

INSECTICIDE CONTROL OF *SALINA CELEBENSIS* SCHAFER (COLLEMBOLA: ENTOMOBRYIDAE), A MINOR PEST OF CACAO IN PAPUA NEW GUINEA

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ABSTRACT

Lindane, dieldrin, chlordane, carbaryl, dicotophos, fenthion, formothion, parathion, trichlorphon and superior white oil were tested against Salina celebensis Schaffer a minor pest of young cocoa in Papua New Guinea. Lindane and parathion at 0.1 per cent a.i. were the best treatments. The addition of superior white oil 0.1 per cent to insecticide mixtures enhanced the effectiveness of treatment. Carbaryl 0.1 per cent a.i. plus superior white oil 1.0 per cent and carbaryl 0.7 per cent a.i. plus superior white oil 1.0 per cent maintained plants substantially free of S. celebensis for ten and 22 days respectively. There was no evidence of phytotoxicity in any of the treatments.

INTRODUCTION

THE springtail *Salina celebensis* Schaffer is listed as a pest of cacao in Papua New Guinea (Dumbleton 1954). The species has caused considerable leaf fall in young cacao seedlings on New Britain (Dun 1953). DDT and BHC were reported to be effective in controlling *S. celebensis* (Dun 1954).

During the course of investigations into entomological aspects of vascular streak dieback (as defined by Keane, *et al* 1972) of cacao, it was found that twice weekly applications of either 0.05 per cent dicotophos or formothion in water were relatively ineffective in reducing *S. celebensis* numbers.

A series of insecticide control trials was therefore carried out from July to September 1967 to evaluate candidate materials to effectively control the species.

METHOD

The first two trials were conducted on ten weeks old cacao seedlings growing in a heavily shaded *Leucaena leucocephala* block. The third was also conducted in a heavily shaded *L. leucocephala* block (the same block), but the

cacao seedlings were 12 weeks old. In all three experiments the seedlings were at the recommended planting distance of 12 feet on the triangle. There were five seedlings per treatment. Treatments were applied by hand atomizer and plants were sprayed to the point of runoff.

An average of 1.4 fl oz of the insecticide mixture was applied to each seedling in trial 1 and 1.8 fl oz to seedlings in trials 2 and 3. This represented an application rate of 4.9 oz per acre active ingredient insecticide for trial 1 and 6.1 oz per acre for trial 2.

A pretreatment count was conducted immediately prior to the application of treatments and a second count was made one hour after treatment. Further counts were made on successive days.

For all three trials, a randomized block design with five replicates per treatment was used.

In trial 1, lindane (e.c.), dieldrin (e.c.), chlordane (e.c.), carbaryl (w.p.), dicotophos (w.s.c.), fenthion (e.c.), formothion (e.c.), parathion (e.c.) and trichlorphon (w.p.) as 0.1 per cent sprays were compared with a 1 per cent superior white oil/water spray. In the second trial, all the above materials were again applied at 0.1 per cent, but 1 per cent superior white oil was added to each insecticide mixture.

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In trial 3, lindane, carbaryl and parathion plus 1 per cent superior white oil were compared at 0.1 per cent, 0.3 per cent and 0.7 per cent plus 1 per cent superior white oil. Equivalent dosages of active ingredient insecticide were 6.1 oz/acre, 18.3 oz/acre and 42.7 oz/acre.

RESULTS AND DISCUSSION

Results of the *S. celebensis* counts for trials 1 and 2 are shown in *Tables 1* and *2* respectively. During trial 1, 239 points of rain fell between the day 1 and day 2 counts. During trial 2, a total of 298 points of rain fell over the recording period of 33 days. The most significant falls were 41 points on the first day, 33 points on the sixth day and 192 points on the tenth day.

From *Table 1* it can be seen that dicrotophos, lindane and carbaryl treatments substantially reduced populations and that this reduction persisted five days after treatment.

From *Table 2*, it can be seen that the carbaryl plus superior white oil, parathion plus superior white oil and lindane plus superior white oil, were the most effective in reducing collembola populations. The carbaryl/white oil treatment maintained plants substantially free of *S. celebensis* (one per seedling) for ten days.

The third trial was carried out to test the three most promising insecticides plus superior white oil at higher rates of application to see whether the period of protection could be lengthened. During the trial a total of 945 points of rain fell, the most significant falls

Table 1.—Effectiveness of nine insecticides against *S. celebensis*

Treatment	Rate (% a.i.)	0 (Pre-treatment)	Mean number of <i>S. celebensis</i> per seedling on day						
			Post treatment counts						
			1/24th	1	2	3	4	5	7
Dicrotophos	0.1	23	0	0.8	4	4	3	8	17
Carbaryl	0.1	37	0	0.6	8	4	7	5	14
Lindane	0.1	17	0	3	5	6	3	6	13
Dieldrin	0.1	30	0.6	0.8	5	3	5	8	15
Fenthion	0.1	14	0.6	3	6	4	8	17	23
Chlordane	0.1	21	2	3	7	9	8	18	16
Trichlorphon	0.1	41	0.2	4	10	11	12	10	29
Formothion	0.1	49	5	2	19	12	15	17	34
Superior White Oil	1.0	23	13	7	15	12	9	13	21
Control		36	36	30	37	32	38	65	45

occurring on day 6 (329 points), day 14 (45 points), day 15 (28 points), day 21 (37 points), day 23 (47 points) and day 24 (171 points). Other heavy falls were experienced during the last week of recordings. The results of this trial are shown in *Table 3*.

All treatments greatly reduced the numbers of *S. celebensis* on treated seedlings. Carbaryl plus superior white oil gave the best results with ten days of substantially *S. celebensis* free plants at 0.7 per cent a.i. plus superior white oil.

From this series of trials it was concluded that carbaryl 0.1 per cent would provide good control of *S. celebensis* and that the addition of superior white oil 1.0 per cent enhanced the activity of carbaryl. Lindane and parathion also provided good initial kills but seedlings

were rapidly recolonised by *S. celebensis*.

There was no evidence of phytotoxicity in any of the treatments applied in the three trials.

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Table 2—Effectiveness of nine insecticides plus 1 per cent superior white oil against *S. celebensis*

Treatment	Rate (% a.i.)	0 (Pre-treatment count)	Mean number of <i>S. celebensis</i> per seedling on day																
			Post treatment counts																
			1/24th	1	2	3	4	5	6	7	8	9	10	13	15	19	22	26	33
Carbaryl	0.1	28	0	0.4	0.2	0	0.2	0.8	0	0.2	0.8	0.2	0.2	3	3	6	15	23	33
Parathion	0.1	22	0.2	1	0.6	1	3	3	1	3	6	3	11	14	9	12	17	41	22
Lindane	0.1	20	0	0.2	0.4	2	4	5	4	1	11	7	6	29	21	38	16	27	27
Dicrotophos	0.1	27	0.4	1	0.6	0.6	5	11	9	11	17	7	6	20	24	36	24	46	35
Dieldrin	0.1	34	0	0.8	5	3	6	4	5	5	14	18	12	19	14	20	16	33	19
Chlordane	0.1	25	0.2	3	2	4	9	13	13	15	11	19	18	40	30	34	25	42	36
Formothion	0.1	44	2	8	8	13	14	12	19	14	17	24	27	40	20	41	54	34	22
Fenthion	0.1	30	0.8	9	12	7	10	24	18	27	36	32	29	62	33	39	38	45	44
Trichlorphon	0.1	36	0	7	6	7	11	15	21	36	33	39	30	60	26	49	58	35	31
Control		23	30	29	37	38	23	41	40	56	74	77	67	81	55	73	71	73	57

Table 3—Effectiveness of carbaryl, lindane and parathion at three concentrations plus superior white oil on *S. celebensis*

Treatment	Rate	0 (Pre-treatment count)	Mean number of <i>S. celebensis</i> per seedling on day										
			Post treatment counts										
			1/24th	1	3	7	10	14	17	24	28	31	
Carbaryl	0.1%	36	0.6	0	0	0	0	0	0.2	15	22	30	
	0.3%	26	0	0	0	0	0	0.4	0.8	12	28	21	
	0.7%	28	0.2	0	0	0	0	0.2	0	0.6	4	4	
Parathion	0.1%	33	2	0	0	0.2	0.4	0.6	2	26	49	69	
	0.3%	12	0	0	0	0	0.2	1	1	12	15	29	
	0.7%	54	6	0	0	0.8	0.6	1	0.6	19	34	36	
Lindane	0.1%	29	0.2	0	0	0.6	2	9	14	49	53	35	
	0.3%	41	0.2	0	0	2	6	10	22	32	62	69	
	0.7%	36	0	0	0	0.2	0	0.4	4	6	12	21	
Control		33	33	13	9	34	49	65	73	187	176	160	