SUSCEPTIBILITY OF EUCALYPTUS TORTOISE BEETLE (*PAROPSIS CHARYBDIS*) TO *BACILLUS THURINGIENSIS* VAR. SAN DIEGO

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SUMMARY

The eucalyptus tortoise beetle, *Paropsis charybdis* Stal., was tested by bioassay for susceptibility to the bacterium *Bacillus thuringiensis* var San Diego. After ingesting the bacteria, larvae stopped feeding and died within 7 days. Tests with first instar larvae indicated that mortality was dose-related with significant mortality occurring at low concentrations of the bacterium. No mortality was recorded among treated adults.

INTRODUCTION

The eucalyptus tortoise beetle, *Paropsis charybdis* Stal., is a major chrysomelid pest of eucalypts in New Zealand. Adults and larvae feed on the leaves and can cause severe defoliation (Bain 1977). Despite several attempts, no successful biological control agents have been found for this pest (Nutall and Alma 1986).

Following the discovery of coleopteran-active strains of the bacterium *Bacillus thuringiensis* (Kreig *et al* 1983; Herrnstadt *et al* 1986), first reported from Darmstadt, Germany, in 1982, coleopteran strains have been found to be effective against leaf feeding chrysomelids. For this reason it was decided to test the susceptibility of eucalyptus tortoise beetle to a coleopteran-active *B. thuringiensis*.

METHODS

Two experiments were conducted in this study. The first experiment used a single high dosage of bacteria against larvae and adults of the beetle. The second was conducted using a range of dosages against first instar larvae.

In both bases the material used was a preparation of *Bacillus thuringiensis* var San Diego (*B.t.SD*), Mycogen M-One, containing 22,5000 Colorado Potato Beetle International Units (CPBIU)/mg.

In the first experiment bacteria were applied in a 10% suspension diluted with distilled water with 1% Tween 80 added as a wetting agent. Insects were selected from natural field populations or from an insectary colony. Fresh, young eucalypt leaves were dipped in the bacterial suspension or distilled water and placed in petri dishes on a filter paper. Three to five larvae were added to each dish. The test was carried out three times with both small and large larvae. Adult beetles were tested by confining individual beetles in a 25 ml tube with a section of treated or untreated foliage. Five replicates were used in each of two tests with the adult beetles. All insects and foliage were examined after 2-3 days to confirm that feeding had taken place. The foliage was then replaced with untreated fresh young leaves, and mortality determined 5-7 days after treatment.

In the second experiment, leaves were dipped into 10 fold serial dilutions of the bacteria and placed in petri dishes as before. Four or five first instar larvae were added to each dish. Three replicates were used for each treatment. Dosages ranged from 2,200 to 0.022 CPBIU's applied in two tests (Fig. 1). All tests were carried out at 20-25 °C.

RESULTS

Results of the first experiment are presented in Table 1. The bacterial treatment induced high larval mortality (>85%) within the 7 day assessment period. Treatment resulted in a cessation of feeding and morbidity within 2-3 days followed by death and septicaemia in 4-7 days. Most (96%) untreated larvae survived.

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Fig. 1: Concentration/mortality response of first instar *P. charybdis* larvae feeding on eucalyptus foliage dipped in a spore suspension of *B. thuringiensis* var San Diego.

TABLE 1: Effect of *B. thuringiensis* var San Diego on mortality of larvae and adults of *Paropsis charybdis*.

Beetle stage	No. dead (No. tested)	
	Bt	Control
1-2nd instar larvae	11 (12)	1 (12)
3-4th instar larvae	11 (13)	0 (13)
Adult beetles	0 (10)	1 (10)
% Mortality Larvae	88***	4
Adults	0	10

*** Significantly different from each other quoted % mortality, $P < 0.001$.

Survival of adult insects was not affected by the bacterium. Both treated and untreated insects continued to feed for more than 14 days although there was a suggestion that food intake may have decreased in the treated group.

The results of the second experiment are presented in Fig. 1. Data were adjusted for control mortality by Abbott's formula. A mortality of 100% was achieved at all concentrations > 22 CPBIU. At lower dosages a clear dosage response was evident with an LC_{50} of approximately 2 CPBIU/mg.

DISCUSSION

The results described above conform to those obtained with chrysomelids in other studies. The Colorado potato beetle, *Leptinotarsa decemlineata*, was found to be highly

susceptible to coleopteran active strains of *B. thuringiensis* (Kreig *et al* 1983; Herrnstadt *et al* 1986). This, however, is the first record of susceptibility of eucalyptus tortoise beetle to the bacterium. The concentration response of first instar eucalyptus tortoise beetle suggests a level of susceptibility similar to that of Colorado potato beetle but further work is necessary to confirm this.

Kreig *et al* (1984) have shown that early instars of Colorado potato beetle were the most susceptible to *B. thuringiensis* var. *tenebrionis*, although adult feeding and egg laying was reduced. It is possible that further study could reveal a similar reduction in adult feeding and egg laying in eucalyptus tortoise beetle.

The results of these preliminary tests are promising and indicate that coleopteran active *B. thuringiensis* strains should be investigated further as potential control agents for eucalyptus tortoise beetle. As eucalypts increase in importance with the decline in availability of native timbers it is likely that this pest will also increase in importance, making the need for biological control agents more necessary.

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REFERENCES

- Bain, J., 1977. *Paropsis charybdis* Stal (Coleoptera: Chrysomelidae), Eucalyptus tortoise beetle. *Forest and Timber Insects in New Zealand No. 10*. Forest Research Institute, Rotorua.
- Herrnstadt, C., Soares, G.G., Wilcox, E.R., and Edwards, D.L., 1986. A new strain of *Bacillus thuringiensis* with activity against coleopteran insects. *Biotechnology* 4: 305-308.
- Kreig, A., Huger, A.M., Lagenbruch, G.A. and Schnetter, W., 1983. *Bacillus thuringiensis* var *tenebrionis*, new variety, a new pathotype effective against larvae of Coleoptera. *Z. angew entomol.* 96: 500-508.
- Kreig, A., Huger, A.M., Langenbruch, G.A. and Schnetter, W., 1984. New results on *Bacillus thuringiensis* var *tenebrionis* with special regard to its effect on the Colorado potato beetle *Leptinotarsa decimlineata*. *Anz. Schaedlingskde., Pflanzenschutz, Umweltshutz* 57 (8): 145-150.
- Nutall, M.J. and Alma, P.J., 1986. Forest entomology in New Zealand. In: H. Lemack (Ed.) 1986 Forest Handbook. N.Z. Institute of Foresters.