

## EFFECTS OF BAVISTIN SPRAY ON SOIL MICROORGANISMS AND VAM FORMATION IN GREENGRAM IN RELATION TO ITS YIELD

HARBANS KAUR KEHRI AND SUDHIR CHANDRA

Botany Department, University of Allahabad, Allahabad - 211 002 (INDIA)

(Accepted April 1993)

Bavistin spray (200, 300 and 500 ppm) was tested for its effect on VAM formation in roots and microbial population in and around roots of greengram. The fungicide suppressed the population of *Macrophomina phaseolina* (dry root rot pathogen of the crop) and improved the yield. However, it caused an unfavourable effect on mycorrhization, nodulation and population of non-symbiotic nitrogen fixers.

**Key Words :** Greengram, VAM formation, Bavistin spray.

Changing agricultural practices have resulted in increasing use of fungicides in the control of plant diseases. However, their unfavourable effects on the beneficial microorganisms like symbiotic or non-symbiotic nitrogen fixers and mycorrhizal fungi have been shown to dilute the benefit which they provide to the plants through the suppression of the harmful activities of the pathogen (Bailey and Safir, 1978; Menge, Johnson and Minassian, 1979; Menge 1982; Manjunath and Bagyaraj, 1984; Trappe, Malina and Castellano, 1984). Bavistin is in common use in controlling the dry root-rot (*Macrophomina phaseolina* (Tassi) Goid.) of greengram in India. The study was undertaken to seek information regarding effects of its application on the microbial assembly in and around roots including the pathogen and some of the known beneficial microorganisms.

### MATERIALS AND METHODS

Greengram cv. T-44 was raised (5 plants/pot) in earthen pots (30x30 cm) filled with field soil (sandy clay loam; pH 6.5-7.0, organic matter, 0.72% (w/w) loaded with indigenous inoculum of dry root-rot pathogen ( $5.1 \times 10^5$  propagules/g dry soil) and VAM fungi (*Glomus* spp, 22 spores/10g dry soil) and maintained under green-house conditions with a regular supply of water. Before sowing, the seeds were treated with *Rhizobium* specific for greengram (procured from C.S.A. University, Kanpur). They were dipped in a slurry prepared from a 5% sugar solution and carrier based Rhizobial inoculant and dried in shade for 6 hrs. The pots were divided into four series and the plants of different series were

given different treatments. Five replicates were maintained for each treatment. The plants of the first three series were sprayed separately with three different concentrations of Bavistin (200, 300 and 500 ppm) at 15 days interval. First spraying was given 20 days after the sowing of the seeds. Plants of 4th series (control) were sprayed with sterilized distilled water instead of Bavistin. 1% glycerine (v/v) was used as wetting agent for better penetration of the spray. It was applied also to the plants of the control series. In all, three sprayings were given for two consecutive days each. Sterilized cotton was placed over the soil surface to prevent the spray falling on it.

Soil and root samples were collected from all the four series 7 days after each spraying. Total population of fungi in the rhizosphere soil was estimated by plating soil dilutions on PDA. Soil extract medium was used instead of PDA for estimating total population of bacteria. The population of *Derxia* and *Azotobacter* was estimated employing specific medium (*Derxia* -medium suggested by Gupta and Sen, 1982; *Azotobacter* - Ashby's mannitol medium).

Surface sterilized (with 2% sodium hypochlorite) pieces of roots were plated on PDA for estimating the population of pathogen within the roots. It was expressed in terms of percentage root bits infected by the pathogen. Mycorrhiza formation in roots was determined after processing them by the method of Phillips and Hayman (1970). It was expressed in terms of percentage root bits showing mycorrhiza formation. Nodulation was recorded in terms of the dry weight of nodules (g)/5 plants while yield in terms of the dry weight of grains (g)/5 plants.

Table 1 : Population of fungi, bacteria, *Derxia* and *Azotobacter* in the rhizosphere of greengram sprayed with different concentrations of Bavistin.

Treatments	Microbial population ( $1 \times 10^6$ /g oven dry soil)			
	Fungi	<i>Derxia</i>	<i>Azotobacter</i>	Other bacteria
Control (water)	0.26	6.2	0.72	1.8
Bavistin-500 ppm	0.30	4.6	1.14	2.7
Bavistin-300 ppm	0.20	1.7	2.26	2.0
Bavistin-200 ppm	0.50	4.4	3.55	2.8

Minimum difference required for significance (C.D.) at 5% level :

Fungi : 0.225	<i>Azotobacter</i> : 0.040
<i>Derxia</i> : 0.270	Other bacteria : 0.057

All the data were analyzed statistically by the method of analysis of variance (Panse and Sukhatme, 1985) at 5% level.

## RESULTS AND DISCUSSION

Table 1 shows that the application of Bavistin caused an alteration in the population of bacteria and fungi. The magnitude of alteration varied with the concentration used. The treatment proved to be favourable for *Azotobacter* but unfavourable for the other non-symbiotic nitrogen fixer - *Derxia*. It is interesting to note that favourable effect of Bavistin on *Azotobacter* showed a direct relation with the concentration used.

Table 2 depicts that Bavistin caused a damaging effect on the nodulation and mycorrhiza formation in the plants. However, the magnitude of damage showed a decrease with decreasing concentration of the fungicide. All the three concentrations of Bavistin suppressed the population of the pathogen and improved the yield in the crop. The quantum of suppression of the colonization and improvement in the yield increased with decreasing concentrations of the fungicide, 200 ppm showing the maximum effect.

Toxicity of the fungicides to mycorrhizal fungi has been reported by many workers (Jalali and Domsch, 1975; Boatman, Paget, Hayman and Mosse, 1978; Jalali, 1978; Nemeč, 1980). Available data on the interaction between mycorrhizal fungi and fungicides clearly indicate that fungicides typically delay or reduce VA-mycorrhizal infection but rarely eliminate it altogether (Menge, 1982). In the present study, application of Bavistin caused a suppressing effect on the mycorrhizal infection. Similar effect was induced by the fungicide on the nodulation as well as population of *Derxia*, a non-

Table 2: Root colonization by *Macrophomina phaseolina*, VA-mycorrhiza, nodulation and yield in greengram sprayed with different concentrations of Bavistin.

Treatments	<i>Macrophomina phaseolina</i> (% root bits infected)	Mycorrhizal infection (% root bits infected)	Nodulation (Dry wt. nodules (g)/5 plants)	Yield (Dry wt. grains (g)/5 plants)
Control (water)	29.0	41.5	0.085	6.0
Bavistin-500 ppm	26.9	13.5	0.010	8.5
Bavistin-300 ppm	19.9	24.0	0.070	9.5
Bavistin-200 ppm	13.2	33.0	0.095	11.5

Minimum difference required for significance (C.D.) at 5% level :

<i>M. phaseolina</i> : 4.145	Nodulation : 0.012
VAM infection : 2.567	Yield : 1.517

symbiotic nitrogen-fixer. The present findings confirm the benefit of the Bavistin application to the crop in terms of increased yield via suppression of the pathogen. Its unfavourable effect on the nodulation, mycorrhizal infection as well as *Derxia*, however, shows that the crop fails to get the full benefit of the treatment. It could be made more beneficial to the crop by exploiting the possibility of employing some method which could nullify its adverse effect on beneficial microorganisms. In this respect, the approach of Kumar and Jayaraman (1987) is noteworthy since they could succeed in nullifying the adverse effect of fungicides on VA-mycorrhizal fungi by soil amendment with suitable fertilizers.

The authors thank the Head of the Botany Department, University of Allahabad, Allahabad for providing necessary facilities.

## REFERENCES

- Bailey J E & G R Safir 1978 The effect of benomyl on soybean endomycorrhizae, *Phytopath* **68** 1810 - 1812.
- Boatman N D Paget D S Hayman & B Mosse 1978 Effects of systemic fungicides on vesicular - arbuscular mycorrhizal infection and plant phosphate uptake, *Trans Brit Mycol Soc* **70** 443 - 450.
- Gupta S B & S P Sen 1982 Utility of phyllosphere nitrogen - fixing microorganisms in the improvement of crop growth, *Plant and Soil* **68** 69 - 74.
- Jalali B L 1978 Response of soil fungitoxics on the development of VA - mycorrhiza and phosphate uptake in cereals, (Abstr.) *Third International Congress Plant Pathology*, Muchen 182.

Jalali B L & K H Domsch 1975 Effect of systemic fungitoxicant on the development of endotrophic mycorrhiza, In : *Endomycorrhizas*, pp 619-626 (ed. by F E T Saunders, B Mosse and P B Tinker) Academic Press New York.

Kumar D & J Jayaraman 1987 Influence of fungicide and fertilizer amendments on mycorrhizal associations in *Vigna mungo* Hepper, *Proc Nat Workshop on Mycorrhizae*, JNU New Delhi pp 488-504.

Manjunath A & D J Bagyaraj 1984 Effect of fungicides on mycorrhizal colonization and growth of onion, *Plant and Soil* **80** 147-150.

Menge J A 1982 Effect of soil fungicides on vesicular-arbuscular fungi, *Phytopath* **72** 1125-1132.

Menge J A, E L V Johnson & V Minassian 1979 Effect of heat treatment and three pesticides upon the growth and reproduction of the mycorrhizal development in sour orange, *Can J Bot* **58** 522-526.

Panse V G & P V Sukhatme 1985 *Statistical method for agricultural workers*, Fourth Edition Publication and Information Division IARI New Delhi.

Phillips J M & D S Hayman 1970 Improved procedures for clearing and staining parasitic and vesicular - arbuscular mycorrhizal fungi for rapid assessment of infection. *Trans Brit Mycol Soc* **55** 158-161.

Trappe J M, R Malina & M Castellano 1984 Reactions of mycorrhizal fungi and mycorrhiza formation on pesticides, *Ann Rev Phytopath* **22** 331-358.