

Nematodes of the order Dorylaimida from Andalucía Oriental, Spain. The genus *Dorylaimoides* Thorne & Swanger, 1936. 3. Opisthodelphic species

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Summary – This paper deals with nematodes of the genus *Dorylaimoides* Thorne & Swanger, 1936 characterized by having an opisthodelphic female genital system and which has been collected from natural habitats in Southeastern Spain. Five species form the group: *D. arcuatus* Siddiqi, 1964 (first record in Europe), *D. baeticus* Peralta & Peña Santiago, 1992, *D. limnophilus* (de Man, 1880) Loof, 1964 and two new species; except for *D. baeticus*, all the species are described and illustrated. *D. grandis* sp. n. can be distinguished by having medium size (L = 1.28-1.77), lip region offset by constriction, lips moderately amalgamated and angular, odontostyle = 5.5-6.5 μm , pharyngeal bulb = 61-81 μm , V = 28.3-32.4, anterior genital branch a simple sac = 56-85 μm or 1.3-2.2 body widths long, tail elongated to filiform with slightly dorsally curved posterior end (113-145 μm , c = 10.2-14, c' = 5.4-6.7 in females and 72-93 μm , c = 16.4-20.8, c' = 2.9-4 in males), spicules = 39-41 μm and a series of nine regularly spaced ventromedian supplements. *D. paraconfusus* sp. n. is characterized by having medium size (L = 1.32-1.48 mm), lip region set off by depression, odontostyle = 5.5-6.5 μm , pharyngeal bulb = 60-70 μm , V = 28.6-33.5, anterior genital branch reduced to a uterine sac with a cell small mass at its anterior end (97-134 μm or 2.5-3.6 body widths long), tail elongated with slightly dorsally curved terminal part (106-118 μm , c = 12.5-12.9, c' = 4.8-5.6 in females and 80-91 μm , c = 13.2-17.3, c' = 3.7-4.0 in males), spicules = 35-40 μm , and six to nine ventromedian supplements. A list of *Dorylaimoides* species from Spain is given.

Résumé – *Nématodes de l'ordre des Dorylaimida provenant d'Andalousie orientale, Espagne. Le genre Dorylaimoides Thorne & Swanger, 1936. 3. Espèces opisthodelphiques* – Cet article traite des nématodes du genre *Dorylaimoides* Thorne & Swanger, 1936 caractérisés par un système génital femelle opisthodelphique et récoltés dans des biotopes naturels du sud-est de l'Espagne. Ce groupe est constitué de cinq espèces: *D. arcuatus* Siddiqi, 1964 (première signalisation en Europe), *D. baeticus* Peralta & Peña Santiago, 1992, *D. limnophilus* (de Man, 1880) Loof, 1964 et deux nouvelles espèces. Toutes les espèces, sauf *D. baeticus*, sont illustrées. *D. grandis* n. sp. se distingue par les caractères suivants: taille moyenne (L = 1,28-1,77 mm); région labiale séparée par une constriction; lèvres moyennement fusionnées et angulaires; odontostyle = 5,5-6,5 μm ; bulbe pharyngien = 61-81 μm ; V = 28,3-32,4; branche génitale antérieure formant un simple sac long de 56-85 μm ou 1,3-2,2 diamètres du corps; queue allongée – filiforme à extrémité courbée dorsalement (113-145 μm , c = 10,2-14, c' = 5,4-6,7 chez les femelles et 72-93 μm , c' = 16,4-20,8, c' = 2,9-4 chez le mâle); spicules = 39-41 μm ; neuf suppléments ventro-médians régulièrement espacés. *D. paraconfusus* sp. n. se distingue par les caractères suivants: taille moyenne (L = 1,32-1,48 mm); région labiale séparée par une dépression; odontostyle = 5,5-6,5 μm ; bulbe pharyngien = 60-70 μm ; V = 28,6-33,5; branche génitale femelle antérieure réduite à un sac utérin comportant une petite masse cellulaire à son extrémité et longue de 97-134 μm ou 2,5-3,6 diamètres du corps); queue allongée à portion terminale légèrement courbée dorsalement (106-118 μm , c = 12,5-12,9, c' = 4,8-5,6 chez les femelles et 80-91 μm , c = 13,2-17,3, c' = 3,7-4,0 chez les mâles); spicules = 35-40 μm ; six à neuf suppléments ventromédians. Une liste des *Dorylaimoides* signalés en Espagne est donnée.

Key-words: Andalucía Oriental, Spain, *Dorylaimoides*, taxonomy, description, opisthodelphic species.

The first and second papers in this series (Peralta & Peña Santiago, 1995 a, b) dealt respectively with the didelphic and pseudodidelphic-opisthodelphic species of the genus *Dorylaimoides* Thorne & Swanger, 1936 found in Southeastern Spain. Now, we present a third species group characterized by having an opisthodelphic female genital system. Five species constitute the group: one has recently been described by the authors, two of them are previously known, and the other two are considered previously undescribed.

For methods used see Peralta and Peña Santiago (1995 a).

Dorylaimoides arcuatus Siddiqi, 1964 (Fig. 1)

MEASUREMENTS

See Table 1.

DESCRIPTION

Female: Slender nematode of medium size. Body cylindrical, tapering towards both extremities but more so

Table 1. Measurements and diagnosis features of *Dorylaimoides arcuatus* Siddiqi, 1964 (all measurements in μm except L in mm).

| Habitat Locality Province n = | Soil under <i>Fraxinus angustifolia</i> Sierra de Andújar Jaén | |
|--|--|------|
| | 1 ♀ | 1 ♂ |
| L (mm) | 1.18 | 0.96 |
| a | 43.7 | 38.5 |
| b | 7 | 5.9 |
| c | 16.4 | 15.9 |
| V | 36.4 | — |
| G1/T1 | 5.2 | 61.4 |
| G2/T2 | 26.4 | 35.2 |
| Ant. gen. br./body diam. | 2.3 | — |
| c' | 4.23 | 3.36 |
| Lip region : diam. | 8.5 | 9.0 |
| " " height | 4 | 4.5 |
| Amphid width | ? | 6.5 |
| Odontostyle (ventral side) | 5.5 | 5.5 |
| Odontophore (max. length) | 15 | 14.5 |
| Stylet length | 20.5 | 20 |
| Guiding ring-ant. end | 5.5 | 6 |
| Nerve ring-ant. end | 84 | 78 |
| Neck length | 169 | 163 |
| Pharyngeal bulb length | 47 | 45 |
| Cardia : width | 9 | 8 |
| " length | 6 | 6 |
| Body diam. at neck base | 24.5 | 22 |
| " " " midbody | 27 | 25 |
| " " " anus | 17 | 18 |
| Cuticle head | 1.5 | 1.5 |
| " midbody | 2.0 | 2.0 |
| " tail | 3.0 | 3.0 |
| Lateral chord : midbody | 4.0 | 3.5 |
| Ant. ovary/testis | — | 118 |
| Ant. genital branch | 62 | 590 |
| Post. ovary/testis | 219 | 134 |
| Post. genital branch | 312 | 338 |
| Vagina : width | 8.0 | — |
| " length | 12 | — |
| Vulva-ant. end | 430 | — |
| Prerectum | 85 | 100 |
| Rectum/cloaca | 25 | 26 |
| Tail | 72 | 61 |
| Spicules arc | — | 29 |
| Ventromedian supplements | — | 5 |
| Sperm length | — | 6 |
| Copulatory muscles | — | 12 |

towards the posterior end. Habitus ventrally curved. Outer cuticle very thin with fine transverse striations; inner cuticle slightly thicker than the outer one, especially in the caudal region. Lateral chords narrow, one-

seventh of the midbody diameter. Lateral pores obscure. Lip region set off by constriction, with rounded contour, twice as wide as high and one-third of the body diameter at pharyngeal base. Lips amalgamated; the inner part slightly elevated. Labial and cephalic papillae hardly visible. Amphid cup-shaped. Odontostyle scarcely longer than half of the head diameter. Odontophore three times the length of the odontostyle. Stoma a truncate cone. Guiding ring simple, clearly refractive. The pharynx consists of a slender and weakly muscular anterior part and a cylindrical basal bulb which occupies 28 % of its total length; the two parts of the pharynx are separated by a depression. Pharyngeal gland nuclei obscure. Cardia hemispherical, surrounded distally by the intestine tissue. Nerve ring located about middle of the total neck length. Genital system monodelphic-opisthodelphic. Ovary long and reflexed, reaching the level of the sphincter. Oocytes numerous. Oviduct consisting of a slender anterior part with prismatic cells and a moderately developed *pars dilatata*. Sphincter present at the oviduct-uterus junction. Uterus unspecialized, containing an egg. Anterior genital branch a simple sac 2.3 body widths long. Vagina cylindrical, encircled by muscles and extending inwards to half of the corresponding body diameter; its wall adjacent to the vulva not offset from the body cuticle. Vulva a transverse slit. Sperm present throughout the genital tract. Intestine-prerectum junction guarded by three cells. Prerectum five anal body diameters long. Rectum as long as the corresponding body diameter. Tail elongated, slightly ventrally curved, tapering gradually from anus to the terminus. Caudal pores two pairs located in the anterior half of the tail : one dorsal and the other subdorsal.

Male : General appearance similar to female but with the posterior body region more ventrally curved. Genital system diorchic. Testes opposite. Spicules curved, 1.6 anal body diameters long. Lateral guiding pieces obscure. In addition to the adanal pair, a series of five ventromedian supplements regularly spaced is present, the most posterior one within the range of the spicules. Tail shape similar to female, slightly shorter. Lateral pores obscure. Sperm spindle-shaped.

DISTRIBUTION

The two specimens examined were found associated to *Fraxinus angustifolia*, on the bank of a rivulet, in Parque Natural de Andújar, province of Jaén, Spain.

REMARKS

This species was originally described (Siddiqi, 1964) on the basis of one female specimen from India, containing sperm throughout the genital tract. Later, Baqri and Jairajpuri (1969) studied three additional populations from India too, with males and females specimens, and identified them as *D. arcuatus* because females were phenotypically similar to the holotype. Almost simultaneously to the original description, Timm (1964) and

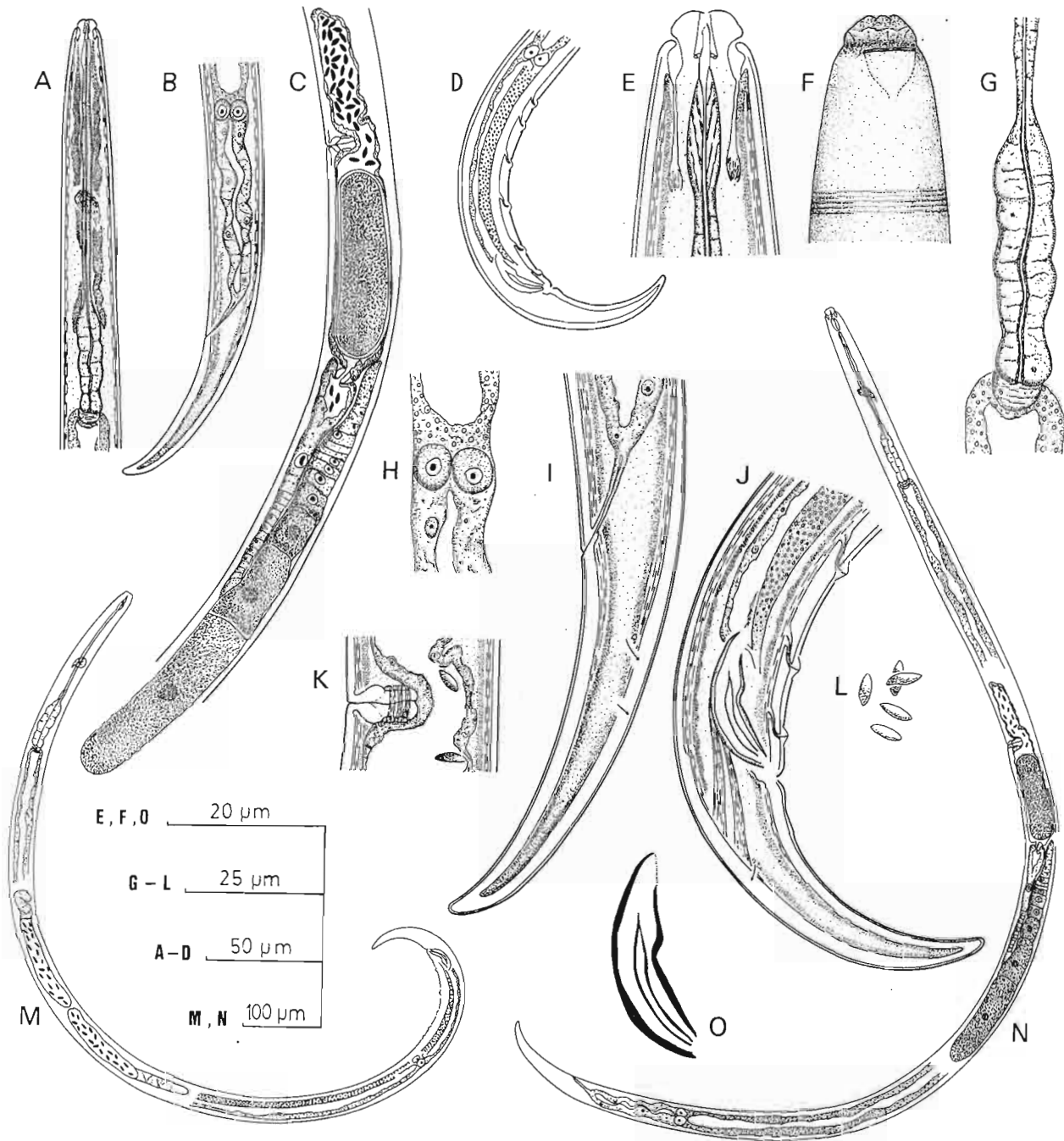


Fig. 1. *Dorylaimoides arcuatus* Siddiqi, 1964. A : Neck region; B : Female posterior body region; C : Female genital system; D : Male posterior body region; E : Lip region in dorsal view; F : Same in surface view; G : Pharyngeal bulb; H : Intestine-prerectum junction; I : Female caudal region; J : Male caudal region; K : Vagina; L : Sperm; M : Entire female; N : Entire male; O : Spicules.

Thorne (1964) respectively described *D. rusticus* from Bangladesh and *D. intermedius* from Puerto Rico. Goseco *et al.* (1976) examined several specimens (the holotype of *D. arcuatus*, type material from *D. rusticus* and *D. intermedius*, and additional material from Puerto Rico and Brazil, but not Baqri and Jairajpuri's populations) and considered *D. arcuatus*, *D. rusticus* and *D. intermedius* conspecific, having *D. arcuatus* priority and accepting some variability in the size and the curvature of the tail, and in the number and the location of the ventromedian supplements. In our opinion, the conspecificity of all these populations is not clear, since the variability of some features can be of interspecific value; as a consequence, a further revision of the material is necessary. The two specimens examined by us are very similar to those previously known, but they present two important differences: the most posterior ventromedian supplement is located within the range of the spicules (*vs* outside in all the males previously described), and the greater length of the spicules (*vs* 20-24 μm).

***Dorylaimoides baeticus*
Peralta & Peña Santiago, 1992**

In addition to the original population, one female and one male specimen were found in the rhizosphere of *Echinopartum boissieri*, *Thymus mastichina* and *Stipa tenacissima* (brushwood) in Sierra de Calar Alto, province of Almería, Spain. No important difference in measurements or morphology was found with respect to the original description.

***Dorylaimoides grandis* sp. n.
(Fig. 2)**

MEASUREMENTS

See Table 2.

DESCRIPTION

Female: Slender nematodes of medium size, 1.28-1.77 mm long. Body cylindrical, tapering slightly towards the anterior end and more so towards the posterior. Habitus ventrally curved, especially in the posterior half. Outer cuticle thin with fine transverse striations. Inner cuticle slightly thicker than the outer one, more thickened at level of the tail. Lateral chords very narrow, occupying one-sixteenth to one-eighth of the midbody diameter. Lateral pores obscure. Lip region set off from adjacent body by a distinct constriction, 2-2.5 times as wide as high and one-fourth to one-third of the body diameter at pharyngeal base. Lips moderately amalgamated, angular; their inner part elevated. Labial and cephalic papillae clear. Amphid cup-shaped, opening at level of the head constriction and occupying 70-80% of the head diameter. Stoma cylindrical to a truncate cone. Guiding ring simple. Odontostyle very broad, about two-thirds of the head diameter long; its ventral side straight. Odontophore about

three times the length of the odontostyle. Pharynx consisting of a slender and weakly muscular anterior region and a cylindrical basal bulb occupying about one-third of the total neck length; both parts of the pharynx are separated by a more or less marked depression. Pharyngeal gland nuclei often visible. Cardia rounded. Nerve ring located at 43-50% of the neck length. Genital system monodelphic-opisthodelphic. Ovary reflexed, often not reaching the sphincter. Oviduct joining to the ovary subterminally and consisting of a slender anterior part with cuboid cells and a well-developed *pars dilatata* with distinct lumen. Sphincter present at the oviduct-uterus junction; its inner part slightly refractive and encircled by muscles. Uterus not specialized. Anterior genital branch a simple sac 1.3-2.2 body diameters long, usually containing sperm. Vagina cylindrical. Vulva a transverse slit. Intestine-prerectum junction guarded by three cells. Prerectum 6-8.5 anal body diameters long. Rectum slightly longer than anal body diameter. Tail elongated to filiform with finely rounded tip, ventrally curved and slightly dorsally bent at its terminal part, tapering markedly in the anterior third, then gradually. Internal core reaching practically the tail tip. Four pairs of caudal pores located in the anterior third of the tail: one subdorsal, slightly behind the level of the anus; other three more posterior, one dorsal, the second subdorsal and the third one lateral.

Male: General appearance similar to female. Habitus straighter, to J-shaped, but more ventrally curved at the posterior body region. Genital system diorchic. Testes opposite. Apart from the adanal pair, a series of nine ventromedian supplements regularly spaced is present, beginning within the range of the spicules. Spicules typical of the genus, stout, curved and 1.7 anal body diameters long. Lateral guiding pieces with acute termini. Sperm spindle-shaped. Rectum short, joined by the ejaculatory duct within the range of the spicules. Tail shape similar to female but shorter. Lateral pores four pairs located as in female.

TYPE HABITAT AND LOCALITY

Alkaline soil around roots of herbaceous plants (meadow) in "Poyo Manquillo", Sierra de Cazorla, province of Jaén, Spain.

OTHER HABITATS AND LOCALITIES

Meadow in Alfarnatejo, province of Málaga, Spain.

TYPE MATERIAL

Female holotype, male allotype, seven female paratypes and one male paratype deposited in the nematode collection, Departamento de Biología Animal, Vegetal y Ecología, Universidad de Jaén, Spain. Two females paratypes at each of the following centres: International Institute of Parasitology, St. Albans, U.K.; Landbouwhogeschool, Wageningen, The Netherlands; Muséum National d'Histoire Naturelle, Paris, France; and Instituut voor Dierkunde, Rijksuniversiteit Gent, Belgium.

Table 2. Measurements and diagnosis features of *Dorylaimoides grandis* sp. n. (all measurements in μm except L in mm).

| Habitat Locality Province | Meadow Sierra de Cazorla Jaén | | | | Meadow Alfarnatejo Málaga |
|---------------------------------|-------------------------------------|----------------------------|---------------|-----------------|---------------------------------|
| | Holotype ♀ | Paratypes 9 ♀♀ | Allotype ♂ | Paratype 1 ♂ | 6 ♀♀ |
| L | 1.74 | 1.62 ± 0.10 (1.39-1.77) | 1.53 | 1.51 | 1.41 ± 0.07 (1.28-1.49) |
| a | 42.1 | 41.7 ± 1.41 (38.7-43.8) | 47.6 | 43.8 | 38.7 ± 1.79 (36.6-41.6) |
| b | 6.0 | 6.34 ± 0.26 (6.0-6.8) | 5.6 | 5.9 | 6.10 ± 0.26 (5.8-6.6) |
| c | 12 | 12.4 ± 0.93 (10.7-14.0) | 16.4 | 20.8 | 11.7 ± 1.06 (10.2-13.2) |
| V | 30.9 | 30.8 ± 1.17 (28.3-32.4) | — | — | 30.2 ± 1.12 (28.6-31.7) |
| G1/T1 | 3.2 | 4.60 ± 0.62 (3.2-5.2) | 50.3 | 54.0 | 3.40 ± 0.62 (2.7-4.3) |
| G2/T2 | 14.1 | 15.4 ± 1.70 (11.1-17.2) | 36.4 | 39.2 | 17.4 ± 1.98 (14.6-20.1) |
| Ant. gen. br./body diam. | 1.35 | 1.90 ± 0.24 (1.35-2.20) | — | — | 1.31 ± 0.22 (1.00-1.67) |
| c' | 6.6 | 6.00 ± 0.34 (5.4-6.6) | 4 | 2.9 | 6.30 ± 0.27 (5.9-6.7) |
| Lip region : diam. | 9.5 | (9.0-9.5) | 9.0 | 9.0 | (8.0-9.0) |
| " " height | 4 | (3.5-4.0) | 3.5 | 3.5 | 3.5 |
| Amphid width | 6.5 | 6.60 ± 0.32 (6-7) | 6.5 | 6.5 | 6.30 ± 0.24 (6.0-6.5) |
| Odontostyle (ventral side) | 6.0 | 6.2 ± 0.4 (5.5-6.5) | 6.2 | 6.2 | 5.75 ± 0.24 (5.6-6.2) |
| Odontophore (max. length) | 18 | 17.7 ± 0.55 (16.5-18.5) | 18 | 18 | 17.3 ± 0.28 (16.8-17.5) |
| Stylet length | 24 | (22-25) | 24 | 24 | (22.5-23.5) |
| Guiding ring-ant. end | 6.5 | (6.0-7.0) | 6.5 | 6.5 | 6.5 |
| Nerve ring-ant. end | 122 | 111 ± 5.5 (100-122) | 119 | 115 | 108 ± 4.22 (103-115) |
| Neck length | 289 | 253 ± 16.7 (230-289) | 268 | 253 | 227 ± 8.45 (211-235) |
| Pharyngeal bulb length | 80 | 76.0 ± 4.35 (66-81) | 77 | 72 | 67 ± 5 (61-75) |
| Cardia : width | 12 | (10.5-15.0) | 10 | 11.5 | (10-11) |
| " length | 8 | (6-10) | 9.5 | 7.5 | (6-9) |
| Body diam. at neck base | 37.5 | 34.6 ± 1.90 (32-38) | 31 | 33 | 32.3 ± 1.37 (31-34) |
| " " " midbody | 41.5 | 39.0 ± 1.70 (36.0-41.5) | 32 | 34.5 | 36.5 ± 1.25 (34-38) |
| " " " anus | 22 | 21.9 ± 0.54 (21-23) | 23 | 24.5 | 19.3 ± 0.98 (17.5-20.5) |
| Cuticle head | 1.2 | 1.2 | 1.2 | 1.5 | 1.5 |
| " midbody | 2.0 | (2.0-2.5) | 2.0 | 2.0 | 2.0 |
| " tail | 6.0 | (4.5-6.0) | 4.5 | 4.5 | 4.5 |
| Lateral chord : midbody | 4.0 | (2.0-5.0) | 2.5 | 2.0 | (3.0-3.5) |
| Ant. ovary/testis | — | — | 97 | 115 | — |
| Ant. genital branch | 56 | 74.8 ± 9.10 (56-85) | 768 | 818 | 48.2 ± 9.35 (34-62) |
| Post. ovary/testis | 119 | 142 ± 53.4 (94-243) | 116 | 109 | 163 ± 35.1 (118-209) |
| Post. genital branch | 246 | 250 ± 30.1 (188-293) | 555 | 594 | 246 ± 29.3 (206-278) |
| Vagina : width | 15.5 | (14-19) | — | — | (13-14) |
| " length | 20 | (16-20) | — | — | (17-18) |
| Vulva-ant. end | 539 | 492 ± 49.1 (406-567) | — | — | 428 ± 31.2 (366-460) |
| Prerectum | 140 | 153 ± 21 (128-194) | 209 | 193 | 123 ± 23.5 (79-156) |
| Rectum/cloaca | 30 | 26.0 ± 1.80 (23-30) | 37 | 34 | 23.8 ± 2.19 (21-26) |
| Tail | 145 | 133 ± 5.5 (127-145) | 93 | 72.5 | 125 ± 8.27 (113-134) |
| Spicules arc | — | — | 39 | 41 | — |
| Ventromedian supplements | — | — | 9 | 9 | — |
| Sperm length | — | — | 7 | 6 | — |
| Copulatory muscles | — | — | 19 | 21 | — |

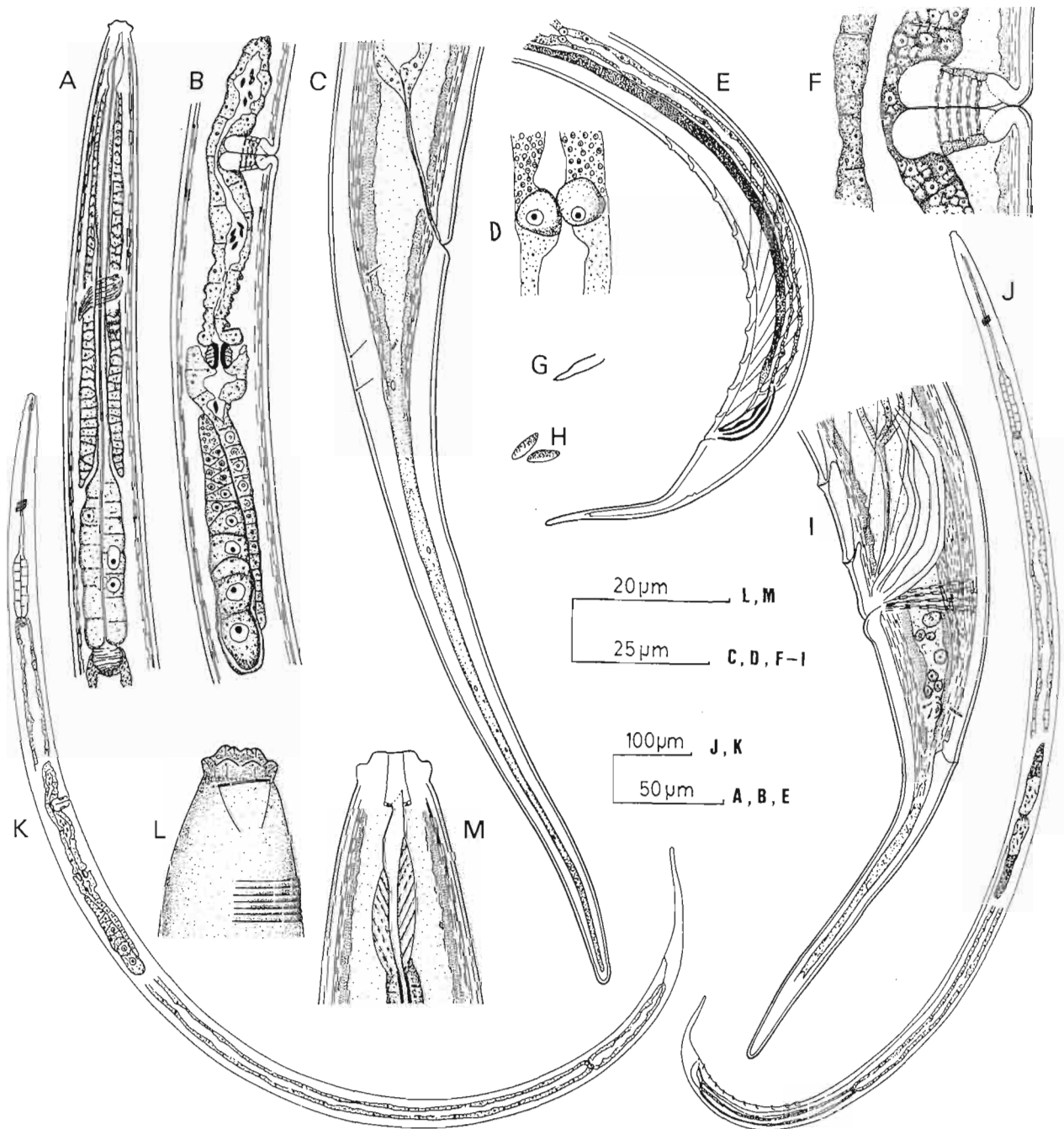


Fig. 2. *Dorylaimoides grandis* sp. n. A: Neck region; B: Female genital system; C: Female caudal region; D: Intestine-prerectum junction; E: Male posterior body region; F: Vagina; G: Lateral guiding piece; H: Sperm; I: Male caudal region; J: Entire male; K: Entire female; L: Lip region in surface view; M: Same in lateral view.

DIAGNOSIS AND RELATIONSHIPS

The new species can be distinguished by having medium size ($L = 1.28-1.77$ mm), lip region offset by constriction, odontostyle $5.5-6.5$ μm long and broad, $V = 28.3-32.4$, anterior genital branch a simple sac $1.3-2.2$ times of the corresponding body diameter, tail elongated to filiform with slightly dorsally curved posterior end, spicules $39-41$ μm and a series of nine regularly spaced ventromedian supplements.

D. grandis resembles to *D. venustus* Andrásy, 1959, *D. limnophilus* (de Man, 1880) Loof, 1964, and *D. bulbosus* (Brzeski & Szczygiel, 1961) Szczygiel, 1965. From *D. venustus* it differs by its greater size ($vs L = 1.13-1.24$ mm), more clearly set off lip region, longer pharyngeal bulb ($vs 25\%$ of the total neck length) and tail ($vs c = 17.8-19.8$), and males known (vs unknown). From *D. limnophilus* can be separated by having broader odontostyle, longer prevulval sac (vs practically absent), shorter female tail ($vs 151-198$ μm in our material, see below), and males known and females containing sperm (vs males unknown and females without sperm). From *D. bulbosus* by its greater size ($vs L = 0.99-1.29$), shorter ($vs 8-8.5$ μm) and stouter odontostyle, relatively longer female tail ($vs c = 14-21$, $c' = 2.8-3.7$) and males known and females containing sperm (vs males unknown and females without sperm).

Dorylaimoides limnophilus
(de Man, 1880) Loof, 1964
(Fig. 3)

MEASUREMENTS

See Table 3.

DESCRIPTION

Female : Slender nematodes of medium size, $1.01-1.39$ mm long. Body cylindrical, tapering towards both extremities but more so towards the posterior end. Habitus ventrally arched, to C-shaped. Outer cuticle narrow and with fine transverse striations. Inner cuticle wider than the outer one, especially thickened at level of the tail. Lateral chords occupying $9-16\%$ of the mid-body width. Lateral pores obscure. Lip region set off by constriction, twice as wide as high and about one-fourth of the body width at neck base. Lips amalgamated along most of their length but with the inner region slightly elevated. Cephalic and labial papillae distinct, not protruding. Amphid cup-shaped, opening at level of the cephalic constriction and occupying three-fourths of the head diameter. Stoma a truncate cone. Odontostyle stout, shorter than cephalic diameter. Odontophore typical of the genus. Guiding ring simple. Pharynx consisting of a slender anterior part and a cylindrical basal bulb; five times as long as wide and occupying 30% of the total neck length. Both parts of the pharynx separated by a shallow constriction. Pharyngeal gland nuclei often visible, one dorsal and two of ventrosublateral pairs;

their location similar to that indicated by Loof and Coomans (1970). Cardia rounded and distally enveloped by the intestinal wall. Nerve ring located at $40-50\%$ of the total neck length. Genital system monodelphic-opisthodelphic. Ovary reflexed and relatively long, sometimes reaching the oviduct-uterus junction, and containing numerous oocytes. Oviduct consisting of a slender anterior part, with prismatic cells, and a moderately developed *pars dilatata* with conspicuous lumen. Oviduct-uterus junction marked off by a sphincter; its inner part refractive and encircled by muscles. Uterus not specialized, relatively short. Anterior genital branch absent or rudimentary. Vagina cylindrical, extending inwards to half of the midbody width; its wall adjacent to the vulva not offset from the inner body cuticle. Vulva a transverse slit. Sperm absent. Prerectum $3.2-5.9$ anal body widths long. Intestine-prerectum junction guarded by three cells. Rectum $1.1-1.6$ anal body diameters long. Tail elongated to filiform with finely rounded terminus, tapering gradually and appears ventrally curved but its posterior end dorsally bent. Two pairs of caudal pores located at anterior third of the tail : one lateral and the other subdorsal.

DISTRIBUTION

The species was found in ten different localities of the provinces of Granada, Jaén and Málaga, associated with *Juniperus sabina*, *Fraxinus angustifolia*, *Quercus faginea*, *Q. rotundifolia*, *Pinus pinea*, *P. pinaster*, *Avena sterilis*, *Ulex parviflorus* and *Genista cinerea*.

***Dorylaimoides paraconfusus* sp. n.**
(Fig. 4)

MEASUREMENTS

See Table 4.

DESCRIPTION

Female : Slender nematodes of medium size, $L = 1.32-1.48$ mm. Body cylindrical, slightly tapering towards the anterior end and more so towards the posterior end. Habitus ventrally curved, to C-shaped. Outer cuticle thin and with fine transverse striations; inner cuticle thicker, especially at level of the tail. Lateral chords occupying $7-14\%$ of the body diameter; glandular bodies are visible in the posterior body region. Lateral pores visible. Lip region somewhat angular, set off from the adjacent body by depression, $2-2.5$ times as wide as high and about one-fourth of the body diameter at neck base. Lips amalgamated, the inner part slightly elevated. Labial and cephalic papillae clear but not interfering the head contour. Amphid cup-shaped, opening at level of the cephalic depression and occupying three-fourths of the head diameter. Odontostyle relatively short; its ventral side slightly longer than half of the head diameter. Odontophore typical of the genus, almost three times the odontostyle length. Stoma a truncate cone. Guiding ring simple. Pharynx consisting of a

Table 3. Measurements and diagnosis features of *Dorylaimoides limnophilus* (de Man, 1880) Loof, 1964 (all measurements in μm except L in mm).

| Habitat Locality Province | <i>Quercus</i> sp. S. Pandera Jaén 17 ♀♀ | Meadow S. Cazorla Jaén 11 ♀♀ | <i>Juniperus</i> S. Cazorla Jaén 6 ♀♀ | <i>Fraxinus</i> S. Cazorla Jaén 5 ♀♀ |
|---------------------------------|---|---------------------------------------|--|---|
| L | 1.14 ± 0.06 (1.06-1.24) | 1.16 ± 0.06 (1.01-1.24) | 1.31 ± 0.05 (1.24-1.39) | 1.11 ± 0.04 (1.06-1.16) |
| a | 32.4 ± 1.92 (30.0-35.7) | 34.3 ± 1.58 (31.7-37.3) | 38.9 ± 1.90 (35.0-40.7) | 31.6 ± 1.10 (30.5-33.1) |
| b | 4.90 ± 0.27 (4.4-5.5) | 5.50 ± 0.20 (5.1-5.8) | 5.90 ± 0.28 (5.5-6.2) | 5.10 ± 0.09 (5.0-5.2) |
| c | 10.5 ± 0.56 (9.20-11.2) | 9.0 ± 0.38 (8.3-9.6) | 9.4 ± 0.47 (8.50-10.0) | 10.0 ± 0.30 (9.80-10.6) |
| V | 32.2 ± 1.20 (29.8-34.1) | 30.2 ± 1.10 (28.7-32.5) | 32.2 ± 0.38 (31.7-32.8) | 32.0 ± 0.87 (31.4-33.7) |
| G1/T1 | - | - | - | - |
| G2/T2 | 13.6 ± 2.48 (10.9-20.6) | 16.3 ± 3.04 (12.3-23.0) | 13.1 ± 2.70 (9.10-17.6) | 11.5 ± 1.65 (9.30-13.9) |
| c' | 5.40 ± 0.18 (5.0-5.6) | 6.60 ± 0.40 (6.0-7.2) | 7.80 ± 0.40 (7.2-8.3) | 5.64 ± 0.21 (5.3-5.9) |
| Lip region : diam. | 8.0 | (8.0-8.5) | (7.5-8.0) | 8.0 |
| " " height | (3.5-4.0) | (3.0-4.0) | (3.0-3.5) | (3.5-4.0) |
| Amphid width | 6.0 | 6.0 | (6.0-6.5) | 6.0 |
| Odontostyle (ventral side) | 5.5 ± 0.0 | 5.40 ± 0.19 (5.0-5.5) | 6.0 ± 0.0 | 5.60 ± 0.20 (5.5-6.0) |
| Odontophore (max. length) | 16.8 ± 0.64 (16.0-17.5) | 16.5 ± 0.33 (16.0-17.0) | 17.3 ± 0.23 (17.0-17.5) | 17.0 ± 0.35 (16.5-17.5) |
| Stylet length | (21.5-23.0) | (21.5-22.5) | (23.0-23.5) | (22-23) |
| Guiding ring-ant. end | (6.0-7.0) | (5.5-6.0) | 6.5 | (6.0-6.5) |
| Nerve ring-ant. end | 102 ± 4.75 (94-109) | 98.0 ± 3.45 (94-104) | 102 ± 3.74 (97-106) | 93.5 ± 2.90 (90.5-97.0) |
| Neck length | 235 ± 12.1 (210-256) | 214 ± 7.07 (201-225) | 221 ± 3.70 (216-225) | 219 ± 6.70 (212-230) |
| Pharyngeal bulb length | 77.0 ± 2.30 (72.0-81.0) | 63.0 ± 2.20 (60.0-67.0) | 63.0 ± 3.40 (60.0-68.0) | 63.5 ± 2.24 (62.0-68.0) |
| Cardia : width | (11.0-17.0) | (9.0-12.0) | (12.0-13.0) | (12.0-13.0) |
| " length | (7.5-10.0) | (7.0-9.5) | (7.0-8.0) | (8.0-9.0) |
| Body diam. at neck base | 33.4 ± 1.96 (30.0-36.0) | 30.4 ± 0.79 (29.0-31.5) | 30.0 ± 1.26 (28.0-32.0) | 33.8 ± 0.98 (32.0-35.0) |
| " " " midbody | 35.5 ± 1.77 (32.5-37.5) | 34.0 ± 1.14 (32.0-36.0) | 33.8 ± 1.00 (32.5-35.5) | 36.0 ± 1.24 (34.0-37.0) |
| " " " anus | 19.9 ± 0.46 (19.0-20.5) | 19.6 ± 0.73 (19.0-20.5) | 18.0 ± 0.50 (17.5-19.0) | 19.5 ± 0.49 (19.0-20.0) |
| Cuticle head | 1.5 | 1.5 | 1.5 | 1.5 |
| " midbody | 2.0 | 2.0 | 2.0 | 2.0 |
| " tail | (4.5-5.0) | (4.0-4.5) | (4.0-4.5) | (4.5-5.0) |
| Lateral chord : midbody | (2.5-4.5) | (3.0-6.0) | 3.0 | (4.0-5.0) |
| Ant. ovary/testis | - | - | - | - |
| Ant. genital branch | - | - | - | - |
| Post. ovary/testis | 105 ± 20.2 (72-140) | 138 ± 31.5 (105-213) | 158 ± 67.4 (73-274) | 81.0 ± 17.4 (66-113) |
| Post. genital branch | 156 ± 27.9 (116-225) | 190 ± 37.9 (142-265) | 175 ± 40.7 (117-240) | 128 ± 18.3 (100-147) |
| Vagina : width | (12.5-17.0) | (12.5-15.5) | (13.0-14.0) | (13.0-17.0) |
| " length | (14.0-17.0) | (13.0-15.5) | 15.0 | (13.0-17.0) |
| Vulva-ant. end | 369 ± 24.4 (320-406) | 350 ± 23.2 (306-373) | 424 ± 13.1 (400-439) | 357 ± 20.2 (333-387) |
| Prerectum | 94.0 ± 13.7 (72-115) | 84.0 ± 11.4 (60-102) | 88.0 ± 9.14 (72-101) | 75.0 ± 7.20 (62-81) |
| Rectum/cloaca | 25.0 ± 1.09 (22.5-27.0) | 24.4 ± 1.30 (22.0-26.0) | 23.2 ± 1.70 (20.0-25.0) | 27.0 ± 2.00 (25.0-31.0) |
| Tail | 109 ± 5.24 (98-121) | 130 ± 5.24 (120-140) | 140 ± 5.80 (135-151) | 111 ± 2.90 (108-115) |

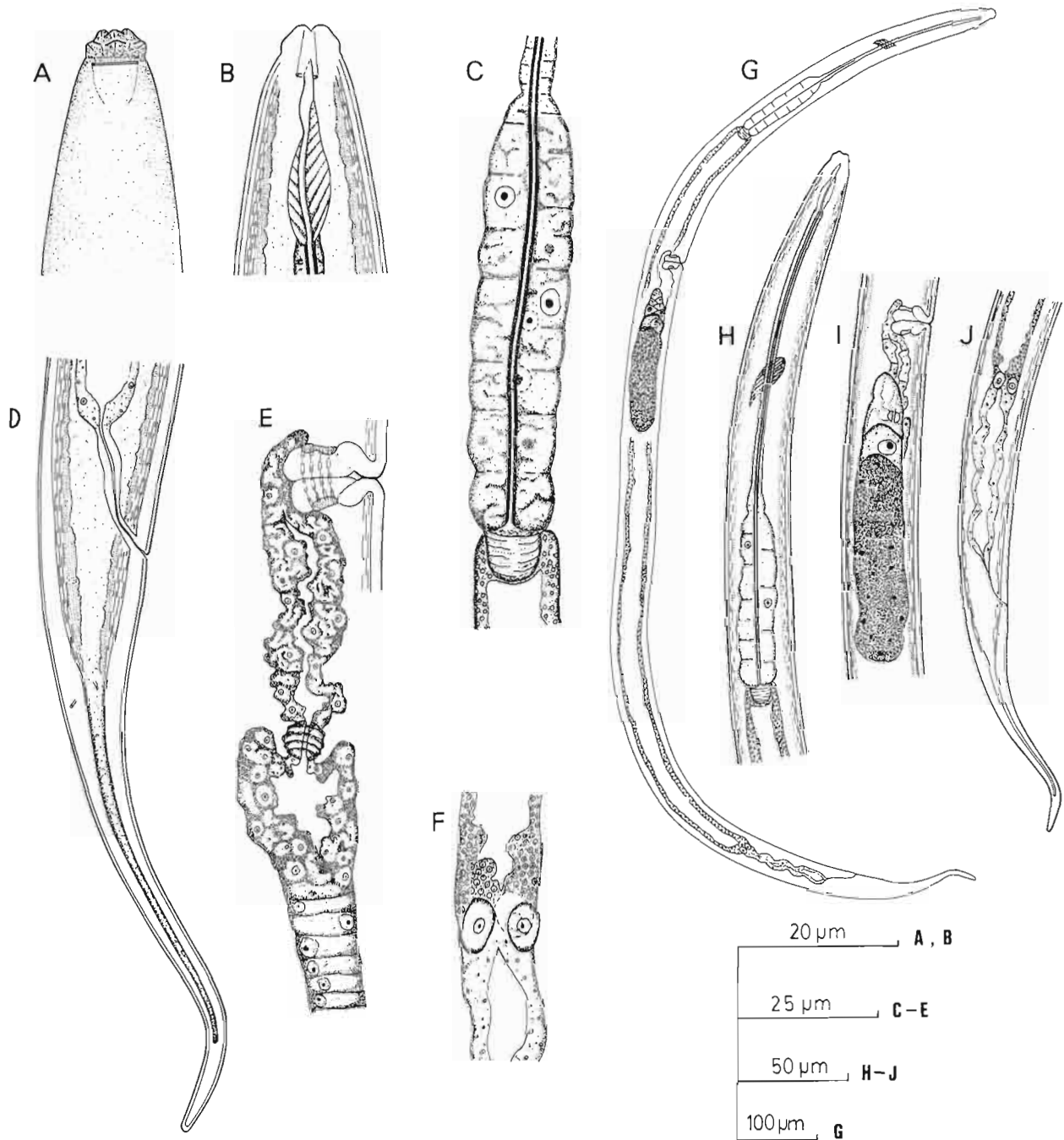


Fig. 3. *Dorylaimoides limnophilus* (de Man, 1880) Loof, 1964. *A* : Lip region in lateral view; *B* : Same in surface view; *C* : Pharyngeal bulb and cardia; *D* : Caudal region; *E* : Anterior third of the genital system; *F* : Intestine-pretectum junction; *G* : Entire female; *H* : Neck region; *I* : Genital system; *J* : Posterior region.

Table 4. Measurements and diagnosis features of *Dorylaimoides paraconfusus* sp. n. (all measurements in μm except L in mm).

| Habitat Locality Province | <i>Populus alba</i> Sierra de Cazorla Jaén | | <i>Fraxinus</i> Sierra de Cazorla Jaén | | <i>Quercus</i> Sierra Pandera Jaén | |
|---------------------------------|--|----------------------------|--|----------------------------|--|------|
| | Holotype 1 ♀ | Paratypes 3 ♀♀ | 1 ♀ | 6 ♂ | 1 ♀ | 1 ♂ |
| L (mm) | 1.48 | 1.40 ± 0.05 (1.32-1.48) | 1.35 | 1.37 ± 0.07 (1.26-1.47) | 1.44 | 1.08 |
| a | 40.0 | 37.0 ± 1.76 (35.5-40.0) | 35.8 | 39.2 ± 1.55 (37.4-42.1) | ?32 | ?29 |
| b | 6.6 | 6.50 ± 0.10 (6.40-6.60) | 6.60 | 6.42 ± 0.28 (6.00-6.70) | 5.80 | 4.90 |
| c | 12.5 | 12.6 ± 0.06 (12.5-12.7) | 12.8 | 16.1 ± 0.80 (14.9-17.3) | 12.9 | 13.2 |
| V | 31.1 | 31.6 ± 1.12 (30.6-33.5) | 28.6 | - | 32.7 | - |
| G1 | 7.6 | 8.00 ± 1.22 (6.90-10.1) | 6.50 | 62.7 ± 2.50 (60.3-67.7) | 4.80 | ? |
| G2 | 5.6 | 20.3 ± 2.73 (16.4-23.9) | 19.4 | 43.2 ± 2.48 (38.9-46.0) | 22.6 | ? |
| Ant. gen. br./body diam. | 2.9 | 2.90 ± 0.49 (2.50-3.60) | 2.50 | - | ?1.53 | - |
| c' | 5.6 | 5.40 ± 0.17 (5.20-5.60) | 4.8 | 3.87 ± 0.11 (3.70-4.00) | 5.3 | 3.6 |
| Lip region : diam. | 8.5 | 8.5 | 9.0 | (9.0-9.5) | 8.0 | 8.0 |
| " height | 3.5 | 3.5 | 4.5 | (3.5-4.5) | 4.0 | 4.0 |
| Amphid width | 7.0 | 6.50 ± 0.50 (6.0-7.0) | 6.5 | 6.90 ± 0.41 (6.5-7.5) | 7.0 | 7.0 |
| Odontostyle (ventral side) | 5.5 | 6.30 ± 0.40 (5.5-6.5) | 6.5 | 6.0 ± 0.0 | 5.5 | 5.5 |
| Odontophore (max. length) | 17.5 | 17.0 ± 0.50 (16.5-17.5) | 16.5 | 18.0 ± 0.49 (17.5-19.0) | 21 | 21 |
| Stylet length | 23 | (23-24) | 23 | (22-24) | 26.5 | 27 |
| Guiding ring-ant. end | 6.5 | (6.5-7.0) | 7.0 | (6.5-7.5) | 8.0 | 7.0 |
| Nerve ring-ant. end | 94 | 96.0 ± 4.30 (90-103) | 90 | 98.0 ± 3.77 (94-106) | 120 | 90 |
| Neck length | 204 | 221 ± 3.30 (217-225) | 204 | 211 ± 8.90 (200-226) | 248 | 221 |
| Pharyngeal bulb length | 62 | 67.0 ± 3.60 (62.0-70.0) | 61 | 61.0 ± 0.65 (60.5-62.0) | 69 | 75 |
| Cardia : width | 11 | (11.0-12.5) | 10.5 | (10.0-13.0) | 12 | 12 |
| " length | 9 | (7.5-9.0) | 8 | (7.0-10.0) | 8 | 6 |
| Body diam. at neck base | 32 | 33.0 ± 0.75 (32.0-34.0) | 34.5 | 31.1 ± 1.59 (28.0-33.0) | ?39 | 32.5 |
| " " " midbody | 37 | 38.0 ± 1.14 (36.5-39.0) | 40 | 35.0 ± 1.04 (33.0-36.0) | ?45 | 37.0 |
| " " " anus | 21 | 21.2 ± 0.43 (21.0-22.0) | 22 | 22.2 ± 1.03 (20.0-23.0) | 21 | 22.5 |
| Cuticle head | 1.5 | (1.2-1.5) | 1.5 | 1.5 | 1.5 | 1.5 |
| " midbody | 2.0 | (2.0-2.5) | 2.0 | (2.0-2.5) | 2.0 | 2.0 |
| " tail | 5.0 | (5.0-6.0) | 4.5 | (4.5-5.5) | 4.5 | 4.0 |
| Lateral chord : midbody | 3.0 | (3.0-5.0) | 3.5 | (2.5-5.0) | ? | 3.0 |
| Ant. ovary/testis | - | - | - | 133 ± 22.7 (109-171) | - | 62 |
| Ant. genital branch | 109 | 111 ± 14.0 (97-134) | 87.5 | 862 ± 71.9 (763-970) | 94 | ? |
| Post. ovary/testis | 138 | 187 ± 28.1 (138-206) | 200 | 134 ± 34.3 (102-206) | 202 | 60 |
| Post. genital branch | 243 | 284 ± 34.9 (243-332) | 262 | 595 ± 53.6 (492-672) | 327 | ? |
| Vagina : width | 16 | (12-16) | 14 | - | ? | - |
| " length | 16 | (16-18) | 18 | - | ? | - |
| Vulva-ant. end | 460 | 443 ± 25.9 (406-474) | 387 | - | 473 | - |
| Prerectum | 108 | 110 ± 15.8 (84-128) | 137 | 157 ± 11.2 (140-172) | 131 | 137 |
| Rectum/cloaca | 26 | 27.0 ± 1.26 (26.0-29.0) | 28 | 34.3 ± 2.90 (31.0-37.5) | 30 | 36 |
| Tail | 118 | 113 ± 3.5 (110-118) | 106 | 85.5 ± 3.44 (80-91) | 112 | 82 |
| Spicules arc | - | - | - | 37.4 ± 2.00 (35.0-40.0) | - | 35.5 |
| Ventromedian supplements | - | - | - | (6-9) | - | 6 |
| Sperm length | - | - | - | (7.0-8.0) | - | 8 |
| Copulatory muscles | - | - | - | 20-23 | - | 19 |

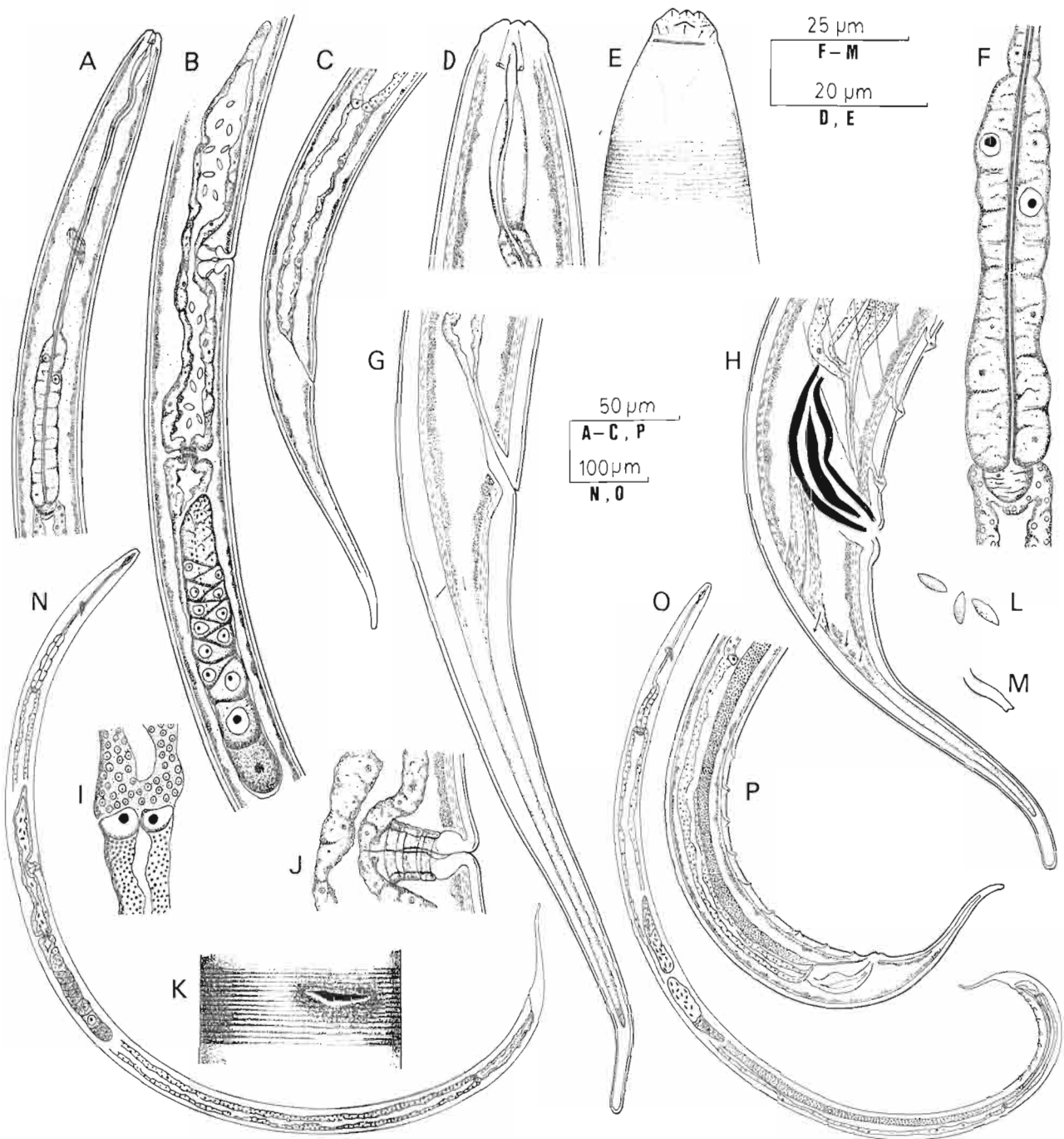


Fig. 4. *Dorylaimoides paraconfusus* sp. n. A : Neck region; B : Female genital system; C : Female posterior body region; D : Lip region in lateral view; E : Same in surface view; F : Pharyngeal bulb and cardia; G : Female caudal region; H : Male caudal region; I : Intestine-prerectum junction; J : Vagina; K : Vulva; L : Sperm; M : Lateral guiding piece; N : Entire female; O : Entire male; P : Male posterior body region.

slender and weakly muscular anterior part and a cylindrical basal bulb occupying one-third of its total length. Both parts separated by a more or less marked constriction. Pharyngeal gland nuclei often obscure. Cardia rounded, relatively small and surrounded by the intestine. Nerve ring located about half of the total neck length. Genital system monodelphic-opisthodelphic. Ovary reflexed, with oocytes arranged first in two or more rows, then in a single row; its anterior end sometimes reaching the sphincter. Oviduct joining the ovary subterminally and consisting of a slender anterior part expanding in a well-developed *pars dilatata* with distinct lumen. Sphincter well developed. Uterus not specialized. Anterior genital branch a simple sac containing sperm, 2.5-3.6 body diameters long; a short cell mass located at anterior end of the uterine sac is present in some specimens, but sphincter is not visible. Vagina cylindrical, encircled by muscles, and extending inwards to half of the corresponding body diameter; its wall adjacent to the vulva not offset from the body cuticle. Vulva a transverse slit. Prerectum 4-7 anal body diameters long. Intestine-prerectum junction guarded by three cells. Rectum slightly longer than anal body diameter. Tail elongated with finely rounded terminus, tapering gradually; its terminal part slightly dorsally bent; hyaline portion of the terminal part of the tail 10-14 μm . Caudal pores two pairs located in the anterior third of the tail, one subdorsal and another lateral.

Male : General morphology similar to female, but more ventrally curved in the posterior region. Genital system diorchic. Testes opposite. In addition to the adanal pair, series of six to nine regularly spaced ventromedian supplements; the most posterior of them within the range of the spicules. Rectum short, joining to the ejaculatory duct at level of the anterior end of the spicules. Tail shape similar to female but shorter. Spicules stout, curved and 1.5 anal body diameters long. Lateral guiding pieces relatively short, stout and slightly sigmoid. Sperm spindle-shaped.

TYPE HABITAT AND LOCALITY

Alkaline soil from a poplar forest (*Populus alba*) in "El Valle", Sierra de Cazorla, province of Jaén, Spain.

OTHER HABITATS AND LOCALITIES

In association with *Fraxinus angustifolia* in Sierra de Cazorla, province of Jaén, Spain, and from a holm-oak forest (*Quercus rotundifolia*) in Sierra de la Pandera, Valdepeñas de Jaén, province of Jaén, Spain.

TYPE MATERIAL

Female holotype, two female paratypes and four male paratypes deposited in the nematode collection, Departamento de Biología Animal, Vegetal y Ecología, Universidad de Jaén, Spain. One female paratype and one male paratype at each of the following centres : Muséum National d'Histoire Naturelle, Paris, France; Instituut

voor Dierkunde, Rijksuniversiteit Gent, Belgium; and Landbouwhogeschool, Wageningen, The Netherlands.

DIAGNOSIS AND RELATIONSHIPS

The new species is characterized by having medium size ($L = 1.32-1.48 \text{ mm}$), lip region offset by depression, odontostyle 5.5-6.5 μm , $V = 28.6-33.5$, anterior genital branch reduced to a simple sac with a cell small mass at its anterior end (2.5-3.6 the corresponding body diameter long), tail elongated with finely rounded tip which tapers gradually and appears dorsally bent at its terminal part, spicules 35-40 μm and six to nine regularly spaced ventromedian supplements.

D. paraconfusus sp. n. resembles closely to *D. confusus* Peralta & Peña Santiago (1995 b) and *D. grandis* sp. n. Moreover, the new species is very similar to a population from The Netherlands which was studied by Goseco *et al.* (1976) and identified as *D. bulbosus* (Brzeski & Szczygiel, 1961) Szczygiel, 1965; by courtesy of Dr. Loof (Wageningen, The Netherlands) we have examined three female specimens from this population. *D. paraconfusus* sp. n. can be distinguished from this material by having shorter odontostyle (*vs* 9.5 μm or longer than head diameter), different morphology of the anterior genital tract (*vs* with a clear sphincter joining the uterine sac to a more or less developed cell chord), and longer female tail (*vs* 88-98 μm) with different shape (*vs* tapering strongly in its anterior third). From *D. confusus* it differs in having lip region offset by depression (*vs* constriction), female anterior genital branch with different morphology (*vs* with sphincter and a cell mass), more anterior vulva (*vs* $V = 32.3-36.8$) and longer female tail (*vs* 78-87.5 μm , $c = 14.5-18.1$, $c' = 3.7-4.2$). Finally, from *D. grandis* sp. n. can be distinguished by its lip region set off by depression (*vs* constriction), more slender odontostyle, longer prevulval sac (*vs* 56-85 μm or 1.3-2.2 body diameters long), and spicules and lateral guiding pieces with different morphology.

The genus *Dorylaimoides* in Spain

In the first paper of this series we referred to the previous reports of five species of the genus (*D. limnophilus*, *D. micoletzkyi*, *D. ariasae*, *D. baeticus* and *D. cylindricaudatus*) in Spain. Ourselves in a recent paper (1992) gave the preliminary results of the study of *Dorylaimoides* species in Andalucía Oriental; there we recorded *D. elegans* (de Man, 1880) Thorne & Swanger, 1936, *D. teres* Thorne & Swanger, 1936 and three other species named respectively *Dorylaimoides* sp. A, B, and C. Now, when the taxonomical study of the whole material is completely finished, we can clarify the species list of *Dorylaimoides* in Southeastern Spain :

i) The material identified as *D. elegans* and part of that included under *D. teres* have become *D. ornatus* Peralta

& Peña Santiago (1995 a). Thus, in our opinion, *D. elegans* is not present in Spain.

ii) The two populations named *Dorylaimoides* sp. A belong to *D. paraconfusus* sp. n.

iii) The population named *Dorylaimoides* sp. C belongs to *D. grandis* sp. n.

iv) The specimens identified as *Dorylaimoides* sp. B represent an undescribed species but because of the scarcity of the material examined we have not described it.

In summary, at present fourteen different species belonging to *Dorylaimoides* have been found and identified in Spain : *D. arcuatus*, *D. ariasae*, *D. baeticus*, *D. confusus*, *D. cylindricaudatus*, *D. grandis* sp. n., *D. hispanicus*, *D. limnophilus*, *D. micoletzkyi*, *D. ornatus*, *D. paraconfusus* sp. n., *D. rotundicephalus*, *D. striatus* and *D. teres*.

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