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PRELIMINARY TRIALS ON THE CONTROL OF LEMON TREE BORER WITH NEMATODES

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Summary

In field trials at Kerikeri, 5% of larval populations of lemon tree borer (*Oemona hirta*) remained alive after larval tunnels in orange and grapefruit trees were injected with suspensions of the nematode *Neoaplectana feltiae* (= *N. carpocapsae*). Eighty two per cent of a similar population survived after their tunnels were injected with rain water.

INTRODUCTION

The lemon tree borer is the major insect problem of citrus in New Zealand. Labour intensive cultural control methods are used at present. Infected wood is removed or the larvae are hooked out of their tunnels in major branches with fine wire. Estimates of the cost of this method range from 10 - 60 cents per borer.

Apart from application of captafol for control of *Alternaria*, citrus orchards are often free from agricultural chemicals. In order to maintain a relatively chemical-free system, a biological control method for the borer using the entomophagous nematode *Neoaplectana feltiae* was investigated. Available evidence suggests that this species of nematode is not harmful to mammals (Gaugler and Boush 1979).

The direct injection method was chosen for this trial as spraying methods with nematodes have been reported to give indifferent results on other wood boring insects (Moore 1970, 1973). However, injection of nematodes into tunnels of *Sciapteron tabaniformis* (Aegeriidae) in poplars killed all larvae in trees that could be cut down for inspection (Wouters 1977).

MATERIALS AND METHODS

Nematodes were obtained from laboratory cultures originating from soil samples gathered at Ashburton.

In the laboratory, borer larvae were placed in petri dishes on filter paper, dampened with a suspension of nematodes (approximate dose 20,000).

A field trial was laid out in three Kerikeri orchards; Site A, 'Harward Late' orange and 'Golden Special' grapefruit, Site B, N.Z. grapefruit, Site C, Navel oranges. A laboratory wash bottle with a hard plastic tip was used to inject aqueous suspensions of nematodes into the tunnels. At site A and B, branches were cut off to expose the tunnel, and the suspension injected down the hole (Fig. 1A). This method exploited the behaviour of the larvae which move up to the opening and plug it with a mass of short strips of wood within 24 hours, thus bringing them into contact with the nematodes. At site C, the suspension was injected directly through the frass hole closest to the point of active boring. This point is easily identified by the fresh plant exudate and fresh frass (Fig. 1C). The control tunnels were injected with rain water.

Treatments were applied on 8 - 12 October 1979 and wood containing the borer tunnels harvested on 8 - 9 November 1979. Wood containing treated tunnels was sawn from the trees and held in plastic bags for transport back to the laboratory. Tunnels in branches too large to be removed were assessed for the presence of recent active boring. Since the harvest was made in the middle of the boring period the absence of fresh frass is a fairly reliable indication of the death or absence of the borer.

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Fig 1 Lemon tree borer tunnel in small citrus branch

In the laboratory the presence of frass in the plastic bag was noted, the wood was split, and the number of samples with live, missing or dead larvae was recorded. Corpses were examined with a dissecting microscope for the presence of nematodes

RESULTS

All borer larvae treated with the suspension of nematodes in petri dishes died within 2 days.

In the field trial, 14 of the 17 (82.3%) rain water treated larvae were alive and healthy. Very few of the larvae in the nematode treated tunnels were alive; site A, 2 out of 38 (5.2%), site B, 2 out of 66 (3.0%), site C, 1 out of 52 (1.9%). These five surviving larvae produced copious amounts of fresh frass during the 2 days they had been held in plastic bags. One of these survivors was placed in a petri dish in contact with moist filter paper containing nematodes. Its death suggested that its survival in the field had been due to escape, rather than resistance.

DISCUSSION

These results show that satisfactory control of lemon tree borer can be obtained by injection of a nematode suspension into the tunnels. The lemon tree borer is particularly suited for control by the injection method, since the larvae are large and quite easily located by their frass. Citrus trees are individually highly valuable. Most commercial orchards have a density of one or two lemon tree borers per tree, and infestations rarely exceed five per tree.

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November, December and January are probably the best months to undertake this control operation as tunnels are easily located by extensive frass. During the winter the larvae are less active and hence harder to detect.

The slightly poorer results at Site A and B may be because larvae block off older portions of their tunnels with frass plugs (Fig. 1). The likelihood that the larvae will come into contact with the nematodes is increased by injecting directly into the frass hole closest to the point of active boring.

There is so far no evidence of natural transfer of the nematode from one larval tunnel to another suggesting that the nematode will need to be applied yearly. The moist conditions in the tunnels favour nematode survival and live infective stages were found in 27% of the injection sites after one month in the field.

The nematode is very cheap to produce, and this technique requires less labour than is required for the present cultural methods. Unfortunately, the borer parasite *Xanthocryptus novozealandicus* is killed by this nematode.

Further field and laboratory trials are underway to determine dose levels.

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