Carpenter Bee Trap Evaluation

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Abstract: Female carpenter bees are wood-destroying insects that build individual gallery nests in exposed, dry wood. Although solitary, these bees may nest in aggregations, especially since offspring sometimes complete their lifecycle close to where they were born. Combined with possible damage from foraging woodpeckers, extensive carpenter bee tunneling can result in aesthetic damage to wood and reduce its structural integrity. For management of this insect, pest professionals apply insecticidal dusts to gallery openings, which kills adult bees and offspring, as well as secondary pests that may occupy used galleries. However, several online resources provide instructions for Do-It-Yourself carpenter bee traps made of scrap wood and plastic bottles that may prevent structural damage and the reactionary use of insecticide applications. This preliminary field study evaluated the use of carpenter bee traps to determine if they are effective at catching females (the sex that creates tunnels and reproduces). Twelve carpenter bee traps were hung at six sites in Westchester County, yielding a total of 54 carpenter bees: 21 males, 33 females. Twenty-seven of these bees were from a single, heavily infested site, where residents noted a dramatic decrease in bee activity as a result of trapping. However, 148 non-target arthropods were collected in traps, including blow flies, European paper wasps (*Polistes dominula*), yellowjacket queens, and especially *Monobia quadridens*, demonstrating the non-selective nature of traps. A proposed method to reduce by-catch is to only deploy traps in the spring during gallery building.

Background and Justification:
The Eastern carpenter bee, *Xylocopa virginica* is a wood-destroying insect that emerges from overwintering sites in the spring. Carpenter bees forage for nectar and may provide early season pollination services. However, female bees are considered pests because they create half-inch wide burrows that extend from four to six inches in exposed, dry wood. Because offspring often return to the same site as their birth (site fidelity) and may reuse galleries, individual burrows up to ten feet long have been reported. Further, suitable locations may have multiple burrows when females create new galleries. This results in aesthetic, and more important, physical damage that can weaken the integrity of wood, especially if woodpeckers attempt to feed on bee larvae.

The public tends to fear carpenter bees because they are considered stinging insects. While female bees have a stinger, they rarely use it. On the other hand, male bees are highly aggressive, dive-bombing people, animals, and other male bees that approach galleries. Despite this aggressive behavior, mate-guarding male bees do not have a stinger and pose no threat to people.

Female carpenter bees start to damage wood in the spring, and pest management professionals are called to manage infestations. The most common technique used to

manage these insects is to apply insecticide dust into the burrow openings. Female bees that enter the nest, and newly emerged offspring that exit the nest contact insecticidal dust, resulting in death. While effective, this technique is a reactionary response to bees that have created new burrows or utilize existing openings, and therefore does not reduce the risk of structural damage.

Passive traps are alternative management tools that have been proposed to address carpenter bees problems. These traps, either for purchase or Do-It-Yourself, are said to exploit the behavior of carpenter bees that explore round openings in wood. Based on the design, insects enter through an opening in a block of wood, but get trapped in a double bottle funnel. In this way, traps are a proactive method of addressing carpenter bees before they cause damage. To date, however, there have been no published studies that demonstrate whether traps are effective at capturing carpenter bees, at reducing carpenter bee populations, or at reducing structural damage caused by bees. Therefore, in this experiment we aimed to address the basic question: do carpenter bee traps capture carpenter bees? Answering this basic question helps to determine if future research should address the latter questions of whether traps reduce overall carpenter bee populations and if they reduce damage caused by these insects.

Objectives:

- Construct at least two different styles of carpenter bee traps to determine the feasibility and ease of construction
- Determine if traps capture carpenter bees

Activities:

Trap Construction: In 2015, JLG created two types of Do-It-Yourself carpenter bee traps. Both traps were designed with the same features that allowed a carpenter bee to enter an opening (created with a half-inch drill bit), but then get trapped inside a closed vessel (two soda bottles). One trap was a box-style trap based on a WikiHow entry: www.wikihow.com/Build-a-Carpenter-Bee-Trap (Figure 1). The second design utilized a seven-inch segment of 4x4 wood, and was based on instructions in a blog post: www.myfrugalhome.com/how-to-build-a-carpenter-bee-trap/ (Figure 2). Due to the complexity of the box-style trap, only one device with this design was utilized. Thus, all remaining traps were the block-style trap (Figures 2-4).

Fig. 1: Box-style trap

Fig. 2: Block trap

Fig. 3: Block trap design

Fig. 4: Block trap design

[Design: a 7/8-inch opening was drilled in the center of the 4X4 block approximately three inches deep. Half-inch holes were drilled at a 45-degree angle from the sides of the trap to connect to the center opening. Two clear plastic bottles were cut to form a funneled trap and stapled to the bottom of the block. A hook was attached to the top of the block and hung to a similar hook affixed to the structure.]

Trap Efficacy Trial:

A total of 12 traps were deployed in Westchester County, NY at six sites where carpenter bees or their damage were observed. Traps were deployed in April 2016 and monitored two to four times per month through July. At each visit, the number and identity of captured arthropods was recorded. Traps were recovered from sites in September 2016.

Results and discussion: Over the course of the season, a total of 54 carpenter bees were collected: 21 males, 33 females. Twenty-seven of these (10 males; 17 females) came from a single site that has extensive damage from years of carpenter bee tunneling (a residential home with wood-siding in North Salem, NY). The homeowner at this site indicated that carpenter bee activity was less this year compared to previous years, likely due to trapping efforts.

In addition to carpenter bees, 148 non-target arthropods were collected in traps, demonstrating that these devices are not selective and may impact local arthropod populations. The most abundant by-catch were *M. quadridens*, with a total of 55 specimens collected at all sites (more numerous than carpenter bees). Twenty-one yellowjackets, and one to several specimens of other arthropods, including paper wasps (*Polistes* spp.), blow flies, jumping spiders, house centipedes, braconid wasps, etc. were found in traps.

The results of this preliminary study demonstrate that carpenter bee traps created from scrap materials such a 4X4 block of wood and plastic drink bottles are able to catch carpenter bees. It was interesting to learn that both male and female carpenter bees were captured in traps throughout the year, suggesting that males too explore half-inch openings in wood.

The capture of abundant non-target organisms is an important consideration for these traps. While homeowners may view these arthropods as pests, they likely play an important role in the local ecosystem. For example, many of the collected non-targets are important predators and parasitic wasps that play a role in population regulation of other arthropods, such as caterpillars and spiders.

Monobia wasps were the most common by-catch in carpenter bee traps. However, these insects did not appear in traps until later in the spring and summer. Therefore, in the case of this species, it might be possible to reduce by-catch by removing traps when carpenter bee activity decreases in the spring.

The next step in carpenter bee trapping is to determine if these devices can be used to reduce the bee populations, and more specifically the damage caused by bees. Because carpenter bee populations are not evenly distributed, such that some areas have very high populations while nearby susceptible areas how low numbers of bees, a "control" for this study might also require an intervention. A possible study design to evaluate the effectiveness of traps is outlined below.

- Count the number of existing carpenter bee tunnels at each site
- Fill and seal existing tunnels to create a smooth surface
    - Wood filler, sealant, dowel and other materials may be tested
- Install traps at treatment sites, but not at control sites
- Conduct timed surveys at each site to estimate the number of carpenter bees
- Record harvest of bees from traps
- Count the number of new tunnels in the structure at the end of the season

Using this study design will provide a covariate for analysis (number of starting tunnels), a measure of activity (number of bees during timed observations), and a measure of trap efficacy (number of new tunnels with and without a trap).

In addition to this study, comparison of box- and block-style traps is planned for a historic site in Huntington, NY, where a larger box-style trap, designed and built by Dr. Tamson Yeh, collected nearly 100 carpenter bees in 2016. This side-by-side comparison

will test the efficacy of the two trap types. Traps may also be deployed in the Capital Region, Geneva and Rochester, NY.