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EFFECT OF METHYL PARATHION ON *PHASEOLUS AUREUS* ROXB. AND ITS PERSISTENCE IN PLANT AND SOIL[1]

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ABSTRACT

The effect and persistence of the organophosphorus pesticide, methyl parathion on *Phaseolus aureus* Roxb. have been studied. Methyl parathion is toxic to the productivity of the plant even at 10 ppm concentration and *P. aureus* was susceptible to this pesticide.

INTRODUCTION

Organophosphorus pesticides are important class of toxicants capable not only of eradicating disease and improving agricultural production, but also contaminating water, soil and vegetation altering theirq uality and producing adverse effects on man and environment through their movement and persistence, (Middleton, 1965 ; Lichtenstein, 1965; Varma and Pant, 1976; Singh *et. al.*, 1978 ; Veeraval and Bhaskaran, 1979 and Wore *et. al.*, 1980). The present investigation was taken up to establish whether *P. aureus* is susceptible or resistant to methyl parathion by studies on length, biomass and productivity of the plants and the persistence of the pesticide in plant and soil

MATERIALS AND METHODS

Plants of *P. aureus* (local market variety) were grown in 10 m² plots of the botanical garden of Nizam College, Hyderabad, during April-August, 1979. Mean maximum temperature was 40°C and mean minimum temperature was 28°C. They were grown for 105 days. The spraying operations of methyl parathion were conducted when the standing crop was 15 days old. Concentrations of this chemical used were 0.01, 0.1, 1.0, 10.0 ppm. Untreated plants constituted control. Plant and soil samples were collected at definite intervals (30, 60, 75, 90 and 105 days). Studies on the length of the plant (cm), biomass (g/m²) were carried out by Milner and Elfyn Huges (1968) methods. Persistence of methyl parathion in plant and soil was analysed by the following method. Material containing the active ingredient (a.i.) of methyl parathion on refluxion with alkali yields acidity. Methyl parathion is produced as dimethyl thiophosphate which is used as base for the estimation of a.i. of this pesticide. Benzene extracted dried material (Zewig.

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1963) was transferred into 250 ml. flask and were washed with ethanol. 40 ml. of 0.5 N ethanolic KOH was added and refluxed for 4 hours and the condenser was rinsed with a few ml. of distilled water. After cooling, exactly 40 ml of 0.5 N HCI acid was added and excess acidity was back titrated by using standard NaOH at pH 5. Percentage of a.i. persisting in the plant and soil were calculated by Singh's (1978) formula.

RESULTS AND DISCUSSION

Growth parameters, *viz.*, length of the plant, biomass, productivity are presented in the Table I-III and the recovery of the pesticide in Table IV.

Growth was studied in terms of length (Table I). Due to methyl parathion treatment there was a significant increase in the length. Increase in length was more pronounced at 0.01 ppm than at 10 ppm concentration.

There was increase in the biomass (Table II), with increase in age of the standing crop due to methyl parathion treatment. Biomass harvested at 105 days has shown reduction of biomass at 10 ppm almost to half that of control. Productivity (Table III)computed at

TABLE I

EFFECT OF METHYL PARATHION ON LENGTH (CM) OF *P. AUREUS*

Concentration (ppm)	Final harvest
Control	51.0
0.01	65.0
0.10	55.0
1.00	52.0
10.00	56.0

Note : All the values are the averages of 10 observations.

ANALYSIS OF VARIANCE

Source of variation	Sums of squares (SS)	Degress of freedom (d.f.) (n-1)	Mean sum of squares (MSS)	F	Probability (P) 5%	Critical Difference (C. 1% D) 5%
Total	2,201.77	24	—			
Due to Age	1,649.59	4	412.39	50.4**	3.01 4.77	4.286*
Due to Concentration	420.24	4	105.06	12.84**		
Error	130.81	16	8.18			

**Highly significant

Analysis of variance as per original observations drawn for 30, 60, 75, 90 and 105 days age period.

TABLE II

EFFECT OF METHYL PARATHION ON BIOMASS (g/m)² OF *P. AUREUS*

Concentration (ppm)	Age (in days)				
	30	60	75	90	105
Control	18.00	18.15	21.3	102.6	95.7
0.01	20.46	21.60	32.6	99.5	72.3
0.10	17.76	20.97	32.52	88.3	82.8
1.00	18.96	18.36	21.60	57.3	62.4
10.00	18.63	20.94	25.02	61.4	46.5

Note: Each value is the average of 10 observations.

ANALYSIS OF VARIANCE

Source of Variation	SS	d.f	MSS	F	Probability (P) 5%	1%	C.D.
Total	16,671.5	24	—				
Due to Age	6,324.9	4	1581.2	2.79 (N. S.)	3.01	—	—
Due to concentration	1,297.7	4	324.4	0.57 (N. S.)	3.01	—	—
Error	9,048.8	16	565.5				

N. S: Not significant.

TABLE III

EFFECT OF METHYL PARATHION ON PRODUCTIVITY OF *P. AUREUS*

Concentration (ppm)	Productivity (g/m²/day)	Relative Productivity (%)
Control	0.914	100
0.01	0.694	75.9
0.10	0.788	86.2
1.00	0.594	64.9
10.00	0.443	48.5

Computed from the figures of biomass at 105 days.

the final stage of the harvest has revealed 50 percent reduction at 10 ppm (0.443 g/m²/days). Application of methyl parathion with toxaphene was reported to produce significantly higher yield than methyl parathion alone on cotton plants (Mc Garr and Wolfenbarger, 1969; Weaver and Harvey, 1963 and Wore *et. al.*, 1980). However, no significant effects (Niemczyck and Dundar, 1976) and adverse effects (Roajk *et al.*, 1964) due to methyl parathion treatment on cotton plants were also reported.

Recovery of methyl parathion is

TABLE IV

PERCENTAGE RECOVERY OF METHYL PARATHION IN *PHASEOLUS AUREUS* ROXB. ACCORDING TO AGE

Concentration (Low dosage) (ppm)	Plant material				Soil material			
	Days Water treatment				Days Water treatment			
	1	6	15	105	1	6	15	105
10.00	46.9 (4.69)	36.00 (3.6)	35.0 (3.5)	6.6 (0.66)	41.62 (4.162)	38.0 (3.8)	34.25 (3.425)	2.4 (0.24)
1.0	41.5 (0.415)	35.5 (0.355)	26.5 (0.265)	1.0 (0.01)	32.60 (0.326)	30.0 (0.30)	29.11 (0.2911)	2.3 (0.023)
0.1	38.0 (0.038)	28.5 (0.0285)	22.1 (0.0221)	0 —	28.98 (0.02898)	19.0 (0.019)	16.47 (0.01647)	2.0 (0.002)
0.01	36.5 (0.00365)	26.2 (0.00262)	9.4 (0.00094)	0 —	24.63 (0.002463)	15.0 (0.0015)	14.63 (0.001463)	2.0 (0.00020)

Figures in parenthesis are the values in parts per million (ppm.) Each value is the average of 3 observations.

Analysis of variance

Source of Variance		SS	df	MSS	F	P 5% & 1%	CD
PLANT	Total	3,810.00	15	15	—	—	
	Due to age	3,300.8	3	1100.3	74.3**	3.86 6.99	7.105*
	Due to concentration	375.6	3	125.2	8.4 **		
	Error	133.6	9	14.8			
SOIL	Total	2,654.9	15				
	Due to age	1,994.3	3	664.77	54.18**	3.86 6.99	6.469*
	Due to concentration	550.2	3	183.40	14.99**		
	Error	110.0	9	12.27			

SS : Sums of squares
df : degrees of freedom
MSS : Mean sums of squares
F : Ratio of mean sum of squares
P : Probability
CD : Critical difference.

represented in Table IV. Application of lower concentrations (Table IV) between 0.01 to 10 ppm of the pesticide resulted in depletion from 6.6 to zero percent in the plant and almost to 2.0 percent in the soil in 105 days which are below the tolerance level and these observations are almost in line with those of Randolph *et . al.*, (1969) in sunflower and Hoelschber *et. al.*, (1968) in cabbage and peas. However, it is explained that toxicity is more pronounced in wet soil than in dry and adsorption is greater in dry soils with high organic matter content (Niemczyck *et. al.*, (1976). The depletion of the organophosphorus pesticidal residues were observed with age, growth of the plants and weather parameters confirming the earlier results of Sloan *et. al.*, (1951) while working on lettuce, cabbage and trunip greens and Wore *et. al.*, (1980) on cotton and hydrolyse parathion residues faster with high pH and temperature of the soil (Singh *et al.*, 1978).

As not all the plants are resistant to this organo-phosphorus pesticide, *P. aureus* is one such which belongs to this category. Thus, *P. aureus* is a susceptible plant to methyl parathion treatment which affected biomass and productivity and they were reduced to half even at 10 ppm concentration when compared to control.

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