Comparative Toxicity of DDT & BHC to the Rice-Swarming Caterpillar *Spodoptera mauritia* Boisd

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THE SWARMING CATERPILLAR *Spodoptera mauritia* Boisd., is on of the major pests of rice the world over. When the crop is about two weeks old, the pest appears in vast numbers and causes damage by defoliating the plants. Infestations of a fairly serious nature occur almost every year in the *punja* tract of Kuttanad, Kerala. The various control measures advocated so far, like flooding, sweeping the caterpillars; and letting in ducklings to feed on the larvae are not effective enough to avert damage. After the advent of the chlorinated hydrocarbon insectides, these materials are being used on a wide scale to control infestations. However, no work appears to have been carried out so far to ascertain the toxicity of any of these chemicals to this insect. The present experiments were therefore undertaken with a view to gaining some information on the action of two of the most commonly used insecticides. DDT and BHC on this insect.

Review of literature.

The earliest mention of the use of an insecticide against this pest is by Henry (1917), who controlled a slight infestation in Ceylon by spraying lead chromate. Pillai (1921), successfully tried ash and lime in equal proportions and paris green and lime in the ratio 1 : 80. Rao (1929), found that treating the surface with kerosene and dusting with calcium arsenate was effective experimentally. A poison bait of sliced cactus and sodium flouride is advocated by Moutia (1935), while Williams (1936) recommends lead arsenate (1 lb) and calcium caseinate ($\frac{1}{2}$ lb) in 12$\frac{1}{2}$ gallons of water. Packard (1946), obtained only poor kill with DDT sprays and dusts applied against field infestations of armyworms while Smith and Caldwell (1947), obtained good control of *Laphygma exempta* Wlk., with sprays of 0.1% DDT. Kern (1954), found that toxaphene, BHC, DDT and endrin were satisfactory against *L. frugiperda.* During infestations of *Spodoptera mauritia* in Ceylon, Fernado *et al* (1954), obtained complete control by airplane spraying of 18% DDT emulsion at 2 pints in 1.5 gallons and 2 to 3 gallons per acre.

Materials and methods.

S. mauritia passes through five instars and is about inches long in the fully grown larval stage. The insect was reared in the laboratory on grass from the progeny obtained from one egg mass and larvae about one inch long (IV instar) were selected for the experiments. They were starved for 12 fars. before being exposed to the treatments.

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Technical DDT (76% para para), and BHC (13% gamma) were dissolved in acetone and the required strengths prepared by dilution. Three experiments were conducted, each having four treatments and one control, replicated three times. Treatments consisted of deposits of the insecticides at 2, 4, 8, and 16 microgrammes per square centimetre. For preparing the deposits, one ml of the respective dilution was evenly spread in the bottom of a 9 cm. diameter petridish using a micropipette. Petridishes treated with blank aceton served as control. One hour was allowed fore the acetone to evaporate, after which ten caterpillars were introduced into each dish and the dish closed with the upper half. Temperature during the experiments ranged from 78 F to 82°F. Mortality was recorded at the end of 6, 12. 18, 24 hours, and the average mortality, corrected according to Abbot's formula is recorded in the Table and graphically represented in figures I to III.

TABLE SHOWING AVERAGE MORTALITY PERCENT OF *SPODOPTERA MAURITIA* LARVA EXPOSED TO DIFFERENT DEPOSITS OF DDT AND BHC

Treatments	Morality % after 6 hrs.	12 hrs.	18 hrs.	24hrs.
DDT				
2 ug./cm²	0	46	47	61
4 ug./cnv	0 ,	39	51	66
8 ug./cm²	0	43	56	'76
16 ug./cnv	3	47	63	91
BHC				
2 ug./cm²	0	15	20	23
4 ug. cnr	0	46	53	80
8 ug./cm²	0	53	66	77
16 ug./cm²	30	75	87	90

Results.

From the data given above it will be seen that at the end of six hours, no morality was caused by any of the treatments except the highest deposits. At the end of 12 hrs , the various DDT trestments caused mortalities ranging from 36 to 47 percent, while for BHC the mortalities for the smallest dose is lower (15) and for the bigger doses, higher (53 and 75). Observation after 18 hours also reveals a similar picture, DDT causing 47 to 63 percent mortality, while for the corresponding figures are 20 to 87. At the end of 24 hours, the mortality figures for DDT are 61 to 91, while for BHC they are 23 to 90.

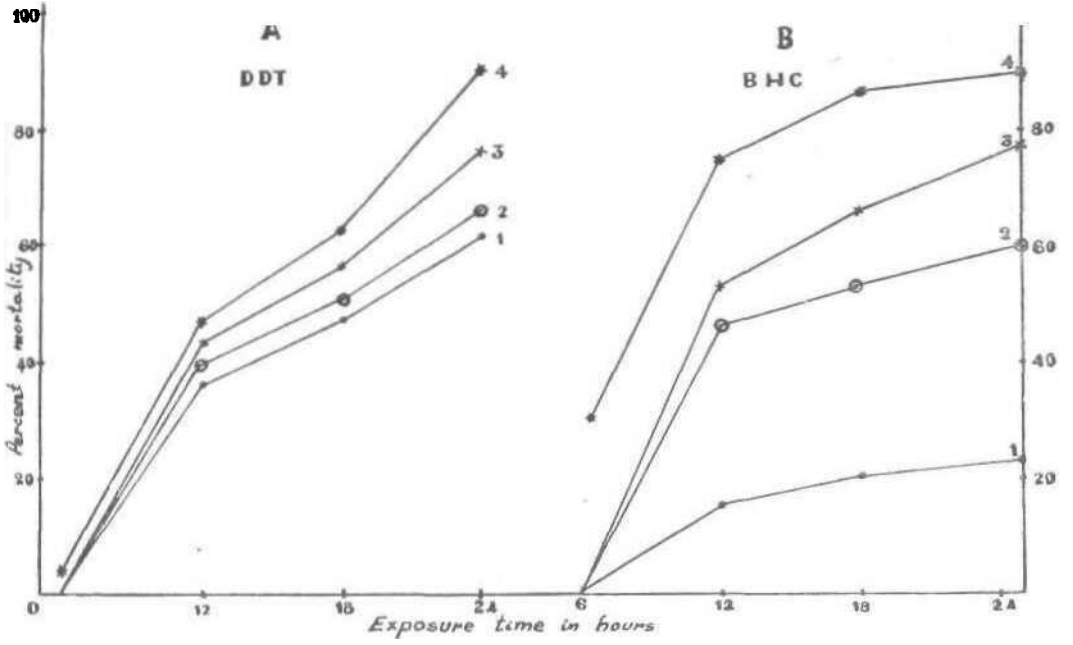

Chart showing comparative toxicity of
DDT and BHC to *Spodoptera mamilia* Boids.

Discussion.

The toxicity of an insecticide is generally assessed on the basis of its Median Lethal Dose (MLD) for a test insect. However, the MLD reveals only one aspect of toxic action, ie., that at the end of a fixed duration of exposure time. By itself the MLD of an insecticide gives no idea of the dosage-mortality relationship, and for this reason, any comparison of insecticides on the basis of their MLDs alone, will not be adequate in assessing their toxic action, especially if they differ in residual and fumigant action. In view of this, toxic action is studied in the present experiments from two aspects, ie., progressive mortality caused by each insecticide with lapse of time, and also the MLD.

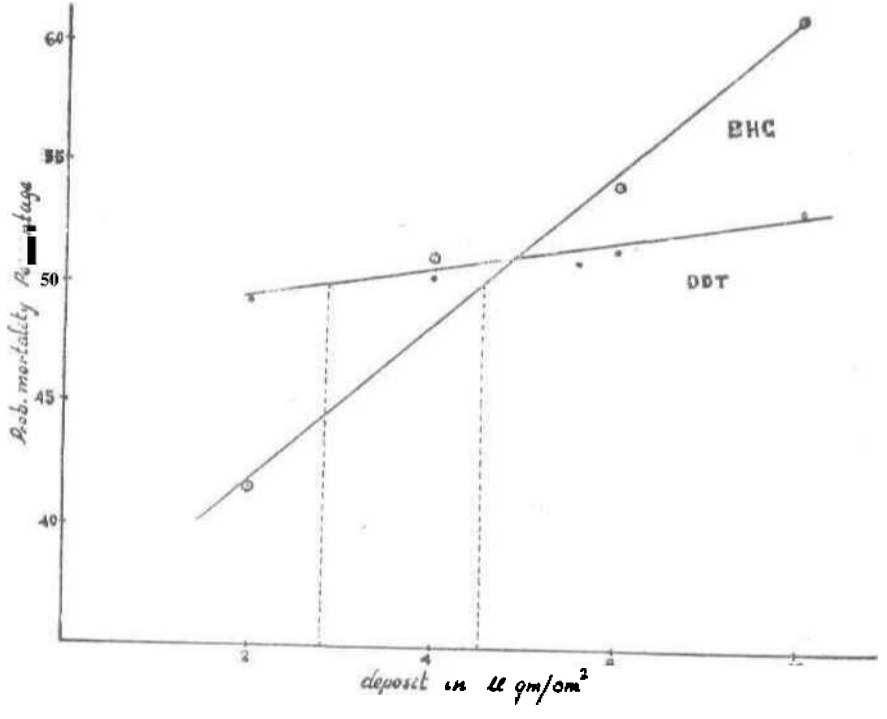

Fig. I showing dosage-mortality relationship of deposits of DDT and BHC at the end of 18 hours of exposure.

The course of action of the various DDT dosages used, when traced shows (vide Fig.I), that the initial mortality for all the strengths after 12 hours is rather high, but an eightfold increase in dosage from 2 ug, to 16 ug. per 2 produces only a small rise in mortality, ie., from 36 to 47 percent. In the case of BHC however; although the initial mortality is low (15%), an eightfold increase in dosage produces a considerable rise in mortality (75%). This same phenomenon is observed at the end of 18 hours also. This observation is in conformity with what is known of the action of insecticides like DDT and BHC possesssing

marked differences in fumigant action (Brown 1951).

It is seen from Fig. I that the toxic action of DDT tends to rise after the 18 hour exposure period, while that of BHC wanes. This observation indicates that the toxic action of DDT increases with lapse of time while that of BHC decreases.

The dosage-mortality relationship as it exists at the end of 18 hours is graphically represented in Fig. n. From the log. dosage prob. mortality lines, the MLD for DDT can be read off as 2.7 ug./cm anc for BHC as 4.9 migm/em The slopes the lines clearly indicate the respective residual and fumigant action of these insecticides. The line for DDT is rather flat, showing that increasing dosage from that required for 50% mortality would not result in any appreciable increase in mortality. In the case of BHC however, this line is rather steep, revealing the fumigant action of the material and indicating that increase in dosage would cause substantial increase in mortality.

The slopes of the time-mortality relationship for the two higher deposits of DDT are rather steep after 16 hours, showing that toxic action continues, while in the case of BHC, the corresponding slopes are rather flat indicating that the effect of the insecticide is fast decreasing. since a deposit of 8 cm of DDT (0.72 !bs/acre), causes 76% mortality in 24 hours, and since its action would continue to persist while that of BHC fast decreases, it would appear that DDT

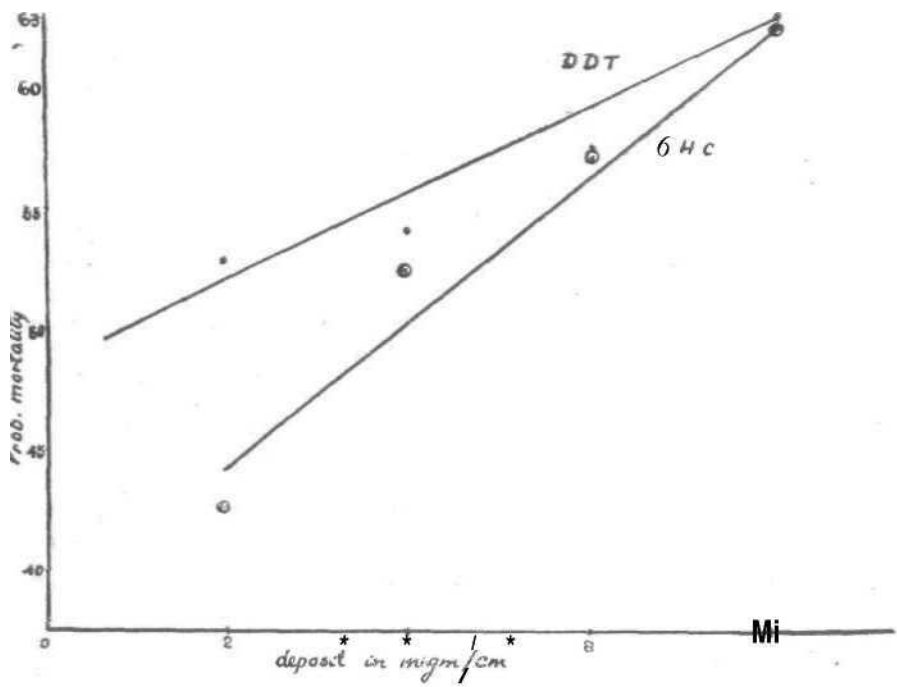

Fig. II showing dosage-mortality relationship of deposit of DDT and BHC at the end of 24 hours of exposure.

has greater toxic action to caterpillars of *Spodoptera mauritia*.

SUMMARY

Laboratory trials using four deposits of DDT and BHC ranging from 2 to 16 micrograms per square centimetre against IV instar larvae of *Spodoptera mauritia* showed that the toxic action of DDT increases with lapse of time while for BHC there is greater initial action but. as time lapses, toxic action decreases. Increasing dosage of DDT from that necessary to kill 50% will not result in any appreciable increase in morality, but for BHC, higher dosages would bring about greater mortality. At 8 to 16 ug. cm⁻², toxic action of DDT continues with lapse of time but that of BHC rapidly declines. In view of its long residual action and its comparatively good initial action, it seems DDT is to be preferrred for controlling infestations of *S. Mauritia*.

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