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EFFECT OF POST-TREATMENT TEMPERATURE ON THE TOXICITY OF PETKOLIN TO SUSCEPTIBLE HOUSEFLIES, MUSCA DOMESTICA L

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Laboratory-reared (PCSIR strain) houseflies, *Musca domestica* L., were treated topically with 1.2 μl acetone solutions of Petkolin, DDT and Heptachlor and held at the post-treatment temperatures of 10, 25 and 40°C for 48 hr. With Petkolin and Heptachlor there were significantly higher mortalities at 40°C whereas in the case of DDT the highest mortality was recorded at 10°C.

The effect of temperature on the toxicity of insecticides particularly the effect of post-treatment temperatures has been studied by several workers including Dustan[1] on DDT; Evans *et al.*[2] on Diazinon and Lindane; Guthrie[3] on DDT, Pyrethrum, Lindane, Aldrin and Dieldrin; Chevalier[4] on Pyrethrum; Hoffman and Lindquist[5] on DDT, Methoxychlor, Heptachlor, Parathion, Chloradane, Dieldrin and Toxaphene; Lindquist *et al.*[6] on Pyrethrum and DDT; Hoffman *et al.*[7] and Fan *et al.*[8] on DDT; Klinger[9] on rotenon; Eagleson[10] on Lethane; Potter and Gillham[11] on lauryl thiocaynate, nicotine and DNOC and Ellisor and Blair[12] on arsenic and fluoride compounds. Some of the insecticides possessed 'negative coefficients' of action with temperature i.e. they were more toxic at low temperatures than at high temperatures, while others possessed 'positive coefficients' and were more toxic within certain limits with increasing temperatures. Compounds belonging to the first category include DDT, DDD, Pyrethrum and Methoxychlor while those having the 'positive coefficients' include Aldrin, Dieldrin, Heptachlor, Toxaphene and Parathion.

The purpose of the present study was to establish the effect of post-treatment temperatures on the toxicity of Petkolin[13] applied topically to susceptible houseflies, *Musca domestica* L. (PCSIR strain) in the laboratory. Two insecticides of known temperature coefficients namely DDT and Heptachlor, each having a different coefficient of action with temperature, were also evaluated simultaneously with Petkolin.

Materials and Methods

Adult houseflies (3–4-day old) reared[14] in the insectary were used throughout the experiment. In all tests flies were given topical applications of acetone solutions of technical grade Petkolin 0.75% DDT 0.09% and Heptachlor 0.0075%. The above dilutions produced (statistically speaking) 50% ±5% mortalities of houseflies after 24 hr at the laboratory temperature.

Flies anesthetized with CO_2 were given 1.2μl solution of each insecticide with a micrometer syringe outfit calibrated to deliver 1.2 μl drop which was placed on the thorax of each fly. For each insecticide 100 flies in 5 replications were exposed to the measured quantities of the chemicals for evaluation at one temperature. The treated flies were placed in mason jars measuring 5″×4″ in which cotton pads soaked in 10% glucose solution had been kept. The mason jars were covered with screw-capped lids whose metallic discs had been removed and replaced with fine wire netting to allow circulation of fresh air.

The treated flies were subjected to one of the three temperatures for a period of 48 hr. The temperatures were regulated at 10 ,25 and 40°C. The first and the last temperatures were regulated in two temperature-controlled cabinets while the temperature of the air-conditioned laboratory in which the treatments were given was adjusted at 25°C showing a variation of ±2°C. During the post-treatment period the relative humidity of the air-conditioned laboratory varied considerably whereas that of the two temperature controlled cabinets was between 70–80% R.H. Acetone check and a control were also kept at the three temperatures with each set of the experiment which was repeated 5 times.

The treated flies were removed from the temperature controlled cabinets after 24 and 48 hr and the number of dead and moribund flies was counted. The counting was done as quickly as possible and the jars were returned to the respective cabinets within 5–7 min. During this interval new cotton pads freshly soaked in the glucose solutions were put in place of the previous ones. The percentages of dead and moribund flies were determined separately after 24 and 48 hr in all the cases and were corrected by using Abbotts[15] formula.

Results and Discussion

The percentages of dead and moribund houseflies and the temperature coefficients of the three insecticides after 48 hr have been presented in Table 1.

The results showed that the toxicities of the three insecticides were influenced at different

Table 1.—Effect of Post-Treatment Temperatures on the Toxicities of Petkolin, DDT and Heptachlor to Susceptible Houseflies, *Musca domestica* L. (PCSIR strain) after 48 hr.

Insecticides	Mortality %			Moribund %			Temperature coefficients
	10°C	25°C	40°C	10°C	25°C	40°C	
Petkolin	33.0	60.0	81.0	15.0	0.0	0.0	
Check	0.0	0.0	3.0	0.0	0.0	0.0	+ve
Control	0.0	0.2	0.0	0.0	0.0	0.0	
DDT	82.0	33.0	17.0	16.0	0.0	0.0	
Check	6.0	1.2	2.0	0.6	0.0	0.0	—ve
Control	0.0	0.0	0.0	0.0	0.0	0.0	
Heptachlor	40.0	57.0	71.6	11.6	0.0	0.0	
Check	2.1	6.8	3.6	0.7	0.7	0.0	+ve
Control	0.0	0.0	0.0	0.0	.0.	0.0	

rates at the selected post-treatment temperatures. With Petkolin and Heptachlor the rate of mortalities was on the increase with increase in the post-treatment temperatures while the reverse was true for DDT. Temperature had the greatest effect on the toxicity of DDT which was respectively 2 times and more than 5 times more effective at 25°C and 10°C than at 40°C. However in the cases of Petkolin and Heptachlor the effect of temperature was considerably less. It was observed that at 25°C Petkolin was 1.25 times and at 40°C approximately 1.7 times more effective while at the latter temperature Heptachlor was 1.4 times more effective than at 10°C. In this case the difference of mortalities between the lowest and the middle temperatures was not significant. Hoffman and Lindquist[5] reported that the speed of knock down and mortality of houseflies exposed to the residues of DDT for 24 hr was higher at 70°F than at 90°F. Conversely Heptachlor was reported to be more toxic at 90°F than at 70°F. Lindquist *et al.*[6] also reported that the houseflies when exposed to the residues of DDT for 24 hr were knocked down much more quickly at 70°F than at 95°F. Guthrie[3] reported that DDT was approximately 20 times more effective when applied topically to the German cockroach, *Blattella germanica* L. at 14.5°C, than at 32°C with a variation of $\pm$1.5°C in each case. He further reported that the other insecticides were much less toxic at one extreme as at the other. Vinson and Kearns[16] reported that DDT was more toxic to American cockroach, *Periplanata americana* L. at 15°C than at 35°C. Similarly negative temperature coefficient for DDT has been reported against few other species of insects also.

Hence from the data obtained for Petkolin and other insecticides in the present study and from that reported by other workers for DDT and Heptachlor, it was concluded that Petkolin like Heptachlor was more toxic to the susceptible houseflies, *Musca domestica* L. at higher temperatures and DDT was more toxic at lower temperatures. It may be, therefore, suggested that Petkolin possessed 'positive coefficient' of action with temperature.

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