ABSTRACT

The carpenterworm, *Prionoxystus robiniae* (Peck), is a native wood boring larva which has become a concern to walnut growers in the southern San Joaquin Valley. Found primarily in older trees with deep bark canker, carpenterworm (CW) activity produces a gallery up to three-eights of an inch in diameter. Its feeding occurs radially in the cambial area; a second gallery is made deep into the heartwood for escape from predaceous woodpeckers and overwintering. Growers report loss of major limbs and reduced yield and nut quality due to weakened trees. Infestation in some well-managed Hartley orchards has been severe enough to justify its complete removal due to inadequate production. Observations by researchers familiar with this pest suggest that it may in fact be spreading deep bark canker during its feeding. This complex inter-action between plant stress, bacterial infection and CW infestation has yet to be addressed.

Research performed during the 1984 season concentrated on development of efficacious and practical control methods. Standard wing traps containing a host-specific pheromone were used to monitor adult insect activity from March to mid-June. Two methods of applying the parasitic nematode, *Neoaplectana carpocapsae*, were evaluated for efficacy. The first, performed August 1, involved the use of a backpack blower-mister calibrated to apply known nematode concentrations to the lower 12 foot surface of treated trees. The second, performed October 26, evaluated a commercially available hand-held two-quart pressure sprayer used to treat active galleries from the ground to a height of about 15 feet. Recent use of micronized charcoal as the storage media for CW provides for easy identification of treated sites. Results indicate emergence of CW adult moths in walnuts is similar to other infested trees species with their flight beginning this season in mid-March and continuing until mid-June. Trap counts as high as four moths per trap per night were recorded in late March and mid-May. Results from the replicated backpack blower-mister trial indicated little control due possibly to an unexpected drop in relative humidity which can have a marked effect on nematode survival. Nematodes applied with the hand-held pressure sprayer provided eighty percent control even though CW larvae were almost inactive due to Fall temperatures.

OBJECTIVE

To develop a practical and efficacious method of controlling carpenterworm (CW) feeding in walnuts. To attempt to evaluate the relationship between plant stress, deep bark canker and CW infestation for determining the actual seriousness of this insect.

PROCEDURE
Three Hartley walnut orchards moderately to severely infested with CW were monitored twice weekly for adult emergence and flight activity from March 15 to June 15 using the standard wing trap and a host-specific pheromone. Trap density was approximately one per acre; they were placed at least 100 feet in from each orchard's periphery. A fourth orchard was identified for application of a completely randomized and replicated trial using the backpack blower-mister treatment method. Initiation of the test was delayed until trap counts indicated adult emergence was essentially complete in mid-June. This would provide for control of newly hatched larvae. However, high temperatures and low relative humidity, two factors having a negative effect on parasitic nematode survival, prevented execution of the trial until the night of August 1.

Prior to application, an agitation test was performed on the blower-mister to assure uniform distribution of nematodes during individual tree treatment. Samples of the dispensed mixture were collected every 30 seconds, serially diluted 1:100, counted under the microscope and compared to the original concentration of nematodes per milliliter.

Four trees for each of six treatments were identified with infestation levels of three to five CW. Plastic thumb tacks were placed at each suspected gallery in the lower twelve feet of each tree for identification and evaluation after treatment. Since nematode cost would be a factor in evaluating the practicality of this treatment method, the following five nematode concentrations were selected for testing:

- 1. $1.5 \times 10^6$
- 2. $5.0 \times 10^6$
- 3. $15 \times 10^6$
- 4. $50 \times 10^6$
- 5. $150 \times 10^6$

These were compared to an untreated control.

Treatment applications were performed throughout the night of August 1 from 10:30 p.m. to 5:00 a.m. in order to provide the nematodes with cooler temperatures and maximum relative humidity. A thermohydrograph and sling psychrometer were used to collect data on these two parameters. Treatments began with the water-only control and then proceeded from low to high nematode concentration.

One week following application, treated galleries were spray painted to determine from the production of frass if CW activity persisted. Three weeks following treatment, each gallery was excavated by chisel to recover the CW larva and evaluate it for parasitization.

The second test, applied October 26, utilized a hand-held pressure sprayer capable of stream sprays up to 15 feet. Twenty partially-active galleries were treated and compared against five controls. One-hundred milliliters of carbon-nematode mixture was added to 1900 ml distilled water and two and one-half teaspoons of water thickener; this aides in suspending the nematodes. An oxygen tab was then added to improve nematode survival. Each treated gallery received about 6 ml of the suspension which equals about
25,000 nematodes. One week after application, treated and untreated galleries were excavated and the CW recovered for microscopic detection of nematode invasion.

RESULTS AND DISCUSSION

Results from the blower-mister trial applied August 1 were disappointing. Due to high temperatures, CW activity was minimal at the time of gallery identification. Consequently, about 25 percent of the chosen sites proved to be deep bark canker and not CW. Also, wind arising during the night-long treatments kept the relative humidity between 50 and 65 percent rather than the anticipated 80 percent needed for three to four hours to allow surviving nematodes time to invade active galleries. The result of these factors was less than 10 percent control in any of the five nematode treatments.

Results from the hand-held pressure sprayer treatment applied October 26 was very successful even though the larvae were becoming inactive from shorter days and reduced night temperatures. Of the twenty galleries treated, 80 percent were confirmed by dissection to have sufficient nematode invasion for mortality. The larvae were also noticeably soft and lethargic when removed from their galleries. The charcoal used to preserve the nematodes also served as an easy treatment indicator. Growers shown the results of this trial indicated a desire to pursue this treatment method in their own orchards.

Further research will focus on timing of application, nematode concentrations needed to assure CW mortality, and treatment methods which may prove even more practical. The blower-mister method may still be efficacious if performed under the proper conditions. With the cost of parasitic nematodes continually decreasing, success with surface applications could lead to commercial speed-sprayer treatments.