

## Trichodoridae from southern Spain, with description of *Trichodorus giennensis* n. sp. (Nemata : Trichodoridae)

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**Summary** – During a survey of Trichodoridae in the province Jaén, south-eastern Spain, a new *Trichodorus* species, *Trichodorus giennensis* sp. n. was found. This species is characterized by two ventromedian cervical papillae, the shape of the spicules with widened manubrium and slender calomus with at mid-level a slight constriction provided with bristles in males, and by a barrel-shaped vagina, small triangular oblique vaginal sclerotized pieces and a single pair of postadulvar lateral body pores in female. *T. giennensis* sp. n. closely resembles the “*Trichodorus aequalis*” species group, and more specifically *T. sparsus* Szczygiel, 1968. The occurrence of *Trichodorus viruliferus* Hooper, 1963 and *Paratrichodorus teres* (Hooper, 1962) represent new records for Spain. Additional morphometric and morphological data are given for *P. hispanus* Roca & Arias, 1986 and *P. teres*.

**Résumé** – *Trichodoridae du sud de l'Espagne et description de Trichodorus giennensis* n. sp. (Nemata : Diphtherophorina). – Au cours de récoltes de Trichodoridae dans la province de Jaén, au sud-est de l'Espagne, une nouvelle espèce du genre *Trichodorus* a été trouvée, décrite ici sous le nom de *Trichodorus giennensis* n. sp. Le mâle est caractérisé par la présence de deux papilles cervicales médioventrales, la forme du spicule (manubrium élargi, calomus mince avec légère constriction pourvue de soies) et la femelle par la forme du vagin (en tonneau), les petites sclérotisations vaginales et la présence d'une paire de pores du corps, latéraux, post-adulvaires. *T. giennensis* n. sp. est proche du complexe “*Trichodorus aequalis*” et en particulier de *T. sparsus* Szczygiel, 1968. Parmi les espèces récoltées, *T. viruliferus* Hooper, 1963 et *Paratrichodorus teres* (Hooper, 1962) sont nouveaux pour la faune d'Espagne. Des données supplémentaires sont fournies pour *P. hispanus* Roca & Arias, 1986 et *P. teres*.

**Key-words** : nematodes, Trichodoridae, *Trichodorus giennensis* sp. n., Spain.

During a study of dorylaimid nematodes from natural vegetation in the province of Jaén (Andalucía Oriental, Spain) in 1982-1983, a small *Trichodorus* population was found by Peña-Santiago in one out of 24 soil samples from a holm-oak forest. They represent a new *Trichodorus* species, *Trichodorus giennensis* n. sp., closely resembling the “*Trichodorus aequalis*” species complex. The new species was formerly recorded as *T. aequalis* by Peña Santiago *et al.* (1987) in a list of plant-parasitic nematodes associated with olive trees in Jaén.

The new species was also found during a survey of trichodorid nematodes in Sierra Morena, Andujar, Jaén, a mountainous area at southeastern Spain. Other trichodorid species found are : *Trichodorus viruliferus* Hooper, 1963, *Paratrichodorus teres* (Hooper, 1962) and *P. hispanus* Roca & Arias, 1986. The first two species are new records for Spain.

So far, only four representatives of the family Trichodoridae were recorded for Spain : *T. cylindricus* Hooper, 1962 (in Gomez Barcina and Castillo, 1988), *T. primitivus* (de Man, 1880) Micoletzky, 1922 (syn. *T. castellanensis* Arias, Jiménez & Lopez, 1965), *P. hispanus* Roca & Arias, 1986 and *P. minor* in Arias and Bello

(1988). Peña-Santiago *et al.* (1982) recorded the presence of a *Paratrichodorus* cf. *acutus* species in their ecological data on plant-parasitic nematodes associated with a holm-oak woodland from Sierra Nevada; this material has not been re-examined.

In agreement with Siddiqi (1983), we consider the family Trichodoridae to belong to the order Triplonchida, suborder Diphtherophorina and not to the order Dorylaimida.

### Materials and methods

The specimens from the samples collected by Peña-Santiago and containing the type population of *T. giennensis* n. sp. were extracted by a modified Baermann funnel technique and fixed in 4 % formaldehyde.

The specimens from the other samples were extracted by Cobb's sieving technique, killed by gentle heat and fixed in 4 % formalin solution. All extracted specimens were processed to anhydrous glycerin according to Seinhorst (1959, 1962) for light microscopy and mounted on Cobb slides.

Drawings and photographs of the new species were made using a Reichert Polyvar with camera lucida.

***Trichodorus giennensis* \* n. sp.**  
(= *T. aequalis* apud Peña-Santiago et al., 1987)  
(Figs 1, 2)

## MEASUREMENTS

See Table 1.

## DESCRIPTION

**Male** : Body elongate cylindrical, tapering slightly anteriorly from mid-body; posterior end curved ventrally. Body cuticle with three main layers, 3-5  $\mu\text{m}$  thick at mid-body : the outer layer usually slightly swollen due to fixation and showing a further subdivision visible by light microscopy; the inner layer with pseudoannulation. Lip region rounded, with protruding outer labial papillae. Amphidial fovea typical for the genus. Stoma fine, tubular, with distinct sclerotized rods, 4.5-6.5  $\mu\text{m}$  long. Guiding ring at 18-27  $\mu\text{m}$  from anterior end. Onchiostyle 44.5-60  $\mu\text{m}$  long (range of mean values : 52.5-57.5  $\mu\text{m}$ ), ventrally curved. Pharynx 138-173.5  $\mu\text{m}$  long (mean values), ending as an elongated bulb with five gland nuclei. The posterior ventro-sublateral gland nuclei lie in the posterior third or fourth of the bulb, the smaller anterior ventro-sublateral gland nuclei at mid-bulb or in the anterior half of the bulb, the large dorsal gland nucleus usually in between both pairs of ventro-sublateral gland nuclei or at the level of the posterior ventro-sublateral gland nuclei. Two ventromedian cervical papillae, CP 1- CP 2 (exceptionally one ventromedian cervical papilla in two specimens) present posterior to the onchiostyle region, when pharynx outstretched, and anterior to the excretory pore (EP). The distance in between both cervical papillae is longer than between CP 2 and EP. A lateral cervical pore (LP) is situated on each side 76-84  $\mu\text{m}$  from anterior, i.e. near the level of CP 1, or the nerve ring or slightly more posteriorly. The excretory pore lies at 98-121  $\mu\text{m}$  (type population) from anterior body end i.e. opposite the anterior part of the pharyngeal bulb or just anterior to it, when pharynx outstretched. Usually no overlap of the subventral pharyngeal glands, exceptionally a small overlap (e.g. of 9  $\mu\text{m}$ ), usually with or rarely without an anterior dorsal intestinal overlap (12-22  $\mu\text{m}$ ) (Fig. 1 G). Reproductive system with a single testis reaching far anteriorly. Sperm cells large (shape variable according to orientation and to the number of sperm present in the *vesicula seminalis*), with a large sausage-shaped nucleus : 7-8 by 2-3  $\mu$  (in transverse section diameter 3.5  $\mu\text{m}$  with a nucleolus of 2-2.2  $\mu\text{m}$  and a pale central core) (Fig. 1 J). The large sperm cells have a strong fibrillar appearance, in transverse optical section seen as several granular fields. Spicules, 39.5-50  $\mu\text{m}$  long (range of mean values : 43-46  $\mu\text{m}$ ), slightly ventrally curved; manubrium

widened, calomus about equally wide, posteriorly tapered to a fine distal end. Near the level of the base of the capsule of suspensor muscles, the calomus shows a slight indentation sometimes with an irregular outline (due to fixation?) and usually with two pairs of bristles (Fig. 1 H). Gubernaculum 11.5-19.5  $\mu\text{m}$  long, parallel with and largely dorsal of the spicules; its distal end thickened and striated or not (Fig. 1 K). Three precloacal supplements (SP) present except in two males with four and one male with five precloacal supplements. The posterior precloacal supplement (SP 1) near (i.e. at level, just anterior or just posterior to) the anterior end of the spicules. The distance between SP 1 and the cloacal opening is smaller than between SP 1 and SP 2, which is again smaller than between SP 2 and SP 3. The anteriormost supplement(s) : SP 3, or SP 3 and SP 4 or SP 4 and SP 5, is/are less developed. One pair of postcloacal papillae present just posterior to the cloaca. Tail broadly rounded, ventrally almost straight, with the cuticle at the tail tip usually slightly thickened. Some specimens with a non-thickened terminal cuticle, others with an obviously swollen cuticle (apparently influenced by fixation) (Fig. 1 F). A pair of subventral, subterminal pores present.

**Female** : Similar to male for most characters. Body straight or slightly ventrally curved. Onchiostyle 49-62.5  $\mu\text{m}$  long (range of mean values : 53-58  $\mu\text{m}$ ). Reproductive system didelphic-amphidelphic, with reflexed ovaries, usually with a well developed spermatheca filled with sperm (Fig. 1 E). Vagina more or less barrel-shaped when relaxed but otherwise may be long cylindrical. Vaginal sclerotized pieces small : small or wider triangular or irregular rounded in lateral optical section; located at an oblique angle to the vaginal lumen. They also show some variability in size. A secretion plug may be present at the distal end of the vagina (it was observed in one third of the females in the populations from soil taken at the rhizosphere of *Asphodelus* sp. and *Alnus glutinosa* L.) (Fig. 1 C). One lateral advulvar body pore on each side, 7-17  $\mu\text{m}$  behind the vulva (Fig. 1 C, E) in the type population; other populations with one pore (postadvulvar) on each side or with two pores : one postadvulvar and one prevulvar (generally on both sides, and about 5 body-widths anterior to the vulva). The prevulvar pore is not likely to be seen and apparently missing in the majority of the specimens. Tail with a pair of subterminal pores (Fig. 1 D).

**Third-stage juveniles** : Similar to adults in most characteristics. Based upon the body length : 568-641 (594)  $\mu\text{m}$ , the onchiostyle length : 45-52 (49.5)  $\mu\text{m}$  with a 16-18  $\mu\text{m}$  long replacement onchium and the reproductive system : 31.4-34  $\mu\text{m}$  long with a clear spicular primordium in the young male, the three specimens found apparently belong to the third stage.

\* The specific name is derived from *Giennis*, the Latin name of the province of Jaén.

**Table 1.** Morphometric data of female of *Trichodorus giennensis* n. sp., type specimens (all measurements in  $\mu\text{m}$ ).

Locality	Sierra Caracolera (Alcaudete), Jaén	Sierra Morena, Andujar, Jaén (Southeastern Spain)			Purchil
	<i>Paeonio-Quercetum rotundifoliae</i>	<i>Asphodelus</i> sp.	<i>Alnus glutinosa</i> L.	<i>Fraxinus angustifolia</i> L.	Grass
n	5	22	15	5	10
L	700-850 (762 $\pm$ 46.2)	776.5-982.5 (875.5 $\pm$ 58.53)	704.5-1176.5 (927.5 $\pm$ 163.0)	770.5-817.5 (797.5 $\pm$ 20.32)	750-922 (861.0 $\pm$ 70.00)
Maximum body width	28-41 (34.3 $\pm$ 4.3)	32.5-48.0 (38.5 $\pm$ 4.01)	33.0-49.5 (40.5 $\pm$ 5.34)	31.5-40.5 (37.0 $\pm$ 4.32)	33.0-45.5 (38.0 $\pm$ 4.66)
Pharynx length	137-185 (162.3 $\pm$ 15.2)	119.0-194.0 (153.0 $\pm$ 20.25)	123.5-167.5 (152.0 $\pm$ 13.04)	125.0-186.5 (155.5 $\pm$ 26.68)	142.5-184.0 (153.5 $\pm$ 17.07)
Onchiostyle length	51.5-61 (57.3 $\pm$ 3.5)	49.5-62.5 (54.0 $\pm$ 3.46)	48.0-57.5 (53.0 $\pm$ 3.01)	50.0-57.0 (53.0 $\pm$ 3.29)	53.0-56.5 (54.5 $\pm$ 1.44)
Anterior end to excretory pore (EP)	104-118 (111 $\pm$ 4.7)	84.5-130.5 (111.0 $\pm$ 11.94)	82.5-135.5 (114.0 $\pm$ 14.16)	91.0-109.5 (101.0 $\pm$ 7.63)	109.0-127.5 (114.0 $\pm$ 7.78)
Anterior genital branch	–	110.5-226.5 (156.5 $\pm$ 29.41)	82.5-285.5 (193.0 $\pm$ 59.30)	132.5-195.5 (161.5 $\pm$ 29.39)	144.0-239.5 (204.0 $\pm$ 39.5)
Posterior genital branch	–	116.0-207.5 (154.0 $\pm$ 19.40)	153.0-367.5 (210.0 $\pm$ 57.33)	164.5-213.0 (192.5 $\pm$ 21.71)	144.0-241.0 (209.5 $\pm$ 38.5)
Ratio a	19.5-25.0 (23.0 $\pm$ 2.1)	19.5-27.5 (23.0 $\pm$ 2.21)	17.5-27.5 (23.0 $\pm$ 2.69)	19.0-25.5 (22.0 $\pm$ 3.03)	16.5-26.0 (23.0 $\pm$ 3.80)
Ratio b	4.0-5.4 (4.7 $\pm$ 0.4)	4.0-8.0 (6.0 $\pm$ 0.82)	5.0-7.5 (6.0 $\pm$ 0.97)	4.5-6.5 (5.5 $\pm$ 0.94)	5.0-6.5 (5.5 $\pm$ 0.58)
Ratio c	77.6-114 (97.3 $\pm$ 12.4)				
Ratio c'	0.40-0.50 (0.44 $\pm$ 0.05)				
Ratio V	54.9-61.0 (58.1 $\pm$ 1.9)	54.0-59.5 (56.0 $\pm$ 1.42)	49.0-60.5 (55.0 $\pm$ 3.02)	54.5-56.5 (55.5 $\pm$ 0.85)	52.5-62.0 (57.5 $\pm$ 3.78)
Ratio G 1 (%)	14.9-33.0 (20.1 $\pm$ 6.0)	13.0-27.5 (18.0 $\pm$ 3.51)	8.0-27.0 (20.5 $\pm$ 4.73)	17.0-24.0 (20.5 $\pm$ 3.51)	19.0-26.0 (23.5 $\pm$ 2.83)
Ratio G 2 (%)	15.2-27.0 (21.3 $\pm$ 4.2)	12.5-24.0 (17.5 $\pm$ 2.67)	17.5-32.0 (22.5 $\pm$ 4.18)	20.0-27.5 (24.0 $\pm$ 3.30)	17.0-31.0 (24.5 $\pm$ 5.07)
Anterior end to EP/Pharynx length (%)	58.4-75.0 (68.7 $\pm$ 6.1)	55.0-90.0 (73.0 $\pm$ 9.54)	64.5-85.5 (75.0 $\pm$ 7.47)	55.5-77.5 (66.5 $\pm$ 10.63)	69.5-76.5 (74.5 $\pm$ 2.81)
Onchiostyle length/Pharynx length (%)	33.0-37.0 (35.4 $\pm$ 1.6)	27.5-46.0 (35.5 $\pm$ 4.68)	30.0-44.5 (35.5 $\pm$ 4.05)	30.5-40.0 (34.5 $\pm$ 4.24)	30.5-39.0 (36.0 $\pm$ 3.30)

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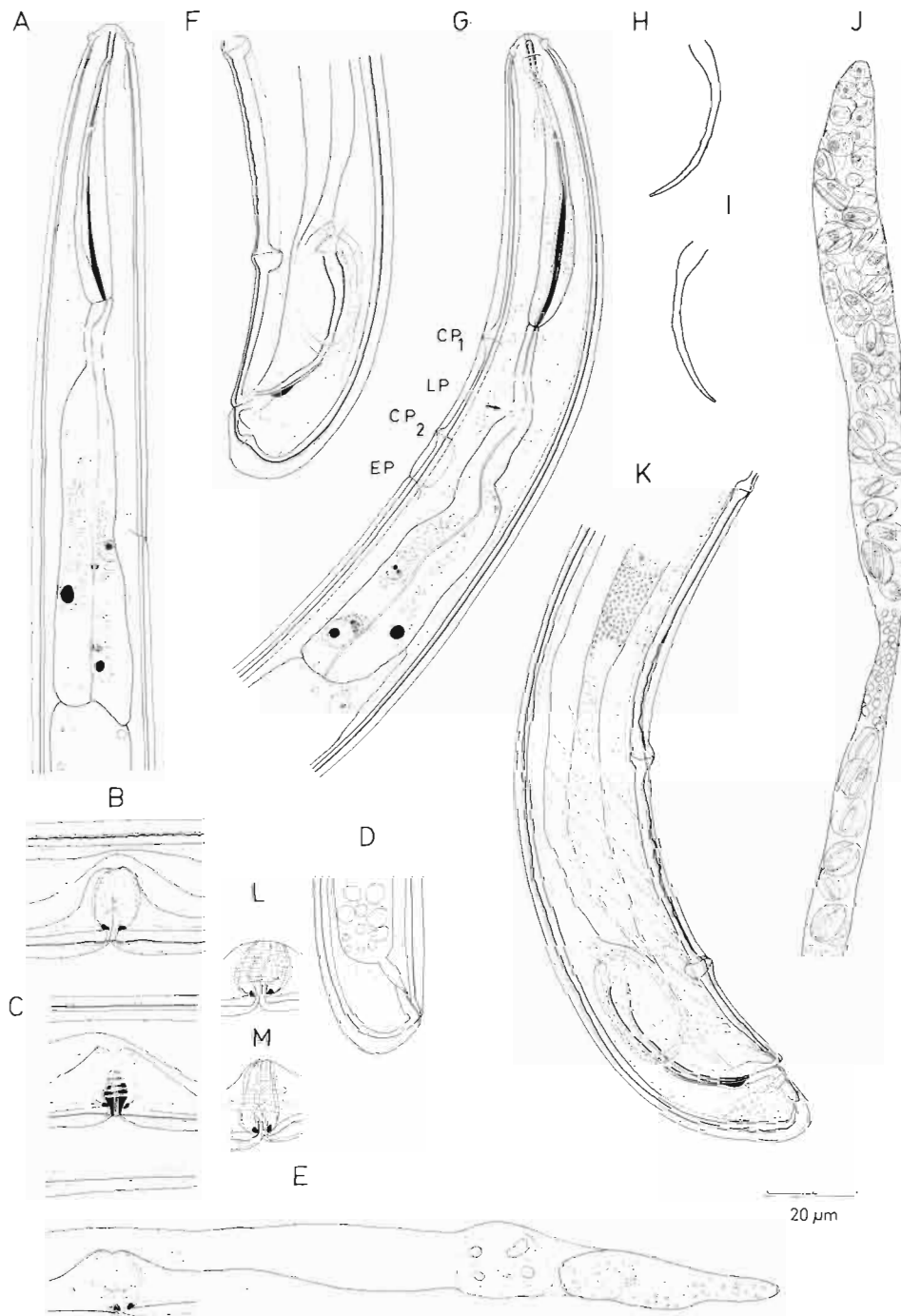
**Table 2.** Morphometric data of males of *Trichodorus giennensis* n. sp., type specimens (all measurements in  $\mu\text{m}$ ).

Locality		Sierra Caracolera (Alcaudete), Jaén	Sierra Morena, Andujar, Jaén (Southeastern Spain)			Purchil
Plant host		<i>Paenio-Quercetum rotundifoliae</i>	<i>Asphodelus</i> sp.	<i>Alnus glutinosa</i> L.	<i>Fraxinus angustifolia</i> L.	Grass
n	Hol ♂	5	26	20	5	10
L	805	705-770 (734 ± 29.5)	716.0-984.0 (861.0 ± 63.00)	550-900 (781.0 ± 82.22)	784.0-789.5 (787.5 ± 3.40)	748.5-1004.5 (887.5 ± 96.77)
Maximum body width	33	31-46 (36.3 ± 4.7)	29.5-40.0 (34.0 ± 2.46)	28.5-40.5 (33.5 ± 2.53)	30.5-34.0 (32.5 ± 1.80)	29.5-37.5 (32.5 ± 3.39)
Pharynx length	162	146-170 (156.8 ± 9.6)	116.0-194.0 (149.0 ± 18.69)	111.5-167.5 (138.5 ± 15.62)	123.5-173.5 (152.5 ± 25.91)	141.0-222.0 (173.5 ± 30.79)
Onchiostyle length	58	54.5-60.0 (57.4 ± 1.8)	44.5-58.0 (52.5 ± 2.97)	49.0-59.0 (54.0 ± 2.68)	53.0-57.0 (55.5 ± 2.12)	51.5-56.5 (53.5 ± 2.02)
Anterior end to LP	77	76-84 (80.7 ± 2.6)				
Anterior end to excretory pore (EP)	112	98-121 (106.5 ± 8.1)	80.5-135.5 (114.5 ± 14.17)	86.0-122.5 (108.5 ± 8.53)	111.5-117.0 (115.0 ± 2.90)	110.0-127.5 (117.5 ± 7.00)
Anterior end to CP 1 *	77		53.0-94.0 (74.5 ± 11.66)	48.5-84.5 (70.0 ± 8.42)	71.5-73.0 (72.5 ± 0.68)	69.5-86.0 (76.0 ± 7.91)
Distance CP 1 to CP 2 *	24	16-28 (22.3 ± 4.7)	14.0-36.0 (27.5 ± 5.57)	17.0-34.0 (27.0 ± 4.37)	26.5-29.5 (28.0 ± 1.48)	18.0-29.5 (27.0 ± 4.89)
Distance CP 2 to EP *	16	8-22 (12.7 ± 5.6)	7.0-20.5 (12.5 ± 3.21)	6.0-19.0 (11.5 ± 2.94)	11.5-14.5 (13.5 ± 1.70)	11.0-17.5 (13.5 ± 2.66)
Spicule length	44	41-47 (43 ± 1.9)	41.0-50.0 (46.0 ± 2.16)	39.5-47.0 (44.5 ± 2.10)	41.0-46.0 (43.5 ± 2.38)	42.5-50.0 (46.0 ± 2.78)
Gubernaculum length	22	13-19 (16.6 ± 2.4)	11.5-18.5 (16.5 ± 1.77)	13.5-19.5 (16.5 ± 1.31)	16.0-17.5 (17.0 ± 1.02)	16.0-20.0 (17.5 ± 1.50)
Distance cloaca to SP 1	28	22-38 (31.7 ± 6.8)	19.5-41.0 (35.5 ± 4.21)	26.5-42.5 (34.5 ± 4.27)	32.5-34.5 (34.0 ± 1.36)	31.0-41.0 (36.0 ± 3.65)

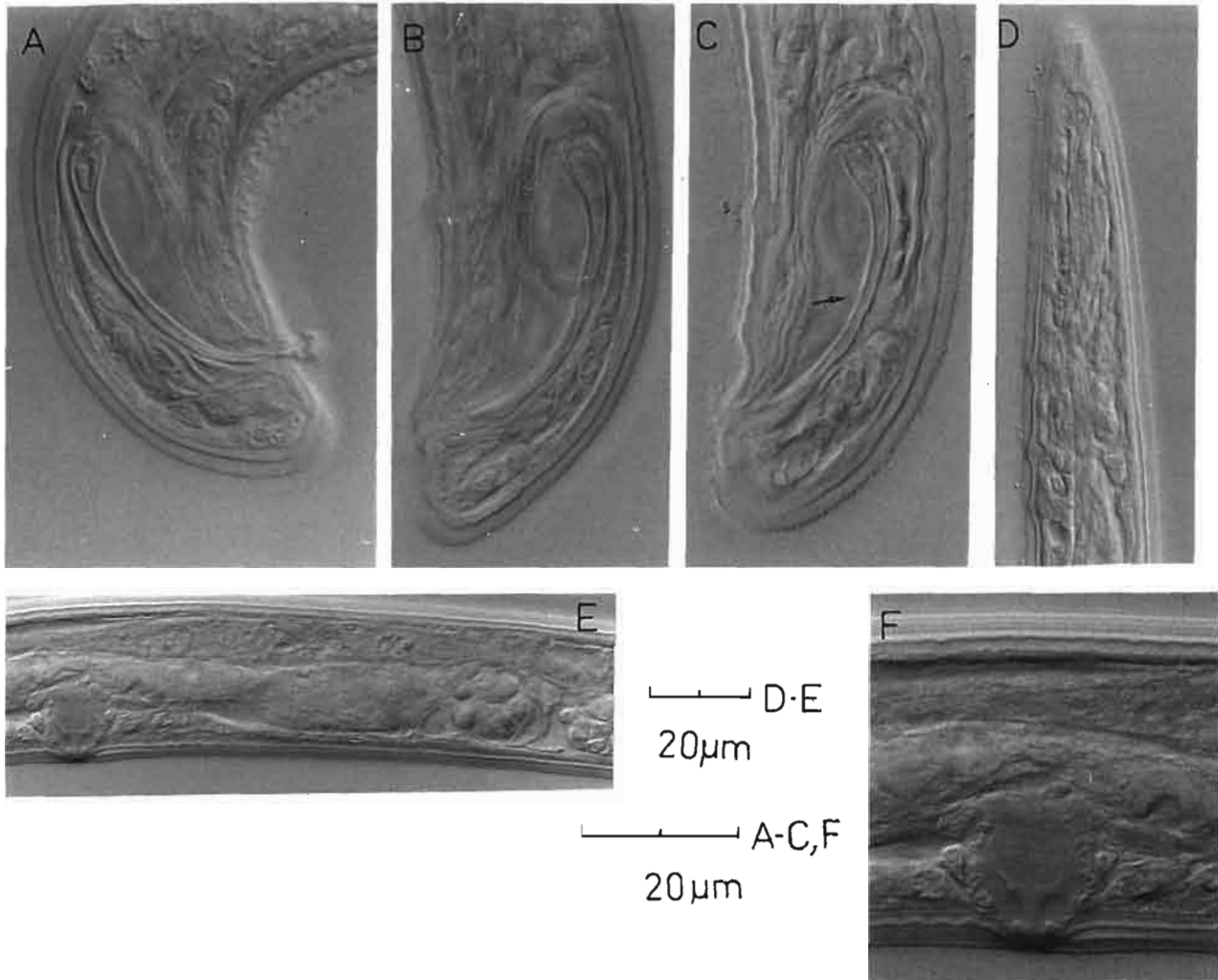
\* Males with one ventral cervical papilla omitted. (EP = excretory pore : respectively posterior, middle, anterior ventro-memidian.)

**Table 2** (cont.). Morphometric data of males of *Trichodorus giennensis* n. sp., type specimens (all measurements in  $\mu\text{m}$ ).

Locality	Sierra Morena, Andujar, Jaén (Southeastern Spain)					Purchil
	Sierra Caracolera (Alcaudete), Jaén	<i>Asphodelus</i> sp.	<i>Alnus glutinosa</i> L.	<i>Fraxinus angustifolia</i> L.	Grass	
Distance SP 1 to SP 2	48	31-57 (46.2 $\pm$ 10.1)	35.5-60.5 (49.5 $\pm$ 7.15)	33.5-58.0 (45.0 $\pm$ 7.26)	46.0-49.5 (48.0 $\pm$ 1.80)	44.5-63.5 (55.0 $\pm$ 8.04)
Distance SP 2 to SP 3	65	46-65 (57.2 $\pm$ 7.1)	50.5-89.0 (75.5 $\pm$ 9.82)	44.5-77.5 (61.5 $\pm$ 9.29)	45.5-52.5 (50.0 $\pm$ 3.92)	54.0-82.5 (64.0 $\pm$ 10.95)
Ratio a	24.5	16.5-22.0 (20.5 $\pm$ 2.0)	22.5-31.0 (25.5 $\pm$ 1.89)	16.0-28.0 (23.0 $\pm$ 2.74)	23.0-25.5 (24.5 $\pm$ 1.26)	25.0-29.5 (27.5 $\pm$ 1.99)
Ratio b	5.2	4.1-6.8 (5.1 $\pm$ 0.8)	4.0-7.5 (6.0 $\pm$ 0.81)	4.5-7.0 (5.5 $\pm$ 0.59)	4.5-6.5 (5.5 $\pm$ 0.99)	3.5-6.5 (5.5 $\pm$ 1.25)
Ratio c	53.7	47.0-59.0 (52.2-4.9)				
Ratio T (%)	64.1	50.9-68.0 (58.9 $\pm$ 6.8)	52.0-68.5 (61.5 $\pm$ 4.23)	54.0-68.0 (62.0 $\pm$ 3.96)	56.5-72.5 (64.0 $\pm$ 8.04)	57.5-72.0 (63.5 $\pm$ 6.07)
Anterior end to EP/Pharynx length (%)	69.1	57.6-76.0 (68.5 $\pm$ 5.1)	47.5-108.0 (78.0 $\pm$ 13.98)	68.0-93.5 (79.5 $\pm$ 7.85)	67.5-94.5 (77.0 $\pm$ 14.88)	53.5-79.0 (69.0 $\pm$ 9.69)
Onchiostyle length/Pharynx length (%)	35.8	32.9-41.0 (36.4 $\pm$ 2.7)	28.0-43.5 (36.5 $\pm$ 3.90)	33.5-48.0 (39.5 $\pm$ 4.31)	30.5-46.0 (37.0 $\pm$ 8.10)	24.0-37.0 (31.5 $\pm$ 5.47)
Cloaca to SP 1/Spicule length (%)	63.6	–	43.5-86.5 (76.5 $\pm$ 8.60)	65.0-100.0 (77.5 $\pm$ 9.10)	75.5-78.5 (77.5 $\pm$ 1.72)	73.5-87.5 (78.0 $\pm$ 5.70)
Cloaca to SP 2/Spicule length (%)	172.7	–	122.5-216.5 (183.5 $\pm$ 20.88)	147.5-211.5 (178.5 $\pm$ 18.00)	182.5-195.5 (187.0 $\pm$ 7.35)	179.0-222.5 (196.5 $\pm$ 16.76)
Cloaca to SP 3/Spicule length (%)	320.4	–	279.5-401.5 (347.0 $\pm$ 32.91)	376.0-250.0 (317.5 $\pm$ 31.10)	285.5-321.5 (301.5 $\pm$ 18.37)	307.0-397.5 (335.0 $\pm$ 35.71)



**Fig. 1.** *Trichodorus giennensis* n. sp. Female paratypes. A : Anterior body region; B-C, L-M : Vaginal region, lateral optical section, with a secretion plug in C and anterior end on right side; D : Tail region; E : Female reproductive system, anterior branch. Males. G : Anterior body region, holotype; H-I : Spicules, paratypes; J : Shape of sperm in testis; K : Posterior body region, holotype. A-K : Specimens from type locality; L-M : Specimens from Andujar, rhizosphere of *Alnus glutinosa*.



**Fig. 2.** *Trichodorus giennensis* n. sp. A-C: Copulatory apparatus and tail region in paratypes and in holotype male (B) (arrow indicates bristle); D: Anterior body region with cervical papillae and excretory pore in holotype male; E: Female reproductive system, anterior branch in paratype; F: Vaginal region, lateral, in paratype female.

#### TYPE MATERIAL

Holotype male and one paratype female (slide 0495) and 4 males, 3 females and 3 juvenile paratype specimens (slides 0494, 0496, 0497, 0499, 061 and V) in the collection of the University of Granada; 2 males (slide 0500 = RIT 396), 6 males (slide RIT 417, from rhizosphere *Asphodelus* sp.) and 2 females (slide 0493 = RIT 397) in the collection of the Koninklijk Belgisch Instituut voor Natuurwetenschappen, Brussels; 3 males and 6 females from rhizosphere of *Asphodelus* sp. (slides

1 and 6) in the collection of the Instituto de Agricultura Sostenible, CSIC, Córdoba, Spain and all other type specimens: 52 males and 46 females in the collection of the Instituto di Nematologia Agraria di Bari, Italy.

#### TYPE HABITAT AND LOCALITIES

Soil around the roots of *Paeonio-Quercetum rotundifoliae* Rivas Martinez, 1946 (holm-oak forest) in Sierra Caracolera, Alcaudete, province of Jaén, Spain, collected by Peña-Santiago.

## OTHER HABITATS AND LOCALITIES

Soil around the roots of olive (*Olea europea* L.), Peal de Becerro, Province de Jaén, Spain, collected on August 1985 by Peña-Santiago. Soil samples from the rhizosphere of *Asphodelus* sp., *Alnus glutinosa* L., *Fraxinus angustifolia* L. and grass from the Sierra Morena, Andújar, Jaén, Spain.

## DIAGNOSIS AND RELATIONSHIPS

*Trichodorus giennensis* n.sp. is characterized by an average onchiostyle length between 52.5 and 58  $\mu\text{m}$  (different populations); in male : by two ventromedian cervical papillae between onchiostyle base and excretory pore, by the shape of the spicules with widened manubrium, a slender calomus distally tapered, at mid-level with a slight narrowing and usually provided with a few bristles, by the arrangement of the usually three precloacal supplements, with the posteriormost SP 1 opposite the anterior end of the spicules and by the tail shape and usually slightly thickened cuticle at tail tip; in female : by a barrel-shaped vagina (when relaxed), by small vaginal sclerotized pieces, small triangular to irregular rounded, clearly separated in lateral optical section, and by the presence of a single pair of postadvulvar lateral body pores, with or without a prevulvar lateral body pore on each side at about five body widths anterior to the vulva.

*T. giennensis* n. sp. closely resembles the species belonging to the "*T. aequalis*" group such as *T. aequalis* Allen, 1957, *T. coomansi* De Waele & Carbonell, 1983; *T. hooperi* Loof, 1973; *T. orientalis* De Waele & Hashim, 1984; *T. parorientalis* Decraemer & Kilian, 1992 and *T. sparsus* Szczygiel, 1968 in males by possessing two well developed ventromedian cervical papillae (CP) anterior to the excretory pore (EP) (except in *T. parorientalis* with EP in between both CP), the posteriormost supplement (SP 1) at the level of the spicule manubrium; and in females by small vaginal sclerotizations. The morphometric data of the new species largely agree with those of *T. sparsus* and *T. parorientalis*. The new species was compared with type specimens of all the species of the *T. aequalis* group.

*T. giennensis* n. sp. differs from the "*T. aequalis*" - like species in male by a different spicule shape (i.e. with enlarged manubrium and slight constriction at mid-calomus), a slightly thickened terminal cuticle (instead of no swelling or a clear swelling as in the other species of the *T. aequalis* group) and in females by the barrel shape of the vagina, by the usually triangular shape and oblique orientation of the small vaginal sclerotized pieces in lateral optical section and by a single pair of lateral postadvulvar body pores in the type population and most other specimens, rarely two pores i.e. a lateral postadvulvar and a prevulvar lateral pore on each side.

**Paratrichodorus hispanus** Roca & Arias, 1986

## MEASUREMENTS

See Tables 3 and 4.

## REMARKS

The specimens from the Sierra Morena agree largely with the original description, apart from some variability in morphometric data. *P. hispanus* specimens from Jaén have a somewhat shorter mean body length (856  $\mu\text{m}$  in male, 808  $\mu\text{m}$  in female) than the type specimens with respectively 956  $\mu\text{m}$  in male, 985  $\mu\text{m}$  in female, due to a wider range of the lower value; a slightly shorter onchiostyle length in females (43-59 (51)  $\mu\text{m}$ ) against 56.4-63.5 (59.6)  $\mu\text{m}$  in type specimens). The excretory pore in both sexes is closer to the anterior body end (79.5-114.5  $\mu\text{m}$  in male, 81-112  $\mu\text{m}$  in female) than in the type specimens (97.6-122.3 male, 103-123.5 female). Males have also somewhat shorter spicules (44-54.5 (48.5)  $\mu\text{m}$  against 53-61.7 (56)  $\mu\text{m}$  in type specimens).

**Paratrichodorus teres** (Hooper, 1962) Siddiqi, 1974

## MEASUREMENTS

Tables 3 and 4.

## REMARKS

The small populations of *P. teres* found in Sierra Morena, Spain are bisexual, with an equal or even higher number of males than females. They largely agree with former descriptions (Hooper, 1962; Kuiper & Loof, 1962; Hooper, 1963; Decraemer, 1990; Decraemer & Reay, 1991) in morphological and morphometric features. They possess a pronounced overlap of the pharyngeal glands as in specimens from Poland (Decraemer & De Waele, 1981), the distance of the excretory pore from anterior end shows a wider range than in the type population. However, no sperm or only few small rounded sperm was observed in the Spanish male and female specimens.

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**Table 3.** Morphometric data of males of *Paratrichodorus hispanus* and *P. teres* from Sierra Morena, Andujar, Jaén (South-eastern Spain) (all measurements in  $\mu\text{m}$ ).

Plant host	<i>P. hispanus</i>		<i>P. teres</i>	
	<i>Fraxinus angustifolia</i> L.	<i>Alnus glutinosa</i> L.	<i>Fraxinus angustifolia</i> L.	
n	6	13	5	
L	691.0-956.0 (856.0 $\pm$ 87.97)	782.5-1029.5 (875.5 $\pm$ 71.65)	614.5-825.0 (754.5 $\pm$ 82.36)	
Maximum body width	29.5-40.0 (36.0 $\pm$ 3.41)	30.5-41.0 (35.5 $\pm$ 2.76)	29.5-36.5 (32.5 $\pm$ 2.58)	
Pharynx length	104.5-225.0 (155.5 $\pm$ 35.57)	123.5-184.0 (147.5 $\pm$ 15.19)	122.0-159.0 (141.0 $\pm$ 16.04)	
Onchiostyle length	49.0-63.5 (54.0 $\pm$ 5.41)	43.0-54.0 (47.5 $\pm$ 3.23)	46.0-54.0 (50.5 $\pm$ 3.02)	
Anterior end to Excretory pore (EP)	79.5-114.5 (96.5 $\pm$ 13.55)	86.0-117.0 (101.5 $\pm$ 8.07)	99.5-116.5 (109.0 $\pm$ 6.89)	
Anterior end to CP 1	74.5-109.5 (91.0 $\pm$ 13.75)			
Spicule length	44.0-54.5 (48.5 $\pm$ 3.14)	36.5-57.5 (46.5 $\pm$ 4.53)	42.5-51.0 (48.0 $\pm$ 3.53)	
Gubernaculum length	11.5-16.0 (14.0 $\pm$ 1.60)	10.5-17.0 (12.5 $\pm$ 1.58)	12.0-15.5 (13.5 $\pm$ 1.42)	
Cloaca to SP 1	8.0-11.5 (10.5 $\pm$ 1.04)	11.0-16.0 (13.0 $\pm$ 1.34)	11.0-14.5 (12.5 $\pm$ 1.29)	
SP 1 to SP 2	11.5-20.5 (17.5 $\pm$ 3.03)	10.0-22.5 (13.5 $\pm$ 3.06)	12.0-19.5 (16.0 $\pm$ 3.49)	
SP 2 to SP 3	50.5-94.0 (67.5 $\pm$ 16.03)	84.5-152.5 (105.5 $\pm$ 16.17)	56.0-101.0 (80.5 $\pm$ 19.37)	
Ratio a	23.0-26.0 (24.0 $\pm$ 1.02)	23.0-27.5 (25.0 $\pm$ 1.35)	18.5-25.5 (23.0 $\pm$ 2.79)	
Ratio b	4.0-8.5 (5.5 $\pm$ 1.42)	4.5-7.5 (6.0 $\pm$ 0.70)	4.3-7.0 (5.5 $\pm$ 0.95)	
Ratio T (%)	57.0-66.5 (62.0 $\pm$ 2.86)	52.0-69.5 (60.5 $\pm$ 4.89)	55.0-64.5 (60.5 $\pm$ 3.99)	
Cloaca to SP 1/ Spicule length (%)	17.5-26.5 (21.5 $\pm$ 2.85)	25.0-35.0 (28.0 $\pm$ 2.74)	23.5-34.5 (26.5 $\pm$ 4.64)	
Cloaca to SP 2/ Spicule length (%)	53.0-66.0 (57.0 $\pm$ 4.66)	46.5-69.5 (57.5 $\pm$ 5.66)	48.0-69.5 (59.0 $\pm$ 9.36)	
Cloaca to SP 3/ Spicule length (%)	146.0-253.5 (196.5 $\pm$ 37.64)	211.0-376.0 (288.0 $\pm$ 41.93)	165.5-296.0 (228.0 $\pm$ 52.65)	
Anterior end to EP/ Pharynx length (%)	40.0-91.5 (65.0 $\pm$ 16.95)	53.0-82.5 (69.5 $\pm$ 8.2)	62.5-91.0 (78.5 $\pm$ 12.51)	
Onchiostyle length/ Pharynx length (%)	23.5-62.5 (37.0 $\pm$ 11.64)	24.5-40.5 (32.5 $\pm$ 4.10)	29.5-41.0 (36.0 $\pm$ 4.40)	

**Table 4.** Morphometric data of females of *Paratrichodorus hispanus* and *P. teres* from Sierra Morena, Andujar, Jaén (Southeastern Spain) (all measurements in  $\mu\text{m}$ ).

Plant host	<i>P. hispanus</i>		<i>P. teres</i>	
	<i>Fraxinus angustifolia</i> L.	<i>Alnus glutinosa</i> L.	<i>Fraxinus angustifolia</i> L.	
n	11	10	7	
L	660.5-1032.5 (808.0 $\pm$ 104.16)	916.0-1325.0 (1096.0 $\pm$ 149.98)	626.5-920.5 (763.5 $\pm$ 111.43)	
Maximum body width	31.5-40.5 (36.0 $\pm$ 3.13)	33.0-43.5 (38.5 $\pm$ 4.82)	31.5-38.0 (35.0 $\pm$ 2.68)	
Pharynx length	120.5-157.5 (141.0 $\pm$ 13.0)	125.0-166.0 (155.5 $\pm$ 17.32)	125.0-151.5 (142.0 $\pm$ 11.09)	
Onchiostyle length	43.0-59.0 (51.0 $\pm$ 4.97)	43.5-53.5 (48.5 $\pm$ 3.98)	41.0-50.0 (45.0 $\pm$ 2.96)	
Anterior end to Excretory pore (EP)	81.0-112.0 (92.5 $\pm$ 8.42)	77.5-137.0 (107.0 $\pm$ 26.68)	67.0-121.0 (89.0 $\pm$ 20.35)	
Anterior genital branch	106.0-250.0 (171.5 $\pm$ 47.46)	151.5-334.0 (234.5 $\pm$ 78.59)	110.5-181.0 (154.0 $\pm$ 25.87)	
Posterior genital branch	107.5-223.5 (166.5 $\pm$ 40.45)	181.0-325.0 (241.0 $\pm$ 70.28)	98.5-219.0 (146.0 $\pm$ 45.99)	
Ratio a	18.5-26.5 (22.5 $\pm$ 2.29)	25.0-32.5 (28.5 $\pm$ 3.43)	19.5-27.5 (22.0 $\pm$ 2.85)	
Ratio b	4.5-6.5 (5.5 $\pm$ 0.64)	6.5-8.0 (7.0 $\pm$ 0.61)	4.0-6.5 (5.5 $\pm$ 0.70)	
Ratio V	51.5-61.0 (55.0 $\pm$ 3.02)	51.0-55.0 (53.5 $\pm$ 1.57)	45.5-58.0 (53.5 $\pm$ 4.49)	
Ratio G 1	14.0-27.0 (21.0 $\pm$ 3.81)	14.5-26.0 (21.0 $\pm$ 4.75)	17.5-26.0 (20.5 $\pm$ 3.38)	
Ratio G 2	14.5-27.5 (20.5 $\pm$ 3.86)	18.5-27.5 (21.5 $\pm$ 4.06)	15.0-27.0 (19.0 $\pm$ 4.45)	
Anterior end to EP/ Pharynx length (%)	58.0-75.5 (65.5 $\pm$ 5.32)	47.0-82.5 (68.5 $\pm$ 14.41)	45.0-82.5 (62.5 $\pm$ 13.23)	
Onchiostyle length/ Pharynx length (%)	30.0-42.5 (36.5 $\pm$ 3.26)	27.5-36.0 (31.5 $\pm$ 3.26)	28.5-35.0 (32.0 $\pm$ 2.38)	

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