DESCRIPTION OF FOUR NEW SPECIES AND TWO POPULATIONS OF *ROTYLENCHUS* (NEMATODA : HOPLOLAIMIDAE)

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Summary. Four new species and two populations of *Rotylenchus* are described and figured. *R. aquaticus* sp. n. is characterized by an annulated, rounded and set off lip region; it is differentiated from *R. robustus, R. uniformis, R. buxophilus, R. eximius, R. rugatocuticulatus* and *R. ascalpi* by the number of head annules and by striations on head and body annules. *R. helenae* sp. n. is characterized by a lip region offset, truncated, bearing 3-4 annules; it is differentiated from *R. usitatus, R. geraerti, R. alius* and *R. capsicumi* by the number of lip annules, the spear and body size and by the longitudinal striations on body. *R. incognitus* sp. n. is characterized by a rounded and set off lip region bearing 8-10 annules; it is differentiated from *R. quartus, R. pruni, R. catharinae, R. ivanovae* and *R. microstriatus* by the number of head annules, the longitudinal striations on the body annules and by the body and stylet size. *R landii* sp. n. is characterized by a conoid, rounded and set off lip region with 5-6 annules; it is distinguished from *R. robustus, R. capensis, R. ascalpi* and *R. provencialis* by the areolation of lateral field and by striations on head and body annules. *R. pumilus* (Perry *et al.*, 1959) Sher, 1961 and *R. cypriensis* Antoniou, 1980 are also reported.

Soil samples were collected in the south region of France and in Algeria. Nematodes were extracted from soil by the Dalmasso's method (1966), killed and fixed in hot 5% formalin and mounted in anhydrous glycerin by the Seinhorst (1959) rapid method. All measurements are expressed in micrometers except the body length (L) in millimetres. The identification of the species has been made using the tabular key proposed by Scotto La Massese *et* Germani, 2000.

DESCRIPTIONS

ROTYLENCHUS AQUATICUS sp. n.
(Fig. 1; Table I)

Female holotype: L = 1.3 mm; a = 33.9; b = 8.2; b' = 7.2; c = 48.7; c' = 0.85; V = 56.4; m = 54.6; o = 12.9; stylet = 37.8 µm; lip annules = 5.

Female body C shaped, to form an open circle. Cuticle coarsely annulated, 2.5 µm wide at mid-body region, without striations. Lateral field with four smooth incisures, areolated at oesophageal region only. Lip region offset, broadly rounded, with 5-6 distinct annules without longitudinal striations; labial disc indistinct. Stylet well developed; metenchium ranges in length from shorter to longer than telenchium. Basal knobs massive, rounded. Outlet of dorsal oesophageal gland 4.6-7 µm behind the stylet base. Median bulb rounded, muscular, with a well-developed valvular apparatus. Isthmus short, encircled by nerve ring. Excretory pore located at the level of oesophago-intestinal junction at 151-177.6 µm from the anterior end. Hemizonid two annules long, 1-2 annules anterior to excretory pore. Vulva a transverse slit; epiptygma double. Ovaries paired, oocytes arranged in a single row. Spermatheca rounded, without sperm. Intestine does not overlap rectum. Phasmid pore like, its position varying from three annules anterior to three annules posterior to anus. Tail conoid, rounded, 25.6-35.8 µm long, bearing 11-15 annules.

Males not found.

Type habitat and locality: rhizosphere of unspecified grasses, from Salin de Badon, 13120, France.

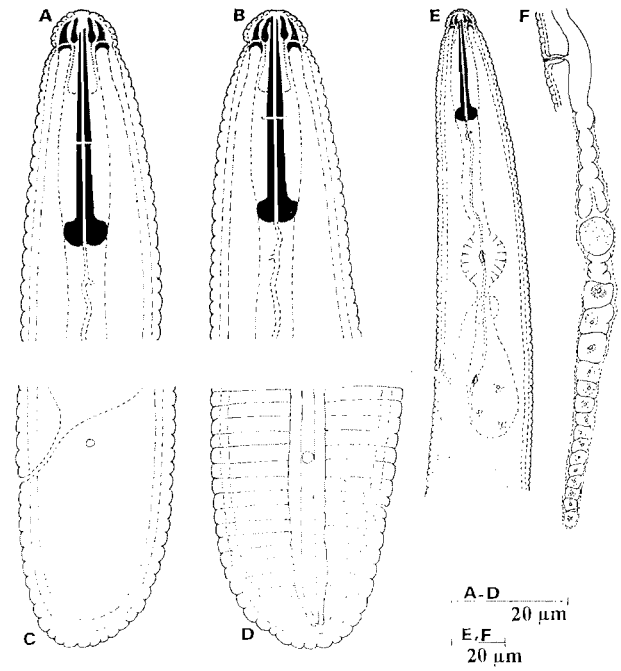

Fig. 1. *Rotylenchus aquaticus* sp.n. Female: A, B: anterior end; C, D: tail; E, oesophageal part; F, genital tract.

Type material: holotype in the collection of Instituut voor Dierkunde, Gent, Belgium. One paratype female in the collection of the following institutes: Istituto di Nematologia Agraria del Consiglio Nazionale delle Ricerche, Bari, Italy; Nematology Department, Agricultural University, Wageningen, Netherlands; Biologische Bundesanstalt, Münster, Germany; CABI Bioscience Center, Egham, United Kingdom; U S D A, MD, Beltsville, USA. Ten paratypes female in the collection of Institut National de la Recherche Agronomique, 06600, Antibes, France.

Differential diagnosis and relationship: *R. aquaticus* sp.n. is characterized by an annulated, rounded and set off lip region, bearing 5-6 annules, it is close to *R. robustus* (de Mann, 1876) Filipjev, 1936, *R. uniformis* (Thorne, 1949) Loof *et* Oostenbrink, 1968, *R. buxophilus* Golden, 1956, R. *eximius* Siddiqi, 1964, *R. rugatocuticulatus* Sher, 1965 and *R. ascalpi* Scotto La Massese *et* Germani, 2000. It can be distinguished from those species by the unstriated head annules *vs* striated. It differs also from *R. buxophilus, R. eximius* and *R. rugatocuticulatus* by the head annules number (5-6 *vs* 4-5); from *R. rugatocuticulatus* and *R. ascalpi* and by the absence of longitudinal striations on body annules *vs* presence; from *R. robustus* by the absence of areolation of lateral field at mid-body *vs* presence; from *R. robustus*, *R. uniformis*, R. *eximius* and *R. ascalpi* by the absence of males *vs* presence.

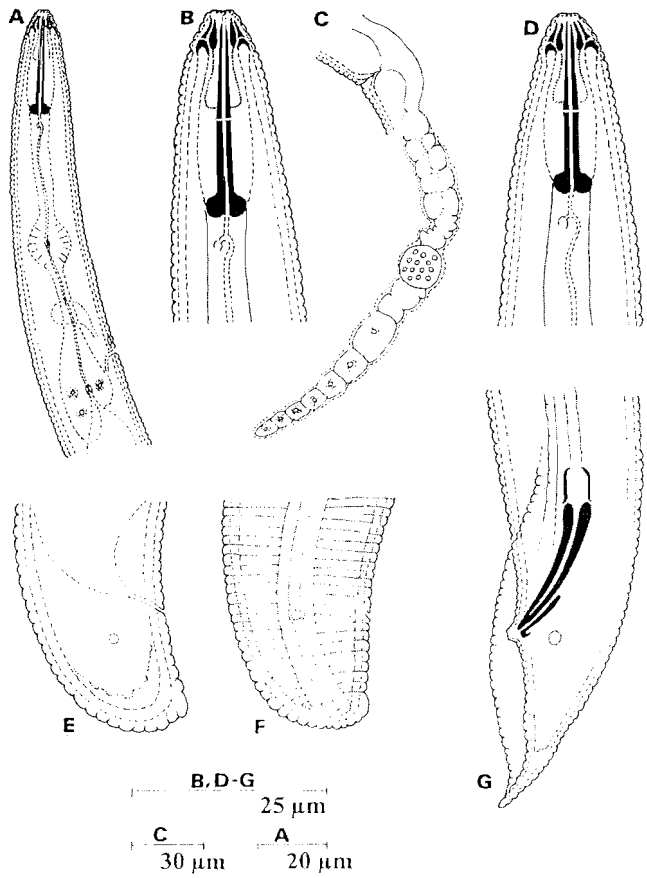

Fig. 2. *Rotylenchus helenae* sp.n.: A, female oesophageal part; B, female anterior end; C, female genital tract; D, male anterior end; E, F, female tail; G, male tail.

ROTYLENCHUS HELENAE sp. n.
(Fig. 2; Table I)

Female holotype: L = 0.85 mm; a = 33; b = 9.1; b' = 7; c = 46.3; c' = 0.94; V = 58.5; m = 50; o = 12.5; stylet = 29.3 µm; lip annules = 4.

Female habitus spiral. Body annules 2 µm wide at mid-body without striations. Lateral field areolated at oesophageal region. Lip region truncate slightly offset with 3-4 annules without longitudinal striations; labial disc distinct. Stylet well developed, metenchium ranges in length from shorter to longer than telenchium. Basal knobs massive, rounded. Outlet of dorsal oesophageal gland 3-4.3 µm behind the stylet base. Median bulb rounded, with a well developed valvular apparatus. Isthmus short, encircled by nerve ring. Excretory pore 100.6-124.3 µm from the anterior end, anterior or posterior to oesophago-intestinal junction. Hemizonid 1-2 annules long, 1-2 annules anterior to excretory pore. Vulva a transverse slit, epiptygma not seen. Ovaries paired, oocytes arranged in a single row. Spermatheca rounded, with rounded sperms. Intestine does not extend over rectum. Phasmid position varying from five annules anterior to four annules posterior to anus. Tail conoid, rounded, 12.2-20.7 µm long bearing 8-17 annules.

Male similar to female except for sexual dimorphism. Bursa crenate. Spicules slightly ventrally curved 28-31.7 µm long. Gubernaculum 9.8-12.2 µm. Vélum and capitulum not observed.

Type habitat and locality: rhizosphere of *Triticum aestivum* L. and *Erica cinerea* L., from Marcenat, 15330, France.

Type material: holotype and one paratype male in the collection of Instituut voor Dierkunde, Gent, Belgium. One paratype female and one paratype male in the collection of the following institutes: Istituto di Nematologia Agraria del Consiglio Nazionale delle Ricerche, Bari, Italy; Nematology Department, Agricultural University, Wageningen, Netherlands; Biologische Bundesanstalt, Münster, Germany; CABI Bioscience Center, Egham, United Kingdom; U S D A, MD, Beltsville, USA. Eleven paratypes female and five paratypes male in the collection of Institut National de la Recherche Agronomique, 06600, Antibes, France.

Differential diagnosis and relationship: *R. helenae* sp.n. is characterized by a truncated, annulated and offset lip region with 3-4 annules; it is close to *R. usitatus* Van den Berg *et* Heyns, , 1974, *R. geraerti* (Jairajpuri *et* Siddiqi, 1979) Zancada *et* Lima, 1986, *R. alius* Van den Berg, 1986 and *R. capsicumi* Firoza *et* Maqbool, 1991. It can be distinguished from *R. usitatus, R. alius* and R. *capsicumi* by the head annules number (3-4- *vs* 4-5) ; from *R.*

Table I. Morphometrics of paratypes of *Rotylenchus* new species.

	R. acquaticus	*R. helenae*		*R. incognitus*		*R. landii*	
n	15 ♀♀	16 ♀♀	10 ♂♂	7 ♀♀	8 ♂♂	10 ♀♀	5 ♂♂
L mm	1.3±0.081 (1.2-1.53)	0.91±0.06 (0.83-0.99)	0.82±0.04 (0.79-0.9)	1.13±0.09 (0.93-1.26)	1±0.15 (0.77-1.16)	1.01±0.04 (0.94-1.09)	0.9±0.07 (0.72-1.03)
a	38.5±5.4 (33.8-45.5)	32.1±2.3 (28.4-36.2)	37.3±2.75 (34.6-44.8)	33.9±3.18 (28.6-36.3)	36.5±5.5(29.6-42.1)	26.8±2 (23.5-30.3)	27.9±1.4 (25.9-32.3)
b	8.6± 1.1 (8.3-10.5)	8.6±0.94 (6.6-9.6)	7.1±0.54 (6.1-7.6)	6.7±0.51 (6-7.3)	6.7± 0.7 (5.7-7.5)	8.5 ± 1.06 (7.09-10.36)	7.1± 0.78 (5.7-8.7)
b'	7.2±1.084 (6.4-9.4)	7±0.3 (7.3-9.9)	6.3±0.33 (5.7-6.9)	6.38±0.45 (5.73-6.9)	6±0.7 (5.1-6.8)	7.25±0.67 (6.4-8.75)	6.1±0.6 (5.3-6.7)
c	45.9±4.7 (38.1-56)	54.4±8.4 (37.7-67.9)	33.9±1.7 (31.6-36.1)	51.6±7.1 (43.8-63)	36.5±5.5 (29.6-42)	64.4±4.4 (55.3-70)	40.4±4.4 (35.4-46)
c'	1±0.16 (0.7-1.1)	0.88±0.14 (0.67-1.18)	1.46±0.06 (1.38-1.54)	0.82±0.06 (0.75-0.91)	1.53±0.13 (1.35-1.7)	0.65± 0.07 (0.55-0.78)	1.1± 0.25 (0.8-1.4)
Head annules	5-6	3-4	4	8-10	8-10	5-6	5-6
Stylet µm	39.2±1.2 (37-41)	29.6±1.06 (28-31.7)	26.8±0.7 (25.6-28.1)	36.3±1.3 (34-37.8)	32.3±0.8 (31-35)	35.4±1 (34.1-37)	32.5±0.6 (32-33)
DOGO* µm	5.4±0.65 (4.6-7)	3.6±0.46 (3-4.3)	3.4±0.5 (2.5-4.3)	4±0.6 (2.5-4.6)	2.9±0.7 (2.5-4)	4.9±0.27 (4.2-5.5)	4.5±0.5 (3.7-5)
m	48.1±2.6 (46-54.8)	49.9±1.9 (47.8-54.2)	51.9±1.6 (50-54.6)	51.6±1.18 (50-53.3)	51.6±1.3 (50-53.2)	46.04±2.84 (40-50)	49±1.04 (48-50)
o	15.6±1.8 (12.5-19)	12.1±1.5 (9.6-14.6)	12.8±1.9 (9.1-15.9)	12.7±0.62 (11.7-13.3)	10.2±0.77 (9.1–11.2)	13.84±0.79 (12.6-15.5)	12.4±0.45 (12-13)
Excretory** pore µm	164±8.9 (151-177.6)	107.4±6.1 (100.6-124.3)	104±6.8 (88-116)	137.4±15.1 (112.5-171.7)	125±9 (113-133)	122±6.3 (115.4-130.2)	120±11 (103-133)
V	54.7±1.15 (52-56.8)	58.1±1.7 (54.1-60.9)	–	54.9±1.84 (51.4-57.8)	–	54.7±1.45 (51.9-58)	–
Tail length µm	29.3±3.7 (25.6-35.8)	17.6±3 (12.2-20.7)	–	22.9±2.6 (18.3-24.4)	–	15.7±1 (14.6-17)	–
Tail annules	12.6±1.36 (11-15)	13±2 (8-17)	–	14.7±1.5 (12-18)	–	14±1.5 (12-18)	–
Spicule µm	–	–	29.9±1.25 (28-31.7)	–	34±1.8 (31-36)	–	32.3±5 (25-36)
Gubernaculum µm	–	–	10.7±0.7 (9.8-12.2)		16.1±1.1 (14-17)	–	15±1.2 (14-16)

* Dorsal Oesophageal Gland Opening from base of stylet knobs.
** From the anterior end.

geraerti by the V value (54-61 *vs* 63-71), a longer stylet (28-31.7 *vs* 26-28) µm and the body size (0.8-1 vs 0.6-0.7) mm. It differs also from *R. usitatus* by the body size (0.8-1 *vs* 1.1-1.2); from *R. alius* by the lateral field areolated only at oesophageal region *vs* areolated at oesophageal region and along the body; from *R. capsicumi* by the absence of longitudinal striations on body *vs* presence and by the presence of males *vs* absence.

ROTYLENCHUS INCOGNITUS **sp.n.**
(Fig. 3; Table I)

Female holotype: L = 1.08 mm; a = 28.6; b = 6.6; b' = 6.9; c = 44.3; c' = 0.8; V = 55; m = 51.6; o = 12.9; stylet = 37.5 µm; lip annules = 10.

Female habitus C shaped. Body annules 1.5-2 µm wide at mid-body striated anteriorly to the excretory pore. Lateral field areolated at oesophageal region and at the phasmid level. Lip region conoid, rounded slightly set off with 8-10 annules without longitudinal striations; labial disc distinct. Stylet well developed, metenchium slightly longer than telenchium. Basal knobs massive with anterior process. Outlet of dorsal oesophageal gland 2.5-4.6 µm behind the stylet base. Median bulb ovate, with a well developed valvular apparatus. Isthmus short, encircled by nerve ring. Excretory pore located at 112.5-171.7 µm from the anterior end. Hemizonid two annules long, two annules anterior to excretory pore. Vulva a transverse slit, epiptygma not seen. Ovaries paired, oocytes arranged in a single row. Spermatheca rounded, with round sperms. Intestine does not extend over rectum. Phasmid position varies from two annules anterior to seven annules posterior to anus. Tail conoid, rounded, 18-24 µm long bearing 12-18 annules.

Male similar to female except for sexual dimorphism. Bursa crenate extending almost to tail tip. Phasmid 10 µm anterior to cloaca. Spicules ventrally curved 31-36 µm long. Gubernaculum 14-17µm. Vélum present. Capitulum not observed.

Type habitat and locality: *Pinus maritimus* L., Sabres, 40630, France. Other localities: *P. maritimus*, Escource-Laffitte, 40210 France; Argelouse, 40430, France.

Type material: holotype and one paratype male in the collection of Instituut voor Dierkunde, Gent, Belgium. One paratype female and one paratype male in the collection of the following institutes: Istituto di Nematologia Agraria del Consiglio Nazionale delle Ricerche, Bari, Italy; Nematology Department, Agricultural University, Wageningen, Netherlands; Biologische Bundesanstalt, Münster, Germany; CABI Bioscience Center, Egham, United Kingdom; U S D A, MD, Beltsville, USA. Two paratype females and three paratype males in the collection of Institut National de la Recherche Agronomique, 06600, Antibes, France.

Differential diagnosis and relationship: *R. incognitus* sp.n., characterized by a rounded and set off lip region bearing 8-10 annules is close to *R. quartus* (Andràssy, 1958) Sher, 1961, *R. pruni* Rashid *et* Husain, 1972, *R. catharinae* Van den Berg *et* Heyns, 1974, *R. ivanovae* Kankina *et* Teben'kova, 1980 and *R. microstriatus* Siddiqi *et* Corbett, 1982. It can be distinguished from those species by the presence of longitudinal striations on body annules anterior to the excretory pore *vs* absence and from the first four species by the number of head annules (8-10 *vs* 7-8). Also it can be differentiated from *R. catharinae, R. microstriatus* and *R. quartus* by a longer stylet (34-37.8 *vs* 29-34) µm; from *R. pruni* by a shorter stylet (34-37.8 *vs* 40-44) µm and by the presence of males *vs* absence; from *R. microstriatus, R. quartus* and *R. ivanovae* by the body size (0.93-1.26 *vs* 0.7-1) mm.

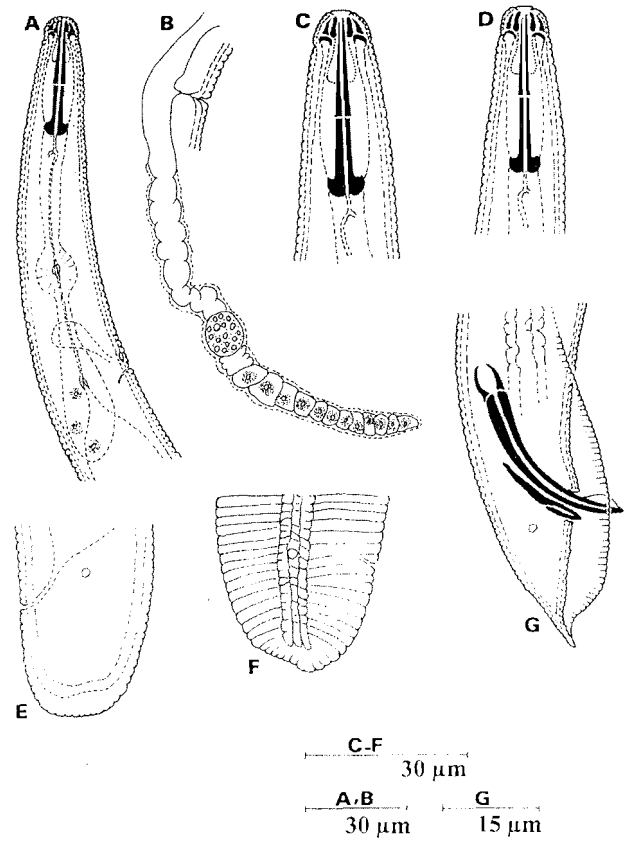

Fig. 3. *Rotylenchus incognitus* sp. n. A, female oesophageal part; B, female genital tract; C, female anterior end; D, male anterior end; E, F, female tail; G, male tail.

ROTYLENCHUS LANDII **sp.n.**
(Fig. 4; Table I)

Female holotype: L = 1 mm; a = 26.4; b = 9.4; b' = 7.2; c = 63; c' = 0.65; V = 54.5; m = 48.3; o = 15.5; stylet = 34.5µm; lip annules = 6

Female habitus spiral. Body annules 2 µm wide at mid-body, striated anteriorly to the excretory pore. Lateral field areolated at oesophageal region only. Lip region conoid, rounded, slightly offset, with 5-6 annules without longitudinal striations; labial disc distinct. Anterior cephalid at three annules behind lip region. Stylet well developed, metenchium shorter than telenchium. Basal knobs massive, anteriorly flattened. Outlet of dorsal oesophageal gland 4.2-5.5 µm behind the stylet base. Median bulb rounded, with a well developed valvular apparatus. Isthmus short, encircled by nerve ring. Excretory pore located at 115.4-130.2 µm from the anterior end. Hemizonid two annules long, 1- 2 annules anterior to excretory pore. Vulva a transverse slit, epiptygma not seen. Ovaries paired, oocytes arranged in a single row. Spermatheca rounded, with rounded sperms. Intestine with fasciculi not extending over rectum. Phas-

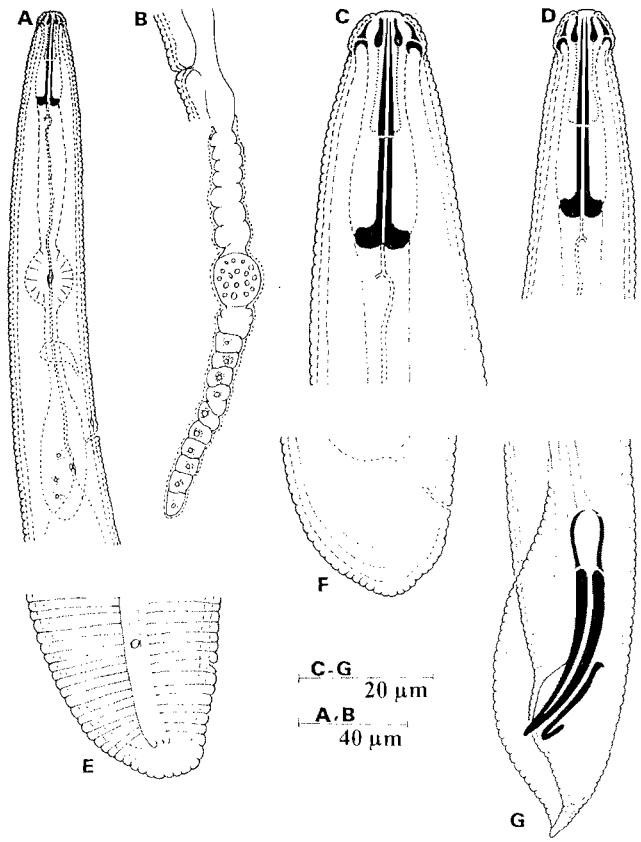

Fig. 4. *Rotylenchus landii* sp.n.: A, female oesophageal part; B, female genital tract; C, female anterior end; D, male anterior end; E, F, female tail; G, male tail.

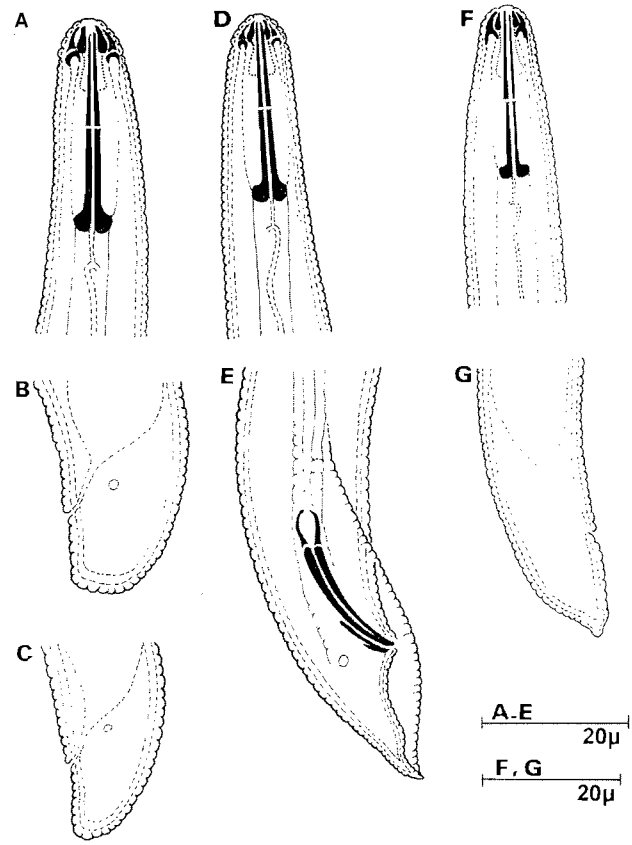

Fig. 5. *Rotylenchus pumilus*: A, female anterior end; B, C, female tail; D, male anterior end; E, male tail. *R. cypriensis*: F, female anterior end; G, female tail.

mid pore like, its position varying from three annules anterior to three annules posterior to anus. Caudalid at five annules behind anus. Tail conoid, rounded, 14.6-17 µm long bearing 12-18 annules.

Male similar to female except for sexual dimorphism. Bursa crenate. Spicules slightly curved ventrally, 25-36 µm long. Gubernaculum 12-17 µm. Vélum present. Capitulum not observed.

Type habitat and locality : rhizosphere of *Pinus maritimus* L., from Uchacq et Parentis, 40090, France.

Type material: holotype and one paratype male in the collection of Instituut voor Dierkunde, Gent, Belgium. One paratype female in the collection of the following institutes: Istituto di Nematologia Agraria del Consiglio Nazionale delle Ricerche, Bari, Italy; Nematology Department, Agricultural University, Wageningen, Netherlands; Biologische Bundesanstalt, Münster, Germany; CABI Bioscience Center, Egham, United Kingdom; U S D A, MD, Beltsville, USA. five paratype females and four paratype males in the collection of Institut National de la Recherche Agronomique, 06600, Antibes, France.

Differential diagnosis and relationship: R. landii sp.n., characterized by a conoid, rounded and set off lip region with 5-6 annules, is close to *R. robustus* (de Mann, 1876) Filipjev, 1936, R. *capensis* Van den Berg *et* Heyns, 1974, R. *ascalpi* Scotto La Massese *et* Germani, 2000 and *R. provencialis* Scotto La Massese *et* Germani, 2000. It can be distinguished from *R. robustus, R. capensis* and *R. provencialis* in having longitudinal striations on body annules *vs* absence; from *R. ascalpi* by the absence of longitudinal striations on head annules *vs* presence and by the body size (0.94-1.1 *vs* 1-1.4) mm. Also it can be distinguished from *R. robustus* by the lateral field areolated anteriorly only *vs* areolated at oesophageal region and at mid body; from *R. provencialis* by the stylet size (34.1-37 *vs* 30-33) µm and the presence of males *vs* absence.

ROTYLENCHUS PUMILUS (Perry et al, 1959) Sher, 1961

(Fig. 5; Table II)

This population was collected in the rhizosphere of *Pinus maritimus* L., from Maillas, 40120, France. The females in this population agree morphometrically with the original description but differ in having fasciculi and by absence of longitudinal striations on lip annules.

ROTYLENCHUS CYPRIENSIS Antoniou, 1980

(Fig. 5; Table II)

This population was collected in the rhizosphere of *Solanum tuberosum* L. from El Kouss, Algeria. The

Table II. Morphometrics of populations of *Rotylenchus pumilus* and *R. cypriensis*.

	R. pumilus		*R. cypriensis*
n	24 ♀♀	12 ♂♂	6 ♀♀
L mm	0,56±0.04 (0,47-0,62)	0,55±0.05 (0,45-0,6)	0,6±0.04 (0,55-0,65)
a	23,4±2.2 (19-27)	32±1.5 (30-35)	29±1 (28-30,3)
b	5,8±0.35 (5,2-6,4)	5.9±0.4 (5,4-6,4)	5,4±0.5 (4-6)
b'	4,9±0.35 (4,4-5,9)	5±0.3 (4,5-5,7)	5,1±0.5 (4,4-4,7)
c	48,4±4.3 (39,3-59,3)	31,3±2.2 (28,5-34,9)	42±5 (36-51)
c'	0,79±0.07 (0,63-0,93)	1,33±0.1 (1,16-1,56)	0.97±0.04 (0.9-1)
Head annules	4	4	3-4
Stylet µm	27,9±1.1 (26-29)	24±0.5 (23,5-25)	24.2±0.38 (24-25)
DOGO* µm	5.1±0.4 4,5-6	–	3.1± 1 (2,6-3,6)
m	54,8±2,3 (52-58)	–	48±0.2 (47-48)
o	12.1±2.2 (10.1-14.6)	–	13±3 (11-15)
Excretory** pore µm	94.6±6 (85-104)	89±6 (87-97)	105±4 (99-110)
V	62,3±1.8 (58,1-65,2)	–	62,2±1 (60,2-63,7)
Tail length µm	11±2.1 (9-13)	18±2 (16-21)	14.2±2 (11.4-15.6)
Tail annules		–	7±2

* Dorsal Oesophageal Gland Opening from base of stylet knobs.
** From the anterior end.

specimens differ from the original description by the absence of longitudinal striations on lip annules and by the lateral field not being areolated.

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