RESEARCH PAPER

Effect of carbofuran insecticide on VAM colonization and phosphorus uptake in chilli plants of Gwalior

NAMITA SHARMA AND **AVINASH TIWARI**

School of Studies in Botany, Jiwaji University, GWALIOR (M.P.) INDIA
Email : namitas87@gmail.com; tiwariavinash2@gmail.com

Vegetables form an important source of essential components of balanced human diet. The indiscriminate use of pesticides in fruits and vegetables is of great concern for health and environment safety. The objective of the present study, is to investigate the effect of carbofuran on VAM colonization and phosphorus uptake in *Capsicum annuum* Linn. plants. Addition of recommended dose of carbofuran decreased root colonization and higher dose of carbofuran effected the root colonization adversely. Various doses of carbofuran effected VAM colonization, which indirectly affected phosphorus uptake in chilli plants.

Key words **:** Carbofuran insecticide, Phosphorus uptake, VAM, Colonization

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INTRODUCTION

Bell pepper (*Capsicum annuum* L.) commonly known as chilli belongs to family Solanaceae. It is one of the most important spice cum vegetable grown in India with great export potential. Chilli is a native of new world subtropics, and is grown in over 1.4 million hectare producing about 18.8 million tones of fresh and dry fruits in India. The crop occupies an area of 0.9 million hectare, with an annual production of 0.9 million tones dry chilli in India (Ukkund *et al.*, 2007).

Vesicular arbuscular mycorrhizal (VAM) fungi are important rhizospheric microorganisms and are widespread in most of the vegetables. They are mutualistic symbionts between soil borne fungi and the roots of higher plants. Phosphorus (P) is one of the major essential macronutrients for biological growth and development. VAM benefit the host plant primarly by increasing the capability of the root system to absorb and translocate phosphorus through an extensive network of external hyphae (Menendez *et al.*,1999). VAM fungi utilize insoluble forms of phosphorus as tricalcium phosphate, root phosphate, super phosphate rather than available forms of phosphate (Sieverding, 1991).

Pesticides are chemicals used in agriculture for the control of pests, weeds and plant disease. The use of a wide range of chemicals to destroy pests and weed is an important aspect of agriculture practice in both developed and developing countries. The aim of pesticides application is to reduce the population of pathogens, but it can also affect the availability of compatible host species necessary for growth of particular mycorrhizal species (Jonas *et al.*, 2004).

Carbofuran is a carbamate insecticide which is effective by their systemic action in crop. The sap feeding pests like thrips, mites, aphids, etc., cause severe damage to chillies and the application of carbofuran to crops as granules is reported to be effective. Furthermore, the application of pesticides will affect the antagonistic interaction between VAM and plant pathogenic organisms and their subsequent beneficial effect on plant development and growth. Malathion, carbofuran, DDT, aldicarb, endosulfan and cypermethrin have been reported to negatively affect the colonization of plant roots when applied at high doses (Venkateswarlu *et al.,* 2004, Veeraswamy *et al.,* 2003).

RESEARCH METHODOLOGY

Field design:

The experiment was conducted at charak garden of Jiwaji University, Gwalior. *Capsicum annuum* Linn. variety sadabahar was grown in field plots (1m x 1m) in triplicates. The design

was random replication design. The agriculture pattern for chilli crop was the same standard recommended procedure.

Pesticide application:

Plants were given different doses of carbofuran once at fruiting stage. Single dose of carbofuran was 125 mg in each plot, while double dose of carbofuran was 250 mg in each plot.

Sampling:

Sampling was done at 60, 70, 80, 90 and 100 days of sowing.

Root colonization:

VAM colonization was assessed after staining the root samples following the method of Phillips and Hayman (1970). Stained root segments were examined under a compound microscope at different magnifications for fungal structures. All fungal structures (hyphae, arbuscules and vesicles) that were formed in the roots were counted, and the percentages of root colonization of the segments were estimated by using the following formula (Krishna and Dart, 1984).

$$\text{Percentage of root colonization} = \frac{\text{Total no. of AM positive segments}}{\text{Total no. of root segments observed}} \times 100$$

Phosphorus determination by UV visible spectrophotometer:

The vanadate – molybdate- yellow procedure (AOAC, 1990) was used for phosphorus analysis by UV visible spectrophotometer.

Mycorrhizal spores were separated from soil by wet sieving and decanting method of Gerdemann and Nicolson (1963). The morphological characteristics of these spores were determined by the key proposed by Schenck and Perez (1990).

RESEARCH FINDINGS AND ANALYSIS

The experimental findings of the present study have been presented in the following sub heads:

Root colonization:

In the first second and third samples, root colonization in control plants was found to be 70 per cent. In fourth and fifth samples the root colonization in control plants were 66 per cent and 80 per cent, respectively (Table 1, Fig. 1).

Table 1 : Results of VAM colonization (%) in chilli plants

Sampling	Control plants	Carbofuran normal dose plants	Carbofuran double dose plants
First	70	40	43
Second	70	53	40
Third	70	60	43
Fourth	66	53	43
Fifth	80	66	60

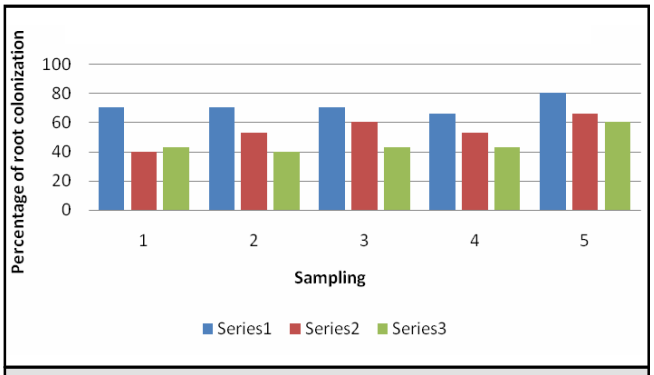


Fig. 1 : Results of VAM colonization (%) in chilli plants

Root colonization in carbofuran-single dose plants was 40 per cent during first sampling. In second and third samples it was 53 per cent and 60 per cent, while in fourth and fifth samples the root colonization in carbofuran single dose plants were 53 per cent and 66 per cent (Table 1, Fig. 1).

In first sampling the root colonization in carbofuran-double dose plants was 43 per cent. In second and third samples it was 40 and 43 per cent, respectively. In fourth and fifth samples the root colonization in carbofuran double dose plants were 43 per cent and 40 per cent, respectively (Table 1, Fig. 1).

Phosphorus content (In milli moles of phosphate per 100 g dry material):

In the first sample, phosphorus content in control plants was 36. In second and third samples the same was 28 and 24, respectively. During fourth and fifth samples the phosphorus content was 20and 44, respectively (Table 2, Fig. 2).

In the first and second samples, phosphorus content in carbofuran single dose plants was found to be 28. In third samples the same was 40, respectively. In fourth and fifth samples the phosphorus content was 28 and 42, respectively (Table 2, Fig. 2).

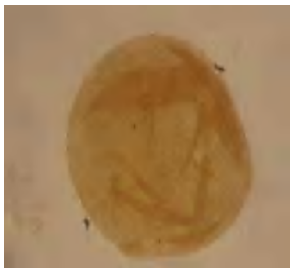
The phosphorus content in carbofuran double dose was 24 during first sampling. In second and third samples of carbofuran double dose it was 20 and 24, respectively. During fourth and fifth samples the phosphorus content was 24 and 40, respectively (Table 2, Fig. 2).

Table 2 : Results of phosphorus uptake of plant leaf (milli moles of phosphate per 100 g Dry material)

Sampling	Control plants	Carbofuran normal dose plants	Carbofuran double dose plants
First	36	28	24
Second	28	28	20
Third	24	40	24
Fourth	20	28	24
Fifth	44	42	40

a) *Glomus microagreegatum*

b) *Glomus intraredices*

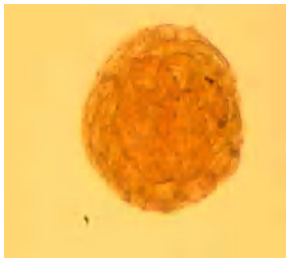


c) *Glomus claroeideum*

d) *Glomus invermium*

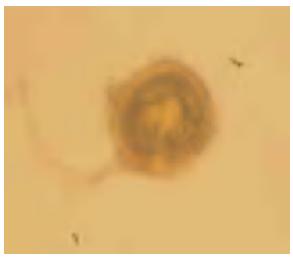
e) *Glomus mosseae*

f) *Glomus agreegatum*



g) *Acaulospora laevis*

h) *Acaulospora elegans*



i)*Gigaspora decipiens*

j) *Gigaspora gigantia*

Plate 1 : VAM spores of different species

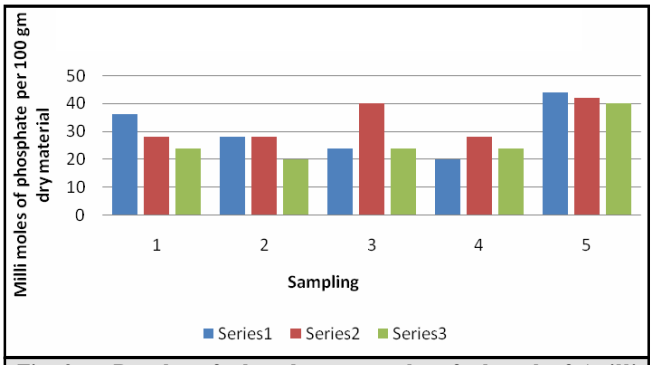


Fig. 2 : Results of phosphorus uptake of plant leaf (milli moles of phosphate per 100 g dry material

Addition of recommended dose of carbofuran decreased root infection and double dose of carbofuran effected the root infection more. High levels of carbofuran significantly inhibited VAM colonization. Plant growth and VAM formation were not affected by 1.25 kg/ha levels of carbofuran (Veeraswamy *et al*., 2003 and Venkateswarlu *et al.*, 2004) Various doses of carbofuran effected VAM colonization, which indirectly affected phosphorus uptake in chilli plants. Menendenz *et al.* (1999) studied that some insecticides have no effect on VAM symbiosis. While high doses of insecticides decrease plant root colonization.

Results of VAM spores:

In present study distribution and abundance of VAM species in the rhizospheric soils of crop plants was also studied. It was observed that VAM species richness is dependent on soil fertility level. Charak garden soils are red sandy loam soils, which have relatively low fertility. In such soils the diversity of VAM species is high e.g., *Glomus, Acaulospora* and *Gigaspora.*

Genus	Species (Plate 1)
Glomus	a) *Glomus microaggregatum*, b) *Glomus intraredices*, c) *Glomus claroeideum*
	d) *Glomus invermium*, e) *Glomus mosseae*
	f) *Glomus agreegatum*
Acaulospora	g) *Acaulospora laevis*
	h) *Acaulospora elegans*
Gigaspora	i)*Gigaspora decipiens*, j)*Gigaspora gigantia*

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LITERATURE CITED

AOAC (1990). *Official methods of analysis.* The association of official analytical chemists. In: Heirich K (ed) Arlington, VA., USA.

Jonas, F. Johnson, Lesile, R. Paul and Roger, D. Finlay (2004). Microbial interactions in the mycorrhizosphere and their significance for sustainable agriculture. *FEMS Microbiol. Ecol*., **48**: 1-13.

Krishna, K.R. and Dart, P.J. (1984). Effect of mycorrhizal inoculation and soluble phosphorus fertilizer on growth and phosphorus uptake of pearl millet. *Plant & Soil,* **81**:247-256.

Menendez Ana, Alicia Martinez, Viviana Chiocchio, Nadia Vendikian and Juan A. Ocampo (1999). Influence of the insecticide dimethoate on arbuscular mycorrhizal colonization and growth in soybean plants. *Alicia Godes Internal Microbiol.Springer- Verlag Iberica*, **2**:43-45.

Phillips, J.M. and Hayman, D.S. (1970). Improved procedure for clearing roots and staining parasitic and VAM fungi for rapid assessment of infection. *Trans. Br. Mycol. Soc.,* **55** : 158-161.

Sieverding, E. (1991). Vesicular arbuscular mycorrhiza management in tropical agroecosystem. Techanical cooperation, federal republic of Germany, Eschborn. **371**.

Ukkund, Krishna C., Madalgeri, M.B., Patil, M.P., Mulage, Ravindra and Kotikal, Y.K. (2007). Variability studies in green chilli (*Capsicum annuum* L.). *Karnataka J. Agric. Sci.,* **20**(1):102-104.

Veeraswamy, J., Padmavati, T. and Venkateswarlu, K. (2003). Effected of selected insecticides on plant growth and mycorrhizal development in *Sorghum*. Department of Microbiology, Sri Krishnadevaraya University, Anantapur (A.P.), *India Sci. Direct.,* **43**:337-343.

Venktaswarlu, K., Al-Garni, S.M. and Daft, M.J. (2004). The impact of carbofuran soil application on growth and mycorrhizal colonization by *Glomus clarum* of groundnut. Biomedical and Life Scicences. *Mycorrhiza*. Springer Berlin / Heidelberg, **5**(2): 125-128.

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