

The Toxicity of some Insecticides to Fayoumi Chicks

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FOUR COMMONLY used insecticides Cyolane, Dursban, Phosvel and Temik were administered in the feed of week-old chicks at 1/2, 1.0 and 2.0 times the concentration recommended in Egypt, in order to find out the effects of poisoning. The investigation included observation of overt symptoms, postmortem dissection and measurement of blood cholinesterase. In general there was a direct relationship between insecticide concentration, mortality and blood cholinesterase. Distinctive overt symptoms appeared only in chicks given the organophosphorous compounds.

No one can dispute the great contribution pesticides have made to the control of insect-borne disease, to increased agricultural production and to control of household pests, thus improving the quality of living the world over. Nevertheless, the almost universal occurrence of pesticide residues in soil, water, air and living organisms has led to the view that pesticides are environmental contaminants or more spectacularly in some of the popular press, insidious, uncontrollable poisons (Mitchell, 1966).

With the increasing use of insecticides it becomes ever more probable that feed fed to chickens has been contaminated. As yet however, it is impossible to ascertain whether ailing chickens are suffering from some disease or from insecticide poisoning, because too little is known about the effects produced by insecticide poisoning in chickens. This paper is the first of a series which hopefully will clarify the symptoms of poisoning so that diagnosis will become easier in the the future.

As the first step, described in this paper, the investigators set out to obtain an unambiguous picture of insecticide poisoning by giving seven day old Fayoumi chicks feed treated with one of four commonly used insecticides in Egypt at relatively high concentrations ; *i.e.* at the normal concentration recommended in Egypt for insect control, or one-half and at twice the recommended concentration.

Similar studies have been done by Sherman and his coworkers in Hawaii (Ross and Sherman 1960 ; Sherman *et al.*, 1963 and 1964).

Material and Methods

Four technical-grade insecticides were investigated: Cyolane (phosfolan) ; N-(1,5-Dithiolan-2-glidene) phosphoramidate, 79.5%, Dursban (chlorpyrifos) ; Diethyl-3,5,6-trichloropyridyl phosphorothioate 97.7%, phosvel (leptophos) ; 0-(4-Bromo-2,5-dichlorophenyl) O-methylphenyl phosphorothioate, 93% and Temik (Aldicarb); 2-Methy-2-(methylthio) propionaldehyd O-(methyl-carbamoyoxime, 98.9%).

Seven day old Fayoumi chicks were used. They were housed in thermostatically controlled starter batteries with wire floors to prevent coprophagy. Feed, water and artificial light were furnished continuously.

The standard starter ration fed to chicks was treated by placing 5 kg of it in a large mixing bowl, slowly adding 100 ml of an acetone solution containing the specified amount of technical grade insecticide and vigorously shaking by hand for 5 min. The mixture was spread in a thin layer on clean paper to allow the acetone to evaporate. The concentrations used, expressed in parts per million based on the amount of technical toxicant in the feed, were 300, 600 and 1200 ppm for Cyolane, Dursban and Phosvel and 0.25, 0.5 and 1.0 ppm for Temik. The treated feed was assigned at random to experimental groups, consisting of 22 chicks each, and completely replaced the basal feed for 11 days. Identical untreated feed was given to the control group. The feeds and untreated water were supplied *ad libitum*.

Mortality and any observed symptoms were recorded daily. After 3 hr of treatment, samples of blood were taken from the chicks to determine cholinesterase activity. Approximately 1 ml of blood was taken by venipuncture from each of 5 chicks at each treatment level and pooled. The pooled samples were then centrifuged and the plasma was analyzed colorimetrically for cholinesterase activity as described by Cook (1954) and Fallscheer and Cook (1956).

Results

As would be expected total mortality for the 11 days was lowest for the lowest concentration levels. Among the organophosphorous compounds it ranged from a low of 23% for phosvel at one half the recommended dosage to a high of 86% for Dursban and Cyolane at double the recommended dosage. Most deaths occurred within 24 hr. A decreasing number occurred in the following 5 days. After the fifth day no deaths occurred, except for 1 on the eleventh day. Mortality after exposure to Temik ranged from 0% at the recommended dosage to 27% at double the recommended dosage. The deaths first occurred on the second day and continued at a low rate until the end of the study.

All insecticides produced general symptoms indicating a lack of well-being, such as the ruffling of feathers, droopiness, dullness and diarrhoea.

In addition, chicks exposed to the organophosphorous insecticides stood on their hocks or showed an inability to stand, with trembling and perosis. Chicks exposed to Cyolane or phosvel also tended to clench their toes which made walking difficult.

Post mortem dissection of chicks treated with the organophosphorous compounds revealed petechial haemorrhage on the liver, spleen, kidneys and brain together with congestion of these organs, liquifaction of the cerebellum, catarrhal or haemorrhagic enteritis and precipitation of ucares in the ureters. Liver degeneration with pin-headed greyish white foci appeared in some chicks 2 to 5 days after administration. Chicks which had received Temik at a concentration of 1 ppm developed splenomegaly after 3 days, severe nephrosis after 8 days and severe hepatomegaly after 11 days.

Blood cholinesterase inhibition was found in all experimental groups. It increased with the concentration of insecticide, as did the mortality generally, ranging from 37.2% for halfstrength Temik to 79.5% for double strength Cyolane. These results are similar to those reported by Sherman *et al.* (1967 and 1972). However, in spite of the markedly lower mortality rate and lack of specific poisoning symptoms, cholinesterase inhibition was not much lower for Temik than for the organophosphorous compounds. The experimental findings are set out in detail in Table 1.

Discussion

In general there was a direct relationship between the insecticide concentration, mortality and level of blood cholinesterase. Pre-morbi symptoms distinctive and regular enough to be considered indicative of poisoning, *i.e.* trembling, perosis and toe clenching, appeared in all groups receiving the organophosphorous compounds, but not in the groups receiving the carbamate compound. These findings accord with those of earlier research (Sherman and Ross, 1961 and Sherman *et al.*, 1967). Post mortem dissection revealed similar internal abnormalities in all groups.

The results were considered interesting enough to warrant further studies using smaller concentrations over longer periods of time.

TABLE 1. Effect of organophosphorous and carbonate insecticides administered in feed on 7-day-old Fayoumi chicks.

Insecticide	Conc. in ppm	Deaths & day occurred	Total deaths	% mortality	Percent blood cholin-esterase inhibition
Cyolane :	300	8(1st) 1(3rd) 1(11th)	10	75	
	600	13(1st) 3(3rd)	16	73	71.5
	1200	16(1st) 2(2nd) 1(4th)	19	86	79.5
Dursban	300	3(1st) 6(2nd) 1(3rd) 4(5th) 2(6th)	16	73	42.8
	600	8(1st) 10(3rd)	18	82	62.6
	1200	9(1st) 6(2nd) 2(3rd) 1(4th) 1(5th)	19	86	75.0
Phosvel	300	2(1st) 2(2nd) 1(6th)	5	23	46.5
	600	2(1st) 4(2nd) 2(3rd)	8	36	57.2
	1200	8(1st) 1(2nd) 5(3rd)	14	64	71.5
Temik	0.25	1(2nd)	1	5	37.2
	0.50	—	—	0	57.2
	1.00	2(2nd) 1(3rd) 1(5th) 1(8th) 1(11th)	6	27	74.3
Control	—	—	—	—	—

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التأثير السام لبعض المبيدات على الكتاكيت الفيومي

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فى هذه الدراسة استعملت أربعة مبيدات واسعة الانتشار وهى السيولين الدورسيان ، الفوسفيل ، والتيميك مخلوطة فى عليقة الكتاكيت الفيومي عمر أسبوع واستخدم ثلاث تراكيزات لكل مبيد منهم أساسها التركيز الذى ينصح به فى مصر ثم نصفه وكذا ضعفه وذلك لدراسة تأثيراتها السامة والتى شملت أعراض التسمم الظاهرية والتشريحية بعد الموت وكذا مدى تثبيط نشاط أنزيم الكولين استيريز .

وقد وجد أن هناك علاقة واضحة بين التراكيزات المستخدمة من هذه المبيدات وتأثيرها السام على الكتاكيت ومدى تثبيط نشاط أنزيم الكولين استيريز عموماً - إلا أن أعراض التسمم الظاهرية كانت واضحة فى حالة استخدام المبيدات الفوسفورية فقط .