Pakistan J. Sci. Ind. Res., Vol. 29, No. 6, December 1986

EFFECT OF DDT ON SOIL MICROORGANISMS ISOLATED FROM PUNJAB PADDY FIELD

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(Received December 12, 1984; revised July 20, 1986)

Comparison between the application of DDT technical 70 % and DDT formulation 50 % WP at recommended dose (1 kg/ha) indicates a similar level of retardation of microbes, showing only 20-30 % growth as compared to control.

Tolerance study indicated that *B. apairius* and *S. epidermidis* can stand DDT formulation up to 200 times higher than the normal field application rate, whereas *B. megaterium, B. subtilis* and *B. circulans* showed minimum tolerance to DDT's normal field application rate.

Key words: Insceticides DDT; Soil Bacteria; Paddy Field; Plate Dilution Methods.

INTRODUCTION

Since the soil microbial population reflects the fertility levels of the soil, studies on the harmful effect of DDT on soil microbes are of great importance. Several workers have studied the influence of pesticides including DDT on soil microbes. Gaur *et. al.* [1] found that DDT used in different concentration had no adverse effect on the nitrification rate in soil. Ko and Lockwood [2] found that DDT at concentration as low as 1 or 10 ppm was highly toxic to soil bacteria and actinomycetes in culture but found little effect on total microbial members in soil by DDT and DDD. Solanius [3] found that treatment of forest soil with massive doses of DDT and fenitrothion did not alter the population number or the respiration of the soil microflora. Martin [4] observed that repeated applicaiton of DDT to a sandy loam soil produced no measurable effect on soil bacteria and fungi count. Hugate [5] found that the growth of *B. succinogenes* and *Ruminococcus albus* was inhibited by DDT at the 100 μg/ml level. Collin *et al.* [6] reported that 50 μg/ml of DDT in media affected the growth of *E. coli* and 50-100 μg/ml was inhibitory to growth of *P. fluorescens*. Pathak [5] tried DDT, Chlordane, BHC and Aldrin upon soil at the rate of 50-100 lb/acre and reported that none on the chemicals reduced the bacterial and fungal population.

The present studies were undertaken to assess and to determine the applicaiton rate of DDT, which may not cause adverse effect on the total soil population of local microbial fauna consisting of beneficial bacteria also. This was considered necessary as DDT is widely used in Pakistan on various crop, alone or in combination, being an indigenous, easily available and cheap product.

MATERIALS AND METHOD

Material used. (a) Soil: Collected from Kala Shah Kaku (Punjab) paddy field ; (b) Nutrient agar: Oxoid; (c) Petri plates: 9 cm dia; (d) Acetone: Distilled; (e) DDT: 50%WP and 75% WP; (f) DDT: Technical 70%; (g) Test tubes; (h) Conical flask: 250 ml capacity; (i) Distilled water.

Method and treatment. Soil analysis was done by the Dilute Plate Culture Technique (Waksman) [8]. Treatments made for carrying out the investigations are as follows:

(A) Control:	(a) Without pesticide.
	(b) With acetone.
(B) DDT 70% Technical:	(a) 0.0015 g a.i./63.64 sq. cms (area of petri plate) equivalent to the recommended dose of 1 kg/ha.
(C) DDT 50%WP:	(a) 0.0015 g a.i./63.64 sq. cms. = (recommended dose of 1 kg/ha).
	(b) 0.01 g a.i./63.64 sq. cm.
	(c) 0.02 g a.i./63.64 sq. cm.
	(d) 0.03 g a.i./63.64 sq. cm.
(D) DDT 75%WP:	(a) 0.01 g a.i. as active ingredient/6 ml media in tubes.
	(b) 0.02 g " " " "
	(c) 0.03 g " " " "

(d) 0.04 g " " " "
(e) 0.05 g " " " "
(f) 0.1 g " " " "
(g) 0.15 g " " " "
(h) 0.2 g " " " "
(i) 0.25 g " " " "
(j) 0.0015 g " " " "

The insecticide is added in petri plates, the melted cooled medium was poured in the plates and incubated at room temperature. (30° – 32°). Growth was observed colonies counted after 24, 48 and 72 hr. and percentage calculated by comparing with the control. The experiment was run in triplicate. Apart from this study tolerance limits to DDT formulation were studied side by side, by selecting eight different colonies from untreated plates (control) and four colonies from DDT treated (0.03 g a.i.) plate which were then transferred on nutrient agar slants for pure culture isolation.

20-30 % growth as compared with control. As the dose is increased 10-30 times from the recommended dose, a gradual decrease in population is apparent (Fig. 2). Observations recorded after 24, 48 and 72 hr. of insecticide applications show gradual increase in growth. Results of the second part of the experiment presented in Tables 1 and 2 shows that out of eight isolates, only 2 isolates G and L tolerated DDT at a very high rate, whereas D, J and E showed 25 % tolerance to the recommended dose after 72 hr. of incubation. 100 % tolerance was indicated by A and K. H tolerated DDT upto 50 times of the normal field applicaiton rate. Out of four bacteria isolate from DDT treated plate, only M showed high tolerance to DDT and the rest three (i.e. N, O and P) tolerated upto 50 times higher than the recommended dose of the insecticide.

From these results it can be concluded that at normal field rate of application DDT has 65 % impact on soil microorganisms and at 30-50 times higher than normal rate of field application show 85 % impact. The bacteria

Table 1. Bacteria isolated from soil and their tolerance to DDT 50%WP.

S. No.	Name of Bacteria	DDT Tech. .0015 g/ 6 ml	DDT Formulations* .0015 g/ 6 ml	.01 g/ 6 ml	.02 g/ 6 ml	.03 g/ 6 ml	.04 g/ 6 ml	.05 g/ 6 ml	0.1 g/ 6 ml	0.15 g/ 6 ml	0.2 g/ 6 ml	0.25 g/ 6 ml
1.	*Bacillus apiarius*	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
2.	*Staph epidermidis*	+++	+++	+++	+++	+++	+++	+++	+++	+++	++	++
3.	*Bacillus laterosporus*	+++	+++	+++	+++	++	++	++	–––	–––	–––	–––
4.	*Bacillus epiphytus*	+++	+++	–––	–––	–––	–––	–––	–––	–––	–––	–––
5.	*Micrococcus luteus*	+++	+++	–––	–––	–––	–––	–––	–––	–––	–––	–––
6.	*Bacillus megaterium*	+	+	–––	–––	–––	–––	–––	–––	–––	–––	–––
7.	*Bacillus subtilis*	+	+	–––	–––	–––	–––	–––	–––	–––	–––	–––
8.	*Bacillus circulans*	+	+	–––	–––	–––	–––	–––	–––	–––	–––	–––

* Insecticide/agar (w/v)

Key = +++ – Maximum growth.
++ – Medium growth.
+ – Minimum growth.

Individually these identified bacteria were studied for their tolerance to different doses of DDT increasing from the recommended doses by adding the insecticide to the medium and observing the growth up to three successive days. The results are presented in Tables 1-2.

RESULTS AND DISCUSSION

Results presented in Figs. 1-2 indicate that DDT technical and its formulations equally affect population of bacteria. Comparison between the application of both types of the insecticide at recommended doses indicate a similar level of retardation of microbes, showing only

Table 2. Tolerance study with bacteria isolated from DDT 50%WP (0.03 g) treated petridish.

S. No.	Name of Bacteria	DDT Formulations* .04 g	.05 g	0.1 g	.15 g	.20 g
1.	*Staph epidermidis*	+++	+++	+++	+++	+
2.	*Bacillus fastidiosus*	+++	+++	–––	–––	–––
3.	*Bacillus freudenreichii*	++	+	–––	–––	–––
4.	*Micrococcus varians*	++	+	–––	–––	–––

* Insecticide/agar (w/v)

Key = +++ – Maximum growth
++ – Medium growth
+ – Minimum growth

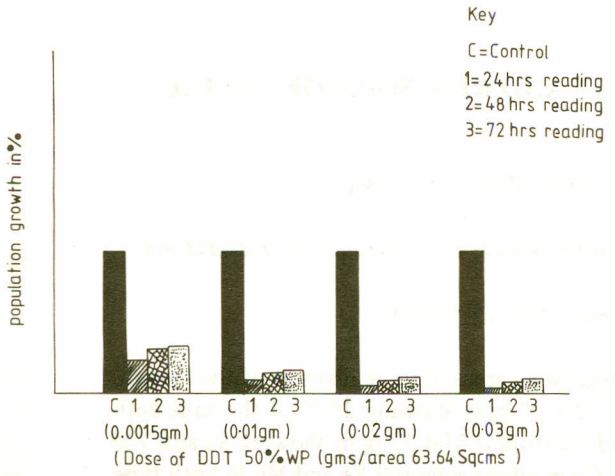

Fig. 1. Effect of DDT 50% WP on total soil bacterial population at the recommended rate and 10-30% high rate.

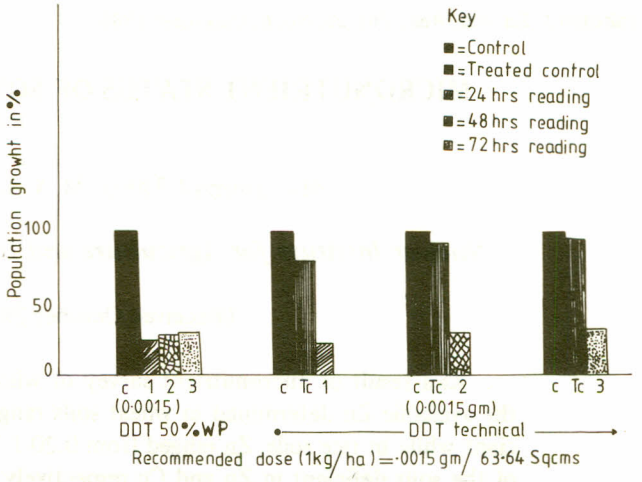

Fig. 2. Comparison of the effect of DDT, Technical DDT, formulation (50 WP) on the total soil population (bacterial) at the recommeded rate (1 kg/ha).

isolated from soil for the tolerance study were identified as:

A = *Bacillus epiphytus*
D = *B. megaterium*
E = *B. subtilis*
G = *B. apiarius*
H = *B. laterosporus*
J = *B. circulans*
K = *Micrococcus luteus*
L = *Staph epidermidis*
M = *Staph epidermidis*
N = *B. freudenreichii*
O = *B. fastidiosus*
P = *Micrococcus varians*

Acknowledgement: The authors gratefully acknowledge the help they received from Mr. Shakeel Ahmed Khan, M.Sc., Cooperative Lecturer, Department of Microbiology, Karachi University, in the identification of bacteria, isolated from soil.

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