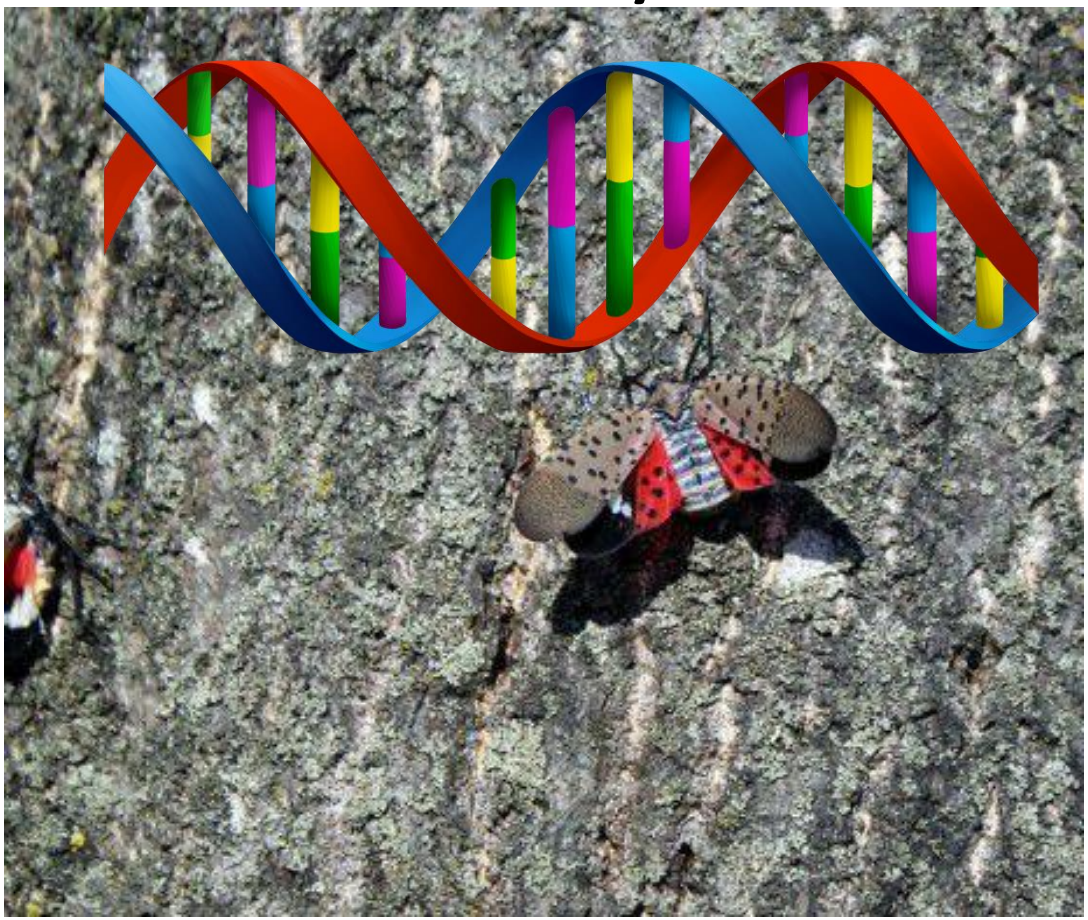
Spotted Lanternfly Environmental DNA Surveys



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Terrestrial eDNA Framework

Early detection of invasive exotic insect infestations using eDNA from crop surfaces

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The number of exotic species invasions has increased over recent decades, as have the ecological harm and economic burdens they impose. Rapid-response eradication of nascent exotic populations is a viable approach to minimizing damage, but implementation is limited by the difficulty of detecting such species during the early stages of infestation due to their small numbers. The use of environmental DNA (eDNA) has helped address this issue in aquatic ecosystems, but to the best of our knowledge has not been trialed for surveillance of exotic species in terrestrial systems. Using a high-resolution, real-time (quantitative) polymerase chain reaction assay, we developed a highly efficient protocol to survey agricultural fields for the invasive non-native brown marmorated stink bug (BMSB; *Halyomorpha halys*). We compared results using eDNA to those for conventional monitoring traps and documented substantially higher sensitivity and detection effectiveness. Our methodology is transferable to situations in which the DNA of terrestrial target species can be accumulated into a single substrate, suggesting that eDNA-based approaches could transform our ability to detect exotic insects in non-aquatic settings.

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eDNA

DNA extraction

Environmental DNA (eDNA) for Spotted Lantern Fly

Spotted Lantern Fly (SLF) *Lycorma delicately*
Honeydew from SLF was confirmed as a viable source of eDNA

(Valentin et al *unpublished data*)

- We have developed genetic assays to detect SLF eDNA in the environment
  - Complete vetting and validation are under way
- SLF eDNA has been detected in the field in Pennsylvania
- Assay sensitivity demonstrated by detecting SLF DNA on “clean” hands of tech that had handled specimens

SLF eDNA Preliminary Results

PA site 1 (high abundance + treated)

	Tree 1	**Tree 2**	**Tree 3**
Sample 1 (bark surface)	1	1	1
Sample 2 (soil below)	1	1	1
Sample 3 (leaf surface)	1	1	1

PA site 2 (high abundance + untreated)

	Tree 1	**Tree 2**	**Tree 3**
Sample 1 (bark surface)	1	1	1
Sample 2 (soil below)	1	1	1
Sample 3 (leaf surface)	1	1	1

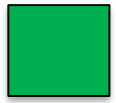
SLF eDNA Field Methodology

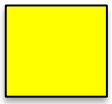
eDNA can be used across multiple terrestrial settings: agricultural, urban, forests, …

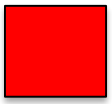
- What to sample
  - Leaves, bark, soil, artificial surfaces
- How to sample
  - Wash, scrub, pick
- How to aggregate
  - Decide on the scale

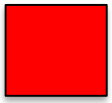
Currently, we are exploring six different ways of collecting and aggregating samples across multiple field settings.

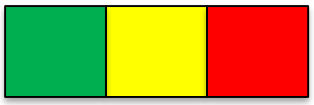
Research Next Steps

1. Complete vetting of assay for SLF specificity 

2. Expand tests of field survey techniques 

3. Quantify risks of false positives and negatives for each technique; adjust accordingly 

4. Quantify power of survey to detect SLF presence across variety of situations 



Likelihood of completion by end of summer based on funding in hand or promised

What can eDNA surveys can do for SLF?

Can detect the presence of SLF ‘sight unseen’, and when abundances are low especially if combined with pheromone lures

Foundation of spatially accurate delimiting surveys that are cost efficient – where is the range boundary?
Powerful combination with citizen science.