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LABORATORY TESTS AGAINST BANANA WEEVIL
BORER SUSPECTED OF BEING RESISTANT TO
DIELDRIN

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SUMMARY

Preliminary laboratory tests in which suspected dieldrin-resistant banana weevil borers (*Cosmopolites sordidus* Germ.) were confined on soil treated with 0.05% and 0.1% dieldrin at 1 ml/4700 mm² (equivalent to the standard field recommendation of 1 pint/stool of radius 3 ft) indicated that they were not resistant.

This was confirmed by the results of a micro-drop insecticide test comparing the suspected dieldrin-resistant and a known susceptible population of banana weevil borers. Percentage kill/log dosage data for the known susceptible population gave an LC50 value of 0.086% dieldrin in kerosene and an LC99.9 value of 1.26% dieldrin. A discriminating dose of 1.2% dieldrin in kerosene is suggested, allowing for one survivor in 1000 weevils tested.

I. INTRODUCTION

Sprays of 0.05% dieldrin applied to the lower part of the banana pseudostem and to the surrounding soil have given satisfactory control of the banana weevil borer (*Cosmopolites sordidus* Germ.) in Queensland plantations for many years. However, resistance to this chemical has developed in areas of northern New South Wales and a report of difficulty in controlling the pest from a grower at Narangba aroused a suspicion that resistance to dieldrin might have developed in Queensland also. The laboratory tests reported here and a field trial (Swaine and Corcoran 1973) were initiated to check on this suspicion.

II. MATERIALS AND METHODS

Insecticides.—The following insecticides were used in Series A, Simulated field tests:

- Lindane—A miscible oil concentrate containing 16% w/v gamma isomer BHC as active constituent; used at 0.1%.
- Chlordane—An emulsifiable concentrate containing 80% w/v active constituent; used at 0.1%.
- Diazinon—An emulsifiable concentrate containing 20% w/v active constituent; used at 0.1%.
- Dieldrin—A miscible oil concentrate containing 30% w/v active constituent; used at 0.05% and 0.1%.

In Series B, Micro-drop application tests, the insecticide used was dieldrin—a solution of the pure material HEOD, obtained by recrystallization from Hexane to a constant melting point of 175°F, in kerosene; used at 1% and over the range of 0.0124% to 0.2% active ingredient.

Methods.—In the simulated field tests soil from an unsprayed bushland area at the Narangba banana plantation was sieved through a $\frac{3}{16}$ in. B.S.S. sieve, slightly moistened and placed to a depth of 2 in. in 4 lb specimen jars. In two tests insecticides were applied to the soil surface only in each jar by means of a fine pipette at a rate of 1 ml/4700 mm² = 1 pint/stool of radius 3 ft. Control jars were treated with the same volume of tap water. Thirty weevils were used per treatment, one individual being placed in each jar together with a large chunk of fresh banana pseudostem as food, and the jars covered with organdie. The insecticides used were 0.1% lindane and 0.05% and 0.1% dieldrin. In a third test using 0.1% chlordane, 0.1% diazinon, and 0.05% and 0.1% dieldrin the insects were immersed approximately 30 sec in the insecticide, air-dried on filter paper and placed individually in 4 lb specimen jars containing soil sprayed as previously. Thirty weevils were again used for each treatment.

The insects in these tests were kept at 26.7°C and checked for mortality on specified days after treatment. The criterion of death was inability to fully extend and flex all six legs.

In an initial micro-drop applicator test, 20 suspected resistant weevils were screened by the discriminating dose method used in New South Wales in which a microlitre drop of a 1.0% solution of technical dieldrin in kerosene is applied to the meta-sternal region of each weevil and a check made for mortality after 72 hr at 25°C (G. Pasfield, personal communication.) The insecticide was applied by means of an automatic Burkard-Arnold micro-applicator and the insects were kept individually after dosing in a closed 4 in. x 1½ in. plastic vial containing a chunk of fresh banana pseudostem as food. Control insects were dosed with a 1 microlitre drop of kerosene only.

More extended tests were carried out using this method to establish base-line data for known dieldrin-susceptible weevils from a neglected farm at Samford which had never been sprayed with dieldrin. Three replicates of a series of doubling dose tests ranging from 0.0125% to 0.2% active ingredients were carried out on batches of 30 weevils and mortality assessed as previously after 72 hr at 25°C. One replicate of the suspected resistant weevils was dosed with the same concentrations of dieldrin and checked for mortality after 72 hr at 25°C. The criterion of death was inability to fully extend and flex all six legs.

III. RESULTS

(a) Series A—Simulated Field Tests

The results in Table 1 show that 0.05% and 0.1% dieldrin applied to the surface of the soil alone at a rate equivalent to that used in the field, or as a combined treatment which included dipping of the weevils in the insecticide, gave complete kill of the suspected resistant weevils in 12–15 days. The other two chlorinated hydrocarbons (BHC and chlordane at 0.1%) also gave good to complete kill over the same period. Diazinon 0.1% as a combined soil surface application and dipping was less effective than the chlorinated hydrocarbons.

TABLE 1

LABORATORY TESTS WITH INSECTICIDES AGAINST SUSPECTED DIELDRIN-RESISTANT BANANA WEEVIL BORERS FROM NARANGBA

Test No.	Treatment	No. of Weevils	Number and Percentage Dead on Specified Day after Treatment			
			6 Days		15 Days	
			Dead	Percentage Dead	Dead	Percentage Dead
1	Control	30	0	0	0	0
	0.05% dieldrin on soil only	30	9	30.0	30	100
	0.1% dieldrin on soil only	30	21	70.0	30	100
2	Control	30	0	0	0	0
	0.05% dieldrin on soil only	30	13	43.4	30	100
	0.1% lindane on soil only	30	20	66.6	27	90.0
3	Control	30	0	0	0	0
	0.05% dieldrin immersion and on soil ..	30	29	96.6	30	100
	0.1% dieldrin immersion and on soil ..	30	27	90.0	30	100
	0.1% chlordane immersion and on soil ..	30	24	80.0	30	100
	0.1% diazinon immersion and on soil ..	30	17	56.6	23	76.6

Soil application by pipette at rate 1 ml/4700 mm² = 1 pint/stool of radius 3 ft.
Immersion of weevils by complete dipping 30 sec.

(b) Series B—Micro-Drop Application Tests

A single test on a batch of 20 suspected dieldrin-resistant weevils by the discriminating dose method of New South Wales gave no indication of resistance (Table 2).

TABLE 2

DISCRIMINATING DOSE TEST OF DIELDRIN AGAINST SUSPECTED RESISTANT BANANA WEEVIL BORERS FROM NARANGBA

Treatment	Number of Weevils	Number of Dead Weevils after 72 hr at 25°C
Control (kerosene only)	20	0
Dieldrin (1 microlitre of 1.0% sol. in kerosene)	20	20

Base-line data for a dieldrin-susceptible population and comparison with a suspected resistant population are shown in Figure 1. The data are presented as a graph of percentage kill in relation to log dosage. The LC50 value for the susceptible population is 0.086% dieldrin and the LC99.9 value is 1.26% dieldrin (slope 2.58472, $> 2 \times$ standard error 0.288 : $P = 0.05$). On the basis of this graph a discriminating dose allowing for one survivor in 1 000 weevils tested would be 1.2% dieldrin. A similar graph based on a single replicate of the suspected dieldrin-resistant population in Figure 1 shows the sample to be susceptible.

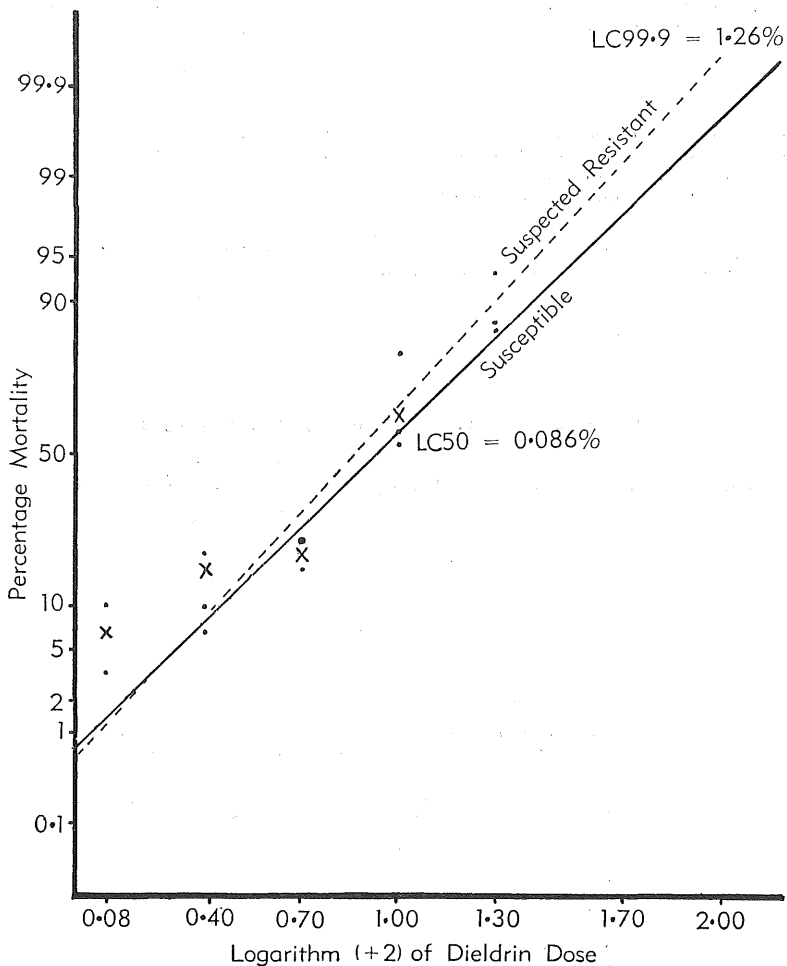


Fig. 1.—Relationship between dosage of dieldrin and mortality of banana weevil borer.

IV. DISCUSSION

All the laboratory tests carried out show that the weevil borer samples taken from the Narangba banana plantation where dieldrin resistance was suspected are not resistant. Reasons for the presence of large number of the borers on this particular plantation are not known.

V. ACKNOWLEDGEMENT

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REFERENCE

SWAINE, G., and CORCORAN, R. J. (1973).—A field trial on a suspected dieldrin-resistant population of banana weevil borer. *Qd J. agric. Anim. Sci.* 30:79-83.

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