

LABORATORY TESTS ON THE TOXICITY OF CHEMICALS FOR CUTWORM (*AGROTIS YPSILON* ROT.) LARVAE

by

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Cutworm (*Agrotis ypsilon* Rot.) is one of the serious pests attacking farm crops on dry land especially in vegetable gardens. Field tests on cutworm control are very difficult, since they keep quiet in the day time, appearing and very active after dark, and seldom distribute evenly in the field. It is considered that a laboratory test in advance is necessary. The results produced here of the laboratory tests of July 1959 meet this requirement and are a reference for specialists who are interested in control by field tests.

I. PETRI-DISH TEST

1. Spraying treatment

(A) Materials and methods

The chemicals with concentrations and methods for chemical treatment are given in table 1. The method of treatments show below.

(a) Place 15 cm in diameter petri-dishes into the well prepared chemical emulsion for two minutes and dry them out in the air. 30 dishes is used for a replication.

(b) Cabbage leaves were dipped into the same diluted emulsion, then transferred into clean petri-dishes to be ready for use after air drying.

(c) Cabbage leaves treated as in step #b were put in treated petri-dishes as mentioned in step #a.

The 5th instar larvae of the cutworm were placed in treated petri-dishes, allowed to stay for six hours, and then placed in clean petri-dishes with fresh cabbage leaves. Mortality counts were made 48 hours latter.

This experiment was run off with 26 units including six chemicals, with two concentrations each and three different treating methods. 30 insects were used for each test. Two replications. The percentage of mortality is listed in table 1.

(B) Results and conclusions

A remarkable and effective result found among all the different treatments is given by method #1-(A)-(c) because that both petri-dish and cabbage were treated with chemicals.

Among the six chemicals endrin emulsion provided the highest toxicity. The order of decreasing toxicity of the chemicals which were tested is: endrin (0.06%*) > aldrin (0.06) > dieldrin (0.06) > heptachlor (0.12) > aldrin (0.03) > endrin (0.03) > dieldrin (0.03) > lindane (0.12) = DDT (0.27) > heptachlor (0.06) > DDT (0.18) > lindane (0.06)

* Active ingredient in the water dilution.

Table 1. Mortality of cutworm larvae treated with emulsions. (petri-dish test)

Chemicals	Active ingredient (%)	Chemical treated on								
		Leaves			Petri-dishes			Leaves & dishes		
		I	II	Average	I	II	Average	I	II	Average
DDT EC (2.5 lbs/gal)	0.27	36.7	40.0	38.4	30.0	33.3	31.7	33.3	36.6	35.0
	0.18	20.0	13.3	16.7	13.3	23.3	18.3	26.6	26.6	26.6
lindane EC (2.0%)	0.12	10.0	13.3	11.7	10.0	16.7	13.4	36.6	33.3	35.0
	0.06	0	6.7	3.4	13.3	6.7	10.0	23.3	16.6	20.0
heptachlor EC (2.0%)	0.12	33.3	36.7	35.0	26.7	33.3	30.0	46.6	50.0	48.3
	0.06	20.0	23.3	21.7	16.7	23.3	20.0	36.6	23.3	30.0
dieldrin EC (1.5%) (Dieldrex-15)	0.06	33.3	53.3	43.3	66.7	53.3	60.0	66.6	56.6	61.6
	0.03	26.7	33.3	30.0	26.6	20.0	23.3	40.0	33.3	36.7
aldrin EC (2.0%) (Aldrex-2)	0.06	53.3	46.7	50.0	66.6	56.6	61.6	63.3	66.6	65.0
	0.03	36.7	43.3	40.0	40.0	43.3	41.7	36.6	56.6	46.6
endrin EC (1.6%)	0.06	73.3	60.0	66.7	53.3	63.3	58.3	63.3	76.6	70.0
	0.03	30.0	26.7	28.4	43.3	46.6	45.0	33.3	43.3	38.3
Check	—	0	0	0	0	0	0	0	0	0

2. Dusting treatment

(A) Materials and Methods:

The impregnated dusts used for this experiment were prepared in this laboratory. The dust was applied evenly in the dishes by a dusting box, rotated at 20 r. p. m. The dosage used for each treatment was 0.5 gm, equivalent to 30 kg/hectare.

The 5th instar larvae were put in chemically treated petri-dishes, one in each dish, 120 dishes in all. They were divided into 4 units of 30 dishes each, the time of contact of larvae with the chemical being different for each unit, they were 10, 20, 30 and 40 minutes respectively. As the larvae were removed from the chemically treated petri-dishes, they were put in untreated dishes supplied with cabbage leaves and then, 48 hours later, mortality counts were made.

Two replications of the same experiment were held at different time but following the same method. The results are shown in table 2.

(B) Results and conclusions:

In the same concentration endrin was more effective than heptachlor. The higher the concentration used the more effective was the treatment. Under the test conditions, the necessary concentrations of heptachlor powder and endrin powder were 5-10% and 2.5-5% respectively.

In the heptachlor block, with a concentration of 10% and 30 minutes chemical contact and/or a concentration of 5% and 40 minutes chemical contact and/or endrin with a concentration of 5% and 30 minutes contact there was a resulting mortality of more than 80%, the longer the time of chemical contact the higher being the mortality.

Table 2. Mortality of cutworm larvae which were treated with chemical powders. (petri-dish test)

Chemicals	Concentration (%)	Time duration of chemical contact (min.)											
		10			20			30			40		
		I	II	Average	I	II	Average	I	II	Average	I	II	Average
endrin dust	5.0	66.7	60.0	63.4	73.3	80.0	76.7	86.7	80.0	83.4	100.0	100.0	100.0
	2.5	36.7	30.0	33.4	63.3	66.7	65.0	70.0	63.3	66.7	80.0	76.7	78.4
	1.5	26.7	23.3	25.0	40.0	26.7	33.4	56.7	63.3	60.0	53.3	60.0	56.7
	0.5	16.7	23.3	20.0	20.0	30.0	25.0	33.3	30.0	31.7	26.7	46.7	36.7
heptachlor dust	10.0	50.0	63.3	56.7	70.0	66.7	68.4	86.7	90.0	88.4	100.0	96.7	98.4
	5.0	43.3	53.3	48.3	63.3	66.7	65.0	76.7	70.0	73.4	80.0	83.3	81.7
	2.5	30.0	33.3	31.7	46.7	36.7	41.7	56.7	60.0	58.4	70.0	66.7	68.4
	1.5	6.7	10.0	8.4	20.0	10.0	15.0	36.7	33.3	35.0	43.3	46.7	45.0
Check	—	0	0	0	0	0	0	0	0	0	0	0	0

II. POT TEST

1. Materials and Methods

(A) Spraying treatment

The chemicals with concentrations are given in table 3. Poured soils into the pot (25 cm in height × 45 cm in diameter). Water was supplied through seven 1 cm (diameter) glass tubes inserted in the soil and extending to the bottom of the pot, so as to maintain a suitable soil humidity. Six cabbage seedlings were planted in the pot for the test.

There were three methods used for chemical treatments as following: (a) In the spraying chamber, applied the chemical evenly over the surface of the soil and the seedlings in the pot, 15 cc of the diluted solution per pot. (b) Chemical only applied on the cabbage seedlings before it was planted in the pot. (c) Chemical applied over the soil only.

(B) Dusting treatment

The pots and plants used for this dusting method were approximately the same as those used for the above mentioned spraying treatment, 0.74 gm (about 35 kg per hectare) of the chemical dust in the dusting bottle was applied in the prepared pots in the dusting box, the method is shown in the experiment #I-2-(A). The pots were taken out from the box three minutes after dusting, the treatment was complete.

The two dusting methods used are shown below: (a) Chemical used for experiment was dusted over the surface of the soil and the seedlings being treated. (b) Chemical was dusted only over the surface of the soil in the pot, the seedlings being kept free from the chemical.

Table 3. Mortality of cutworm larvae which were treated with chemicals (pot test)

Chemicals	Active ingredient (%)	chemical treated on								
		Seedlings			Soil surface			Seedling & soil		
		I	II	Average	I	II	Average	I	II	Average
endrin EC (1.6 lbs/gal)	0.12	60.0	70.0	65.0	73.3	66.7	70.0	86.7	83.3	85.1
	0.06	43.3	36.7	40.0	50.0	73.3	61.7	36.7	50.0	43.4
heptachlor EC (2.0 lbs/gal)	0.24	56.7	53.3	55.0	53.3	63.3	58.3	76.7	80.0	78.4
	0.12	26.7	36.7	31.2	33.3	33.3	33.3	46.7	36.7	41.7
endrin P	5.0	—	—	—	76.7	60.0	63.4	73.3	66.7	70.0
	2.5	—	—	—	60.0	63.3	61.7	56.7	76.7	66.7
heptachlor P	10.0	—	—	—	70.0	63.3	66.7	80.0	73.3	76.7
	5.0	—	—	—	40.0	30.0	35.0	36.7	56.7	46.7
Check	—	0	0	0	0	0	0	0	0	0

Five pots and two replications for each of the spraying and dusting methods were treated. Ten 5th instar larvae being put in each pot at the same time. The mortality counts made 72 hours after treatment, are shown in table 3.

2. Results and conclusions

Under the conditions of this experiment, 10% of heptachlor dust and/or 0.24% of active ingredient in the emulsion diluted solution can produce considerable result, though it can not provide a result as good as 0.12% active ingredient of endrin emulsion.

endrin, either dust or emulsion, is considerably better than heptachlor, however, endrin is more expensive than heptachlor though it provides better results on insect control, so that further study should be undertaken to see it one is more favourable than the other on an equal economic basis.

It is clear that the best results are obtained in cutworm control when the soil and plants were both treated by the spraying method. On the other hand, chemical treats on either seedlings or soil alone can never provide a good result.

Summary

As showed in the petri-dish tests and pot tests of this experiment, the toxicity of the insecticides is influenced by the different methods of application, the chemicals used for both contact and stomach poison at the same time are more effective than that of individual.

In the emulsion form, to the 5th instar larvae, endrin shows the best effectiveness, the order of the decreasing toxicity of the chemicals tested is 0.06% endrin (active ingredient) > 0.06% aldrin > 0.06% dieldrin > 0.12% heptachlor > 0.03% aldrin > 0.03% endrin > 0.03% dieldrin > 0.12% lindane = 0.27% DDT. In the pot test, heptachlor can give better results but 0.24% of its active ingredient is minimum requirement. Still, it is less effective than 0.12% of endrin.

In the powder form, endrin is more effective than heptachlor, 5% of endrin and 10% of heptachlor provide the better results.

幾種殺蟲藥劑對切根蟲幼蟲 室內毒力比較試驗

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摘 要

切根蟲 (*Agrotis ypsilon* Rot.) 爲旱地農作物之重要害蟲，其幼蟲日伏夜出，爬行能力頗強，且在田間之分佈又極不均勻，故其田間藥劑防治之研究，除較爲粗放之藥效示範試驗以外，精確之田間試驗頗難實施；且田間示範試驗又當依據室內毒力比較試驗結果，選拔效果較佳之藥劑及濃度進行研究，俾減少田間試驗之處理項目，而增加其重複次數，以期減少害蟲分佈不勻之影響而增加該試驗之精確性。作者等於民國48年度，就殺蟲藥劑藥效生物檢定之便，以數種可能利用之藥劑進行室內毒力比較試驗。茲將其試驗結果稍加整理，草成此文，或可供從事田間試驗工作者之參考。本試驗共包括玻璃皿試驗及盆栽試驗兩個部分；各試驗均分別進行液劑及粉劑兩處理。所用昆蟲爲自行飼育之切根蟲第5齡幼蟲。其試驗結果摘要如下。

一、玻璃皿試驗：用於乳劑時，在所測定之6種藥劑中其胃毒及接觸之混合毒力（玻璃皿及茶葉均施藥劑）以endrin之毒力最強，其各處理之毒力順序爲0.06%^a endrin (死亡率70^b) > 0.06% addrin (65) > 0.06% dieldrin (62) > 0.12% heptachlor (48) > 0.03% aldrin (47) > 0.03% endrin (38) > 0.03% dieldrin (37) > 0.12% lindane (35) = 0.27% DDT (35) > 0.06% heptachlor (30) > 0.18% DDT (27) > 0.06% lindane (20)。各劑之毒力因施藥部位之不同而有極大差異，玻璃皿及茶葉均施有藥劑者，其治蟲效果顯較單獨處理玻璃皿或茶葉者爲佳。用於粉劑處理時，endrin之毒力亦較 heptachlor 爲強，其毒力因所施之濃度及所接觸之時間而不相同。在本試驗之處理環境下，10% heptachlor 接觸30分鐘，5% heptachlor 接觸40分鐘及 5% endrin 接觸30分鐘均可獲得80%以上之治蟲效果。

二、盆栽試驗：據噴霧及撒粉兩種處理證實，10% heptachlor 粉劑，0.25% heptachlor 乳劑或 0.12% endrin 乳劑均有較高之治蟲效果，唯各劑均需施於茶苗及土面方能獲得較佳之成效。

註 a. 有效成分%。

b. 平均死亡率。