

***Trichodorus petrusalberti* n. sp.**
(Nematoda: Trichodoridae) from Rice with
Additional Notes on the Morphology of
T. sanniae* and *T. rinae

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Abstract: A new species in the family Trichodoridae, from the rhizosphere of rice (*Oryza sativa* L.) in Northern Natal, South Africa, is described and illustrated. *Trichodorus petrusalberti* n. sp. resembles *T. taylori* De Waele, Mancini, Roca, and Lamberti, 1982, *T. hooperi* Loof, 1973, and *T. complexus* Rahman, Jairajpuri, and Ahmad, 1985, from which it is distinguished by the shape of the spicules. It is distinguished from the former two species by the nonthickened terminal cuticle in the males and by the shape and sclerotization of the vulval-vaginal region in lateral view in the females. Additional morphological details are given for *T. sanniae* Vermeulen and Heyns, 1985 and *T. rinae* Vermeulen and Heyns, 1985.

Key words: stubby-root nematode, taxonomy, morphology, *Oryza sativa*, South Africa.

Trichodorus species have only recently been found on the African continent. In 1982, De Waele and Carbonell (4) described *T. coomansi* from Kenya in eastern Africa and *T. eburneus* from the Ivory Coast in western Africa. The latter species was later reported from Senegal and Upper Volta (1,3). In 1985, Vermeulen and Heyns (9) described *T. sanniae* and *T. rinae* from South Africa. The known geographical distribution of these species is restricted to Africa. In 1985, a soil sample collected from the rhizosphere of rice (*Oryza sativa* L.) in a rice pilot project in Northern Natal, South Africa, contained a new *Trichodorus* species described herein as *T. petrusalberti* n. sp. Also, re-examination of *T. sanniae* and *T. rinae* from South Africa revealed some additional morphological information that is reported for these species.

MATERIALS AND METHODS

The nematodes were extracted from soil by sugar centrifugal-flotation (6). Specimens were killed and fixed with hot 4% formalin, processed to pure glycerin by a

modified Seinhorst method (2), and mounted in glycerin on glass slides. Unless indicated otherwise, all measurements are in micrometers (μm).

SYSTEMATICS

Trichodorus petrusalberti n. sp.
(Fig. 1A, B, E, H, K, N)

Measurements: Holotype, paratype males in Table 1; allotype, paratype females in Table 2.

Males (Fig. 1A, H, N): General appearance typical of family. Posterior end curved ventrally. Cuticle swollen after fixation, about 6-6.5 thick at midbody region, with three distinct layers: thin outer (1.5-2), thicker middle (3-4), and thin inner layer (1). Esophageal bulb occupies 25-33% esophagus length. Five esophageal gland nuclei present (Fig. 1A): anterior ventro-sublateral nuclei small, indistinct, in anterior third of bulb; posterior ventro-sublateral nuclei in posterior third of bulb; large dorsal nucleus near mid-bulb. Intestine overlaps esophageal bulb dorsally (Fig. 1A). Nerve ring about mid-esophagus. Two distinct ventromedian cervical papillae present (Fig. 1A): anterior papilla (CP1) posterior to onchiostyle region, 70-116 (89) from anterior end of body; posterior papilla (CP2) in mid-bulb region, 7-12 (9) anterior to excretory pore. Excretory pore (EP) 104-157 (128), or 64-97% esophagus length, from anterior end, usually poste-

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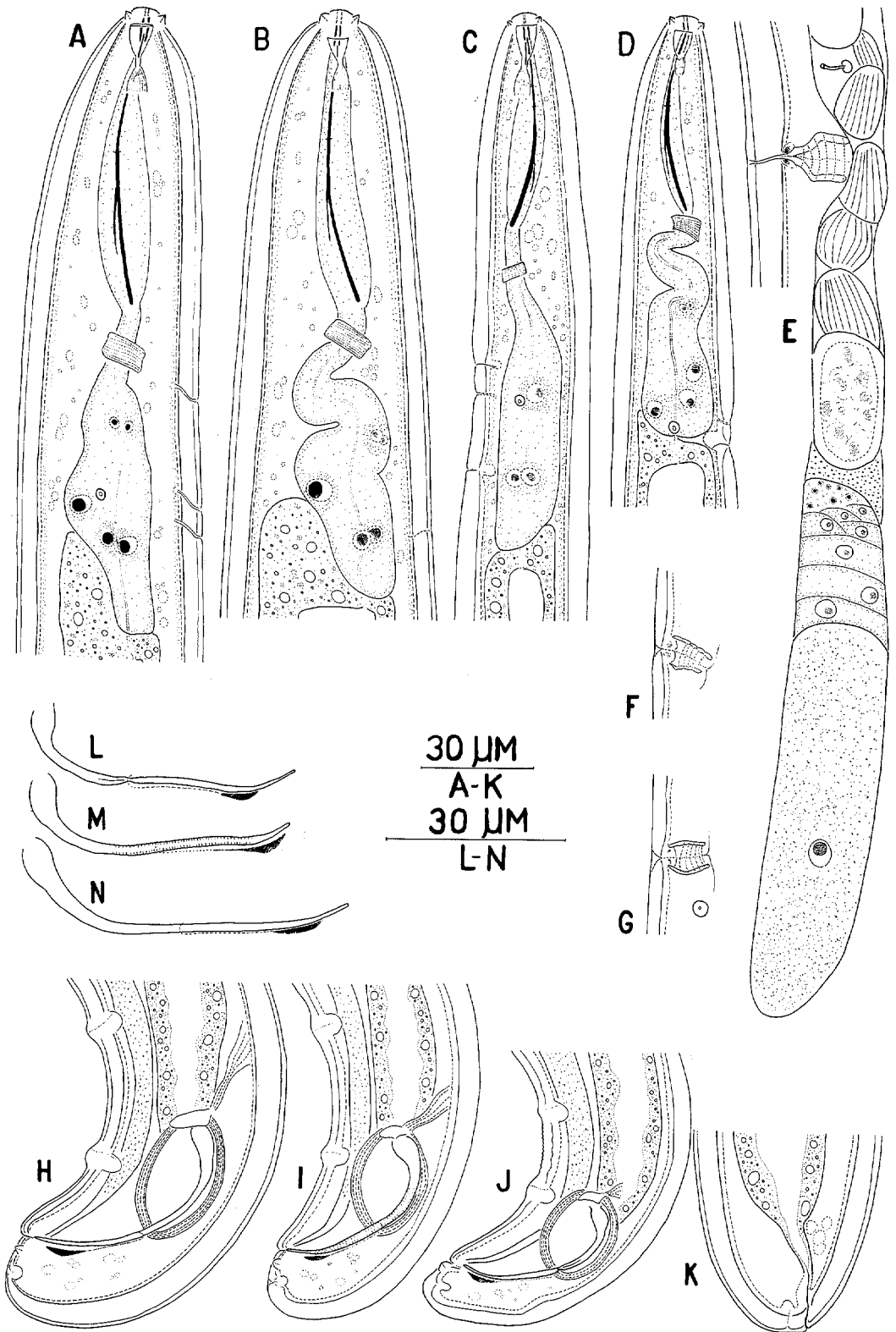


TABLE 1. Morphometric data of 10 males of *Trichodorus petrusalberti* n. sp.

Character	Holotype	Range	Mean	Standard deviation	Coefficient of variation (%)
Length	873.0	707.0–967.0	884.0	92.4	10.9
Body width	61.0	53.0–66.0	59.0	4.5	7.6
Esophagus length	149.0	128.0–174.0	154.0	14.6	9.5
Onchiostyle length	71.0	67.0–73.0	70.0	2.1	3.0
Anterior end to CP1	81.0	70.0–116.0	89.0	13.8	15.6
CP1 to CP2†	31.0	21.0–33.0	28.0	4.8	16.9
CP2 to EP	7.0	7.0–12.0	9.0	1.7	19.5
Anterior end to EP†	119.0	104.0–157.0	128.0	15.1	11.8
Spicule length	70.0	62.0–71.0	67.0	3.3	5.0
Gubernaculum length	27.0	23.0–99.0	26.0	1.9	7.2
Anus to SP1	27.0	27.0–33.0	30.0	2.5	8.2
SP1 to SP2	37.0	34.0–55.0	41.0	7.3	17.9
SP2 to SP3	64.0	55.0–84.0	67.0	8.5	12.6
a	14.3	11.9–17.1	14.3	1.6	11.0
b	5.9	4.7–6.1	5.5	0.5	8.4
T	73.2	58.9–73.2	66.5	4.1	6.1
Anterior end to EP/total esophagus length (%)	79.9	64.2–96.9	82.9	10.4	12.6
Onchiostyle length/total esophagus length (%)	47.7	41.4–49.0	45.2	2.7	6.0
Anus to SP1/spicule length (%)	38.6	38.6–53.2	45.1	5.3	11.7
Anus to SP2/spicule length (%)	91.4	89.9–123.1	105.3	11.3	10.7
Anus to SP3/spicule length (%)	182.9	182.9–236.9	206.0	22.1	10.7

All measurements are in micrometers (µm) unless otherwise indicated.

† (n = 9) male with EP anterior to CP2 omitted.

rior to CP2 except in one specimen, EP3 anterior to CP2, 100 (68% esophagus length) from anterior end. One pair of lateral cervical pores present, positioned laterally between CP1 and CP2 (Fig. 1A). Testis single, outstretched. Spicules long, 62–71 (67), slender, manubrium and calomus arcuate, lamina straight, proximally cephalated, not setose or striated (Fig. 1N). Gubernaculum 23–29 (26), with thickened keel (Fig. 1N). Three preanal supplements (Fig. 1H): posterior one (SP1) 27–33 (39–53% spicule length) anterior to anus, within range of retracted spicules; median one (SP2) 62–84 (90–123% spicule length) anterior to anus, anterior to retracted spic-

ules; anterior one (SP3) 121–168 (183–237% spicule length) anterior to anus. Distance between SP2 and SP3 55–84 (67); between SP1 and SP2 34–55 (41). One small pair postanal subventral papillae and one pair subterminal caudal pores present (Fig. 1H). Terminal cuticle not thickened (Fig. 1H).

Females (Fig. 1B, E, K): General appearance similar to males. Posterior end straight. Intestine usually with distinct, anteriorly directed overlap of esophagus (Fig. 1B); one female without overlap. Excretory pore 123–143 (135), or 1.8–2.1 times onchiostyle length, from anterior end of body, about the middle to posterior third

FIG. 1. Characteristics of three *Trichodorus* species. A, B, E, H, K, N) *Trichodorus petrusalberti* n. sp. A) Anterior region of male. B) Anterior region of female. E) Anterior reproductive branch of female (allotype). H) Posterior region of male (holotype). K) Female tail. N) Male, spicule and gubernaculum (lateral). C, F, I, M) *Trichodorus rinae*. C) Anterior region of male. F) Female, vulva and vagina region (lateral). I) Posterior region of male. M) Male, spicule and gubernaculum (lateral). D, G, J, L) *Trichodorus sanniae*. D) Anterior region of male (holotype). G) Female, vulva and vagina region (lateral). J) Posterior region of male (holotype). L) Male, spicule and gubernaculum (lateral).

TABLE 2. Morphometric data of eight females of *Trichodorus petrusalberti* n. sp.

Character	Allotype	Range	Mean	Standard deviation	Coefficient of variation (%)
Length	882.0	809.0–957.0	892.0	55.9	6.3
Body width	65.0	51.0–65.0	58.0	4.6	7.9
Esophagus length	154.0	144.0–180.0	162.0	13.5	8.3
Onchiostyle length	73.0	68.0–73.0	71.0	1.4	2.0
Anterior end to EP	131.0	125.0–143.0	135.0	6.6	4.9
Anterior genital branch	239.0	154.0–250.0	196.0	34.6	17.7
Posterior genital branch	203.0	149.0–230.0	192.0	27.9	14.5
a	13.6	13.5–18.8	15.0	1.8	11.9
b	5.7	5.0–6.0	5.5	0.3	5.9
V	53.0	51.5–56.1	54.1	1.8	3.3
G1	27.1	16.8–27.1	22.0	4.0	18.0
G2	23.0	18.1–24.8	21.6	2.7	12.4
Anterior end to EP/total esophagus length (%)	85.1	78.5–89.6	84.5	3.9	4.6
Onchiostyle length/total esophagus length (%)	47.4	39.1–49.3	43.9	4.0	9.1

All measurements are in micrometers (μm) unless otherwise indicated.

of esophageal bulb (Fig. 1B). Female reproductive system didelphic, amphidelphic. Ovaries reflexed, large spermathecae present (Fig. 1E). Lined oblong objects from unknown origin present in the uterus (Fig. 1E). Vaginal sclerotizations well developed (Fig. 1E). Vagina length 24–28, extends inward 39–48% corresponding body width. Usually two pairs lateral body pores present: one pair 15–30 posterior to vulva, within one body width (Fig. 1E); one pair 105–175 anterior to vulva, 1.6–2.5 times corresponding body width; in two females one additional pair present, 179 and 231 anterior to vulva, 2.9 and 3.9 times corresponding body width. Anus subterminal. One pair subventral subterminal caudal pores present (Fig. 1K).

Type habitat and locality: Wet soil around the roots of *Oryza sativa* L. at the rice pilot project site of the Industrial Development Corporation, Ngwavuma District, Northern Natal, South Africa. Collected by J. A. M. van der Mey on 21 February 1985.

Diagnosis: *Trichodorus petrusalberti* n. sp. resembles *T. taylori* De Waele, Mancini, Roca, and Lamberti, 1982, *T. hooperi* Loof, 1973, and *T. complexus* Rahman, Jairajpuri, and Ahmad, 1985 in having a thick cuticle consisting of three distinct layers; males usually with two conspicuous ventromedian cervical papillae posterior to the on-

chiostyle, but anterior to the excretory pore; and three ventromedian preanal supplements, the posterior one positioned within range of the retracted spicules. The males of *T. petrusalberti* n. sp. are easily distinguished from the males of *T. taylori*, *T. hooperi*, and *T. complexus* by the characteristic shape of the spicules, and from the males of *T. taylori* and *T. hooperi* by thickness of the terminal cuticle (not thickened in *T. petrusalberti* n. sp. vs. thickened in the other two species). Males of *T. petrusalberti* n. sp. differ from the males of *T. hooperi* and *T. complexus* by the longer onchiostyle (67–73 vs. 54–62 in *T. hooperi* and 45 in *T. complexus*) and from *T. hooperi* and *T. complexus* in the longer spicules (62–71 vs. 44–53 in *T. hooperi* and 43 in *T. complexus*). The females of *T. petrusalberti* n. sp. are distinguished from the females of *T. taylori*, *T. hooperi*, and *T. complexus* by the characteristic shapes of the vulval–vaginal region and vaginal sclerotizations. They also differ from *T. taylori*, *T. hooperi*, and *T. complexus* in having two pairs of lateral body pores instead of only one pair of pores. Furthermore, females of *T. petrusalberti* n. sp. differ from the females of *T. hooperi* and *T. complexus* in the longer onchiostyle (68–73 vs. 53–60 in *T. hooperi* and 42–45 in *T. complexus*).

Type specimens: Holotype male (the lower

right-hand specimen in slide no. 22678), allotype female (the upper left-hand specimen in slide no. 22679), and 10 paratype males and females deposited in the National Collection of Nematodes, Plant Protection Research Institute, Pretoria, Republic of South Africa. Two paratype males and two paratype females (slides nos. 801–804) deposited in the Nematode Collection, Instituut voor Dierkunde, Laboratorium voor Morfologie, Rijksuniversiteit Gent, Belgium.

This new species is named in memory of the author's father, Dr. P. A. De Waele.

Additional Morphological and
Taxonomic Notes on *Trichodorus sanniae*
Vermeulen and Heyns, 1985
(Fig. 1D, G, J, L)

Type specimens: Designation of type specimens on holotype slide no. 14430. In the original species description of *T. sanniae* (9), the holotype slide and designated type specimens were listed as follows: "Holotype male the left-hand specimen on slide 14430. Two female and three male paratypes on the same slide." Upon re-examination of slide 14430 it was discovered that the slide contained the holotype and two paratype females, but contained only two male paratypes instead of the three listed in the description. The slide is deposited in the National Collection of Nematodes, Plant Protection Research Institute, Pretoria, Republic of South Africa.

Males (Fig. 1D, J, L): General appearance typical of family. Cuticle swollen after fixation, 5–6 at midbody, with two distinct layers: thick outer (3.5–4.5) and thin inner (1.5). Esophageal bulb occupies 25–33% esophagus length. Five esophageal gland nuclei present (Fig. 1D). Intestine always with distinct, anteriorly directed, overlap of esophagus (Fig. 1D) (in the original description "Posterior end of oesophagus set off from the intestinum" is mentioned). Excretory pore 93–109 from anterior end of body. One pair lateral cervical pores present, positioned at level of excretory pore and ventromedian cervical papilla (Fig. 1D). Testis single, outstretched. Spic-

ules not striated (Fig. 1L). Posterior preanal supplement (SP1) 57–60% spicule length anterior to anus, opposite heads of retracted spicules (Fig. 1J); median one (SP2) 102–115% spicule length anterior to anus; anterior one (SP3) 175–186% spicule length anterior to anus. One pair postanal subventral papillae and one pair subterminal caudal pores present (Fig. 1J). Terminal cuticle not thickened.

Females (Fig. 1G): General appearance similar to males. Excretory pore 99–104 from anterior end of body. Vaginal shape and sclerotizations as shown in Figure 1G. Vagina length 16–17, extends inward 40–41% corresponding body width. One pair lateral body pores present posterior to vulva, within one body width.

Additional Morphological Notes on
Trichodorus rinae
Vermeulen and Heyns, 1985
(Fig. 1C, F, I, M)

Measurements: Holotype male and nine paratype males in Table 3.

Males (Fig. 1C, I, M): General appearance typical of family. Cuticle consisting of two layers: inner one always 1.5; outer one variable after fixation (not swollen, 2–2.5; moderately swollen, 3.5–4.5; distinctly swollen, 5.5–6.5). Esophageal bulb occupies 25–33% esophagus length. Five esophageal gland nuclei present (Fig. 1C). Intestine in half of specimens with distinct, anteriorly directed, overlap of esophagus (Fig. 1C); in other half of specimens without overlap. (In the original description "Posterior end of oesophagus set off from the intestinum, or with a slight ventral overlap of the oesophagus over the intestinum" is mentioned.) Excretory pore 79–114 from anterior end of body, usually between two ventromedian cervical papillae (Fig. 1C), but in one male situated 5 anterior to CP1, at 98 from anterior end. CP1 usually about anterior one-third and CP2 about posterior one-third esophageal bulb (Fig. 1C); CP2 exceptionally at level of anterior part of intestine. Testis single, outstretched. Posterior preanal supplement (SP1) 49–78% spicule length anterior to

TABLE 3. Additional morphometric data of ten paratype males of *Trichodorus rinae*.

Character	Range	Mean	Standard deviation	Coefficient of variation (%)
Anterior end to CP1†	64.0–102.0	85.0	13.9	16.4
CP1 to EP†	8.0–16.0	11.0	2.9	25.7
EP to CP2†	5.0–20.0	13.0	4.8	36.6
Anterior end to EP†	79.0–114.0	96.0	14.4	15.0
Spicule length	45.0–55.0	49.0	3.7	7.5
Anus to SP1	24.0–38.0	30.0	4.1	13.7
SP1 to SP2	27.0–40.0	32.0	4.0	12.3
SP2 to SP3	32.0–48.0	39.0	5.2	13.6
Anus to SP1/spicule length (%)	49.0–77.6	61.1	8.3	13.6
Anus to SP2/spicule length (%)	107.3–142.9	127.2	11.7	9.2
Anus to SP3/spicule length (%)	181.8–229.8	206.4	19.1	9.3

All measurements are in micrometers (μm) unless otherwise indicated.

† (n = 9) male with EP anterior to CP1 omitted.

anus, slightly anterior, opposite or slightly posterior to heads of retracted spicules (Fig. 1I); median one (SP2) 107–143% spicule length anterior to anus; anterior one (SP3) 182–230% spicule length anterior to anus. One pair postanal subventral papillae and one pair subterminal caudal pores present (Fig. 1I). Terminal cuticle slightly thickened.

Females (Fig. 1F): General appearance similar to males. Excretory pore 81–107 from anterior end of body. Vaginal shape and sclerotizations as shown in Figure 1F. Vagina length 16–17, extends inward 32–50% corresponding body width. One pair lateral body pores present 12–24 posterior to vulva, within one body width.

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