

Studies on *Longidorus closelongatus* Stoyanov and *L. cohni* Heyns, with description of *L. proximus* sp. nov. (Nematoda, Dorylaimida)

Dieter STURHAN and Dorothee ARGO *

*Biologische Bundesanstalt für Land- und Forstwirtschaft, Institut für Nematologie,
Toppheideweg 88, 4400 Münster, Federal Republic of Germany.*

SUMMARY

Additional informations are given on certain morphological characters and on the variability of *Longidorus closelongatus* and *L. cohni*, based on studies of topotype specimens. Both species are regarded as distinct and valid. A similar species, *L. proximus* sp. nov., is described from Germany. It is characterized by a slightly expanded lip region, shape and length of the amphid pouches, a short bluntly-conoid to almost hemispherical tail ($c' < 1$), rather great body length (6.5-8.2 mm), high a-value (104-138) and long odontostyle (102-112 μm) and absence of males. All three species form a group of closely related species, which is mainly characterized by the position of the oesophagus gland nuclei and the relative size of their nucleoli (dorsal gland nucleus located in the middle of the oesophageal bulb and subventral gland nuclei in the posterior third or quarter; nucleolus of dorsal gland nucleus much thicker than nucleoli of the subventral gland nuclei).

RÉSUMÉ

Etudes sur Longidorus closelongatus Stoyanov et L. cohni Heyns, et description de L. proximus sp. nov. (Nematoda, Dorylaimida)

Des précisions nouvelles sont données sur certains caractères morphologiques et sur la variabilité de *Longidorus closelongatus* et *L. cohni*, basées sur l'examen de topotypes. Les deux espèces sont considérées comme distinctes et valides. Une espèce similaire, *L. proximus* sp. nov. est décrite, originaire d'Allemagne. Elle est caractérisée par une région labiale légèrement élargie, par la forme et la longueur des poches amphidiales, une queue conoïde-arrondie à presque hémisphérique ($c' < 1$), un corps assez long (6,5-8,2 mm), une valeur élevée du coefficient a (104-138), un long odontostyle (102-112 μm) et l'absence de mâles. Les trois espèces forment un groupe très homogène qui est surtout caractérisé par la position des noyaux des glandes oesophagiennes et la taille relative de leurs nucléoles (noyau de la glande dorsale situé au milieu du bulbe oesophagien et noyaux des glandes subventrales dans le tiers ou le quart postérieur; nucléole du noyau de la glande dorsale beaucoup plus épais que les nucléoles des noyaux des glandes subventrales).

Specimens of a *Longidorus* population from Rheinland-Pfalz, obtained for identification by Dr. Maria Rüdel, Landes-Lehr- und Forschungsanstalt für Landwirtschaft, Weinbau und Gartenbau at Neustadt, much resembled *Longidorus closelon-*

gatus Stoyanov, 1964, described from Bulgaria. Differences seemed to exist in, e.g., shape of the amphid pouches and of the tail, and the position of the oesophagus gland nuclei appeared peculiar in the unidentified population, but nothing had been

* Present address : A.D.S.R.I., Private Bag X 2, 1675 Irene, South Africa.

recorded about this character in the *L. closelongatus* description. Holotype and paratypes of *L. closelongatus* have been lost and no additional specimens or populations of this species could be found at the type locality or elsewhere in Bulgaria so far (pers. communication by D. Stoyanov and B. Choleva). Fortunately, two topotype females and five juveniles, mounted in glycerine on February 2, 1964, are kept in the nematode collection of Rothamsted Experimental Station at Harpenden, England. The topotype slides were forwarded us for examination by D.J. Hooper.

Another species resembling the unidentified German population is *L. cohni* Heyns, 1969. Topotype material of this species, supplied by E. Cohn in 1967 and collected by the senior author in 1979, was available in the German Nematode Collection at the Nematology Institute in Münster.

Additional informations on morphology and variability of both *L. closelongatus* and *L. cohni* are reported in this paper. The German *Longidorus* population obviously represents a distinct species. It is described here as *L. proximus* sp. nov. All three species form a group of closely related species. Position of the oesophageal gland nuclei and size of their nucleoli are considered here as important diagnostic characters.

Longidorus closelongatus Stoyanov, 1964

(Fig. 1 A & B)

MEASUREMENTS

Topotype females (n = 2) : L = 5.3, 7.3 mm ; a = 123, 151 ; b = 12, 17 ; c = 123, 166 ; c' = 1.45, 1.28 ; tail = 43, 43 μ m ; V = 47.6, 46.5% ; odontostyle = 116, 122 μ m ; odontophore = 40, 41 μ m ; spear = 156, 163 μ m ; oral aperture to guide ring = 32, 31.5 μ m. The measurements are within the range given in the original description, except those of the indistinctly delimited odontophore.

DESCRIPTION

Female : Cuticle around 2.5 μ m thick in midbody and 8-9 μ m at tail end, with fine subsurface striation. Inner cuticle layer much thinner than outer layers in median portion of body, increasing in thickness towards posterior end, where it is radially striated. Numerous lateral pores along each body side ; 15-17 situated in the oesophagus region and 5-6 within range of odontostyle (first one anterior to

guiding ring). Within odontostyle region 3 dorsal and 3 ventral pores present. Two lateral pores on each tail side. One (intersex ?) female with series of 7 distinct ventromedian pores before anus.

Lip region distinctly expanded (as in original description) ; body at base of oesophagus about 2.5 times as wide as lip region. Amphid pouches as figured by Stoyanov (1964), but only slightly lobed at base. Guiding ring about two lip region widths from anterior end of body.

Nerve ring close to base of odontophore. Hemizonid and hemizonion not seen. Basal bulb of oesophagus 6-7 times as long as wide, surrounded by a distinct epithelial sheath. Nucleus of dorsal gland located in the middle and nuclei of the subventral glands at the beginning of the posterior fourth of the bulb. Nucleoli of the subventral gland nuclei much smaller than nucleolus of the dorsal gland nucleus. No sperms visible in female genital tracts. Tail of one topotype female distinctly more conical than that figured in the original description.

Juveniles : The topotype juveniles available for study are probably J3 and J4. The tail shapes resemble those figured by Stoyanov (1964). Measurements of odontostyle and replacement odontostyle length and their range of variation recorded in the original description raises some doubt about the correct assignment of the juveniles measured to the four larval stages.

REMARKS

L. closelongatus and *L. vineacola* Sturhan & Weischer, 1964 are not identical, as argued by Andr ssy (1970). They distinctly differ in position of the oesophagus gland nuclei : in *L. vineacola* dorsal gland nucleus located in the anterior part and subventral gland nuclei in about the middle of the oesophagus bulb ; nucleoli of almost similar size or nucleolus of dorsal gland nucleus slightly smaller. Additional differences exist in, e.g., tail shape, odontostyle length and presence of males.

Longidorus cohni Heyns, 1969

(Fig. 1 C & D)

The measurements refer to material collected March 1979 from a barley field at the type locality, fixed in FP 4 : 1 and mounted in glycerine. The other observations are in addition based on topotype material collected in 1967.

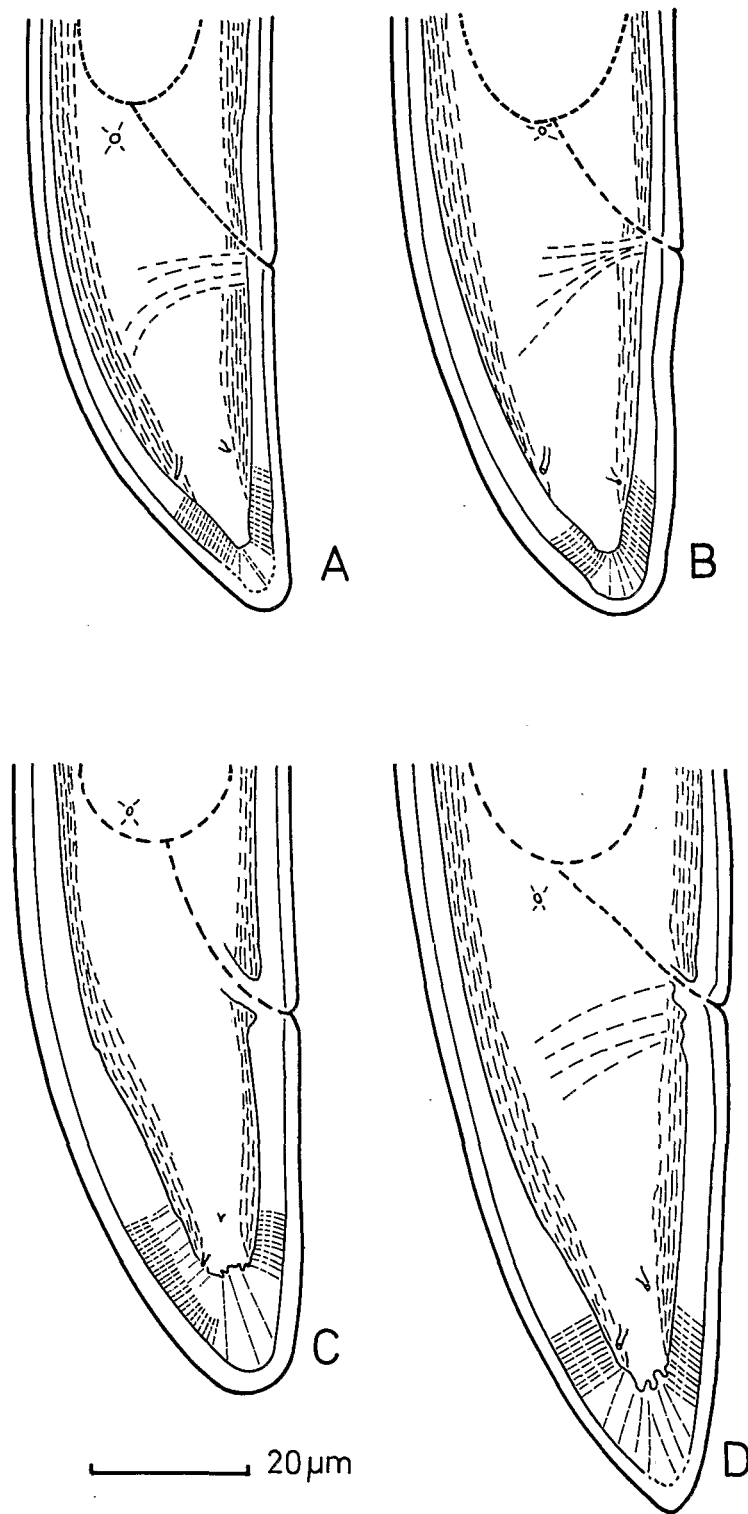


Fig. 1. *Longidorus closelongatus*. A & B : tails of topotype females.
L. cohni. C & D : tails of topotype females.

MEASUREMENTS

Female (n = 4) : L = 7.6-8.7 (8.3) mm ; a = 160-196 (183) ; b = 16.8-19.1 (18.2) ; c = 171-202 (181) ; c' = 1.28-1.43 (1.36) ; tail = 43-50 (46) μm ; V = 49.2-51.8 (50.2)% ; odontostyle = 114-120 (117) μm ; oral aperture to guide ring = 32-34 (33) μm .

Male (n = 7) : L = 7.0-8.8 (7.7) mm ; a = 166-211 (183) ; b = 15.4-19.6 (17.2) ; c = 141-190 (169) ; c' = 1.21-1.49 (1.38) ; tail = 41-52 (46) μm ; odontostyle = 108-119 (113) μm ; oral aperture to guide ring = 32-35 (33) μm .

The measurements closely agree with those of the original description. Maximum body length of topotype females collected in 1967 was 10.0 mm, maximum tail length 63 μm . The posterior end of the odontophore is not distinct and measurements are therefore not given.

DESCRIPTION

Cuticle 2.0-2.5 μm thick in most parts of the body, increasing to 14-16 μm at female tail end. Inner cuticle layer considerably thinner than outer layers, much increased in thickness and radially striated at posterior end of body. Indistinct median layers at posterior end visible, more or less interrupted at tail tip. Outer and inner cuticle layers of almost equal thickness at level of guiding ring. In oesophagus region on each body side 15-20 lateral pores, 4-6 of which are within odontostyle range, the first one always located anterior to guiding ring. In odontostyle region 2-4 dorsal and ventral pores, first pore mostly located behind guide ring, exceptionally before. In females two lateral pores on posterior part of tail.

Amphid pouches occasionally wider than figured by Heyns (1969) and sometimes distinctly bilobed at base. Basal bulb of oesophagus between five and seven times as long as wide, with dorsal gland nucleus located around 50% of bulb length and subventral gland nuclei at almost 75%. Diameter of nucleolus of dorsal gland nucleus about 3 μm and of subventral gland nuclei around 1.5 μm . No "mucro" observed in oesophageal tissue.

Tail of females more variable in shape than is evident from the original description. Tails of juveniles as figured by Heyns (1969).

REMARKS

L. cohni differs mainly from *L. closelongatus* in its more slender body, thicker cuticle at tail end and the

presence of males. Other similar species such as *L. vineacola* Sturhan & Weischer, 1964, *L. attenuatus* Hooper, 1961 and *L. apulus* Lamberti & Bleve Zacheo, 1977 differ e.g. in position and size of nucleoli of the oesophagus gland nuclei.

Longidorus proximus sp. nov.

(Fig. 2)

MEASUREMENTS

Holotype (female) : L = 7.17 mm ; a = 122 ; b = 15.1 ; c = 191 ; c' = 0.9 ; V = 48.5% ; odontostyle = 109 μm ; odontophore = 47 μm ; oral aperture to guide ring = 32.5 μm .

Measurements of paratype females and the four larval stages are given in Table 1. The specimens were fixed in TAF and mounted in dehydrated glycerine.

DESCRIPTION

Females : Body habitus of heat-relaxed females varying from closed C to circular and almost spiral. Cuticle with fine transverse subsurface striation, at mid-body around 4 μm thick, slightly reinforced towards lip-region and strongly thickened towards posterior end ; at tail end 10-13.5 μm thick. Inner cuticle layer markedly thinner than outer layers along body, of almost equal thickness behind lip region and considerably thickened and radially striated at posterior end, where also two median layers are clearly visible. These are more or less interrupted at tail end, where the radial striation of the inner layers is often only sparse or lacking.

Along each body side around 300 lateral pores, 15-28 of them situated in the oesophagus region (3-6 within range of odontostyle) and two on the tail (generally on posterior half). On the anterior part of the neck region 4-10 ventral pores (2-4 within range of odontostyle) and 1-3 dorsal pores (all within odontostyle range). First lateral pore anterior to level of guiding ring (exceptionally, two pores) ; first ventral and dorsal pore posterior. Lateral chord at mid-body occupying around 30% of corresponding body diameter.

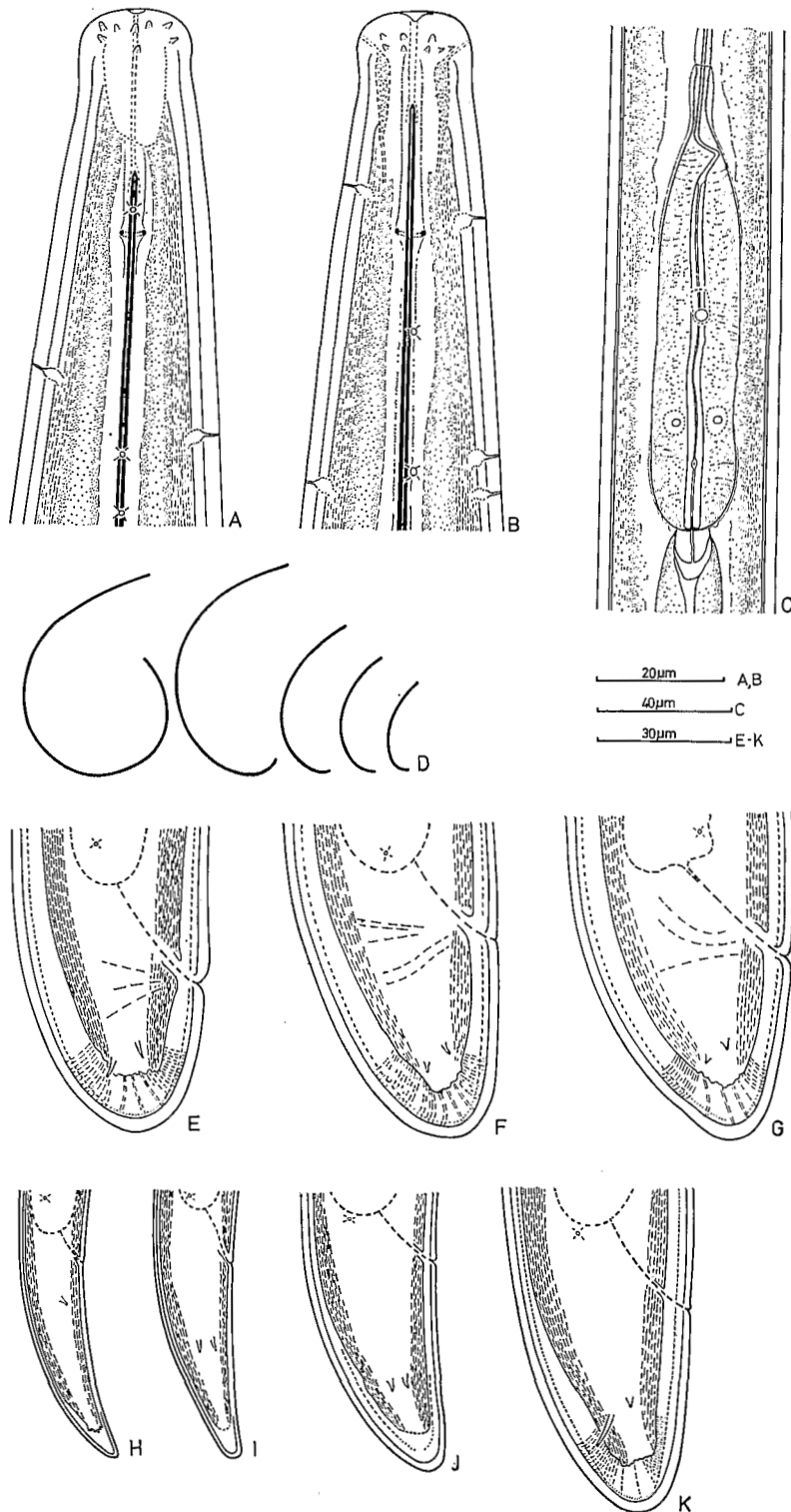


Fig. 2. *Longidorus proximus* sp. n. A : anterior end, lateral view ; B : anterior end, dorso-ventral view ; C : posterior part of oesophagus ; D : habitus of female and the four juvenile stages ; E-G : female tails ; H-K : tails of the four juvenile stages.

Table 1
Dimensions of the juvenile stages and females of *Longidorus proximus* sp. n.

	<i>J 1</i> (<i>n</i> = 3)	<i>J 2</i> (<i>n</i> = 4)	<i>J 3</i> (<i>n</i> = 8)	<i>J 4</i> (<i>n</i> = 17)	♀♀ (<i>n</i> = 33)
L (mm)	1.67 (1.60-1.75)	2.27 (2.00-2.60)	3.44 (3.10-4.00)	4.96 (4.15-5.70)	7.33 (6.50-8.20)
a	72 (68-77)	77 (74-82)	91 (86-97)	108 (95-120)	124 (104-138)
b	6.7 (6.3-7.3)	7.3 (6.8-7.9)	9.9 (8.9-11.3)	12.2 (10.5-14.0)	15.4 (14.0-16.8)
c	35 (35-36)	53 (45-59)	74 (67-83)	119 (101-157)	192 (165-249)
c'	3.3 (3.0-3.6)	2.2 (2.0-2.2)	1.5 (1.3-1.7)	1.1 (0.95-1.3)	0.85 (0.73-0.95)
Tail (μm)	48 (46-50)	44 (40-51)	46 (44-49)	42 (33-47)	38 (31-44)
V (%)	—	—	—	—	47.6 (45-50)
Odontostyle (μm)	58 (56-59)	67 (66-68)	82 (80-85)	95 (89-100)	107 (102-112)
Odontophore (μm)	24 (22-26)	30 (27-35)	35 (32-39)	41 (37-46)	45 (41-51)
Spear (μm)	82 (78-85)	95 (92-97)	117 (114-122)	136 (128-143)	153 (148-160)
Replacement odontostyle (μm)	68 (67-69)	82 (82-83)	94 (90-99)	106 (101-112)	—
Oral opening to guide ring (μm)	18 (17.5-18)	22 (21-23)	26.5 (26-27.5)	30 (29-32)	34 (31.5-37.5)

Lip region more or less rounded, slightly expanded, 17-19 μm wide. Body diameter at base of oesophagus divided by width of lip region varies from 2.5 to 3.1, and body width at guide ring divided by lip region width ranges between 1.2 and 1.4. Amphid pouches rather broad, generally slightly tapering posteriorly, not lobed at base, but often slightly elongated ventrally, extending over little more than half the distance from oral opening to guiding ring. Guide ring about two lip region widths behind oral aperture. Odontostyle around 2.2 μm wide at base; odontophore less than half as long as odontostyle. No "mucro" present in the slender part of the oesophagus. Nerve ring located about one body width posterior to the odontophore. Hemizonid and hemizonion indistinct. Oesophageal bulb measuring one quarter of the total oesophagus length (head

end to base of oesophagus), between four and five times as long as wide; epithelial sheath mostly distinct, especially around anterior end of bulb and extending over some distance around the slender part of the oesophagus. Dorsal gland nucleus located in the middle of the bulb and nuclei of the subventral glands at the beginning of the posterior third to fourth of the bulb. Nucleolus of the dorsal gland nucleus almost 4 μm in diameter; nucleoli of the subventral gland nuclei about 2.5 μm wide. Cardia bluntly conoid.

Genital tract paired, opposed and of about equal length, anterior and posterior part lying on either side of the body. Each ovary reflexed (anterior ovary outstretched in one female), oviduct with proximal long and slender and short and dilated distal part, separated from the long uterus by a

sphincter. Blind sac of oviduct very long. No sperms observed in uteri. Vagina occupying three fifths of the body width; its inner part surrounded by three or four thick sphincter muscle bands.

Tail bluntly conoid to almost hemispherical. Rectum shorter than body width at anus. Prerectum varying from 10 to 16 body diameters in length.

Male: not observed.

Juveniles: The four larval stages are distinctly separated, in particular, by differences in length of body, functional odontostyle and replacement odontostyle. With increasing body length, the specimens become more slender and also the *b* and *c* values increase. The relative tail length decreases from more than three body widths at anus in the J 1 to less than one anal body width in the female; the average actual tail length is greater in all juvenile stages than in the adults. The tail shape changes from slender conical in the J 1 to bluntly conoid in the females, and the body curvature is continuously increasing during ontogeny.

The lip region is rather broad and slightly offset only in the J 1, more distinctly offset in the J 2 and J 4, but markedly expanded in the J 3 (much more than in the females). The guide ring is less than two lip region widths behind oral aperture in the J 1 and the J 2, and diameter of body at base of oesophagus divided by width of lip region increases from 2.0 in the J 1 to 2.5-3.1 in the females. Unlike its expression in the females and J 4, the outer cuticle layers behind lip region are markedly thinner than the inner in the first three juvenile stages. But in all stages the outer layers are considerably thicker along the body, and also position and relative size of the nucleoli of the oesophagus gland nuclei are similar to those in the females.

TYPE MATERIAL

Holotype, 21 paratype females and 45 juveniles on slides 1/22/1-1/22/29 in the German Nematode Collection at the Nematology Institute, Münster. Additional paratypes deposited at Nematology Department, Rothamsted Experimental Station, Harpenden, England (4 ♀♀, 3 juveniles); Muséum national d'Histoire naturelle, Laboratoire des Vers, Paris, France (3 ♀♀); Landbouwhogeschool, Laboratorium voor Nematologie, Wageningen, Netherlands (2 ♀♀); Zoological Institute, Academy of Sciences of the U.S.S.R., Leningrad (2 ♀♀); Nematode Collection of Rand Afrikaans University, Johannesburg, South Africa (2 ♀♀).

TYPE LOCALITY AND HABITAT

Friedelsheim near Bad Dürkheim, Rheinland-Pfalz, Federal Republic of Germany; UTM grid reference MV 47. Arable soil, sandy loam. Soil sample taken in 1979 by M. Rüdell.

DIAGNOSIS AND DISCUSSION

L. proximus sp. nov. is a rather long and slender species (body length of females > 6 mm; *a* > 100) with a fairly long odontostyle (> 100 µm), a slightly expanded lip region and a relatively short, bluntly conoid to almost hemispherical tail (*c'* < 1). Among the described *Longidorus* species sharing most characters with *L. proximus* sp. nov., *L. apulus* Lamberti & Bleve Zacheo, 1977 and *L. vineacola* Sturhan & Weischer, 1964 differ, e.g., in the shape of the amphids and the latter also by the common occurrence of males. *L. pseudoelongatus* Altherr, 1976 is separated by, for instance, slightly shorter body and longer odontostyle (5.1-5.6 mm and 115-125 µm, respectively), *L. euonymus* Mali & Hooper, 1974 by shorter odontostyle (81-90 µm) and relatively longer tail (*c'* = 1.0-1.6). In addition, all four species differ from *L. proximus* sp. nov. in the position of the oesophageal gland nuclei, the dorsal gland nucleus lying in the anterior part and the nuclei of the subventral glands in the middle of the oesophageal bulb (own observations on type specimens of *L. apulus* and *L. pseudoelongatus*; characters not recorded in the original descriptions of both species).

L. closelongatus Stoyanov, 1964 and *L. cohni* Heyns, 1969 are the known *Longidorus* species most closely resembling *L. proximus* sp. nov. and position of the oesophagus gland nuclei and relative size of the nucleoli are identical. In *L. closelongatus* the lip region is more distinctly expanded, the tail more elongated conoid (*c'* > 1), the cuticle thinner along body (2.5 µm vs. 4 µm) and at tail end (8-9 µm vs. 10-13.5 µm), and the basal bulb of oesophagus longer (6-7 times vs. 4-5 times as long as wide). *L. cohni* is considerably more slender (*a* = 180-230 vs. 104-138), has a longer conoid female tail (40-54 µm vs. 31-44 µm) and higher *c'* values (1.2-1.5 vs. 0.73-0.95); the cuticle is thinner around midbody (2.0-2.5 µm vs. 4 µm) and males are common.

L. closelongatus, *L. cohni* and *L. proximus* sp. nov. obviously form a group of closely related species. The main character peculiar to this group is the position of the oesophageal gland nuclei and the relative size of their nucleoli: the dorsal gland nucleus being located in the middle of the bulb and having a rather large nucleolus, the two subventral gland nuclei situated in the posterior third or

quarter of the bulb, with much smaller nucleoli. This character is different in most other *Longidorus* species, but it has not been recorded for a great number of the described species. A new species from Iran is obviously also belonging to the *L. closelongatus* species group and has also many other characters in common with the three species described so far (Sturhan & Barooti, 1983).

ACKNOWLEDGEMENT

This study was supported by grants of the Deutsche Forschungsgemeinschaft, Bonn-Bad Godesberg.

REFERENCES

- ALTHERR, E. (1976). La faune des eaux profondes interstitielles de la région de Wiesbaden. *Bull. Soc. Vaud. Sc. nat.*, 73 : 97-116.
- ANDRÁSSY, I. (1970). Nematoden aus einigen Fluss-Systemen Südafrikas. *Opusc. zool. Bpest*, 10 : 179-219.
- HEYNS, J. (1969). *Longidorus cohni* n. sp., a nematode parasite of alfalfa and Rhodes grass in Israel. *Israel J. agric. Res.*, 19 : 179-183.
- LAMBERTI, F. & BLEVE ZACHEO, T. (1977). Two new species of *Longidorus* (Nematoda : Longidoridae) from Italy. *Nematol. mediterr.*, 5 : 73-83.
- MALI, V.R. & HOOPER, D.J. (1974). Observations on *Longidorus euonymus* n. sp. and *Xiphinema vuittenezi* Luc *et al.*, 1964 (Nematoda : Dorylaimida) associated with spindle trees infected with *Euonymus mosaic virus* in Czechoslovakia. *Nematologica*, 19 (1973) : 459-467.
- STOYANOV, D. (1964). [A contribution to the nematodofauna of the grape vine]. *Rastit. zasht. (Sofija)*, 12 : 16-24.
- STURHAN, D. & BAROOTI, S. (1983). *Longidorus iranicus* n. sp. (Nematoda, Dorylaimida). *Systematic Parasitology*, 5 : 21-24.
- STURHAN, D. & WEISCHER, B. (1964). *Longidorus vineacola* n. sp. (Nematoda : Dorylaimidae). *Nematologica*, 10 : 335-341.

Accepté pour publication le 4 mai 1982.