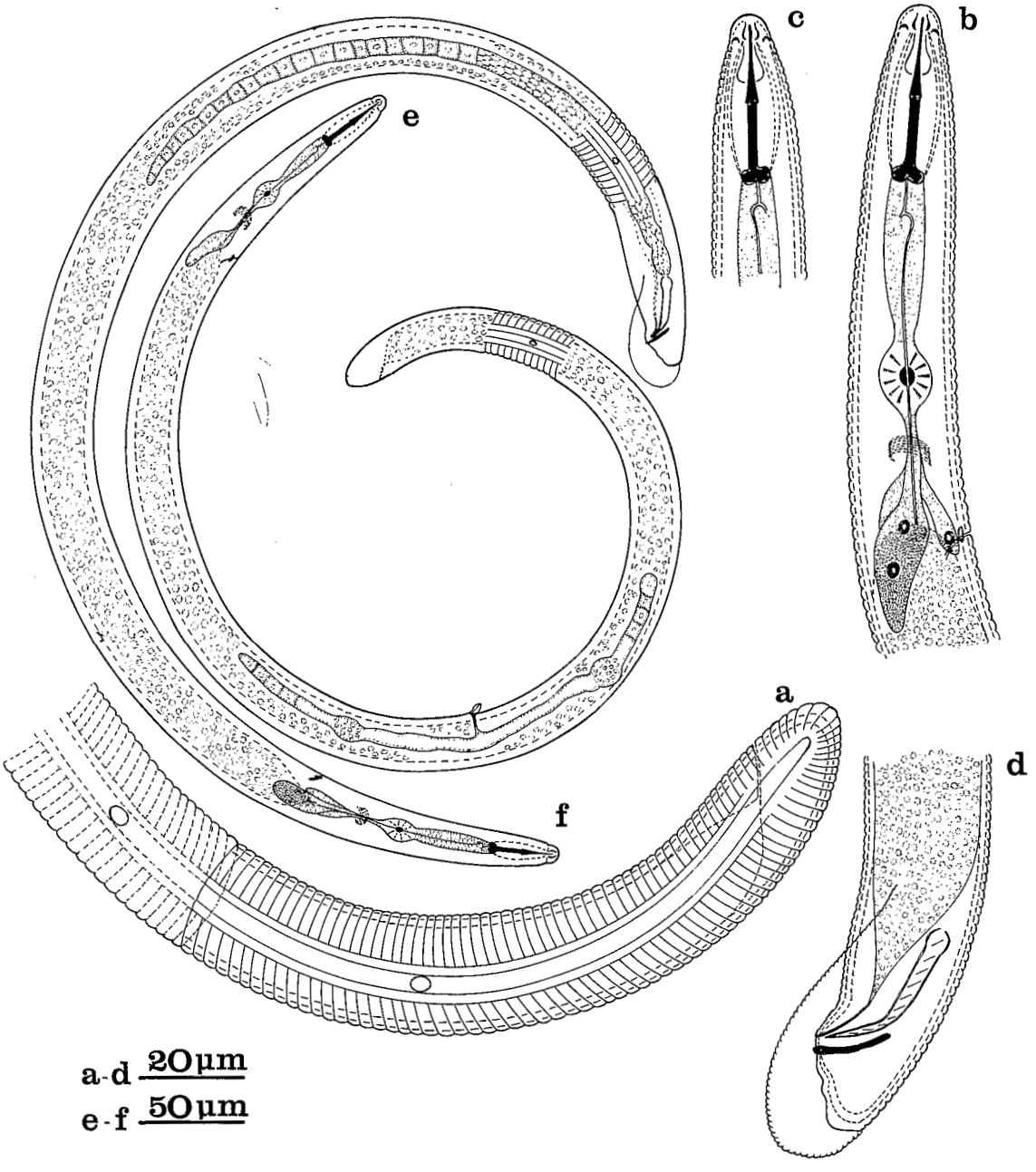

Fig. 4. *Peltamigratus nigeriensis* Sher, 1964 : a : Female, posterior region; b : Female, anterior region; c : Male, anterior region; d : Male, posterior region; e : Female, whole nematode; f : Male, whole nematode.

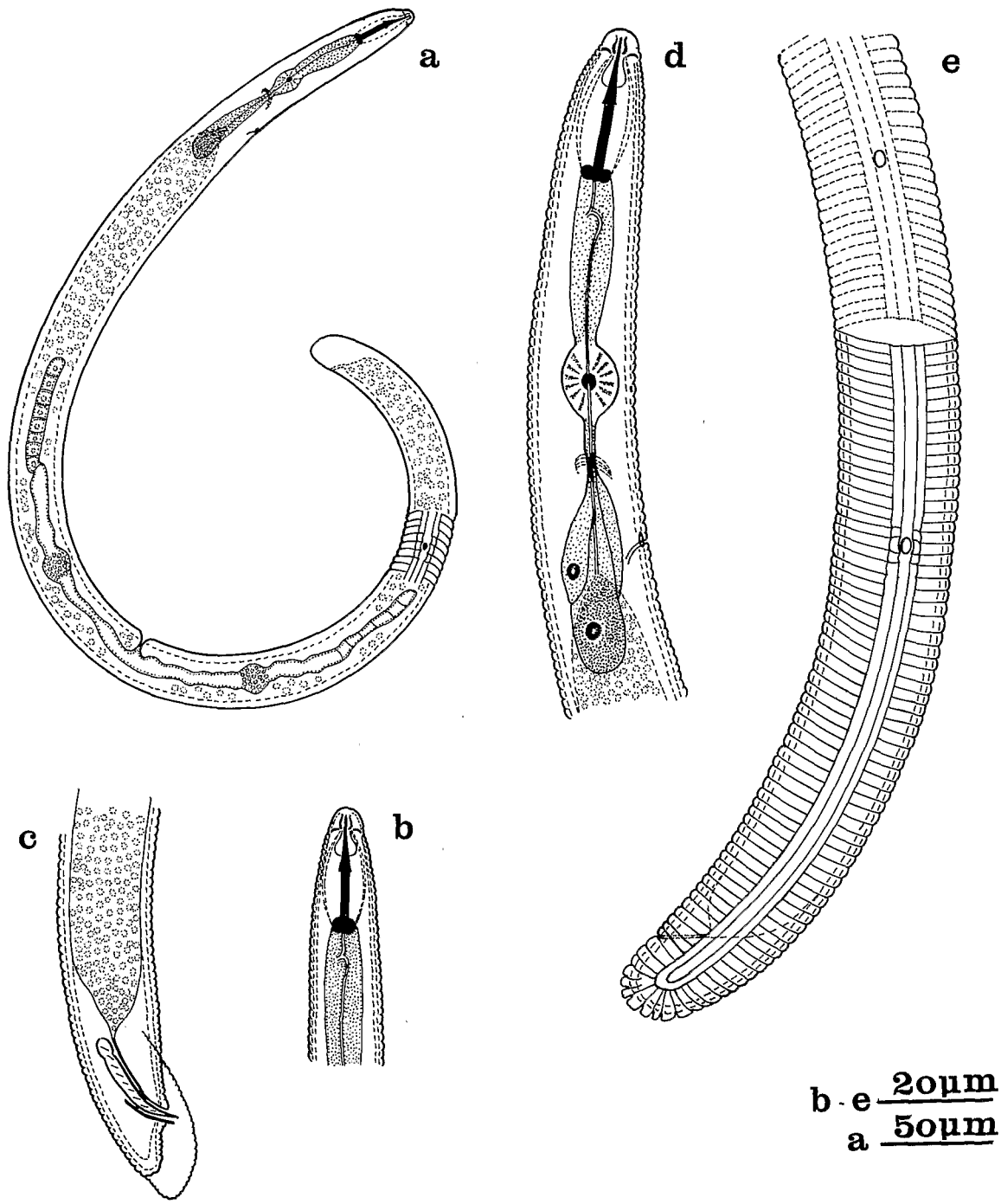

Fig. 5. *Peltamigratus areolatus* sp. n. : a : Female, whole nematode; b : Male, anterior region; c : Male, posterior region; d : Female, anterior region; e : Female, posterior region.

Table 4

Measurements of *Peltamigratus nigeriensis* in Sher (1964) and of a Brazilian population.

Measurements	Types (Sher, 1964)		Brazilian population				
	Female	Male	Female (4)			Male (2)	
			Range	Average	Standard Deviation	Range	Average
L (mm)	0.80	0.64	0.70-0.83	0.77	0.05	0.78-0.82	0.80
Stylet (µm)	30	27	28.5-32	30.2	17	30-30.5	30.2
a	31	28	27-31	29.1	1.6	28-29.2	28.6
b	7.5	6.7	6.8-9.1	8.2	1.2	7.7-9.4	8.5
b′	5.8	5.3	6.7-6.8	6.7	0.1	5.7-7.2	6.4
c	50	49	49-71	57.2	9.5	46-57	51.5
o	21	23	15-22	17.6	3.7	12-20	16
V	56	—	56-57	56.6	0.5	—	—
Ant. phasmid (%)	—	—	78-81	79.2	1.2	80.1-80.4	80.2
Post. phasmid (%)	—	—	85-87.5	86.3	1.1	87-88	87.5
Spicules (µm)	—	26	—	—	—	32-34	33
Gubernaculum (µm)	—	12	—	—	—	14.5	14.5

Table 5

Measurements of *Peltamigratus areolatus* sp. n.

Measurements	Holotype Female	Allotype male	Paratypes Females (7)		
			Range	Average	Standard Deviation
L (mm)	0.64	0.53	0.62-0.73	0.67	0.04
Stylet (µm)	26	19	25-26.5	26	0.59
a	28	33.8	25.8-31.3	29.1	1.84
b	8.3	6.1	7.5-9.4	8.3	0.61
b′	5.6	4.7	5.4-6.8	5.9	0.51
c	54	32.4	48.3-70.3	59.5	7.1
V	57.3	—	55.8-59.1	57.8	1.18
Ant. phasmid (%)	76	77.8	75.8-77.8	76.9	1.09
Post. phasmid (%)	87.6	86.9	86-90.9	87.8	1.48
Spicules (µm)	—	18	—	—	—
Gubernaculum (µm)	—	9	—	—	—

annules. Spear knobs rounded. Body annules in the region between the phasmids measure 1.6-2.0 µm. Excretory pore located anterior to the esophageal-intestinal junction. Hemizonid at level of excretory pore or anterior it. Spermatheca rounded, filled with sperms. Epiptygma not observed. Lateral fields with four incisures, areolated in the esophageal region and vicinity of the phasmids. Intestine not overlapping the rectum. Tail hemispherical with 6-9 ventral annules, not wider than other body annules. Distal annules of tail separated by deep cuticular striae.

Males : Similar to females, except in sexual characters.

TYPE MATERIAL

Holotype : Female collected by C. R. Bueno and E. N. Franklin, 1981. Slide number 1412, Nematode Collection of University of Brasília.

Allotype : Same date as holotype. Slide number 873/1, Nematode Collection of University of Brasília.

Paratypes : Seven females, deposited in the Nematology Collection of the University of Brasília.

TYPE HABITAT AND LOCALITY

Rhizosphere of corn *(Zea mays).* Solimões River bank near the city of Manaus, State of Amazonas.

DIAGNOSIS AND COMMENTS

P. areolatus sp. n. resembles *P. longistylus* Doucet, 1980, *P. perscitus* Doucet, 1980, *P. conicori* Doucet, 1984, *P. brevicaudatus* Doucet, 1984 and *P. triticeus* Doucet, 1984 in that the lateral fields are areolated anteriorly in the esophageal region and the vicinity of phasmids. It differs from *P. longistylus* by the presence of a spermatheca filled with sperms, shorter body (0.62-0.73 mm *vs* 0.88- 1.10 mm) and stylet (25-26 µm *vs* 33-37 µm). *P. areolatus* sp. n. is distinguished from *P. perscitus* by shorter body and stylet (0.62-0.73 mm *vs* 0.95-1.16 mm and 25-26.5 µm *vs* 31-33 µm, respectively) and by the anterior phasmid being located more posteriorly (77-80 % *vs* 64-72 %). It is separated from *P. conicori* by shorter body and stylet (0.62-0.73 mm *vs* 0.88-1.1 mm and 25-26,5 µm *vs* 28-32 µm, respectively) *P. areolatus* sp. n. differs from *P. brevicaudatus* and *P. triticeus* by shorter body and stylet and lack of epiptygma (*vs* epiptygma double).

Peltamigratus levicaudatus sp. n.

(Fig. 6)

DIMENSIONS (see Tab. 6)

DESCRIPTION

Female (n = 21) : Body assumes open spiral to open C-shape after killing. Lip region slightly set off. Spear knobs oval, slightly flattened anteriorly. Body annules in the vulval region measure 1.6-2.3 µm. Excretory pore usually opposite to anterior portion of esophageal glands. Hemizonid two body annules long, at level 1-2 annules below excretory pore. Spermatheca oval, filled with sperms. Epiptygma double, well developed. Lateral fields with two, rarely four incisures. Anterior phasmid at the right or left-hand side of the body. Intestine not overlapping the rectum. Tail conical or gradually tapering to a round terminus, with 5-9 ventral annules. Outer cuticle at the tail terminus markedly thickened. Distal end of the tail smooth or very weakly annulated.

Male (n = 11) : Similar to female, except in sexual characters.

TYPE MATERIAL

Holotype : Female, collected by N. S. Santos, 1981. Slide number 1509/4-2. Nematode Collection of the University of Brasília.

Allotype : Male, same date as holotype, slide number 1509/3S. Nematode Collection of the University of Brasília.

Paratypes : Ten males and 20 females distributed as follows : University of California Nematode Collection at Davis (3 females, 1 male); USDA, Beltsville (2 females, 1 male); University of California Nematode Collection Riverside (4 females, 1 male); Muséum national d'Histoire naturelle, laboratoire des Vers, Paris (4 females), and the rest in the Nematode Collection of the University of Brasília (slides numbers 1509/3, 1509/4, 1509/6 and 1509/7).

TYPE HABITAT AND LOCALITY

Rhizosphere of dryland rice *(Oryza sativa).* Municipality of Água Boa, State of Mato Grosso.

DIAGNOSIS AND COMMENTS

P. levicaudatus sp. n. resembles *P. pachyurus* Loof, 1964, in having a conical tail with two-layered cuticle whose outer layer is conspicuously thickened. It differs from *P. pachyurus* in that the hemizonid is located posterior to excretory pore, the lateral fields have two incisures and males are present and spermatheca are filled with sperms.

Peltamigratus amazonensis sp. n.

(Fig. 7)

DIMENSIONS (see Tab. 7)

DESCRIPTION

Female (n = 30) : Body assumes open C, L, or irregular form after fixation. Lip region markedly set off with 4-5 annules. Spear knobs oval slightly flattened anteriorly. Body annules in the phasmid region measure 1.3-1.8 µm. Excretory pore located anterior to esophageal-glands. Hemizonid at level of excretory pore or 1-3 annules posterior to it. Spermatheca oval, filled with sperms. Epiptygma not observed. Lateral field with four incisures along most of the body but outer lines fade away after posterior phasmid and disappear after anus. Anterior phasmid at right-hand or left-hand side of body. Intestine not overlapping rectum. Tail conical with 6-9 ventral annules, the distal ones being wider than the others.

Male (n = 1) : Similar to females, except in sexual characters.

TYPE MATERIAL

Holotype : Female collected by C. R. Bueno and E. N. Franklin, 1981. Nematode Collection of the University of Brasília. Slide number 1545/2.

Allotype : Male, same data as holotype, slide number 1545/1A. Nematode Collection of the University of Brasília.

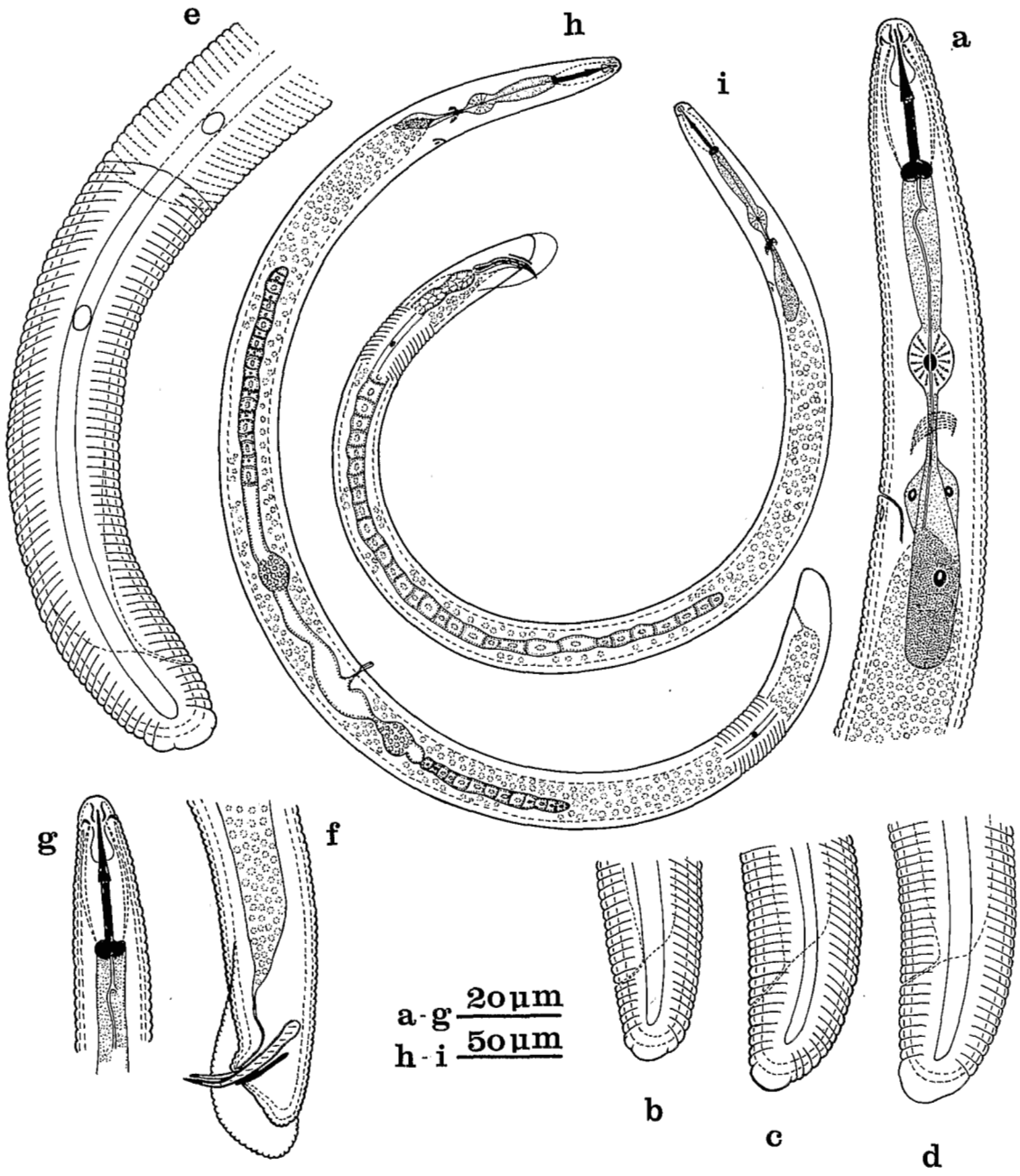

Fig. 6. *Peltamigratus levicaudatus* sp. n. : a : Female, anterior region; b-d : Female tails; e : Female, posterior region; f : Male, posterior region; g : Male, anterior region; h : Female, whole nematode; i : Male, whole nematode.

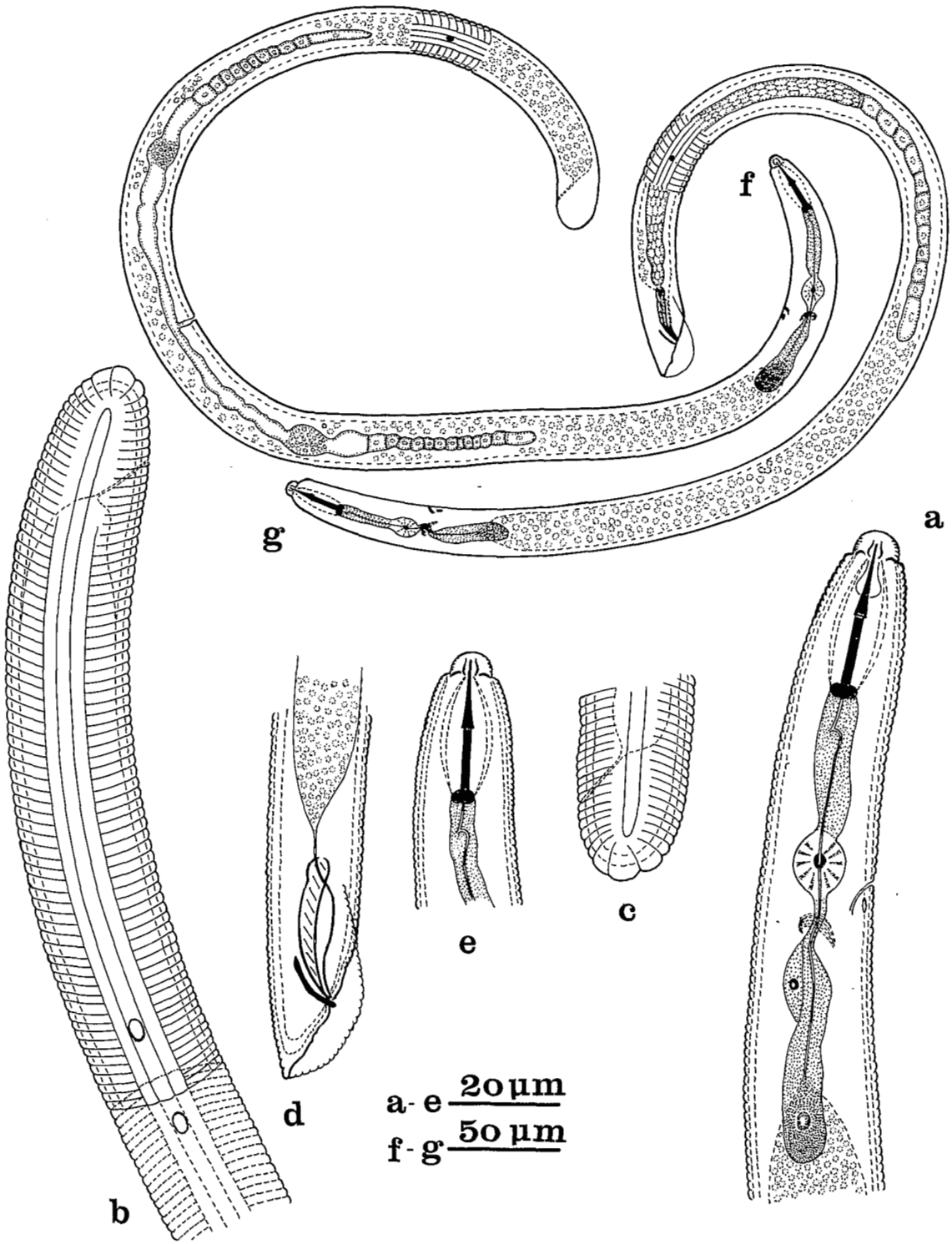

Fig. 7. *Peltamigratus amazonensis* sp. n. : a : Female, anterior region; b : Female, posterior region; c : Female, tail; d : Male, posterior region; e : Male, anterior region; f : Female, whole nematode; g : Male whole nematode.

Table 6

Measurements of *Peltamigratus levicaudatus* sp. n.

Measurements	Holotype Female	Allotype Male	Paratypes Females (20)			Paratypes Male (10)		
			Range	Average	Standard Deviation	Range	Average	Standard Deviation
L (mm)	0.73	0.73	0.71-0.87	0.77	0.04	0.62-0.73	0.68	0.03
Stylet (µm)	31.5	28.5	29-32.5	30.8	0.7	27-29.5	28.2	0.7
a	25	32	25.7-34.5	28.7	2.4	30.5-35.9	33	1.8
b	8.5	7	6-9.5	8	0.8	6.6-8.3	7.5	0.6
b′	6	5.3	4.8-6.8	5.7	0.5	4.7-6.4	5.5	0.5
c	40	62.3	38.8-78	57.1	10.3	46-66	55.4	6.7
o	18	—	10.4-20	15.9	2.7	13.6-20.9	16.7	2.8
V	57	—	52.3-58.8	56.2	1.8	—	—	—
Ant. phasmid (%)	80	84.8	76.6-84	80.3	2	77.9-85.3	82.2	2.7
Post. phasmid (%)	87	92.4	85-89.1	87.5	1.1	86.9-92.4	89.3	1.9
Spicules (µm)	—	28	—	—	—	25-28	27	1
Gubernaculum (µm)	—	12	—	—	—	10-12.5	11.5	0.7

Table 7

Measurements of *Peltamigratus amazonensis* sp. n.

Measurements	Holotype Female	Allotype Male	Paratypes Female (29)		
			Range	Average	Standard Deviation
L (mm)	0.69	0.62	0.59-0.77	0.66	0.05
Stylet (µm)	30	26	25-30	27.8	1.3
a	26	29.8	24-30.1	26.6	1.7
b	9.6	8.7	8.3-9.8	9	0.4
b′	7.2	6.1	5.7-6.8	6.3	0.3
c	63	38	43.4-63.2	50.7	4.9
o	17	—	15.2-22.2	18.2	2
V	51	—	51.2-58.8	54.3	1.8
Ant. phasmid (%)	80.6	83	79.6-84.9	82.1	1.6
Post. phasmid (%)	81.3	84	81-85.9	83.3	1.3
Spicules (µm)	—	24	—	—	—
Gubernaculum (µm)	—	11	—	—	—

Paratypes : Twenty females, distributed as follows : University of California Nematode Collection, Davis (4 females, 1 juv.); University of California Nematode Collection, Riverside (2 females, 2 juv.); USDA, Beltsville (2 females); Muséum national d'Histoire naturelle, Laboratoire des Vers, Paris (1 female) and the rest in the University of Brasília Nematode Collection.

TYPE HABITAT AND LOCALITY

Rhizosphere of *Vigna unguiculata.* Vegetable garden beside the Amazon river " Solimões ", municipality of Iranduba, State of Amazonas.

DIAGNOSIS

P. amazonensis sp. n. is closest to *P. sheri* Andrássy, 1968, because of its markedly set off lip region. It can be separated from *P. sheri* however by the distinct lip annulations, hemizonid located posterior to excretory pore and by the lateral fields with four incisures instead of two.

Peltamigratus cerradoensis sp. n.

(Fig. 8)

DIMENSIONS (see Tab. 8)

DESCRIPTIONS

Females (n = 13) : Body C-shaped after killing. Lip region hemispherical, slightly separated from body. Stylet knob rounded. Body annules between the two phasmids measure 1.8-2.2 µm. Body width at mid-body measures 34 µm (32-38 µm). Excretory pore usually at level of esophageal-intestinal junction or slightly posterior, rarely opposite to end of posterior esophageal glands. Hemizonid at level of excretory pore or 1-2 body annules below it. Spermatheca rounded, with sperms. Epiptygma double, well developed. Lateral fields with two incisures. Anterior phasmid at the right-hand or left-hand side of the body. Intestine not overlapping rectum. Tail conical with 4-9 ventral annules, the distal ones being wider than the others.

Males (n = 7) : Similar to females, except in sexual characters.

TYPE MATERIAL

Holotype : Female, collected by J. E. Cares and J. Muñoz, 1981. Slide number 1681/1. Nematology Collection of University of Brasília.

Allotype : Male, same data as holotype. Slide number 1681/1A.

Paratypes : Six males and 18 females distributed as follows : University of California Nematode Collection, Davis (1 female); University of California Nematode Collection, Riverside (1 female), and the rest in the University of Brasília.

TYPE HABITAT AND LOCALITY

Rhizosphere of *Diospyrus hispida.* Highway Brasilia-Fortaleza, at km 33 from State line of the Federal District of Brasília.

DIAGNOSIS

P. cerradoensis sp. n. differs from the closely related species *P. macbethi* Sher, 1964 in the longer spear (30.5-33 µm *vs* 27-29 µm) and more anteriorly located phasmid (72-80 % *vs* 82-87 %). *P. cerradoensis* sp. n. differs from *P. raskii* sp. n. in having a double epiptygma, greater body length (0.80-0.92 mm *vs* 0.72-0.83 mm) and greater body width at mid-body (34 µm *vs* 24 µm). It differs from *P. paraensis* sp. n. in the longer stylet (30.5-33 µm *vs* 27-31 µm) and in the distal annules of tail wider than the others annules (*vs* distal annules not differing from the other tail annules).

The species name was given in recognition of the type habitat known in Brazil as " Cerrado " which roughly means " closed savana ". " Cerrado " is the typical vegetation in the Brazilian Central plateau.

Peltamigratus raskii sp. n.

(Fig. 9)

DIMENSIONS (see Tab. 9)

DESCRIPTION

Females (n = 8) : Body assumes spiral to open circle form after fixation. Lip region hemispherical, not set-off. Spear knobs rounded. Body annules in the region between phasmids measure 1.4-1.8 µm. Excretory pore located at level of anterior portion of the esophageal glands. Hemizonid 1-4 body annules posterior to excretory pore. Body width at mid-body measures 24 µm (23-27 µm). Spermatheca rounded, with sperms. Epiptygma simple, poorly developed, slightly projected out of body. Lateral fields with two incisures. Intestine not overlapping rectum. Tail conical with 6-9 ventral annules, the distal ones being wider than the other body annules.

Males (n = 8) : Similar to females, except in sexual characters.

TYPE MATERIAL

Holotype : Female collected by J. P. Pimentel, 1981. Slide number 1677/6. Nematode Collection of the University of Brasília.

Allotype : Male, same data as the holotype. Slide number 1766/6A.

Paratypes : Seven males and seven females distributed as follows : University of California Nematode Collection, Davis (1 female); USDA, Beltsville (1 female); Muséum national d'Histoire naturelle, Laboratoire des Vers, Paris (1 female) and the rest in University of Brasília Nematode Collection.

TYPE HABITAT AND LOCALITY

Rhizosphere of unidentified Graminae in the " Cerrado " (closed savana). Campus of the University of Brasília.

DIAGNOSIS

P. raskii sp. n. differs from the closely related species *P. browni* Khan & Zakiuddin, 1969 by the hemispherical lip region without annules (*vs* lip region truncate with

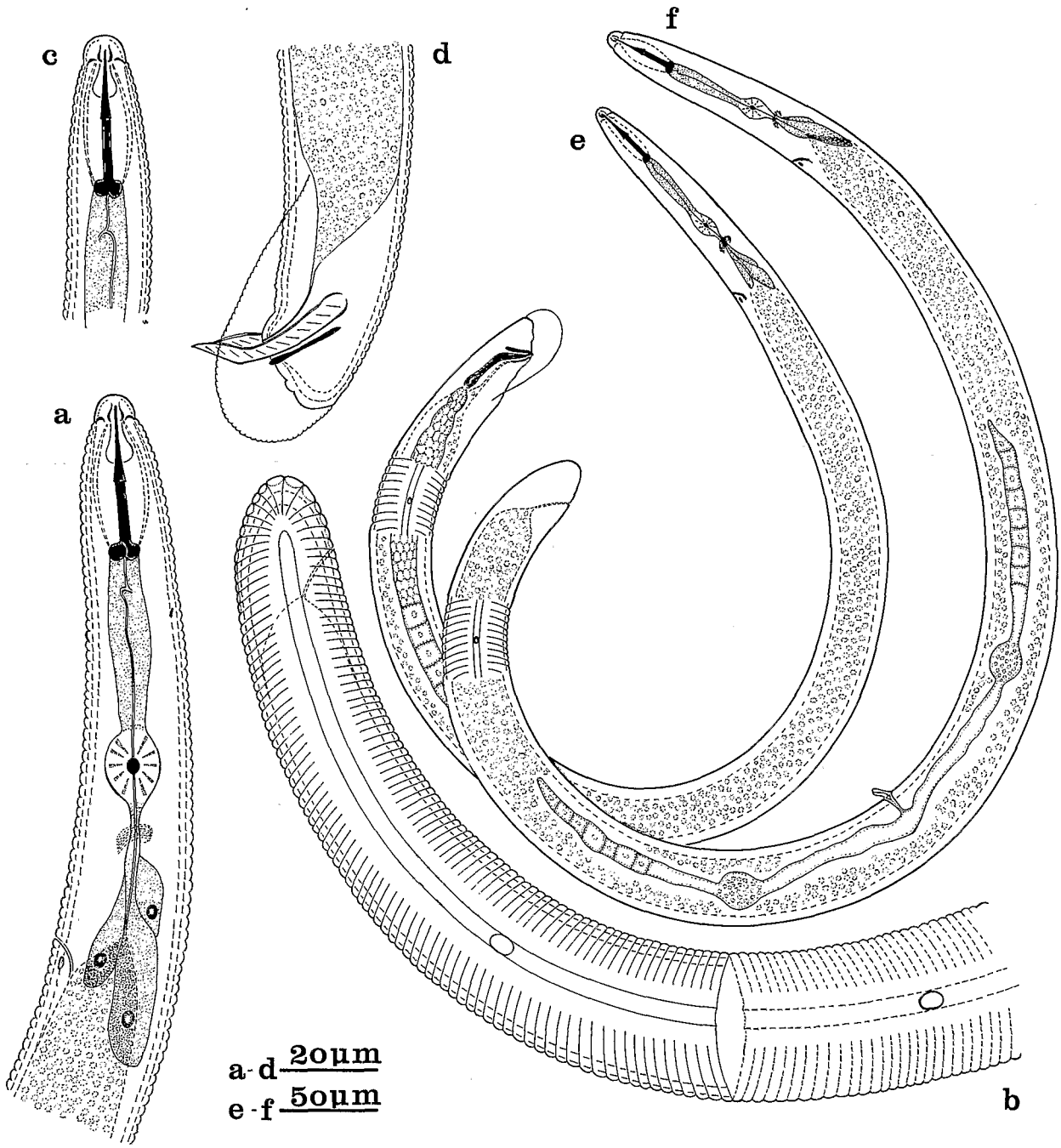

Fig. 8. *Peltamigratus cerradoensis* sp. n. : a : Female, anterior region; b : Female, posterior region; c : Male, anterior region; d : Male, posterior region; e : Male, whole nematode; f : Female, whole nematode.

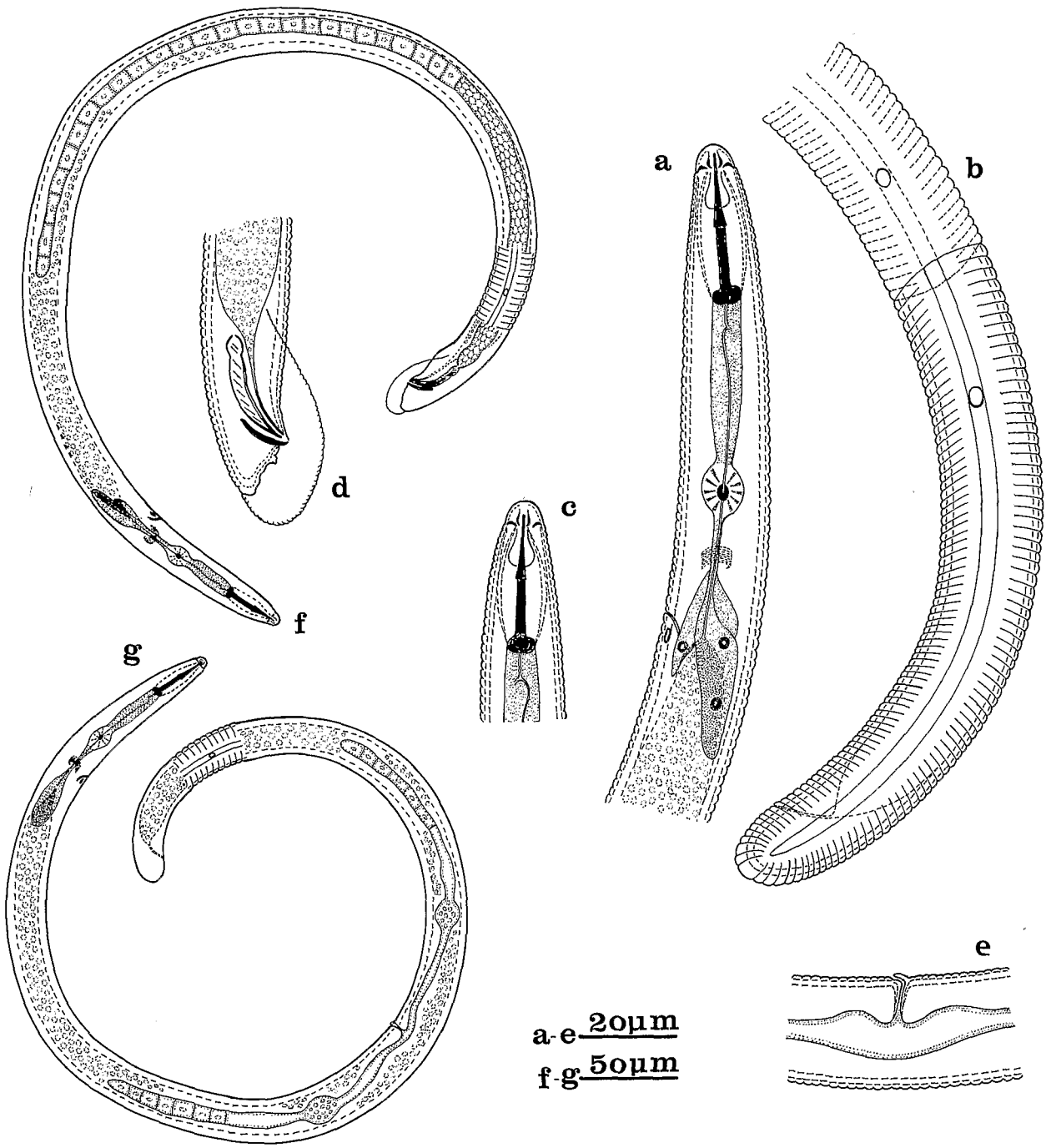

Fig. 9. *Peltamigratus raskii* sp. n. : a : Female, anterior region; b : Female, posterior region; c : Male, anterior region; d : Male, posterior region; e : Female, vulval region, showing epiptygma; f : Male, whole nematode; g : Female, whole nematode.

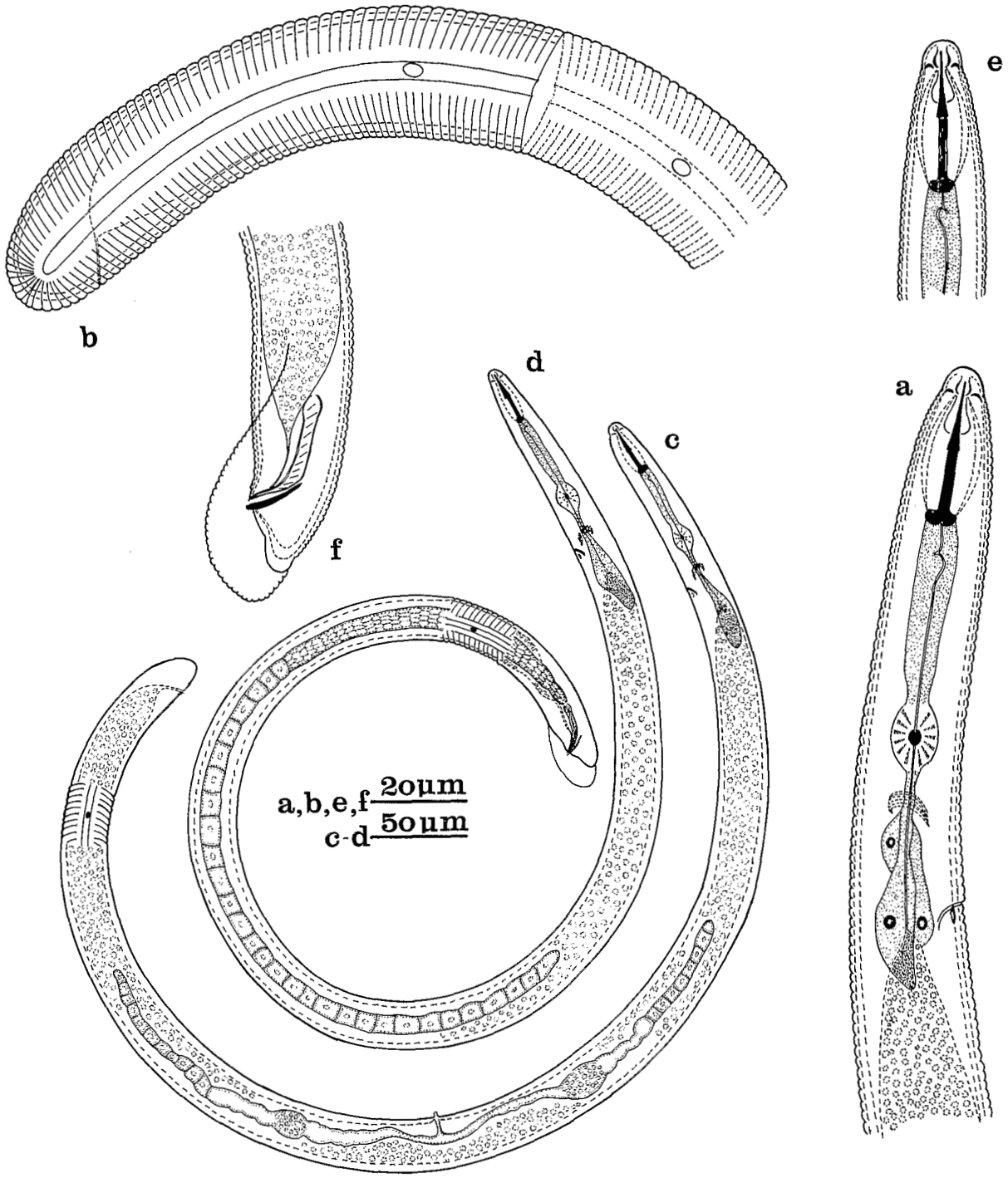

Fig. 10. *Peltamigratus paraensis* sp. n. : a : Female, anterior region; b : Female, posterior region; c : Female, whole nematode; d : Male, whole nematode; e : Male, anterior region; f : Male, posterior region.

Table 8

Measurements of *Peltamigratus cerradoensis* sp. n.

Measurements	*Holotype* *Female*	*Allotype* *Male*	*Paratypes* *Female (12)*			*Male (6)*		
			Range	*Average*	*Standard Deviation*	*Range*	*Average*	*Standard Deviation*
L (mm)	0.86	0.77	0.80-0.92	0.86	0.04	0.76-0.82	0.79	0.02
Stylet (µm)	32	31	30.5-33	31.6	0.6	29.5-32	30.9	0.7
a	25	27.9	23.9-27.4	25.4	1.2	25.9-27.9	26.4	0.9
b	8.6	—	7.2-9.6	8.3	0.6	7.1-8.1	7.8	0.3
b′	6.5	5.3	5.3-7	6.2	0.4	5.3-6.3	5.6	0.3
c	44	48	44.4-59.4	50.4	5.1	47.9-58.8	51.7	3.7
o	—	14.3	11.7-23.5	18.6	3.6	14.3-23.9	20.3	4.2
V	58	—	55.4-59.4	57.7	1.2	—	—	—
Ant. phasmid (%)	72	78.9	72.7-80	76.7	2	78.1-80.6	79.6	0.9
Post. phasmid (%)	84	88	83.6-88.8	86.1	1.6	86.0-89.6	87.7	1.5
Spicules (µm)	—	34.7	—	—	—	30.5-34.7	32.8	1.6
Gubernaculum (µm)	—	16	—	—	—	14.5-16	15.3	0.6

Table 9

Measurements of *Peltamigratus raskii* sp. n.

Measurements	*Holotype* *Female*	*Allotype* *Male*	*Paratypes* *Female (7)*			*Male (7)*		
			Range	*Average*	*Standard Deviation*	*Range*	*Average*	*Standard Deviation*
L (mm)	0.83	0.67	0.72-0.83	0.78	0.04	0.66-0.77	0.71	0.03
Stylet (µm)	31	27	29.5-31.5	30.4	0.7	27-30	28.7	0.9
a	34	32	30.8-34	32.5	1	31.4-35.9	33.6	1.7
b	8.1	7.5	7.8-9.4	8.5	0.5	7.1-8.8	8.1	0.5
b′	6.3	5.7	5.2-6.9	6.1	0.5	5.6-6.6	5.9	0.4
c	55	58	55-70	61.1	5	44.2-62.3	54.6	5.8
o	18	12	15-18	16.5	0.9	12-17.7	15.2	2
V	57	—	54-57	56.3	1	—	—	—
Ant. phasmid (%)	79	81	79-82.5	80.7	1.6	78-81.7	79.9	1.3
Post. phasmid (%)	85	86	85-89	86.1	1.5	82.7-90.1	87.2	2.4
Spicules (µm)	—	24	—	—	—	24-29.5	27.2	1.8
Gubernaculum (µm)	—	11	—	—	—	11-13.5	16.1	1

annules), more anteriorly located vulva (54-57 *vs* 57-60) and by the anterior phasmid being located more anteriorly (79-82 *vs* 85-88). *P. raskii* sp. n. differs from *P. paraensis* sp. n. by the distal annules of the tail being wider than the other body annules (*vs* not wider than other body annules) and shorter body (0.72-0.83 mm *vs* 0.85-1.13 mm).

The species name was given in honor of Dr. Dewey J. Raski who contributed much to the taxonomy of nematodes.

Peltamigratus paraensis sp. n.

(Fig. 10)

DIMENSIONS (see Tab. 10)

DESCRIPTIONS

Female (n = 24) : Body spiral or C-shaped after fixation. Lip region hemispherical, not set off from

Table 10

Measurements of *Peltamigratus paraensis* sp. n.

Measurements	Holotype Female	Allotype Male	Paratypes Female (23)			Paratypes Male (5)		
			Range	Average	Standard Deviation	Range	Average	Standard Deviation
L (mm)	0.90	0.91	0.85-1.13	0.94	0.07	0.77-0.96	0.86	0.06
Stylet (µm)	27	29	27-31	29	1.1	26-28	27.2	1.1
a	29	34	28.1-36	31.9	2.2	30.3-33.6	32.3	1.2
b	9.6	9.3	8.1-11	9.3	0.7	8.5-9.6	9	0.4
b′	6.7	6.4	5.9-9.6	7.1	0.9	6.3-6.8	6.4	0.2
c	62	58	49-78	64.7	7.5	55-73	64.3	6.9
o	19	17	15-24	19.4	2.4	13-19	15.5	2.8
V	54	—	53-58	54.9	1.3	—	—	—
Ant. phasmid (%)	84	84	79-86	82.9	2	81-83	81.9	0.7
Post. phasmid (%)	90	90	87-92	89.6	1.6	87-91	89.4	1.5
Spicules (µm)	—	31	—	—	—	28-30	28.6	0.8
Gubernaculum (µm)	—	11	—	—	—	12-13	12.2	0.4

body, rarely with annules. Spear knobs rounded, slightly flattened anteriorly. Body annules in the region between phasmids measure 1.4-1.6 µm. Excretory pore located opposite to posterior esophageal glands. Hemizonid at level of excretory pore or up to two annules away from it. Spermatheca rounded, with sperms. Body width at mid-body measure 30 µm (26-33 µm). Epiptygma simple, poorly developed. Lateral fields with two incisures. Intestine not overlapping rectum. Tail hemispherical with 7-12 ventral annules whose distal ones do not differ from the other tail annules.

Males (n = 6) : Similar to females except in sexual characters.

TYPE MATERIAL

Holotype : Female, collected by C. S. Huang and W. A. Moreira, 1980. Slide number 1106/3A. Nematology Collection of the University of Brasília.

Allotype : Male, same data as holotype. Slide number 1106/2 (1).

Paratypes : Five males and 23 females, distributed as follows : University of California Nematode Collection, Davis (2 females); USDA (2 females, 2 juv.); Muséum national d'Histoire naturelle, Laboratoire des Vers, Paris (2 females, 1 juv.); University of California Nematode Collection, Riverside (2 females, 1 juv.) and the rest in the Nematode Collection of the University of Brasília.

TYPE HABITAT AND LOCALITY

Rhizosphere of palm tree " pupunha " *(Guilielma speciosa).* At the left hand side of Belém-Brasília Highway, 35 km the city of Belém, municipality of Benevides, State of Pará.

DIAGNOSIS

P. paraensis sp. n. differs from closely related *P. luci* Sher, 1964 in having lateral fields with two incisures and longer body (0.85-1.13 mm *vs* 0.71-0.88 mm). *P. paraensis* sp. n. differs from other related species *P. thornei* Knobloch, 1969 in that the lateral fields have two incisures and the presence of males and spermatheca filled with sperms. It is separated from another related species, *P. striatus* Smit, 1971, by the lateral fields with two incisures, the lip region without annules and by the longer body (0.85-1.13 mm *vs* 0.75-0.92 mm). From *P. holdemani, P. paraensis* sp. n. is distinguished by lateral fields with two incisures.

The species name was adapted from Pará, a typical Brazilian Amazonian State, from where the type specimens were obtained.

General comments

Smit (1971) and Doucet (1980) suggested that absence of lateral striation of lip region is not a stable character and therefore should be eliminated from the generic diagnoses of *Peltamigratus.* It is interesting to note that Golden and Taylor (1956) mentioned the presence of lateral striation in the lip region of some individuals of *Rotylenchus christiei* (= *P. christiei* Sher, 1964). The description of Golden and Taylor (1956) apparently escaped the attention of Sher (1964) when the genus *Peltamigratus* was erected. Our studies agree with the observations of Smit (1971) and Doucet (1980).

Sher (1964) considered the position of the anterior phasmid on the right-hand side or the left-hand side of the body as a specific character. Our studies of the Brazilian populations showed that this is an intraspecifically highly variable character of no taxonomic value.

Key to the species of *Peltamigratus* Sher, 1964

1 - Lateral field with transverse lines in the vicinity of the phasmids 2
- Lateral field without transverse lines in the vicinity of the phasmids 7
2 - Epiptygma not observed or simple 3
- Epiptygma double 4
3 - Body length 0.62-0.73 mm and stylet length 26-26.5 µm ..... *P. areolatus* sp. n.
- Body length 0.88-1.1 mm and stylet length 28-32 µm ..... *P. conicori* Doucet, 1980
4 - Males present; female tail rounded ..... *P. perscitus* Doucet, 1980
- Male absent; female tail truncate or conoid 5
5 - Stylet length more than 35 µm, tail truncate *P. longistylus* Doucet, 1980
- Stylet length less than 35 µm; tail conoid or slightly conoid 6
6 - Lip region hemispheric; tail with 6-11 annules .... *P. brevicaudatus* Doucet, 1980
- Lip region truncate, tail with 11-16 annules .. *P. triticeus* Doucet, 1980
7 - Spermatheca not observed, male absent 8
- Spermatheca observed, male present 9
8 - Tail without annules ..... *P. pachyurus* Loof, 1964
- Tail with annules ..... *P. thornei* Knobloch, 1969
9 - Epiptygma simple or double, inconspicuous or poorly developed 10
- Epiptygma double, projected, well developed 16
10 - Lip region markedly set of ..... *P. amazonensis* sp. n.
- Lip region slightly set off or continuous 11
11 - Lateral field with two lines at mid-body 12
- Lateral field with four lines at mid-body 13
12 - Distal annules of female taill not wider than other tail annules ..... *P. paraensis* sp. n.
- Distal annules of female tail wider than other tail annules ..... *P. raskii* sp. n.
13 - Hemizonid anterior to excretory pore ..... *P. striatus* Smit, 1971
- Hemizonid at level of or posterior to excretory pore 14
14 - Lip region truncate ..... *P. browni* Khan & Zakiuddin, 1969
- Lip region hemispheric 15
15 - Body length 0.81-1.1 mm and two phasmids at 78-90 % positions ..... *P. holdemani* Sher, 1964
- Body length 0.7-0.79 mm and two phasmids at 89-93 % positions ..... *P. indicus* Khan & Husain, 1973
16 - Lateral field at mid-body with four incisures 17
- Lateral field at mid-body with two incisures 19
17 - Hemizonid at level of or posterior to excretory pore 18
Hemizonid anterior to excretory pore ..... *P. christiei* (Golden & Taylor, 1956) Sher, 1964
18 - Tail with more than 12 annules; distal tail annules narrower than other tail annules ..... *P. luci* Sher, 1964
- Tail with less than 10 annules; distal tail annules wider than others ..... *P. nigeriensis* Sher, 1964
19 - Hemizonid at level of or posterior to excretory pore 20
- Hemizonid anterior to excretory pore 22
20 - Tail conical without annules or with very weak annules not easily seen ..... *P. levicaudatus* sp. n.
- Tail rounded with annules 21
21 - Stylet 30-33 µm; caudal alae indented distally .... *P. cerradoensis* sp. n.
- Stylet 27-29 µm; caudal alae slightly indented .... *P. macbethi* Sher, 1964
22 - Lip region markedly set off ..... *P. sheri* Andrássy, 1968
- Lip region not set off 23
23 - Tail rounded with annules separated by deep constrictions ..... *P. christiei*
- Tail conical with annules not separated by deep constrictions ..... *P. ibiboca* Monteiro & Choudhury, 1978

ACKNOWLEDGMENTS

We thank Conselho Nacional de Desenvolvimento Cientifico e Tecnológico - CNPq and Financiadora de Estudos e Projetos - FINEP, Brazil, whose financial help made many of the collection trips possible. Gratitude is also extended to Abi S.A. Marques, Centro Nacional de Recuros Genéticos - Empresa Brasileira de Pesquisa Agropecuária (CENARGEN-EMBRAPA), Brasília, Brazil, for preparing the illustrations in this work.

REFERENCES

ANDRÁSSY, I. (1968). Fauna Paraguayensis. 2 Nematoden aus den Galeriewäldern des Acaray-Flusses. *Opusc. Zool. Bdpest*, 8 : 167-315.

DOUCET, M. E. (1980). Description de deux nouveaux *Peltamigratus* et d'une population d'*Hoplolaimus galeatus* (Nematoda, Tylenchidae) de la province de Córdoba, Argentina. *Nematologica*, 26 : 34-46.

DOUCET, M. E. (1984). Trois nouvelles espèces du genre *Peltamigratus* Sher, 1964 (Nematoda : Tylenchida) de la province de Córdoba, Argentina. *Revue Nématol.*, 7 : 35-47.

GOLDEN, A. M. & TAYLOR, A. L. (1956). *Rotylenchus christiei* n. sp., a new spiral nematode species associated with roots of turf. *Proc. helminth. Soc. Wash.*, 23 : 109-112.

HOOPER, D. J. (1970). Handling, fixing, staining and mounting nematodes. *In :* Southey, J. F. (Ed.) *Laboratory methods for work with plant and soil nematodes.* London, Ministry of Agriculture, Fisheries and Food : 39-54.

KHAN, F. A. & HUSAIN, S. I. (1973). A new species of the genus *Peltamigratus* Sher, 1963 (Nematoda : Hoplolaimidae) from India. *Zool. Anz.*, 191 : 136-138.

KHAN, S. H. & ZAKIUDDIN (1969). A new species of the genus *Peltamigratus* Sher, 1964 (Nematoda : Hoplolaiminae) from Trinidad, West Indies. *Ann. Zool. Ecol. anim.*, 1 : 495-498.

KNOBLOCH, N. A. (1969). *Peltamigratus thornei* sp. n. (Nematoda : Hoplolaimidae) from soil in Central America. *Proc. helminh. Soc. Wash.*, 36 : 208-210.

LOOF, P. A. A. (1964). Free-living and plant parasitic nematodes from Venezuela. *Nematologica*, 10 : 201-300.

LOPES, E. B. & LORDELLO, L. G. E. (1980). Nematóides associados à batatinha *(Solanum tuberosum* L.) na Paraíba. *Publ. Soc. brasil. Nematol.*, 4 : 143-157.

MONTEIRO, A. R. & CHOUDHURY, M. M. (1978). *Peltamigratus ibiboca* n. sp. from Brazil (Nemata : Hoplolaimidae), *Revta Agric. Brazil*, 53 : 189-192.

Accepté pour publication le 5 octobre 1985.

SHARMA, R. D. (1976). Nematodes of the cocoa region of the State of Espírito Santo, Brazil. II. Nematodes associated with field crops and forest trees. *Revta Theobroma*, 6 : 190-217.

SHARMA, R. D. (1977). Nematodes of the cocoa region of Bahia, Brasil. VII. Nematodes associated with tropical fruit trees. *Public. Soc. brasil. Nematol.*, 2 : 109-125.

SHARMA, R. D. (1978). Nematóides fitoparasitas associados com cereais e outras culturas no Rio Grande do Sul. *Fitopatol. brasil.*, 3 : 132 [Abst.].

SHARMA, R. D. & LOOF, P. A. A. (1972). Nematodes associated with different plants at the Centro de Pesquisa do Cacau, Bahia, Brazil. *Revta Theobroma*, 2 : 38-43.

SHARMA, R. D. & LOOF, P. A. A. (1974). Nematodes of the cacao region of Bahia, Brazil. III. Plant parasitic and free-living nematodes in the rhizosphere of six different plant-species. *Revta Theobroma*, 4 : 39-43.

SHER, S. A. (1964). Revision of the Hoplolaiminae (Nematoda). IV. *Peltamigratus* n. gen. *Nematologica*, 9 : 455-467.

SMIT, J. J. (1971). Deux nouvelles espèces africaines d'Hoplolaiminae (Nematoda : Tylenchoidae) : *Peltamigratus striatus* sp. et *Scutellonema africanum* sp. n. *Nematologica*, 17 : 113-126.