PHYTOTOXICITY AND MAMMALIAN TOXICITY OF MAKROLIN IN COMPARISON WITH OTHER CHLORINATED INSECTICIDES

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Investigations were carried out to find the phytotoxicity of Makrolin. Young tomato and bean plants were used. One ml. of 3% solution of Makrolin in acetone was sprayed separately on each plant. Results showed that Makrolin gave low phytotoxicity, but was less phytotoxic than D.D.T., B.H.C., Aldrin and Dieldrin.

Male white rats were used for investigating the mammalian toxicity of Makrolin. It was found that 3200 mg./kg. were required to get oral LD_{50}. Hence it is less toxic than D.D.T., Aldrin, Dieldrin, Heptachlor, B.H.C. and Toxaphene against mammals.

Introduction

Makrolin is a newly developed pesticide of the Central Laboratories, P.C.S.I.R., Karachi. As it is essential to find out the phytotoxicity and mammalian toxicity of a new insecticide before introducing it for controlling plant and household insects investigations were carried out to find out the phytotoxicity of Makrolin on young bean and tomato plants of known age, and also its mammalian toxicity against the male white rats of the same age. Later the toxic effects of Makrolin were compared with the toxicity of other chlorinated insecticides against plants and rats.

Material and Methods

Taking into consideration the normal dosages, applied in field experiments, 3% solutions of Makrolin, Heptachlor, Aldrin, Dieldrin, Chlordane, D.D.T. and B.H.C. were prepared in acetone for phytotoxic studies. The test plants used were beans, *Dolichos lablab* Linn. and tomatos, *Lycopersicum esculentum* Mill. The plants were one month old and grown under identical environments of the growing media. One ml. of each formulation was sprayed from a distance of one foot through the open side of the closed chamber. The pots were rotated by hands in order to ensure uniform spraying throughout the plants. The experiments were run in triplicates along with a control to compare the results of phytotoxic effects resulting from chemical spraying on the plants. After this treatment, the plants were kept in open plots under the direct exposure of sunlight and other weather conditions. The final readings were taken after 72 hours.

To find out the toxic effects of Makrolin on root growth, the plants were grown in the nutrient solutions described by Hoagland and Arnon.[1] Different concentrations of Makrolin ranging from 1000 to 5000 p.p.m. were added to the nutrient solutions and observations were taken up to 15 days.

To find out the mammalian toxicity of Makrolin, albino male rats were used in the experiments. The rats were reared under standard conditions of environment, temperature and diet. All the four arms of the rat were fastened to an operation table. The mouth was held in an open position by the help of two strings to hold the upper and lower jaws separately. A sterilized polyethylene tube of 1 mm. diameter was passed through the mouth of the rat to reach up to the stomach. A measured quantity of Makrolin was released into the stomach through this tube by the help of a syringe. Syringes made by Fritz Kulm, Frankfurt, of 0.25 ml., No. 3765 and 0.5 ml., No. 3256 were used to give measured quantities of Makrolin. In order to ensure that all the quantity of Makrolin has reached the stomach, 0.2 ml. saline was also passed through the tube after releasing Makrolin each time. Different dosages of Makrolin ranging from 100, 150, 300, 600, 1000, 2000, 4000, 5000, 6000 and 7000 mg./kg. body weight were given to the rats orally through the sterilized polyethylene tube. Five rats were used for each dosage along with a control. The experiments were run in triplicates.

Results and Discussion

Phytotoxic Effects.—After spraying the plant with different concentrations of insecticide formulations, in some cases leaves showed up black spots due to the chemical reaction. These phytotoxic effects were divided into three categories, low, high, and beyond recovery, according to the criteria that when a leaf showed three or less black spots, each of less than 1/2 cm. square area, the effect was put under the category of low phytotoxicity. When the leaf showed more than three spots, they were included in the grade of high

phytotoxicity, and when the leaf was completely burned and could not recover within 3 days, they were put under the class of "beyond recovery" phytotoxicity.

The phytotoxic effects of Makrolin with other chlorinated insecticides have been compared in and it was found that none of the insecticides gave high phytotoxicity or phytotoxicity beyond recovery, but at the same time they all showed low phytotoxic effects against young tomato and bean plants.

Other workers like Brown[2] and Martin[3] have reported low phytotoxic effects of D.D.T. under normal dosages to various *Cucurbitaceaes*, young tomato and bean plants. Kostov[4] and Smyth[5] found that low concentrations of B.H.C. showed phytotoxicity and Boswel[6] investigated that Aldrin and Dieldrin were found more toxic to plants than D.D.T. and Chlordane. Similarly other chlorinated insecticides were also reported to give low phytotoxicity at normal dosages of application. The present investigation showed that 3% concentration of D.D.T., Heptachlor, B.H.C., Chlordane, Aldrin, Dieldrin and Makrolin also gave low phytotoxicity against young tomato and bean plants, but Makrolin was found to be less phytotoxic than others.

Thurston[7] investigated that the root growth of valentine bean seedling was completely suppressed at 10 p.p.m. of B.H.C. in nutrient solution and Wilson[8] found that 30 p.p.m. of B.H.C. inhibited the growth of legumes but it was found that 1000 p.p.m. concentration of Makrolin in nutrient solution did not affect the growth of bean roots.

Boswel[6] found marked injury to seed germination due to B.H.C. treatment of bean and corn seeds, and he also reported the injury to seed germination after Chlordane treatment of the soil, but the direct treatment of wheat and corn seeds with Makrolin did not inhibit the seed germination.

Thus it was concluded that Makrolin is less phytotoxic than D.D.T., Aldrin, Dieldrin, B.H.C., Chlordane, Heptachlor and Dilan,[9] and it does not check the growth rate of seed germination at low dosages.

Mammalian Toxicity.—The mammalian toxicity results showed that 1-400 mg./kg. body weight of the rat did not give any mortality up to 10 days. The oral LD_{50} values of Makrolin along with D.D.T. and B.H.C. were done experimentally under standard laboratory conditions. It was

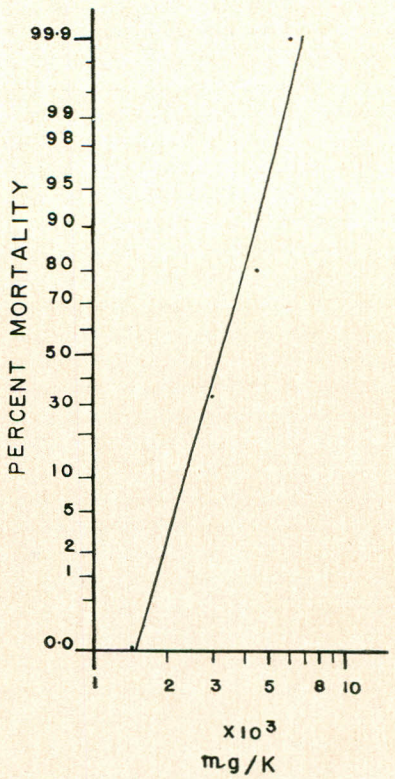

Fig. 1.—LD_{50} value of Makrolin against white rat.

found that in the case of D.D.T. and B.H.C. the oral LD_{50} values for albino rats were within the difference of 0.5 to 1 ± as compared with the values already reported. Hence the oral LD_{50} values found by other workers were added for comparative account. It was found that LD_{50} for male white rats was 3200 mg./kg. of the body weight. For other chlorinated insecticides, Metcalf[10] reported 67, 87, 590 mg./kg. oral LD_{50} for Aldrin, Dieldrin and chlordane, respectively. Lehman[11] showed 69 and 4000 mg./kg. oral LD_{50} of Toxaphene and Dilan for rats. Fitzhugh et al.[12] and Philips et al.[13] have reported 135 and 800 mg./kg. oral LD_{50} of Heptachlor and D.D.T., respectively.

By comparing the results of other chlorinated insecticides, it was found that Makrolin is of low mammalian toxicity than Aldrin, Toxaphene, Dieldrin, Heptachlor, B.H.C., Chlordane and D.D.T., Hansen[14] had also reported that Makrolin is less toxic than D.D.T. to the rats.

Therefore, it can be concluded that Makrolin is safer to be used to control pests in houses and fields where human beings and animals may come into contact with it.

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