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Departments of Vegetable Crops and Biochemistry,
Punjab Agricultural University, Ludhiana 141004, India

EFFECTS OF ROOT-KNOT NEMATODE *MELOIDOGYNE INCOGNITA* INFECTION ON THE PEROXIDASE AND POLYPHENOLOXIDASE ACTIVITIES IN THE ROOTS OF SELECTED VEGETABLE CROPS

by

SUDESH AHUJA and S. P. AHUJA

Plants resistant to virus, bacteria and fungi show accumulation of phenols (Gaumann, 1956) and increased activity of oxidative enzymes like peroxidase and polyphenoloxidase (Goodman *et al.*, 1967) during hypersensitive reactions to infection. Also, levels of phenol oxidising enzymes in healthy plants have been correlated with the level of resistance to such infective organisms (Goodman *et al.*, 1967). However, little is known about the pathogenicity and biochemical basis for resistance in plants to the parasitic nematodes. A study was, therefore, carried out to compare the levels of peroxidase and polyphenol oxidase activities in the roots of vegetables infested with the root-knot nematode, *Meloidogyne incognita* (Kofoid *et* White) Chitwood.

Four week old seedlings of brinjal (*Solanum melongena* L.) cv. Punjab Bahar, tomato (*Lycopersicon esculentum* Mill.) cv. S-12, and seeds of okra (*Abelmoschus esculentus* L.) cv. Pusa Sawani, and bottle-gourd [*Lagenaria siceraria* (Mohxa) Standl.] cv. Punjab Round, were either transplanted or sown singly in pots containing steam sterilized soil. Fifteen days later 1000 second stage larvae of *M. incognita*, obtained from tomato roots, were inoculated into each pot around the root zone of the plants. Ten inoculated and ten control pots for each plant type were kept in glasshouse for three months. Then the plants were removed from the pots and the roots washed with running tap water followed by distilled water. The dry matter,

gall size and colours of normal and infested roots were recorded. The peroxidase and polyphenoloxidase activities in the root extracts of healthy and infested plants were determined (Perur, 1967) using pyrogallol and catechol as substrates, respectively. The optical densities were read at 425 nm.

Except for okra, there was no difference in the dry matter content of the roots of healthy and those infested with root-knot nematodes. The dry matter content of the roots of infested okra plants was 12.3% whereas that of healthy ones was 26.2% (Tab. I). The extracts of roots of infested okra plants were highly viscous as compared to those from normal roots. The roots of bottle-gourd and okra plants infested with the root-knot nematode were darker than those of healthy plants and had much larger galls (Tab. I).

The activity of peroxidase was much higher than that of the polyphenoloxidase in the roots of all the four vegetable crop tested (Tab. II).

Table I - *Some characteristics of the roots of selected vegetable crops infested by* Meloidogyne incognita.

Plant	Dry matter (%)		Gall size (mm)		Colour of the roots	
	Healthy	Infested	Healthy	Infested	Healthy	Infested
Tomato	10.9	11.9	—	1 - 10	Light brown	Brown
Okra	26.2	12.3	—	1 - 10	Whitish	Brown
Brinjal	13.6	14.1	—	1 - 10	Brown	Brown
Bottle gourd	12.9	13.4	—	1 - 60	Brown	Coffee Coloured

Table II - *Peroxidase and polyphenoloxidase activities in root extracts of plants infested by* M. incognita.

Plants	Peroxidase (units/100 mg fresh tissue)		Polyphenoloxidase (units/100 mg fresh tissue)	
	Healthy	Infested	Healthy	Infested
Tomato	175.5 (1610)	205.0 (1723)	not detectable	not detectable
Okra	37.2 (190)	46.8 (382)	»	1.5 (12.2)
Brinjal	437.0 (3260)	314.0 (2225)	»	4.5 (32.1)
Bottle gourd	67.0 (520)	427.0 (3185)	1.3 (10.0)	15.6 (116.4)

I unit = 0.001 change in optical density at 425 nm; figures in parentheses represent the units of enzyme activity per 100 mg dry tissue.

The roots of nematode infested okra and bottle-gourd plants showed browning and higher activities of peroxidase and polyphenoloxidase (Tab. II). Peroxidase activity in the roots of both healthy and infested brinjal plants was high but the polyphenoloxidase activity was present only in the infested ones. The roots of healthy as well as infested tomato plants lacked polyphenoloxidase activity indicating that in tomato plants polyphenoloxidase may not be of significance in affecting tissue reaction to infection.

The infected roots of okra, brinjal, and bottle gourd relatively showed increasing levels of polyphenoloxidase activity. The level of polyphenoloxidase, therefore, may determine the extent of hypersensitive reaction in these crop plants. Goodman *et al.*, (1967) speculated that phenol oxidizing enzymes have an important role in the processes leading to tissue necrosis and a decrease in the activity of these enzymes leads to a decrease in the resistance of the plant to infection by bacteria, fungi and viruses. Hussey and Krusberg (1970) observed that peroxidase activity was higher in plants inoculated with *Ditylenchus dipsaci.* The quinones or semiquinones produced by the action of polyphenolases accumulate as a result of local lesions in the host and act as antimicrobial agents (Farkas and Kiraly, 1962). Overeem (1976) reported that unstable orthoquinones, formed in apple leaves under the influence of polyphenoloxidase, are fungitoxic. It was further reported that quinones must remain in the oxidized state in the region of parasitation to be effective. The browning of roots of the crop plants studied during the present investigation may be due to the accumulation of products of the action of these enzymes.

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