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On the occurrence of an inner stylet in adult trichodorids and additional information on *Trichodorus nanjingensis* Liu & Cheng, 1990

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Summary – An inner stylet was observed in some males of *Trichodorus nanjingensis* but not in other specimens, males and females. It was therefore considered as an incidental maintenance of a juvenile character. Additional information on morphometric data and on the variability of diagnostic features of *Trichodorus nanjingensis* is presented, together with detailed illustrations.

Résumé – ***Sur la présence d'un stylet interne chez les Trichodorides adultes et informations complémentaires sur* Trichodorus nanjingensis *Liu & Cheng, 1990.*** – La présence d'un stylet interne chez certains mâles de *Trichodorus nanjingensis*, mais non chez d'autres spécimens, mâles ou femelles, est considérée comme la persistance d'un caractère juvénile. Des informations supplémentaires sont données sur la morphométrie et la variabilité de caractères diagnostiques chez *T. nanjingensis*. Une illustration détaillée est également fournie.

Key-words : Nematodes, Trichodoridae, *Trichodorus nanjingensis*.

The presence of an additional inner or second stylet, similar to the replacement stylet in juvenile, has rarely been observed in adult trichodorid specimens. It was described in three *Paratrichodorus* species : *P. minor* (Colbran, 1956) Siddiqi, 1974 [= *P. christiei* (Allen, 1957) Siddiqi, 1974], *P. nanus* (Allen, 1957) Siddiqi, 1974, *P. porosus* (Allen, 1957) Siddiqi, 1974 and recently also in *Trichodorus petrusalberti* De Waele, 1988.

Seinhorst (1970) recorded the presence of a second stylet in adult specimens of several *P. nanus* populations from the Netherlands. The author did not specify if he observed this feature in females only; however, males are rare in this species. The first author observed an inner stylet in all female specimens of *P. nanus* from Belgium present in the nematode collections of the Institute in Brussels and of the University in Gent (Figs 1J, 2I). The presence of an inner stylet in adult *P. minor* specimens was first shown in TEM studies of female specimens by Hirumi *et al.* (1968). Decraemer and Chavez (1989) observed an inner stylet in all adult female and male specimens from Argentinian soil samples (Figs 1K, 2H). Bird (1971) described an inner stylet in *P. porosus* females. However, the feature was not mentioned in either the original or later species descriptions, nor did we observe it in any *P. porosus* female specimens. Recently, Decraemer and Marais (1993) described an inner stylet in males and females of *Trichodorus petrusalberti* De Waele, 1988 (Fig. 2J).

Results and discussion

Looking through some slides with type and other specimens of *Trichodorus nanjingensis* Liu & Cheng, 1990, the first author observed, in a population from the rhizosphere of plum tree from Suzhou, Jiangsu Province, two males with an inner stylet but two other males and eight females from the same sample, and with the same morphological and morphometric features, lacked the inner stylet. The second author made a similar observation on material from another sample : only one male out of fourteen males and eighteen females possessed an inner stylet.

For the first time, the occurrence of an inner stylet in adult specimens of a trichodorid species appears as an incidental maintenance of a juvenile character. This feature is known within the genus *Xiphinema* where in the last moult (J4 - adult) occasionally a tip (= vestigium) or even a complete odontostyle is formed (Dalmasso, 1967).

Additional information on morphometric data for males and females of *Trichodorus nanjingensis* is presented in Table 1.

Variability was observed in the following diagnostic features : In males : – the number of ventromedian cervical papillae usually two, may vary between zero and two; – although rarely males with four precloacal supplements (SP) were found, the majority have three SP,

Table 1. *Morphometric data of males and females of two populations of* Trichodorus nanjingenis *(all measurements in μm).*

Locality/habitat	Suzhou rhizosphere plum tree		Linbao, rhizosphere apple tree		Suzhou, rhizosphere plum tree		Linbao, rhizosphere apple tree	
Sex	Male	Male	Male	Male	Female	Female	Female	Female
Number	20	4	20	4	20	8	20	4
L	777-1133 970 ± 86	865-1045 948 ± 64	826-1092 938 ± 86	980-1070 1026 ± 32	884-1123 1014 ± 77	980-1315 1062 ± 106	982-1231 1059 ± 67	900-1060 979 ± 57
Onchiostyle	45-50 47 ± 1.3	50-52 51 ± 0.7	47-52 49 ± 1.5	50-52 50.7 ± 0.8	41-50 47 ± 2.1	45-53 49.3 +2.4	46-51 49 ± 1.4	50-52.5 50.8 ± 1.2
Onchium	–	20-24 22.7 ± 1.6	–	23-26.5 25.1 ± 1.7		20-32 24.8 +3.7		23
Fore end to excretory pore, EP	99-133 122 ± 9	107-125 117.5 ± 7.4	107-135 123 ± 8.7	121-134 126 ± 5.1	109-147 127 ± 8.9	114-142 127 ± 9.3	119-145 128 ± 7	116-144 127 ± 10.5
Distance CP1-CP2	9-15 11 ± 1.5	8-30 16 ± 9.9	9-19 12 ± 2.3	10-12 11.5 ± 0.9				
Distance CP2-EP	10-20 14 ± 3.6	9-19 13.5 ± 4.1	5-21.5 11.4 ± 3.9	7-13 10.5 ± 2.3				
Fore end to lateral cephalic pore	–	91-100 97 ± 3.4	–	89-110 102.5 ± 8.0				
Spicule	43-53 48 ± 2.8	48-53 50.5 ± 2.0	46-50 48 ± 1.2	46-52 49 ± 2.2				
Gubernaculum	18-24 21 ± 1.8	21.5-24 22.5 ± 1.1	20-23 22 ± 0.9	19-22 20.8 ± 1.1				
Distance cloaca - SP1	21.5-28 25.4 ± 2.1	20-26 23.5 ± 2.2	24-32 27 ± 2.3	25-31 27 ± 2.4				
Distance SP1-SP2	24-44.5 32.5 ± 5.3	30-33 31.4 ± 1.6	30.5-42 35 ± 3.2	31-61 45 ± 10.7				
Distance SP2-SP3	28-61 43 ± 10.4	47-60 53 ± 5.2	35.5-66 46.7 ± 8.3	49-116 82 ± 26.6				
a	20-25 22 ± 1.5	21.6-22.7 22.1 ± 0.5	18-27 23 ± 2.3	24.3-28.8 25.7 ± 1.8	20-28 23 ± 1.8	20.4-27.4 23.2 ± 2.2	21-28 24 ± 1.8	21.4-23.5 22.4 ± 0.8
b	5.3-7.3 6.1 ± 3.5	5.4-6.3 5.7 ± 0.4	3.7-7.1 6.2 ± 0.8	5.5-7.6 6.5 ± 0.8	5.5-7.2 6.2 ± 0.5	5.2-8.4 6.4 ± 0.9	6.0-7.8 6.9 ± 0.5	5.8-7.2 6.4 ± 0.5
T	53-65 61 ± 3.5	59.2-76.3 65.1 ± 6.9	53-67 60 ± 4.0	56.7-69.6 63.7 ± 5.9				
V	–				53-59 55 ± 1.7	52-63 56 ± 3.2	53-59 56 ± 1.4	52.5-54.5 54 ± 0.8
Ratio length onchiostyle/pharynx length (%)	–	27.1-34.4 30.9 ± 3.0	–	29.2-35.4 32.2 ± 2.3				
Ratio fore end to EP/pharynx lenght (%)	–	59.4-84.5 71.4 ± 8.9	–	67.9-90.1 80.2 ± 9.7		62.6-91.0 76.6 ± 7.9		73.1-94.7 82.8 ± 8.1
G1	–					16.12-22.50 19.74 ± 2.1		15.85-22.35 20.2 ± 2.6
G2	–					17.56-25.80 21.4 ± 2.7		17.9-22.72 20.5 ± 2.3

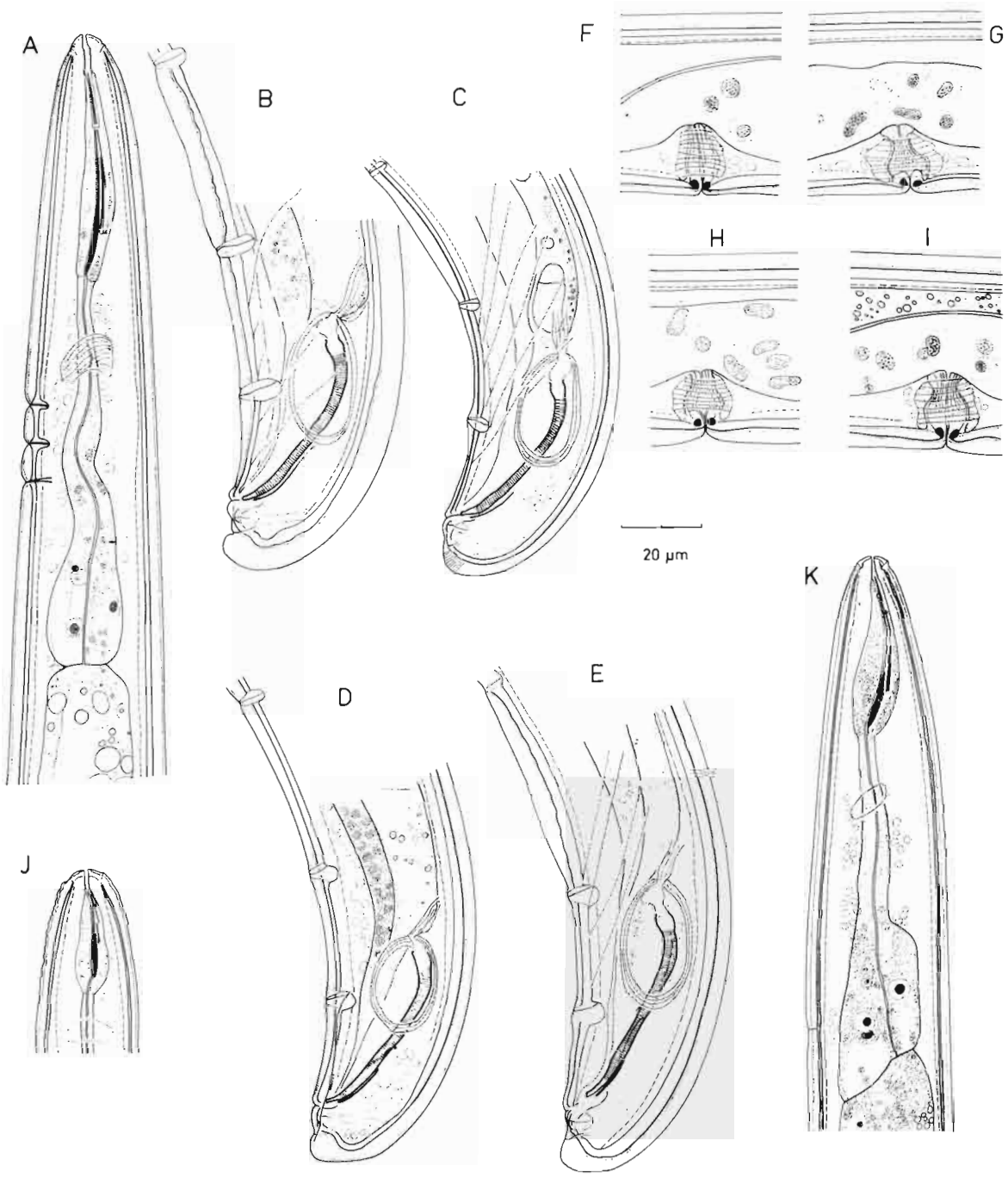

Fig. 1. Trichodorus nanjingensis. *Male. A : Anterior body region (♂ from Suzhou); B-E : Tail and copulatory apparatus (B-C : male paratypes; D-E : males from Suzhou). Female. F-G : Vaginal region (females from Suzhou).* – Paratrichodorus nanus. *J : Anterior end of female with reserve stylet (Belgian specimen)* – Paratrichodorus minor. *K : Anterior body region of female with reserve stylet (specimen from Argentina).*

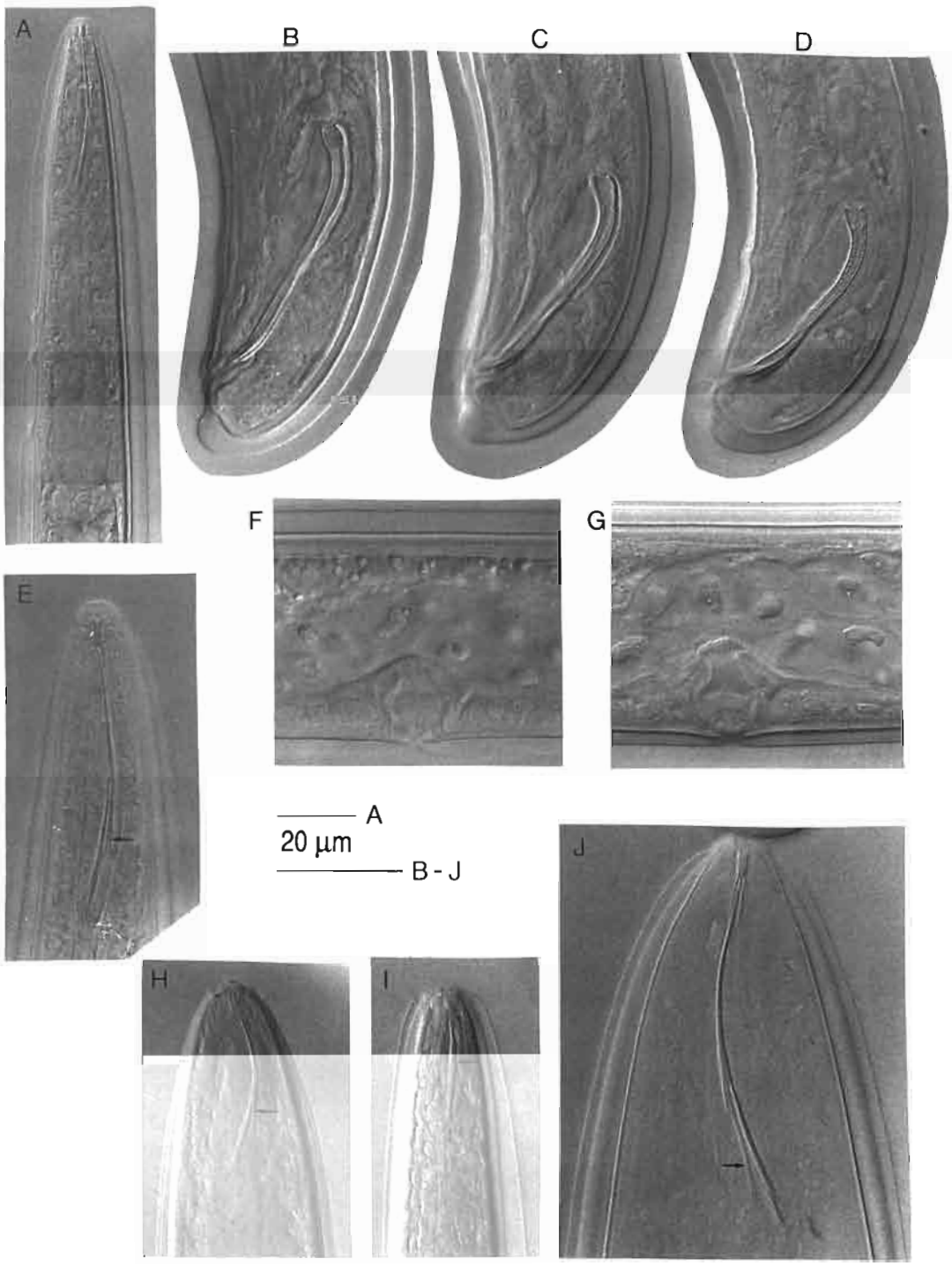

Fig. 2. Trichodorus nanjingensis : *Male. A : Anterior body region; B-D : Tail and copulatory apparatus (paratypes); E : Male paratype with reserve stylet. Female. F-G : Vaginal region; H-J : Anterior body region of female showing reserve stylet in* Paratrichodorus minor *(H),* P. nanus *(I) and* Trichodorus petrusalberti *(J).*

Table 2. *Variation in number of ventromedian cervical papillae (CP) and precloacal supplements (SP) in males of two populations of* Trichodorus nanjingensis.

	CP			SP	
	0	1	2	3	4
Pop. Suzhou (n = 34)	1	3	30	33	1
Pop. Linbao (n = 73)	0	8	65	70	3

the typical number for the genus (Table 2); – the middle supplement (SP2) varies in position from near the spicule head (Fig. 1E) to further anterior (Fig. 1D); – the striated ornamentation of the spicules varied in appearance from weakly developed (male from Suzhou, Fig. 1D) to strongly marked (paratype male, Fig. 1C); – the bristles are usually not observed or are obscure when the scales are not detached from the spicule corpus; – the position of the excretory pore varies in relation to the posteriormost ventromedian cervical papilla (CP2) (range between 5.1 and 21.5 μm) and to the pharyngo-intestinal junction (ratio anterior end to excretory pore/pharynx length (%) = 59.4-90.1 %, range for mean values from 71.4 to 80.2 %); – the terminal tail cuticle shows various degrees of thickening : from the rarely observed thin cuticle (Figs 1C, 2D), to a more usual moderately swollen cuticle to an obviously swollen terminal cuticle (Figs 1B, 2C); the subventral body wall may show a slight bursa-like protrusion/fold in some specimens (see Fig. 1D); both tail features seem influenced by fixation.

In females, some minor variability was observed in the shape and size (1.5-2.5 μm) of the sclerotized pieces at the vulva/vagina junction : from triangular to almost rounded, and in the shape and length of the vagina in longitudinal optical section (from a distinct pear-shape to an elongated shape and 16-18 μm long in Linbao specimens, 16-21 μm in specimens from Suzhou). The pair of postvulvar lateral body pores are located at 12-28 μm or 7-10 μm respectively in specimens from Suzhou and from Linbao.

Trichodorus nanjingensis is characterized in females by a pore-like vulva in ventral view and by the shape and size of the vaginal sclerotizations, but mainly by the absence of spermathecae and sperm equally spread throughout the uteri, a feature common for many *Paratrichodorus* species but unique with the genus *Trichodorus*. *Trichodorus* species possess two spermathecae, rarely obscured as e.g. in the absence of sperm. In a specimen of *Trichodorus cedarus* sperm was observed all over the uteri, but it still showed a concentration near the oviduct indicating the existance of a spermatheca (Decraemer, 1988). *T. nanjingensis* males are characterized by the length (42-53 μm) and shape of the spicules, with corpus almost straight except for a slight bend at the head and at the smooth tip; by the presence of a single precloacal supplement (SP1) clearly within spicule range and by the presence of two ventromedian cervical papillae anterior to the excretory pore.

References

BIRD, G. W.(1971). Digestive system of *Trichodorus porosus*. *J. Nematol.*, 3 : 50-57.

DALMASSO, A. (1967). Cas de femelles de *Xiphinema* possédant deux odontostyles. *Nematologica*, 13 : 474-476.

DECRAEMER, W. (1988). Morphometric variability and value of the characters used for species identification in *Trichodorus* Cobb, 1913. *Bull. K. Belg. Inst. Nat. Wet., Biol.*, 58 : 29-44.

DECRAEMER, W. & CHAVES, E. (1989). Morphology of the reproductive system and structure of sperm cells in some species of the genus *Paratrichodorus* with uncommon males (Nematoda : Diphtherophorina). *Revue Nématol.*, 11 : 405-409.

DECRAEMER, W. & MARAIS, M. (1993). Two new species of *Trichodorus* from South Africa, with a note on *T. petrusalberti* (Nemata : Trichodoridae). *Fundam. appl. Nematol.*, 16 : 273-282.

HIRUMI, H., CHEN, T. A., LEE, K. L. & MARAMOROSCH, K. (1968). Ultrastructure of the feeding apparatus of the nematode *Trichodorus christiei*. *J. Ultrastr. Res.*, 24 : 434-453.

LIU, R. & CHENG, H. (1990). [Occurrence of trichodorid species (Nematoda : Trichodoridae) in China]. *J. Nanjing agric. Univ.*, 13 : 50-54.

SEINHORST, J. W. (1971). Replacement stylet in adult *Trichodorus nanus*. *Nematologica*, 16 : 330.