PROTECTION OF PRUNING WOUNDS: FAVOURABLE OVIPOSITION SITES FOR THE LEMON TREE BORER

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SUMMARY

Trapping of adult lemon tree borer (*Oemona hirta*) over a 4 year period showed most flights and egg laying occurred from October to December although some adults could be collected throughout the summer. Females preferred to lay eggs in cuts in citrus branches. Navel orange and Satsuma mandarin were more acceptable than Ugli tangelo and root stock. While covering the cut surface with paint containing dieldrin gave effective control, this treatment is not registered by the Pesticides Board.

INTRODUCTION

The lemon tree borer, a native cerambycid beetle, has been damaging healthy branches of citrus trees in New Zealand orchards for many decades (Cottier 1938). Borer control has not improved from that described in the February 1936 issue of the Kerikeri Gazette.

"Your orchards not too good today.	You'll have to look for borer now,
Your oranges look sick.	Of that there is no doubt.
You might as well have none at all	So fetch a jar of Stockholm tar
For all you have to pick.	And wire to poke them out."

Post war organic pesticides contributed little to borer control as the larval niche is largely inaccessible to sprays. When it hatches, the lemon tree borer larva chews through the egg shell directly into the wood (Dumbleton 1937) and, once inside the citrus branch, the lemon tree borer is completely protected from pesticide sprays.

The increasing costs of manual removal of the borer and borer damaged branches has prompted our investigation of improved control methods.

METHODS

Seasonality of the lemon tree borer

Seven types of trap were tested as potential tools for a survey of the borer. Traps baited with floral odours (2-phenylethanol), liver, virgin females or males, or UV light were used from mid November 1978 to mid-January 1979 at Kerikeri. From January 1982 to May 1983, weekly catches from two traps baited with fermented molasses were compared with catches from a Malaise trap in a 500 tree citrus block on Puketutu Island, Auckland. Trapping with the Malaise trap continues.

Assessment of oviposition sites

The oviposition rates (eggs/female/week) of females with access to citrus branches with cut ends were compared with the rates for females with access to branches with the cut ends sealed with a plastic sheet. Five commercial varieties (Satsuma mandarin, Navel orange, Haward Late orange, Seminole tangelo and Ugli tangelo) and the rootstock *Poncirus trifoliata* were tested. The first group of oviposition sites (uncut twigs) was prepared by cutting 10-15 cm long twigs from citrus trees. The cut end of each twig was wrapped with moist cotton wool and sealed with a plastic sheet. The second group of oviposition sites (cut twigs) was made from thicker (1-1.5 cm) citrus branches cut into 4-8 cm long sections. Many, 1-2 cm long slits were made with secateurs in both butt ends of the branches.

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Adult lemon tree borer were obtained from pupae collected from infested citrus wood from Auckland and the Bay of Islands. Females were mated when at least 4 days old and caged in 10 litre plastic bowls with two prepared oviposition sites from each variety tested. The beetles were provided with orange fruit for food and the bowl sprayed regularly to provide water droplets for drinking. Eggs were counted each week, with 14 counts obtained from eight females in the first group and 10 counts from six females in the second group. To compensate for the range of eggs laid by the females (1-66) our data was subjected to an empirical logistic transformation. This method compares the proportion of eggs laid by a female on a twig of a given cultivar to the total number of eggs laid by that female. This form of analysis of variance is unaffected by the observed differences in fecundity.

Deterrent properties of dieldrin/paint mixtures

The ability of dieldrin/paint mixtures to deter the establishment of newly hatched borer larvae was assessed. A filter paper collar was taped around a cut end of 1-1.5 cm thick citrus branch and the cut surface painted. When dry, five borer eggs were dropped onto the treated surface and held in place with a disc of filter paper. A logarithmic dilution series (0.015-15 g dieldrin/litre) was prepared from a "Dielmoth" stock solution (150 g/litre) and white (British Paints "Four Seasons" Acrylic) paint. The dieldrin treatments, unpainted sites and sites with paint alone were replicated 13 times. The experiment was assessed 2 weeks later.

Field trial of dieldrin/paint mixtures

A block of Satsuma mandarins at Katavo Orchard, Katikati was pruned and treated with wound dressing on September 30 — October 1 1980 and another block in the same orchard was only pruned. The wound dressing was made with 20 g of dieldrin, plus 20 g of copperoxychloride in 600 ml of Resene "Decorator" water based paint (=33 g dieldrin/litre). Eggs and larvae were counted from 125 pruning wounds on twenty protected trees and 108 pruning wounds on twenty unprotected trees, on February 4th.

Fig. 1: Adult borers caught weekly by a Malaise Trap in a citrus block on Puketutu Island, Auckland. Breaks in the x-axis indicate missing data.

RESULTS

Seasonality of the lemon tree borer

Adult borers were captured only by fermented molasses traps and a Malaise trap. The latter was more effective during the 1982/83 season capturing 71 borers compared with 24 from two molasses traps.

Adult borers flew from September to May in the Puketutu Island citrus block though greatest numbers were captured between October and December in the three complete seasons examined (Fig. 1). Most of the season's chorionated eggs (96% in 1982/3) were dissected from females captured during these 3 months. Female beetles can live for over a month in the laboratory after completion of oviposition if given adequate food and water. Females present late in the season probably lay few eggs.

Assessment of oviposition sites

Female borers laid significantly more eggs on cut twigs of the five commercial varieties compared with uncut twigs ($p=0.002$) (Fig. 2). Cutting failed to increase the number of eggs deposited on *Poncirus trifoliata* significantly. Navel orange and Satsuma mandarin were more acceptable than Ugli tangelo and root stock (Fig. 2). The order of preference of the varieties was not changed significantly by cutting the twigs.

Fig. 2: The effect of cutting and types of citrus on the rate of egg laying by females of the lemon tree borer.

Deterrent properties of dieldrin/paint mixtures

Dieldrin is repellent and toxic to neonate borers attempting to establish themselves in citrus wood. Significantly more larvae had died ($p<0.05$) and none had established themselves in wood coated with paint containing 15 g dieldrin/litre compared with the control and other treatments (Table 1). Larvae that remained alive on the surface had made little attempt to burrow through the treated surface. Four of the dead larvae showed everted hindguts, a symptom typical of organochlorine poisoning. Cannibalism was very low in this treatment due possibly to inhibition of activity by the pesticide.

Most of the living larvae in the painted and unpainted control successfully established themselves in the wood during the 2 weeks allowed (Table 1). Half of the larvae placed on painted surfaces with low concentrations of dieldrin (0.015 g — 1.5 g) remained on the surface, apparently deterred from burrowing into the wood. This effect was not statistically significant because of the high control mortality, probably due to damage to the eggs as they were prised free from the adhesive used by the female when

TABLE 1: Response of newly hatched borer larvae to wood protected with a dieldrin/paint layer.

Treatment	% Alive in wood	% Alive on surface	% Dead	% Cannibalised	Number recovered
unpainted	43	5	38	12	54
painted only	39	3	43	13	53
dieldrin					
0.015 g ai/litre paint	19	19	46	14	62
0.15 g ai/litre paint	16	16	45	21	55
1.5 g ai/litre paint	11	26	49	13	61
15 g ai/litre paint	0	23	75	1	64

(65 larvae tested at each concentration of dieldrin and in each control)

ovipositing. Larvae made many shallow scrapings on the paint surface in the 1.5 g/litre treatment. Larvae that had broken through the paint layer of the 1.5 g treatment were moribund and may have died had the experiment been allowed to continue.

Field trial of dieldrin/paint mixtures

Fiftyfour larvae and nine eggs were found on 108 unprotected pruning wounds compared with one larvae and one egg on 125 pruning wounds protected by a dieldrin/paint mixture in a nearby block.

DISCUSSION

Pruning increases the vulnerability of citrus trees to the lemon tree borer. Chemicals found in citrus bark are highly attractive to egg-laying females (Clearwater in prep.). Cutting the branch releases these chemicals.

Pruning of citrus normally occurs in September following harvest. Because borer flight activity and egg laying are at a maximum between October and December, pruning wounds must be protected. Dieldrin paint mixtures gave effective protection in the laboratory bioassay and in the Katikati mandarin block.

Dieldrin is not registered for use on a food crop and would be unlikely ever to be acceptable as a spray application. Dieldrin immobilised in the paint layer would be most unlikely to contaminate the soil, or be translocated to the fruit. Even if dieldrin is unacceptable to the Pesticide Board in this form, our experiments demonstrate that a toxicant in paint confers protection from lemon tree borer.

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