Sanitation Measures to Control Walnut Twig Beetle (*Pityophthorus juglandis*) Emergence from Felled Black Walnut Logs

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INTRODUCTION

The walnut twig beetle (WTB), *Pityophthorus juglandis* (Blackman) and its fungal associate *Geosmithia morbida* have recently been discovered to produce thousand cankers disease (Tisserat et al. 2009). The disease occurs in multiple walnut species, but it has devastated black walnut (*Juglans nigra*) populations in several western states (Utley et al. 2013). *Pityophthorus juglandis* is native to the southwestern United States, but its geographic range is expanding, as is incidence of thousand cankers (Cranshaw 2011). Finding effective management options for the disease is critical to decrease further expansion into urban and eastern walnut forests.

MATERIALS & METHODS:

Fig. 1. Logs from the 2012 felled Fort Collins black walnut tree.

In a series of experiments, insecticides, temperature, and chipping treatments were tested for their ability to control WTB. The logs used in the experiments were taken from trees felled in Fort Collins, CO in the summer of 2012 (Fig. 1). Although the data are still being collected, temperature and chipping experiments were repeated in 2013 with logs from a tree felled in LaPorte, CO. Each replication in the randomized complete block design consisted of logs cut from a limb section into 30.5 cm lengths.

1. *Insecticides*- logs were sprayed until runoff with carbaryl or bifenthrin
2. *Heat*- logs were heated in a 220 volt 12 kw drying oven, temperatures were recorded with loggers, and half of the heat treated logs were re-exposed to WTB (210 WTB per log) (Fig. 2)
3. *Cold*- logs were placed in a chest freezer set at -25°C for 7 days, and half of the cold treated logs were re-exposed to WTB (310 WTB per log) (Fig. 2)
4. *Chipping*- branch sections were chipped into pieces ranging from 4.5 to 0.5 cm in length (Fig. 3)

After the treatments, individual logs were placed in emergence cages (Fig. 4). Walnut twig beetles were collected and emergence was recorded from August to November.

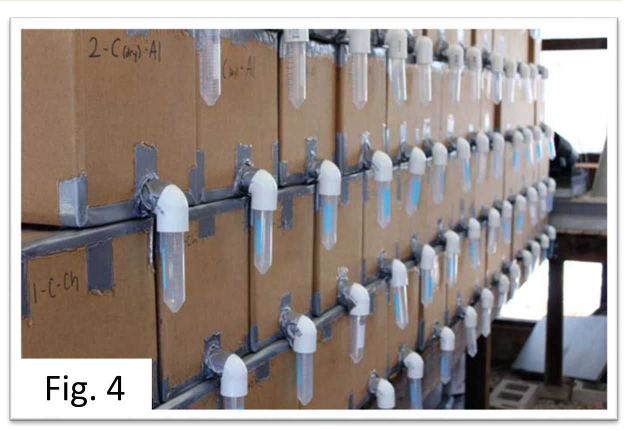
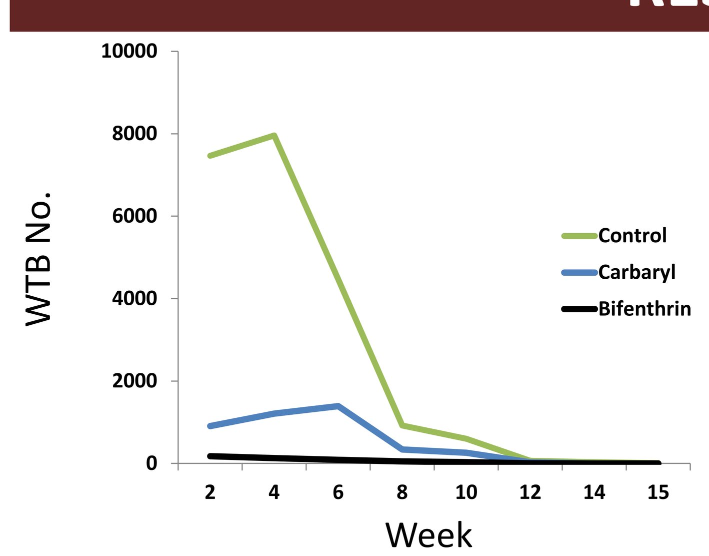


Fig. 2. Infesting a temperature treated log with adult WTB for the re-exposure treatment. Logs were stored in individual 66-liter clear plastic tubs with lids amended with breathable fabric. **Fig. 3.** An average sized chip from the chipping experiment. **Fig. 4.** Emergence cages were constructed out of cardboard boxes, 90° PVC elbows and 50 mL tubes. Insects were attracted to the light entering the boxes from the tubes.

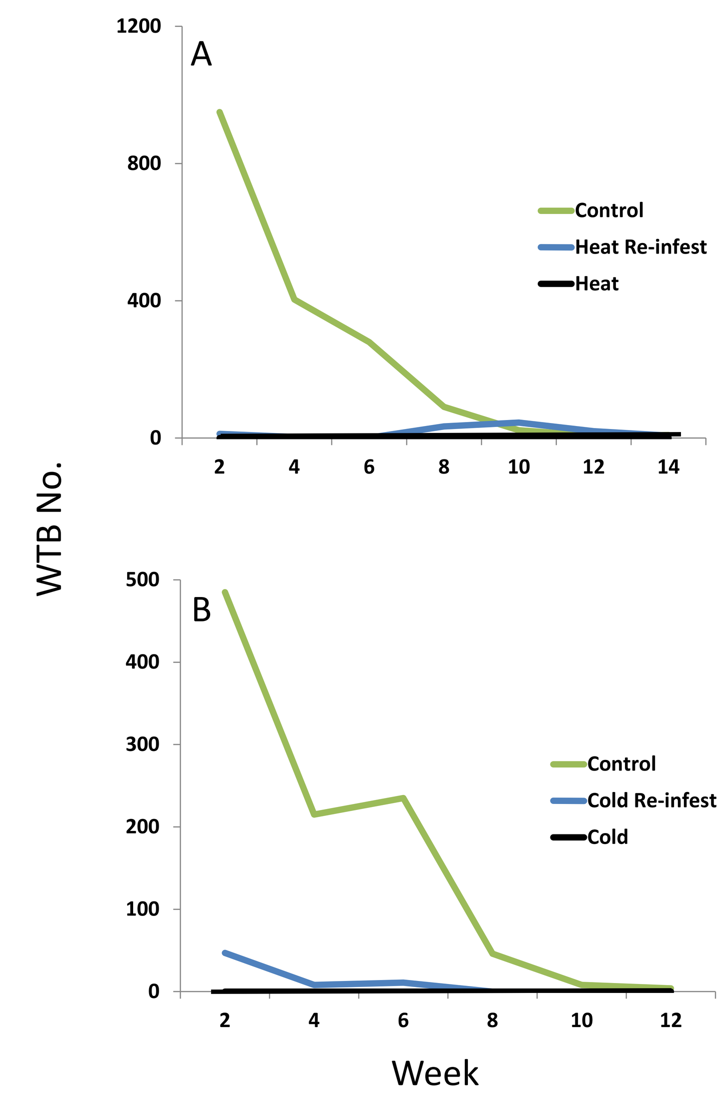
RESULTS AND DISCUSSION:



The insecticide carbaryl decreased WTB emergence by 81 percent while bifenthrin decreased WTB emergence by 98 percent (Fig. 5). Fewer beetles emerged from bifenthrin treated logs (32.5±1.13) than from carbaryl treated logs (314.2±1.14), and both insecticide treatments decreased emergence compared to control logs (1,702.8±1.12) (means are significantly different, Tukey's HSD, $P<0.05$).

Fig. 5. The bi-weekly emergence of WTB from water check walnut logs (control), or from logs drenched with the insecticides carbaryl or bifenthrin.

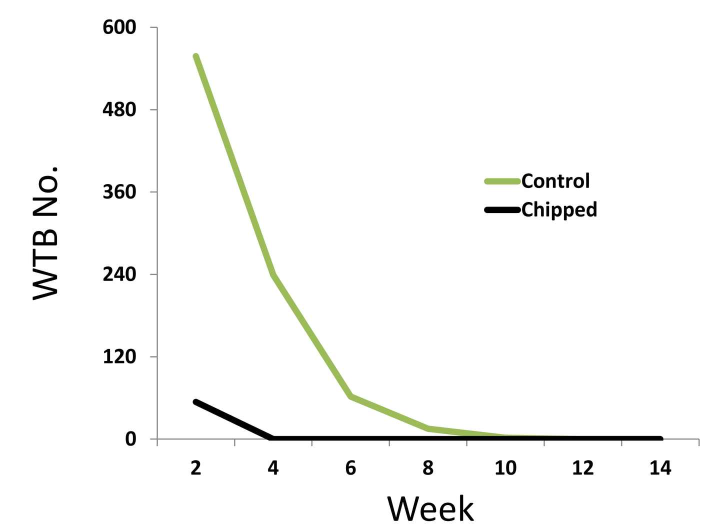
RESULTS AND DISCUSSION:



Heat treatments reached temperatures between 60°C and 72°C for 30 min. in the 2012 experiment, and these temperatures killed all WTB (LSMeans, $P<0.001$). Although the 2012 heat treatments eliminated initial WTB populations, eighty percent of the logs re-exposed to beetles were re-colonized. An average of 12.2±9.9 beetles emerged from the re-exposed logs. The greatest WTB emergence from the logs was eight to nine weeks after the treatment (Fig. 5A), which is within the generation time of this insect genus (Amman 1974).

Significantly fewer beetles emerged from the cold treated logs when compared to the control logs (LSMeans, $P<0.05$). All beetles were killed in the 2012 experiment (Fig. 5B). The mean number of WTB emerged from the logs with subsequent re-exposure was 10.1±1.1 in the 2012 experiment, and the highest emergence occurred during mid-August, the first few weeks of the experiment. (Note: in 2013, four WTB have emerged from the cold treated logs and 2,761 WTB from the control logs).

Fig. 5A-B. The bi-weekly emergence of WTB. A) *Heat*- emergence from control, heated, and re-exposed logs. B) *Cold*- emergence from control, frozen, or re-exposed logs.



Chipping logs had an impact on beetle emergence ($P = 0.07$), with 94 percent of the WTB killed during the chipping process (Fig. 6). Emergence occurred from chipped material for two weeks after the treatment. In contrast, WTB adults emerged from the 2013 experiment for at least five weeks.

Fig. 6. The bi-weekly emergence of WTB from control walnut sections, or from chipped branch sections.

CONCLUSIONS:

- Heat treatments were the only treatments that killed all of the beetles.
- Cold treatments were over 99% effective.
- The re-exposure experiments indicate that if felled walnut logs are re-exposed to WTB after sanitation measures, they have the potential to harbor live beetles for extended periods.
- Insecticide treatments and chipping branches greatly reduce WTB emergence. These treatments may have value in a sanitation program.

These experiments provide baseline management options for walnut logs infested with WTB, and show the importance of properly storing treated logs to prevent re-colonization.

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USDA United States Department of Agriculture National Institute of Food and Agriculture

NPDN National Plant Diagnostic Network