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THE RESIDUAL TOXICITY OF PETKOLIN IN COMPARISON WITH PHOSALONE AND DDT

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The residual life of Petkolin, Phosalone [*O,O*-diethyl-*S*-(6-chlorobenzoxazolone-3-ylmethyl) phosphorodithioate] and DDT alone and Petkolin + 15% Phosalone mixture was determined by using three to four-week old adults of red flour beetle, *Tribolium castaneum* (Herbst).

At 90°F and a R.H. (relative humidity) of 55% ± 5% filter papers treated with Petkolin, Phosalone, DDT and Petkolin + 15% Phosalone mixture remained toxic for 4, 4, 161 and 28 days respectively.

Petkolin was compatible with Phosalone in the present formulation and the residual life of the mixture was longer than that of both the component insecticides.

The environmental conditions play an important role on the residual life of insecticides. Results reported by other workers indicate the importance of physical factors of the environment in relation to residual life. Sweetman[1] reported that temperature in the range of 90°F–102°F with high humidity conditions decreased the residual life of DDT. Burgess and Sweetman[2] also reported similar findings. Teotia and Dahm[3] reported that hign temperature and low humidity shortened the residual life of a number of insecticides more than low temperature and high humidity.

Keeping in view the results of residual toxicity of insecticides reported by the above workers in different environmental conditions, the present investigation was undertaken to determine the residual life of Petkolin, Phosalone (Zolone) and DDT at 90°F and 55% ± 5% R.H. in the laboratory by using *Tribolium castaneum* (Herbst). A mixture of Petkolin + 15% Phosalone was also included for the residual evaluation as the same formulation was being tried for its compatibility and efficacy against different pests of field crops.

Procedure

The test insect used was red flour beetle, *Tribolium castaneum* (Herbst) which was reared in the insectary as described by Peterson.[4] Three to four-week old adults were used throughout the period of evaluation.

Two test dilutions of each of the three insecticides and one mixture were made in acetone. To test the persistence of the insecticides 1 ml of acetone solutions of the insecticides were spread evenly on 9 cm circles of No. 1 Whatman filter papers. Two concentrations were used for each insecticide, 2% and 5% for Petkolin and DDT, and 7% and 10% for Phosalone, and a solution of 15% Phosalone in Petkolin. In all 16 papers were treated, two with each concentration of each insecticide. The filter papers were kept in petri dish halves and were dried for 24 hr in the same laboratory in which the bioassay was made. After drying, the treated filter papers were kept in marked petri dishes which were placed in a desiccator whose humidity was adjusted at 55% ± 5% R.H. by saturated solution of calcium nitrate. The desiccator was kept in a constant temperature cabinet maintained at 90°F ± 2°F.

For each test 40 beetles (3–4 week old) were exposed for 3 hr to each of the 16 treated filter papers. Following exposure, the beetles were transferred to clean petri dishes and held in the laboratory for 24 hr after which the mortality counts were made. Mortality was recorded daily for the first seven days in all the cases. Then once a week in the cases of Petkolin, Phosalone and Petkolin + 15% Phosalone mixture and at intervals of 3 weeks in the case of DDT. Acetone check and untreated control were also kept with each set of the experiment and the mortalities were corrected by using Abbott's formula.[5] After each test the filter papers were returned to the desiccator to be stored in the controlled temperature cabinet till the time of next exposure.

Results

The residual toxicities of Petkolin, Phosalone and DDT alone and a mixture of Petkolin + 15% Phosalone stored at 90°F and 55% ± 5% R.H. diminished at different rates.

Petkolin.—The Petkolin-treated papers were toxic for only 4 days. Papers treated with 2% Petkolin killed 50% of the insects in the first test, 30% on the 4th day but only 10% on the 5th day (Fig. 1). Similarly the toxicity of papers treated with 5% Petkolin decreased from 85% on the first day, 61% after 4 days and to only 10% after 5 days (Fig. 2).

Phosalone.—The toxic effect of Phosalone like that of Petkolin persisted for 4 days, though in this case the loss of toxicity of residues was not gradual. In the residues of 7% dilutions no mortalily was noted on the 5th day as compared to 70% mortality the day before (Fig. 1). Similarly, the toxicity of the papers treated with 10% Phosalone

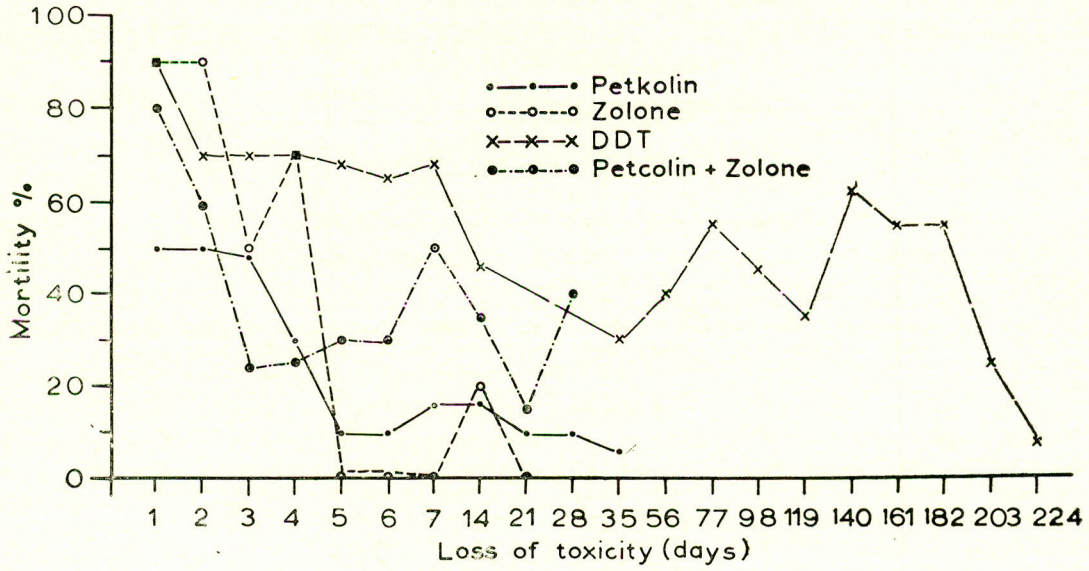

Fig.1.—Loss of toxicity residue in the smaller doses of insecticides

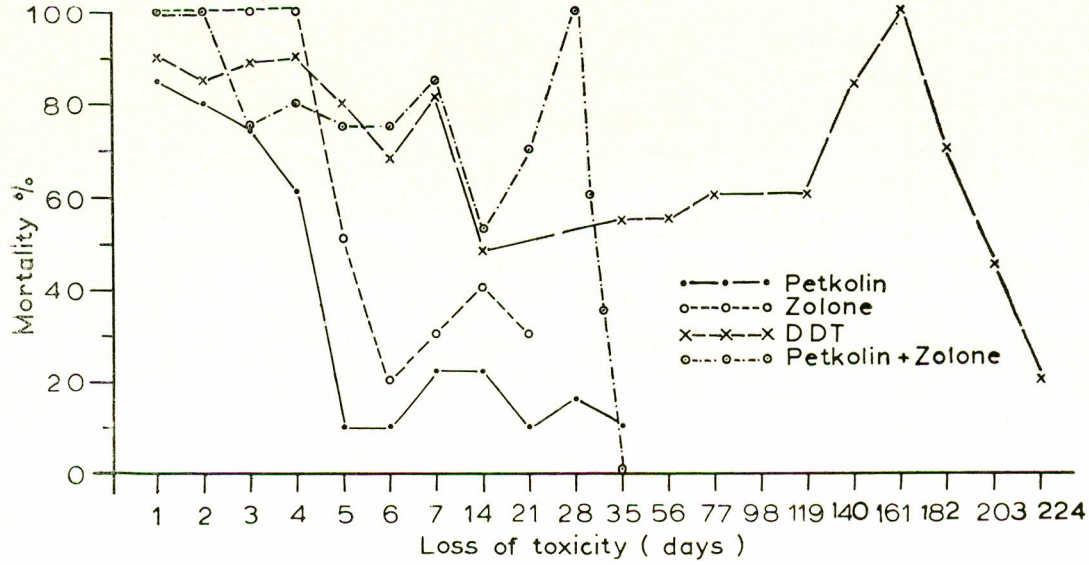

Fig.2.—Loss of toxicity residues in the larger doses of insecticides

dropped to 51% the 5th day as compared to previous days when 100% mortality was recorded. The next observation showed a further decline of toxicity which with slight variations continued till the 21st day after which the residues were not toxic (Fig. 2).

DDT.—In case of DDT the observations were continued for 224 days. During the first week of evaluation 65%–70% mortality was recorded in the residues of 2% dilution with the exception of first day when 90% mortality was noted (Fig. 1). As compared to the above toxicity 80%–90% mortality was obtained with the residues of 5% dilution during the same period of evaluation (Fig. 2). However, on the 14th day, i.e. one week after the last observation only, 46% mortality was noted in the smaller dose and 48% mortality in the larger dose. The subsequent observations showed an increase of toxicity in both the residual formulations. Though the increase in the toxicity was not significant till the 119th day, on the 140th day 62% and 84% mortalities were recorded respectively in the two residues and, unexpectedly on the 161st day, the residues in 5% dilution gave 100% mortality (Fig. 2). Such variations did not occur after this day and a continuous decline in

morality was noted during the remaining observations. When the testing was finally discontinued after 224 days, i.e. after about seven and a half months, negligible toxicities were noted in the two residues.

Petkolin+15% Phosalone.—The residues of Petkolin+15% Phosalone mixture persisted for much longer duration than those of component insecticides.

In the smaller dose the residual toxicities were 80% and 59% respectively in the first and the second tests whereas on the 3rd day the residues gave only 24% mortality. On the 7th day and again on the 28th day the residues were more toxic than on other days but were no more toxic after 35 days (Fig. 1).

On the other hand the residues in the larger doses continued to give more than 70% mortality till 21 days. The toxicity was 100% on the 28th day as was earlier recorded during the first two tests. In this case also the toxicity was totally lost after 35 days (Fig. 2).

Discussion

The evaluations of toxicity were made in an air-conditioned laboratory whose temperature was adjusted at 78°F±2°F with no check over the relative humidity.

The results showed that the residues of Petkolin and Phosalone were short lived and the discrepancies in their toxicity on different days were negligible. However, in the cases of DDT and Petkolin+15% Phosalone the residues persisted for much longer duration than those of the above insecticides and significant fluctuations in the toxicity were noted in these cases. The increase in the residual toxicity in the case of above insecticides, once it was apparantly lost, might be due to the variations in the atmospheric humidity of the laboratory at the time of bioassay. The humidity might have activated the residues which were present in effective concentrations for considerably longer periods in these cases as compared to the residues of Petkolin and Phosalone. Hence the effect of humidity in the cases of persistent insecticides was significantly marked. Under similar conditions of testing discrepancies of toxicity have also been reported by Kalkat *et al.*[6] in the cases of Diazinon, Parathion, Aldrin, Heptachlor, Heptachlor epoxide and Malathion.

It was, therefore, concluded from the above study that at a temperature of 90°F and 55%± 5% R.H. the residues of Petkolin and Phosalone persisted for much less duration than those of DDT and Petkolin+15% Phosalone mixture. It was also noted that atmospheric humidity at the time of bioassay greatly affected the toxicity of the chemicals.

The above results further showed that by mixing 15% Phosalone with Petkolin the residual life of the mixture could be increased considerably as compared to that of the component insecticides. Hence under similar atmospheric conditions during the field trials a suitable dose of Petkolin+15% Phosalone mixture could be used to control the insects more effectively for a longer duration than by using them individually.

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