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Reproductive and Damage Potential of *Ditylenchus destructor* on Six Peanut Cultivars[1]

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Abstract: Commercial peanut cultivars were evaluated for host suitability and sensitivity to *Ditylenchus destructor*. All cultivars were susceptible. Approximately 94% of the final population were in the pods. Highest Pf occurred at harvest on early maturing cultivars. Damage occurred on four of six cultivars at Pi = 100/3 liters of soil and all six cultivars at Pi = 1,000. Norden and Selmani were the most susceptible cultivars. Sellie was the most tolerant and highest yielding cultivar. This cultivar may be the most profitable one for growers.

Key words: Arachis hypogaea, Ditylenchus destructor, economic loss, nematode, pathogenicity, peanut.

Peanut (*Arachis hypogaea* L.) is grown on about 200,000 ha annually in South Africa. The cultivar Sellie is grown on 97% of this area. Eighteen plant-parasitic nematode species are associated with Sellie peanut (11). A dominant endoparasite is *Ditylenchus destructor* Thorne. This nematode, a pest in the major peanut producing areas of South Africa (4), is found in the seed.

The reproductive and damage potential of *D. destructor* on Sellie peanut was determined under greenhouse conditions (10). This nematode caused seeds to germinate before harvest, suppressed seed yield, and increased seed blemishes, which directly affects market value of the seed (10). The objectives of the study were to determine (i) the reproductive potential of *D. destructor* on several peanut cultivars, and (ii) economic damage at low and high initial infestation densities.

MATERIALS AND METHODS

Nematode-free seeds of peanut cultivars Sellie (140 days to maturity), Harts (100 days), Misga (110 days), Natal Common (130 days), Norden (150 days), and Selmani (160 days) were planted in the greenhouse in 3-liter (20-cm-d) plastic pots filled with steam-sterilized soil (93% sand, 4% silt, 3% clay), which was inoculated with *Bradyrhizobium* sp. for peanut. Seedlings were thinned to one per pot 2 weeks after planting and inoculated with *D. destructor* 3 weeks after planting. The trial was completely randomized with three inoculum levels (0, 100, or 1,000 *D. destructor*/pot), six cultivars, and 15 replications.

Inoculum of *D. destructor* consisting of various life stages was obtained from monoxenic cultures by macerating the peanut leaf callus tissue (9). Nematodes were pipetted in 10-ml aqueous suspensions into holes in the soil around the plant roots. Plants were fertilized weekly with a nutrient solution (6.5% N, 2.7% P, 13% K), watered three times a week, and maintained at 20–25 C with a 13-hour photoperiod. Each cultivar was harvested at its date of maturity.

Pod disease severity (PDS) was rated on a 0–10 scale: 0 = no discoloration; 10 = ≥80% of surface area discolored. Seed disease severity (SDS) was computed as the ratio of the number of blemished seeds to the number of seeds per plant × 10 (10). The number of germinated seeds, whole pods, and seeds were counted. Fresh hull, seed, and root weights per plant were determined.

Nematodes were extracted from 200-cm^3 soil subsamples by a modified decanting and sieving method (5) using nested 710-μm-pore and 45-μm-pore sieves. Final separation of nematodes from soil was by centrifugal flotation (6). Nematodes were

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extracted from 5-g subsamples of fresh roots by a modified centrifugal flotation method (3), and from 5-g subsamples of fresh hulls and seeds by soaking the tissues in shallow water in petri dishes for 24 hours at 22 C (2).

The relative market value of the harvested seeds was based on the grading regulations: SDS < 1.0 is choice edible seed; SDS ≥ 1.0 and < 2.0 standard edible seed; SDS ≥ 2.0 crushing seed.

Most data were analyzed with appropriate analyses of variance. The pod and seed disease severity was analyzed with Kruskal-Wallis tests for nonparametric data (8). Parameters such as numbers of pods and seeds per plant were standardized by converting them to percentages of the control.

Results

Ditylenchus destructor was primarily recovered from the pods (average = 94%). Differences in host suitability were evident at a Pi of 1,000 (Table 1). The Pf for Harts was greater ($P = 0.01$) than those of Sellie, Natal Common, Norden, and Selmani. The Pf on Misga was also large.

The percentage of the Pf in the hulls (59%) was greater than in the seeds per plant (41%) for five of the six cultivars. The trend was strongest for Misga (78% in the hull vs. 22% in the seed) and reversed for Natal Common (46% vs. 54%). The population density in the hulls correlated positively with that in the seeds but was not significant for Misga (Table 1). Pf did not correlate ($P = 0.01$) with number of pods and seeds, hull or seed fresh weight, or number of germinating seeds.

This nematode caused disease on all inoculated plants, but severity varied among cultivars. PDS was greater ($P = 0.05$) for Misga and Sellie than for Harts and Selmani (Table 2). SDS was greatest for Selmani (Table 2). It was also high for Norden, especially at Pi = 1,000.

The highest correlations ($P = 0.01$) between PDS and Pf per hull and between SDS and Pf per seed were obtained with Harts, Misga, and Selmani (Table 2). PDS was correlated ($P = 0.01$) to SDS (Table 2).

Ditylenchus destructor caused most seed to be downgraded in quality. Norden and Selmani were the most sensitive to damage, and the quality would be acceptable for crushing only, regardless of Pi. The economic value decreased by 59 and 66%, respectively. Harts and Natal Common were less susceptible to the nematode. The peanuts were graded as standard edible at both Pi; the decrease in value was 12%. Misga and Sellie were tolerant of 100 *D. destructor*/3 liters of soil but sustained damage at the 1,000-nematode inoculum level. The reduction in value was 12%.

Discussion

Ditylenchus destructor was found in greater numbers in the hulls and seeds than in the soil and roots of peanut. Basson

Table 1. Population densities (Pf) of *Ditylenchus destructor* in the pods and plants of six peanut cultivars at harvest, and the correlation coefficient (r) of the Pf in the hulls vs. seeds of each plant.

Cultivar	Pods		Plant		
	100†	1,000†	100	1,000	r
Harts	12,747 a	35,620 c	12,860 a	36,048 c	0.746**
Misga	9,696 a	27,003 bc	10,379 a	29,509 bc	0.466
Sellie	13,508 a	17,782 ab	14,189 a	19,111 ab	0.725**
Natal Common	8,827 a	10,883 a	9,394 a	12,089 a	0.785**
Norden	13,931 a	13,251 ab	14,095 a	13,578 a	0.713**
Selmani	7,745 a	9,187 a	8,332 a	10,264 a	0.819**
Mean	11,077	18,954	11,542	20,100	

Analysis of variance tests for parametric data. Means in a column followed by the same letter are not significantly different ($P < 0.01$). Each value is the mean of 15 replicates.

† Plants were inoculated with 100 or 1,000 nematodes.

** Significant at $P \leq 0.01$.

TABLE 2. Disease severity in pods and seeds of six cultivars resulting from infection by 100 or 1,000 *Ditylenchus destructor*, and Spearman's rank correlations (*r*) for pod disease severity (PDS), seed disease severity (SDS), and nematode final population density in hulls (H) and seeds (S).

Cultivar	PDS		SDS		*r*		
	100	1,000	100	1,000	PDS vs. H	SDS vs. S	SDS vs. PDS
Harts	0.87 a	1.42 ab	1.20 ab	1.16 a	0.613**	0.597**	0.545**
Misga	3.09 b	4.18 d	0.90 a	1.80 a	0.519**	0.576**	0.540**
Sellie	2.80 b	3.52 cd	0.63 a	1.58 a	0.323	0.397*	0.557**
Natal Common	1.80 ab	2.29 bc	1.83 ab	1.28 a	0.156	0.265	0.503**
Norden	2.13 ab	2.15 abc	2.91 bc	4.21 b	0.432**	0.265	0.553**
Selmani	0.84 a	0.60 a	4.85 c	6.32 c	0.732**	0.636**	0.508**

Means in a column followed by the same letter are not significantly different ($P < 0.05$) according to the Kruskal-Wallis tests for nonparametric data. Each value is the mean of 15 replicates.

* Significant at $P \leq 0.05$.

** Significant at $P \leq 0.01$.

et al. (1) also found 90% of the final population in the hulls and seeds of the cultivars they tested.

Ditylenchus destructor did not affect root or hull weight or the number of pods or seeds per plant in any of the six cultivars, as confirmed on Sellie (10). In contrast to this earlier research (10), *D. destructor* did not increase the seed germination before harvest or suppress seed yield. Because both the Pi and Pf in these two trials were similar, the reason(s) for the difference is unknown. It is possible that the virulence of the two *D. destructor* populations may be different. The present population of *D. destructor* increased the SDS.

Host suitability of these cultivars is inversely related to cultivar maturity date. The early-maturing cultivars supported the highest Pf, whereas the late-maturing cultivars supported the lowest Pf per plant.

The ability of the hull to support greater populations than in the seeds may be due to the amount of suitable tissue. All tissues of the hull, but only the testa and embryo of the seed, are invaded by this nematode (7). Basson et al. (1), whose results were similar to ours, suggested that *D. destructor* may preferentially colonize hulls.

Because PDS was significantly correlated to SDS across cultivars, they are reliable indications of SDS. The PDS did not increase in late-maturing cultivars, nor was it associated with the cultivar type. The damage to the pods of Harts and Selmani was comparatively low, although these cultivars supported high population densities of *D. destructor*. The nematode may migrate out of the hulls into the seeds or soil after slight damage has occurred. The time and mode of entry and development of *D. destructor* in the hulls and seeds of Sellie peanut are complex processes (7). Further trials and histopathological observations of the behavior of *D. destructor* in the commercial cultivars are necessary to verify these observations.

The SDS was generally greater in the late-maturing cultivars. Because the Pf per seed of Norden and Selmani peanut were not higher than those of the early maturing cultivars, it is probable that the increased seed damage was due to the increased period for colonization by the nematode. The early-maturing cultivars are able to escape greater degrees of damage.

Because all cultivars allow high numbers of *D. destructor* to develop, none of them provided an advantage over Sellie in this respect. Sellie, however, was comparatively tolerant to damage and is also the highest yielding commercial cultivar in South Africa. Thus, this cultivar is the most likely to give the highest economic return.

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