

## New data on *Psilenchus hilarus* Siddiqi, 1963 and description of two new species of *Psilenchus* de Man, 1921 (Nematoda : Tylenchida) from Argentina

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Accepted for publication 12 September 1995.

**Summary** – One known and two new species of the genus *Psilenchus* are described from Argentina: *P. hilarus* Siddiqi, 1963, *P. pratensis* n. sp., and *P. bahiablancae* n. sp. *P. pratensis* n. sp. is a medium sized and thin species, characterized by a smooth, conical-truncate, slightly set off from body labial area; knobless stylet; lateral fields with four incisures; conical tail with clavate terminus; male spicules 25-32  $\mu\text{m}$  long. *P. bahiablancae* n. sp. is a long and thin species, characterized by a smooth and rounded, slightly set off from body labial area; knobless stylet; lateral fields with four incisures; conical tail with clavate terminus; male spicules 30-38  $\mu\text{m}$  long. *P. pratensis* n. sp. differs from *P. bahiablancae* n. sp. by the shape of labial area (truncate *vs* rounded) and by the length of spicules (30-38 *vs* 25-32  $\mu\text{m}$ ).

**Résumé** – *Nouvelles données sur Psilenchus hilarus Siddiqi, 1963 et description de deux nouvelles espèces du genre Psilenchus de Man, 1921 (Nematoda : Tylenchida) originaires d'Argentine* – Trois espèces, une déjà connue et deux nouvelles, du genre *Psilenchus* de Man, 1921 originaires d'Argentine sont décrites: *P. hilarus* Siddiqi, 1963; *P. pratensis* n. sp. et *P. bahiablancae* n. sp. *P. pratensis* n. sp. est caractérisé par: longueur moyenne du corps; région labiale conique-tronquée lisse, séparée du corps par une faible constriction; stylet dépourvu de boutons basaux; champs latéraux à quatre incisures; queue conique à extrémité légèrement renflée; spicules longs de 25-32  $\mu\text{m}$ . *P. bahiablancae* n. sp. est caractérisé par: région labiale lisse à contour arrondi, séparée du corps par une légère constriction; stylet dépourvu de boutons basaux; champs latéraux à quatre incisures; queue conique à extrémité légèrement renflée; spicules long de 30-38  $\mu\text{m}$ . *P. pratensis* n. sp. se différencie de *P. bahiablancae* n. sp. par la forme de la région labiale (tronquée *vs* arrondie) et par la longueur des spicules (30-38 *vs* 25-32  $\mu\text{m}$ ).

**Key-words**: Argentina, grasses, nematodes, *Psilenchus*.

Nematode surveys made in natural regions in Argentina provided three populations of plant-parasitic nematodes of the genus *Psilenchus* which are here described and illustrated. This genus was cited for the first time in this country associated with potato fields in several sites in the southeastern part of the province of Buenos Aires by Chaves and Torres (1993).

Nematodes were extracted from soil samples by use of centrifugal-flotation method (Jenkins, 1964). Specimens were killed and fixed in hot fixative (Netscher & Seinhorst, 1969) and processed to glycerin (Seinhorst, 1959). Measurements were made on nematodes mounted in glycerin; and are expressed as (range)  $X \pm SD$ , [coefficient of variation]; drawings were made with a camera lucida.

### *Psilenchus hilarus* Siddiqi, 1963 (Fig. 1)

#### MEASUREMENTS

See Table 1.

#### DESCRIPTION

*Female*: Body ventrally curved after fixation like an open C, thin, elongate, with anterior end slightly flattened; posterior end conical elongate. Cuticle with fine transverse annulation about 1  $\mu\text{m}$  wide at mid-body. Annulation of the subcuticle pronounced. Lateral field marked by four incisures, not areolated, occupying a variable percentage of body width: 23-38% ( $28 \pm 4.4$ ); the two internal incisures fainter than the external ones, delimiting a central band narrower than the lateral ones. Head conical truncate, with three to five faint transversal striae on the posterior part of the head, delimiting one first wide cephalic annule and two to four narrow posterior cephalic annules; head 4-6  $\mu\text{m}$  ( $5 \pm 0.4$ ) in height, 8-11  $\mu\text{m}$  ( $9 \pm 0.9$ ) in width, slightly demarcated from body. In face view, labial region divided into four sectors, two lateral, one ventral, and one dorsal, by faint oblique lines; oral aperture circular; amphidial apertures located along the external edges of the lateral sectors. Cephalic framework well marked for the genus, extending posteriorly up to five annules of body. Orifice of dorsal oesophageal gland about 10  $\mu\text{m}$  behind base of stylet. Median bulb located at 90-110  $\mu\text{m}$  ( $99 \pm 5.7$ )

**Table 1.** Morphometrics of *Psilenchus hilarus* Siddiqi, 1963 from Córdoba, Argentina.

	Females	Males	Juveniles
n	19	16	3
L (mm)	1.25 ± 0.1 [8] (1.07-1.44)	1.07 ± 0.1 [9.3] (0.85-1.33)	0.90 ± 0.06 [6.6] (0.84-0.96)
Body diameter	32 ± 4.5 [14.1] (22-38)	22 ± 3.2 [14.5] (18-29)	22 ± 4 [18.1] (18-26)
a	44.7 ± 4.8 [10.7] (37.1-51.2)	48.4 ± 5.1 [10.5] (37.6-55.6)	41.7 ± 5.1 [12.2] (36.7-46.9)
Oesophagus length	164 ± 8.7 [5.3] (146-176)	155 ± 10.5 [6.7] (136-178)	145 ± 1.15 [0.7] (144-146)
b	7.6 ± 0.6 [7.8] (6.5-8.7)	6.9 ± 0.5 [7.2] (6.1-7.9)	6.2 ± 0.3 [4.8] (5.8-6.5)
MB	60.4 ± 2.1 [3.4] (57.9-65.8)	59.7 ± 1.8 [3] (56.2-63.5)	-
Stylet	17 ± 0.7 [4.1] (15-18)	17 ± 1.1 [6.4] (14-18)	16 ± 0.6 [3.7] (15-16)
Conus	7 ± 0.4 [5.7] (6-8)	6 ± 0.6 [10] (4-7)	5.5 ± 0.6 [10.9] (5-6)
m	37.7 ± 6 [15.9] (28.5-53.8)	37.3 ± 3.8 [10.2] (33.3-46.6); 10.2	-
dgo (n = 9)	7 ± 0.9 [13.4] (5-9)	-	-
O (n = 9)	46.5 ± 17.1 [36.7] (35.7-61.5)	-	-
V	50 ± 1.3 [2.6] (47-52)	-	-
V'	54.7 ± 1.4 [2.55] (51.1-56.9)	-	-
Tail length	122 ± 7.9 [6.4] (107-138)	120 ± 11.9 [9.9] (100-149)	102 ± 2.1 [2] (100-103)
c	10.6 ± 0.8 [7.5] (9.3-12.2)	8.9 ± 0.4 [4.4] (8.2-9.6)	9.5 ± 0.05 [0.5] (9.4-9.6)
Body diameter at anus	22 ± 4.2 [19.1] (18-38)	9 ± 1.9 [10] (16-24)	18 ± 2.6 [14.4] (16-21)
c'	5.5 ± 0.7 [12.7] (3.4-6.4)	6.3 ± 0.5 [7.9] (5.3-7.3)	5.4 ± 0.9 [16.6] (4.8-6)
Spicules	-	30 ± 1.7 [5.6] (27-33)	-
Gubernaculum	-	11 ± 1.1 [10] (10-13)	-

All measurements are in  $\mu\text{m}$ , except body length. The disposition of the measurements correspond to the following arrangement: arithmetic mean  $\pm$  standard deviation; coefficient of variation between square brackets; range.

from anterior end, 20-25  $\mu\text{m}$  ( $22 \pm 1.1$ ) in length, 12-14  $\mu\text{m}$  ( $13 \pm 0.6$ ) in width. Hemizonid two to four annules long located from the level of the excretory pore to four body annuli anterior to it. Nerve ring located

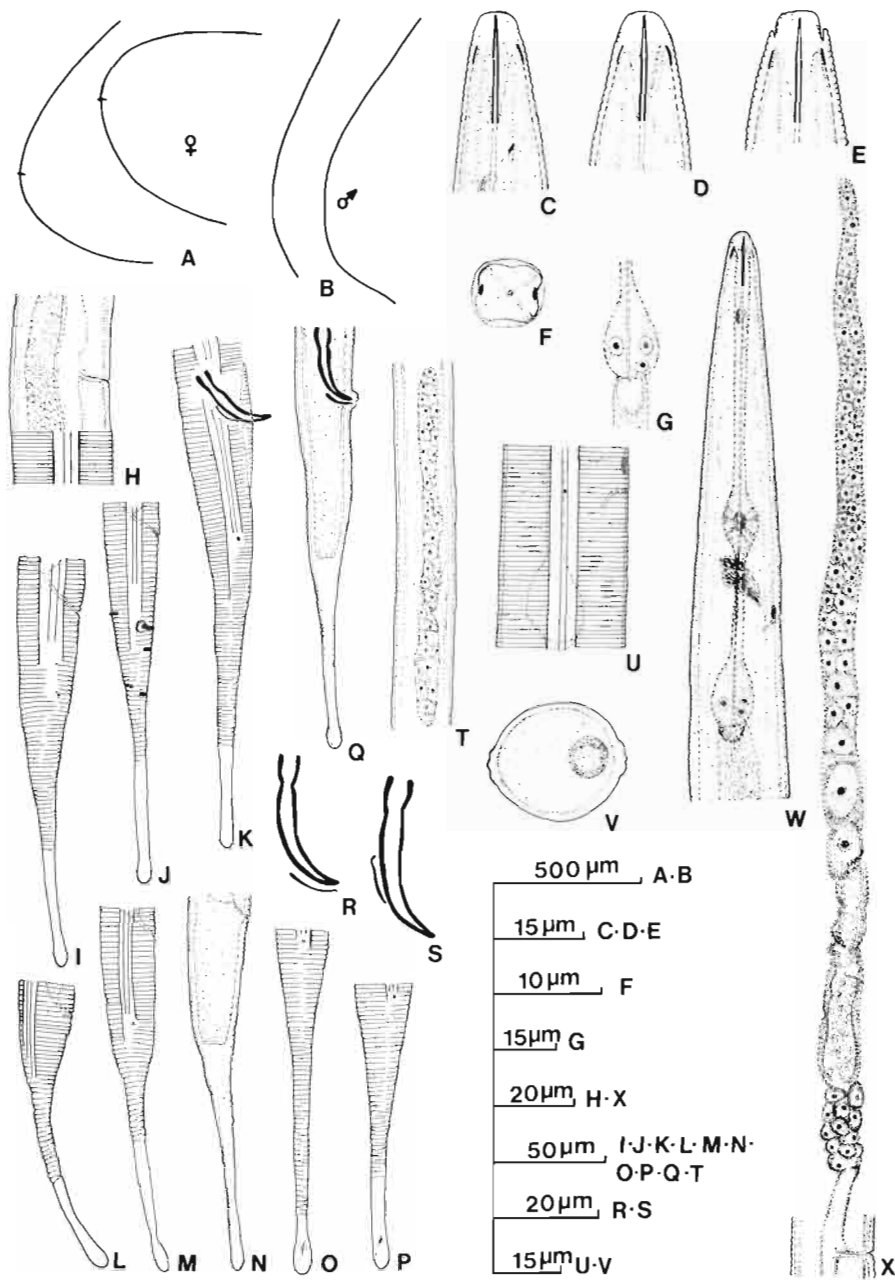
behind the median bulb, at 104-144  $\mu\text{m}$  ( $117 \pm 10.1$ ) from anterior end. Excretory pore located at 112-150  $\mu\text{m}$  ( $129 \pm 7.9$ ) from the anterior end. Deirids clearly visible at level of excretory pore. Isthmus long; oesophageal basal bulb 21-27  $\mu\text{m}$  ( $24 \pm 1.7$ ) in length, 11-16  $\mu\text{m}$  ( $13 \pm 1.5$ ) in width, always offset from intestine. Cardia voluminous, hemispheric. Intestine a straight tube. Genital branches outstretched; proximal region as a quadricolumella. Tail straight (in only one case a marked ventral curvature was observed), conical up to 50 % of tail and then almost cylindrical up to the clavate terminus. Hyaline part occupying 46-78 % of tail length ( $65 \pm 11.3$ ); terminal third of the tail smooth; on the cuticle of one specimen were observed structures similar to those described as parasites for *P. elegans* (Thorne & Malek, 1968). Phasmid punctiform, 10-42  $\mu\text{m}$  ( $30 \pm 6.9$ ) posterior to the anus, at 7-34 % ( $26 \pm 5.7$ ) of tail length.

**Male:** Body slightly ventrally curved after fixation. General morphology similar to females. Cuticle with fine transverse annulation about 1  $\mu\text{m}$  wide at mid-body. Annulation of the subcuticle pronounced. Lateral field with the same pattern as indicated for females, occupying 23-35 % ( $30 \pm 3.9$ ) of body width. Labial area 4-5  $\mu\text{m}$  ( $4.5 \pm 0.4$ ) in height, 8-9  $\mu\text{m}$  ( $8.5 \pm 0.4$ ) in width, continuous with body contour. Face view and cephalic framework as for females. Median bulb at 82-104  $\mu\text{m}$  ( $92 \pm 5$ ) from anterior end, 17-23  $\mu\text{m}$  ( $20 \pm 1.9$ ) in length, 10-15  $\mu\text{m}$  ( $11 \pm 1.3$ ) in width. Hemizonid four to six annules wide, located from just above excretory pore to up to four body annules anterior to excretory pore. Nerve ring at 96-126  $\mu\text{m}$  ( $108 \pm 8.3$ ) from anterior end. Excretory pore located at 107-136  $\mu\text{m}$  ( $121 \pm 7$ ) from anterior end. Deirids well marked at level of excretory pore. Isthmus long; oesophageal basal bulb 20-25  $\mu\text{m}$  ( $22 \pm 1.2$ ) in length, 10-14  $\mu\text{m}$  ( $12 \pm 0.9$ ) in width, offset from intestine. Cardia and intestine as in females. One testis elongate. Spicules and gubernaculum ventrally curved; in some cases, proximal end of gubernaculum strongly curved. Bursa adanal, finely striated. Tail conical, straight, gradually tapering over its whole length; terminus clavate. Hyaline part between 50-65 % of tail length ( $55 \pm 7.08$ ); terminal fourth of the tail smooth. Phasmid punctiform at 21-45  $\mu\text{m}$  ( $33 \pm 5.6$ ) behind anus, 21-40 % ( $28 \pm 4.9$ ) of tail length.

**Juveniles:** General characteristics similar to those of females. It is assumed that the specimens found belong to the third larval stage because their reproductive system is only an outline, and no outlines of vagina or spicules are observed yet. It is represented by a tube of cellular structure, 70-130  $\mu\text{m}$  ( $98 \pm 29.13$ ) long.

#### GEOGRAPHIC LOCALITY AND HABITAT

Associated with the roots of *Poa* sp., soil of natural meadow, sandy acid soil (pH = 6) in Ciudad de Amér-



**Fig. 1.** *Psilenchus hilarus* Siddiqi, 1963 from Córdoba, Argentina – Female. A : Habitus; D-E : Anterior region (lateral view); F : Anterior region (en face view); G : Oesophagus - intestine junction; H : Vulvar region (lateral view); I, J, L, M, N : Tails (lateral view); O-P : Posterior half of tails (lateral view); U : End of oesophagus (lateral view); V : Cross section at middle of body; W : Oesophageal region (lateral view); X : Genital branch (anterior portion) – Male. B : Habitus; C : Anterior region (lateral view); K, Q : Tails (lateral view); R, S : Spicules and gubernaculum – Juvenile (J3). T : Reproductive system.

ica, Santa María Department, Province of Córdoba, Argentina.

#### VOUCHER SPECIMENS

Deposited in the nematode collection of the following institutions: Laboratorio de Nematología, Centro de Zoología Aplicada, Universidad Nacional de Córdoba, Argentina (twelve males, eleven females and three juveniles); Muséum National d'Histoire Naturelle, Paris, France (two males and six females); USDA Nematode Collection, Maryland, USA (two males and one female); Laboratorium voor Dierkunde, Faculteit Wetenschappen, Ghent, Belgium (one male and one female).

#### REMARKS

The population of *P. hilarus* has general morphometrical and morphological characters corresponding to those of the type population (Siddiqi, 1963). In the present population, transversal striae on the labial area are difficult to see and their numbers may vary, whereas five striae were found in the type population.

### *Psilenchus pratensis* n. sp.

(Fig. 2)

#### MEASUREMENTS

See Table 2.

#### DESCRIPTION

*Female*: When killed by gentle heating habitus straight or slightly curved ventrally. Body thin, elongate, cylindrical, with anterior end slightly flattened; posterior end conical, elongate. Cuticle with fine transverse annulation about 1  $\mu\text{m}$  wide at mid-body. Annulation of the subcuticle pronounced. Lateral field marked by four incisures, not areolated, 23-32% (27  $\pm$  3.3) of body width, delimiting three bands of equal width (in only two cases the internal band wider than the lateral ones). The four incisures extending up to the vicinity of the phasmid. Labial area conical flattened, smooth, 3-5  $\mu\text{m}$  (4  $\pm$  0.6) in height, 7-8  $\mu\text{m}$  (7.5  $\pm$  0.5) in width, slightly set off from body. In face view, oral aperture circular, slightly prominent; amphidial apertures dorso-ventrally elongate. Cephalic framework well marked for the genus, hexaradiate, extending posteriorly up to five annules of body. Stylet with thin walls, without thickening at its base. Orifice of dorsal oesophageal gland located about 10  $\mu\text{m}$  behind stylet base. Median bulb ovoid with crescentic valves in the middle, located 70-92  $\mu\text{m}$  (78  $\pm$  5.6) from anterior end, 16-22  $\mu\text{m}$  (18  $\pm$  1.4) in length, 9-19  $\mu\text{m}$  (11  $\pm$  2.4) in width. Hemizonid extending between three to four body annules wide, located from just over the excretory pore to up to ten body annules of body anterior to it. Nerve ring located below the median

bulb, at 86-106  $\mu\text{m}$  (93  $\pm$  6.3) from the anterior end. Excretory pore located at 106-118  $\mu\text{m}$  (112  $\pm$  3.7) from the anterior end. Deirids clearly visible at level of excretory pore. Isthmus long, expanded into oesophageal basal bulb, 18-22  $\mu\text{m}$  (20  $\pm$  1.1) in length, 9-12  $\mu\text{m}$  (11  $\pm$  0.9) in width, offset from intestine (in one case the dorsal part of the oesophageal basal bulb slightly recovering the intestine). Cardia voluminous, hemispheric. Intestine a straight tube. Reproductive system didelphic with genital branches outstretched; ovary with oocytes in two-three rows; oviduct straight or tortuous; spermatheca full of refringent spermatozoa, mostly rounded, sometimes oval or rectangular in shape; proximal region as a quadricolumella; uterus elongate with thin walls; vagina straight; vulva transversely located in a slight depression. Tail conical, slightly curved ventrally, gradually tapering to the clavate tip. Terminal third of the tail devoid of annulation. Phasmid punctiform located at 25-40  $\mu\text{m}$  (33  $\pm$  3.9) from the anus, or 20-29% (25  $\pm$  2.8) of tail length.

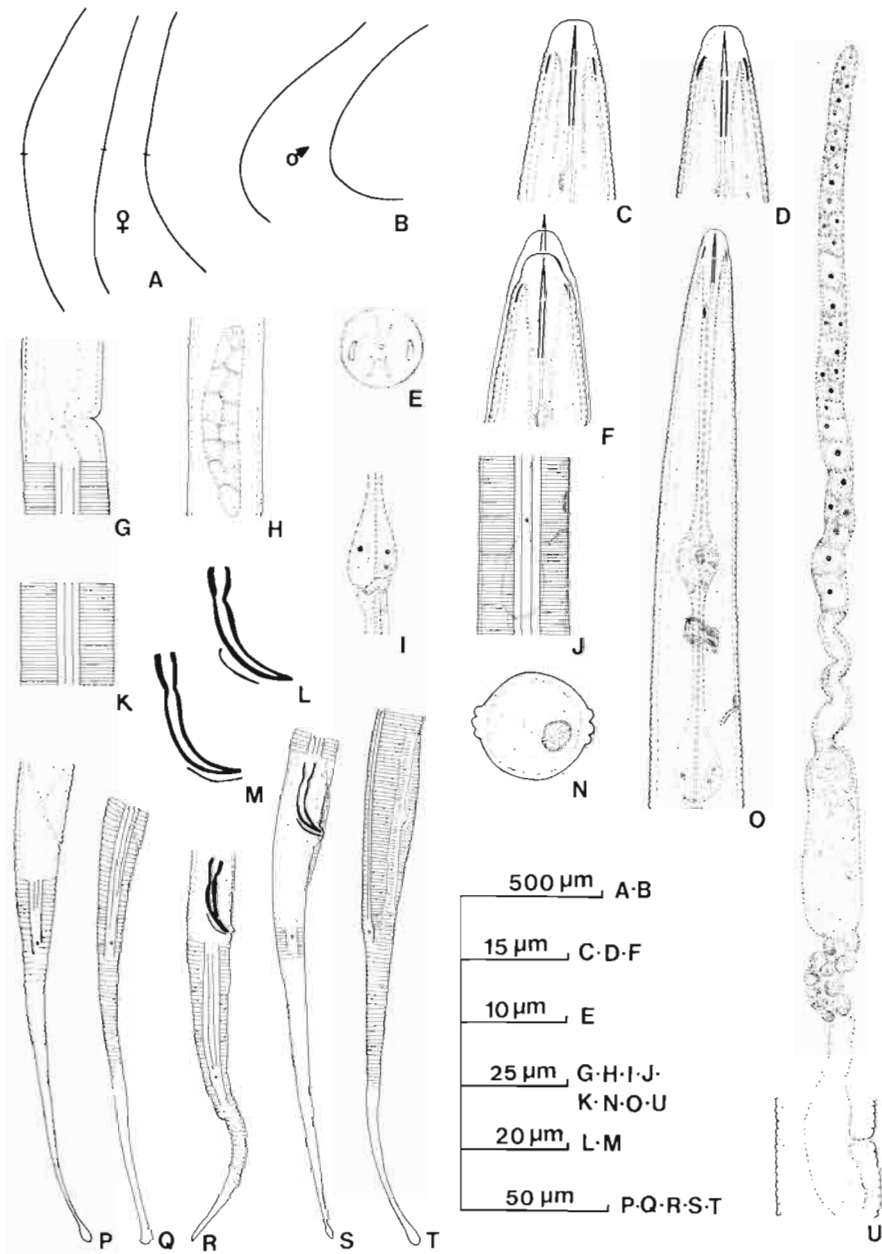
*Male*: When killed by gentle heating, habitus ventrally curved or having the shape of an open C. Body thin, elongate, cylindrical, with anterior end slightly flattened; posterior end conical, elongate. Cuticle with fine transverse annulation about 1  $\mu\text{m}$  wide at mid-body. Annulation of subcuticle pronounced. Lateral field marked by four incisures, not areolated, 25-39% (33  $\pm$  4.6) of body width, with the same pattern as indicated for females; external and internal incisures extending to the proximity of phasmid. Labial area same as in females, 3-4  $\mu\text{m}$  (3.5  $\pm$  0.2) in height, 7  $\mu\text{m}$  (7  $\mu\text{m}$   $\pm$  0) in width, slightly set off from body. Face view, cephalic framework, and stylet as in females. Median bulb ovoid with crescentic valves in the middle, located 60-98  $\mu\text{m}$  (77  $\pm$  8.3) from anterior end, 15-19  $\mu\text{m}$  (17  $\pm$  0.8) in length, 7-10  $\mu\text{m}$  (8  $\pm$  0.7) in width. Hemizonid between three to four body annules wide, located from just above the excretory pore to up to four body annules anteriorly. Nerve ring located below the median bulb, at 76-110  $\mu\text{m}$  (90  $\pm$  7.4) from the anterior end. Excretory pore located at 96-114  $\mu\text{m}$  (106  $\pm$  3.58) from the anterior end. Deirids clearly visible at the level of excretory pore. Isthmus long, expanded into oesophageal basal bulb, 17-23  $\mu\text{m}$  (18  $\pm$  1.8) in length, 8-12  $\mu\text{m}$  (10  $\pm$  0.9) in width, offset from intestine. Cardia and intestine as in females. Testis simple, elongate. Spicules well developed, ventrally curved. Gubernaculum regularly curved or with proximal end deeply curved. Bursa short, or extending to the level of phasmids (in two specimens), finely striated. Tail conical, straight, gradually tapering, terminus clavate; in one specimen tail terminus dorsally curved. Terminal third of the tail devoid of annulation. Phasmid punctiform located at 27-42  $\mu\text{m}$  (35  $\pm$  4.8) from anus, 20-32% (25  $\pm$  3.3) of tail length.

*Juveniles*: General characteristics similar to those of females. It is assumed that the specimens found belong

**Table 2.** Morphometrics of *Psilenchus pratensis* n. sp. from Córdoba, Argentina.

	Females		Males		Juveniles
	Holotype	Paratype	Allotype	Paratype	
n		13		20	3
L (mm)	1.03	1.1 ± 0.08 [7.2] (0.97-1.24)	0.95	0.9 ± 0.06 [6.6] (0.84-1.1)	0.8 ± 0.04 [5] (0.76-0.84)
Body diameter	20	20 ± 2.6 [13] (17-26)	18	17 ± 1.7 [10] (14-20)	16 ± 0 [0] (16-16)
a	51.5	53.2 ± 4.4 [8.2] (45.4-59.3)	53	58.8 ± 5.5 [9.3] (49.1-76.2)	49.4 ± 2.4 [4.8] (47.6-52.2)
Oesophagus length	143	140 ± 10.1 [17.2] (130-166)	134	137 ± 12.7 [9.2] (116-174)	117 ± 3.5 [2.9] (114-119)
b	7.2	7.7 ± 0.8 [10.3] (6.2-9.1)	7.1	7.1 ± 0.5 [7] (6.1-7.8)	6.8 ± 0.6 [8.8] (6.4-7.3)
MB	56	55.9 ± 1.29 [2.3] (53.6-58.1)	60	56.3 ± 1.7 [3] (57.1-59.2)	-
Stylet	13	13 ± 1 [7.6] (12-15)	12	13 ± 0.7 [5.3] (11-14)	12.5 ± 0.57 [4.5] (12-13)
Conus	6	6 ± 0.8 [13.3] (5-7)	5	5 ± 0.8 [16] (4-6)	5 ± 1 [20] (4-6)
m	46.15	47.7 ± 5.6 [11.9] (38.4-58.3)	41.66	41.3 ± 5.5 [13.3] (30.7-50)	-
dgo	-	5.5 ± 1 [18.1] (4-6)	-	(n = 4) 7 ± 0.8 [11.5] (6-8)	-
O	-	40.7 ± 7.8 [19.1] (31-50)	-	(n = 4) 52.6 ± 5.8 [11] (46.1-61.5)	-
V	50	49 ± 2.1 [4.2] (46-55)	-	-	-
V'	58.76	54.7 ± 2.5 [4.5] (50.5-61.2)	-	-	-
Tail length	135	133.5 ± 10.1 [7.5] (110-144)	154	137 ± 11.1 [8.1] (110-157)	107 ± 13.9 [12.9] (91-116)
C	7.6	8.2 ± 0.7 [8.5] (7.2-9.8)	6.2	7.1 ± 0.5 [7] (6.1-8.7)	7.4 ± 0.8 [10.8] (6.7-8.4)
Body diameter et anus	13	14 ± 1.3 [9.2] (12-16)	16	14 ± 0.9 [6.4] (12-16)	13 ± 1 [7.6] (12-14)
c'	10.4	9.3 ± 0.9 [9.6] (8.3-11)	9.6	9.6 ± 0.9 [9.3] (7.3-11.1)	8.2 ± 0.6 [7.3] (7.6-8.7)
Spicules	-	-	29	28 ± 1.6 [5.7] (25-32)	-
Gubernaculum	-	-	10	10 ± 0.9 [9] (8-12)	-

All measurements are in  $\mu\text{m}$ , except body length. The disposition of the measurements correspond to the following arrangement : arithmetic mean  $\pm$  standard deviation; coefficient of variation between square brackets; range.



**Fig. 2.** *Psilenchus pratensis* n.sp. – Female. A : Habitus; C : Anterior region (lateral view); E : Anterior region (en face view); G : Vulvar region (lateral view); I : Oesophagus - intestine junction; J : End of oesophagus (lateral view); K : Mid-body region (lateral view); N : Cross section at middle of body; O : Oesophageal region (lateral view); P, Q : Tails (lateral view); U : Genital branch (anterior portion) – Male. B : Habitus; D : Anterior region (lateral view); K, L : Spicules and gubernaculum; R, S : Tails (lateral view); T : Tail (ventro-lateral view) – Juvenile (J3). H : Reproductive system.

to the third larval stage because the reproductive system is more than a primordium and because no outlines of vagina or spicules were observed. It is represented by a tube of cellular structure, 45-65  $\mu\text{m}$  ( $54 \pm 8$ ) long. According to the length of the genital primordium specimens belong probably to the third stage (see the description of juveniles of *P. bahiablancae* n. sp.).

#### TYPE LOCALITY AND HABITAT

Associated to roots of *Poa* sp. in natural meadow, sandy, acid soil (pH = 6), Ciudad de América, Santa María Department, Province of Córdoba, Argentina.

#### TYPE SPECIMENS

Holotype female and allotype male catalogue number RAC 88, seven females, thirteen males and three juveniles in the collection of the Laboratorio de Nematología, Centro de Zoología Aplicada, Universidad Nacional de Córdoba, Argentina. Two female and two male paratypes deposited in the following institutions: Muséum National d'Histoire Naturelle, Paris, France; USDA Nematode Collection, Maryland, USA; Laboratorium voor Dierkunde, Faculteit Wetenschappen, Ghent, Belgium.

#### DIAGNOSIS AND RELATIONSHIPS

*Psilenchus pratensis* n. sp. is characterized by medium sized and thin body; labial area smooth, conical-flattened, slightly set off from body; stylet knobless; lateral fields with four incisures; conical tail, gradually tapering to the tip, terminus clavate.

It is close to *P. iranicus* Kheiri, 1970, *P. hilarulus*, de Man, 1921 and *P. bahiablancae* n. sp. by most of the measurements. It differs from the first species by the lip region (smooth *vs* striated) and by the post-anal intestinal sac (absent *vs* present); from the second species by the lateral fields (three bands of equal width *vs* middle band narrower than the lateral bands) and by the tail terminus (clavate *vs* filiform); from the third species by the body length (0.97-1.24 *vs* 1.13-1.54 mm), by the lip region (flattened *vs* rounded), and by the length of spicules (30-38 *vs* 25-32  $\mu\text{m}$ ).

#### *Psilenchus bahiablancae*\* n. sp.

(Fig. 3)

#### MEASUREMENTS

See Table 3.

#### DESCRIPTION

*Female*: Habitus slightly curved ventrally or having the shape of a somewhat open "C" when killed by gentle heating. Body thin, elongate, cylindrical, with anterior end hemispherical; posterior end conical elongate.

\* This species is named after Bahía Blanca City, type locality of this species.

Cuticle with fine transverse annulation about 1  $\mu\text{m}$  wide at mid-body. Annulation of the subcuticle pronounced. Lateral field marked by four equidistant incisures, not areolated, 25-42% ( $29 \pm 4.3$ ) of body width. Incisures extend continuously up to the vicinity of the phasmid. Labial area rounded, slightly flattened, smooth, 4-5  $\mu\text{m}$  ( $4 \pm 1.1$ ) in height, 7-8  $\mu\text{m}$  ( $7 \pm 0.5$ ) in width, set off from body by a narrowing of the body contour. In face view, labial sectors divided into four (two ventrolateral and two dorsolateral) sectors by faint lines; oral aperture circular, amphidial apertures elongate. Cephalic framework well marked, extending posteriorly to five annules of body. Stylet with thin walls, without thickenings at its base. Orifice of dorsal oesophageal gland located at 7-8  $\mu\text{m}$  ( $n = 6$ ) from base of stylet. Median bulb ovoid with crescentic valves in the middle, located 66-86  $\mu\text{m}$  ( $75 \pm 4.1$ ) from anterior end, 16-28  $\mu\text{m}$  ( $18 \pm 2.3$ ) in length, 10-22  $\mu\text{m}$  ( $12 \pm 2.2$ ) in width. Hemizonid between three and four annules wide, located from just above the excretory pore to up to five body annules anterior to it. Nerve ring located behind the median bulb, at 86-110  $\mu\text{m}$  ( $101 \pm 5.5$ ) from the anterior end. Excretory pore located at 94-132  $\mu\text{m}$  ( $120 \pm 7.9$ ) from the anterior end. Deirids clearly visible, located just above the level of the excretory pore. Isthmus long, expanded into oesophageal basal bulb, 19-26  $\mu\text{m}$  ( $23 \pm 2.5$ ) in length, 11-31  $\mu\text{m}$  ( $15 \pm 4.3$ ) in width, always set off from intestine. Cardia represented by three well developed cells, separated or fused, forming a structure of hemispherical shape (cardia absent in three specimens). Intestine a straight tube. Reproductive system didelphic with genital branches outstretched; ovary with oocytes in two to three rows; oviduct straight or tortuous; spermatheca axial, short, with refringent spermatozoa, rounded to square-rectangular in shape; proximal region as a quadricolumella; uterus short with thin walls; vagina straight; vulva a transverse slit, with non prominent lips (in three cases, vulvar lips well prominent). Tail conical, straight or slightly curved ventrally or dorsally, tapering gradually to a clavate tip (in one case the tail is short-conoid). Terminal third of the tail devoid of annulation (except in one specimen). Phasmid punctiform located at 25-47  $\mu\text{m}$  ( $34 \pm 5.5$ ) behind the anus, 15-41% ( $22 \pm 5.1$ ) of tail length.

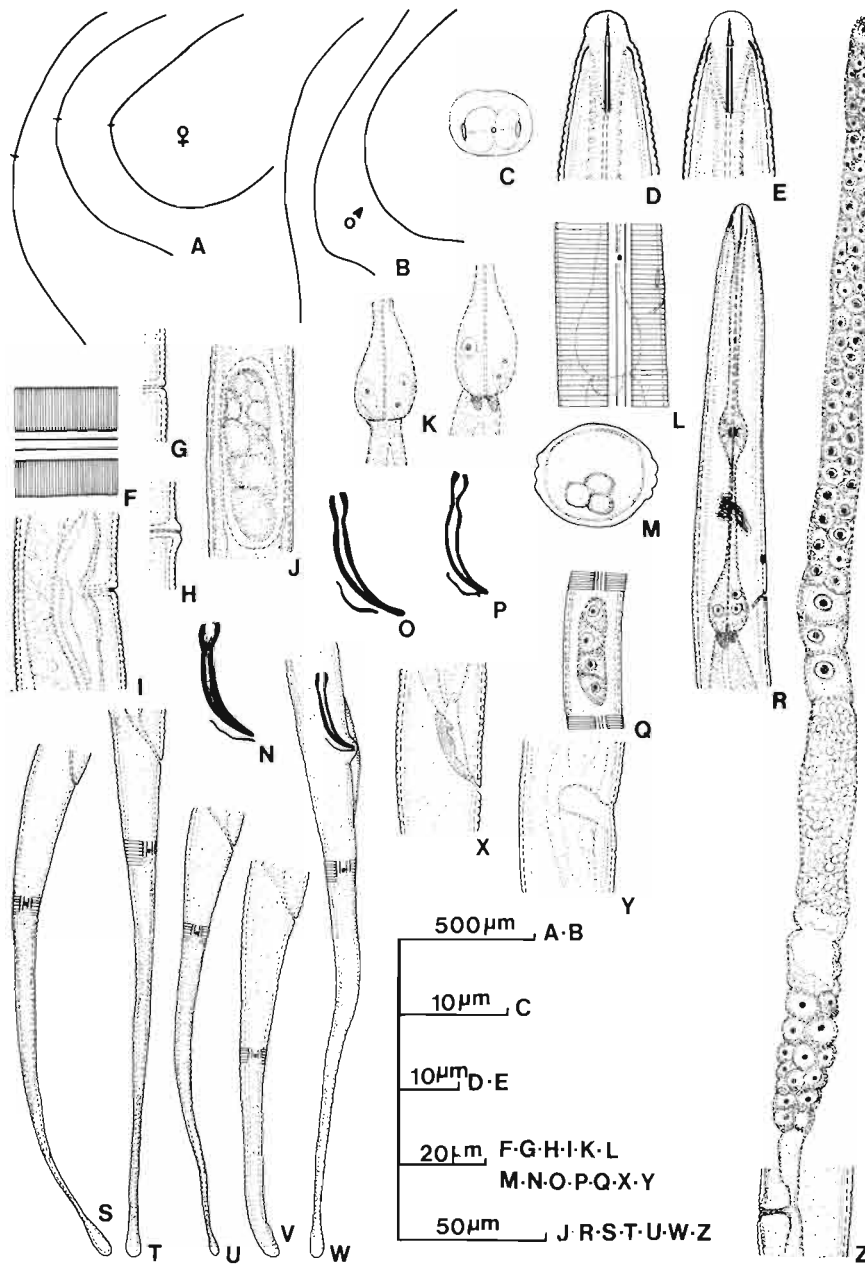
*Male*: Habitus slightly curved ventrally or with the shape of an open C when killed by gentle heating. Body thin, elongate, cylindrical, with anterior end rounded and posterior end conical elongated. Cuticle with fine transverse annulation about 1  $\mu\text{m}$  wide at mid-body. Annulation of the subcuticle pronounced. Lateral field as in females marked by four incisures, not areolated, 25-42% ( $29 \pm 4.3$ ) of body width; central band sometimes wider than the lateral ones in the caudal area; external and internal incisures extend to the vicinity of the phasmid. Labial area rounded, hemispherical, rarely flattened (four cases), 4-5  $\mu\text{m}$  ( $4.5 \pm 0.5$ ) in height;

**Table 3.** Morphometrics of *Psilenchus bahiablancae* n. sp. from Buenos Aires, Argentina.

	Females		Males		Juveniles (J2)	Juveniles (J3)	Juveniles (J4 ♀)	Juveniles (J4 ♂)
	Holotype	Paratype	Allotype	Paratype				
n		31		15	2	3	4	1
L (mm)	1.27	1.4 ± 0.1 [7.1] (1.1-1.5)	1.05	1.1 ± 0.1 [9] (0.9-1.3)	0.5 ± 0.07 [12.7] (0.5-0.6)	0.7 ± 0.02 [2.8] (0.7-0.8)	1 ± 0.04 [4] (0.9-1)	0.98
Body diameter	25	26 ± 3.1 [1.9] (18-32)	18	20 ± 1.9 [9.5] (16-23)	13 ± 1.4 [10.7] (12-14)	15 ± 2.3 [15.3] (14-18)	22 ± 1.2 [5.4] (21-24)	20
a	50.8	52.7 ± 4.9 [9.2] (45.7-70.2)	58	56.7 ± 3.1 [5.4] (50.5-61.8)	45.7 ± 3.9 [8.5] (45.2-48.5)	50.3 ± 5.6 [11.1] (43.9-54.5)	45.6 ± 1.9 [4.1] (43.1-47.9)	49.3
Oesophagus length	138	137 ± 7.2 [5.2] (122-148)	137	131 ± 7.5 [5.7] (117-148)	108 ± 2.8 [2.5] (106-110)	117 ± 1.1 [0.9] (116-118)	131 ± 8.7 [6.6] (120-138)	136
b	9.2	9.8 ± 0.7 [7.1] (8.4-11.6)	7.7	8.7 ± 0.8 [9.1] (6.9-9.9)	5.5 ± 0.1 [2.5] (5.4-5.6)	6.5 ± 0.1 [1.5] (6.3-6.7)	7.8 ± 0.4 [5.1] (7.3-8.2)	7.2
MB	55	54.7 ± 1.4 [2.5] (51.4-58.1)	57	55.9 ± 1.9 [3.3] (52.9-59.6)	-	-	-	-
Stylet	14	14.5 ± 0.9 [6.2] (13-17)	13	14 ± 0.9 [6.4] (13-15)	12 ± 0 [0] (12-12)	13 ± 1 [7.6] (12-14)	13 ± 1.5 [11.5] (12-15)	13
Conus	4	5 ± 0.8 [16] (4-7)	5	5 ± 0.6 [12] (5-7)	4 ± 0 [0] (4-4)	5 ± 1 [20] (4-6)	4.5 ± 0.5 [11.1] (4-5)	5
m (n = 28)	28.57	37.6 ± 6 [15.9] (28.5-53.8)	38.46	37.3 ± 3.8 [10.18] (33.3-46.6)	-	39.1 ± 9.6 [24.5] (31.7-50)	34.1 ± 5.4 [15.8] (28.5-41.6)	-
dgo (n = 9)	-	7 ± 0.9 [13.4] (5-9)	-	-	-	-	-	-
O (n = 9)	-	46.5 ± 17.1 [36.7] (35.7-61.5)	-	-	-	-	-	-
V	47	46 ± 1.8 [3.9] (43-50)	-	-	-	-	-	-
V'	53	51.5 ± 2.01 [3.9] (48.4-55.9)	-	-	-	-	-	-
Tail length	164	163 ± 17.4 [10.6] (114-192)	152	159 ± 19.9 [12.5] (131-186)	70 ± 11.3 [16.1] (62-78)	100 ± 0 [0] (100-100)	125.5 ± 6.2 [4.9] (120-134)	130
c	7.7	8.3 ± 0.7 [8.4] (7.4-11.5)	6.9	7.1 ± 0.5 [7] (6.3-8.1)	8.6 ± 1.6 [18.6] (7.4-9.6)	7.6 ± 0.2 [2.6] (7.3-7.9)	8.1 ± 0.3 [3.7] (7.6-8.4)	7.1
Body diameter at anus	16	18 ± 1.4 [7.7] (16-22)	18	17 ± 1.1 [6.4] (16-19)	10.5 ± 2.1 [20] (9-12)	13 ± 1.1 [8.4] (12-14)	16.5 ± 0.5 [3] (16-17)	18
c'	10.2	9.1 ± 0.9 [9.8] (6.7-11.1)	8.4	9.3 ± 1.2 [12.9] (8-11.6)	6.9 ± 2.4 [34.7] (5.1-8.6)	7.9 ± 0.7 [8.8] (7.1-8.3)	7.7 ± 0.2 [2.5] (7.5-7.8)	7.6
Spicules	-	-	30	33.5 ± 2.1 [6] (30-38)	-	-	-	-
Gubernaculum	-	-	11	12.5 ± 1.5 [12] (10-15)	-	-	-	-

All measurements are in  $\mu\text{m}$ , except body length. The disposition of the measurements correspond to the following arrangement : arithmetic mean  $\pm$  standard deviation; coefficient of variation between square brackets; range.





**Fig. 3.** *Psilenchus bahiablancae* n. sp. – Female. A : Habitus; C : Anterior region (en face view); D : Anterior region (lateral view); F : Mid-body region (lateral view); G, H : Vulvar lips (lateral view); I : Vulvar region (lateral view); J : Egg; K : Oesophagus-intestine junction; L : End of oesophagus (lateral view); M : Cross section at middle of body; R : Oesophageal region (lateral view); S, T, U, V : Tails (lateral view); Z : Genital branch (anterior portion) – Male. B : Habitus; E : Anterior region (lateral view); N, O, P : Spicules and gubernaculum; W : Tail (lateral view) – Juvenile. Q : (J2) : Reproductive system; X : (J4) : Outline of spicules; Y : (J4) : Outline of vagina.

7-8  $\mu\text{m}$  ( $7 \pm 0.3$ ) in width. Face view, cephalic framework, and stylet as for females. Median bulb ovoid with crescentic valves in the middle, located 66-82  $\mu\text{m}$  ( $73 \pm 3.9$ ) from anterior end, 12-18  $\mu\text{m}$  ( $16.50 \pm 1.5$ ) in length, 8-16  $\mu\text{m}$  ( $10.50 \pm 2.3$ ) in width. Hemizonid extending three-six annules wide, located from just above the excretory pore to up to twelve annules above it. Nerve ring located behind the bulb at 82-110  $\mu\text{m}$  ( $97 \pm 6$ ) from the anterior end. Excretory pore located at 98-124  $\mu\text{m}$  ( $113 \pm 7$ ) from the anterior end. Deirids clearly visible just above the level of excretory pore. Isthmus long, expanded into oesophageal basal bulb, 18-29  $\mu\text{m}$  ( $20 \pm 2.7$ ) in length, 8-12  $\mu\text{m}$  ( $11 \pm 1.1$ ) in width, offset from intestine. Cardia and intestine as in females. Testicle simple, elongate. Spicules well developed, ventrally curved. Gubernaculum mostly strongly curved in the middle, with extremities straight or slightly curved. Bursa short, adanal, finely striated. Tail conical, straight, gradually tapering to a clavate terminus. Phasmid punctiform located at 34-52  $\mu\text{m}$  ( $45 \pm 6$ ) from the anus, 22-35 % ( $28 \pm 4.3$ ) of tail length.

**Juveniles:** General characteristics similar to those of females. The juvenile stages have been identified by the length of the genital primordium and by the presence of vagina and spicules outlines. Genital primordium 20-35  $\mu\text{m}$  long, composed of four uniseriated cells in J2; in J3 genital primordium 90-140  $\mu\text{m}$  long; in female J4 s ( $n = 4$ ), the length of genital primordium ranges between 180-220  $\mu\text{m}$  and outline of vagina is present in the mid-body; in male J4s, genital primordium 120  $\mu\text{m}$  long and outline of the spicules present in the cloacal region.

#### TYPE LOCALITY AND HABITAT

Associated to non identified species of grass, banks of the stream Arroyo Napostá Grande river, Bahía Blanca City, province of Buenos Aires, Argentina.

#### TYPE SPECIMENS

Holotype female and allotype male catalogue number RAC 89, 23 females, nine males and ten juveniles in the collection of the Laboratorio de Nematología, Centro de Zoología Aplicada, Universidad Nacional de Córdoba, Argentina. Two female and two male paratypes are deposited in the USDA Nematode Collection, Maryland, USA and Laboratorium voor Dierkunde, Faculteit Wetenschappen, Ghent, Belgium; four females and two males in the Muséum National d'Histoire Naturelle, Paris, France.

#### DIAGNOSIS AND RELATIONSHIPS

*Psilenchus bahiablancae* n. sp. is characterized by a long and thin body; a smooth labial area, rounded, set off from body; stylet knobless, lateral fields with four incisures; long conical tail, gradually tapering to a clavate tip. It is close to *P. iranicus* Kheiri, 1970; *P. hilarulus* de Man, 1921 and *P. bahiablancae* n. sp. by most of the measurements. It differs: from the first species by

the length of the oesophagus (127-148 *vs* 155-183  $\mu\text{m}$ ), by the shape of the lip region (rounded-smooth *vs* flattened striated) and by the post-anal intestinal lobe (absent *vs* present); from the second species by female and male body length (1.13-1.54 *vs* 0.86 mm and 0.9-1.27 *vs* 0.89 mm, respectively), by spicules length (30-38 *vs* 28  $\mu\text{m}$ ), by the shape of the labial area (rounded, slightly flattened, set off by a narrowing of the body contour *vs* rounded with a truncated appearance, continuous with body contour), by lateral field ornamentations (three bands of equal width *vs* middle band narrower than the lateral bands), and by tail terminus (clavate *vs* filiform); from the third species by female body length (1.13-1.54 *vs* 0.97-1.24 mm), by the shape of lip region (rounded *vs* truncate), and by length of spicules (30-38 *vs* 25-32  $\mu\text{m}$ ).

#### Use of characters for species identification in the genus *Psilenchus*

Variability of morphological and morphometrical characters for the genus *Psilenchus* was considered by some authors (Kheiri, 1970; Brzeski 1989, 1991). For each species, the first group of characters appear less variable than the second group. The analysis of described species in this paper has permitted studying the variability of morphometric characters used in the genus *Psilenchus*.

Variability evaluation was based on the analysis of coefficients of variation (CV). Most of the characters analyzed were female characters because the taxonomy of the genus takes into account mostly specimens of this sex.

The exclusive characters of females ("V" and "V'") and males (spicules and gubernaculum length) are the ones that show the lower CV.

Among the characters shared by females and males, only the ratio "MB" show a CV lower than 5 % in the three species. Some characters show similar CV in the three studied species (Table 4). Another character with a low CV in the three species is the distance between anterior end and excretory pore (less than 5 % in *P. pratensis* n. sp. and 5 %-10 % in *P. bahiablancae* n. sp.

**Table 4.** Grouping of biometrical characters according to their coefficient of variation (CV).

CV	Characters
< 5 %	V' - V - MB
5 %-10 %	Stylet length - c - Body length - Distance between anterior end and nerve ring - Tail length
> 10 %	Distance between stylet base and orifice of dorsal oesophageal gland - m

**Table 5.** Correlations coefficients between couplets of morphometrical characters in three species of *Psilenchus*.

Characters	r	<i>P.</i> <i>hilarus</i>	<i>P.</i> <i>pratensis</i> n. sp.	<i>P.</i> <i>bahiablancae</i> n. sp.
Body length/Oesophageal length	0.44	0.56*	0.09	0.17
Body length/Distance between anterior end and excretory pore	0.43	0.54*	0.08	0.50
Body length/Distance between base of oesophagus and vulva	0.80	0.79*	0.87*	0.89*
Body length/Distance between anterior end and vulva	0.87	0.87*	0.91*	0.94*
Body length/Distance between vulva-anus	0.83	0.93*	0.69*	0.77*
Body length/Tail length	0.60	0.74*	0.31	0.36
Oesophagus length/Distance between anterior end and excretory pore	0.45	0.46*	0.59*	0.29
Oesophagus length/Distance between base of oesophagus and vulva	0.10	0.33	-0.22	-0.05
Oesophagus length/Distance between anterior end and vulva	0.32	0.47*	-0.05	0.18
Oesophagus length/Distance between vulva-anus	0.41	0.53*	0.17	0.20
Oesophagus length/Tail length	0.48	0.65*	0.32	0.25
Distance between anterior end and excretory pore/Distance between base of oesophagus and vulva	0.23	0.41*	-0.16	0.13
Distance between anterior end and excretory pore/Distance between anterior end and vulva	0.33	0.48*	-0.05	0.47*
Distance between anterior end and excretory pore/Distance between vulva-anus	0.38	0.48*	0.27	0.34
Distance between anterior end and excretory pore/Tail length	0.40	0.44*	-0.07	0.62*
Distance between base of oesophagus and vulva/Distance between anterior end and vulva	0.95	0.91*	0.99*	0.97*
Distance between base of oesophagus and vulva/Distance between vulva-anus	0.50	0.63*	0.34	0.55*
Distance between base of oesophagus and vulva/Tail length	0.32	0.47*	0.28	-0.06
Distance between anterior end and vulva/Distance between vulva-anus	0.50	0.67*	0.34	0.60*
Distance between anterior end and vulva/Tail length	0.44	0.59*	0.35	0.22
Distance vulva-anus/Tail length	0.39	0.61*	-0.14	0.21
Tail length/Stylet length	0.05	0.04	0.40	-0.35
Body length/b	0.63	0.59*	0.74*	0.74*
Body length/c	0.24	0.00	0.49	0.64*
Body length/c'	0.03	0.24	0.47	-0.69*
Body length/V	-0.32	-0.49*	-0.43	-0.22
Body length/V'	-0.33	-0.39*	0.32	-0.49*
Body length/MB	-0.25	-0.29	-0.13	-0.19
Oesophagus length/V	-0.30	-0.45*	-0.20	-0.11
Oesophagus length/MB	-0.25	-0.43*	-0.02	-0.24
Distance between anterior end and vulva/MB	-0.15	-0.17	-0.36	-0.06
Distance between anterior end and vulva/V	0.17	-0.05	0.79*	0.13
Tail length/c	-0.62	-0.66	-0.67	-0.49*
Tail length/c'	0.65	0.73*	0.42	-0.13

(Numbers followed by \* are significantly different at the 0.05 level)

and *P. hilarus*). In the rest of the characters, the CV can be different according to the species (oesophagus length: CV = 5.2 in *P. bahiablancae* n. sp., 5.3 in *P. hilarus*, and 17.2 in *P. pratensis* n. sp.; conus of stylet: CV = 5.7 in *P. hilarus*, 13.3 in *P. pratensis* n. sp. and 16 in *P. bahiablancae* n. sp.).

The CV for the same character was more or less different between females and males of each species depending on the considered species. If this difference is

indicated as a percentage, that for ratio "a", for example, is 2 % in *P. hilarus*, 12 % in *P. pratensis* n. sp., and 41 % in *P. bahiablancae* n. sp.

Range of variability of morphometrical characters in the genus *Psilenchus* would be different for different species. It has been observed in *P. aestuarius*, *P. hilarulus* and *P. terextremus* that the smallest CV correspond to the following characters: oesophagus length, stylet length, distance between anterior end and excretory

**Table 6.** Ratios of correlation coefficients of selected characters in three *Psilenchus* species.

X	Y	<i>P.</i> <i>hilarus</i>	<i>P.</i> <i>pratensis</i> n. sp.	<i>P.</i> <i>bahiablancae</i> n. sp.
Body length	Distance between base of oesophagus and vulva	0.99	0.49	0.86
Body length	Oesophagus length	1.51	1.05	1.34
Body length	Distance between anterior end and excretory pore	1.21	2.04	1.17
Body length	Distance between anterior end and vulva	1.10	0.68	1.04
Body length	Distance between vulva and anus	0.75	0.85	0.52
Body length	Tail length	0.74	0.93	1.08
Oesophagus length	Distance between anterior end and excretory pore	0.80	1.93	0.87
Oesophagus length	Distance between base of oesophagus and vulva	0.65	0.46	0.64
Oesophagus length	Distance between vulva and anus	0.50	0.80	0.39
Distance between anterior end and excretory pore	Distance between base of oesophagus and vulva	0.81	0.23	0.73
Distance between anterior end and vulva	Distance between vulva and anus	0.68	1.24	0.50
Distance between vulva and anus	Tail length	0.98	1.10	2.05

pore, stylet length + distance between stylet base and orifice of dorsal oesophageal gland (Brzeski, 1989). Despite that, the same author indicates for *P. vinciguerrae* that the smallest CV is of the "distance between anterior end and centre of median bulb" character (Brzeski, 1991).

Correlation coefficients between different morphometrical characters for each of *P. hilarus*, *P. pratensis* n. sp., and *P. bahiablancae* n. sp. were calculated (Table 5). Significant correlations were observed only among few characters for all three species (body length – distance between oesophagus base and vulva; body length – distance between anterior end and vulva; body length – distance between vulva and anus; distance between oesophagus base and vulva – distance between anterior end and vulva; body length – ratio b; tail length – ratio c). For the majority of the other characters correlation is positive especially in *P. hilarus*. In this species, the correlation between distance between vulva and anus – tail length is significant; for the other two species correlation

is not significant, just as it was observed for *P. vinciguerrae* (Brzeski, 1991).

Ratios between coefficients of variability were calculated for some characters (Table 6). For a few of them, and not for all three species simultaneously, the values are near to 1 (the regression line does not pass through the origin); for the others, values were greatly different from other species in this genus (Brzeski, 1989; 1991).

The results obtained in this work and comparisons made between morphometrical characters do not allow definitive conclusions for the genus *Psilenchus* (the number of measured specimens was different for each species and probably not high enough in all the cases). They show that the morphometrical characters would change in different ways according to the species.

The following key is based in the use of morphological characters (except spicules length).

#### Key to the species of *Psilenchus*

- 1 – Labial area striated ..... 2
- Labial area smooth ..... 6
- 2 – Labial area rounded ..... *gigas* Thorne & Malek, 1968
- Labial area truncate ..... 3
- 3 – Lateral field with two incisures ... *striatus* Thorne, 1949
- Lateral field with four incisures ..... 4
- 4 – Tail conical up to 50 % of its length and then almost cylindrical up to the tip ..... *hilarus* Siddiqi, 1963
- Tail conical, gradually tapering to the tip ..... 5
- 5 – External incisures of lateral field smooth. Post anal intestinal lobe present ..... *iranicus* Kheri, 1970
- External incisures of lateral field crenated. Post anal intestinal lobe absent .... *elegans* Thorne & Malek, 1968
- 6 – Labial area rounded ..... 7
- Labial area truncated ..... 13
- 7 – Lateral field with two incisures ..... 8
- Lateral field with four incisures ..... 9
- 8 – Spicules 18–21 µm long ..... *bilineatus* Mizukubo & Nakasono, 1987
- Spicules 24–26 µm long ..... *pini* Lal & Khan, 1990
- 9 – External incisures of lateral field crenated. Post anal intestinal lobe present ..... *aestuarius* Andrassy, 1962
- External incisures of lateral field smooth. Post anal intestinal lobe absent ..... 10
- 10 – Tail tapering to bluntly rounded terminus ..... *klingleri* Brzeski, 1989
- Tail terminus clavate ..... 11
- 11 – Internal band of lateral field wider than the external ones ..... *magnificus* Lal & Khan, 1991
- Bands of lateral field of equal width ..... 12
- 12 – Tail conical up to 50 % of its length and then almost cylindrical up to the tip. Spicules 29 µm long ..... *neoformis* Jairajpuri & Siddiqi, 1963
- Tail conical, gradually tapering to the tip. Spicules 30–38 µm long ..... *bahiablancae* n. sp.

- 13 – Lateral field with two incisures .....  
 ..... *intermedius* Thorne & Malek, 1968  
 – Lateral fields with more than two incisures ..... 14
- 14 – Lateral field with three or five incisures. Posterior end of stylet with minute swellings .....  
 ..... *vinciguerrae* Brzeski, 1991  
 – Lateral field with four incisures. Posterior end of stylet without minute swellings ..... 15
- 15 – Tail terminus clavate. Spicules 25-32  $\mu\text{m}$  long .....  
 ..... *pratensis* n. sp.  
 – Tail tapering to bluntly round terminus. Spicules shorter than 18-24  $\mu\text{m}$  long ..... 16
- 16 – External incisures of lateral field crenated, inner portion areolated around anal region .....  
 ..... *terextremus* Hagemeyer & Allen, 1952  
 – External incisures of lateral field smooth, inner portion not areolated ..... *hilarulus* de Man, 1921

#### Acknowledgements

The author thanks the Consejo de Investigaciones Científicas y Técnicas (CONICET) for the grant N° 0005/92 and the Consejo de Investigaciones Científicas y Tecnológicas de la Provincia de Córdoba (CONICOR) for the grant N° 3068/94 that made this work possible. He is also grateful to Professor D. Tanzola (Universidad Nacional del Sur, Argentina) for sending soil samples from Bahía Blanca City.

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