

EFFECT OF FOLIAR APPLICATION OF FUNGICIDES ON PHYLLOPLANE FUNGI OF MAKOI LEAF

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Abstract: The composition of phylloplane mycoflora of plant is determined by the interaction of many factors, including the agrochemicals. The chemical nutrients, growth regulators, insecticides, weedicides and fungicides, etc. frequently applied to plants may alter the mycoflora either directly by affecting particular components, or indirectly by altering the physiology of the host. These chemicals are frequently introduced into the environment of the plant and its microflora to alleviate diseases. The present paper deals with the foliar application of fungicides (Dithane M-45, Bavistin and Blitox) on phylloplane mycoflora of Makoi (*Solanum nigrum* L.) leaf. The fungal flora was decreased on leaves treated with fungicides.

Keywords: *Solanum nigrum*, Fungicides (Dithane M-45, Bavistin, Blitox), Phylloplane mycoflora

INTRODUCTION

In modern agriculture systems, agrochemicals are used in order to enhance the yield. These chemicals eliminate some harmless saprophytes and the other microorganisms with which they were in competition may become pathogenic and dominant. Many factors may affect the toxicity of agrochemicals to the saprophytic and parasitic mycoflora of plants. These include dose, frequency and application, mode of action and persistence to toxic residues on plant surfaces, besides the pattern of chemical deposits after spray and redistribution by rain. Many different types of chemicals are used in such procedures and they are often applied to aerial plant surfaces where they may affect host systems, and epiphytic organisms other than their target (Dickinson and Wallace, 1976). A few reports are available on the effect of foliar spray of various chemicals on phylloplane mycoflora, such as insecticide (Shamiyeh and Johnson, 1973); herbicides (Quility and Geoghegan, 1975); antibiotics (Klincare *et al.*, 1971); Fungicides (Fokkema, 1973; Pace and Campbell, 1974) and growth hormones and amino acids (Sindhu *et al.*, 1987).

Solanum nigrum L. (Makoi) belonging to the family Solanaceae. *S. nigrum* L., a common weed, especially growing in cultivated ground is an erect, nearly glabrous annual herb, with much branched stems. *S. nigrum* is medicinally used for. The present paper deals with the

foliar application of fungicides on phylloplane mycoflora of Makoi leaf.

MATERIAL AND METHODS

Mature blackberries were collected from the field; the seeds were taken out from the blackberries with sterilized forceps. Seeds were soaked in water for twenty four hours, kept in running water for a few hours and then they were sown in earthen pots (18 × 25 cm). Four plants were maintained in each pot and for each treatment three replicates were used. The pots were irrigated at intervals of five days. Three fungicides Dithane M-45, Bavistin and Blitox were selected. For each fungicide 0.05 %, 0.2 % and 0.5 % concentrations were prepared in sterilized distilled water. The foliar application of the fungicides in above concentration was made by an atomiser until run off from the leaves. The first spray was done when the plants were 45-days old and the subsequent one at the interval of 10 days. Isolation of fungi was done five days after every spray. In all, four sprays of each chemical were given. Leaves sprayed with sterilized distilled water served as control. Twenty five leaves were removed by sterilized scissors, transferred aseptically into sterilized polythene bags separately for each treatment and brought to the laboratory for isolation of mycoflora. The isolation of phylloplane fungi was done by dilution plate method.

Table 1. Mycoflora isolated from Dithane M-45 sprayed leaves of *Solanum nigrum* [the average number against a species represents number of colonies cm⁻² leaf surface] (C=control).

Name of Fungi	SAMPLINGS															
	I				II				III				IV			
	C	0.05 %	0.2 %	0.5 %	C	0.05 %	0.2 %	0.5 %	C	0.05 %	0.2 %	0.5 %	C	0.05 %	0.2 %	0.5 %
<i>Acremonium sp.</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	8	5	-
<i>Alternaria Alternata</i>	20	16	16	13	23	15	12	10	27	12	12	10	29	12	10	8
<i>Aspergillus flavus</i>	25	20	18	-	30	20	8	-	34	18	6	-	25	20	6	-
<i>A. fumigatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	11	-	-
<i>A. luchuensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	18	14	13
<i>A. nidulans</i>	-	-	-	-	-	-	-	-	-	-	-	-	9-	12	9	10
<i>A. niger</i>	23	28	25	37	26	37	34	32	30	37	35	35	32	36	32	30
<i>Candida albicans</i>	24	-	8	-	18	-	-	-	28	-	-	-	32	-	-	-
<i>Chaetomium globosum</i>	-	-	-	-	8	-	-	-	15	-	-	-	17	-	-	-
<i>Cladosporium</i>	38	30	24	21	40	28	22	16	45	24	23	16	50	24	20	18
<i>cladosporioides</i>																
<i>C. herbarum</i>	11	19	18	17	13	18	18	16	21	20	20	17	-	-	-	-
<i>Curvularia lunata</i>	10	6	-	-	11	-	-	-	14	-	-	-	16	-	-	-
<i>Drechslera australiensis</i>	-	-	-	-	-	25	21	20	19	19	16	17	29	20	18	10
<i>Emercellopsi terricola</i>	-	-	-	-	26	-	-	-	-	7	-	-	-	7	-	-

<i>Epicoccum purpurascens</i>	12	-	-	-	-	-	-	-	13	-	-	-	-	-	-	-
<i>Fusarium moniliforme</i>	-	-	-	-	13	-	-	-	14	-	-	-	14	10	-	-
<i>F. oxysporum</i>	16	6	-	-	-	-	-	-	23	-	-	-	26	-	-	-
<i>Mucor recemosus</i>	-	-	-	-	20	-	-	-	-	-	-	-	9	5	7	-
<i>Mycelia sterilia</i> (Brown)	-	-	-	-	5	8	-	10	-	-	-	-	-	13	-	-
<i>Mycelia sterilia</i> (White)	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-
<i>Myrothecium indicum</i>	-	-	-	-	-	-	-	-	10	-	-	-	16	-	-	-
<i>Nigrospora sphaerica</i>	18	18	16	16	-	17	16	12	12	11	9	8	10	9	9	9
<i>Pencillium sp.</i>	-	-	-	-	17	-	-	-	-	-	-	-	7	-	-	-
<i>Pestalotia sp.</i>	-	-	-	-	3	-	-	-	3	-	-	-	7	-	-	-
<i>Phoma humicola</i>	-	-	-	-	-	7	-	-	14	4	-	-	19	6	-	-
<i>Rhizopus arrhizus</i>	-	-	-	-	10	-	-	-	7	-	5	3	9	9	8	7
<i>Stemphylium botryosum</i>	-	-	-	-	-	8	-	-	-	-	-	-	-	8	6	-
<i>Torula herbarum</i>	-	-	-	-	-	-	-	-	10	-	-	-	12	-	-	-
<i>Trichoderma lignorum</i>	13	7	-	-	-	-	-	-	16	-	-	-	20	-	-	-
					12											
Total fungal species	11	9	7	5	16	10	7	7	19	9	8	7	21	17	12	8
Total fungal population (Average number of colonies)	210	150	125	93	286	183	131	116	355	152	126	106	392	228	144	105

Table 2. Mycoflora isolated from Blitox sprayed leaves of *Solanum nigrum* [the average number against a species represents number of colonies cm⁻² leaf surface] (C=control).

Name of Fungi	SAMPLINGS															
	I				II				III				IV			
	C	0.05	0.2	0.5	C	0.05	0.2	0.5	C	0.05	0.2	0.5	C	0.05	0.2	0.5
	%	%	%		%	%	%		%	%	%		%	%	%	
<i>Acremonium sp.</i>	-	-	-	-	-	-	-	-	8	-	-	-	7	-	-	-
<i>Alternaria Alternata</i>	25	20	16	13	24	23	26	10	27	28	28	18	32	28	27	20
<i>Aspergillus flavus</i>	26	20	-	-	28	-	-	-	30	-	-	-	42	-	-	-
<i>A. fumigatus</i>	-	-	-	-	-	-	-	-	-	16	13	-	-	24	22	21
<i>A. luchuensis</i>	-	-	-	-	-	-	-	-	-	23	23	19	-	35	30	28
<i>A. nidulans</i>	-	-	-	-	-	-	-	-	-	-	-	-	8	-	6	-
<i>A. niger</i>	22	28	28	25	30	34	30	30	32	33	31	30	34	33	35	32
<i>Cnadida albicans</i>	24	26	16	15	28	19	13	10	29	31	10	-	33	16	14	-
<i>Chaetomium globosum</i>	-	-	-	-	7	-	-	-	10	-	-	-	16	15	13	7
<i>Cladosporium</i>	38	10	8	7	44	8	7	6	40	6	7	4	50	6	7	4
<i>cladosporioides</i>																
<i>C. herbarum</i>	12	29	26	30	31	35	33	35	28	27	28	30	-	-	-	-
<i>Curvularia lunata</i>	15	10	-	-	14	-	-	-	17	-	-	-	18	-	-	-
<i>C. pallescens</i>	-	-	-	-	-	-	-	-	-	7	-	-	-	9	-	-
<i>Diplodia sp.</i>	-	-	-	-	-	-	-	-	-	5	-	-	-	7	-	-

<i>Drechslera australiensis</i>	-	-	-	-	16	11	6	7	18	18	14	13	21	19	17	16
<i>D. rrostratum</i>	-	-	-	-	-	-	-	-	-	13	-	-	-	15	-	-
<i>Epicoccum purpurascens</i>	10	-	-	-	11	-	-	-	13	-	-	-	-	-	-	-
<i>Fusarium moniliforme</i>	-	-	-	-	-	-	-	-	13	-	-	-	16	20	-	-
<i>F. oxysporum</i>	19	6	-	-	21	-	-	-	26	-	-	-	28	-	-	-
<i>Mucor recemosus</i>	-	-	-	-	4	-	-	-	-	-	7	-	7	-	-	-
<i>Mycelia sterilia</i> (Brown)	-	11	-	-	-	-	-	-	-	-	-	-	13	-	-	-
<i>Myrothecium indicum</i>	-	-	-	-	-	-	-	-	13	8	6	-	16	15	6	-
<i>Nigrospora sphaerica</i>	17	18	17	13	9	16	16	14	11	18	13	13	18	15	16	11
<i>Pencillium sp.</i>	-	-	-	-	6	-	-	-	-	6	-	-	7	5	4	-
<i>Pestalotia sp.</i>	-	-	-	-	-	-	-	-	4	-	-	-	5	-	-	-
<i>Phoma humicola</i>	-	-	-	-	9	8	5	-	14	10	6	-	19	11	9	-
<i>Rhizopus arrhizus</i>	-	-	-	-	-	-	-	-	6	6	8	4	7	8	9	7
<i>Stemphylium botryosum</i>	-	-	-	-	-	-	-	-	-	3	-	-	-	3	-	-
<i>Torula herbarum</i>	-	-	-	-	-	-	-	-	11	-	-	-	13	-	-	-
<i>Trichoderma lignorum</i>	15	11	10	-	15	12	-	-	18	13	9	-	22	16	11	-
Total fungal species	11	11	7	6	16	9	8	7	20	18	14	8	22	19	15	9

Total fungal population (Average number of colonies)	223	189	121	103	297	166	136	112	368	271	203	131	432	300	226	146
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Table 3. Mycoflora isolated from Bavistin sprayed leaves of *Solanum nigrum* [the average number against a species represents number of colonies cm⁻² leaf surface] (C=control).

Name of Fungi	SAMPLINGS															
	I				II				III				IV			
	C	0.05 %	0.2 %	0.5 %	C	0.05 %	0.2 %	0.5 %	C	0.05 %	0.2 %	0.5 %	C	0.05 %	0.2 %	0.5 %
<i>Acremonium sp.</i>	-	-	-	-	8	-	-	-	10	8	-	-	11	6	5	-
<i>Alternaria Alternata</i>	28	18	16	10	25	16	10	9	28	15	12	9	35	16	9	7
<i>Aspergillus flavus</i>	24	10	-	-	35	-	-	-	34	-	-	-	42	-	-	-
<i>A. nidulans</i>	-	-	-	-	-	-	-	-	-	-	-	-	7	-	-	-
<i>A. niger</i>	23	18	16	10	29	16	10	6	28	16	8	5	33	14	5	5
<i>Cnadida albicans</i>	20	15	9	-	28	11	7	-	26	16	6	-	30	16	9	-
<i>Cladosporium</i>	35	20	14	8	40	19	9	5	45	18	8	3	50	10	6	6
<i>cladosporioides</i>																
<i>C. epiphyllum</i>	12	11	9	6	15	10	7	-	22	12	-	-	-	-	-	-
<i>Curvularia lunata</i>	13	20	19	16	18	19	17	16	15	20	22	28	10	25	19	20
<i>Drechslera australiensis</i>	-	-	-	-	18	16	-	-	20	18	-	-	22	3	5	-

<i>Epicoccum purpurascens</i>	11	-	-	-	13	-	-	-	15	-	-	-	-	-	-	-
<i>Fusarium moniliforme</i>	-	-	-	-	-	-	-	-	13	17	-	-	16	12	-	-
<i>F. oxysporum</i>	19	11	-	-	20	-	3	-	26	-	-	-	27	-	-	-
<i>Mucor recemosus</i>	-	-	-	-	4	-	-	-	-	-	-	-	7	-	5	-
<i>Myrothecium indicum</i>	-	-	-	-	-	-	5	-	13	-	5	-	14	-	7	-
<i>Nigrospora sphaerica</i>	8	4	3	-	10	-	-	-	11	9	-	-	7	6	-	-
<i>Pencillium sp.</i>	-	-	-	-	5	-	-	5	-	-	-	-	8	-	-	6
<i>Periconiata sp.</i>	-	-	-	-	-	-	-	-	3	-	-	-	5	-	-	-
<i>Phoma humicola</i>	-	-	-	-	12	7	7	-	13	9	8	-	21	19	8	6
<i>Rhizopus arrhizus</i>	-	-	-	-	-	-	-	-	8	10	12	12	8	14	12	12
<i>Sepedonium sp.</i>	-	-	-	-	-	-	-	-	-	-	-	-	7	5	6	5
<i>Torula herbarum</i>	-	-	-	-	-	-	-	-	11	-	-	-	11	-	-	-
<i>Trichoderma lignorum</i>	13	9	-	-	14	-	-	-	16	-	-	-	20	-	-	-
Total fungal species	11	10	7	5	16	8	9	5	19	12	8	5	21	12	12	8
Total fungal population (Average number of colonies)	206	136	86	50	294	114	75	41	357	168	81	57	391	146	96	67

TABLE 1. Indicates that after first spray of fungicides Dithane M-45 the population of *Alternaria alternata* and *Cleadosporiou cladosporioides* gradually decreased. Average number of colonies cm⁻² leaf surface of *Aspergillus flavus*, *Candida albicans*, *Curvularia lunata*, *Fusarium orgysporum*, *Phoma humicola* and *Trichoderma lignorum* were reduced by Dithane M-45. *Aspergillus niger*, *Cladosporium herbarum*, *Drechslera australiensis* and *Nigrospora sphaerica* were tolerant to Dithane M-45.

Table 2. Indicates that *Aspergillus flavus*, *Curvularia lunata*, *Fusarium oxysporum* and *Trichoderma lignorum* were reduced by Blitox. *Aspergillus niger*, *Candida albicans*, *Cladosporium herbarum* and *Nigrospora sphaerica* were tolerant to Blitox.

Table 3. Indicates that *Aspergillus flavus*, *Drechslera australiensis*, *Fusarium oxysporum*, *Nigrospora sphaerica* and *Trichoderma lignorum* were severely affected by Bavistin. *Epicoccum purpurascens* and *Torula herbarum* were obtained only on untreated leaves. With increasing concentration of Bavistin, decrease in fungal population on the leaf surface was observed, the maximum being at 0.5% concentration.

DISCUSSION

In the present study, it was observed that treated leaves with different concentrations of fungicides Bavistin, Dithane M-45 and Blitox showed decrease in the fungal population cm^{-2} leaf surface significantly (Tables 1, 2 and 3) in each sampling. The decrease in the phylloplane mycoflora become increasingly pronounced with the increase in concentration of the fungicides, the maximum being at 0.5%. The inhibitory effect of sprayed residues washed from the leaves on fungal growth has been reported by various workers (Hislop and Cox, 1969; Hislop, 1976; Bainbridge and Dickinson 1972; Dickinson and Wallace, 1976; Rai and Singh 1982). The decrease in the number of fungi cm^{-2} leaf surface and the number of species on treated leaf samplings might be due to inhibitory effect of the fungicides on majority of the species.

The present study revealed that *Curvularia lunata* and *Rhizopus arrhizus* were tolerant to Bavistin, while *Aspergillus niger* and *Nigrospora sphaerica* and *Cladosporium herbarum* were tolerant to Blitox and Dithane M-45 because the population of these fungi were higher on leaves treated with these fungicides in the first sampling itself as compared to control. There may be changes in tolerance of the fungi to fungicides as well as gross changes in the balance of species, since a number of fungi can be trained to tolerate fungicides. The tolerance and susceptibility of fungi to fungicides may be directly attributed to their metabolite producing capacity. The tolerant species which were recorded in the present investigation, seem to have capacity to produce metabolites in excess of their metabolic needs due to which they could overcome the inhibitory effect of fungicides. Significant variations in the effect of the three fungicides on the fungi cm^{-2} leaf surface were noted in the present study. The differences in the effect of the three fungicides might be due to their foliar absorption and translocation (Bainbridge and Dickinson, 1972). The degree of action of fungicides is known to depend also upon the structure and nature of fungi.

Dickinson (1973b) observed that the process of leaf senescence was less rapid in case of treated plants as compared to that of control. In the present study no

gross difference in the rate of plant senescence was observed which would be correlated with fungicide applications.

Maximum reduction in the number of fungi was in second spray of Bavistin and Blitox and third spray of Dithane M-45. Certain fungi, viz. *Alternaria alternata* and *Cladosporium cladosporioides* gradually declined after the first spray of the fungicides and *Aspergillus flavus*, *Curvularia lunata*, *Fusarium oxysporum* and *Trichoderma lignorum* were found to be most susceptible to the fungicides.

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