Survey Guideline for *Agrilus biguttatus*, (Coleoptera: Buprestidae), the Oak splendor beetle

By
Adam J. Silagyi, Lisa D. Jackson, Nichole K. Campbell, and Avraham Eitam

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INTRODUCTION

Many of the target species in the Exotic Wood Boring/Bark Beetle (EWB/BB) National Survey Manual, four of which are on the CAPS 2011 Analytical Hierarchy Process (AHP) Prioritized Pest List, are not known to be attracted by any specific trap and lure combination. Barclay and Humble (2009) mention that many insects that are candidates to be accidentally imported or introduced will not have a pheromone or suitable trapping method known. These targets will have to be monitored using generic traps and lures such as ethanol, sticky traps or some other capturing device. For these pest species, information from the scientific literature and recommendations from subject matter experts will have to be used to make decisions on survey methodology.

Currently, the only method for early detection of these EWB/BB species is through visual surveys. However, visual surveys for most insects, small or large, not known to occur in an area or a country, provide little or no confidence when reporting negative data and may actually give a false sense of security. Additionally, many of the EWB/BB species are nocturnal; feeding, mating, and ovipositing at night. Therefore, surveys for EWB/BBs with no specific trap and lure should be conducted only when considered essential (i.e., the State CAPS committee, SPHD, SPRO, etc. deem it necessary) and only when a species-specific protocol has been designed for minimum standards. The State CAPS Committee may consider the target species a potential threat due to various factors such as industry concern, recent interceptions, high-risk pathways, etc. The protocols for this survey will be designed so that surveys are conducted within a minimum set of guidelines that would allow negative data to be reported with relative confidence.

It is important to remember that this protocol is to be considered a <u>minimal guide</u> to conducting the survey. States may add additional efforts, risks, survey sites, etc. to improve the local survey and render better, more reliable results for reporting negative data specific to their State or area.

BIOLOGY

The oak splendor beetle, *A. biguttatus*, is native to Asia and has not been found in North America. It is considered a significant pest of oak forests in parts of Europe and Russia; it is also present in northern Africa and the Middle East. Like other metallic wood-boring beetles, including emerald ash borer, oak splendor beetles are strong fliers which are able to fly several miles in search of a suitable host. The beetles are readily moved in wood products such as firewood or other materials with attached bark. Oak is the primary host, but chestnut and beech are also susceptible. This beetle may have one generation a year in warm climates, but a two-year cycle is more common. Adult females feed on oak foliage before depositing clusters of 5-6 eggs in bark crevices. The south side of large oaks (diameter at breast height of 11-15 inches) is preferred. Larvae feed in the cambium creating frass-filled, ‘zig-zag’ galleries. Mature larvae are creamy white, legless grubs,1-1 3/4 inches in length. The first thoracic segment is wider than the other body segments. Two hornlike projections (urogomphi) are found on the last abdominal segment. Pupation occurs in the bark. The insect overwinters in both the larval and pupal stages. In May to June, adults emerge leaving D-shaped exit holes. Adults are attractive, metallic green, slender insects about 1/3

to 1/2 of an inch in length. The posterior third of the wing covers have two distinct white marks on their interior edge. Damage typically results in dieback, development of epicormic branches, thin crown, and tree mortality (Center for Invasive Species & Ecosystem Health).

PATHWAYS

A Mini-Pest Risk Analysis (PRA) of *Agrilus* spp. was compiled in 2005: "The majority of other *Agrilus* sp interceptions have been associated with dunnage (68%), crating (13%), grape leaves (*Vitis* sp) (5%), or unspecified cargo (5%). These materials were typically found in general cargo (60%), ship holds (13%), baggage (13%), or miscellaneous (7%). The majority of interceptions were reported from San Francisco, CA (17%), Alabaster, AL (12%), Houston, TX (12%), Erlanger, KY (12%), Long Beach, CA, and Chicago, IL (8%). These ports are the first points of entry for infested material coming into the United States and do not necessarily represent the final destination of infested material. Possible pathways include, but are not limited to, dunnage, solid-wood packing materials (SWPM), (including crates, spools, pallets, etc.), and plant parts (grape leaves) attached to plants for planting. These pathways are those that have been identified in the past and are by no means the only way this species can enter the United States or individual States. If other pathways are identified by the State, they should be incorporated if deemed necessary.

INTERCEPTIONS

Mini-PRA (2005): "No interceptions of *Agrilus biguttatus* have been reported by USDA/APHIS in the Port Interception Network-309 database (USDA 2005a). "*Agrilus* spp." have been intercepted at least 22 times between 1985 and 2004 (incomplete records complicate the accuracy of this count). Some interceptions of *Agrilus* spp. might have been identified simply as "Buprestidae; species of." Between 1985 and 2004, unspecified Buprestidae have been intercepted on average at 4.21 (±0.88) times per year (USDA 2005a)."

SURVEY METHODOLOGY

A. Site Selection

In order to maintain consistency when reporting negative data, a minimum of 20 sites are needed to be selected per state and 25 trees per site. Site selection should be identified by each respective State based on the highest risk, which will allow each State to have more flexibility when determining State-specific risk for this species. Some examples to consider could be transit sites, ports, rail yards, destination sites, warehouses, nurseries, pallet recyclers, landfills, green waste sites, urban parks, forests, cemeteries, etc.

B. Site Sampling

When a site has been chosen for visual inspection, two types of visual monitoring should be conducted. First, upon arriving at the site a general macro-level overview should be done to see if there are any areas that stand out and require a more detailed inspection. Those areas should be inspected first and if there are no areas as such, then random areas should be chosen for inspection. The number of trees that will be required per site will be 25. Each site should be monitored at least one time during the season, generally May through August. The below survey methodology should be performed during the site visit if negative data is to be recorded in the NAPIS database.

Visual Inspection (What to do to each tree to consider it "surveyed"):

1. At the stand level: Look for host trees first that have signs of damage/ infestation:
    - Thin crowns

- Epicormic shoots and branching
- Limb and tree mortality
- Twig and branch dieback
- Bark splits
- Excessive woodpecker damage

2. At the individual tree level: If any trees are found with the signs mentioned above, inspect the individual trees for further signs of damage. If no trees were found to have the above signs of damage, then survey 25 host trees at random. This beetle, like emerald ash borer, produces D-shaped exit holes.

a. Superficial inspection:

- D-shaped adult exit holes

  Look for adult beetles in foliage in the crowns of trees. (Sweep foliage of smaller oaks in sunspots and/or sunny areas around the trap and/or along the edge of tree lines. If no smaller oaks are available, sweep nearby foliage. Also, any recently downed oak trees would be ideal for inspection and/or sweeping. Sweeping of oak foliage is a very effective way to determine if there are any *Agrilus spp*. present, including *A. biguttatus*. A minimum of five areas at each site should be swept and an aerial-net is suggested with 8-10 sweeps per area. Any buprestid specimens collected should be turned in for identification.

b. Under the bark (ONLY if D-shaped exit holes or adult beetles present)

- Larvae under the bark
- Frass-filled transverse, winding larval galleries in the cambium layer

Note: Remove bark for thorough inspection ONLY if you observe other signs of infestation AND receive permission from the land owners.

3. If able to remove bark or if bark is already exposed, collect samples of any beetles that look similar to the target species, especially if D-shaped exit holes present.

C. Trap Placement (OPTIONAL)

Since visual surveys are inefficient at best, perhaps the survey would be improved by adding a trapping component. This trapping component is **optional** unless there are indications or signs of larvae and galleries, and then traps should be used to rule out native *Agrilus* spp. If traps are to be used, a minimum of two purple prism traps should be used. These traps should be used alone or with oak bolts (made from oak sections 1-3" in diameter and around 24" long). Girdled trees are thought to be more attractive than bolts (Rabaglia: personal communication), but this can ONLY be done with permission of the land owner as it will kill the tree. Traps should be placed at each site as close as logistically possible to areas of risk such as dunnage piles, SWPM piles and/or storage areas if and when available. **Traps should be placed within host trees (oak trees) and preferably on edges and tree lines**. Traps should be checked at least once during the season, and if lures are being used they will last approximately 60 days and should be replaced just prior to expiration. Purple prism traps without a lure, hung in oak trees may also be used, which is also used for *Agrilus coxalis* and would allow data collection for two targets from one survey method.

DATA REPORTING

Use the appropriate NAPIS code below in Table 1 to report data per your chosen survey method. If the above steps are followed at the stand level and the individual tree level and no species-specific sign of infestation or targeted insect life stage is found, then negative data may be recorded for that site.

Negative data is based on visual survey. The addition of traps should be considered "experimental," as there is currently no data to confirm that any of these trap and lure combinations effectively traps *Agrilus biguttatus*. However, by reporting negative data on the combination of visual survey + one of the additional methods, the survey method is strengthened by using an additional method that may turn out to be an effective survey method for this target. If the trapping method is found out to cause an inhibitory effect on the species, data reported from the visual survey is still able to stand alone.

Table 1: NAPIS Code

Survey	NAPIS Code
Visual survey only	
Visual survey + Purple prism (no lure), hung in oak trees	
Visual survey + Purple prism w/ oak bolts (1-3" in diameter & 12-24" in length), hung in oak trees	

OUTREACH EFFORTS

Outreach with businesses and agencies that can increase our survey/monitoring effectiveness is always encouraged. Please consider this component when planning and organizing your surveys!

- **Arborists**
- **Tree Nurseries**
- **Foresters (County, State, Federal, etc.)**

IMAGES

D-shaped exit holes from *A. biguttatus*. Image: C. Bystrowski

Woodpecker foraging signs. Image: Hilszczanski

A. biguttatus gallery in shape of zig-zag (final stage) and cambium necrosis. Image: L.-M. Nageleisen, Département de la Santé des Forêts, Bugwood.org

A. biguttatus galleries in the shape of stairs (first stage). Image: L.-M. Nageleisen, Département de la Santé des Forêts, Bugwood.org

Agrilus biguttatus pupae. Louis-Michel Nageleisen, Département de la Santé des Forêts, Bugwood.org.

Agrilus biguttatus larva. Image: Louis-Michel Nageleisen, Département de la Santé des Forêts, Bugwood.org.

Agrilus biguttatus adult. Image: Gyorgy Csoka, Hungary Forest Research Institute, Bugwood.org.

Agrilus biguttatus adult. Image: Natasha Wright, Florida Department of Agriculture and Consumer Services, Bugwood.org

REFERENCES

Barclay H.J. and Humble L. (2009). Probability models to facilitate a declaration that an exotic insect species has not yet invaded an area. Biological Invasions 11: 1267-1280.

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