

## *Neothada hades* n.sp. from South Africa, with notes on the genus and a key to the species (Nematoda: Tylenchidae)

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*Neothada hades* n.sp. from South Africa is characterized by the possession of small but distinct stylet knobs, 149–175 body annules intersected by 14 longitudinal lines (incisures), protruding lateral fields marked by four incisures, and an elongate-conoid tail with bluntly rounded tip. Reasons are given why *N. cancellata* (Thorne 1941) and *N. tatra* (Thorne & Malek 1968) are regarded as two distinct species, and why *N. cancellata* apud Andrassy, 1982 is regarded as distinct from Thorne's species. Andrassy's species is renamed *N. andrassyi* n.sp. A key is presented for the six recognized species of *Neothada*.

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The genus *Thada* was erected by Thorne (1941) to accommodate two new species, *T. striata* and *T. cancellata*. Both species had deep transverse striae and conspicuous annules, while the latter species also had longitudinal striae (= incisures; lines). A third species, *T. tatra*, also with longitudinal striae and very similar to *T. cancellata* was described by Thorne & Malek in 1968. Khan (1973) proposed the genus *Neothada* for the two species with longitudinal striae. Geraert (1974) described specimens which he identified as *T. cancellata* from Morocco. Andrassy (1982) regarded Geraert's identification as erroneous, and renamed the Moroccan population *Thada geraerti*. In the same paper Andrassy described and illustrated a Hungarian population which he regarded as typical of *T. cancellata*. Siddiqi (1986) presented illustrations of *Neothada cancellata*, based on Thorne's type specimens, and transferred *T. geraerti* to *Neothada*. One further species, *Neothada major*, was described by Maqbool & Shahina (1989) from Pakistan. Apart from this there has been little reference to either *Thada* or *Neothada* in the literature.

Specimens of an undescribed species of *Neothada* were recently collected in the Western Cape Province, presenting an opportunity for the first SEM study of this genus. The species is herein described as *Neothada hades* n.sp. Longitudinal incisures, longitudinal striae and longitudinal lines are used interchangeably as synonyms in this article, whereas ridges refer to the areas inbetween the striae.

### *Neothada hades* n.sp. (Figures 1A-L; 2A-G)

#### Measurements

Holotype female: L = 0.59 mm; a = 24.2; b = 6.3; c = 9.2; c' = 5.0; V = 71.7; stylet = 10.5  $\mu$ m; R = 160; Roes = 36; RH-V = 117; RV-An = 22; RTail = 23.

For measurements of female and male paratypes see Table 1.

Body slightly ventrally curved over its entire length; cylindrical for most of its length, narrowing only slightly anteriorly but evenly tapered towards posterior end; most female specimens narrowing rather abruptly at vulva. Maximum body width 21.1 (17.5–24.5)  $\mu$ m in female, 18.9 (16–21)  $\mu$ m in male. Cuticular annules prominent, mostly regular except towards extremities and body openings, rarely somewhat

irregular with sporadic smaller, 'double' annules. Annules slightly broader in females than in males, and less than half as wide on anterior part of neck than at midbody (1.7–2.0  $\mu$ m vs. 4.0–4.6  $\mu$ m in females; 1.6–1.9  $\mu$ m vs. 3.7–4.4  $\mu$ m in males). Lateral field with four incisures (lines), delimiting three ridges or wings, all three wings originating at about the same level slightly beyond the middle of the neck, the two central lines starting at this point through division of a single anterior line, while the two outer lines are mere continuations of longitudinal lines from further forward, but without such definite a starting point as that shown by Thorne (1941) for *Neothada cancellata* (compare our Figure 1A with his Figure 24a). Lateral field protruding beyond body surface, especially around midbody (Figure 1H). Apart from the lateral lines there are 14 longitudinal striae, demarcating 16 longitudinal ridges, arranged so that mid-dorsally and mid-ventrally the body bears a stria or incisure. Where the annules are regular, the transverse and longitudinal striae produce regular, rectangular blocks (Figures 1A & B and 2C & D), except over the first six or more annules, where the cuticular pattern may be rather irregular (Figures 1A & B and 2A). Head flatly rounded, 7.6 (7–9)  $\mu$ m wide in female, 7.2 (6.8–7.5)  $\mu$ m in male. The minute mouth opening is surrounded by a small rectangular, six-lobed labial disc. Amphid apertures conspicuous longitudinal slits. Cephalic framework inconspicuous, weakly sclerotized. Stylet delicate, 9.8 (9–10.5)  $\mu$ m long, the cone 4.9–6.1  $\mu$ m, and the shaft 4–5.6  $\mu$ m with the base of the shaft split, tripartite, bearing three small but distinct, roundish knobs. Dorsal oesophageal gland opening 2.5–3.5  $\mu$ m from stylet base. Oesophagus 96 (90–104)  $\mu$ m long in female, 95 (89–99)  $\mu$ m in male; anterior part cylindrical, without any apparent median broadening and no narrowing towards isthmus; basal bulb short, pyriform; gland cells mostly indistinct. Cardia hemispherical. Excretory pore towards end of basal bulb, at 90 (80–96)  $\mu$ m from anterior end in female, 83 (77–90)  $\mu$ m in male, about 34 (31–38) annules from anterior end in both sexes. Hemizonid not seen. Deirids mostly distinct, at level of, or slightly anterior to excretory pore.

#### Female

Vulva a large transverse slit, the lips not protruding. Vagina

**Table 1** Morphometrical characteristics of *Neothada* species

Reference	<i>N. cancellata</i>		<i>N. tatra</i>	<i>N. geraerti</i>		<i>N. major</i>		<i>N. andrassyi</i> n.sp.	<i>N. hades</i> n.sp.	
	Thorne, 1941	Geraert, 1994	Thorne & Malek, 1968	Geraert, 1974		Maqbool & Shahina, 1989		Andrássy, 1982	Original	
	<i>n</i>	Female	2 Females (types)	Females	7 Females	7 Males	15 Females (types)	5 Males (types)	Females (types)	11 Females (types)
L (mm)	0.52	0.56–0.58	0.56	0.49–0.57	0.47–0.50	0.64–0.80	0.64–0.70	0.57–0.60	0.53–0.62	0.49–0.55
a	25	29*	31	32*	30	34–39	32–34	32–34	24–31	25–34
b	5.4	5.8–5.9*	5.6	6.4*	5.8*	5.9–6.3	5.6–5.7	5.3–6.4	5.3–6.4	5.2–6.3
c	8	9.7*	9.6	8.9*	7.7*	9.0–10.2	8.2–9.0	9.2–9.6	8.1–10.3	8.2–9.0
c'	5.3*		5.5*	5.5*	5.8*	5.5–6.0	5.0–5.8	6.2–6.9	4.6–6.0	4.3–6.0
V	66	69.5	71	69.5–74	–	70–73	–	61–72	70–74	
Spicule length (µm)	–		–	–	13.5–17	–	20–23	–	–	19–21
Gubern. length (µm)	–		–	–	4.5–6	–	5–5.6	–	–	7.5–10
Annules length (µm)	2.4–4.2*	3.6–3.9	3.1–5*	2.5–3.2	2.7	3.2–4.0	3–4	2.2–4.2	4.0–4.6	3.7–4.4
Stylet length (µm)		9.5–10	11	8.5–10	8.5–10		12.5–14.5	10–11	9–10.5	9–10.5
Basal knobs	?		No	No	No			No	Yes	Yes
Long. lines	16		16	10	10	20	20	14	14	14
R	155–175			±192*		215–245	220–232	195–203	149–160	161–175
R Oes				±35*		45–50	38–43	36–40	30–38	34–38
RHV/RHAn				±136*		154–156	185–198	140–142	107–123	135–145
RVAn				±32*		36–42		33–37	21–26	
R Tail	±22*		±18*	±24*		24–34	30–40	20–24	20–26	25–30
Tail length (µm)		57	61*	52–66	58–67	67–80	75–82	62–65	55–66	56–64

\* Calculated from data in text or illustrations in relevant publications

length less than one third of body diameter. Postuterine sac mostly less than half of body diameter long. Quadricolumella with about 20 cells (four rows of five cells each); spermatheca variable in size, but seldom more than one body diameter long. Ovary outstretched, with developing oocytes in single file. Tail elongate-conoid, the tip bluntly rounded. Phasmids not seen, not even in a dorso-ventral view.

#### Male

Testis with outstretched or reflexed terminus. Sperm cells small, rounded, about 2 µm in diameter. Spicules distinctly differentiated into capitulum, calomus and lamina. In a dorso-ventral view of the spicules (Figure 1E), the first two sections appear hollow, whereas the lamina appears to be a solid plate-like structure. Gubernaculum without special features. Bursa originating opposite anterior end of spicules and extending almost to middle of tail, smooth except for a few annulations anteriorly and posteriorly. Cloacal lips prominently protruded. Tail as in female, but with a tendency to be more cylindroid in posterior half.

#### Type specimens

Holotype female on slide 31226, paratype females and males on slides 31226–31233 in the National Collection of Nema-

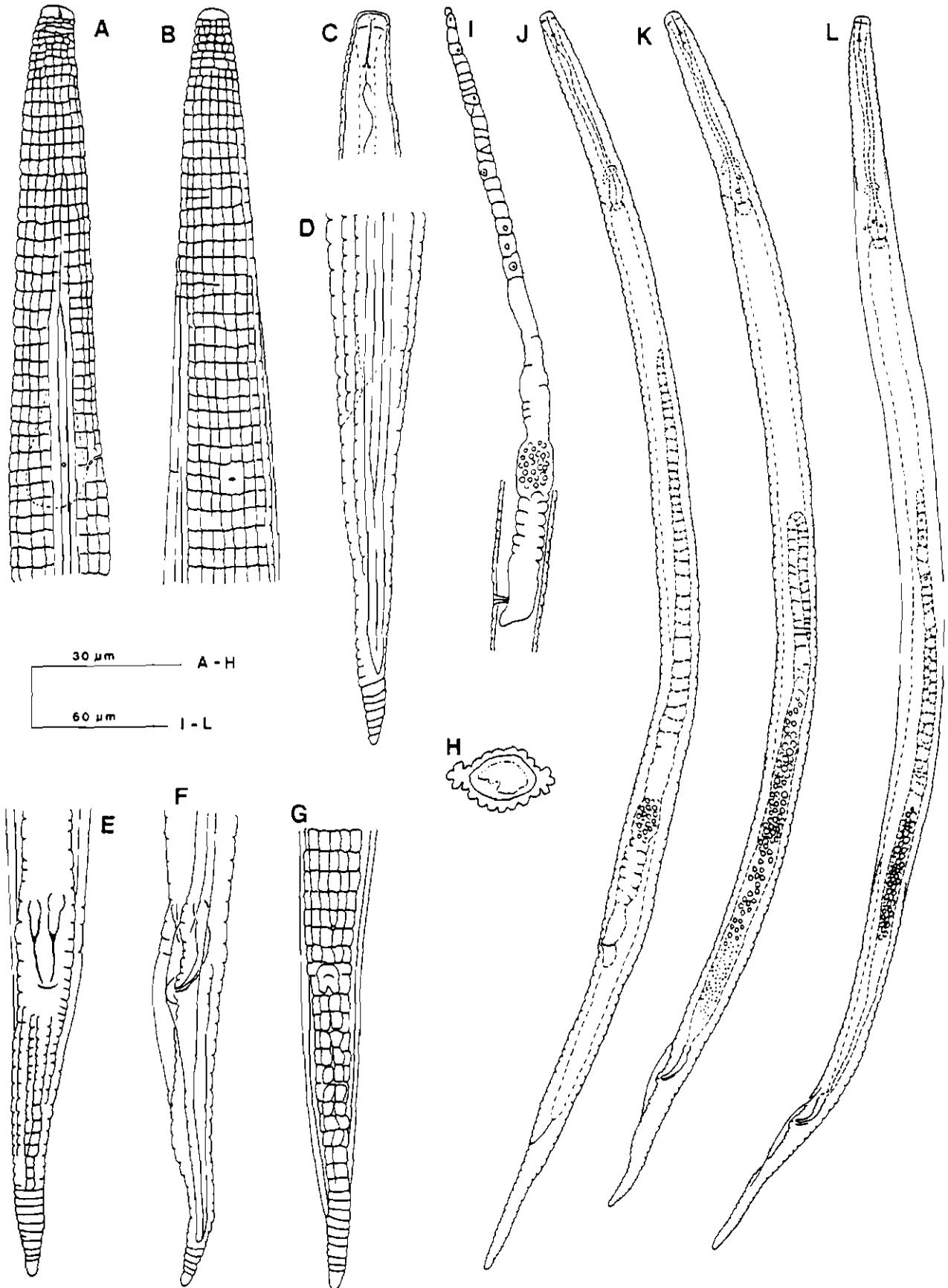
todes, Biosystematics Division, Plant Protection Research Institute, Pretoria, South Africa.

#### Type locality and habitat

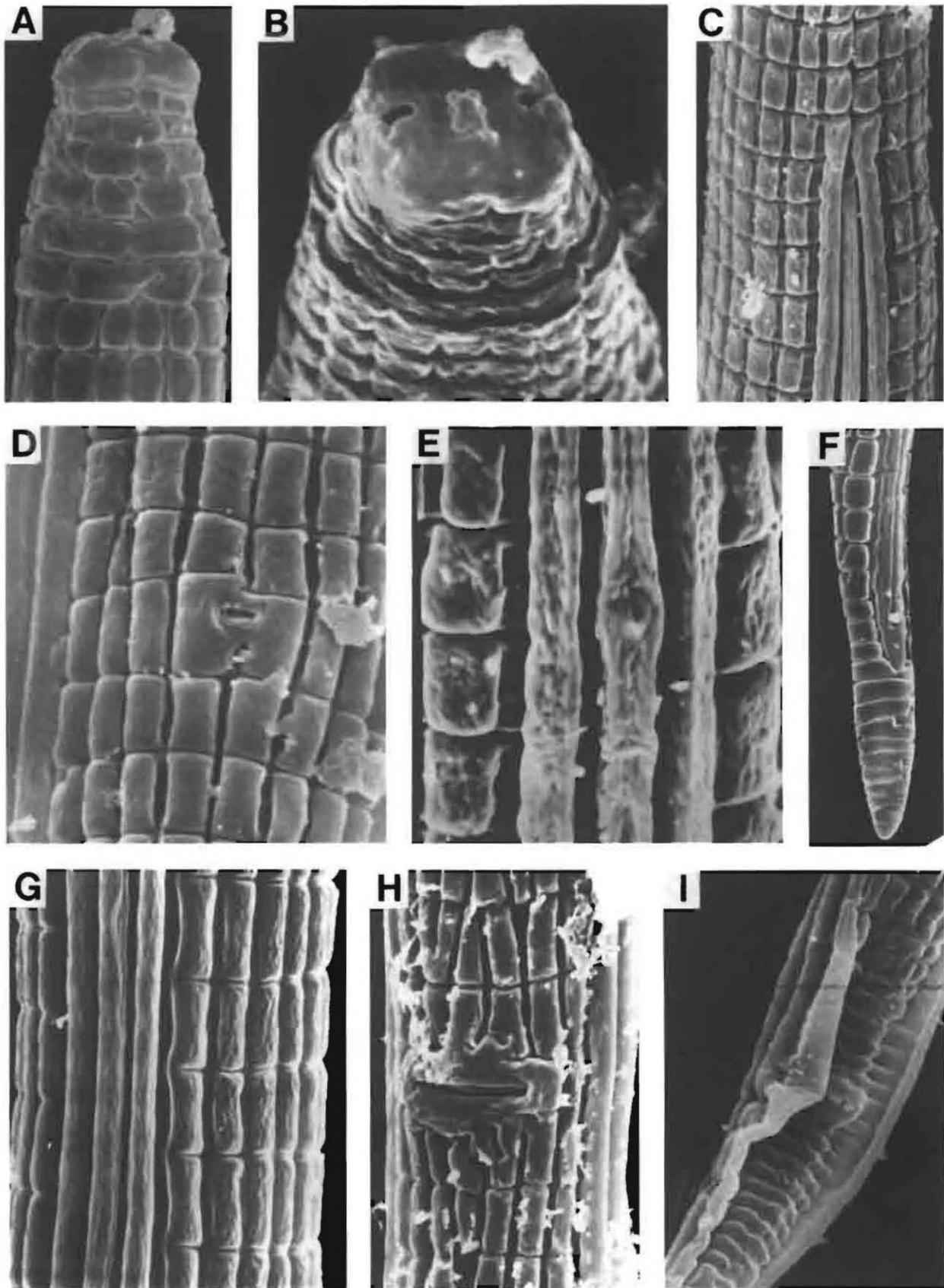
Eleven females, nine males and a few juveniles from soil around the roots of *Panicum* sp. on the farm Ouplaas in Gamkaskloof (commonly known as The Hell), Western Cape Province, South Africa; 33°31'S 21°35'E, collected by M. de Jager, 16 April 1995.

#### Differential diagnosis

*Neothada hades* n.sp. can be distinguished from all known species in the genus by the possession of distinct stylet knobs. The new species further differs from *Neothada cancellata* (Thorne, 1941) Khan, 1973 and the very similar *Neothada tatra* (Thorne & Malek, 1968) Khan, 1973 by the number of longitudinal lines (14 vs. 16 in *N. cancellata* and *N. tatra*); from *Neothada geraerti* (Andrássy, 1982) Siddiqi, 1986 by the number of longitudinal lines (14 vs. 10) and by a bluntly rounded tail tip vs. a pointed tail tip in *N. geraerti*; from *Neothada major* Maqbool & Shahina, 1989 by the number of longitudinal lines (14 vs. 20), shorter body (0.49–0.62 mm vs. 0.64–0.80 mm), shorter stylet (9–10.5 µm vs. 12–14.5 µm) and fewer body annules (149–175 vs. 215–245); and lastly



**Figure 1** *Neothada hades* n.sp. A: Surface view of neck region, lateral view; B: Ditto, ventral view showing excretory pore; C: Head, median view; D: Female tail, surface view; E: Ventral view of male tail; F: Lateral view of male tail; G: Ventral view of female tail, surface view; H: Transverse section showing the lateral fields each with four incisures and three wings, as well as the 14 longitudinal lines and 16 ridges; I: Female reproductive system; J: Female; K: Male with reflexed testis; L: Male with outstretched testis, and body twisted so that lateral fields lie on the sides and annulations do not show in middle part of body.



**Figure 2** *Neothada hades* n.sp. A: Lateral view of head and part of neck anterior to origin of lateral lines, X 3850; B: Oblique *en face* view, showing amphid apertures and labial disc, X 5700; C: Origin of lateral field, X 2400; D: Excretory pore, X 4000; E: Lateral field with deirid, X 5000; F: Sublateral view of posterior part of female tail; X 2200; G: Lateral field and area with very regular cuticular pattern near midbody, X 4200; H: Subventral view of vulva, X 2200; I: Subventral view of cloacal region of male, X 2200.

from *Neothada andrassyi* n.sp. by a smaller number of body annules (149–175 vs. 195–203), and a shorter, pyriform basal bulb compared with a longer, cylindroid bulb in *N. andrassyi* n.sp.

### Notes on *Neothada* species

#### *Neothada cancellata* and *Neothada tatra*

Geraert (1974) suggested that *N. tatra* may be a junior synonym of *N. cancellata* and Andrassy (1982) endorsed this view by formally synonymizing *N. tatra* with *N. cancellata*. Siddiqi (1986), however, retained *N. tatra*, the type species of *Neothada*, as a distinct species. Without having examined type specimens of either species, we are inclined to agree with Siddiqi. Thorne & Malek (1968) regarded the shape of the lip region as the main diagnostic difference between the two species, and scrutiny of the relevant illustrations in Thorne (1941) and Thorne & Malek (1968) does indeed show a difference in shape, with the lip region of *N. cancellata* more conoid and that of *N. tatra* more truncate. It is worth noting that in Siddiqi's (1968, Figure 23F) rendering of the lip region of *N. cancellata*, based on a paratype specimen, the region is even more sharply conoid than shown by Thorne (1941, Figure 24) and distinctly different from *N. tatra*, as shown by Thorne & Malek (Figure 32D). Moreover, the pattern created by the lateral field on the tail seems to differ in the two species (compare Thorne's (1941) Figure 24b and Siddiqi's (1986) Figure 23H with Thorne & Malek's (1968) Figure 32E). The disc-shaped cardia and the thick-walled rectum of *N. tatra* may be further differentiating characters.

#### *Neothada cancellata* apud Andrassy, 1982

We cannot agree with this identification, for the following reasons: The Hungarian population has fewer longitudinal striae than Thorne's *N. cancellata* (14 vs. 16), and a larger number of transverse striae (R = 195–203 vs. 155–175). We are convinced that these two characters, and especially the number of longitudinal striae, which seems to be constant within each species, are important diagnostic characters, and accordingly rename the Hungarian population *Neothada andrassyi* n.sp. (for description see Andrassy 1982). The wide range in vulva position for this species, given as 61–72% in Andrassy (1982), is possibly a printer's error, since no other *Neothada* population has such a wide range, the vulva always being between 70 and 74% for all known species. It should also be noted that the distribution records as listed on page 143 in Andrassy (1982) are no longer valid, and that the only certain record for *N. cancellata* is its type locality, viz. Fort Collins, Colorado, U.S.A. (Thorne 1941). The records for North and South Dakota refer to *N. tatra*, and that for Hungary to *N. andrassyi* n.sp. The record for South Africa (Heyns 1971) was based on a single specimen which has since deter-

iorated to the extent where positive identification is impossible, and the record is now regarded as highly doubtful. The records from the Netherlands (Dao 1970) and Cyprus (Philis & Siddiqi 1976) are only listings without measurements, descriptions or illustrations, and can be accepted only as positive identification of the genus, or at most as references to *N. cancellata* sensu lato.

### Key to *Neothada* species

1. Longitudinal striae 10, tail tip rather acute . . . . . *N. geraerti*  
Longitudinal striae at least 14, tail tip bluntly rounded . . . . . 2
2. Longitudinal striae 20, L = more than 0.6 mm;  
R = 215 or more. . . . . *N. major*  
Longitudinal striae 14 or 16; L = mostly less than 0.6 mm; R = less than 210 . . . . . 3
3. Stylet with distinct basal knobs . . . . . *N. hades* n.sp.  
Stylet without distinct basal knobs . . . . . 4
4. Longitudinal striae 14; R = 195 or more. . . . . *N. andrassyi* n.sp.  
Longitudinal striae 16; R = less than 195 . . . . . 5
5. Lip region conoid. . . . . *N. cancellata*  
Lip region more truncate . . . . . *N. tatra*

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