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EFFECT OF SPINACH MOSAIC VIRUS, ROOT-KNOT AND STUNT NEMATODES ON GROWTH OF SUGAR BEET

by

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In experimental plots of sugar-beet (*Beta vulgaris saccharifera* L.) many of the plants were infected with spinach mosaic virus. Some of the infected plants were severely damaged and others were not. The roots of the most severely damaged plants contained egg masses of the root-knot nematode, *Meloidogyne incognita* (Kofoid *et* White) Chitwood, and the surrounding soil was infested with the stunt nematode, *Tylenchorhynchus brassicae* Siddiqi. There have been several reports of interactions between nematodes and viruses (Schlosser, 1962; Bird, 1969; Weischer 1969, 1975; Swarup and Goswami, 1969; Fritzsche, 1970; Khurana *et al.*, 1970; Goswami *et al.*, 1971, 1974; Goswami and Raychaudhuri, 1973; Goswami and Chenulu, 1974; Mayee *et al.*, 1974; Mahmood *et al.*, 1974; Naqvi and Alam, 1975) and it was therefore thought useful to investigate possible interactions between the nematodes and virus affecting sugar-beet in the experiment described here.

Materials and methods

Seeds of sugar-beet cv. Katari-6 were sown singly in 15 cm clay pots, each containing 1 kg of an autoclaved mixture of soil, sand and peat (7:2:1). When the plants were 6 wk old 5,000 hand picked (Alam, 1975) *T. brassicae* or 2,500 newly hatched *M. incognita* larvae were added to some of the pots. Some of the plants were manually

Table I - *Effect of spinach mosaic virus and* Meloidogyne incognita, *alone or in combination, on the growth of sugar-beet cv. Katari-6.*

Treatment	Inoculations (No. of wk)			Fresh wt (g)		Root-knot index[1]
	1	2	3	Shoot	Root	
No pathogen (control)				28.00	3.23	
Nematode (N) only			N	20.66	2.16	4.0
Virus (V) only	V			12.26	1.16	
Virus only		V		15.46	1.50	
Virus only			V	19.00	1.66	
V + N	V		N	8.90	1.06	3.0
V + N		V	N	11.36	1.43	3.3
V + N			VN	15.83	0.83	3.8
LSD (P = 0.05)				2.36	0.07	0.2
LSD (P = 0.01)				3.28	0.10	0.2

[1] 0 = no galling; 1 = light; 2 = moderate; 3 = heavy; 4 = severe.

Table II - *Effect of spinach mosaic virus and* Tylenchorhynchus brassicae, *alone or in combination, on the growth of sugar-beet cv Katari-6 and virus infection on nematode multiplication.*

Treatment	Inoculations (No. of wk)			Fresh wt g)		Final population per pot[1]
	1	2	3	Shoot	Root	
No pathogen (control)				28.00	3.23	
Nematode (N) only			N	22.93	2.40	6040
Virus (V) only	V			12.26	1.16	
Virus only		V		15.46	1.50	
Virus only			V	19.00	1.66	
V + N	V		N	10.73	1.00	2960
V + N		V	N	12.83	1.16	3800
V + N			VN	16.00	1.33	4260
LSD (P = 0.05)				0.65	0.08	322
LSD (P = 0.01)				0.89	0.11	447

[1] Initial population (inoculated) of *T.brassicae* = 5000/pot.

inoculated with spinach mosaic virus either at the time of adding nematodes or one or two weeks before to provide the combination of treatments and controls shown in Tables I and II, with three replicates of each. The experiment was undertaken in an insect-proof glasshouse at 25° C ± 5° C. Two months after adding the nematodes to the plants the fresh weights of shoots and roots were determined. The extent of root-knot infestation of the roots was assessed by visual observation of galling. Soil populations of nematodes were extracted from each pot by Cobb's sieving and decanting method with a modified Baermann funnel technique (Southey, 1970) and counts were made using a stereoscopic microscope.

Results

Spinach mosaic virus and *M. incognita* separately caused a reduction in the fresh weight of the plants (Table I). Virus infection caused a greater reduction in plant growth than the nematode inoculum, and had the greatest effect when the plants were infected earlier (week 1) than later (week 3). Virus in combination with nematodes resulted in a greater loss in fresh weight of shoots and roots than expected by adding together the independent effect of the two organisms. Galling per plant as assessed by root-knot index was less on virus infected plants than on non-infected ones (Table I) but there were more galls per gram of root on virus infected plants (i.e. root-knot index related to root weight).

Similarly, mosaic virus in combination with *T. brassicae* resulted in a greater loss of fresh weight than expected from the independent effects of the organisms (Table II). At the end of the experiment there were more *T. brassicae* in pots with non-virus infected plants but population densities per gram of root were similar in all pots (Table I).

Discussion

The 'synegistic' effect of spinach mosaic virus in combination with *M. incognita* or *T. brassicae* has similarly been observed with root-knot nematode and leaf curl virus in tomato (Swarup and

Goswami, 1969), with maize mosaic virus in maize (Khurana *et al.*, 1970) with tobacco mosaic virus in tobacco (Goswami and Raychaudhuri, 1973) and in tomato (Goswami and Chenulu, 1974). In our experiments there was some indication of interaction between virus infection and the two nematode species with the lowest populations in pots where the plants were inoculated 3 weeks before the nematodes were added. However, it is likely that the relatively poor multiplication of the nematodes was due to the poor growth of the root system of infected plants rather than any direct effect of virus on nematode physiology. A direct effect cannot entirely be discounted as *Meloidogyne* spp. have been reported to show relative increases on virus infected plants (Swarup and Goswami, 1969; Goswami and Raychaudhuri, 1973, Mahmood *et al.*, 1974).

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