AN EVALUATION OF CROP PLANTS AS HOSTS FOR *DITYLENCHUS DESTRUCTOR* ISOLATED FROM PEANUT†

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ABSTRACT

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The suitability of 38 host lines belonging to 12 crop plant species as hosts of *Ditylenchus destructor* was tested under greenhouse conditions. All maize (*Zea mays*) and grain sorghum (*Sorghum bicolor*) host lines and one of the four tobacco (*Nicotiana tabacum*) host lines supported as many *D. destructor* per 5 g of root as 'Sellie' peanut (*Arachis hypogaea*). All host lines of wheat (*Triticum aestivum*), sunflower (*Helianthus annuus*), lupin (*Lupinus albus*), drybean (*Phaseolus vulgarus*), cowpea (*Vigna unguiculata*), soybean (*Glycine max*), alfalfa (*Medicago sativa*), cotton (*Gossypium hirsutum*), pea (*Pisum sativum*) and three of the four tobacco host lines supported less *D. destructor* per 5 g of root than 'Sellie' peanut. In all host lines, including 'Sellie' peanut, the number of *D. destructor* recovered per root system was lower than the number of nematodes used for inoculation.

Key words: alfalfa, *Arachis hypogaea*, cotton, cowpea, *Ditylenchus destructor*, drybean, *Glycine max*, *Gossypium hirsutum*, *Helianthus annuus*, host suitability, grain sorghum, lupin, *Lupinus albus*, maize, *Medicago sativa*, *Nicotiana tabacum*, pea, peanut, *Phaseolus vulgaris*, *Pisum sativum*, *Sorghum bicolor*, soybean, sunflower, tobacco, *Triticum aestivum*, *Vigna unguiculata*, wheat, *Zea mays*.

RESUMEN

Basson, S., D. De Waele y A. J. Meyer. 1990. Una evaluación de cultivos extensivos como hospedadores de *Ditylenchus destructor* aislado de maní. Nematrópica 20:23–29.

Se evaluaron 38 líneas de 12 especies de cultivos extensivos como hospedadores potenciales de *Ditylenchus destructor* bajo condiciones de invernadero. Todas las líneas de maíz (*Zea mays*), sorgo, (*Sorghum bicolor*) y una de tabaco (*Nicotiana tabacum*), sustentaron una población de *D. destructor* por 5 g de raíz similar al maní 'Sellie' (*Arachis hypogaea*). Todas las líneas de trigo (*Triticum aestivum*), girasol (*Helianthus annuus*), lupino (*Lupinus albus*), frijol (*Phaseolus vulgaris*), caupí (*Vigna unguiculata*), soya (*Glycine max*), alfalfa (*Medicago sativa*), algodón (*Gossypium hirsutum*), guisante (*Pisum sativum*) y tres de las cuatro líneas de tabaco sustentaron una menor población de *D. destructor* por 5 g de raíz que el maní 'Sellie.' En todas las líneas hospedadores, incluyendo el maní 'Sellie,' la cantidad de *D. destructor* recuperado por sistema radicular fue menor al inóculo inicial.

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Palabras claves: alfalfa, algodón, *Arachis hypogaea*, caupí, *Ditylenchus destructor*, frijol, girasol, *Glycine max*, *Gossypium hirsutum*, guisante, *Helianthus annuus*, lupino, *Lupinus albus*, maíz, maní, *Medicago sativa*, *Nicotiana tabacum*, *Phaseolus vulgaris*, *Pisum sativum*, preferencia hacia el hospedero, *Sorghum bicolor*, sorgo, soya, tabaco, trigo, *Triticum aestivum*, *Vigna unguiculata*, *Zea mays*.

INTRODUCTION

Ditylenchus destructor Thorne, also known as the potato rot nematode, is the most important soilborne pest of peanut (*Arachis hypogaea* L.) in the Republic of South Africa. It is widespread in all major producing areas and can destroy 40–60% of the seeds in heavily infested fields (5,14). Outside South Africa, *D. destructor* is known mainly as a serious pest of potato and bulbs of several ornamental flowers (12). In South Africa, *D. destructor* has not been found on potato (*Solanum tuberosum* L.), but it has been reported in corms of the ornamental *Liatris spicata* (L.) Willd., causing severe damage (16).

Numerous weed and fungus species have been recorded as hosts of *D. destructor* (6,7,10). Information on the host suitability of cultivated plants for *D. destructor*, however, is sparse. In addition to potato and flowers only carrot (*Daucus carota* L.) (6,11), radish (*Raphanus sativus* L.) (7), sugarbeet (*Beta vulgaris* L.) (2), alfalfa (*Medicago sativa* L.) (7), clovers (*Trifolium* spp.) (6,11), and hop (*Humulus lupulus* L.) (9,10) have been reported as hosts. In South Africa, peanut is usually cultivated in rotation with potato, maize (*Zea mays* L.), wheat (*Triticum aestivum* L.), and cotton (*Gossypium hirsutum* L.). Since no peanut cultivars resistant to *D. destructor* are available, one method for managing *D. destructor* is rotation of peanut with either nonhosts or less susceptible crop plants. The objective of our study was to determine the suitability of 12 crop plant species commonly cultivated in South Africa as hosts of *D. destructor*.

MATERIALS AND METHODS

Six greenhouse experiments were conducted to evaluate the host suitability to *D. destructor* of 38 lines (Table 1) belonging to 12 crop plant species: maize, grain sorghum (*Sorghum bicolor* (L.) Moench), wheat, sunflower (*Helianthus annuus* L.), lupin (*Lupinus albus* L.), drybean (*Phaseolus vulgarus* L.), cowpea (*Vigna unguiculata* (L.) Walp), soybean (*Glycine max* (L.) Merr.), alfalfa, cotton, tobacco (*Nicotiana tabacum* L.) and pea (*Pisum sativum* L.). In each experiment peanut cv. Sellie was included as the control.

Seeds of each host line and nematode-free 'Sellie' peanut seeds were planted in 20-cm-diam plastic pots filled with 4 dm^3 steam sterilized sandy soil (85% sand, 8% silt, and 7% clay). After emergence, wheat and alfalfa seedlings were thinned to five and ten per pot, respectively, and

those of all other plants to one per pot. The pots were irrigated three times a week with a hydroponic nutrient (Chemicult: 6.5% N, 2.7% P, and 13% K), dissolved in tap water. Pots were maintained in a greenhouse at an ambient temperature of 17–27C and an 11-hour photoperiod.

Mixed life stages of *D. destructor* were obtained from 2-month-old monoxenic cultures on peanut callus tissue (17). Three weeks after planting, each seedling was inoculated with 3 500 nematodes. Nematodes were pipetted in 10 ml aqueous suspensions into holes in the soil around the roots. Six weeks after inoculation, plants were harvested and fresh root weights determined. Nematodes were extracted from one 200-cm^3 soil subsample per pot by a modified decanting and sieving method (8) using 710 μm-pore and 45-μm-pore sieves, followed by centrifugal flotation (13). Nematodes in 5 g of fresh root per plant were extracted using the centrifugal flotation method (1) and counted.

The experimental design was a randomized complete block and each host line was replicated eight times. Root population data were transformed to $\log_e$ before analyses of variance were calculated. Means were separated by the Student-Newman-Keuls range test.

RESULTS

Few *D. destructor* (< 10/200 cm^3) were extracted from soil subsamples and therefore were not included in the calculations of the nematodes recovered.

In all host lines, including 'Sellie' peanut, the number of *D. destructor* recovered per root system was lower than the number of nematodes used for inoculation. The maize and grain sorghum host lines and one of the four tobacco host lines supported as many *D. destructor* per 5 g of root as 'Sellie' peanut ($P = 0.05$) (Table 1). In all other host lines, the number of nematodes per 5 g of root was significantly ($P = 0.05$) lower than in 'Sellie' peanut.

All maize host lines supported the same number of *D. destructor* per 5 g of root. Differences in host suitability also were not observed among the lupin, soybean and pea host lines when expressed per 5 g of root. In all other plant species significant ($P = 0.05$) differences among host lines of the same plant species in ability to support *D. destructor* were observed. The differences, however, always were small.

Among the cereals, root population densities of *D. destructor* were significantly ($P = 0.05$) higher in all maize and grain sorghum host lines than in any of the wheat host lines. Wheat only supported 8–18 nematodes per root system compared with 358–541 nematodes in maize and 160–423 nematodes in grain sorghum.

Table 1. Population densities of *Ditylenchus destructor* in roots of 12 crop plant species, measured 6 weeks after inoculation with 3 500 nematodes. Peanut cv. 'Sellie' included in each experiment as control.

Host species	Cultivar	*D. destructor*/ 5 g of roots
	Experiment 1	
Zea mays	PNR 473	87 cd
	SNK 2244	63 c
	AX 305 W	79 cd
	CG 4502	69 c
	K 64 R	63 c
Sorghum bicolor	SNK 3144	105 cd
	PNR 8496	59 c
	DC 99	140 d
Triticum aestivum	SST 66	3 a
	Palmiet	3 a
	Elize	6 b
Arachis hypogaea	Sellie	99 cd
	Experiment 2	
Heliantus annuus	CAR 1006	13 abc
	SNK 32	10 ab
	PNR 7225	9 ab
	AS 504	21 cd
	SO 210	20 cd
Lupinus albus	Buttercup	15 abc
	Kiev	4 a
Phaseolus vulgaris	Bonus	26 d
	Kamberg	8 ab
Vigna unguiculata	RV 16	21 cd
	RV 18	9 ab
A. hypogaea	Sellie	116 e
	Experiment 3	
Glycine max	Forrest	5 ab
	Edgar	5 ab
	Success	6 ab
	PNR 577 G	17 b
Medicago sativa	Cuf 101	2 a
A. hypogaea	Sellie	86 c
	Experiment 4	
Gossypium hirsutum	Deltapine Acala 90	9 ab
	Acala 1517-70	37 c
	Alpha	11 bc
	Tetra	5 a
A. hypogaea	Sellie	210 d

Table 1. (continued)

Host species	Cultivar	*D. destructor*/ 5 g of roots
	Experiment 5	
Nicotiana tabacum	Baracao	5 a
	TL 33	3 a
	TL 38	16 b
	Galpao	4 a
A. hypogaea	Sellie	57 b
	Experiment 6	
Pisum sativum	Miranda	7 a
	All Round	16 a
	Finale	11 a
A. hypogaea	Sellie	51 b

Numbers are the means of eight replicates. Within an experiment, column means followed by the same letter do not differ significantly ($P = 0.05$) according to the Student-Newman-Keuls range test.

DISCUSSION

Based on the number of nematodes recovered from the roots, all host lines tested, including 'Sellie' peanut, can be considered poor hosts of *D. destructor*. In 'Sellie' peanut, however, most nematodes occur in the hulls and the seeds (15). Failure of *D. destructor* to reproduce in roots has been reported previously. On excised clover and tomato roots, *D. destructor* either did not develop large populations (3) or was unable to penetrate the roots (7). It was suggested (7) that either the cell walls were too thick or that the nematodes did not have sufficient leverage or traction in the type of medium used. The potential of *D. destructor* to attack the seeds of peanut will, however, not only depend on its ability to survive on alternate hosts in the absence of peanut, but also on its reproductivity. Although the reproductivity of *D. destructor* has only been studied in vitro, the results obtained show that the reproductive potential of *D. destructor* is high. On peanut callus tissue, inoculation with 50 juveniles and adults resulted in a 600-fold increase within 5 weeks (17); on callus tissues of carrot, clover, potato, and tobacco, *D. destructor* increased 4 000-fold within 4 months (7). At 28 C, the length of the life cycle of *D. destructor* was 6–7 days (4). These data suggest that a small population of *D. destructor* present in the soil at the beginning of the growth season may build up a large population causing severe damage. It is thus possible that even poor hosts are not effective to manage *D. destructor*.

The results also indicate a differential host suitability among the 12 crop plant species tested and their host lines for *D. destructor* under greenhouse conditions. Maize and grain sorghum were able to maintain populations similar to those found on 'Sellie' peanut, whereas fewer nematodes were recovered from all other crop plant species except one of the four tobacco host lines.

Our data, therefore, indicate that maize and grain sorghum should not precede peanut as a rotation crop in fields heavily infested with *D. destructor*. Few *D. destructor* developed on wheat which is used commonly in South Africa as a winter crop rotated with peanut. The effect of wheat on numbers of *D. destructor* in the field and in the succeeding peanut crop needs further investigation.

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