

THE LETHAL EFFECT OF SOME INSECTICIDES ON THE B.H.C.-  
RESISTANT BLUE TICK, *BOOPHILUS DECOLORATUS* KOCH.

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The control of *B. decoloratus* became a serious problem when, in 1937 a strain was discovered in the East London area, which had developed a high degree of resistance to arsenical dipwashes. The introduction of the new synthetic insecticides seemed to provide the solution to the problem and benzene hexachloride (B.H.C.) in particular gave very good results. The gamma-isomer of B.H.C. at a strength of 50 parts per million (p.p.m.) was sufficient to kill adult females of the arsenic-resistant tick and, as claimed by Whitnall and Bradford (1947, 1949), weekly dipping in B.H.C. eventually brought this strain of the blue tick under control.

Some eighteen months after the B.H.C.-dips were introduced a loss of effectiveness against the arsenic-resistant strain of blue tick became apparent. It could be demonstrated by *in vitro* as well as by field tests (Whitnall *et al.*, 1949) that the tick had developed a strong resistance to B. H. C. in addition to arsenic.

Other contact insecticides, e.g. D.D.T. and Toxaphene, which had been used in field trials, also had different effects upon the resistant blue tick. D.D.T. was consistently effective whereas Toxaphene, which had been introduced more recently gave rather variable results and in general was less effective than D.D.T.

A number of *in vitro* tests were conducted to determine the susceptibility of the B.H.C.-resistant strain of blue tick to some of the new insecticides.

*Experimental.*

Eggs from normal blue ticks derived from the highveld of the Transvaal and from B.H.C.-resistant females from the East London area were kept at constant temperature and humidity ( $\pm 80.5^{\circ}$  F. and 78 per cent rel. hum.) and allowed to hatch. The resultant larvae were submitted to insecticidal tests under identical conditions at an age of four weeks. Porcelain evaporating dishes ten inches in diameter were sprayed with an acetone solution of the particular insecticide at the rate of 50 mg. per square foot. About 500 larvae at a time were transferred into each dish by brushing them from the breeding tubes. Vaseline was applied around their upper edges to prevent the larval ticks from escaping. The ticks were kept under observation for 24 hours.

The following insecticidal compounds were included in the tests:—

1. Pure gamma-isomer of benzene hexachloride (Lindane, CELA, Irgelheim).

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2. Pure alpha-isomer of benzene-hexachloride (CELA, Ingelheim).
3. Para para D.D.T. (Klipfontein Organic Products).
4. Toxaphene (Hercules Powder Co.).
5. Dieldrin (Julius Hyman).
6. Ticodol (Bayer, Leverkusen), the active ingredient of which (E605 or Parathion) constitutes 20 per cent of the compound.

The elapsed time between introduction and knock-down of all larval ticks in a dish was used as the criterion to evaluate the efficacy of the insecticides under trial in all the experiments. The readily observed stage of paralysis, where the larvae are no longer able to make any forward movement, has been defined as "knock-down".

*Results.*

In table I are given the observations made for the normal as well as the resistant strain, the figures representing the average knock-down time of four tests expressed in hours and minutes.

TABLE 1.  
*Effect of Insecticides on Larvae of Boophilus decoloratus.*

Insecticides.	Gamma B.H.C.	Alpha B.H.C.	D.D.T.	Toxaphene.	Dieldrin.	Ticodol.
Normal Strain...	10 mins.	5 hrs.	30 mins.	2 hrs.	1 hr. 30 mins.	1 hr. 30 mins.
Resistant Strain..	5 hrs.	24 hrs.	30 mins.	4 hrs.	24 hrs.	3 hrs. 45 mins.
Time Relation-ship.....	30	4.8	1	2	±13	2.5

*Conclusion.*

The tests demonstrated clearly that a degree of resistance to gamma B.H.C. had developed in the resistant strain of blue tick larvae since a period 30 times as long as that necessary for the normal strain was required to produce complete "knock-down". It is, however, of interest to note that the resistant strain shows a relatively higher degree of susceptibility to the alpha-isomer than to the gamma.

The only insecticide tested for which no loss of efficacy could be demonstrated is D.D.T. The resistant larvae always become paralysed in the same period of time as the normal larvae.

Toxaphene and Ticodol (Parathion) show a definite loss of toxicity to the resistant strain. This may be due to some carry-over of resistance from the B.H.C.

Finally and quite unexpectedly, the B.H.C.-resistant tick was found to be resistant to Dieldrin.

Methoxychlor and D.D.D. (Rothane), which are two insecticides closely related to D.D.T., have been subjected to a few pilot tests. Both showed a rapid knock-down effect on the resistant larvae within a period of one to two

hours. Chlordane and Aldrin on the other hand, which are potent insecticidal compounds allied to Dieldrin, took over five and 24 hours, respectively, to paralyse the larvae of the East London resistant strain.

*Summary.*

D.D.T. and its related compounds seem to be the only group of the new contact insecticides against which the blue tick has not been able to build up any resistance. Toxaphene as well as Parathion are definitely less effective against the B.H.C.-resistant strain and higher concentrations are needed to achieve a good control. Dieldrin and related compounds, which otherwise are very powerful insecticides appear to be of little value for the control of the B.H.C.-resistant blue tick.

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