THE USE OF CHLORPYRIFOS IN CONTROLLING WEEVIL BORER, *RHABDOSCELUS OBSCURUS* BOISD. (COLEOPTERA : CURCULIONIDAE) IN SUGARCANE SETTS

L. S. Kuniata[1] and G.R. Young[1,2]

ABSTRACT

The weevil borer, Rhabdoscelus obscurus is a serious pest of sugarcane at Ramu Sugar estate, Papua New Guinea. A mode of infesting newly planted sugarcane crops is from the use of infested seedcane. Field trials were established in 1987-89 to select a suitable insecticide for treating infested seedcane. It was shown that chlorpyrifos was superior to dichlorvos, dieldrin and fenitrothion as a dip to disinfest setts. The LC50 and LC95 for chlorpyrifos were 0.03% a.i. and 1.50% a.i. and 4.60% a.i. against all weevil borer stages.

Key words: Weevil borer, sett dipping, chlorpyrifos, sugarcane.

INTRODUCTION

The larvae of weevil borer, *Rhabdoscelus obscurus* Boisd. (Coleoptera : Curculionidae) are a serious pest of sugarcane (hydrids of *Saccharum officinarum*) in village gardens in Papua New Guinea (PNG) (Szent-Ivany & Ardley 1962; Bourke 1968). Recently a commercial sugarcane industry was established in the upper reaches of the Ramu valley with the intention of producing sugar for PNG market and also export purposes (Eastwood 1990). Kuniata and Sweet (1991) pointed out that *R. obscurus* is currently rated as the second major stalk borer after *Sesamia grisescens* (Lepidoptera : Noctuidae) at Ramu Sugar Ltd (RSL) estate.

It has been shown that weevil borer starts entering a sugarcane crop at about four months after planting (Young & Kuniata, unpublished data). But in ratoon cane (regrowth after harvest), a high proportion of *R. obscurus* remain in the stubble after harvest and may emerge to infest the subsequent crop. Movement of weevil borer adults in the field is probably largely by flight rather than along the ground. Van Zwaluwenburg and Rosa (1940) observed that weevil adults were able to travel up to 500 m from point of release in the field. Seedcane infested with weevil borer can be transported to greater distances thus infesting newly established crops.

Possible control measures were discussed by Kuniata and Sweet (1991). They concluded that an integrated approach may be required to bring this pest to manageable levels. One approach is the use of planting material free of weevil borer life stages. Therefore, sett dipping trials were initiated to select suitable insecticides for this purpose.

MATERIALS AND METHODS

Field trials to screen various insecticides for controlling weevil borer in infested planting material were established between 1987-1989 at Ramu Sugar Ltd, Madang, Papua New Guinea.

[1] Ramu Sugar Ltd., P O Box 2183, Lae, Papua New Guinea.
[2] Present address: 27 Boyce St., Ryde, NSW 2112, Australia.

Trial 1 was a non-replicated trial established in February, 1987 to compare four insecticides (Table 1). One hundred 3-bud setts per treatment of sugarcan *var. Cadmus* showing weevil borer damage were dipped in the appropriate concentrations of each insecticide for 5 -10 seconds before being planted in furrows 30 cm deep. Plot sizes used were 1.5 m x 30 m. After five days these setts were recovered from the soil, carefully split-open and the number of live and dead weevil borer life stages and germinated sugarcane buds were counted.

Trial 2 was established in October 1987 using chlorpyrifos (LORSBAN 50 EC*) at concentrations of 0 (tap water only), 0.05, 0.10, 0.20, 0.40, and 0.80% a.i. Fifty two infested setts of var. Cadmus were dipped in each concentration. A randomised complete block design trial with 4 replicates was used. Plot sizes used were 4 rows x 5 m with 1.5 m and 1m separating replicates and treatment plots,

Table 1. **Mortalities of weevil borer and germination of sugar cane buds (%) in Trial 1.**

Treatments (% a.i.)	Mortalities of Weevil borer (%)			Germinated buds (%)
	Larvae	Pupae	Adults	
Control (0)	1 (86)	14 (22)	0 (21)	47
Dichlorvos				
(NUVAN* 50EC)				
(0.10)	0 (55)	11 (19)	17 (30)	49
(0.50)	2 (55)	8 (12)	0 (19)	52
Dieldrin 15EC				
(0.05)	12 (58)	50 (8)	25 (44)	74
(0.10)	23 (71)	29 (7)	38 (24)	68
Fenitrothion				
(DICOFEN* 50EC)				
(0.10)	16 (50)	29 (7)	6 (31)	56
(0.50)	58 (26)	64 (11)	55 (31)	51
Chlorpyrifos				
(LORSBAN* 50EC)				
(0.10)	85 (34)	100 (3)	50 (22)	64
(0.40)	94 (35)	100 (5)	92 (38)	60

* Trade names.

Figures given in parenthesis indicate total number of insects found per 100 setts.

respectively. Methods of planting and assessment were similar to those described for Trial 1. The trial was repeated in 1988 and 1989 as Trials 3 & 4, respectively.

Trial 5 was established in March 1988 to compare the germination of weevil damage and undamaged setts (taken from first 5 internodes from base of sugarcane stalks) and test for any interactions with various concentrations of chlorpyrifos. Fifty infested setts were used for each concentration. A split-plot design was used where the damaged and undamaged setts were used as main plots while the concentrations of chlorpyrifos as sub-plots with 3 replicates. Planting and assessment procedures were similar to those described for Trial 1.

The observed mortalities were transformed using arcsine and used in analysis of variance. Average mortalities were corrected using Abbott's (1925) formula and used in probit analysis. Probit analysis regressions were used to determine the LC50 and LC95 of each insecticide against weevil borer in infested setts.

RESULTS

In Trial 1, weevil borer mortalities in chlorpyrifos - treated setts were higher than in untreated control setts or setts treated with the other insecticides (Table 1). Dieldrin gave the highest percentage of germinated buds but did not control weevil borer.

It was observed from Trial 2 (1987) and the two similar trials established in 1988 and 1989 that the larvae of weevil borer in infested setts were susceptible to all the rates of chlorpyrifos (Table 2). In 1987, differences between mortalities were highly significant ($p < 0.01$) for both larvae and pupae and significant ($p < 0.05$) for the adults. Highly significant ($p < 0.001$) differences were observed in larval mortalities in 1988 (Trial 3). These were significant ($p < 0.05$) for adults but not significant for the pupae. Similarly, Trial 4 in 1989 showed highly significant ($p < 0.001$) mortalities for larvae while these were not significant for pupae and adults.

Regression analysis between various concentrations of chlorpyrifos used and probits are summa-

Table 2. Mean mortalities of weevil borer (arcsine transformed).

Chlorpyrifos (% a.i.)	1987			1988			1989		
	Larvae	Pupae	Adults	Larvae	Pupae	Adults	Larvae	Pupae	Adults
0 (Control)	4c*	25b	0b	1e	6	6b	1c	10	8
0.05	44b	74a	70a	23d	15	20ab	42b	35	15
0.10	63ab	90a	68a	32cd	40	23ab	53ab	54	19
0.20	70a	90a	80a	43bc	27	32ab	65ab	41	19
0.40	63ab	90a	65a	52ab	22	21ab	67ab	81	22
0.80	70ab	90a	82a	64a	27	42a	73a	74	36

*** Means followed by same letter in each column are not significantly different by DMRT (p 0.05).**

Table 3. **Regression analysis between log. concentrations and probits for weevil borer mortalities from 3 replicated trials (Trials 2-4).**

	1987		1988		1989	
	Larvae	All stages	Larvae	All stages	Larvae	All stages
r	0.823ns	0.744ns	0.999***	0.995***	0.955*	0.960**
a	6.49	6.47	6.33	5.98	6.69	5.95
b	0.67	0.67	1.28	1.03	0.91	0.61
SE of b	0.256	0.349	0.034	0.057	0.164	0.103
LC50	0.01	0.07	0.09	0.11	0.01	0.03
LC95	1.66	1.80	1.75	4.34	0.91	13.68

LC50 and LC95 are given in % a.i.

n.s., not significant, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4. **Mean germination of sugarcane buds in Trials 2-4 (%).**

Treatments (% a.i.)	Mean germination (%)		
	1987	1988	1989
0 (Control)	36	23	22abc
0.05	43	24	24ab
0.10	36	18	25ab
0.20	33	18	27a
0.40	35	21	18bc
0.80	44	20	17c

Means having similar letters in each column are not significantly different by DMRT ($p = 0.05$).

rized in Table 3. Except for 1987 data, highly significant positive correlations were observed between concentrations and probits. Average larval LC50 and LC95 was 0.03% a.i. and 1.40% a.i., respectively. These were 0.03% a.i. and 4.62% a.i. for all the weevil borer life stages.

Average percentage of germinated sugarcane buds were very low and are summarized in Table 4. The various concentration of chlorpyrifos did not significantly affect mean germination in 1987 and 1988. However, in 1989 concentrations were higher than 0.20% a.i. significantly ($p < 0.05$) reduced mean germination.

Comparisons of weevil borer damaged and undamaged setts from Trial 5 showed highly significant ($p < 0.01$) differences in mean germination between these with various concentrations of chlorpyrifos (Figure 1). There was a 24% reduction in germination observed in weevil damaged setts compared to

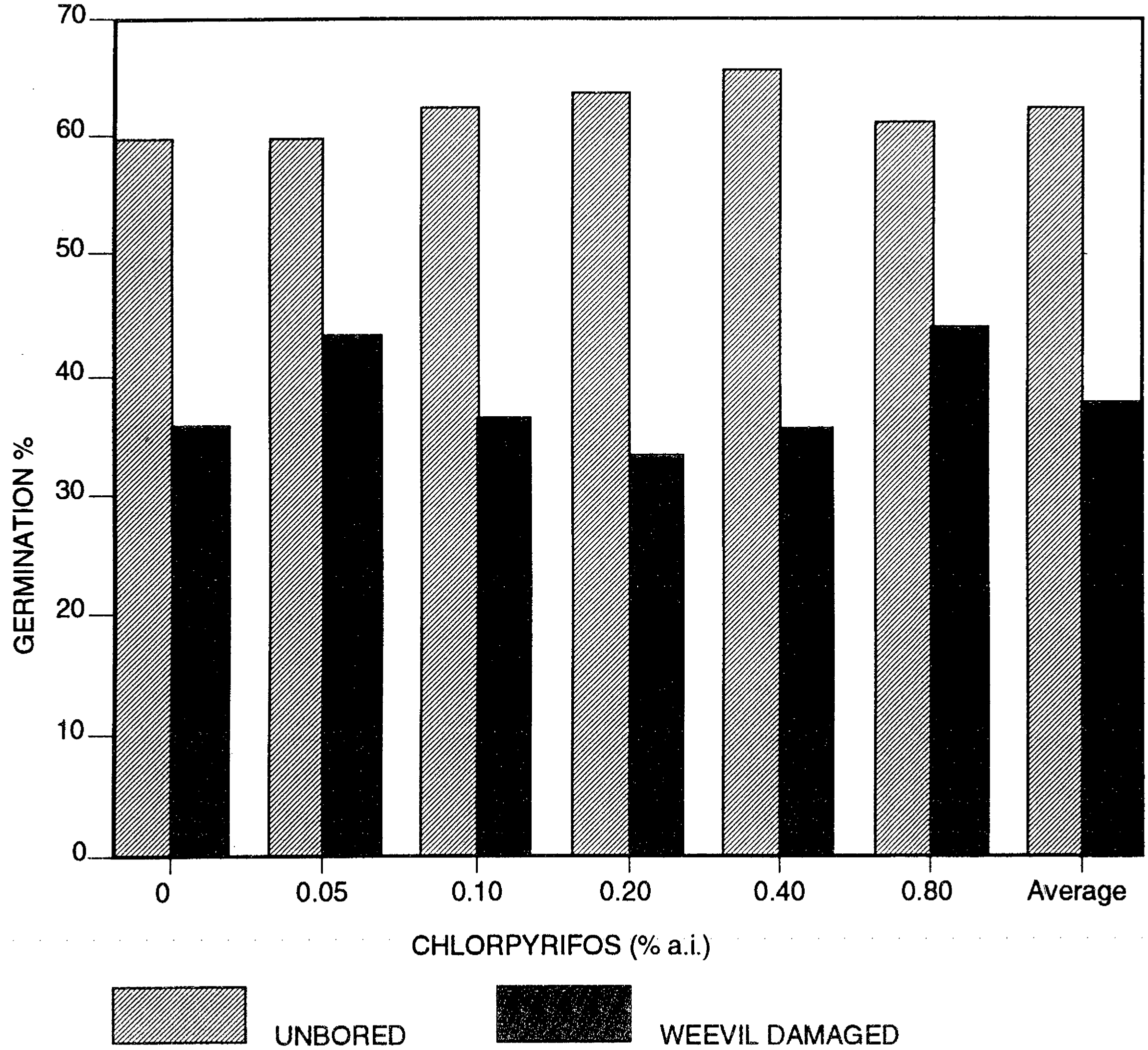

Figure 1. **Effects of chlorpyrifos on germination of weevil borer damaged and unbored sugarcane setts.**

undamaged ones. There were no significant interactions observed between types setts used and chlorpyrifos.

DISCUSSION

Emulsifiable concentrates of chlorpyrifos have largely been used as sprays against foliar feeding insects on other crops. These data indicated that chlorpyrifos can effectively control weevil borer infestations in sugarcane setts. Similar mortality trends observed in all these trials indicated that the larvae were most susceptible followed by pupae and adults. Larvae continue to move around and feed inside the setts for some time after treatment and therefore may become exposed to the insecticide. The pupal and adult mortalities were very variable. These stages do not feed and live inside tightly spun fibrous cocoons where they may be protected from the insecticide. The higher average mortalities observed in Trial 2 in 1987 were probably due to the additional effect from a severe drought experienced during the duration of the trial.

Generally, setts infested with weevil borer gave lower germination than unbored setts. Plant reserves in infested setts may have been used up by the larva of weevil borer with lesser amounts available for utilization by the growing buds and shoots. Dipping infested setts in chlorpyrifos did not improve germination and therefore infested setts should not be used wherever possible. A phytotoxic effect of chlorpyrifos on germination was not clear from these trials. However, a concentration of 0.20% a.i. has been suggested for use in dis-infesting sugarcane setts at planting.

Adults of weevil borer have been shown to travel more than 500 m from point of release in the field (Van Zwaluwenburg and Rosa, 1940). Infested seedcane can be transported to greater distances thus infesting newly established sugarcane crops. Sett dipping provides a means of minimizing weevil borer spread and reducing infestation in newly planted crops.

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