A Mechanical Approach to Quantifiable Spotted Lanternfly Egg Mass Control

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Client(s): Cornell CALS Extension / E&J Gallo Winery / National Grape

Problem Statement

Current control methods for the spotted lanternfly (SLF) fail to ensure destruction or provide a reliable way to quantify how many egg masses were destroyed. Eggs are protected by a waxy coating and 68.5% are adhered to rough surfaces such as tree bark (2); if scraped onto the ground, they can still hatch if not destroyed. Our challenge is to develop a mechanical system that removes and collects egg masses across a variety of surfaces to ensure destruction, with minimal physical effort, and enables growers to numerically analyze the system's success.

Impact

Vineyards reduce SLF populations at the source by targeting egg masses, which prevents the emergence of 30 to 50 insects per egg mass (1). Verifying destruction allows vineyards to quantify population reduction, improving confidence in control protocols and providing a scalable solution.

Proposed Direction: Jaw-Bucket Egg Removal and Containment System

What It Is: Jaws scrape off and collect egg masses. An internal bucket stores eggs for disposal.

How it Would be Used:

- Uses a trigger on a handle to create a high mechanical advantage to close the jaws
- Jaws designed to scrape against a variety of surfaces, removing and collecting the egg masses
- Uses a sliding door container to allow egg masses to fall in but not back out onto the ground

Why it's Better Than the Status Quo:

- More efficient and comfortable than scraping with a card, but still hand-held and chemical-free
- Enables easy counting of egg masses in the bucket to numerically evaluate the device's impact

End-of-Semester Proof-of-Concept: By the end of the semester, we will have a tested prototype showing proof of concept that efficiently removes and collects simulated egg masses off a variety of surfaces. It will also require little force input to operate.

Key Risks / Unknowns

- Use of the device can be labor and time intensive for farmers with tight margins — if too slow, vineyards won't adopt it; test by finding time per egg mass and the mechanical advantage.
- Damage to grapevines or grapes when the egg masses are scraped off — if it damages vines, they may be unusable; test by inspecting after repeated use and altering jaw material.
- Interference with growing regulations by introducing a device into the vineyard — if it violates regulations, it can't be used; test by checking growing standards and making device hand-held.

Questions for the Client

1. **Do egg masses vary significantly in size, thickness, or shape throughout the season?**
   Decision affected: Jaw opening width, bucket size, and shape of teeth on the jaw
2. **What surfaces are the most difficult to remove the egg masses from?**
   Decision affected: Material of the jaw to withstand forces and stress needed to remove
3. **Are eggs often laid in places throughout vineyards that can't be reached by hand?**
   Decision affected: Impacts whether or not the tool is extendable to enable greater reach

References

1. J Keller, J Rost, K Hoover, J Urban, H Leach, M Porras, B Walsh, M Bosold, D Calvin. "Dispersion Patterns and Sample Size Estimates for Egg Masses of Spotted Lanternfly (Hemiptera: Fulgoridae)," Environmental Entomology, Volume 49, Issue 6, December 2020, Pages 1462–1472. https://doi.org/10.1093/ee/nvaa107

2. Houping Liu, Oviposition Substrate Selection, Egg Mass Characteristics, Host Preference, and Life History of the Spotted Lanternfly (Hemiptera: Fulgoridae) in North America, Environmental Entomology, Volume 48, Issue 6, December 2019, Pages 1452–1468, https://doi.org/10.1093/ee/nvz123

Figure

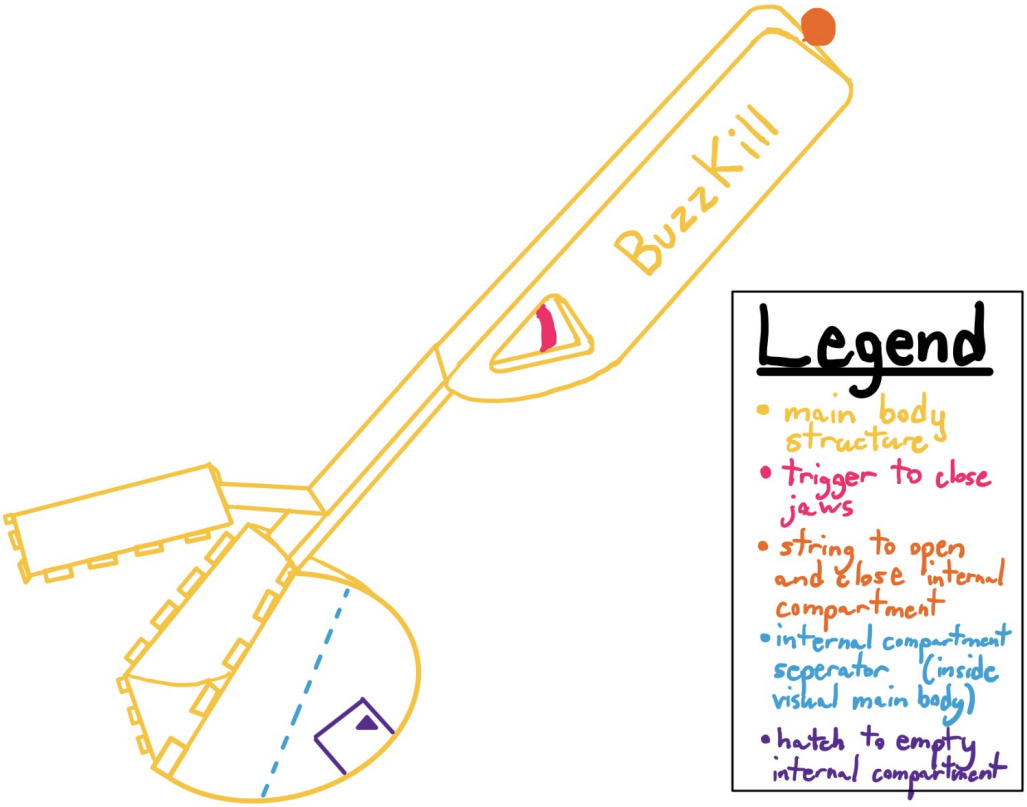

Figure 1: Mechanical Jaw Bucket Design with Internal Compartment