# Effective Duration of Toxicity to the Mexican Bean Beetle of Derris Deposits on Foliage*

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The fact that rotenone insecticides deteriorate when exposed to sunlight has been known for several years (Jones *et al.* 1933). Experimental data to indicate the rate at which this action takes place are scant. In order to secure some information on this point, the experiments reported here were conducted at Clemson, S. C., during the summer of 1937.

Procedure.—The dust used in these tests was made by diluting powdered air-floated derris containing 5 per cent rotenone with cosmetic talc. A commercial insecticide mixer of the agitator type driven by an electric motor was used to prepare the dust. The components were agitated together for 15 minutes in order to secure an even mixture. Enough material was mixed at one time to supply the needs for the entire season. After being mixed, the insecticide was stored in water-proofed pasteboard cartons which had tight-fitting lids.

The derris for spray suspensions was obtained from the same lot as that used for the dust mixture. A suspension in tap water was made fresh for each application.

Bean plants for the tests were grown in eight-inch clay pots, each containing three healthy, vigorous plants at the time the tests were started.

The dust was applied with a hand-operated plunger duster. The spray was applied with a hand-operated, continuous-stream type sprayer. Special efforts were made to secure thorough application of the insecticides, and it is probable that a better application was obtained than would be possible under field conditions. Plants for a number of delayed tests were treated at the same time and with the same mixture of materials. After the insecticide had been applied, some of the potted plants were immediately taken inside the screened insectary and plunged the full depth of the pots in soil tables filled with moist sand where they were protected from direct sunlight and rain. The others were left exposed to prevailing weather conditions until put on test 3 to 20 days later. After the desired exposure in the open, these plants were placed in soil tables in the screened insectary as described above.

Tests were made immediately on the treated plants in the pots which had been set in the soil tables; 25 specimens of Mexican bean beetle, *Epilachna varivestis* Muls., (either larvae or adults) were caged on each pot of plants. The cages used were made of screen wire on sheet metal frames 14 inches in diameter and 18 inches high. The results of the tests were checked at the end of three days, and all the insects were removed from the plants. Beetles were placed on the shaded plants during more than one interval after the original application of derris, because the plants remained healthy and vigorous enough to afford sufficient foliage for the insects. The plants exposed to the sun were used for only one test. Check tests, in which untreated plants were used, were made for all the tests, and corrections were made in computing results for any mortality which occurred.

Insects for experimental work were collected in the vicinity of Clemson from bean fields in which no insecticide had been applied. After adults of the current season appeared, no overwintering adults were used, and at all times only those individuals which appeared healthy and vigorous were selected. No insects were used for more than one test.

No attempt was made to eliminate the factor of new growth on experimental plants after treatment, since the experiment was designed primarily to indicate the effective duration of derris under field conditions.

Results.—The figures presented in table 1 are representative of a large amount of data secured in these tests.

The data indicate the rate at which derris loses its toxicity for the Mexican bean beetle when exposed in thin films on bean foliage.

In table 1, it is apparent that bean foliage treated with 0.75 per cent rotenone

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dust and exposed to the sun retains some of its toxicity for the Mexican bean beetle over a period of 14 days. Even though this toxicity was apparent in the mortality of the insect, no indications of any protection being afforded the foliage could be detected after an exposure beyond 5 days. In the 6–8 day column, in which it is indicated that 100 per cent of the insects were dead or moribund, as much of the foliage was consumed as on the check plants. However, at the end of 20 days no toxicity was evident.

In table 1, showing the results in bean plants treated with 0.018 per cent rotenone spray, it is evident that the original toxicity is not so great as when a dust containing 0.75 per cent rotenone is used. It is also evident that the toxicity is lost more rapidly, regardless of the exposure given. There is evidence of toxicity through the 6–8 day period in both mortality and the amount of plant tissues consumed. Beyond this period there is no evidence of plant protection remaining.

In all the shaded tests, the plants were afforded good protection from insect injury for a period of two weeks. It will be noted that the mortality was high throughout this period also. Under shade conditions the plants did not hold up for further tests.

On three occasions, eggs were deposited on shade test plants in the first three days that the plants were on test. One egg mass containing 31 eggs did not hatch. Another containing 54 eggs hatched and all the larvae died without showing evidence of having fed. The third contained 43 eggs which hatched. These larvae left some feeding injury but all died in the first instar.

**Table 1.—Mortality[1] of Mexican bean beetle on bean plants treated with derris.**

| Exposure | Condition | Days Elapsed Between Treatment and Starting Tests | | | | | |
|---|---|---|---|---|---|---|---|
| | | None | 3–5 | 6–8 | 9–11 | 12–14 | 20 |
| | Dust, 0.75 Per Cent Rotenone | | | | | | |
| Sun | Dead, per cent | | 12 | 4 | 4 | 16 | 0 |
| | Moribund, per cent | | 69 | 96 | 8 | 8 | 0 |
| | Total dead and moribund, per cent | | 81 | 100 | 12 | 24 | 0 |
| Shade | Dead, per cent | 66 | 52 | 27 | 39 | 22 | |
| | Moribund, per cent | 29 | 45 | 69 | 53 | 63 | |
| | Total dead and moribund, per cent | 95 | 97 | 96 | 92 | 85 | |
| | Spray, 0.018 Per Cent Rotenone | | | | | | |
| Sun | Dead, per cent | | 8 | 0 | 0 | | |
| | Moribund, per cent | | 32 | 28 | 0 | | |
| | Total dead and moribund, per cent | | 40 | 28 | 0 | | |
| Shade | Dead, per cent | 25 | 13 | 12 | 18 | 0 | |
| | Moribund, per cent | 61 | 73 | 76 | 50 | 68 | |
| | Total dead and moribund, per cent | 86 | 86 | 88 | 68 | 68 | |

[1] The number of tests for each period and exposure ranged from 1 to 12. Twenty-five insects were used in each individual test. Counts were made three days after beetles were placed on plants. Comparative tests on sun and shade plants were made at the same time on samples from the same collection of insects.

SUMMARY.—From the data presented it appears that derris on bean foliage under field conditions did not afford protection against the Mexican bean beetle beyond seven days of exposure.

On shaded bean plants protected from the weather, derris was very effective over a period of two weeks or as long as the plants held up.—1-7-38.

## LITERATURE CITED

**Jones, H. A.**, W. A. Gersdorff, E. L. Gooden, F. L. Campbell and W. N. Sullivan. 1933. Loss in toxicity of deposits of rotenone and related materials exposed to light. JOUR. ECON. ENT. 26(2):451–70. Illus.