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Effect of Two Organophosphorus Insecticides on Survival of *Azotobacter chroococcum* Beij. in Soil and their Degradation *in vitro* *

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The insecticides Disyston (disulfoton) and Dasanit (fensulfothion) at the normal (5 ppm) and the higher (10 ppm) concentrations adversely affected the survival of Azotobacter cells inoculated into soil for 20 days but the population built up thereafter. However, the subnormal (2 ppm) level of the insecticides showed no significant effect on the survival of the organism in the soil. The organism degraded the insecticides *in vitro* in a short period and also utilised them as the sole nutrient source.

Present day agricultural practice encourages application of enormous quantities of pesticides for crop protection. These pesticides are likely to accumulate in soil as residues over a long period of continuous application and interfere with the most vital microbiological activities in soil. (Balasubramanian *et al.*, 1973, Balasubramanian and Siddaramappa, 1974; Balasubramanian and Gita Nilakantan 1976). The effect of several pesticides on the soil microorganisms has been reported by several workers (Gaur and Mishra, 1970; Sreenivasulu and Rangaswami, 1973). Very little information is available on the effect of the insecticides Disyston (disulfoton) and Dasanit (fensulfothion) on the survival of the beneficial group of microorganism *Azotobacter chroococcum* Beij in soil and their interaction with the insecticides. The present report deals with this aspect of study.

MATERIAL AND METHODS

The isolate *Azotobacter chroococcum* Beij employed in the present studies was obtained from the culture bank of microbiology laboratory, Department of Biology, Tamilnadu Agricultural University. The original culture was transferred to Waksman 77 agar slants and used for further studies.

(i) Survival of A. chroococcum in soil as influenced by the insecticide

Five hundard g of red soil (organic C 0.682% total N 0.07% and pH 7.2) passed through a 2 7 mm sieve was taken in each of the 1 L glass bottles

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with wide mouth. The soil was mixed thoroughly with 2.5 and 10 ppm of Disyston and Dasanit and inoculated with 5 ml quantity of a cell suspension (approximately 1×10^6 cells per ml) of *A. chroococcum*. The bottles were covered with polythene sheet and the moisture level was adjusted to 50 per cent of the maximum water holding capacity and incubated at 28 ± 2°C. Soil samples were taken at 10 day interval for 60 days and the population of *A. chroococcum* was enumerated by the serial dilution technique (Allen, 1953) using Waksman 77 medium.

(ii) Degradation of the insecticides by A. chroococcum

One ml of a 72 hr old inoculum was transferred to flasks containing 9 ml of Waksman 77 medium with only 0.25 per cent mannitol and 1000 ppm of the insecticides (1.00 ml of pure technical material of disulfoton and fensulfothion added to the medium to obtain 1000 ppm concentration). Two replications were maintained in each treatment and the uninoculated medium served as control. The flasks were incubated for 8 days at 28°C after which the bacterial cells from the culture fluid were centrifuged off and the supernatant was analysed for the insecticide residues as per the method of Schumann and Olson (1964).

RESULTS AND DISCUSSION

Disyston and Dasanit at 2 ppm concentration stimulated the population of *A. chroococcum* in soil while at 5 and 10 ppm concentrations reduction in the population was observed upto the 20th day of incubation after which the population built up to the maximum on the 30th day. The initial (Table I) suppression of the *A. chroococcum* population with the higher concentrations of the chemicals may be due to their toxicity. The subsequent stimulation in the population of the organism may probably indicate the degradation of the insecticides and also their utilization by the organism as a nutrient source.

While Gaur and Mishra (1970) observed adverse effect on the *Azotobacter* population in the soil treated with sevin on the first day of incubation but not later. Sreenivasulu and Rangaswami (1973) reported that Disyston and Dasanit at 20 ppm concentration significantly increased the *Azotobacter* population in the soil.

The results on the degradation of the insecticides *in vitro* by *A. chroococcum* indicated that nearly 70.75 per cent of disulfoton and 59.45 per cent of fensulfothion were degraded within a period of 8 days (Table II). Hence, it was clear that *A.chroococcum* degraded these inscticides in

TABLE I Effect of two organophosphorus insecticides on survival of *Azotobacter chroococcum* in soil

(Population expressed in 10^3/g moisture free soil.)

Treatment	Initial	10th day	20th day	30th day	40th day	60th day
No insecticide (control)	12.7	20.2	26.0	21.1	16.0	8.7
Disyston 2 ppm	13.7	20.1	23.5	21.6	17.8	11.4
,, 5 ppm	14.3	13.8	19.2	21.0	16.5	9.9
,, 10 ppm	13.1	10.9	27.3	33.9	24.2	15.1
Dasanit 2 ppm	13.6	19.3	24.2	20.0	18.4	10.5
,, 5 ppm	13.4	12.2	20.2	21.4	20.4	11.7
,, 10 ppm	14.3	11.6	29.4	35.1	29.6	12.5

	S.E	C.D (P=0.05)
Chemicals	0.153	0.433
Doses	0.153	0.433
Stages	0.305	0.866

TABLE II Degradation of the insecticides by *A. Chroococcum in vitro*

Treatment	Insecticide residue in ppm		*Insecticide degraded %
	Uninoculated medium	Inoculated medium	
Disulfoton	811.32	237.36	70.75
Fensulfothion	846.62	343.31	59.45

*Insecticide degraded over a period of 8 days.

a short period. Kandasamy *et al* (1976) reported that *Azotobacter* degraded and metabolised Dasanit (fensulfothion) in the growth medium. Kandasmy *et al* (1974) have also reported that certain other organophosphorus insecticides viz fenthion, malathion, phosphamidon, phorate and parathion were also utilised as sole source of phosphorus by *Azotobacter*. Narayanan (1977) has demonstrated that *A. chroococcum* urilised the insecticides disulfoton and fensulfothiod as the sole source of phosphorus and sulphur in the medium. Hence, it may be concluded from the results that though the survival of *A. chroococcum* in soil was adversely affected initially by the normal and higher concentrations of Dasanit and Disyston, the bacterium not only degraded the chemicals in a short period but also utilized them as nutrient sources for their proliferation.

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