

Meloidogyne kralli n. sp. (Nematoda : Meloidogynidae) a root-knot nematode parasitising sedge (*Carex acuta* L.)⁽¹⁾

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SUMMARY

Meloidogyne kralli n. sp. from sedge (*Carex acuta* L.) in Estonia, U.S.S.R. is described and illustrated. The species is distinguished from related species (*M. graminicola* Golden & Birchfield and *M. sewelli* Mulvey & Anderson) by juvenile tail shape, male head and stylet morphology, female stylet morphology and perineal pattern.

RÉSUMÉ

Meloidogyne kralli n. sp. (Nematoda : Meloidogynidae) un nématode à galles parasitant *Carex acuta* L.

Meloidogyne kralli n. sp. parasite de *Carex acuta* L. en Estonie (U.R.S.S.) est décrit et figuré. Cette espèce se distingue des espèces voisines (*M. graminicola* Golden & Birchfield et *M. sewelli* Mulvey & Anderson) par la forme de la queue des juvéniles, la morphologie de la tête et du stylet du mâle, la morphologie du stylet de la femelle et par la figure périnéale.

Meloidogyne kralli n. sp. was found by Dr. E. Krall, Institute of Zoology and Botany, Estonia, U.S.S.R., in galled roots of sedge, *Carex acuta* L. collected from the bank of the River Emajogi, near Ranna, Tartu district, Estonia in September 1968. This species was subsequently found to be common and widespread in Estonia, and also occurs in Latvia, Lithuania, Pskov and Leningrad regions of Russia bordering Estonia.

Measurements (made to 0.5 μm precision) and micrographs were taken under differential interference contrast illumination. For head and stylet morphology only lateral views were examined. A juvenile is designated as the holotype because of the distinctive tail morphology which distinguishes it from closely related species.

Meloidogyne kralli n. sp. (Figs 1-4)

Materials and methods

The description is based on material from three collections in the type locality made in 1971. Specimens were fixed in formaldehyde and mounted in lactophenol; they were not suitable for scanning electron microscopy (SEM).

MEASUREMENTS

Females : L ($n = 15$) = 351-564 μm (463 ; 60*);
body width ($n = 15$) = 218-487 μm (306 ; 69);

• (mean ; standard deviation ; 95 % confidence limit, when calculated).

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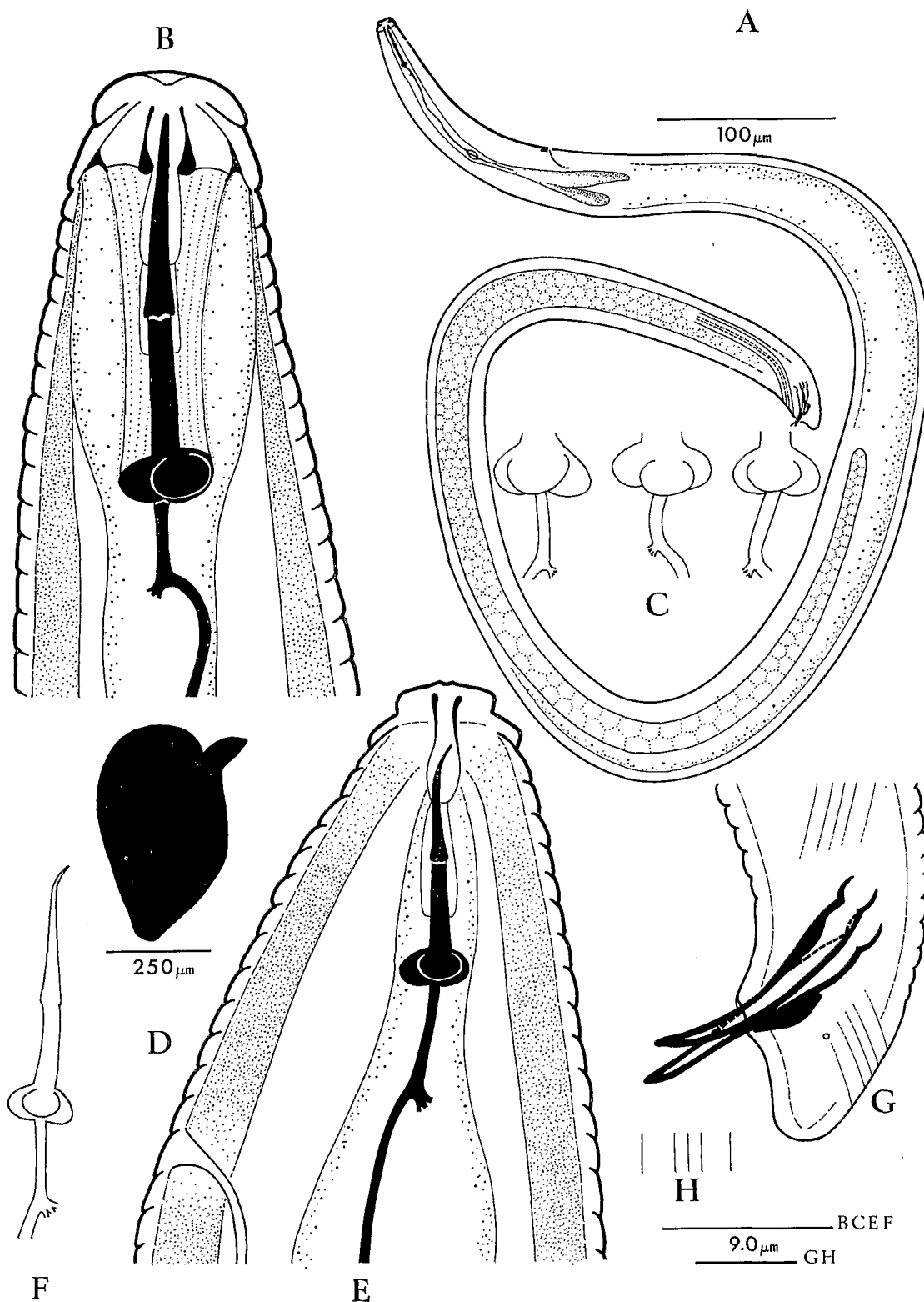


Fig. 1. *Meloidogyne kralli* n. sp. Male ; A : whole specimen ; B : anterior end (lateral view) ; C : stilet knobs ; G : tail ; H : lateral field. Female ; D : whole specimen ; E : anterior end ; F : stilet.

stylet length ($n = 20$) = 12.5-14.5 μm (13.3; 0.6; 0.3); stylet knob width ($n = 20$) = 3.0-4.5 μm (3.8; 0.3; 0.2); stylet knob length ($n = 20$) = 2.0-2.5 μm (2.0; 0.2, 0.1); distance from DGO to stylet base ($n = 20$) = 3.5-4.5 μm (4.4; 0.3, 0.2); median bulb 'valve' length ($n = 20$) = 9.0-11.0 μm (10.2; 0.7; 0.3); distance from excretory pore to anterior end ($n = 20$) = 10.0-24.5 μm (15.8; 4.6; 2.1).

Males: L ($n = 6$) = 947-1 143 μm (1 076; 77); a ($n = 5$) = 25.7-39.4 (31.7; 5.0); b ($n = 3$) = 9.4-11.0 (10.2; 0.8); c ($n = 6$) = 104.3-127.1 (116.1; 9.4); c' ($n = 6$) = 0.6-0.8 (0.7; 0.1); stylet length ($n = 5$) = 18.0-20.0 μm (18.8; 0.9); stylet cone length ($n = 5$) = 9.0-10.0 μm (9.5; 0.5); M (ratio of means) 50.7%; stylet knob width ($n = 6$) = 4.5-6.0 μm (5.0; 0.5); stylet knob length ($n = 6$) = 2.5-3.0 μm (2.7; 0.3); distance from DGO to stylet base ($n = 4$) = 3.5-6.0 μm (4.4; 1.0); median bulb 'valve' length ($n = 6$) = 4.5-5.5 μm (5.1; 0.5); distance from excretory pore to anterior end ($n = 6$) = 120.0-133.5 μm (127.4; 4.8); spicule length ($n = 6$) = 22.5-28.0 (26.3; 2.1).

Second-stage juveniles: L ($n = 30$) = 408-476 μm (439; 16; 6); a ($n = 20$) = 26.7-35.3 (31.0; 2.3; 1.3); b ($n = 15$) = 5.9-7.1 (6.5; 0.4; 0.2); c ($n = 20$) = 5.6-7.1 (6.5; 0.3; 0.2); c' ($n = 20$) = 5.5-8.9 (7.0; 0.8; 0.4); stylet length ($n = 29$) = 10.5-11.5 μm (10.8; 0.3; 0.1); distance from stylet base to anterior end ($n = 30$) = 13.5-15.5 μm (14.6; 0.5; 0.2); stylet knob width ($n = 32$) = 2.0-2.5 μm (2.4; 0.2; 0.1); stylet knob length ($n = 32$) = 1.5-2.0 μm (1.5; 0.1; 0.1); distance from DGO to stylet base ($n = 27$) = 3.0-4.5 μm (4.1; 0.5; 0.2); distance from excretory pore to anterior end ($n = 30$) = 64.0-88.0 μm (78.3; 5.6; 2.1); tail length ($n = 26$) 61.0-78.0 μm (68.1; 3.8; 1.6); hyaline tail length ($n = 30$) = 14.5-21.0 μm (17.4; 1.6; 0.6).

Holotype (second-stage juvenile): L = 442 μm ; stylet length = 11.0 μm ; distance from stylet base to anterior end = 14.5 μm ; stylet knob width = 2.5 μm ; stylet knob length = 1.5 μm ; distance from DGO to stylet base = 4.0 μm ; distance from excretory pore to anterior end = 78.5 μm ; tail length = 63.0 μm ; hyaline tail length = 17.0 μm .

DESCRIPTION

Females: Body pearly white, globular to elongate, with a distinct neck and head not offset; vulva on a posterior protuberance. Stylet cone about half stylet length with anterior dorsal curvature; knobs set off from shaft, rounded and transversely ovoid in lateral view. Excretory pore variable in position from

anterior to stylet knobs to posterior to dorsal oesophageal gland orifice (DGO). Perineal pattern with faint, fine striae. Overall pattern circular to ovoid in antero-posterior direction, with a low arch with the same contour as the other striae. Striae single, straight and widely spaced, circular and broken in tail area; vertical striae just anterior to tail tip; usually a fold over the anus. Lateral field faintly visible at junction of posterior and anterior striae. There is also a characteristic postero-laterally directed irregular double incisure on either side of the tail region. Perivulval region free from striae, often bounded laterally by more distinct antero-lateral striae. Phasmids small and less widely spaced than the width of the vulva.

Males: Cuticle with transverse annulations. Lateral field with four to eight incisures, frequently five, not areolated. Head truncate, not offset. Labial cap flat with slight depression at stoma and rounded median lips. Labial cap almost as broad across as the single post-labial annule at its apex and base. Post-labial annule straight sided and slightly tapering anteriorly. Labial annule more shallow than post-labial annule. Stylet with cone about half stylet length, knobs set off from shaft, rounded and somewhat transversely ovoid in lateral view. Hemizonid one or two annules anterior to excretory pore. Single testis. Tail morphology typical for the genus including spicules, gubernaculum and tail shape; phasmids at level of cloaca.

Second-stage juveniles: Cuticle with transverse annulations. Lateral field with four main incisures but in some individuals five to eight incisures may be visible. Lateral field not areolated. Head not offset, with labial cap and one post labial annule. Stylet with cone about half the total length, knobs prominent, rounded and sloping backwards. Hemizonid directly anterior to excretory pore. Tail shape distinct, the hyaline portion tapering gradually and then more sharply towards the terminus, the terminal portion very narrow ending in a finely rounded tip. Phasmids distinct at about 1/3 hyaline tail length from the tail tip.

TYPE HOST AND LOCALITY

Carex acuta L., Elva River near Elva, Tartu district, Estonia.

TYPE MATERIAL

Holotype (second-stage juvenile): Collected by

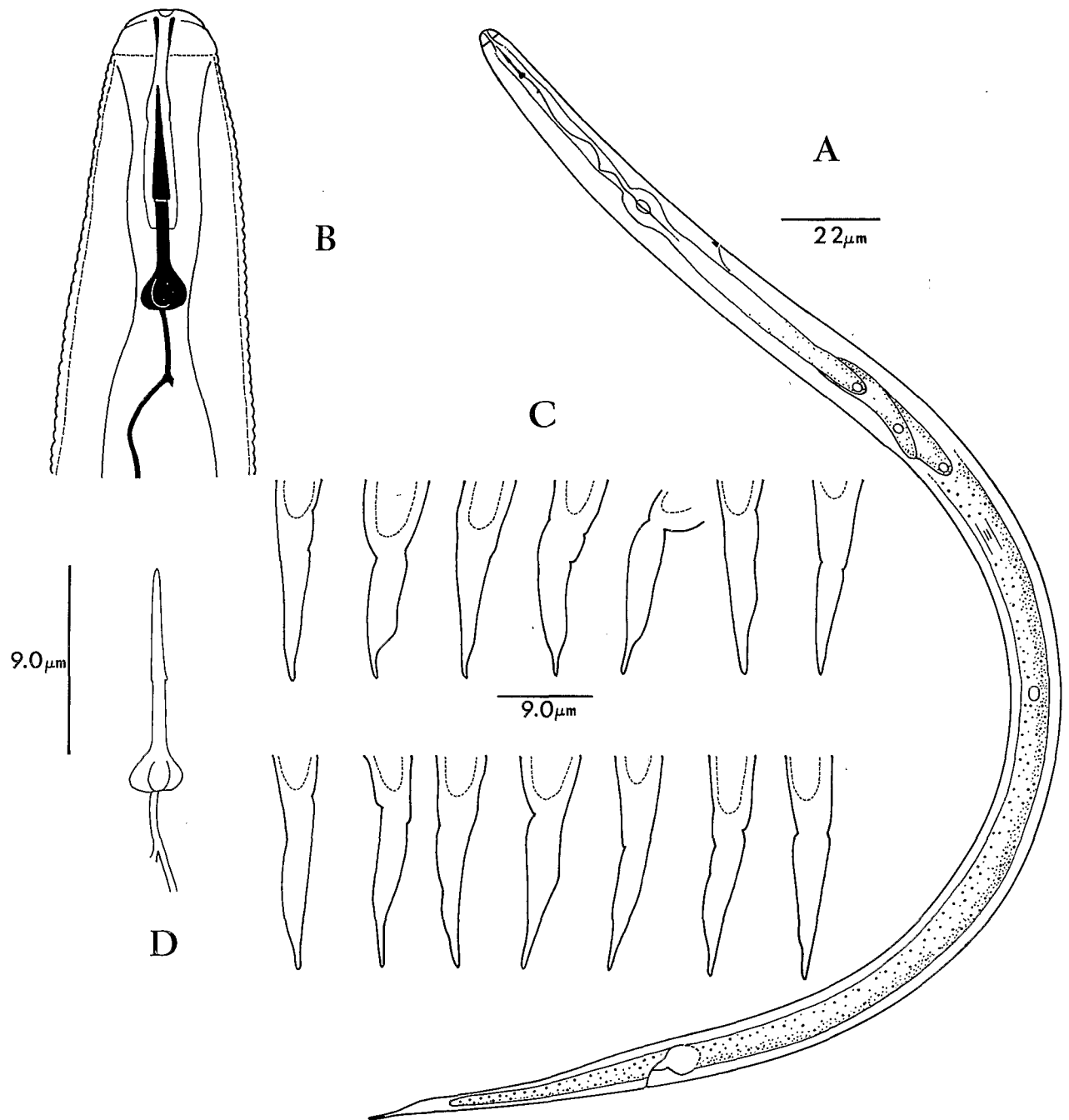


Fig. 2. *Meloidogyne kralli* n. sp. : Second-stage juvenile ; A : entire ; B : anterior end, lateral view ; C : tails ; D : stylet.

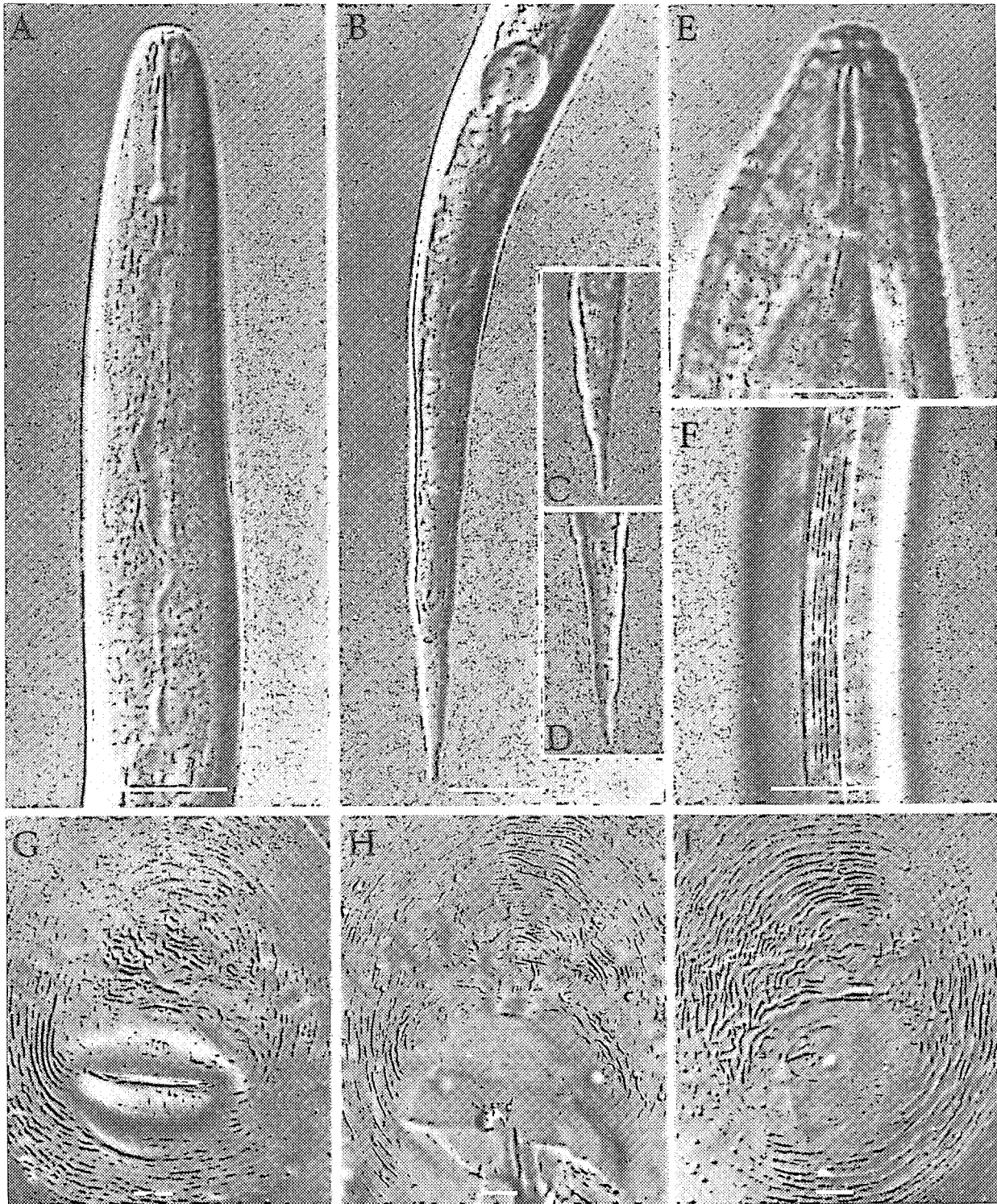


Fig. 3. *Meloidogyne kralli* n. sp. Second-stage juvenile ; A : anterior region (lateral view) ; B : posterior region (lateral view) ; C and D : tails ; F : lateral field of second-stage juvenile. Female ; E : anterior end (lateral view) ; G, H, I : perineal patterns. (Bar = 10 μ m.)

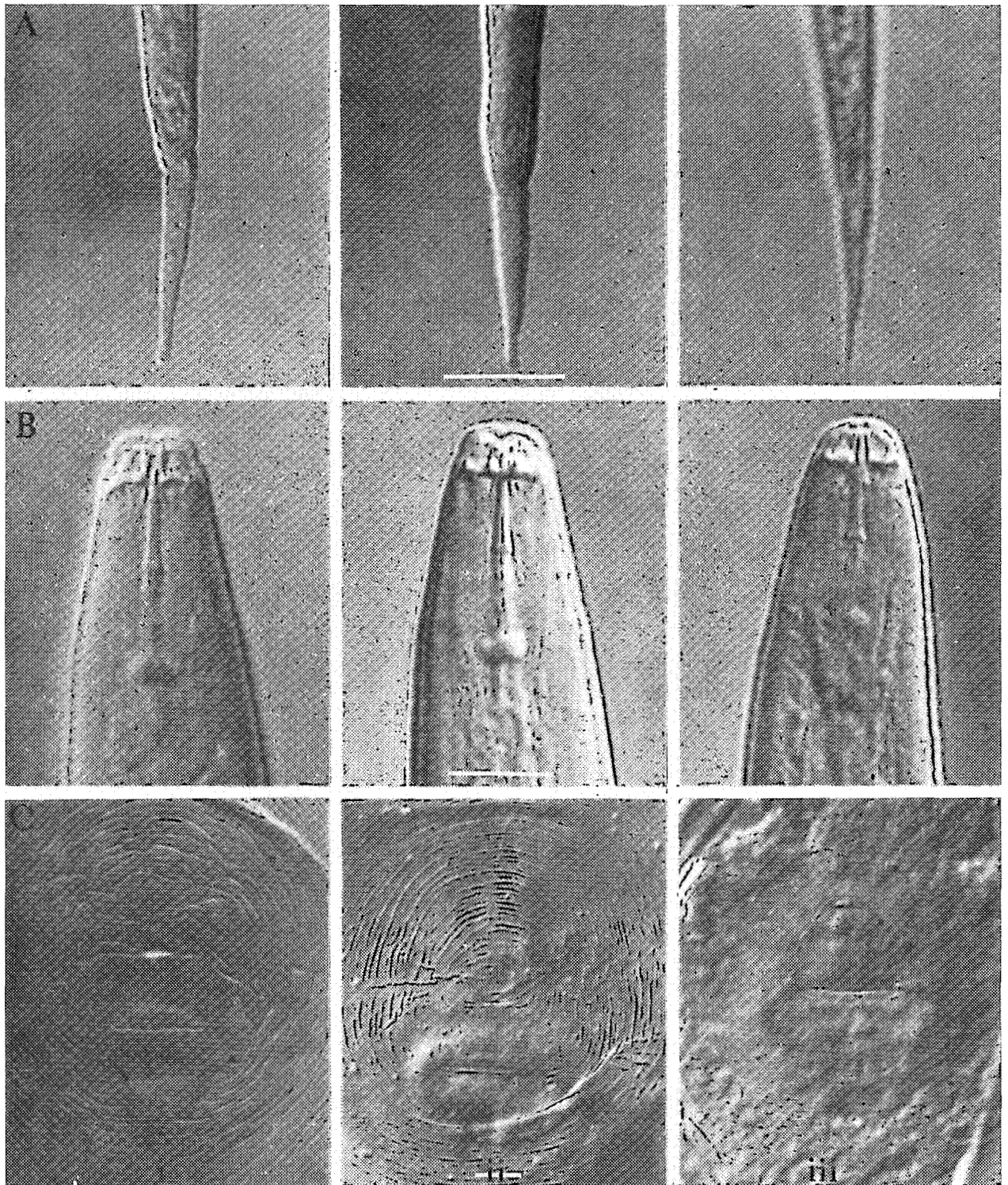


Fig. 4. Comparison of *Meloidogyne kralli* n. sp. (ii) with *M. graminicola* (i) and *M. sewelli* (iii). A : Second stage juvenile tails. B : Male heads in lateral view. C : Female perineal patterns. (Bar = 10 μ m.)

E. Krall, 2.VI.71, Elva River, Estonia, U.S.S.R. Slide 77/30/1 Rothamsted Experimental Station, Harpenden, Hertfordshire, England.

Paratypes (males, females and second-stage juveniles) : Slides 77/30/1-9, Rothamsted Experimental Station, Harpenden, Hertfordshire, England ; USDA Nematode Collection, Beltsville, Md, U.S.A.

DIAGNOSIS AND RELATIONSHIPS

M. kralli n. sp. most closely resembles two species which also parasitise Gramineae and Cyperaceae : *M. graminicola* Golden & Birchfield, 1965, a major pest of rice, and *M. sewelli* Mulvey & Anderson, 1980, from spike rush (*Eleocharis acicularis* L.).

In second-stage juvenile characters, *M. kralli* n. sp. is distinguished from both *M. graminicola* and *M. sewelli* by the distance of the DGO from the stylet base : 4.0 μm ; 3.2-3.6 μm (for four different populations) ; 7-8 μm respectively. *M. kralli* n. sp. and *M. sewelli* have very similar tapering tails, each with a sharply tapering terminus and narrow terminal portion ending in a finely rounded tip, although that of *M. sewelli* is more slender (Fig. 4A ii & iii). The tail of *M. graminicola* is different in shape with a more or less clavate terminus (Fig. 4A i). *M. kralli* n. sp. differs from *M. sewelli* in tail length (68 and 74 μm respectively) but overlaps with the range of mean lengths from different populations of *M. graminicola* (63-72 μm). The hyaline tail terminus length of the three species are different : *M. kralli* n. sp. 17.4 μm ; *M. graminicola* 20.5 μm ; *M. sewelli* 11.8 μm .

The male head shape in lateral view of *M. kralli* n. sp. is almost identical with *M. graminicola*, being truncate with a flat labial cap almost as broad across as the post-labial annule at its apex and base (Fig. 4B i and ii). The head of *M. sewelli* is different, tapering anteriorly, with labial cap fused with the post-labial annule to form a dome (Fig. 4B iii). The stylet knobs of both males and females are distinct in the three species : backwardly sloping and transversely ovoid in *M. kralli* n. sp., backwardly sloping and pear shaped in *M. graminicola* and set off from the shaft and rounded-slightly transversely ovoid in *M. sewelli*.

In females the distance from the stylet knobs to the DGO is different in the three species : *M. kralli* n. sp. 4.4 μm , *M. graminicola* 3.2 μm and *M. sewelli* 7.0 μm . In female stylet length, *M. kralli* n. sp. resembles *M. graminicola* (13.3 and 13.4 μm respectively) but differs from *M. sewelli* (15.0 μm). The perineal pattern of *M. kralli* n. sp. most closely resembles that of *M. graminicola* in overall shape and presence of the postero-laterally directed double incisure on either side of the tail region, but the

striae of *M. kralli* n. sp. are much less distinct, finer and more widely spaced (Fig. 4 C i & ii). The pattern of *M. sewelli* is very different from the other two species having a characteristic circle of striae between the phasmids and the rest of the pattern with fine but mostly indistinct striae (Fig. 4 C iii).

DISTRIBUTION

Estonia : Polva district, shore of Lake Peipus (*Carex acuta*) ; Estonia : Polva district, Viira, River Vohandu (*Carex acuta*, *Scirpus sylvaticus* L.) ; Estonia : Saaremaa Island, River Volupe (*Carex acuta*, *C. pseudocyperus* L., *C. riparia* Curt.) ; Estonia : Parnu district, Rannamesta, Canal Timmkanal (*Scirpus sylvaticus*, *Carex acuta*) ; Estonia : Tartu district, Elva River (*Carex acuta*) ; Estonia : Tartu district, River Ahja, near Voobste (*Carex acuta*, *C. vesicaria* L.) ; Lithuania : Kedainiai district, River Nevesis, near Kedainiai (*Carex acuta*) ; also in Latvia, Russia/ Pskov and Leningrad regions.

M. kralli n. sp. occurs in sandy, peat and silt soils, usually in wet places on the banks of rivers and shores of lakes. Withstands low temperatures. *M. kralli* n. sp. has only been observed parasitising sedges (Cyperaceae) in natural conditions. Populations from *Carex acuta* have reproduced on the Gramineae *Festuca pratensis* (few and small galls) and barley (well developed galls) in laboratory conditions.

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