

## Effect of Foliar Application of Growth Regulators on Pea Plants Infected by *Meloidogyne incognita*

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The effect of ascorbic acid, 6-benzylamino purine, gibberellic acid, indole-3-acetic acid, coumarin, maleic hydrazide and 2, 3, 5-triiodobenzoic acid on root-knot development and growth of *Pisum sativum* was investigated. The growth regulators reduced root-knot index, except IAA. TIBA was most effective against *Meloidogyne incognita*. It reduced the root-knot index from 2.94 in control to 0.33 and 0.28 at 2 mg and 10 mg application per plant, respectively. There was no adverse effect on the growth and vigour of the plant by the application of TIBA. Bacterial nodulation was influenced by growth regulators.

Key Words - Growth regulators *Meloidogyne incognita* Root-knot

The development of root-knot disease is associated with the formation of galls and giant cells within galls in the roots of susceptible host plants. Infection by the root-knot nematode increased in the concentration of endogenous auxins and kinetins in susceptible plants (Balasubramanian & Raṅgaswamy, 1962; Kochba & Samish, 1972). The growth promoters also influence the resistance of plants against nematodes (Dropkin *et al.*, 1969; Masood *et al.*, 1979). The effect of growth regulators in conferring resistance against root-knot nematodes has not been studied. We have investigated the growth and development of pea plants infected by *Meloidogyne incognita*, treated with growth regulators.

**MATERIALS & METHODS** Surface sterilized pea seeds of cultivar 'Bonneville' were sown in 15 cm pots in steam sterilized soil (sand and farm-yard manure in a ratio of 4:1) after having been treated with specific *Rhizobium* strain. Six week old seedlings were inoculated with 2,000 larvae per plant.

Ascorbic acid (AA), 6-benzylamino purine (BAP), coumarin, gibberellic acid (GA), indole-3-acetic acid (IAA), maleic hydrazide (MH) and 2,3,5-triiodobenzoic acid (TIBA) were dissolved in sterile distilled water

and applied at concentrations of 2 mg and 10 mg per plant as foliar spray. Each treatment was replicated 4 times. One set was left untreated as control. After 6 weeks of inoculation, the growth of plants was measured in terms of dry weight of root and shoot. The effect on bacterial nodulation was estimated by counting the number of nodules. Similarly, the effect on nematodes was estimated by counting the galls on the roots. The rating of root-knot development (root-knot index) was done on the following lines: 0 = 0 galls/plant (no galling), 1 = 1-50 galls/plant (light galling), 2 = 51-100 galls/plant (moderate galling), 3 = 101-150 galls/plant (heavy gallina) and 4 = 151 or more galls/plant (severe galling). Final soil population of larvae was measured by Cobb's sieving and decantation technique and their number was counted under a stereo-microscope.

**RESULTS & DISCUSSION** Ascorbic acid had no effect on growth of plants and bacterial nodulation (Table 1) but it significantly reduced the galling. Arrigoni *et al.* (1979) observed a reduction in root galling by the application of ascorbic acid. BAP at 10 mg/plant adversely affected the growth of plants and nodulation. However, the number of root-knot galls decreased. IAA had no significant effect on plants but at 10 mg, it increased root galling. Myuge & Viglierchio (1975) repor-

Table 1 Responses of *M. incognita* - infected Pea Plants to Growth Regulators as Foliar Sprays

Treatment	Dose/Plant (mg)	Shoot weight dry (g/plant)	Root weight dry (g/plant)	Number of bacterial nodules/plant	Root-knot Index	Final soil population per pot
Ascorbic Acid	2 10	0.77 1.80	0.30 0.47	52 65	0.93 1.54	554 925
BAP	2 10	1.02 0.62	0.47 0.21	54 17	1.20 0.50	732 312
Gibberellic Acid	2 10	1.55 0.72	0.27 0.27	35 71	0.81 0.76	477 451
IAA	2 10	0.80 1.22	0.69 0.78	56 65	2.05 2.99	1226 1801
Coumarin	2 10	1.12 1.70	0.27 0.33	48 40	1.67 0.41	990 232
Maleic Hydrazide	2 10	1.20 1.15	0.49 0.46	62 56	1.15 1.06	699 612
TIBA	2 10	1.01 1.01	0.46 0.39	32 69	0.33 0.28	201 172
Control	—	1.50	0.71	52	2.94	1760
SEM $\pm$	—	$\pm 0.34$	$\pm 0.12$	$\pm 15$	$\pm 0.31$	$\pm 28$
CD at 5%	—	0.68	0.24	31	0.62	56
CD at 1%	—	NS*	0.31	NS*	0.82	74

NS = Not significant.

ted an increase in root mass and root galling by the application of IAA as soil drench.

Gibberellic acid, when applied at 10 mg/plant, caused reduction in weight of plants and root-galling (Table 1). Nematotoxic effect of GA due to direct toxicity to the nematode has been reported by Cuthbert (1982). However, Peacock (1960) Orion & Minz (1968) reported that GA did not affect the number and weight of galls. The application of MH caused significant growth reduction and root galling. This is in agreement with the findings of Myuge & Viglierchio (1975). MH affects the larval penetration, rate of development and sex differentiation of root-knot nematode (Davide & Triantaphyllou, 1968) and reduces the production of egg masses and eggs (Krishna Prasad & Setty, 1973). Similarly, coumarin and TIBA caused severe reduction in root galling, however, there was no adverse effect on plants. No adverse effect was recorded on bacterial nodulation by the application of MH. coumarin and TIBA.

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