A Nematode Disease of Peanut Caused by *Tylenchorhynchus brevilineatus*

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ABSTRACT

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A severe nematode disease of peanut (*Arachis hypogaea*) was first observed in 1976 in the Kalahasti area of Andhra Pradesh State, India. The disease was characterized by small, brownish yellow lesions on the pegs and pod stalks and on young, developing pods. The margins of the lesions were slightly elevated. Pod stalks were greatly reduced in length, and in advanced stages of the disease, the pod surface became completely discolored. The nematode *Tylenchorhynchus brevilineatus* was shown to be the causal agent. Soil treatment with carbofuran or aldicarb was effective in reducing the populations of *T. brevilineatus* and controlling the disease.

During the 1975–1976 postrainy season, a severe disease of peanut (*Arachis hypogaea* L.), characterized by a reduction in pod size and brownish black discoloration of the pod surface, was observed in farmers' fields near Kalahasti, Andhra Pradesh State, India. This disease is now locally known as "Kalahasti Malady." Small, brownish yellow lesions appeared on the pegs and pod stalks and on young, developing pods. The margins of the lesions were slightly elevated because of the proliferation of host cells around the lesion. Pod stalks were greatly reduced in length, and in advanced stages of the disease, the pod surface became completely discolored (Fig. 1). Kernels from such diseased pods were apparently healthy. Discoloration was also observed on roots but was less severe than on pods.

Affected plants appear in patches in the field and are stunted and have greener than normal foliage. The disease is most serious in sandy soils and occurs in the same area year after year. Since 1976, the disease has been widespread in the Kalahasti area and has also been observed in Nellore District in Andhra Pradesh.

This paper reports the pathogenicity of *T. brevilineatus* on peanuts and the results of preliminary trials using chemical control.

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MATERIALS AND METHODS

Isolation and identification of nematode. Soil samples were collected during the 1981–1982 postrainy season from peanut fields in seven locations in the Kalahasti area where the disease was most serious. Soil samples were collected from around the roots (15–20 cm deep) and pods of 3-mo-old plants. Similar soil samples were also collected from plants in areas where the disease was not present. All soil samples were brought to the laboratory in polyethylene bags.

Nematodes were isolated from soil

using a modified Baermann funnel technique (10). After 24 hr, nematode suspensions were collected and used for identification and estimation of populations of each species present. A *Tylenchorhynchus* sp. was predominant in soil from around diseased plants. This species was handpicked from the suspensions, heat-killed, and fixed in formalin-acetic acid-alcohol (FAA) solution. It was identified as *T. brevilineatus* Williams (=*T. indicus* Siddiqi) by M. R. Siddiqi, Commonwealth Institute of Parasitology, 395A Hatfield Road, St. Albans, Herts, UK.

Culturing of nematode. *T. brevilineatus* isolated from soils collected from Guttivaripalli Village were multiplied on peanut plants (cultivar TMV 2) grown in plastic pots (12 cm diam., 13.5 cm deep) containing steam-sterilized red sandy soil. Five pots, each containing two plants, were used for nematode multiplication. Ten-day-old plants inoculated with about 500 *T. brevilineatus* per pot were kept in the glasshouse at 20–30 C for about 3 mo. Nematodes were isolated in large numbers for pathogenicity tests from these pots, using the modified Baermann funnel technique (10).

Pathogenicity tests. One-month-old TMV 2 peanut plants were grown in plastic pots (12 cm diam., 13.5 cm deep) containing a steam-sterilized garden soil-sand-farmyard manure mixture (3:3:1, v/v/v) in the glasshouse. Ten pots, each containing two 1-mo-old plants, were infested with 500 *T. brevilineatus* per pot. Pots were kept at 20–30 C in the glasshouse. Seventy days after inoculation, plants were uprooted and disease symptoms recorded.

Pathogenicity tests were also conducted by inoculating pods developing in isolation. Peanut plants (cultivar TMV 2) were grown in earthenware pots (40 cm diam., 65 cm deep) and aerial pegs were diverted into plastic cups (4 cm diam., 6 cm deep) containing steam-sterilized red sandy soil. A week later, each cup was inoculated with 100 *T. brevilineatus*. Five pods were detached 15, 30, 45, and 60 days after inoculation and examined for disease development. All pathogenicity tests were repeated three times on different dates.

Control with chemicals. In a preliminary trial in the 1981–1982 postrainy season, four rectangular plots (10 × 10 m) were established on a farmer's field at Guttivaripalli Village near Kalahasti in Andhra Pradesh State. The disease had been severe on peanuts in the field in previous seasons. Seeds of TMV 2 peanuts were sown 10 cm apart. Treatments were control, carbofuran 3G, aldicarb 10G, and phorate 10G. There was only one plot per treatment. The pesticides were all applied at 6 kg a.i./ha in the furrow at sowing.

Disease control was evaluated at harvest by estimating the percentage of plants with diseased pods, the mean height of the main stems of 10 randomly selected plants, the mean length of 20 randomly selected pod stalks, and pod yield. Soil was collected from around the roots (15–20 cm deep) and pods for estimating *T. brevilineatus* populations.

On the basis of the results obtained from the 1981–1982 trial, an additional trial was conducted during the 1982–1983 postrainy season in a farmer's field in Katur Village, Andhra Pradesh State. Twenty days after sowing, two chemicals, carbofuran 3G and aldicarb 10G, were applied as granular preparations to the soil around plants at rates of 2, 4, 6, and 8 kg a.i./ha. Plots were 10 × 5 m and there were four replicates per treatment. Seeds of TMV 2 peanuts were sown at 10-cm spacing in rows 30 cm apart.

Disease control was evaluated at harvest for each treatment by estimating the mean height of the stems of 10 randomly selected plants from each plot, percent infected pods, extent of discoloration based on number of lesions and area of pod surface affected, pod size (determined on 100 pods randomly selected from each plot), pod yield, and weight of 100 pods and 100 kernels selected randomly. Soil was collected from around the roots (15–20 cm deep) and pods for estimation of *T. brevilineatus* populations.

RESULTS AND DISCUSSION

Nematode populations. Populations of *T. brevilineatus* were extremely high in

Table 1. Occurrence of *Tylenchorhynchus brevilineatus* in peanut fields with healthy and diseased plants in seven locations of the Kalahasti area in Andhra Pradesh State, India, during the 1981–1982 postrainy season

Location	Populations of *T. brevilineatus* in 100 g of soil	
	Healthy	Diseased
Guttivaripalli I	4	144
Guttivaripalli II	6	164
Yedalla Cheruvu I	2	40
Yedalla Cheruvu II	10	122
Panagallu I	4	142
Panagallu II	16	246
Katur	10	137

Table 2. Evaluation of three chemicals for control of *Tylenchorhynchus brevilineatus* during the 1981–1982 postrainy season

Type of evaluation	Soil treatment			
	Aldicarb	Carbofuran	Phorate	Check
Plants with diseased pods (%)[a]	30.0	6.0	100.0	100.0
Plant height (cm)[b]	57.3	62.8	43.2	39.4
No. of pods per plant:[b]				
Mature	15.9	20.2	14.7	13.5
Immature	1.6	1.7	1.8	4.3
Pod stalk length (cm)[c]	3.1	3.9	2.2	1.9
Pod yield (kg)[d]	25.6	26.6	17.3	19.4
No. of *T. brevilineatus* per 100 g soil	28.0	6.0	198.0	235.0

[a] Estimated from total number of plants present in unreplicated plots (10 × 10 m).
[b] Mean of 10 plants from each treatment.
[c] Mean length of 20 pod stalks randomly selected from each treatment.
[d] Pod yield per plot (10 × 10 m).

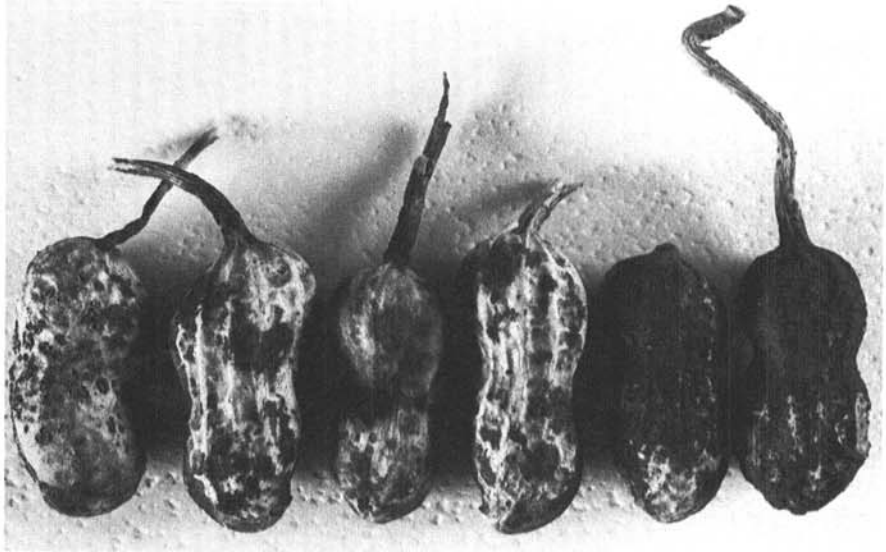

Fig. 1. Discolored peanut pods caused by *Tylenchorhynchus brevilineatus*.

Table 3. Effects of soil treatments with aldicarb and carbofuran at different dosages on *Tylenchorhynchus brevilineatus* populations and on peanut plants in field plots during the 1982–1983 postrainy season

Treatment and dosage (kg a.i./ha)	No. of *T. brevilineatus*	Plant height (cm)[a]	Infected pods (%)[b]	Disease severity on pods[c]	Yield of pods (kg/ha)	Weight of 100 pods (g)	Weight of 100 kernels (g)
Aldicarb (2)	53.5	60.1	94.3	Moderate	2,930	83.8	38.5
Aldicarb (4)	29.3	60.6	71.0	Moderate	3,405	86.3	41.0
Aldicarb (6)	19.0	64.2	56.8	Low	3,243	89.5	41.5
Aldicarb (8)	12.0	59.0	38.5	Low	3,295	94.0	43.5
Carbofuran (2)	17.3	58.7	64.0	Moderate	3,188	91.0	41.3
Carbofuran (4)	4.3	56.9	13.8	Low	3,565	95.0	48.3
Carbofuran (6)	2.8	55.2	10.3	Very low	3,560	95.3	47.8
Carbofuran (8)	1.8	60.5	5.8	Very low	3,815	101.8	47.3
Check	149.8	46.2	100.0	High	2,475	62.3	32.3
LSD (5%)	15.18	5.54	14.53		270.38	8.24	4.09

[a] Height of the main stem. Mean of 10 plants randomly selected from each plot.
[b] Mean of 100 pods randomly selected from each replicated plot.
[c] Extent of discoloration of pod surface and pod size: very low = very few small lesions on the pod and pod size normal, low = few small lesions on the pod and pod size normal, moderate = many small lesions on the pod and pod size normal, and high = 50–100% of pod surface discolored and pod size greatly reduced.

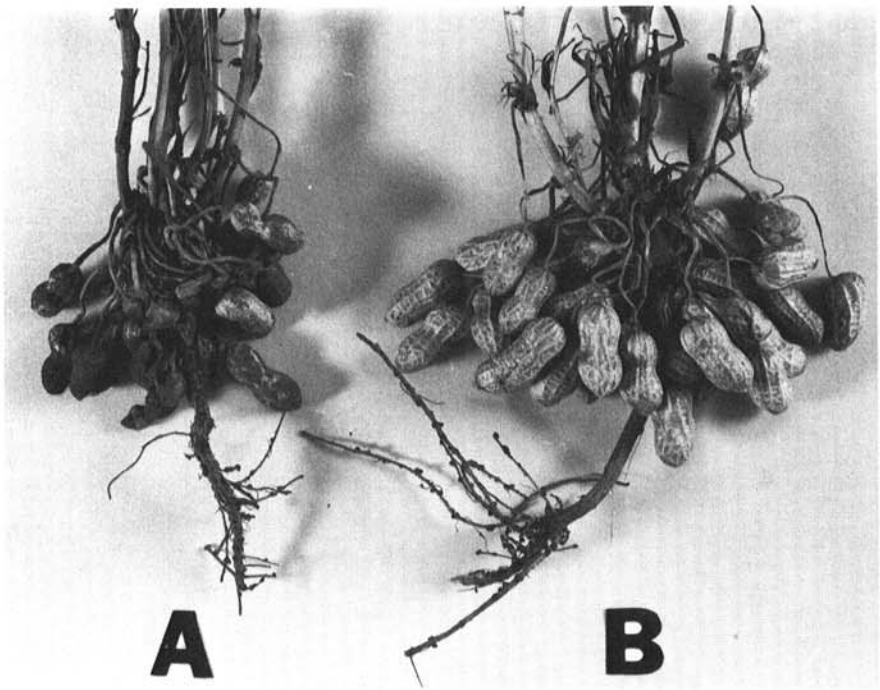

Fig. 2. (A) Peanut plants from *Tylenchorhynchus brevilineatus*-infested plots showing small, severely discolored pods. **(B)** Normal peanut plants from plots treated with carbofuran (8 kg a.i./ha).

soil samples from diseased peanut fields in all seven locations examined. *T. brevilineatus* was also present in soil collected from fields with apparently healthy peanut plants but only in small numbers (Table 1). Other plant-parasitic nematodes present in small numbers were species of *Helicotylenchus* and *Xiphinema*. They were present in healthy and disease-affected soils in similar numbers for specific areas, but their occurrence was not consistent across locations. For example, *Xiphinema* sp. was observed in three of seven locations in soils collected from disease-affected fields. The presence of *T. brevilineatus* in high populations in disease-affected fields across all locations indicated that the disease might be caused by *T. brevilineatus*.

Pathogenicity of *T. brevilineatus*. All plants inoculated with *T. brevilineatus* showed severe stunting and reduced root growth at maturity. Pods were severely discolored and reduced in size. However, kernels from such diseased pods were apparently healthy. Lesions were also observed on roots but were not extensive. Pod stalks were discolored and reduced in length.

Individual pods inoculated with *T. brevilineatus* also showed severe disease development. Brownish yellow lesions were observed on pods by 15 days after inoculation. The lesions increased in number and extensive discoloration was observed by 30 days after inoculation.

Disease symptoms were not observed in uninoculated plants or pods. All three pathogenicity tests gave consistently positive results.

Disease control. In the 1981–1982 field trial, phorate was not effective in controlling the disease but both carbofuran and aldicarb reduced the percentage of plants with diseased pods, increased mean plant height and length of pod stalks, and increased the number of mature pods per plant and pod yields (Table 2; Fig. 2). Carbofuran- and aldicarb-treated soils had much lower populations of *T. brevilineatus* than untreated or phorate-treated soils.

In the 1982–1983 field trial, all aldicarb and carbofuran treatments decreased soil populations of *T. brevilineatus* and decreased the percentage of diseased pods (Table 3). The treatments increased plant height and yield of pods and increased pod and kernel weights. Both pesticides were more effective at the high than at the low dosage rates. Carbofuran was superior to aldicarb in controlling the disease (Table 3).

T. brevilineatus has been reported to infect several crop plants in India: *Cicer arietinum* (5), *Citrus sinensis* (6), *Cuminum cyminum, Dahlia* spp. (7,8), and *Sorghum* spp. (1). There is no report of *T. brevilineatus* as a pest of peanut in India (9). Similarly, the nematode has not been reported as a pest of peanut in other parts of the world (2–4, 11). We believe this is the first record of *T. brevilineatus* causing a disease of peanut.

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