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Paralongidorus iberis sp.n. and *P. monegrensis* sp.n. from Spain with a polytomous key to the species of the genus *Paralongidorus* Siddiqi, Hooper & Khan, 1963 (Nematoda : Longidoridae)

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Summary – Species of the genus *Paralongidorus* were found for the first time in Spain near Serreta Negra (Huesca), in the North-West of the country. Two new species, *P. iberis* sp.n. and *P. monegrensis* sp. n., are described. *P. iberis* sp. n. is characterized by its medium size (4.4-4.9 mm), rounded set off lip region, stirrup-shaped amphidial pouch and conical dorsally convex tail with conical terminus. It is close to *P. lemoni* from which it differs in tail shape, presence of males, body length, position of guiding ring, and a and c ratios. *P. monegrensis* sp. n. is characterized by its large body size (7.5-12 mm), hemispherical expanded lip region, stirrup-shaped amphidial pouch, and conical dorsally convex tail with rounded terminus. It resembles *P. sandellus* and *P. xiphinemoides*. It differs from *P. sandellus* by its longer body and odontostyle and anterior position of guiding ring, and from *P. xiphinemoides* by presence of males, odontostyle length, position of guiding ring, and c' ratio. A polytomous key of the 70 species described in the genus is proposed and two new combinations are proposed, *P. sativus* (Soni & Nama, 1983) n. comb. and *P. wiesae* (Heyns, 1994) n. comb.

Résumé – Paralongidorus iberis *sp. n. et P.* monegrensis *sp. n. provenant d'Espagne et clé polytomique des espèces du genre* Paralongidorus *Siddiqi, Hooper & Khan, 1963 (Nematoda : Longidoridae)* – Des espèces du genre *Paralongidorus* ont été trouvées pour la première fois en Espagne, près de Serreta Negra (Huesca) dans la région nord-ouest du pays. Deux nouvelles espèces, *P. iberis* sp. n. et *P. monegrensis* sp. n., sont décrites. *P. iberis* sp. n. est caractérisé par une taille moyenne (4,4-4,9 mm), une région labiale arrondie et en relief, des poches amphidiennes en forme d'étrier et une queue conique, convexe dorsalement et à extrémité conique. *P. iberis* sp. n., proche de *P. lemoni*, en diffère par la forme de la queue, la présence de mâles, la longueur du corps, la position du guide du stylet, et la valeurs des coefficients a et c. *P. monegrensis* sp. n. est caractérisé par sa grande taille (7,5-12 mm), une région labiale hémisphérique très en relief, des poches amphidiennes en forme d'étrier, une queue conique, convexe dorsalement à extrémité arrondie. Cette espèces est proche de *P. sandellus* et *P. xiphinemoides*. Elle diffère de *P. sandellus* par sa taille plus grande, un odontostyle plus long, la position du guide du stylet, et de *P. xiphinemoides* par la présence de mâles, la longueur de l'odontostyle, la position du guide du stylet et le coefficient c'. Une clé polytomique des 70 espèces du genre est proposée, de même que deux nouvelles combinaisons : *P. sativus* (Soni & Nama, 1983) n. comb et *P. wiesae* (Heyns, 1994) n. comb.

Key-words : Longidoridae, key to species, *Paralongidorus iberis* sp. n., *P. monegrensis* sp. n. *P. lemoni, P. sandellus, P. xiphinemoides*. Nematodes.

During a nematode survey near Serreta Negra (Huesca), in the North-West of Spain, two populations of the genus *Paralongidorus* Siddiqi, Hooper & Khan, 1963, were found for the first time in Spain. Two new species, *P. iberis* sp. n. and *P. monegrensis* sp. n., were identified in the same soil sample, from a dry area with xerophytic vegetation of a *Rhahmno-Cocciferetum* association, frequent in the valleys and in the shadiest places.

Khan *et al.* (1978) erected the genera *Siddiqia* Khan, Chawla & Saha, 1978 for *Paralongidorus* species having a clear offset lip region and funnel- to stirrup-shaped amphids, and *Longidoroides* Khan, Chawla & Saha, 1978 for those having a continuous lip region, exceptionally expanded, and pouch-like amphids, which left only the species having a continuous lip region and funnel shaped amphid remaining in the genus *Paralongidorus*. Luc and Doucet (1984)* and later Jana and Baqri (1984)** as well as Coomans (1985) regarded *Siddiqia* as a junior synonym of *Paralongidorus*. Hunt (1993) proposed *Paralongidorus* and *Siddiqia* as subgenera in *Paralongidorus* based on head and amphid pouch shapes; in the same year, but later, Siddiqi *et al.* (1993) regarded *Longidoroides* as a junior synonym of *Paralongidorus* on the basis of the variability in the shape and size of amphidial pouch in some species of both genera.

Since amphidial pouches of some species -*P. duncani; P. hooperi; P. esci; P. sativus; P. spiralis; P. strelitziae; Paralongidorus* sp. *in* Rashid *et al.* (1986)- do not correspond to the funnel or bilobed types, we consider also the genera *Longidoroides* and *Siddiqia* as junior synonyms of *Paralongidorus*, and do not recognize the subgenera proposed by Hunt (1993) as valid. *Longidoroides sativus* Soni & Nama, 1983 and *L. wiesae* Heyns, 1994 are transfered to *Paralongidorus* as *P. sativus* (Soni &

* August 1984.

** December, 1984.

Table 1. *Morphometric data of* Paralongidorus iberis *n. sp.* (All measurements in μm except L in mm).

	Holotype	Paratypes					
		Females	Males	J1	J2	J3	J4
n		18	14	5	9	6	10
L	5.3	5.8 ± 0.6 (4.4-6.9)	5.1 ± 0.7 (3.6-5.9)	1.9 ± 0.6 (1.5-3.0)	2.6 ± 0.1 (1.9-3.1)	3.6 ± 0.6 (2.5-4.3)	3.9 ± 0.6 (2.8-4.6)
a	176	191.3 ± 26.1 (138-262)	179 ± 25 (121-223)	104 ± 23 (81-141)	130 ± 18 (107-160)	155 ± 16.3 (129-178)	168 ± 25 (141-202)
b	18	15.1 ± 5.9 (12-23)	16.2 ± 2.5 (11-16)	8.6 ± 3.1 (7-13)	10.3 ± 2.4 (7-15)	11.4 ± 2.8 (8-16)	13 ± 1.7 (11-16)
c	106	124 ± 17.7 (98-178)	108 ± 13 (80-124)	43.7 ± 12.2 (36-65)	58 ± 11 (39-73)	76.4 ± 14.6 (51-91)	82 ± 9.5 (72-98)
c'	3.1	2.2 ± 0.3 (1.9-3.1)	2.1 ± 0.1 (1.9-2.4)	3.2 ± 0.4 (2.7-3.9)	3 ± 0.3 (2.4-4)	2.5 ± 0.2 (2-3)	2.6 ± 0.2 (2-3)
V	51	49 ± 2.3 (46-56)	– –	– –	– –	– –	– –
Stylet	110	112 ± 7.9 (104-126)	104 ± 13 (82-119)	81 ± 5.3 (75-86)	86 ± 4.1 (81-95)	94 ± 6.3 (86-101)	95 ± 10.4 (78-107)
Odontostyle	66.5	66.7 ± 4.4 (61-80)	65.7 ± 5.1 (56-73)	49 ± 3.3 (44-53)	52 ± 2.6 (47-54)	57 ± 3.6 (54-60)	57.8 ± 6.2 (48-66.5)
Odontophore	43.7	45.7 ± 5 (38-55)	38.7 ± 8.8 (21-50)	34.4 ± 6 (27-42)	34 ± 4 (28-42)	37 ± 4.4 (32-41)	40 ± 9.6 (28-63)
Rpl. od.style	–	–	–	48.6 ± 1.2 (46-49)	56 ± 3.3 (52-62)	61 ± 2 (58-63)	68.6 ± 4.6 (64-78)
Tail	50.3	47 ± 4.3 (39-55)	47.3 ± 3 (43-52)	43.3 ± 2.7 (40-47)	46 ± 3.8 (41-55)	47.5 ± 3.3 (42-51)	47 ± 4.2 (40-56)
Guiding ring	22.8	23.7 ± 1.1 (22-26)	24.2 ± 1.6 (21-28)	17 ± 1.2 (16-19)	19 ± 1 (18-21)	22 ± 2 (20-25)	21 ± 1.5 (18-24)
Spicule	–	–	34 ± 2	–	–	–	–
	–	–	(30-38)	–	–	–	–
Supplements	–	–	(6-9)				

Nama, 1983) n. comb. and *P. wiesae* (Heyns, 1994) n. comb.

Nematodes were extracted by Flegg's method, fixed in hot F.G. 4/1 and processed and mounted in anhydrous glycerin by the Seinhorst's rapid method.

Paralongidorus iberis* sp. n.
(Fig. 1)

MEASUREMENTS

See Table 1.

DESCRIPTION

Female : Body elongate-slender, C-shaped or ventrally arcuate when relaxed by gentle heating. Large size, maximum width 24-26 μm. Cuticle smooth, 2-3 μm thick at oesophageal region, 4-6 μm at midbody and on tail. Lip region 8-10 μm wide, rounded, flattened anteriorly, well set off by constriction at level of amphidial aperture. Amphidial aperture distinct, slit-like, 3-4 μm wide or about half as long as head width, fovea stirrup-shaped. Lateral body pores arranged in lateral hypodermal chords irregularly along the body. Odontostyle thin, straight, slightly arcuate in posterior half, 6-8 times head width long or about 1.5-2 times odontophore length, with smooth unsplit base. Odontophore with slightly swollen posterior region. Stylet guiding ring single, 2-3 head widths from anterior end. Oesophagus dorylaimoid, posterior enlarged part cylindroid, 77-96 × 9-11 μm. Cardia cylindroid-rounded. Nerve ring just behind stylet. Vulva a transverse slit with slightly raised lips or flush with body surface, 2.62-3.20 mm from anterior end of body, 2.1-3.2 mm from tail terminus. Vagina about 60 % body width long. Two branches of reproductive organs equally developed; a distinct sphincter present at the junction of muscular and glandular parts of the uterus. Rectum 22-29 μm long. Conoid dorsally convex tail, with conical terminus.

* From the Latin name (Iber) of the river Ebro, close to the type locality.

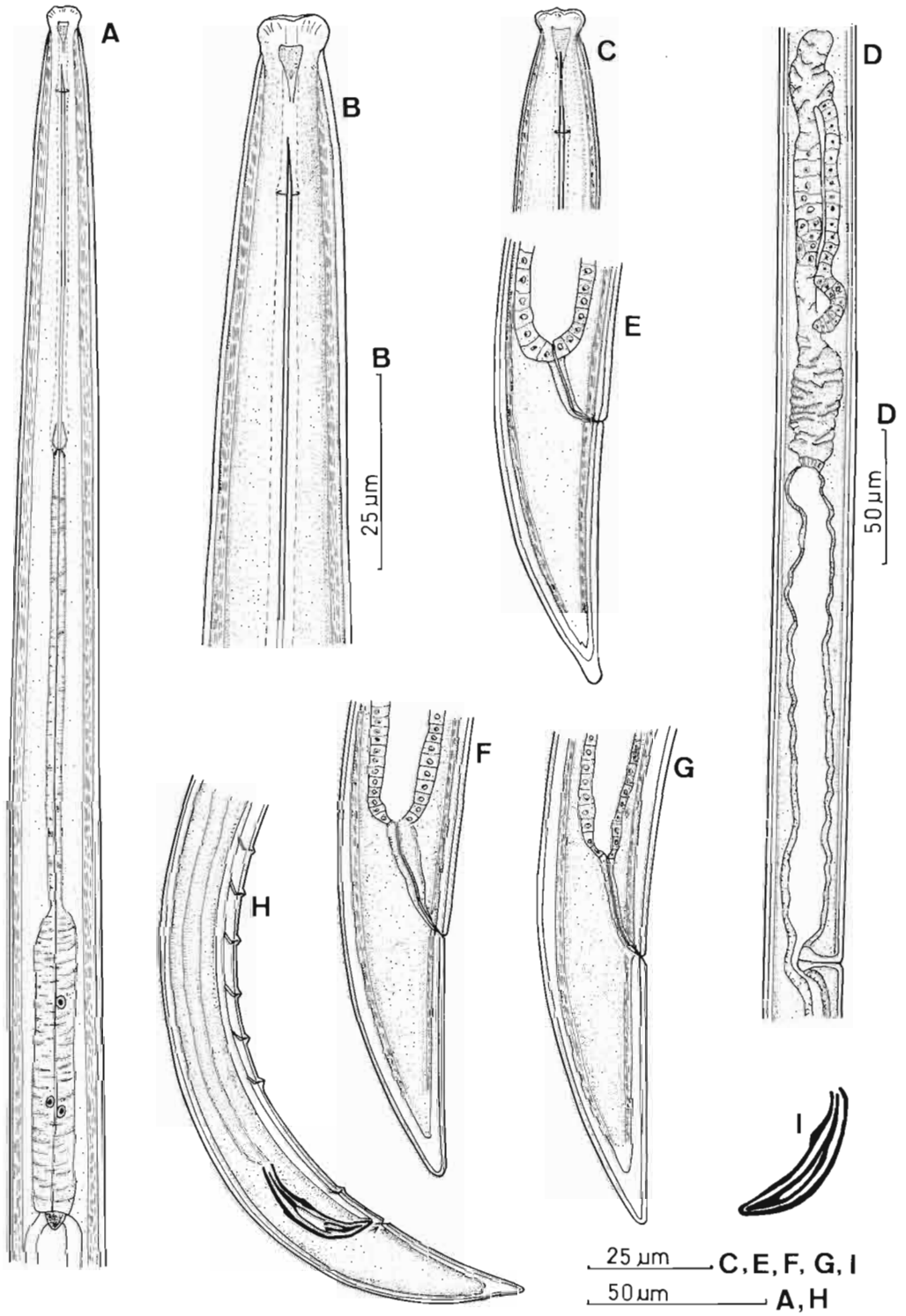

Fig. 1. Paralongidorus iberis *sp. n. A : Oesophageal region; B-C : Anterior region of juvenile and female respectively; D : Anterior genital branch; E-H : Tail region of J1, J2, female and male, respectively; I : spicule.*

Male : Body ventrally curved in a C-shape; tail end curved. Cephalic region, cuticle, stylet and oesophagus as described for female. Testes paired, dorylaimoid; sperm oval to sausage-shaped, about 3.5-4 µm long and 1.5-2 µm wide. Supplements consisting of one adanal pair opposite the middle of the spicules, and a ventromedial series of six to nine supplements starting near the proximal end of the spicules or 42-49 µm from the cloacal opening. Spicules thick, slightly arcuate ventrally; with distinct lateral guiding pieces. Pores arranged irregularly along the body. Tail dorsally convex-conoid, ventrally slightly concave, attenuated towards the conical somewhat spicate terminus with thickened hyaline inner layer of the cuticle.

Juveniles : Resembling female except by tail length and shape (more elongate). First stage juvenile tail with a somewhat digitate terminus.

Type habitat and locality

Soil around plants of *Rhamno-Cocciferetum* association in Barranco de la Valcuerna, Peñalva, province of Huesca, Spain.

Type material

Holotype female and eleven paratypes deposited in the collection of the Centro de Ciencias Medioambientales, CSIC, Madrid, Spain and one female and male paratypes at each of : Muséum National d'Histoire Naturelle, Paris, France; International Institute of Parasitology, St. Albans, U.K.; Nematology Laboratory, University of Wageningen, The Netherlands; Indian Agricultural Institute, New Delhi, India; South African National Collection of Nematodes, Pretoria; and USDA Nematode Collection, Beltsville, MD, USA.

Diagnosis and relationships

P. iberis sp. n. is recognised by its medium size, rounded lip region well set off by constriction, stirrup-shaped amphidial pouch or fovea, about half as long as head width, and stylet guiding ring two-three head widths from anterior end; tail conical, dorsally convex, with conical terminus and about two to three times anal body width long.

P. iberis is close to *P. lemoni* Nasira *et. al,* 1993 in the shape of amphidial pouch and lip region. It differs in the tail shape, conical with a conoid terminus in *P. iberis* sp. n. and conical with a round terminus in *P. lemoni;* by the presence of males, and also by body length (4.4-6.9 *vs* 2.8-3.8 mm), position of the guiding ring (22-26 *vs* 32-38 µm), " a " ratio (138-262 *vs* 99-125) and " c " ratio (98-178 *vs* 77-96).

Paralongidorus monegrensis* sp. n.

(Fig. 2)

Measurements

See Table 2.

Description

Female : Body of large size, elongate-slender, maximum width of 79 (64-95) µm, C-shaped or ventrally arcuate when relaxed by gentle heating. Cuticle apparently smooth but finely striated transversely; 2-3 µm thick at oesophageal region and 4-6 µm at midbody and on the tail. Lip region hemispherical 15-21 µm width at amphidial level, smooth, slightly offset by expansion which is slightly wider than adjacent body. Amphidial aperture distinct, slit-like, 7-9 µm wide or about as long as half head width, pouch or fovea stirrup-shaped. Lateral hypodermal chords 10-12 µm wide or 1.5 of body width. Lateral body pores arranged irregularly along the body with two pores in tail region, one ventrolateral, and another dorsolateral. Odontostyle thin, straight, slightly arcuate in posterior half, 7-9 times head width long or about 1.5-2 times odontophore length, with smooth unsplit base. Odontophore with slightly swollen posterior region. Stylet guiding ring single, 1.4-1.8 head widths from anterior end. Oesophagus dorylaimoid, posterior enlarged part cylindroid 130-136 µm long, 19-25 µm wide. Cardia cylindroid-rounded. Nerve ring just posterior to stylet base. Vulva a transverse slit with slightly raised lips or flush with body surface; 4.5-6.8 mm from anterior end of body, 3.8-5.3 mm from tail terminus. Vagina about 60 % body width long. Two branches of reproductive organs equally developed; a distinct sphincter present at the junction of muscular and glandular parts of the uterus. Prerectum 114-118 µm long. Tail conoid, dorsally convex, with round terminus.

Male : Body ventrally curved in a C-shape; tail end slightly more curved. Cephalic region, cuticle, stylet and oesophagus as described for female. Testes paired, dorylaimoid; sperm oval to sausage-shaped, about 6-8 µm long and 2-3 µm wide. Supplements consisting of two or three adanal pairs, the first pair near the anus, the second and third pairs opposite the middle of the spicules, and a ventromedial series of ten to eleven supplements starting nearby the opposite proximal end of the spicules. Spicules thick, slightly arcuate ventrally, with distinct lateral guiding pieces. Pores arranged irregularly along the body; three caudal papillae on tail, one ventrodorsal, one dorsolateral and the other one dorsal. Tail broadly conoid, dorsally convex, ventrally slightly concave attenuated towards the blunt terminus with thickened hyaline inner layer of the cuticle.

Juveniles : Resembling female except in the more elongate and differently shaped tail.

* From the name of the type locality, Monegros.

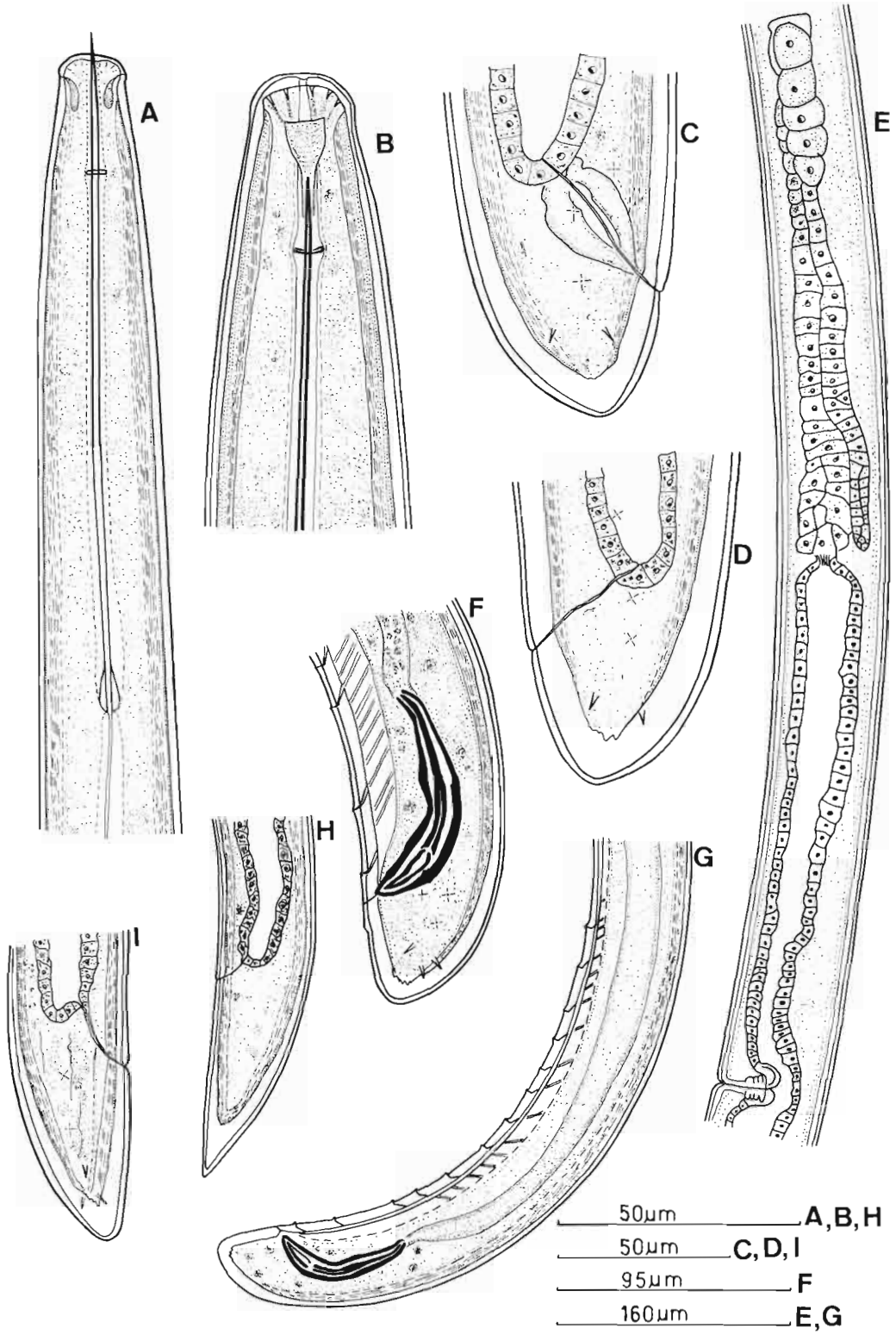

Fig. 2. Paralongidorus monegrensis *sp. n. A, B : Anterior region of J2 and female, respectively; C, D : Female tails; E : Anterior genital branch; F, G : Male tail region; H, I : J1 and J2 tails respectively.*

Table 2. *Morphometric data of* Paralongidorus monegrensis *n. sp.* (All measurements in μm except L in mm)

	Holotype	Paratypes					
		Females	Males	J1	J2	J3	J4
n		21	22	1	18	8	15
L	9.82	9.57 ± 1.2 (7.54-12.1)	9.47 ± 0.8 (7-11)	2.1	3.2 ± 0.3 (2.6-4.1)	4.4 ± 0.4 (3.8-4.7)	6.1 ± 0.7 (4.7-7.2)
a	126	119.2 ± 12.5 (99-145)	127.3 ± 16 (105-181)	75	82 ± 6.3 (73-92)	96.3 ± 12 (77-114)	109 ± 24.6 (83-172)
b	16	17.6 ± 2.9 (12-22)	17.56 ± 4.2 (11-29)	8.9	8.6 ± 1.1 (6.8-11.7)	9.1 ± 0.6 (7.8-10)	12.8 ± 2 (9-15)
c	230	272.5 ± 41.4 (198-341)	218.7 ± 26.8 (146-257)	49	75.6 ± 12.3 (60-114)	112 ± 9.4 (100-127)	158 ± 29 (89-194)
c′	0.97	0.64 ± 0.1 (0.5-0.8)	0.82 ± 0.1 (0.7-1)	2.1	1.2 ± 0.1 (1-1.7)	0.9 ± 0.1 (0.8-1)	0.8 ± 0.1 (0.68-1.1)
V	50	53.5 ± 1.8 (50-56)	–	–	–	–	–
Stylet	216.6	203 ± 10.6 (188-223)	207.4 ± 14 (185-235)	122	140.9 ± 7.8 (123-156)	166 ± 8.7 (151-178)	178 ± 20.5 (109-196)
Odontostyle	140.6	133 ± 6 (120-140)	135.1 ± 4.9 (123-146)	63	82.9 ± 4 (72-92)	104 ± 4 (97-111)	115 ± 4.6 (104-123)
Odontophore	76	70.3 ± 9.9 (56-86)	72 ± 11.6 (54-97)	59	58 ± 6.7 (43-74)	62 ± 6 (50-70)	69.2 ± 4.3 (63-78)
Rpl.od.style	–	–	–	82	103 ± 4.9 (90-111)	115 ± 5.4 (107-121)	131.4 ± 5.5 (122-143)
Tail	42.7	35 ± 4.2 (28-42)	43 ± 4.7 (29-52)	40.8	42 ± 4.3 (37-55)	39 ± 3.4 (35-44)	39 ± 5.2 (31-53)
Guiding ring	33.2	31.8 ± 1.5 (28-34)	32.6 ± 1.8 (29-35)	19	22.7 ± 1.7 (20-27.5)	26.5 ± 1.2 (25-28)	29 ± 2.7 (25-36)
Spicule	–	–	92.6 ± 4 (81-100)	–	–	–	–
Supplements	–	–	(10-11)				

TYPE HABITAT AND LOCALITY

Same as *P. iberis*.

TYPE MATERIAL

Holotype female and 69 paratypes deposited in the collection of the Centro de Ciencias Medioambientales, CSIC, Madrid, Spain. One female and male paratypes at each of : Muséum National d'Histoire Naturelle, Paris, France; International Institute of Parasitology, St. Albans, U.K.; Nematology Laboratory, University of Wageningen, The Netherlands; Indian Agricultural Institute, New Delhi, India; South African National Collection of Nematodes, Pretoria, Republic of South Africa; and USDA Nematode Collection, Beltsville, MD, USA.

DIAGNOSIS AND RELATIONSHIPS

P. monegrensis sp. n. is characterised by its large body size, hemispherical lip region slightly offset by expansion, stirrup-shaped amphidial pouch or fovea, about half as long as head width, and stylet guiding ring one to one-half head width from anterior end. The tail is conoid, dorsally convex, with rounded terminus, more than a half anal body width long.

P. monegrensis sp. n. resembles *P. sandellus* (Heyns, 1966) Coomans, 1985 and *P. xiphinemoides* Heyns, 1965 in amphidial pouch, lip region and tail shapes. It differs from *P. sandellus* in having longer body (7.5-12 *vs* 2.9-3.5 mm) and odontostyle length (120-140 *vs* 81-89 μm) and in the anterior position of guiding ring (28-34 *vs* 50-60 μm); and from *P. xiphinemoides* in the presence of males.

Genus *Paralongidorus* Siddiqi, Hooper & Khan, 1963

= *Longidoroides* Khan, Chawla & Saha, 1978
= *Siddiqia* Khan, Chawla & Saha, 1978
= *Inagreius* Khan, 1982
= *Paralongidorus (Paralongidorus); in* Hunt, 1993
= *Paralongidorus (Siddiqia); in* Hunt, 1993

TYPE SPECIES

8*. *P. sali* Siddiqi, Hooper & Khan, 1963
= *P. (P.) sali* Siddiqi, Hooper & Khan, 1963; *in* Hunt, 1993

* Numbers before each valid species refer to the order in the key.

VALID SPECIES

55*. *P. afzali* (Khan, 1964) Siddiqi & Husain, 1965
= *Longidorus afzali* Khan, 1964
= *Longidoroides afzali* (Khan, 1964) Khan, Chawla & Saha, 1978

4. *P. agni* Sharma & Edward, 1985
= *P.(P.)agni* (Sharma & Edward, 1985); *in* Hunt, 1993

10. *P. australis* Stirling & McCulloch, 1984
= *P. (P.) australis* (Stirling & McCulloch, 1984); *in* Hunt, 1993

18. *P. beryllus* Siddiqi & Hussain, 1965
= *Siddiqia beryllus* (Siddiqi & Hussain, 1965) Khan, Chawla & Saha, 1978
= *Inagreius beryllus* (Siddiqi & Hussain, 1965) Khan, 1982
= *Longidoroides beryllus* (Siddiqi & Hussain, 1965) Luc & Doucet, 1984
= *P.(S.) beryllus* (Siddiqi & Hussain, 1965); *in* Hunt, 1993

69. *P. bikanerensis* (Lal & Mathur,1987) Siddiqi, Baujard & Mountport, 1993
= *Longidoroides bikanerensis* Lal & Mathur, 1987

64. *P. boshi* Khan, Saha & Seshadri, 1972
= *Longidoroides boshi* (Khan, Saha & Seshadri, 1972) Khan, Chawla & Saha, 1978

23. *P. buchae* Lamberti, Roca & Chinappen, 1985
= *P.(S.) buchae* (Lamberti, Roca & Chinappen, 1985); *in* Hunt, 1993

41. *P. buckeri* Sharma & Edward, 1985
= *P.(P.) buckeri* (Sharma & Edward, 1985); *in* Hunt, 1993

14. *P. bullatus* Sharma & Siddiqi, 1990
= *P.(S.) bullatus* (Sharma & Siddiqi, 1990); *in* Hunt, 1993

48. *P. capensis* Heyns, 1967
= *Siddiqia capensis* (Heyns, 1967) Khan, Chawla & Saha, 1978
= *P.(S.) capensis* (Heyns, 1967); *in* Hunt, 1993
= *Siddiqia natalensis* Jacobs & Heyns, 1982
= *P.natalensis* (Jacobs & Heyns, 1982) Luc & Doucet, 1984
= *P.(S.) natalensis* (Jacobs & Heyns, 1982); *in* Hunt, 1993

5. *P. cebensis* Heyns & Coomans, 1989
= *P. (P.) cebensis* (Heyns & Coomans, 1989); *in* Hunt, 1993

62. *P. cedari* (Khan, Chawla & Saha, 1978) Siddiqi, Baujard & Mountport, 1993
= *Longidoroides cedari* Khan, Chawla & Saha, 1978

32. *P. christiani* Liebenberg, Heyns & Swart, 1993

27. *P. citri* (Siddiqi, 1959) Siddiqi, Hooper & Khan, 1963
= *Xiphinema citri* Siddiqi, 1959
= *Longidorus citri* (Siddiqi, 1959) Thorne, 1961
= *Siddiqia citri* (Siddiqi, 1959) Khan, Chawla & Saha, 1978
= *P.(S.) citri* (Siddiqi, 1959); *in* Hunt, 1993
= *Paralongidorus droseri* Sukul, 1972
= *Longidoroides droseri* (Sukul, 1972) Khan, Chawla & Saha, 1978

47. *P. clavicaudatus* (Jacobs & Heyns, 1982) Hunt, 1993
= *Longidoroides clavicaudatus* Jacobs & Heyns, 1982
= *Paralongidorus (P.) clavicaudatus* (Jacob & Heyns, 1982) *in* Hunt, 1993

60. *P. costatus* (Jacobs & Heyns,1987) Siddiqi, Baujard & Mountport, 1993
= *Longidoroides costatus* Jacobs & Heyns, 1987

44. *P. dasturi* (Ganguly, Patil & Khan, 1981) Luc & Doucet, 1984
= *Siddiqia dasturi* Ganguly, Patil & Khan, 1981
= *P.(S.) dasturi* (Ganguly, Patil & Khan, 1981); *in* Hunt, 1993

36. *P. deborae* (Jacobs & Heyns, 1982) Luc & Doucet, 1984
= *Siddiqia deborae* Jacobs & Heyns, 1982
= *P.(S.) deborae* (Jacobs & Heyns, 1982); *in* Hunt, 1993

6. *P. distinctus* Baqri & Jairajpuri, 1981

50. *P. duncani* Siddiqi, Baujard & Mountport, 1993

17. *P. epimikis* Dalmasso, 1969
= *Siddiqia epimikis* (Dalmasso, 1969) Khan, Chawla & Saha, 1978
= *P.(S.) epimikis* (Dalmasso, 1969); *in* Hunt, 1993

30. *P. erriae* Heyns, 1965
= *Siddiqia erriae* (Heyns, 1965) Khan, Chawla & Saha, 1978
= *P.(S.) erriae* (Heyns, 1965); *in* Hunt, 1993

9. *P. esci* Khan, Chawla & Saha, 1978
= *P.(P.) esci* (Khan, Chawla & Saha, 1978); *in* Hunt, 1993

37. *P. eucalypti* Fisher, 1964
= *Siddiqia eucalypti* (Fisher, 1964) Khan, Chawla & Saha, 1978
= *P. (S.) eucalypti* (Fisher, 1964); *in* Hunt, 1993

67. *P. eugeni* (Khan, 1987) Hunt, 1993
= *Inagreius eugeni* Khan, 1986

* Numbers before each valid species refer to the order in the key.

= *Longidoroides eugeni* (Khan, 1987) Jairajpuri & Ahmad, 1992
= *P.(S.) eugeni* (Khan, 1987) Hunt, 1993

25. *P. fici* Edward, Misra & Singh, 1964
= *P. (P.) fici* (Edward, Misra & Singh, 1964); *in* Hunt, 1993

45. *P. fischeri* Heyns, 1972
= *Siddiqia fischeri* (Heyns, 1972) Khan, Chawla & Saha, 1978
= *P.(S.) fischeri* (Heyns, 1972); *in* Hunt, 1993

1. *P. flexus* Khan, Seshadri, Weischer & Mathen, 1971
= *P. (P.) flexus* (Khan, Seshadri, Weischer & Mathen, 1971); *in* Hunt, 1993

26. *P. georgiensis* (Tulaganov, 1937) Siddiqi, 1964
= *Longidorus georgiensis* Tulaganov, 1937
= *Siddiqia georgiensis* (Tulaganov, 1937) Khan, Singh & Singh, 1981
= *Paralongidorus (S.) georgiensis* (Tulaganov, 1937); *in* Hunt, 1993

68. *P. gloriosus* (Khan, 1982) Hunt, 1993
= *Inagreius gloriosus* Khan, 1982
= *Longidoroides gloriosus* (Khan, 1982) Luc & Doucet, 1984
= *P. (S.) gloriosus* (Khan, 1982) *in* Hunt, 1993

31. *P. hanliae* Liebenberg, Heyns & Swart, 1993

54. *P. hooperi* Heyns, 1966
= *Siddiqia hooperi* (Heyns, 1966) Khan, Chawla & Saha, 1978
= *Longidoroides hooperi* (Heyns, 1966) Jacobs & Heyns, 1982
= *P. (S.) hooperi* (Heyns, 1966); *in* Hunt, 1993

15. *P. iberis* sp. n.

19. *P. inagreinus* (Chawla & Samathanam, 1981) Luc & Doucet, 1984
= *Siddiqia inagreina* Chawla & Samathanam, 1981
= *P. (S.) inagreinus* (Chawla & Samathanam, 1981); *in* Hunt, 1993

28. *P. indicus* (Phukan & Sanwal, 1983) Luc & Doucet, 1984
= *Siddiqia indicus* Phukan & Sanwal, 1983
= *P.(S.) indicus* (Phukan & Sanwal, 1983); *in* Hunt, 1993

65. *P. latilabiatus* (Jacobs & Heyns, 1982) Siddiqi, Baujard & Mountport, 1993
= *Longidoroides latilabiatus* Jacobs & Heyns, 1982

13. *P. lemoni* Nasira, Shahina, Firoza & Maqbool, 1993

70. *P. longiurus* (Chawla & Samathanam, 1981) Siddiqi, Baujard & Mountport, 1993
= *Longidoroides longiurus* Chawla & Samathanam, 1981

42. *P. lutensis* Hunt & Rahman, 1991
= *P. (P.) lutescens* (Hunt & Rahman, 1991); *in* Hunt, 1993 *[lapsus calami]*

52. *P. lutosus* (Heyns, 1965) Aboul-Eid, 1970
= *Longidorus lutosus* Heyns, 1965
= *Longidoroides lutosus* (Heyns, 1965) Khan, Chawla & Saha, 1978
= *P.(P.) lutosus* (Heyns, 1965) Aboul-Eid, 1970 *in* Hunt, 1993

24. *P. major* Verma, 1973
= *Siddiqia major* (Verma, 1973) Khan, Singh & Singh, 1981
= *P.(S.) major* (Verma, 1973); *in* Hunt, 1993

35. *P. maximus* (Bütschli, 1874) Siddiqi, 1964
= *Dorylaimus maximus* Bütschli, 1874
= *Dorylaimus (Longidorus) maximus* Bütschli, 1874 (Micoletzky, 1922)
= *Longidorus maximus* (Bütschli, 1874) Thorne & Swanger, 1936
= *Siddiqia maxima* (Bütschli, 1874) Khan, Chawla & Saha, 1978
= *P.(S.) maximus* (Bütschli, 1874); *in* Hunt, 1993

21. *P. mediensis* (Ganguly, Patil & Khan, 1981) Luc & Doucet, 1984
= *Siddiqia mediensis* Ganguly, Patil & Khan,1981
= *P.(S.) mediensis* (Ganguly, Patil & Khan, 1981); *in* Hunt, 1993

12. *P. microlaimus* Siddiqi, 1964
= *P. (P.) microlaimus* (Siddiqi, 1964); *in* Hunt, 1993

7. *P. monegrensis* sp. n.

29. *P. namibiensis* Jacobs & Heyns, 1987
= *P.(S.) namibiensis* (Jacobs & Heyns, 1987); *in* Hunt, 1993

20. *P. nudus* (Kirjanova, 1951) Lamberti, 1975
= *Longidorus nudus* Kirjanova, 1951
= *P.(P.) nudus* (Kirjanova, 1951); *in* Hunt, 1993

11. *P. oryzae* Verma, 1973
= *P.(P.) oryzae* (Verma, 1973); *in* Hunt, 1993

39. *P. paramaximus* Heyns, 1965
= *Siddiqia paramaximus* (Heyns, 1965) Khan, Chawla & Saha, 1978
= *P.(S.) paramaximus* (Heyns, 1965); *in* Hunt, 1993

63. *P. pini* (Jacobs & Heyns, 1987) Siddiqi, Baujard & Mountport, 1993
= *Longidoroides pini* Jacobs & Heyns, 1987

59. *P. pulcher* (Jacobs & Heyns, 1982) Siddiqi, Baujard & Mountport, 1993
= *Longidoroides pulcher* Jacobs & Heyns, 1982

56. *P. pulcheroides* (Jacobs & Heyns, 1987) Siddiqi, Baujard & Mountport, 1993

= *Longidoroides pulcheroides* Jacobs & Heyns, 1987

22. *P. remyi* (Altherr, 1963) Siddiqi & Husain, 1965
= *Longidorus remyi* Altherr, 1963
= *Siddiqia remyi* (Altherr, 1963) Khan, Chawla & Saha, 1978
= *P.(S.) remyi* (Altherr, 1963); *in* Hunt, 1993

40. *P. rex* Andrássy, 1986
= *P.(S.) rex* (Andrássy, 1986); *in* Hunt, 1993

46. *P. rotundatus* Khan, 1987
= *P.(P.) rotundatus* (Khan, 1987); *in* Hunt, 1993

3. *P. sacchari* Siddiqi, Hooper & Khan, 1963
= *P.(P.) sacchari* (Siddiqi, Hooper & Khan, 1963); *in* Hunt, 1993

51. *P. sandellus* (Heyns, 1966) Coomans, 1985
= *Xiphinema sandellum* Heyns, 1966
= *Longidorus sandellus* (Heyns, 1966) Khan, Chawla & Saha, 1978
= *Brevinema sandellum* (Heyns, 1966) Chaves & Coomans, 1984
= *P. (P.) sandellus* (Heyns, 1966); *in* Hunt, 1993

53. *P. sativus* (Soni & Nama, 1983) n. comb.
= *Longidoroides sativus* Soni & Nama, 1983

34. *P. seclipsi* (Khan, Singh & Singh, 1981) Jana & Baqri, 1984
= *Siddiqia seclipsi* Khan, Singh & Singh, 1981
= *Longidoroides seclipsi* (Khan, Singh & Singh, 1981) Luc & Doucet, 1984
= *P.(S.) seclipsi* (Khan, Singh & Singh, 1981); *in* Hunt, 1993

2. *P. similis* Khan, Chawla & Prasad, 1972
= *P.(P.) similis* (Khan, Chawla & Prasad, 1972); *in* Hunt, 1993

33. *P. spasskii* Heyns, 1972
= *Siddiqia spasskii* (Heyns, 1972) Khan, Chawla & Saha, 1978
= *P. (S.) spasskii* (Heyns, 1972); *in* Hunt, 1993

38. *P. spaulli* (Jacobs & Heyns, 1982) Luc & Doucet, 1984
= *Siddiqia spaulli* Jacob & Heyns, 1982
= *P.(S.) spaulli* (Jacobs & Heyns, 1982); *in* Hunt, 1993

57. *P. spiralis* Khan, Saha & Seshadri, 1972
= *Longidoroides spiralis* (Khan, Saha & Seshadri, 1972) Khan, Chawla & Saha, 1978

49. *P. strelitziae* (Heyns, 1966) Aboul-Eid, 1970
= *Longidorus strelitziae* Heyns, 1966
= *Longidoroides strelitziae* (Heyns, 1966) Khan, Chawla & Saha, 1978

66. *P. teres* (Khan, 1987) Hunt, 1993
= *Inagreius teres* Khan, 1987
= *Longidoroides teres* (Khan, 1987) Jairajpuri & Ahmad, 1992
= *P. (S.) teres* (Khan, 1987); *in* Hunt, 1993

58. *P. utriculoides* (Corbett, 1964) Siddiqi & Husain, 1965
= *Longidorus utriculoides* Corbett, 1964
= *Longidoroides utriculoides* (Corbett, 1964) Khan, Chawla & Saha, 1978

61. *P. wiesae* (Heyns, 1994) n.comb.
= *Longidoroides wiesae* Heyns, 1994

16. *P. xiphinemoides* Heyns, 1965
= *Siddiqia xiphinemoides* (Heyns, 1965) Khan, Chawla & Saha, 1978
= *P.(S.) xiphinemoides* (Heyns, 1965); *in* Hunt, 1993

43. *P. zenobiae* Hunt & Rahman, 1991
= *P. (P.) zenobiae* Hunt & Rahman, 1991; *in* Hunt, 1993

Polytomous key

		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1.	*P. flexus*	1	1	1	1	2	2	34	1	4	4	2	13	1	1	1
2.	*P. similis*	1	1	1	2	1	1	1	1	1	2	1	1	1	–	–
3.	*P. sacchari*	1	1	1	2	1	2	34	1	3	23	23	1	2	–	–
4.	*P. agni*	1	1	1	2	2	2	12	12	1	1	1	1	13	1	1
5.	*P. cebensis*	1	1	1	2	2	4	5	3	2	1	3	1	3	3	3
6.	*P. distinctus*	1	1	1	2	1	4	7	2	2	1	4	1	3	–	–
7.	*P. monegrensis*	1	1	1	2	2	56	45	1	23	1	3	23	3	3	1
8.	*P. sali*	1	1	1	3	1	1	3	1	1	1	2	1	1	–	–
9.	*P. esci*	1	1	1	3	2	2	6	2	2	1	34	1	1	1	3
10.	*P. australis*	1	1	1	3	2	56	67	3	12	1	34	13	23	4	3
11.	*P. oryzae*	1	1	1(3)	2	1	1	1	1	2	3	1	1	1	–	–
12.	*P. microlaimus*	1	1	1(3)	2	2	12	2	1	12	23	2	1	1	1	1
13.	*P. lemoni*	1	1	2	1	1	12	1	1	2	4	1	23	1	–	–
14.	*P. bullatus*	1	1	2	1	1	2	57	1	23	3	34	3	12	–	–
15.	*P. iberis*	1	1	2	1	2	24	12	1	34	4	1	34	1	1	1

Polytomous key *(continued)*

		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
16.	*P. xiphinemoides*	1	1	2	2	1	12	3	3	12	3	2	12	1	–	–
17.	*P. epimikis*	1	1	2	2	2	6	7	1	2	2	4	4	2	1	2
18.	*P. beryllus*	1	1	3	1	1	2	2	1	2	3	3	2	1	–	–
19.	*P. inagreinus*	1	1	3	2	1	2	3	1	12	12	3	23	2	–	–
20.	*P. nudus*	1	1	3	2	1	2	3	1	3	23	2	1	1	–	–
21.	*P. mediensis*	1	1	3	2	1	2	45	1	2	3	2	23	1	–	–
22.	*P. remyi*	1	1	3	2	1	2	7	1	2	1	1	–	–	–	–
23.	*P. buchae*	1	1	3	2	1	23	4	1	2	2	3	3	2	–	–
24.	*P. major*	1	1	3	2	1	24	4	1	2	2	23	23	2	–	–
25.	*P. fici*	1	1	3	2	1	34	45	1	2	23	3	3	2	–	–
26.	*P. georgiensis*	1	1	3	2	1	34	5	1	2	2	3	3	2	–	–
27.	*P. citri*	1	1	3	2	1	4	5	1	2	23	3	3	2	–	–
28.	*P. indicus*	1	1	3	2	1	45	3	1	2	2	2	3	13	–	–
29.	*P. namibiensis*	1	1	3	2	1	45	67	1	12	13	4	34	12	–	–
30.	*P. erriae*	1	1	3	2	2	12	1	1	12	23	2	13	1	1	2
31.	*P. hanliae*	1	1	3	2	2	23	23	1	12	13	23	13	–	1	13
32.	*P. christiani*	1	1	3	2	2	3	2	2	2	1	2	1	1	2	2
33.	*P. spasskii*	1	1	3	2	2	34	2	1	2	2	34	23	12	12	2
34.	*P. seclipsi*	1	1	3	2	2	34	56	1	2	1	4	12	3	2	2
35.	*P. maximus*	1	1	3	2	2	56	7	2	2	1	6	13	3	4	2
36.	*P. deborae*	1	1	3	2	2	6	7	12	2	2	45	4	23	2	23
37.	*P. eucalypti*	1	1	3	23	1	23	56	2	3	3	3	23	12	–	–
38.	*P. spaulli*	1	1	3	3	2	23	12	1	12	3	1	23	1	1	13
39.	*P. paramaximus*	1	1	4	2	2	4	4-7	12	12	12	45	34	13	13	23
40.	*P. rex*	1	1	4	3	1	6	7	2	3	1	6	23	3	–	–
41.	*P. buckeri*	1	2	1	2	1	1	1	1	2	2	1	1	1	–	–
42.	*P. lutensis*	1	2	1	3	1	35	57	3	1	1	12	1	–	–	–
43.	*P. zenobiae*	1	2	1	3	1	46	7	3	24	1	1	1	1	–	–
44.	*P. dasturi*	1	2	3	2	1	23	35	1	1	1	3	12	23	–	–
45.	*P. fischeri*	1	2	3	2	2	2	2	12	23	3	2	12	12	1	1
46.	*P. rotundatus*	1	2	3	3	1	2	67	2	1	1	3	1	1	–	–
47.	*P. clavicaudatus*	1(3)	1	1	3	2	2	2	2	12	12	1	12	1	1	1
48.	*P. capensis*	1(3)	1	3	2	2	26	45	2	2-4	3	3	34	1-3	12	2
49.	*P. strelitziae*	1(3)	2	1	23	2	26	25	3	12	1	34	2	3	23	23
50.	*P. duncani*	2	1	2	1	2	1	1	1	34	4	1	1	1	1	12
51.	*P. sandellus*	2	1	2	2	2	1	2	3	1	23	2	1	1	1	1
52.	*P. lutosus*	2(3)	1	2(3)	2	2	4	23	12	2	3	2	34	13	1	1
53.	*P. sativus*	2	2	1	2	1	2	1	2	–	2	2	1	1	–	–
54.	*P. hooperi*	2	2	2	2	2	56	7	3	23	12	45	4	2	23	12
55.	*P. afzali*	3	1	1	1	1	12	4	1	4	4	2	23	1	–	–
56.	*P. pulcheroides*	3	1	1	2	1	12	1	1	2	3	12	23	1	–	–
57.	*P. spiralis*	3	1	1	2	1	12	2	2	2	3	2	1	1	–	–
58.	*P. utriculoides*	3	1	1	2	1	2	1	1	2	3	2	3	1	–	–
59.	*P. pulcher*	3	1	1	2	1	2	2	1	12	12	2	13	13	–	–
60.	*P. costatus*	3	1	1	2	1	2	34	1	24	3	2	23	12	–	–
61.	*P. wiesae*	3	1	1	2	1	2	34	2	23	12	23	1	23	–	–
62.	*P. cedari*	3	1	1	2	2	2	56	3	1	1	2	1	2	3	1
63.	*P. pini*	3	1	1	2	2	3-6	34	23	23	3	3	23	23	2	12
64.	*P. boshi*	3	1	1	3	2	2	4	3	1	1	2	1	1	1	1
65.	*P. latilabiatus*	3	1	2	2	1	4	2	3	2	3	3	4	1	–	–
66.	*P. teres*	3	1	3	2	1	24	45	1	2	2	3	13	2	–	–
67.	*P. eugeni*	3	1	3	2	1	2-5	46	2	1	2	2	13	2	–	–
68.	*P. gloriosus*	3	1	3	2	1	34	45	1	2	3	2	3	2	–	–
69.	*P. bikanerensis*	3	1	3	2	1	34	5	1	2	2	3	3	1	–	–
70.	*P. longiurus*	3	2	1(2)	1	1	1	2	1	4	4	2	1	1	–	–

Polytomous key for *Paralongidorus* species identification

CHARACTERS USED FOR THE POLYTOMOUS KEY

The code

A. Shape of amphidial pouches :
   1. Funnel- or stirrup-shaped (Fig. 3 F, J, M)
   2. Wine glass-shaped (Fig. 3 C, E)
   3. Pouch-shaped, bilobed or not (Fig. 3 A, B)

B. Width of amphid aperture :
   1. Aperture of amphid half or more as wide lip region
   2. Aperture less than half of lip region width

C. Shape of lip region :
   1. Continuous with outline of the body (Fig. 3 A, B)
   2. Expanded (Fig. 3 C, E, F)
   3. Set off by constriction without neck (Fig. 3 H, J)
   4. Clearly set off by a deep constriction with neck (Fig. 3 M)

D. Tail shape of female :
   1. Conoid (Fig. 3 D, G, I)
   2. Conoid with a terminus broadly rounded to subhemispherical (Fig. 3 K, L, O, P)
   3. Hemispherical (Fig. 3 Q, N)

E. Males :
   1. Unknown
   2. Known

F. Body length of females :
   1. < 3.6 mm
   2. 3.6-5.6 mm
   3. 5.7-6.2 mm
   4. 6.3-7.6 mm
   5. 7.7-8.2 mm
   6. > 8.2 mm

G. Length of odontostyle :
   1. < 70 µm
   2. 70-94 µm
   3. 95-110 µm
   4. 111-124 µm
   5. 125-140 µm
   6. 141-152 µm
   7. > 152 µm

H. Distance from anterior end to guiding ring :
   1. < 37 µm
   2. 37-47 µm
   3. > 47 µm

I. Tail length :
   1. < 27 µm
   2. 27-38 µm
   3. 39-50 µm
   4. > 50 µm

J. Ratio c' :
   1. < 0.8
   2. 0.8-1.0
   3. 1.1-1.8
   4. > 1.8

K. Lip region width :
   1. < 10 µm
   2. 10-15 µm
   3. 16-20 µm
   4. 21-25 µm
   5. 26-30 µm
   6. > 30 µm

L. Ratio a :
   1. < 95
   2. 95-108
   3. 109-145
   4. > 145

M. Length of basal bulb of oesophagus :
   1. < 108 µm
   2. 108-128 µm
   3. > 128 µm

N. Length of spicules :
   1. < 60 µm
   2. 60-80 µm
   3. 81-100 µm
   4. > 100 µm

O. Number of supplements in male tail :
   1. < 11
   2. 11-16
   3. > 16

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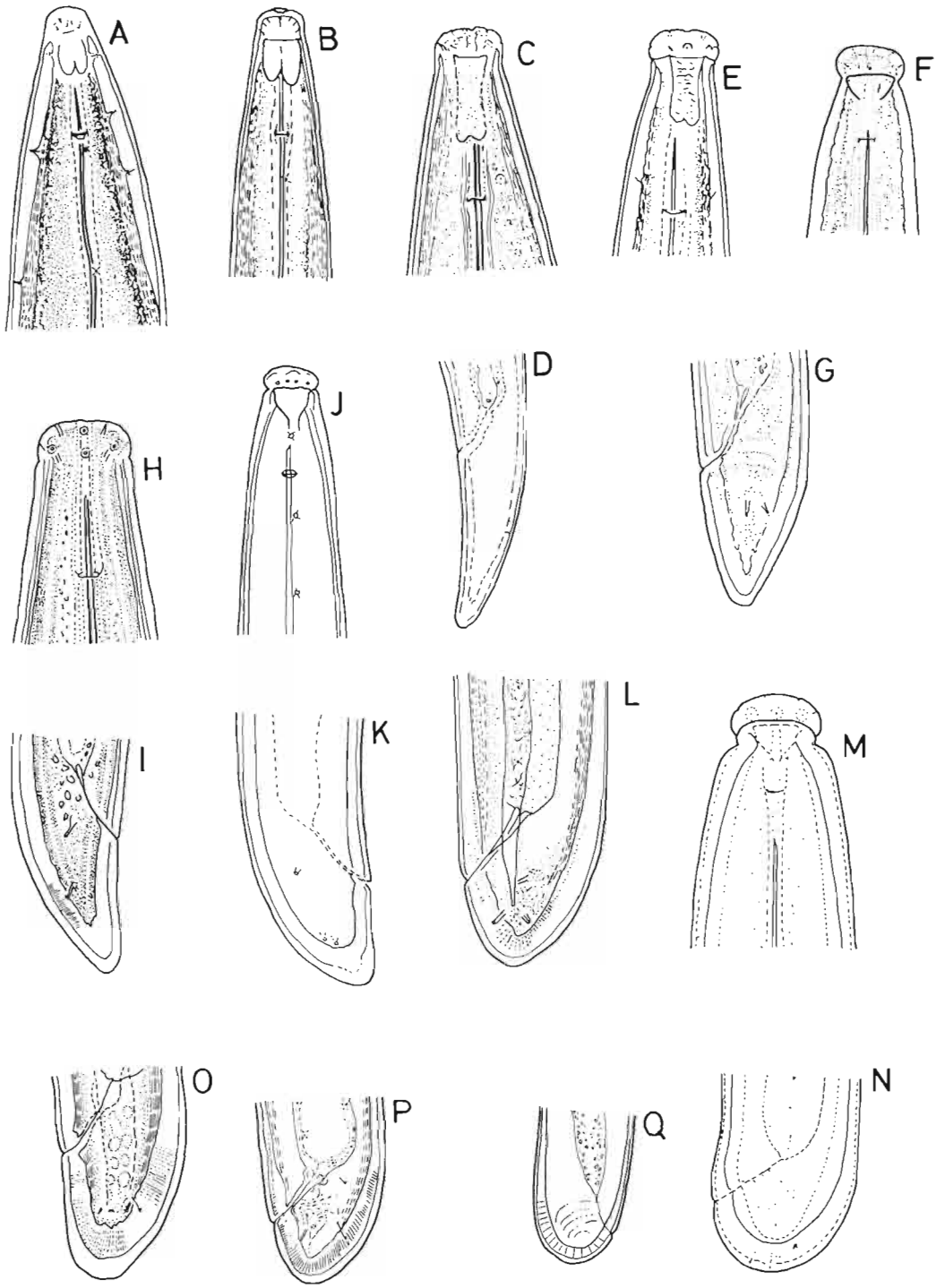

Fig. 3. *A-C, E, F, H, J, M : Lip region and amphidial pouch shapes (Codes A and C). A (codes A3, C1)* P. pini; *B (codes A3, C1)* P. pulcheroides; *C (codes A2, C2)* P. duncani; *E (codes A2, C2)* P. lutosus; *F (codes A1, C2)* P. bullatus; *H (code C3)* P. beryllus; *J (codes A1, C3)* P. buchae; *M (codes A1, C4)* P. rex. *D, G, I, K, L, N-Q : Caudal region (Code D). D, G, I (code D1)* P. duncani, P. bullatus *and* P. beryllus *respectively; K, L, O, P (code D2)* P. buchae, P. deborae, P. fischeri *and* P. cebensis; *N, Q (code D3)* P. rex, P. australis *respectively. (Redrawn from the original descriptions).*

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