

Responses of *Vigna mungo* to Malathion and Carbendazim-Effect on Carbon and Nitrogen Metabolism

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A time course study of the effect of spray of malathion on 6 day old seedlings of *Vigna mungo* showed a marked decline chlorophyll and reducing sugars in primary leaves. The effect was maximum on day 2 after treatment, but the plants showed rapid recovery on the 8th day. Malathion treatment enhanced nitrogen metabolism in the primary leaves. Treatment of bavistin, however, had no effect on carbon and nitrogen metabolism of the leaves.

Key Words *Vigna* Leaf Malathion Bavistin Carbon Nitrogen Metabolism

In studies on phytotoxicity of pesticides, gross parameters such as per cent germination, growth rates and yield have generally been emphasized (Tomas, 1971; Varma, 1974, Sharma *et al.* 1978). These parameters do not serve as reliable indicators of plant tolerance to pesticides. The possible effect of pesticides on the physiological processes has not been emphasized (Sharma *et al.*, 1978). Information about the pesticides which are effective in controlling crop pests without impairing biochemical parameters of the crop would be of great help from the point of view of plant protection. The present investigation was undertaken to screen malathion, an organophosphorous insecticide, and bavistin, a carbendazim based systemic fungicide for their effect on some biochemical parameters of *Vigna mungo* (L) Hepper, with respect to carbon and nitrogen metabolism.

MATERIALS & METHODS The seeds were sown in earthenware pots, containing garden soil, under natural conditions of light and temperature. The pesticides were sprayed after 6 days of germination. Malathion was used at 0.2, 1 and 2% and bavistin at 0.05, 0.1 and 0.2%. The control plants were sprayed with

distilled water. The primary leaves were collected after 2, 4, 6 and 8 days and thoroughly washed with tap water to remove traces of the pesticide from the leaf. Chlorophyll (Arnon, 1949), reducing sugars (Somogyi, 1952), and nitrogen (Doneen, 1932) were estimated.

RESULTS A time course study of the effects of spray of different concentrations of malathion and of bavistin showed that chl a chl b and total chlorophyll in primary leaves were markedly reduced by malathion (Table 1 and Fig. 1). While its effect was maximum on day 2 after spray, the plants showed rapid recovery, and by 8th day no difference was discernible between

Table 1 Chlorophyll (a-b) in the primary leaves of *V. mungo* at different age after malathion spray

Days after spray	Concentration (per cent) of malathion							
	Control		0.2		1.0		2.0	
	a	b	a	b	a	b	a	b
Start	5.8	2.2	5.8	2.2	5.8	2.2	5.8	2.2
2	6.0	2.6	5.5	2.4	4.6	2.3	3.9	2.1
4	6.0	2.6	5.8	2.5	4.9	2.3	4.5	2.3
6	6.1	2.8	6.1	2.6	5.5	2.6	5.2	2.4
8	6.2	3.0	6.1	2.8	6.6	3.1	6.0	3.0

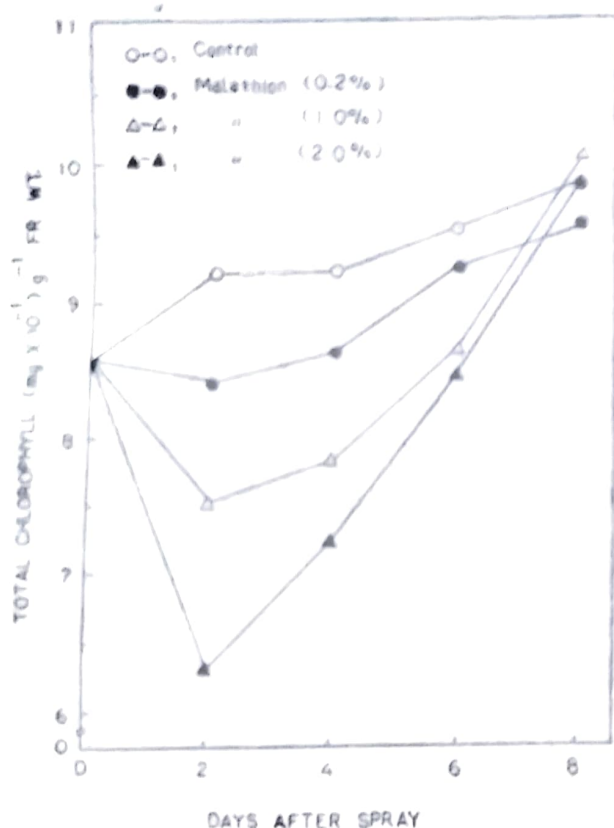


Fig. 1. Total chlorophyll in primary leaves at different age after foliar spray of malathion on 6-day old seedlings of *V. mungo*.

the control and treated plants. But treatment of bavistin did not affect the chlorophyll content of leaves. Malathion treatment also markedly decreased the total reducing sugars over control (Fig. 2), but the effect was dose dependent and was maximum on the 2nd day. The treated plants, however, showed rapid recovery and on the 8th day the sugar content was same as in the control. Bavistin treatment caused no effect.

The nitrogen metabolism of primary leaves was, however, affected by the treatment. The level of ethanol soluble nitrogen in the primary leaves (treated as well as control) varied with age and increased gradually up to 6 days after spray. The alcohol soluble nitrogen increased over the control in 1 and 2% malathion treated plants. This enhancement was concentration dependent and

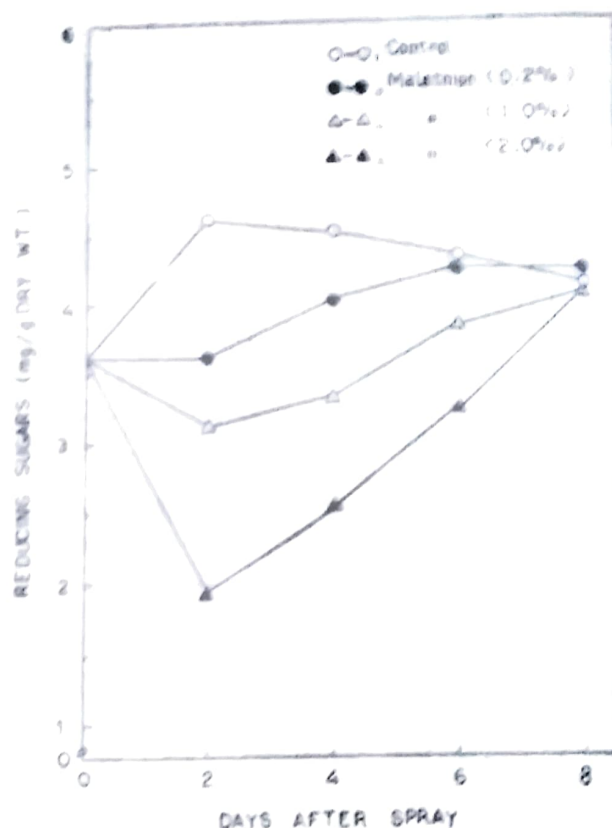


Fig. 2. Total reducing sugars in primary leaves at different age after foliar spray of malathion on 6-day old seedlings of *V. mungo*.

was maximum on the 2nd day followed by a gradual decrease. On the 8th day, the level was almost equal to the control (Table 2). Bavistin had no such effect. The insoluble nitrogen content also increased gradually in the primary leaves up to 8th day after spray. Like soluble nitrogen, the insoluble nitrogen was also enhanced in 1% and 2% malathion treated plants. The trend in changes in the insoluble nitrogen was similar to that observed in soluble nitrogen (Table 2).

Changes in total nitrogen in the primary leaves of control plants and plants treated with malathion and bavistin were similar to those of soluble and insoluble nitrogen in leaves (Table 2).

DISCUSSION The biochemical parameters were affected by malathion. The levels of chlorophyll and reducing sugars were markedly reduced by treatment with malathion, consistent with the

Table 2 Nitrogen fractions in the primary leaves of *V. mungo* at different age after foliar spray with malathion (a = soluble, b = insoluble, c = total nitrogen)

Pesticide	Concentration (%)	Nitrogen fraction (mg g ⁻¹ dry wt)	Days				
			Start	2	4	6	8
Control		a	4.0	4.6	5.1	5.4	5.4
		b	18.2	19.6	20.1	20.6	21.1
		c	22.2	24.0	25.2	26.0	26.5
Malathion	0.2	a	4.0	4.6	5.2	5.4	5.2
		b	18.2	19.8	20.1	20.4	21.3
		c	22.2	24.4	25.3	25.8	26.5
	1.0	a	4.0	5.8	5.6	5.5	5.4
		b	18.2	22.0	21.6	21.3	21.1
		c	22.2	27.8	27.2	26.8	26.5
	2.0	a	4.0	6.3	6.0	5.7	5.4
		b	18.2	24.0	23.5	22.5	21.3
		c	22.2	30.3	29.5	28.2	26.7

findings of Belyaeva (1974) and Belyaeva & Lukpanov (1975).

Increase in nitrogen fractions of plants treated with malathion agreed with the findings of Zelena (1977). Chandra & Mathur (1986) reported enhanced activity of nitrate and nitrite reductase and some nitrogenous metabolites (total amino acids and protein) in the malathion treated plants.

Interestingly, the treated plants, regardless of the concentration readjusted to the biochemical parameters during growth. Whether these changes are associated with decline in the active concentration of the insecticide is not known. However, the mode of action of bavistin on *Vigna* continues to be a moot question.

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