TOXICITY OF PETKOLIN TO PLANTS AND RATS, AS COMPARED WITH OTHER CHLORINATED INSECTICIDES

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Toxicity of Petkolin and certain other chlorinated insecticides has been tested on wheat, maize, sugar cane, cotton and certain vegetables. Petkolin, Makrolin, Heptachlor and Methoxychlor were not toxic at 3% concentration, while DDT, Aldrin, Dieldrin, BHC, Toxaphene and Chlordane showed toxicity. At the same concentration the toxicity of Endrin was much higher than that of the other insecticides tried. At 5 percent concentration, Petkolin was non-toxic while Heptachlor, Methoxychlor and Makrolin were found toxic to plants.

Toxicity of Petkolin, in comparison with Makrolin, DDT and BHC, has been studied on albino rats by means of subcutaneous injection. The LD_{50} values for Petkolin, Makrolin, DDT and BHC were 9000-11000, 9000, 1800 and 70 mg./kg. body weight of the rat, respectively.

In continuation of previous work, [1,2] the chlorinated petroleum products named as Petkolin-A and Petkolin-S[3]* have been tested for their toxicity to certain common plants and rats.

Material and Methods

Toxicity to Plants.—Toxicity of Petkolin, Makrolin and other chlorinated insecticides was tested on Wheat, *Triticum aestivum* Linn; Maize, *Zea mays* Linn.; Sugar cane, *Saccharum officinarum* Linn.; Cotton, *Gossypium hirsutum* Linn.; Tomatoes, *Lycopersicum esculentum* Mill.; Cabbage, *Brassica oleracea* Linn.; Beet roots, *Beta vulgaris* Linn.; Bean, *Dolichos lablab* Linn.; Mung bean, *Phaseolus aureus* Roxb.; Smooth gourd, *Luffa aegyptiaca* Mill.; and Pumpkin, *Cucurbita maxima* Duch. These experiments were conducted in a green house, on plants grown in pots, and also under field conditions, where seedlings were transplanted in small plots of 10′×10′ each plot consisting of about twenty-five to thirty plants. Experiments were carried out at different stages of growth. The first spraying was done one month after transplantation, the second after an interval of two weeks and the third when the plants were two-month old.

The normal strength of insecticides, used in the field, generally range from 0.01 percent to 3 percent. In the present investigation, Petkolin and Makrolin were used in 3 percent to 5 percent concentration. The insecticides were applied in the form of emulsions in water and also as solutions in acetone. The toxicity of these insecticides was compared with Aldrin, Dieldrin, Heptachlor, Methoxychlor, Chlordane, BHC, DDT and Toxaphene (Technical grades).

All experiments were conducted in triplicate along with a control. To find the toxic effects of Petkolin on root growth of the plants, nutrient culture solution technique as described by Hoagland and Arnon[4] was employed. Different concentrations of Petkolin, ranging from 10 to 50 ppm. dissolved in acetone, were added to the nutrient solutions and observations were made at intervals of one week.

The insecticides which did not cause any injury were classed as *Non-toxic*. Those which produced slight to moderate injury, the plants recovering after one week, were grouped as *Toxic*, and where the test plants did not recover, the insecticides were classified as *Highly-toxic*.

Toxicity to Mammals.—Toxicity of the chlorinated insecticides was tested upon male white rats through subcutaneous injection. Six cages with five rats in each cage, were under observation. Petkolin-A, Petkolin-S and Makrolin were injected subcutaneously at 2, 4, 6, 8, 10 and 12 ml. per kilogram body weight of rat. A 10 percent solution of DDT was prepared in absolute alcohol and 2, 4, 6, 8 and 10 ml. of the solution per kilogram body weight of rat were injected. In case of BHC 1 percent solution of alcohol was used and 1, 2, 4, 6, 8 and 10 ml. of the solution per kilogram body weight of rat were injected. Male white rats of the same age were used and their body weight was in the range of 350 to 450 g. The readings were taken after every 24 hours, for six weeks, continuously.

Results and Discussion

Toxicity to Plants.—The toxic effects of Petkolin on plants as compared with other chlorinated insecticides have been presented in Table 1. It was found that all the tested insecticides in 3 percent concentration did not cause high-toxicity to any of the plants tried. Some of the insecticides were non-toxic, while others showed slight to moderate toxicity towards

*Petkolin—A and —S have been obtained through the chlorination of petroleum cuts in the boiling range of 35-155°C.

some plants. The symptoms which appeared on plants on account of slight to moderate toxicity of the insecticides were classified as follows: (1) Slight necrosis on the surface of the leaves. (2) Chlorosis and mottling. (3) Tip burn of the leaves.

TABLE 1.—TOXICITY OF PETKOLIN AND OTHER CHLORINATED INSECTICIDES, TO CERTAIN PLANTS.

Plants tested	Insecticides	Toxicity
Maize ..	Endrin	+
Wheat		
Sugar cane ..	Aldrin	+
Tomato		
Smooth gourd ..	Toxaphene	+
Pumpkin		
Beans ..	Dieldrin	+
Beet root		
Cabbage ..	Heptachlor	—
Cotton		
	BHC	+
	Chlordane	+
	DDT	+
	Methoxychlor	—
	Petkolin-A	—
	Petkolin-S	—
	Makrolin	—

(— Negative, + Present)

The symptoms of injury to plants resulting from insecticides were of short duration and the plants generally recovered after one week of spraying, except in the case of necrosis. Endrin produced tip burning on the leaves of maize and wheat; and caused necrosis on the leaves of smooth gourd, pumpkins and tomatoes. Aldrin produced less toxic effects on the young leaves of tomato, maize and wheat as compared to beans, cabbage and cotton. Dieldrin produced chlorotic spots on the tip of the leaves of wheat, maize, sugar cane, tomato and cotton. Heptachlor caused no toxic effects on the above tested plants. BHC and Toxaphene produced chlorosis and tip burning on young leaves of maize, wheat, tomato, and gourds; however, they were less toxic to the leaves of cotton, beans, sugar cane and cabbage. Chlordane caused minor tip burning and DDT produced slight chlorotic spots on the leaves of tomato, bean, cotton and wheat. Cabbage leaves were also slightly effected. Methoxychlor, Petkolin and Makrolin were found non-toxic to all the tested plants.

The present investigation indicated that Endrin was more toxic than Aldrin, Dieldrin, BHC and DDT. Dieldrin was more toxic than DDT, Chlordane and Toxaphene. The toxic effects of BHC were higher than those of DDT. Petkolin, Makrolin, Heptachlor, and Methoxychlor were found non-toxic at 3 percent concentration. Methoxychlor, Heptachlor and Makrolin produced toxic effects at 5 percent concentration, while Petkolin at this concentration was still found non-toxic. The results were in confirmation of the studies of Brown,[5] Martin,[6] Kostov,[7] Smyth[8] and Boswel[9] in respect of the known chlorinated insecticides.

10 ppm. Petkolin in nutrient solution did not at all effect the growth of tomato plants while the growth of valentine bean seedlings was completely suppressed at 10 ppm. of BHC.[10,11]

The effect of Petkolin on seed germination has also been investigated. The seeds of cotton, wheat, maize, beans and tomatoes were soaked in 5 percent solution of Petkolin, DDT, BHC, Aldrin and Chlordane prepared in acetone. There was no inhibitory effect of Petkolin on seed germination of maize, cotton, wheat, beans and tomatoes. The growth of beet roots after Petkolin treatment of the soil was also normal. Boswel 9 reported marked injury to seed germination as the result of BHC treatment of beans and maize seeds; and also found that the seed germination was markedly inhibited after treating the soil with Chlordane. Thus it is concluded that Petkolin is less toxic to plants than DDT, Aldrin, BHC, Chlordane, Methoxychlor, Heptachlor and Makrolin.

Toxicity to Mammals.—The results of toxicity of Petkolin and Makrolin to rats have been presented in Table 2. It was found that the percent

TABLE 2.—SHOWING PERCENT MORTALITY AFTER TWO WEEKS, OF MALE WHITE RATS AS THE RESULT OF TOXICITY OF PETKOLIN AND MAKROLIN.

Concentration	Percent mortality after two weeks		
	Petkolin-A	Petkolin-S	Makrolin
1. 5660 mg./kg.	0.0	0.0	0.0
2. 8490 mg./kg.	40	40	40
3. 11320 mg./kg.	40	60	60
4. 14150 mg./kg.	60	100	100
5. 16980 mg./kg.	80	100	100
6. Control	0.0	0.0	0.0

mortality on account of the subcutaneous injection of these insecticides remained the same after six weeks as after two weeks. Therefore, the results obtained after two weeks of experimentation are presented in Table 2. The calculated LD_{50} values of Petkolin-A, Petkolin-S, Makrolin, DDT and BHC have been reported in Table 3. In the

TABLE 3.—SUBCUTANEOUS LD50 VALUES OF PETKOLIN, MAKROLIN, DDT AND BHC AGAINST MALE WHITE RATS AFTER TWO WEEKS.

Insecticides	LD50 (mg./kg. body weight)
1. Petkolin-A	9000
2. Petkolin-S	11000
3. Makrolin	9000
4. DDT	1800
5. BHC	70

present investigations, the LD_{50} values for Petkolin, Makrolin, DDT and BHC were 9000-11000, 9000,1800 and 70 mg./kg. body weight of rat respectively. Cameron and Burgess[12] reported LD_{50} for DDT to be 1500 mg./kg. against white rats and Dallemagne and Phillipot,[13] 50 mg./kg. for BHC. It is concluded that Petkolin is very likely safer to use against mammals than Makrolin, DDT and BHC.

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