THE EFFECT OF VARIOUS DILUENTS ON THE TOXICITY OF DERRIS DUST TO HOUSE FLIES (*MUSCA DOMESTICA* L.)

F. E. WHITEHEAD, Oklahoma A. and M. College, Stillwater

The ground roots of certain tropical plants in the legume family are commonly referred to as derris and have in recent years been used extensively as the killing agent in an increasing number of insecticidal dusts and sprays. When used as a dust it is customary to mix the derris with some inexpensive powdered material, which serves as a carrier and diluent, thus making it possible to bring the dust in contact with a greater number of insects per pound of derris used.

A very commonly used diluent is talc. This material has the advantages of being inexpensive, readily available, and well adapted to dusting operations. Lime is a constituent of many insecticidal dusts but it was soon recognized that when lime was mixed with derris the killing ability of the derris was adversely affected.

Since the effectiveness of derris is known to vary with these two diluents it appeared likely that it would likewise vary with other carriers and that it might be possible to find one that would result in a dust more effective than the mixture of derris and talc. The following experiment was designed to test this theory.

TECHNIC

The common house fly was selected as the test insect. This species was reared in a room in which the temperature was held constantly at 78°F and the relative humidity at 50 percent. The larval flies were fed on moistened crimped oats, and the adult flies on milk. The larval food was kept in ordinary milk crocks and fly eggs were placed on top of the food. When the eggs hatched the larvae crawled down into the oats, fed until maturity was reached, returned to the dry area near the top, and pupated. Cylindrical cages with conical tops were placed over the crocks so that when the adult flies emerged they were trapped in the cages.

When the majority of the flies were two to three days of age they were permitted to crawl through an opening at the conical top of the cage into a cylindrical screen wire cage 3.25 inches in diameter and 6 inches high. From 100 to 200 flies was the usual number placed in each cage. The cage containing the flies was then placed in a cylinder constructed of sheet iron 14 inches in diameter and 3.5 feet in length. A wire rack held the caged flies at the center of the cylinder.

A current of air from a vacuum sweeper was then blown directly on the flies, and carefully weighed amounts of dust mixtures were fed evenly through a sieve into the air stream during 30 seconds. When the dusting was completed the cage was removed and the flies were transferred to an undusted cage, fed, and replaced in the constant-temperature room.

At the end of 48 hours a small pill box was inserted through a sleeve in the cage and all flies that were on the floor of the cage were placed in the box. Flies able to get out of the box were regarded as alive; those that could not were considered dead, even though they were able to move to a slight extent. The live flies left in the cage were then killed by heat to facilitate counting them.

The diluents tested were selected mostly on the basis of whether or not they would lend themselves to dusting and whether they were available from chemical supply houses.

In each case three parts (by weight) of the diluent to one part of derris (5 percent rotenone) were thoroughly mixed and two grams of the mixture were used at each dusting. In order to avoid variations in resistance that might occur in different rearings of flies, the experiments were conducted only when sufficient numbers of those insects were available that each of the 16 mixtures used could be tested on the same group of flies. The entire experiment extended over a period of three and one-half months.

RESULTS OF THE TESTS

The results of the experiment are shown in Table I. It is seen that the comparative toxicity of derris dust to the house fly is influenced greatly by the kind of carrier or diluent used. The range in toxicity was from 93.5 percent with the derris-sulphur mixture to 11.5 percent for the derris-manganese dioxide combination. Of the 15 diluents which were compared with talc 7 were more and 8 less effective. It is interesting to note that the three most effective diluents were either sulphur or sulphur compounds.

TABLE I

Effect of 16 diluents on the toxicity of derris to house flies

DILUENT	Number of flies tested	Percentage killed
1. Precipitated sulphur, S	1827	93.5
2. Cupric sulphide, CuS	1909	90.9
3. Dusting sulphur, Freeport Sulphur Co.	1832	89.5
4. Powdered sodium chloride, NaCl	1751	85.4
5. Tannic acid, from oak	1813	69.8
6. Barium carbonate, $BaCO_3$	1774	71.0
7. Zinc oxide, ZnO	1872	69.4
8. Talc, $H_2O \cdot 3MgO \cdot 4SiO_2$	9040[a]	41.0
9. Acetanilide, $C_6H_5NHCOCH_3$	1823	40.3
10. Paraformaldehyde, $(CH_2O)_n$	1928	33.3
11. Calcium carbonate, $CaCO_3$	1845	22.8
12. Zinc carbonate, $ZnCO_3$	1751	17.6
13. Calcium hydroxide, $Ca(OH)_2$	1646	15.6
14. Magnesium oxide, MgO	2000	14.9
15. Kaolin, $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$	1753	11.6
16. Manganese dioxide, MnO_2	1905	11.5

[a] Because talc is so commonly used, several cages of flies were dusted with the talc-derris mixture at each dusting.

DISCUSSION

Numerous workers have shown that the toxicity of an insecticide varies with the species of insect against which it is used and therefore it is probable that if the above mixtures were tested with other insects, their positions with regards to relative toxicity would be shifted. It is also known that it would not be practical to use some of the diluents tested because they might injure the host of the insect. An example of this is that sulphur which stands at the top of the list can not be used against insects infesting cantaloupe because dusting cantaloupe vines with sulphur results in severe burning of the vines. However the data obtained strongly indicate that materials more effective than talc as a diluent for derris powder may be found for use against insects controlled by derris dust.