

Longidoridae from Argentina with the description of *Paraxiphidorus brevistylus* sp. n. (Nematoda: Longidoridae)

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Summary – *Paraxiphidorus brevistylus* sp.n. is described based on male, female, and juvenile specimens from uncultivated soil in Argentina. The new species is characterized by the short odontostyle, the comparatively anterior position of the guide ring, and a combination of body length, lip region width, and number of ventromedian supplements similar to those of *P. michelluci* and ratios a and c, spicule length, and length of lateral guiding pieces similar to those of *P. heynsi*. Additional information is provided on *Xiphidorus minor*, *Xiphinema surinamense*, and *X. krugi*. The reproductive system (structure of the uteri) of Argentinean females of *X. surinamense* was somewhat different from earlier descriptions: in the posterior branch, the proximal part of the uterus is well differentiated from a narrower strongly developed muscular median uterus filled with spiniform crystalloid structures; in the anterior branch, the uterus is long, glandular, and not clearly differentiated. © Orstom/Elsevier, Paris

Résumé – *Longidoridae* provenant d'Argentine avec description de *Paraxiphidorus brevistylus* sp. n. (Nematoda: *Longidoridae*) – *Paraxiphidorus brevistylus* sp.n. est décrit sur des spécimens mâles, femelles et juvéniles provenant de sol non cultivé d'Argentine. Cette nouvelle espèce est caractérisée par un odontostyle court, un guide du stylet en position comparativement antérieure et une combinaison de caractères similaire à celle de *P. michelluci* : longueur du corps, largeur de la région labiale et nombre de suppléments medioventraux ; elle présente également des caractères rappelant *P. heynsi* : rapports a et c, longueur des spicules et des pièces latérales du gubernaculum. Des données nouvelles sont apportées sur *Xiphidorus minor*, *Xiphinema surinamense* et *X. krugi*. Les caractères de l'appareil reproducteur femelle de *X. surinamense* d'Argentine diffèrent quelque peu de ceux précédemment décrits par la partie proximale de l'utérus bien séparée de la partie médiane étroite, très musclée et contenant des structures cristalloïdes spiniformes, ainsi que par l'utérus antérieur long, glandulaire et à peine différencié. © Orstom/Elsevier, Paris

Keywords: Argentina, Longidoridae, nematodes, *Paraxiphidorus*, *Xiphidorus*, *Xiphinema*, Xiphidorini.

An extensive survey of longidorids in Argentina (Luc & Doucet, 1990) resulted in the collection of numerous populations pertaining to various species of *Xiphidorus*: *X. achalae* Luc & Doucet, 1984; *X. balcarceanus* Chaves & Coomans, 1984; *X. saladillensis* Chaves & Coomans, 1984; *X. yepesara yepesara* Monteiro, 1976; *X. yepesara parthenus* Monteiro, Lordello & Nakasono, 1981; and an unnamed species close to *X. achalae*. *X. amazonensis* Uesugi, Huang & Cares, 1985 was recorded later (Decraemer *et al.*, 1996). During recent field trips, several populations of *X. balcarceanus* and one population of *X. minor* Rashid, Coomans & Sharma, 1986 were recorded as well as a new species of *Paraxiphidorus* Coomans & Chaves, 1995, the other genus of the Xiphidorini. *Paraxiphidorus brevistylus* n.sp., the third species described in this genus, was found in association with *Xiphidorus balcarceanus* and *Xiphinema surinamense* Loof & Maas, 1972. The association of two species belonging to the two genera of the Xiphidorini con-

firms the observations made by Coomans *et al.* (1996) and their remark on Xiphidorini being less rare than previously thought. Additional data were collected on the variability of morphometric features and on the variation of uterus structure in *X. surinamense*. These observations led to some comments on the relationships of this species with *X. krugi* Lordello, 1955. Argentinean populations of the latter species were also studied.

The populations of the *Xiphidorus*, *Paraxiphidorus* and *Xiphinema* species studied were the following:

Pop. 1: Pampa de Achala, San Alberto Department, Córdoba Province; rhizosphere of grasses on sandy soil.

Pop. 2: Estancia Los Condoritos, San Alberto Department, Córdoba Province; rhizosphere of grasses on sandy soil.

Pop. 3: Los Gigantes, Punilla Department, Córdoba Province; rhizosphere of grasses.

Pop. 4: Cerro Hermoso; Pampa de Achala, San Alberto Department, Córdoba Province; rhizosphere of grasses on sandy soil.

Pop. 5: San Clemente, Calamuchita Department, Córdoba Province; rhizosphere of grasses.

Pop. 6: Malena, Rio Cuarto Department, Córdoba Province; rhizosphere of soybean.

Pop. 7: Marcos Juarez, Marcos Juarez Department, Córdoba Province; habitat unknown.

Pop. 8: Parque Nacional 'El Palmar', Colón Department, Entre Ríos Province; rhizosphere of grasses.

Pop. 9: El Manzano, Colón Department, Córdoba Province; rhizosphere of *Morus alba*.

The specimens were extracted from the soil by centrifugation-flotation, fixed with 4% formalin, and mounted in pure glycerine using a modified Seinhorst (1959) method. Drawings were made using a Reichert Polyvar light microscope.

Type material of *X. surinamense*, *Paraxiphidorus michelluci*, and *P. heynsi* Coomans, Chaves & De Leon, 1996 was also studied.

***Paraxiphidorus brevistylus* sp.n.**

(Figs 1, 2)

MEASUREMENTS

See Table 1

DESCRIPTION

*Male**: Body long and rather slender, spiral upon fixation, with posterior part more ventrally curved than in female. Cuticle 3 µm thick at neck region and mid-body and 14 µm (holotype) thick at tail tip, with three main layers and with fine transverse striations well defined in the tail region. Lateral chord 4.5 µm at level of cardia, 19 µm wide at mid-body or 26% of the corresponding body width in holotype. Numerous lateral body pores present along the body (twenty in neck region of holotype) but few pores present dorsally and ventrally. Dorsal pores present only in odontostyle region (five, holotype) and ventral pores only in neck region (nine, holotype). Lip region hemispherical to slightly flattened anteriorly, offset by marked constriction. Body cuticle behind constriction bulging outward (3.5 µm thick) due to a thickening of the median layer. Anterior sensilla arranged into inner and outer circles with six and ten sensilla, respectively. Amphids with stirrup-shaped fovea and slit-like opening 10.5 µm wide or 78% (holotype) of head width at constriction. Odontostyle long and slender, with forked base; odontophore with weakly developed flanges, 6-8 µm wide; pharyngeal retractors weakly developed. Guide ring single, posteriorly located. Vestig-

ium present at 73 µm from base of odontophore in holotype and in a male paratype. Pharyngeal bulb not sharply offset from slender part of pharynx; dorsal gland nucleus smaller than both ventrosulateral nuclei. Positions of outlets and nuclei as percentages of bulb length in holotype: DO = 6.5, DN = 31, RSN = 48.5, LSN = 50, and SO = 60. Pharyngo-intestinal junction wide and flattened with rather obscure conoid central valve. Anterior part of intestine with three to four cells in circumference. Prerectum 1.5 to twice as long as the region of copulatory muscles. Reproductive system typical for the genus, entirely contained in the posterior half of the body or slightly longer; sperm 7 × 3.5 µm. Each side of the reproductive system includes four to five ejaculatory glands and 42-46 copulatory muscles extending to a level slightly anterior to the anteriormost supplement. Four (one paratype) or five caudal copulatory muscles present. In some specimens, two cloacal muscles observed between the spicules, and two rectal glands present dorsally from cloaca. Six or eight (in one paratype) equally developed ventro-median supplements present, in addition to the paired genital papilla opposite the posterior third of retracted spicules. Spicules stout, curved ventrad; lateral guiding pieces rod-shaped. Tail dorsally convex-conoid with broadly rounded terminus and slightly concave ventral side, without blind canal; two to three caudal pores on each side, one pore around opposite cloacal opening. Seven to nine subventral body pores in the region of the copulatory muscles.

Female: Similar to males in most respects except for sexual characteristics. Posterior part of body less strongly curved ventrad. Cuticle 3-3.5 µm thick at level of cardia, 3.7-4 µm at mid-body, 14-15.5 µm at tail tip. Lateral chord 19-22 µm wide or 30.5-34% of corresponding body diameter at mid-body. Neck with 4-5 dorsal, 8-11 ventral, and 17-22 lateral pores (n = 2). Vestigium 54-87 µm posterior to base of odontophore. Tail dorsally convex-conoid with broadly rounded terminus without blind canal; two caudal pores present on each side. Reproductive system didelphic-amphidelphic; both branches about equally developed. Uterus without *pars dilatata*; proximal parts of both uteri forming a poorly developed ovejector; sperm present in some cases throughout the uterus, stored in the *pars dilatata oviductus* (= functional spermatheca). Vagina 39-43 µm or 60-72% of corresponding body diameter.

Second stage juvenile: General body shape similar to females. Cuticle 2 µm at mid-body, 9 µm at tail tip; lateral chord 9.5 µm wide or 25% of mid-body width. Tip of the replacement odontostyle 20 µm posterior to base of odontophore. Genital primordium 28 µm long. Tail dorsally convex-conoid, slightly longer than

* The indication of a male specimen as holotype, an uncommon procedure in the description of longidorids, is justified by the type species of the genus with female unknown.

Table 1. Morphometrics of type specimens of *Paraxiphidorus brevistylus* sp. n. (all measurements in μm , except L in mm).

	Holotype	Males	Females	J2	J3
n		2	3	1	2
L	5.26	5.74; 5.99	5.54-5.94	2.27	4.00; 3.58
a	73.1	75.5; 80.9	78.5-98.8	59.6	67.8; 67.5
b	14.9	15.6; 17.1	14.4-17.9	8.2	11.6; 11.7
c	146.1	140.0; 157.6	148-158	70.8	111.1; 111.9
c'	0.8	0.80; 0.79	0.78-0.88	1.14	0.82; 0.91
V/T	51.9	53.2; 54.7	48-49.3		
Lip region diam.	15	15; 15	14-15.6	11	12.6; 12.5
Demarcation diam.	13.5	14; 13	12.5-15.2	10	11.8; 11.8
Amphid aperture length	10.5	9.5; 11	10.5-11	10	9; 9
Odontostyle	81	88; 79	63-80	61.5	75; 72
Odontophore	49	57; 52	48-66	35.5	44; 41
Stylet	130	145; 131	128-133	97	119; 113
Flanges (width)	6	7; 7.8	6.7-8.1	6.7	8.2; 7.4
Guide ring	65	70; 66	65-67	47	- ; 45
Repl. od.				66	85; 78
Neck	354	369; 351	331-392	275	345; 305
Pharyng. bulb - length	73	63; 82	79-85	60	76; 68
- width	23	22; 25	22-25.5	16	22; 25
Hemizonid	185	?; 199	188-215	158	196; -
Nerve ring	206	209; 184	187-221	142	177; 169
Body diam.					
- at cardia	50	55; 55	45-54	33	50; 43
- at mid-body	72	76; 74	46-65	38	59; 53
- at anus/cloacal opening	45	51; 48	40-46	28	44; 35
G1			541; 545*		
- % L			9.6; 9.8		
- ovary			138; 130		
- oviduct			205; 252		
- uterus			289; 261		
G2			527; 531*		
- % L			9.3; 9.6		
- ovary (incl. ovarian sac)			148; 126		
- oviduct (incl. <i>pars dil. ovid.</i>)			223; 224		
- uterus			289; 287		
Genital primordium				28	66; 45
Prerectum	367	347; 802	224 *	169	205; 505
Prerectum/anal body diam.	8.2	6.8; 16.7	4.9; 8.0	6	7.3; 14.4
Rectum			33 *	16	28; 23
Rectum/anal body diam.			0.7; 0.7	0.6	1.0; 0.7
Tail	36	41; 38	35-40	32	36; 32
Spicule left	77.5	82; 84			
Spicule right	77	81.5; 80			
Lateral guiding piece left	18	19; 16			
Lateral guiding piece right	18	18.5; 15			
Suppl. from cloacal opening					
- paired genital papilla	18	20; 18			
- pap. 1	98	93; 79			
- pap. 2	114	105; 90			
- pap. 3	130	119; 106			
- pap. 4	148	138; 120			
- pap. 5	163	153; 138			
- pap. 6	177	171; 156			
- pap. 7		187; -			
- pap. 8		197; -			

* n=2

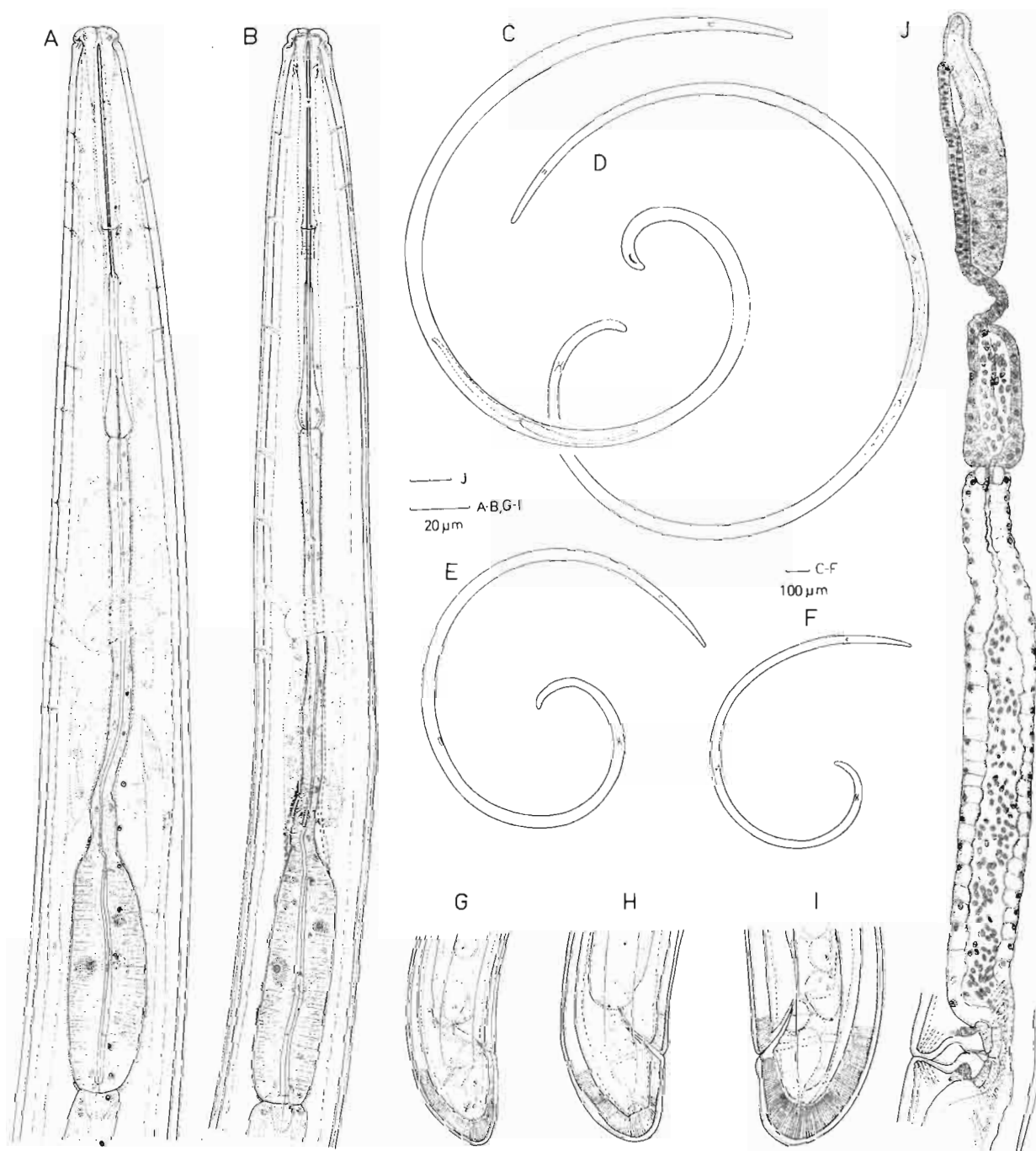


Fig. 1. *Paraxiphidorus brevistylus* sp. n. A: Neck region of female; B: Neck region of male; C: Male holotype, entire; D: Female, entire; E, J3, entire; F: J2, entire; G: Tail of J2; H: Tail of J3; I: Tail of female; J: Anterior branch of female reproductive system.

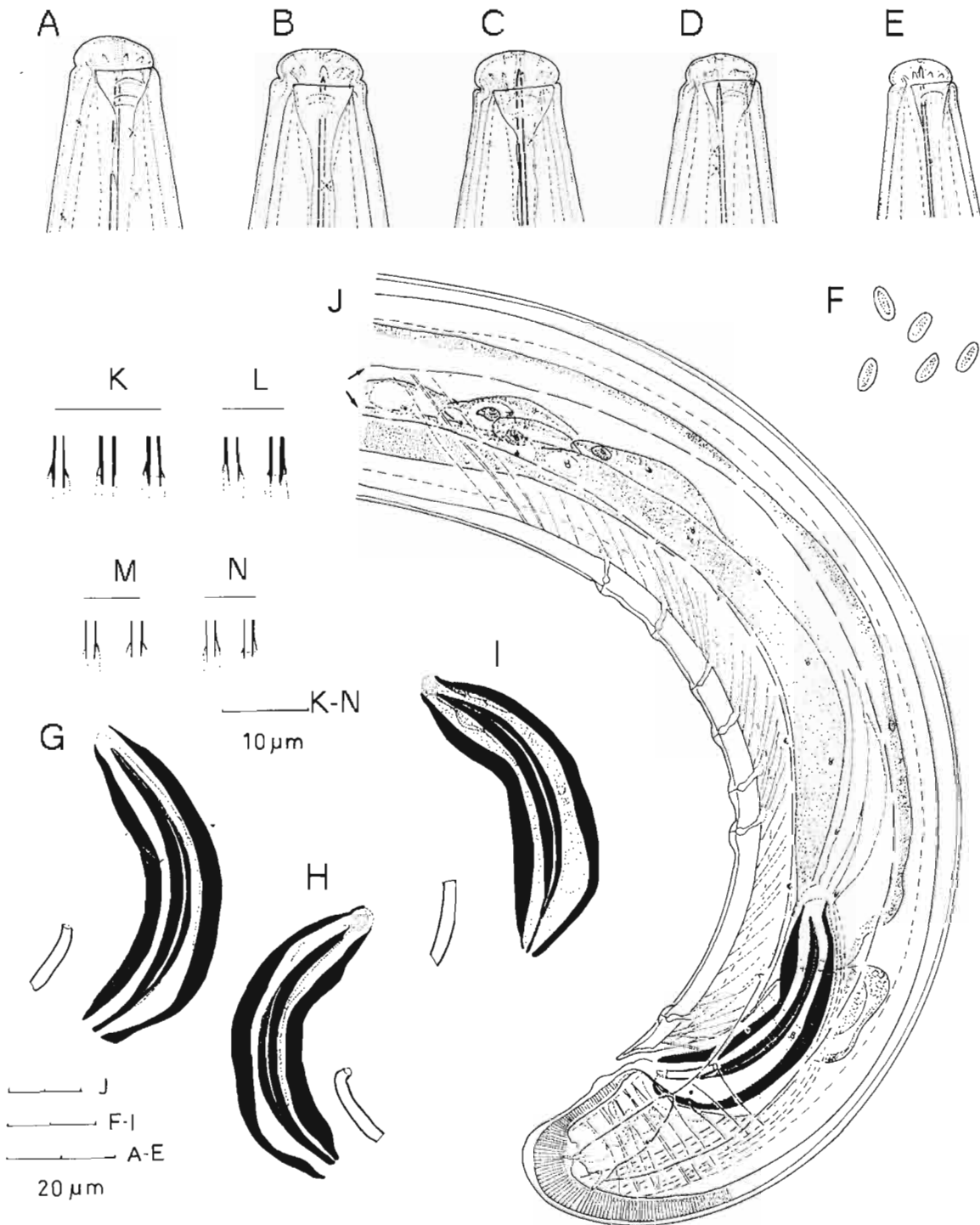


Fig. 2. *Paraxiphidorus brevistylus* sp. n. A: Anterior end of female; B-C: Anterior end of male, resp. holotype and paratype; D: Anterior end of J3; E: Anterior end of J2; F: Sperm (from testis); G-I: Spicules and lateral guiding pieces (H: holotype); J: Posterior body region of male holotype; K: Odontostyle base of three females; L: Odontostyle base of two males; M: J3 functional odontostyle base left, reserve odontostyle base right; N: J2, functional odontostyle base left, reserve odontostyle base right.

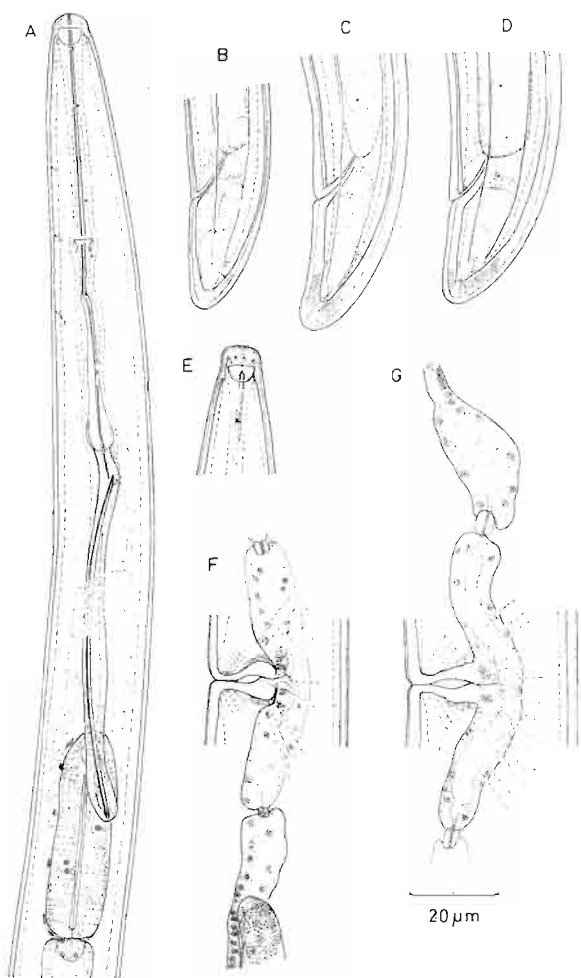


Fig. 3. *Xiphidorus minor*. Preadult. A: Anterior end; B: Tail region. Female C-D: Tail region; E: Anterior end; F-G: Central part of reproductive system.

one anal diameter, *i.e.*, clearly longer than tails of adults.

Third stage juveniles: General body shape similar to females. Cuticle 2.5-3 µm at mid-body, 10.5-12 µm at tail tip; lateral chord 15-17.5 µm or 28-29.5 % of mid-body width. Tip of the replacement odontostyle 4.5-26 µm posterior to base of odontophore. Tail as in females. Genital primordium 45-66 µm long; the more developed ones showing the beginning of a differentiation in two branches.

DIFFERENTIAL DIAGNOSIS

Paraxiphidorus brevistylus sp.n. differs from the other two species of the genus – *P. michelluci* Coomans &

Chaves, 1995 and *P. heynsi* Coomans, Chaves & De León, 1996 – by the shorter odontostyle and the anterior position of the guide ring in males. It further differs from *P. michelluci* by longer spicules and lateral guiding pieces, and from *P. heynsi* by a narrower lip region and lower number of supplements (see Table 2).

TYPE LOCALITY AND HABITAT

Pampa de Achala, San Alberto Department, Córdoba Province, Argentina (Pop. 1); rhizosphere of grasses on sandy soil; associated with *Xiphidorus balcarceanus* and *Xiphinema surinamense*.

TYPE SPECIMENS

Male holotype (slide RAC 105), one paratype female (slide RAC 106), one J3 (slide RAC 107), and one J2 (slide RAC 108) in the Collection of the Centro de Zoología Aplicada, Universidad nacional de Córdoba. One male paratype (slide RIT 556), one female paratype (slide RIT 557), and one J3 (slide RIT 558) in the Collection of the Royal Belgian Institute of Natural Sciences, Brussels. One male paratype (slide RUG 2946) and one female paratype (slide RUG 2947) in the Collection of the Instituut voor Dierkunde, Universiteit Gent, Belgium.

***Xiphidorus minor* Rashid,
Coomans & Sharma, 1986
(Fig. 3)**

MEASUREMENTS

See Table 3.

OBSERVATIONS

Six females and one juvenile (Pop. 9) were studied. The females agree with the original description and type material in all morphological characteristics. Their morphometric data, specifically body length and stylet length, are closer to the specimens from Uruguay (Coomans *et al.*, 1996) (Table 3). The uteri are always short and, except in one specimen, the anterior branch is slightly longer than the posterior one. The juvenile specimen is probably in the pre-adult stage, based on body length, stylet length, and replacement odontostyle as long as odontostyle in female, although its genital primordium is poorly developed (24 µm long) and without differentiation into two branches or into different components.

***Xiphinema surinamense* Loof & Maas, 1972
(Fig. 4)**

MEASUREMENTS

See Tables 4 and 5.

Table 2. Comparison of morphometric data of Paraxiphidorus species (all measurements in μm , except L in mm).

	<i>P. michelluci</i>	<i>P. heynsi</i>		<i>P. brevistylus</i> sp.n.	
	Male	Male	Female	Male	Female
n	2	2	5	3	3
L	4.75; 5.91	6.46; 6.37	5.10-7.32	5.26 - 5.99	5.54-5.94
a	116; 118	80.2; 85.5	63-93	73.1-80.9	78.5-98.8
c''	1.1; 1.03	0.8; 1.0	0.7-0.9	0.8-0.8	0.8-0.9
Lip region diam.	12-14	20-21	19-21.5	15	14-15.6
Odontostyle	128.5; 123	165; 149.5	147-168.5	79-88	63-80
Odontophore	43; 52	60; 66.5	61-72	49-57	48-60
Guide ring	113-115	133-151	124-157	65-70	65-67
V	-	46-48	-	48-49.3	-
Spicule left	55-57	80-86	-	77.5-84	-
Spicule right	54-56	83-85.5	-	77-81.5	-
Lat. guid. piece	12-14	17-20.5	-	15-19	-
Ventromedian suppl.	6; 7	10; 11	-	6-8	-

OBSERVATIONS

The specimens from different populations from Argentina (Pops 1-5) roughly conform to earlier descriptions in morphometric data and in general morphology (Loof & Maas, 1972; Loof & Sharma, 1979; Ferraz, 1980; Luc & Coomans, 1992), and it is thus unnecessary to give a complete redescription of this species. Some variations in morphometric data have been observed, which further enhance the large published intraspecific variability of *X. surinamense*. The lower range of the c-value is extended: $c = 55.9-79$ (males), $c = 65.7-94.5$ (females) vs $c = 63-104$ (males), $c = 67-114$ (females), as well as the lower range of V, due to a more anterior position of the vulva (in specimens from four out of five populations): $V = 32.3-36.4$ vs $36-45$; males have longer and more slender spicules: $77-92$ vs $48-75 \mu\text{m}$, longer accessory pieces: $15-20$ vs $12-14 \mu\text{m}$, and a larger number of single ventromedian supplements varying from four to six vs one to four in earlier descriptions of *X. surinamense*.

The structure of the uteri is somewhat different from earlier descriptions. In the posterior genital branch of the Argentinean females studied, the ovejector (the proximal part of the uterus) is quite distinct from a more or less equally long but narrower, strongly developed muscular median uterus filled with refractive spiniform cristalloid structures. This muscular uterus is demarcated from the glandular distal uterus, which is as long or (usually) shorter than the proximal part. Sperm cells were observed in females of four of the five populations, located in a somewhat inflated proximal part of the narrow oviduct. In the anterior branch, the ovejector is not clearly demar-

cated from the long glandular uterus; the sphincter is less developed than the sphincter of the posterior branch, the oviduct is vestigial, and there is no ovary (Fig. 3B, C).

Previous descriptions of *X. surinamense* mentioned a posterior uterus with a weak or distinct very short muscular part adjacent to ovejector and a short glandular distal part, the anterior uterus being equally developed or longer but similar in structure (Loof & Maas, 1972; Luc & Coomans, 1992). The present study of a female paratype confirms the observations made by Luc and Coomans (1992) on a female specimen from French Guyana, but showed a somewhat longer muscular uterine part in both branches, with some granulation/gravel at this level in the posterior branch (Fig. 4A).

REMARKS

X. surinamense most closely resembles *X. krugi* but is differentiated from this species by a much longer female anterior genital branch with the uterus equally long and of the same structure as the posterior uterus. This results in a usually more posterior position of vulva in *X. surinamense* than in *X. krugi* ($V = 32-45$ vs. $29-36$). With the current extension of the lower range of V in *X. surinamense*, this feature is no longer a reliable diagnostic character (see overlap of data). Other differences include, e.g., the abundance of males in *X. surinamense* (Luc & Hunt, 1978) and shape and length of tail. However, tail shape is a highly variable feature in *X. krugi* (tail with rounded tip or provided with a digitate process).

The main differentiating characteristic between the two species is the structure of the female genital sys-

Table 3. Comparison of morphometric data of *Xiphidorus minor* from Argentina with other populations (all measurements in μm , except L in mm).

	Argentina Pop. 9	Brazil (Rashid. <i>et al.</i> , 1986)			Uruguay (Coomans <i>et al.</i> , 1996)
	Females	J4	Females Type pop.	Pop.2	Females
n	6	1	3	4	2*
L	2.15±0.13 (1.98-2.32)	1.51	1.72-1.74	1.6-1.9	2.47
a	58.3±5.1 (54.5-69.3)	53.8	57-62	63-72	65
b	7.9±0.7 (7.1-8.7)	6.1	6.4-6.6	7.2-7.4	10
c	85.1±11.4 (73.5-96.7)	57.9	75-83	66-81	99
c'	1.3±0.1 (1.2-1.6)	1.5	1.3	1.4-1.6	1.21
V	47.5±1.1 (44.7-47.5)		46-48	49-51	49
Lip region width	9.0±0.4 (8-9)	8.0	-	-	9 (9)
Width fovea	5.4±0.3 (4.5-5.5)	5.2	-	-	6 (4)
Odontostyle	79.0±1.3 (76-80)	65	73-79	74-76	84 (75.5)
Odontophore	40.5±0.8 (39-41)	34	36-37	34-36	39 (38)
Stylet	119.5±1.9 (115-120)	99	109-116	108-111	123 (113.5)
Flanges (width)	5.5±0.3 (5.5-6.0)	-	-	-	-
Guide ring	63.5±6.8 (48-66)	51	67-68	64-66	72 (64)
Repl. odontostyle	-	80	-	-	-
Pharynx	151.5±12.0 (143-170) **	148	143-148	137-146	166-168
Pharyng. bulb - length	49.5±3.6 (46-54)	44	-	-	50 (52)
- width	14.8±0.5 (14-15)	13	-	-	14.5 (15.5)
Hemizonid	115.0±7.5 (115-128)	-	-	-	134
Nerve ring	142±14 (138-175)	127	-	-	146
Vestigium (from od.phore base)	34.0±8.9 (24-46)	-	-	-	-
Body diam.					
- at mid-body (vulva)	35.5±2.7 (32-39)	28	28-30	25-27	-
- at anus	19.5±0.7 (18.5-20)	17	16-17	14-18	-
Prerectum	312±43 (274-390)	314	-	-	-
Prerectum/ anal body diam.	16.4±6.8 (13.7-19.5)	18	-	-	-

End of Table 3 next page

Table 3. (End).

	Argentina	Brazil		Uruguay
	Pop. 9	(Rashid. <i>et al.</i> , 1986)		(Coomans <i>et al.</i> , 1996)
	Females	J4	Females	Females
			Type pop.	
			Pop.2	
Rectum	17.0±0.8 (16-18)	16	-	-
Tail	25.5±2.6 (24-31)	26	21-23	22-28
G1	126±20 (116-175)	-	-	-
- % L	5.9±1.0 (5.47-8.15)	-	-	8.-1
- ovary	38.0±9.9 (28-56)	-	-	152
- ovarial sac	30.0±6.4 (19-34)	-	-	-
- oviduct	51.0±11.4 (48-82)	-	-	114
- spermatheca	25.0±4.2 (22-33)	-	-	-
- sphincter	3.3±0.5 (2.5-4)	-	-	-
- uterus	26.5±6.2 (25-44)	-	-	24
G2	130±18 (101-147)	-	-	-
- % L	6.0±0.7 (4.8-6.3)	-	-	6.1
- ovary	31.0±7.8 (26-48)	-	-	89
- ovarial sac	31.0±6.8 (22-38)	-	-	-
- oviduct	53.5±9.4 (41-63)	-	-	119
- spermatheca	20.0±8.8 (16-39)	-	-	-
- sphincter	3.5±0.7 (2.5-4.5)	-	-	-
- uterus	32.0±3.1 (26-35)	-	-	22
Vagina	19.0±1.0 (17-20)	-	-	-
Genital primordium	-	-	-	-
Width body cuticle	-	24	-	-
- at mid-body	2.6±0.3 (2.2-3)	1.50	-	-
- at tail tip	6.0±0.5 (6-7.3)	5	-	-
Width lateral chord at mid-body	11.5±1.4 (8-12)	8	-	-
in % corresp. body diam.	32.6±3.2 (25-34.3)	29	-	-

* data from damaged female in parenthesis; ** n=5

Table 4. Comparison of morphometric data of different populations of *Xiphinema surinamense* females described (all measurements in μm , except for *L* in mm).

Population	Suriname		Brazil			Fr. Guyana		Argentina (orig.)				
	Type pop.	(Loof & Maas, 1972) Pop. 2	(Loof & Sharma, 1979) Pop. 1	(Ferraz, 1980) Pop. 2	(Carvalho, 1955 in Ferraz, 1980) Pop. 1	(Luc & Coomans, 1992) Pop. 1	Pop. 1	Pop. 1	Pop. 2	Pop. 3	Pop. 4	Pop. 5
n	14	9	30	7	14	1	1	4	1	1	1	3
L		3.21-3.74				2.2	1.29	2.84±0.25	2.91	3.39	3.16	2.78±0.13
	(2.42-2.70)		(1.94-3.11)	(2.08-2.46)	(2-2.5)			(2.66-3.07)				(2.58-2.87)
a	(38-45)	44-49	(42-59)	(50-56)	(40-48)	39	45.8	42.7±3.3 (40.3-45.0)	40.3	47.1	39.4	38.8±1.4 (37.8-39.8)
b	(5.4-6.7)	6.3-7.5	(5.2-7.6)	(5.2-6.1)	(5.1-5.7)	5.2	6.2	6.3±0.4 (6.0-6.6)	6.1	6.5	7.5	7.0±1.5 (5.9-8.1)
c	(71-96)	76-86	(67-114)	(83-95)	(76-87)	68	104.1	67.9±3.0 (65.7-78.7)	74.5	94.2	78.9	71.3±5.9 (67.1-83.1)
c'	-	-	(0.7-1.0)	(0.8-1.0)	(0.8-0.9)	0.8	0.7	0.9±0.0 (0.8-0.9)	0.8	0.8	0.7	0.8±0.0 (0.7-0.8)
V	(36-42)	41-45	(36-43)	(38-41)	(36-39)	39	40.6	35.7±1.0 (34.9-36.4)	32.3	35.0	32.6	39.2±1.4 (38.0-40.2)
G1	-	-	-	-	-	-	-	12.3±0.3 (11.9-14.2)	12.6	13.3	-	15.5±0.7 (15.0-19.9)
Ant. genital branch	-	-	-	-	-	-	-	349.0±38.2 (322-436)	366	451	-	431±40 (403-513)
- uterus	-	-	-	-	-	-	-	329.0±43.8 (298-409)	307	432	-	394.5±37.0 (368-497)
- vestigial oviduct	-	-	-	-	-	-	-	17.5±2.1 (16-34)	55.0	19.0	-	29.5±2.0 (13-31)
G2	-	-	-	-	-	-	-	16.7±2.0 (15.3-18.1)	20.5	18.3	17.5	19.7±3.3 (17.4-26.9)
Post. genital branch	-	-	-	-	-	-	-	472.0±14.1 (462-549)	596	620	552	550±117 (467-694)
- uterus	-	-	-	-	-	-	-	307.0±5.7 (293-319)	348	365	234	270±4 (267-325)
- p.musc.uteri	-	-	-	-	-	-	-	92.5±10.6 (85-108)	100	125	107	97±18 (84-147)
- p.dil.uteri	-	-	-	-	-	-	-	93.5±17.7 (81-106)	117	119	31	77±10 (70-89)
- p.dil.ovid.	-	-	-	-	-	-	-	45.5±7.8 (40-76)	63	53	53	49±7 (44-54)

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Table 4. (End).

	Suriname		Brazil			Fr. Guyana	Argentina (orig.)					
	(Loof & Maas, 1972)		(Loof & Sharma, 1979)	(Ferraz, 1980)	(Carvalho, 1955 in Ferraz, 1980)	(Luc & Cooman, 1992)						
Population	Type pop.	Pop. 2	Pop. 1	Pop. 2	Pop. 1		Pop. 1	Pop. 1	Pop. 2	Pop. 3	Pop. 4	Pop. 5
- narrow part of ovi- duct	-	-	-	-	-	-		56.5±10.6 (49-64)	109	96	132	103±45 (71-135)
- ovary	-	-	-	-	-	-		51.5±13.4 (42-67)	79	108	106	74±38 (47-154)
-ovarial sac	-	-	-	-	-	-		91.5±0.7 (89-108)	89	138	176	215±157 (104-326)
Ant. genit. branch/body diam. at vulva	-	-	-	-	-	-		5.3±0.5 (4.9-6.0)	5.1	6.3		6.0±0.5 (5.7-7.7)
Odontostyle		153-168				126	144	115.5±0.7 (115-120)	128	133	116	112.0±9.9 (105-119)
	(121- 133)		(101- 125)	(101- 109)	(113- 122)							
Odontophore		91-99				85	79	82.5±3.5 (80.0-85.0)	87	95	86	82.5±3.5 (80-85)
	(75-82)		(65-79)	(67-72)	(73-79)							
Stylet		244-267				211	223	198.0±2.8 (196-203)	215	228	202	194.5±6.0 (190-203)
	(201- 215)		(167- 203)	(168- 181)	(186- 200)							
Guide ring	-	-				-	-	90.0±5.7 (84-94)	99	97	95	101.5±5.0 (98-105)
			(90-115)	(94-106)								
Nerve ring	-	-	-	-	-	-	-	234.0±0.0 (232-237)	250	169	-	228.5±13.0 (219-238)
Vestigium	-	-	-	-	-	-	-	274.0±16.3 (263-286)	-	135	-	261.0 (261-273)
Lip region width	-	-	-	-	-	-	-	18.0±0.0	20	18	-	16.4±0.0 (16.0-18.0)
Neck		-				-	-	456.0±17.0 (444-476)	479	525	497	449.0±3.0 (439-451)
	(418- 466)*		(306- 438)	(373- 413)								
Pharynx	-	-	-	-	-	-	-	248.5±17.7 (236-262)	250	295	280	240.0±7.0 (220-245)
Pharyng. bulb: - length	-	-				-	-	89.0±5.7	88	107	95	90.5±3.5 (85.0-96.0)
			(70-115)	(92-102)								(84.0-93.0)
- width	-	-				-	-	28.0±2.8 (26.0-30.0)	28	27	27	26.5±0.7 (23.5-27)
			(14-22)	(17-21)								
Mid body diam.	-	-	-	-	-	-	-	66.5±0.7 (66.0-73.0)	72	72	80	71.5±0.7 (67.0-72.0)
Tail	-	-				-	-	42.0±5.7 (38.0-46.0)	39	36	40	39.0±1.4 (31.0-40.0)
			(20-38)	(23-28)								
Anal body diam.	-	-				-	-	46.0±5.7 (42.0-50.0)	47	48	55	49.5±0.7 (43.0-50.0)
			(28-40)	(28-32)			22					

* values for a mixture of four females and two males.

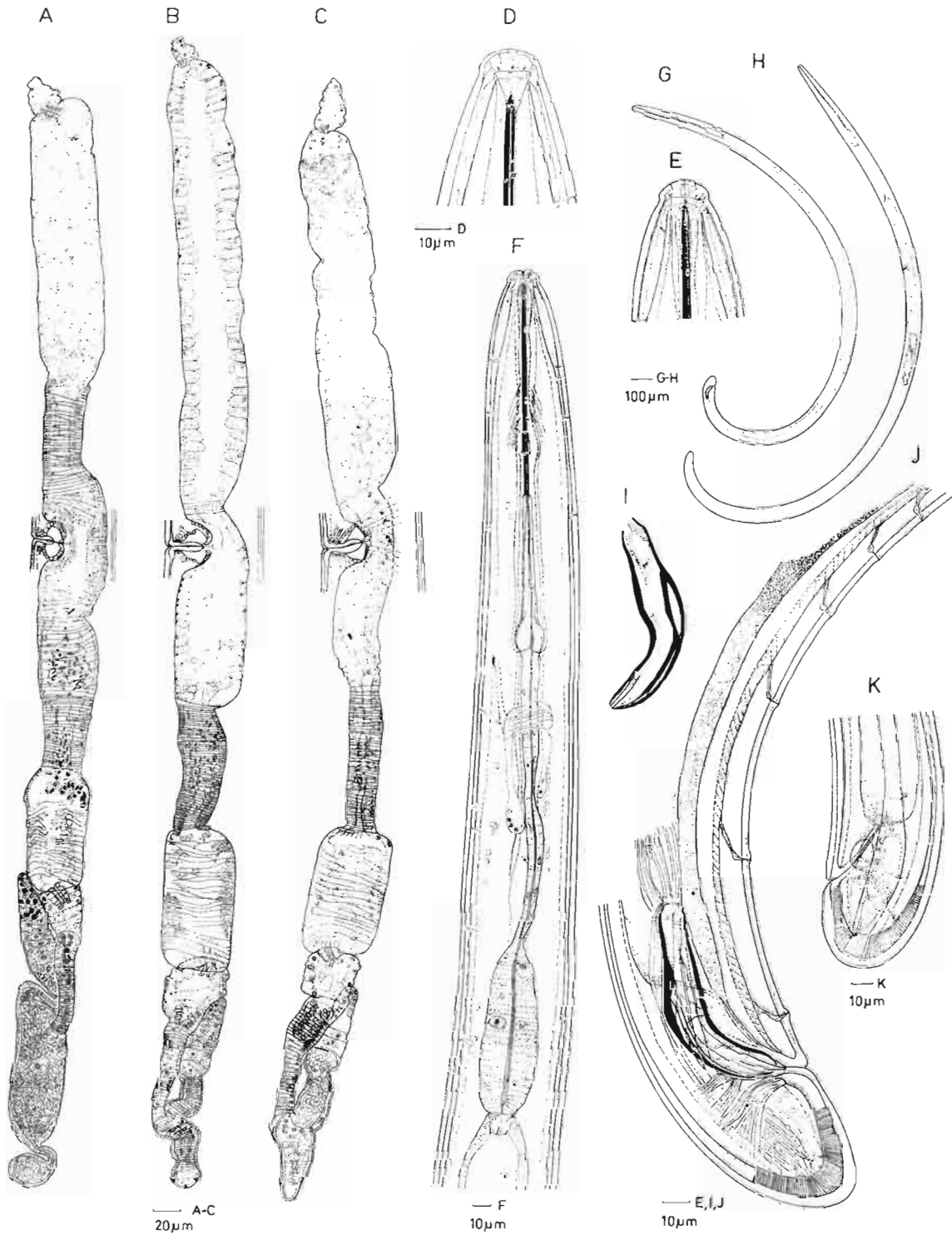


Fig. 4. *Xiphinema surinamense*. Female. A-C: Reproductive system (A: paratype, B-C: specimens from Argentina); E: Anterior end; H: Entire specimen; F: Neck region; K: Tail region. Male. D: Anterior end; G: Entire specimen; I: Spicule; J: Posterior body region.

Table 5. Comparison of morphometric data of different populations of *Xiphinema surinamense* males described (all measurements in μm , except for *L* in mm).

Population	Suriname		Brazil	Guyane	Argentina			
	(Loof & Maas, 1972)		(Loof & Sharma, 1979)	(Luc & Coomans, 1992)				
	Type pop.	Pop. 2	Pop. 1	Pop. 1	Pop. 1	Pop. 3	Pop. 4	Pop. 5
n	11	7	15	1	3	1	2	1
L	(2.19-2.85)	(3.45-3.79)	(1.78-2.48)	2.36	2.92±0.1 (2.72-3.01)	3.22	3.42; 3.44	3.16
a	(42-46)**	(48-60)	(46-62)	52.4	51.2±2.8 (44.5-53.1)	48.1	50.2;42.4	49.3
b	(5.6-6.8)**	(6.4-7.3)	(4.9-7.1)	6.7	8.0±1.7 (6.2-9.2)	6.7	7.7;6.8	6.96
c	(61-81)	(72-82)	(63-104)	90.8	64.1±11.5 (55.9-72.2)	70	72.7;79	60.67
c'	-	-	(0.7-1.0)	0.8	1.0±0.1 (0.8-1.1)	0.92	0.85;0.82	0.98
T	-	-	-	-	70.3±5.7 (66.2-74.3)	69.5	70.9;69.6	71.32
Odontostyle	(125-133)	(157-167)	(97-119)	142	117.0±1.4 (116-118)	129	133;133	119
Odontophore	(75-80)	(93-98)	(63-72)	80	79.5±0.7 (79.0-80.0)	87	92;92	79
Stylet	(203-213)	(251-265)	(161-186)	222	196.5±2.1 (195-200)	216	225;225	198
Guide ring	-	-	(86-114)	-	79.5±9.2 (73-92)	93	106;122	106
Nerve ring	-	-	-	-	217.5±21.9 (202-250)	249	-	219
Vestigium	-	-	-	-	215.0±41.7 (215-274)	266	-;315	275
Lip region width	-	-	-	-	18.0±0.0 (16-18)	18	-;20	16.4
Neck	(418-465)*	-	(300-413)	-	427±20 (413-443)	487	488;525	457
Pharynx	-	-	-	-	229.5±20.5 (215-244)	266	253;279	248
Pharyng. bulb - length	-	-	(72-97)	-	84.5±10.6 (77-92)	93	103;94	96
- width	-	-	(15-19)	-	26.0±0.0 (26-27)	28	21;23.5	27
Mid body diam.	-	-	-	-	57.0±5.7 (53-61)	67	68;81	64
Tail	-	-	(24-31)	26	45.0±8.5 (39-51)	46	47;43.5	52
Spicule	(63-76)	(69-75)	(48-61)	53	77.5±0.7 (77-83)	79	84;92	76/80
Accessory piece	(12-14)	-	-	14	16.5±0.7 (15-17)	18	19;20	16.4
Medioventral suppl.	1	1	3 (2-4)	3	4.5±0.7 (3-5)	6	5;5	4

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Table 5. (End).

Population	Suriname		Brazil	Guyane	Argentina			
	(Loof & Maas, 1972)		(Loof & Sharma, 1979)	(Luc & Coomans, 1992)	Pop. 1	Pop. 3	Pop. 4	Pop. 5
Suppl. from cloacal								
- paired genital papilla	-	-	-	-	20.0±1.4 (17-21)	21	22;20	18
-pap. 1	-	-	-	-	96.5±31.8 (74-119)	94	86;94	126
-pap. 2	-	-	-	-	157.5±26.2 (139-176)	133	122;141	172
-pap. 3	-	-	-	-	193.0±26.9 (174-212)	175	169;170	214
-pap. 4	-	-	-	-	232.5±46.0 (200-265)	222	207;195	260
-pap. 5	-	-	-	-	220***	254	244;244	
-pap. 6	-	-	-	-	-	291		
Cervical pores (left or right)								
- lateral	-	-	-	-	10.7±2.5 (8-11)	10	9;11	11
- dorsal	-	-	-	-	2-3	3	3;3	3
- ventral	-	-	-	-	8±1.7 (6-9)	9	8;7	10

* values for a mixture of four females and two males.

** a = 35 in one specimen; b = 4.8 in one specimen.

*** n = 1.

tem with a non-differentiated posterior uterus, except for a very short enlarged distal part, and a much shorter anterior genital branch in *X. krugi*. Furthermore, the tail end in *X. surinamense* has no blind canal, whereas this structure is present in *X. krugi*.

Xiphinema krugi Lordello, 1955

(Fig. 5)

MEASUREMENTS

See Table 6.

OBSERVATIONS

Females of *X. krugi* were found in several samples from Córdoba Province (Pops 5-7) and in one sample from Entre Rios Province (Pop. 8). They agree with earlier descriptions and show obvious between-population variation in tail shape, from almost regularly ogival with a very slight bulge at its extremity to conoid rounded with a distinct peg, as described by Luc and Hunt (1978). The specimens of Pop. 8 have

low total spear length, which slightly extends the lower limit of the range of values from 154 µm (Brazilian Pop. 3 in Luc & Hunt, 1978) to 151 µm.

Acknowledgements

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References

- COOMANS, A. & CHAVES, E. (1996). *Paraxiphidorus michel-luci* n.g., n.sp. from Argentina (Nematoda: Longidoridae). *Fundam. appl. Nematol.*, 18: 303-306.
- COOMANS, A., CHAVES, E. & DE LEON, L. (1996). *Xiphidorini* (Nematoda: Longidoridae) from Uruguay. *Bull. K. Belg. Inst. Nat. Wet., Biol.*, 66: 5-15.
- DECRAEMER, W., LUC, M., DOUCET, M.E. & COOMANS, A. (1996). Study of the genus *Xiphidorus* Monteiro, 1976 (Nematoda: Longidoridae). *Fundam. appl. Nematol.*, 19: 207-255.

Table 6. Morphometric data of Argentinean females of *Xiphinema krugi* (all measurements in μm , except L in mm).

	Pop.5	Pop.6	Pop.7	Pop.8
n	5	3	1	3
L	2.30 \pm 0.08 (2.23-2.36)	2.37 \pm 0.03 (2.36-2.40)	2.35	2.14 \pm 0.18 (2.07-2.19)
a	46.0 \pm 0.5 (43.8-47.9)	46.6 \pm 0.7 (46.1-48.0)	45.1	54.1 \pm 0.8 (53.5-55.9)
b	5.3 \pm 0.4 (5.1-5.6)	5.7	5.8	6.1 \pm 0.3 (5.7-6.3)
c	61.5 \pm 3.4 (59.1-69.7)	57.4 \pm 4.2 (54.4-60.4)	57.2	55.6 \pm 4.8 (52.2-59.1)
c'	1.2 \pm 0.2 (1.0-1.3)	1.3 \pm 0.0 (1.2-1.3)	1.4	1.4 \pm 0.1 (1.4-1.5)
V	34.4 \pm 1.4 (33.4-35.4)	32.7 \pm 2.2 (30.2-34.2)	33.2	34.0 \pm 0.5 (33.6-34.9)
G1	4.7 \pm 0.7 (4.0-5.2)	4.3 \pm 0.6 (3.9-4.7)	3.6	3.7 \pm 0.8 (3.2-4.3)
Ant. genital branch	107.0 \pm 12.7 (93-116)	102.5 \pm 14.9 (92-113)	86	79.5 \pm 13.4 (70-89)
- uterus	63.0 \pm 2.8 (47-65)	61.5 \pm 10.6 (54-86)		48.0 \pm 9.9 (41-55)
- sphincter	3.1 \pm 0.6 (2.7-3.7)			2.8 (2.5-3)**
- reduced oviduct	17.3 \pm 2.5 (15.5-19.0)	22.0 \pm 1.4 (19-23)		17.8 \pm 8.1 (10-23.5)
Ant.gen.branch/body diam at vulva	2.2 \pm 0.3 (1.9-2.4)	2.0 \pm 0.3 (1.8-2.2)	1.65	2.0 \pm 0.4 (1.8-2.3)
G2	12.8 \pm 0.5 (12.4-19.8)	19.5 \pm 1.8 (18.2-20.8)	12.4	16.4 \pm 3.7 (13.8-22.5)
Post. genital branch	294.0 \pm 22.6 (293-455)	463.5 \pm 48.8 (429-498)	290	350.0 \pm 67.9 (302-465)
- uterus	118.5 \pm 5.0 (100-139)	179.5 \pm 57.3 (59-220)	150	136.0 \pm 19.8 (105-122)
- sphincter	4.6 \pm 1.3 (3.6-8.0)	116 *	2.7	4.8 \pm 0.4 (3.5-5.0)
- spermatheca	17.0 \pm 0.0 (15.5-25.0)	28.0 \pm 17.0 (16-185)	23	16.5 \pm 5.0 (13-20)
- oviduct	71.5 \pm 6.4 (67-98)	104.5 \pm 16.3 (91-116)	79	79.0 \pm 17.0 (67-105)
- ovary	60.5 \pm 2.1 (56-83)	127.0 \pm 2.8 (125-139)	59	51.0 \pm 14.1 (41-90)
- ovarial sac	59.0 \pm 8.5 (53-282)	183.5 \pm 30.4 (160-205)	37	145.0 \pm 91.9 (80-257)
Odontostyle	115 \pm 0.1 (114-117)	111.0 \pm 4.2 (108-114)	110	93.5 \pm 2.1 (92-95)
Odontophore	71.5 \pm 0.7 (69-74)	71.0 \pm 2.8 (69-73)	68	59.0 \pm 0.0 (59)
Stylet	186.5 \pm 2.1 (184-190)	182 \pm 1.4 (181-183)	178	152.5 \pm 2.1 (151-154)
Flanges width	13.5 \pm 0.7 (13-14)	13 *	-	10.5 \pm 0.7 (10-12)
Guide ring	101.5 \pm 0.7 (101-112)	89.0 \pm 2.8 (83-91)	86	80.5 \pm 5.0 (77-85)

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Table 6. (End).

	Pop.5	Pop.6	Pop.7	Pop.8
Nerve ring	207.5±2.1 (200-214)	210.5±2.1 (206-212)	-	171.5±0.7 (171-177)
Vestigium	230.0±4.2 (224-241)	232.5±13.4 (223-242)	-	206.0±4.2 (203-216)
Hemizonid	194 *		-	181.0±1.4 (180-199)
Lip region width	14.3±0.4 (13.5-14.5)	14.1±0.6 (13.5-14.5)	13	11.0±0.0 (11)
Width amphideal fovea	8.6±0.6 (8.2-11.0)	7.8±0.6 (6.5-8.2)	-	7.2±1.1 (6.4-8.2)
Neck	433.5±13.4 (406-443)	417.0±5.7 (413-421)	402	351.5±5.0 (348-362)
Pharynx	233.0±11.3 (221-241)	230.5±3.5 (228-238)	224	192.0±11.3 (184-202)
Pharyng. bulb: - length	91.0±4.2 (86-94)	94.0±5.7 (90-98)	87	76.0±0.0 (76-81)
- width	21.0±1.4 (20-24)	25.5±0.0 (25.2-26.5)	23	17.0±1.4 (16-19)
Vagina	27.3±1.1 (22-27)	27.0±0.0 (24.5-27)		24.5±3.2 (22-26.5)
At vulva: - body diam.	50.0±1.4 (48-51)	51.0±1.4 (50-52)	52	39.5±0.7 (37-40)
- width lateral chord	9.5±0.7 (9-10)	11.0±0.0 (10-11)	-	8.1±1.3 (7.2-9)**
- width cuticle	2.5±0.3 (2-2.7)	-	-	1.8
At anus: - body diam.	32.0±2.8 (30-34)	33.3±1.8 (31-34.5)	29	24.6-27 26.8±0.4
- width lateral chord	8.8±0.4 (8-9)	10.0±0.0 (7.5-10)	-	7.2 (6.4-8)**
Tail	37.5±3.5 (33-40)	41.5±3.5 (39-44)	41	38.5±2.1 (37-40)
Width cuticle at tail tip	12.5±0.7 (11-13)	-	-	14.3±1.8 (13-16)
Tail peg	-	-	-	6.5±0.0 (6.5-10)
Rectum	33.5-±3.5 (31-36)	35.5 (35-36)	-	27.5±2.1 (26-32)
Egg: - length	-	173 (171-175)**	-	-
- width	-	45.5 (44-47)**	-	-

* n=1.

** n=2

FERRAZ, L.C.C.B. (1980). Observations on some *Xiphinema* species found in Brazil (Nematoda: Dorylaimidae). *Nematol. medit.*, 8: 141-151.

LOOF, P.A.A. & MAAS, P.W.TH. (1972). The genus *Xiphinema* (Dorylaimida) in Surinam. *Nematologica*, 18: 91-119.

LOOF, P.A.A. & SHARMA, R.D. (1979). Plant parasitic nematodes from Bahia State, Brazil: the genus *Xiphinema* Cobb, 1913 (Dorylaimidae). *Nematologica*, 25: 111-127.

LORDELLO, L.G.E. (1955). *Xiphinema krugi*, n.sp. (Nematoda, Dorylaimidae) from Brazil with a key to the species of *Xiphinema*. *Proc. helm. Soc. Wash.*, 22: 16-21.

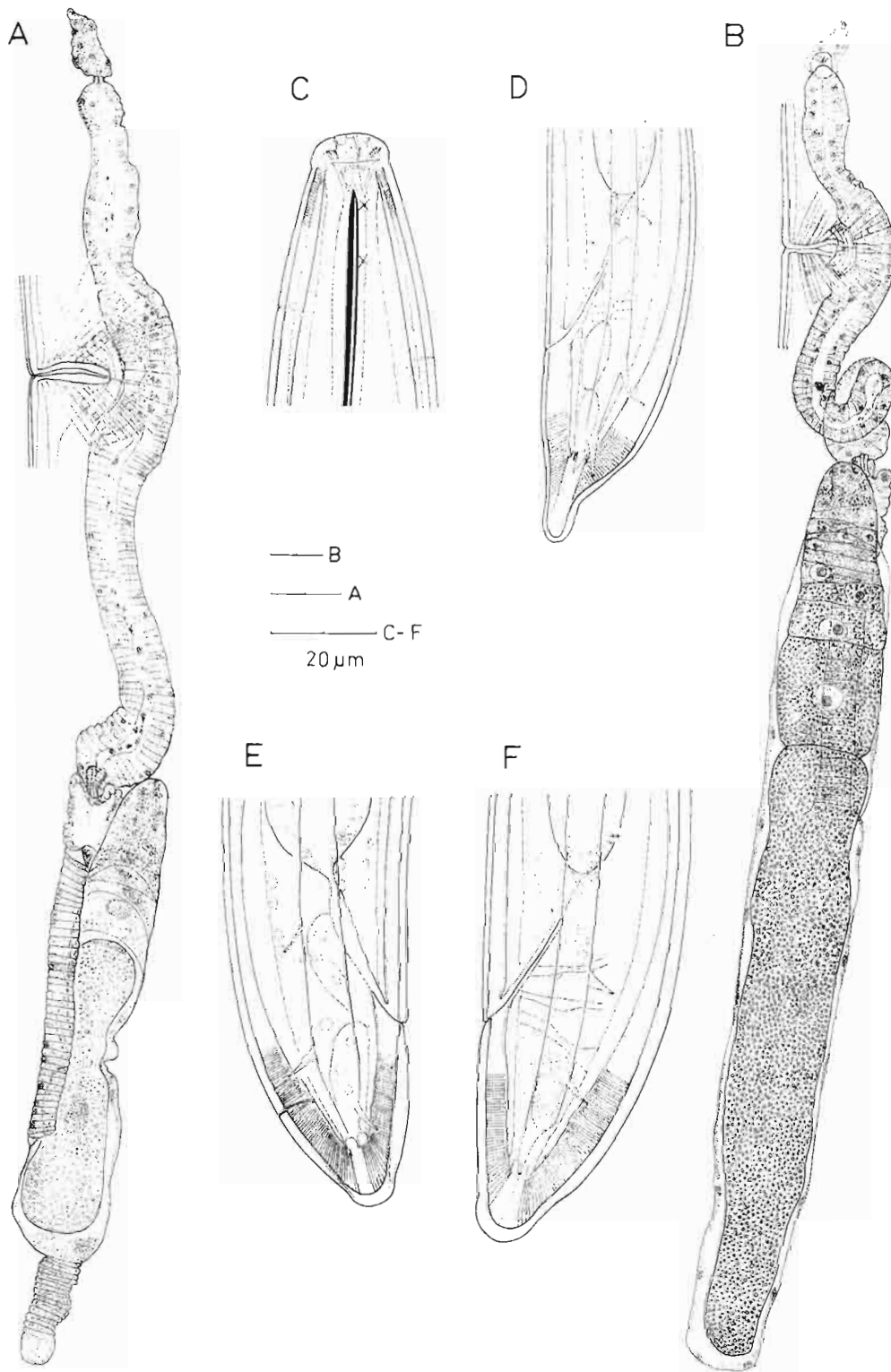


Fig. 5. *Xiphinema krugi*. Female. A-B: Reproductive system; C: Anterior end; D-F: Tail region.

- LUC, M. & COOMANS, A. (1992). Les nématodes phytoparasites du genre *Xiphinema* (Longidoridae) en Guyane et en Martinique. *Belg. J. Zool.*, 122: 147-183.
- LUC, M. & DOUCET, M.E. (1990). La familia Longidoridae Thorne, 1935 (Nemata) en Argentina. 1. Distribución. *Revta Cienc. agropec., Córdoba, Argentina*, 7: 19-25.
- LUC, M. & HUNT, D. (1978). Redescription of *Xiphinema longicaudatum* Luc, 1961 and observations on *Xiphinema krugi* Lordello, 1955 (Nematoda: Longidoridae). *Nematologica*, 24: 1-18.
- RASHID, F., COOMANS, A. & SHARMA, R.D. (1986). Longidoridae (Nematoda: Dorylaimida) from Bahia State, Brazil. *Nematol. medit.*, 14: 235-250.
- SEINHORST, J.W. (1959). A rapid method for the transfer of nematodes from fixative to anhydrous glycerin. *Nematologica*, 4: 67-69.