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Ditylenchus destructor in Hulls and Seeds of Peanut

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Abstract: The potato rot nematode, *Ditylenchus destructor* Thorne, is reported for the first time in hulls and seeds of peanut. The populations found differed from *D. dipsaci* and *D. myceliophagus* in habitat, number of lateral incisures, shape of tail tip, and length of postvulval sac. Infected hulls had brown necrotic tissue at the point of connection with the peg, and a black discoloration appeared first along the longitudinal veins. Infected seeds were usually shrunken, and testae and embryos had a yellow to brown or black discoloration. Of 877 seed samples graded "damaged" from all major peanut producing areas of South Africa, 73% were infected.

Key words: Arachis hypogaea, Ditylenchus destructor, morphology, peanut, peanut rot nematode, South Africa, symptom.

In May 1987, a black discoloration of peanut (*Arachis hypogaea* L. cv. Sellie) pods, resembling black hull caused by *Chalara elegans* NagRaj and Kendrick in irrigated peanut fields (14,16), was observed in several rain-fed peanut fields in the Schweizer-Reneke district, Transvaal, Republic of South Africa. Approximately 40–60% of the pods and seeds were destroyed in heavily infested fields. Examination of the discolored pods revealed the presence of *Ditylenchus destructor* Thorne, not only in the hulls but also in the seeds (12).

D. destructor, a migratory endoparasite also known as the potato rot nematode, has been reported mainly from temperate regions (localized areas in the United States, many parts of Europe, and the USSR) and occasionally from the Mediterranean region, Hawaii, Peru, Iran, Bangladesh, People's Republic of China, New Zealand, and South Africa (4,6,9,11,13). It is important as a pest of potato tubers and bulbs of flowers, but sugar beet, carrot, and hops have also been affected (10). *D. destructor* has not been reported in hulls or seeds of peanut.

This is the third confirmed record of a seed-borne nematode infestation of peanut. *Aphelenchoides arachidis* Bos, the groundnut testa nematode, was found in peanut seeds in Nigeria (1,2). In India, Singh (17) reported the presence of adults and eggs of nematodes "resembling *Pratylenchus zeae* Graham in shape and size" between the testa and the cotyledons of peanuts with pod rot symptoms. A fungus, *Fusarium oxysporum* Schlecht. emend. Snyd. & Hans., was also associated with the disease (17); however, neither the identity nor the role of the nematodes in the disease was confirmed. Information is given here on 1) the morphology of *D. destructor,* 2) the symptoms caused on peanut seeds and, 3) its occurrence in the peanut producing areas of South Africa.

Materials and Methods

Nematodes for morphological observations and inoculum were extracted from hulls and seeds of infected Sellie peanut pods, collected from fields in the Schweizer-Reneke district. The tissues were soaked in shallow water in petri dishes for 24 hours at room temperature. For morphological observation, extracted nematodes were killed with gentle heat (60 C for 1 minute), fixed in TAF, processed to pure glycerine, and mounted on aluminum slides.

Pathogenicity studies were conducted in a greenhouse. Nematode-free Sellie peanut seeds were planted in 16 plastic pots (20 cm d) filled with 3 dm^3 steam sterilized sandy soil (93% sand, 4% silt, 3% clay). Plants were thinned to one per pot after emergence. A nutrient balance was main-

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tained through regular irrigation with a hydroponic nutrient (Chemicult) dissolved in tap water. Pots were maintained at 17–27 C with an 11:13 hours dark : light ratio. After seedling emergence, eight of the pots were inoculated with *D. destructor* obtained by soaking as described in the previous paragraph. A suspension of 8,000 nematodes of mixed life stages was pipetted into holes in the soil around the roots in each pot. Plants were harvested 20 weeks after inoculation. Nematodes were extracted from hulls and seeds as described, and the hulls and seeds were observed for symptoms.

The distribution of *D. destructor* was determined in a survey of seven major peanut-producing areas of the Republic of South Africa. Seed samples graded "damaged" from the 1987 peanut harvest were obtained from all major producers. Subsamples of 10 seeds each were soaked in water contained in petri dishes for 24 hours and the numbers of nematodes that emerged were counted.

Results and Discussion

Morphological studies: The morphometrics of the nematodes as given here agree with those reported for *D. destructor.* All measurements are given in micrometers (μm) unless otherwise stated.

Ditylenchus destructor Thorne, 1945 (Fig. 1)

Measurements

Females (n = 10): L = 657–996 (mean 842 ± standard deviation 98.4); a = 27.9–40.8 (35.2 ± 4.0); b = 6.7–9.1 (8.0 ± 1.1); c = 12.6–16.3 (14.2 ± 1.1); c′ = 3.7–4.6 (4.3 ± 0.3); V = 76–83 (79 ± 2.4); ovary length = 34–45 (39 ± 3.9); stylet length = 8.5–9.9 (9.5 ± 0.4).

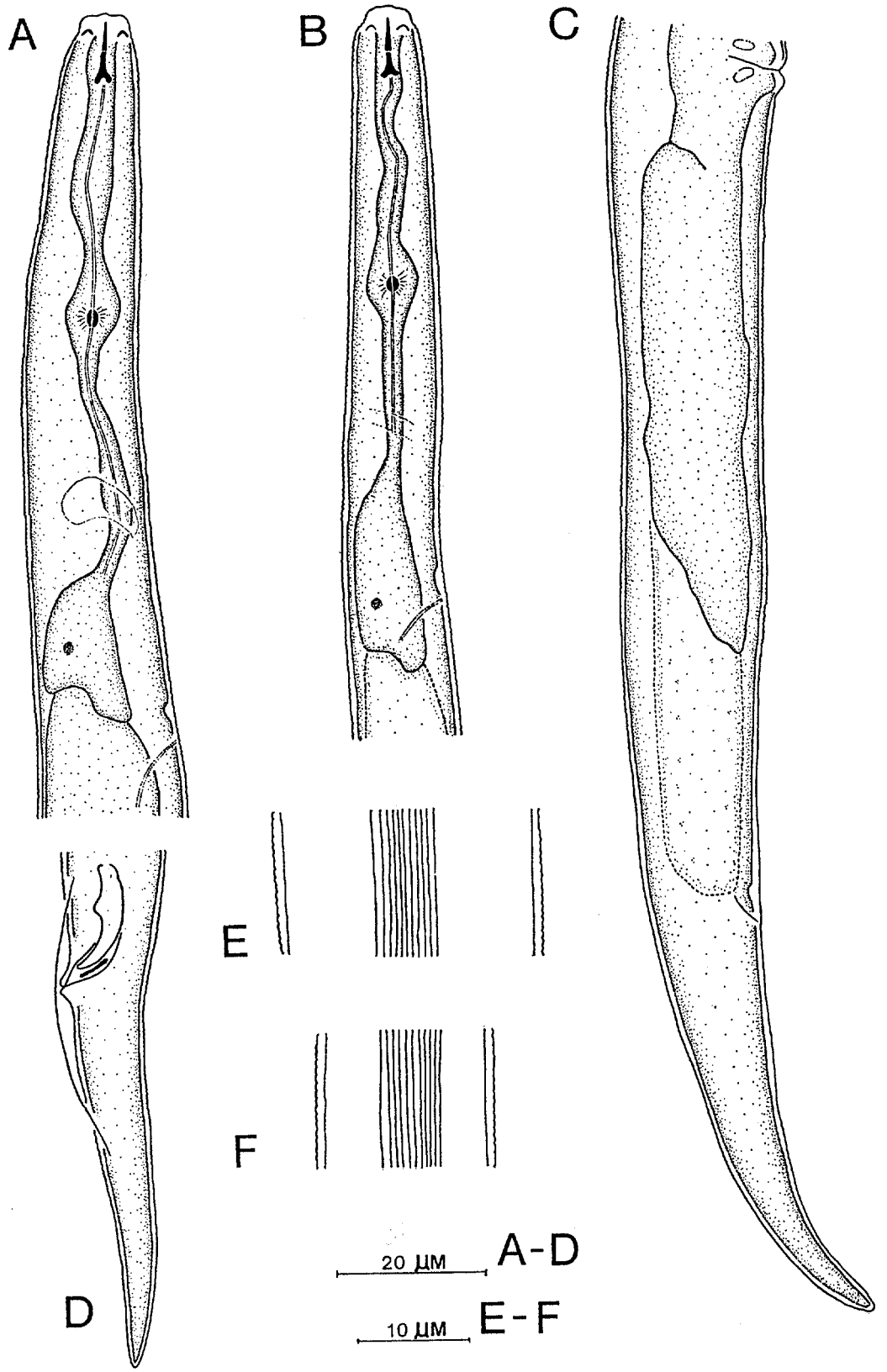
Males (n = 10): L = 576–904 (723 ± 94.6); a = 32.9–41.0 (36.8 ± 3.0); b = 5.2–8.0 (7.1 ± 1.0); c = 12.4–14.7 (13.3 ± 0.8); c′ = 4.2–5.3 (4.5 ± 0.3); stylet length = 8.5–9.6 (9.0 ± 0.3); spicule length = 15.4–22.1 (18.0 ± 2.2); gubernaculum length = 4.8–7.0 (6.3 ± 0.7).

Description

Females: Body slightly arcuate ventrally. Lip region flattened, with 3–4 annules, 5.2–6.3 (5.8 ± 0.4) wide and 1.8–2.9 (2.4 ± 0.4) high. Stylet small with small, well separated, backward sloping knobs. Procorpus about ½ to ¾ as wide as median bulb, narrowing slightly toward the median bulb. Median bulb 9.6–13.2 (11.0 ± 1.3) long and 5.9–7.4 (6.6 ± 0.5) wide. Isthmus long and slender with nerve ring encircling posterior part. Basal bulb with a slight overlap over intestine. Esophagus 40–50 (45 ± 2.8) from anterior end of body to middle of median bulb valve and 54–81 (61 ± 8.7) from this point to base of esophageal lobe. Excretory pore 93–115 (104 ± 6.9) from anterior end of body, situated from opposite posterior part of esophageal lobe to posterior end of base of esophageal lobe. Hemizonid 4–6 annules long, posterior edge within four annules anterior to excretory pore. Hemizonion visible in only one specimen, two annules long, situated 30 annules posterior to hemizonid. Annules 0.7 wide at midbody region. Body width 19.9–30.5 (24.1 ± 3.2) at midbody, 17.3–25.4 (20.1 ± 2.6) at level of excretory pore. Lateral field usually distinct, 5.9–8.5 (7.4 ± 1.0) wide, i.e., about ⅓ of body width, with 6–11 incisures. Post-uterine branch 51–95 (72 ± 14.1) or 53–83% (62 ± 10.4) of vulva to anus length. Tail 58–64 (61 ± 2.1), tapering gradually to a finely rounded tip.

Males: Body similar to females in general shape and morphology. Tail 46–61 (53 ± 4.5), tapering to a finely rounded tip. Bursa small, extending about one spicule length anterior to cloaca and for about 1½ spicule lengths posterior to cloaca. Hemizonid six annules long, its posterior edge 2–3 annules anterior to excretory pore. Hemizonion visible in only one specimen, 1½ annules long, situated 35 annules posterior to hemizonid.

D. destructor is closely related to *D. dipsaci* (Kuhn) Filipjev and *D. myceliophagus* Goodey. Indentification of these and other *Ditylenchus* species is difficult because of the intraspecific variability of most morpho-


A
B
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20 µM
A-D
10 µM
E-F

logical and morphometrical characters which are often dependent on the host (5,7,8). The populations found on peanut are similar to the type population (18). They occur only in the underground parts (roots, pods, and pegs) of the plant (vs. *D. dipsaci* in stems, leaves, and flowers and *D. myceliophagus* in mushroom mycelium), have 6–11 lateral incisures (vs. four lateral incisures in *D. dipsaci*), a rounded tail tip (vs. sharply pointed in *D. dipsaci*), and a long post-uterine sac relative to vulva–anus distance (vs. short post-uterine sac in *D. myceliophagus*). Number of lateral incisures and shape of tail end are considered valuable taxonomic characters (7). Fortuner (7) questions the taxonomic validity of the length of the post-uterine sac, although *D. destructor* has usually been described with a long post-uterine sac and *D. myceliophagus* with a short post-uterine sac (5,7,8,13).

Nematodes were present in the peg, exocarp, endocarp, testa, embryo, and on the cotyledons of inoculated peanut plants grown in a greenhouse. The first symptom of disease was observed at the pod base where the peg joins the pod. The infected tissue was dark brown and had a corky appearance on the outside. Removal of the peg revealed brown necrotic tissue at the point of connection with the pod. When the disease development was well advanced, the most distinct symptom was a dark brown to black discoloration of the veins which extended longitudinally in the exocarp just beneath the pod surface (Fig. 2A). Infected pods lacked the luster of healthy pods and appeared dead (Fig. 2A, B). Infected seeds were usually shrunken and the micropyles were dark brown to black (Fig. 2C, D). The testae were flaccid, had darker vascular strands, and were easily removed. The inner layer of the testa had a distinct yellow discoloration. Infected embryos were usually olive green to brown instead of having the normal colorless to yellow appearance.

TABLE 1. *Ditylenchus destructor* infestation of peanut seed samples from seven major producing areas in the Republic of South Africa.

Area	Samples (no.)	Samples infested (%)	Nematodes/seed† (no.)
Southwestern Transvaal	432	86	216
Central western Transvaal	255	62	58
Magaliesburg	64	35	101
North Transvaal	38	76	151
Northwestern Transvaal	34	79	183
East Transvaal	29	72	75
Natal	25	100	87
All areas	877	73	160

† Numbers are the means of 10 seeds per sample.

The symptoms caused by *D. destructor* on peanut seeds are similar to those caused by *A. arachidis* (1–3). They are, however, distinctly different from the symptoms caused by root-knot nematodes and root-lesion nematodes. Pods infected with root-knot nematodes develop knobs, protuberances, or small warts, whereas pods infected with root-lesion nematodes develop brown pinpoint patches that can become larger and darker with indistinct margins (15). Neither root-knot nor root-lesion nematodes were found in the seeds.

Seventy-three percent of the seed samples collected from growers were infected with *D. destructor* (Table 1). The Natal region had the highest percentage of infected seed samples (100%) and Magaliesburg the lowest (35%). The average number of *D. destructor* per seed was 160. Southwestern Transavaal had the highest average number of nematodes per seed (216) and the central western Transvaal the lowest (58). Up to 3,338 nematodes per seed were found in the southwestern Transvaal.

The numbers of *D. destructor* per seed were low compared with the numbers reported for *A. arachidis*, 5,000 to 20,000 per

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FIG. 1. *Ditylenchus destructor.* A) Anterior part of female body. B) Anterior part of male body. C) Posterior part of female body. D) Tail, male. E) Lateral field, female. F) Lateral field, male.

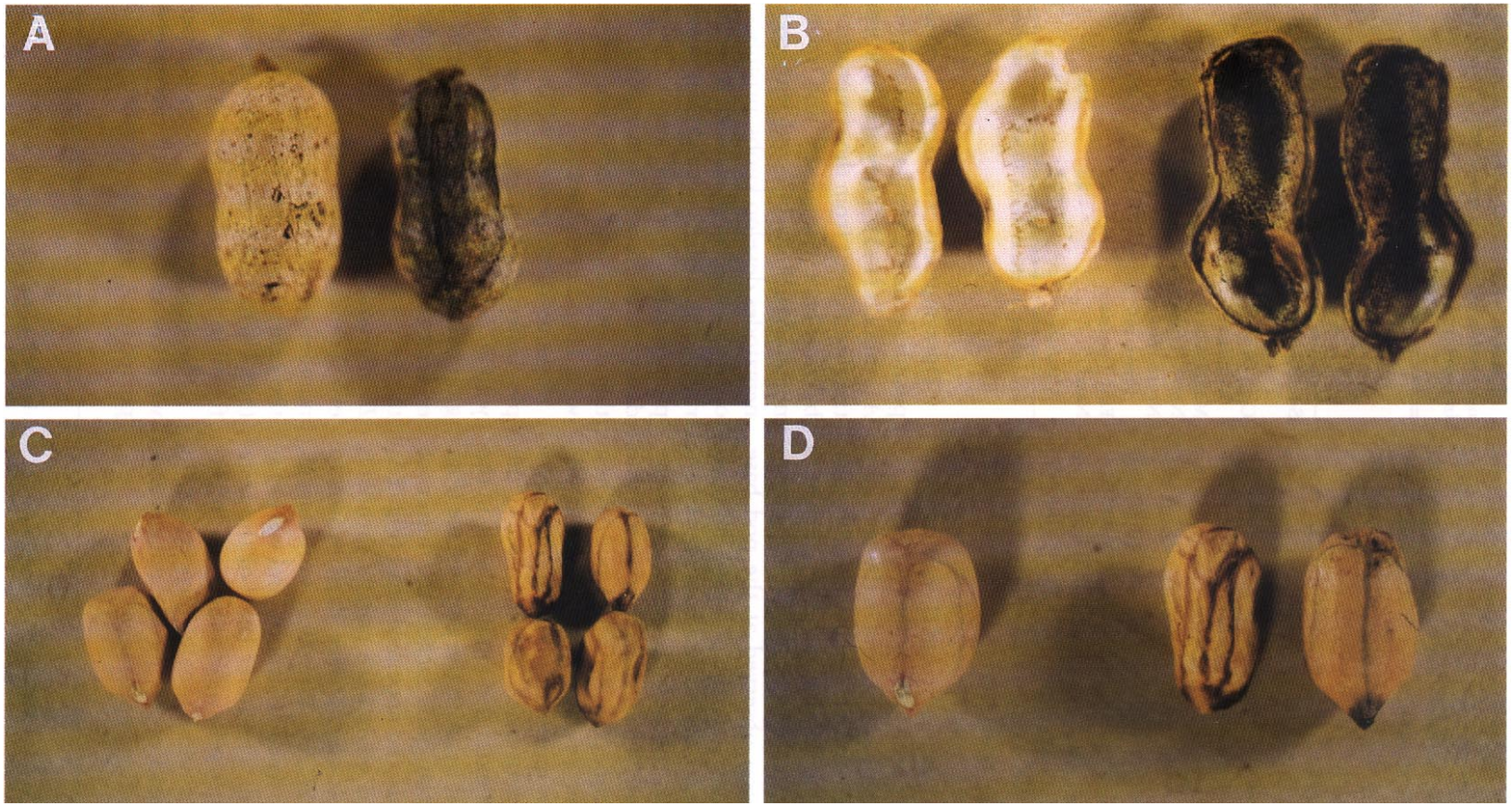

FIG. 2. Symptoms on fruit of Sellie peanut caused by *Ditylenchus destructor*; left healthy, right infected. A) Whole pods. B) Opened pods. C, D) Seeds.

testa (2). This difference may be due to differences in extraction method used. Seeds infected with *D. destuctor* were soaked in water for 24 hours, whereas *A. arachidis*-infected seeds were soaked for 72 hours. Preliminary observations (unpubl.) show that juveniles of *D. destructor* were still emerging from seeds after 11 days of soaking in water. These observations indicate that only part of the nematodes had emerged from seeds soaked for 24 hours. Therefore, the average number of *D. destructor* per seed is higher than reported in Table 1.

Although *D. destructor* is widespread in South Africa, no damage to potatoes or other plants has been reported. Therefore, the populations found on peanut could form a distinct race with a limited host range.

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