# Non-Crop Hosts of Agriculturally Important Organisms in the Natural Area Teaching Lab.

## NATL Minigrant Final Report

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## Introduction

Natural areas have been known to serve as a reservoir for harmful pests and diseases as well as a refuge for beneficial natural enemies and pollinators. Because of the impact these natural areas can have on agricultural systems there has been an increased interest in understanding the relationship between non-crop plants and the organisms they support. The Natural Area Teaching Laboratory (NATL) at the University of Florida provides a useful experimental setting for this work, as a variety of successional areas, ranging from recently burned land to hammocks and upland pine allows observation of a range of possible habitats that may harbor agriculturally-relevant organisms.

The primary objective of this project was to investigate the occupancy of NATL by pests, pathogens, and beneficial organisms of significance to agricultural production areas. To complete these goals a broad survey was conducted by members of the Doctor of Plant Medicine Student Organization (DPMSO) during the project period employing a variety of techniques, including soil samples for nematodes, trapping and net sampling for pest and beneficial insects, and collection of suspect plant pathogens for laboratory diagnosis.

In addition to surveying for agricultural pests and beneficial insects, this minigrant project contained an outreach and extension component. An educational event (referred to as the “trap day”) was held. This event provided an opportunity for participating students to learn about some of the traps commonly used for insect surveys. Invited speakers included members of relevant laboratories at University of Florida and well as a survey specialist from the Florida Department of Agriculture and Consumer Services. Additionally, an infographic was designed for use as a brochure sign to be placed in NATL. This infographic summarized the findings of the project and provided information on the interface between natural and agricultural areas.

# Insects

## Visual Survey/Sweep Netting

Areas of NATL were surveyed on a monthly basis during the study period using sweep nets in conjunction with visual surveys. Beneficial natural enemies were observed, including lady beetles (Family Coccinellidae), lacewings (Family Chrysopidae) and assassin bugs (Family Reduviidae). Visual observations of pest damage included injury to fruit caused by the plum curculio, *Conotrachelus nenuphar* (Figure 1).

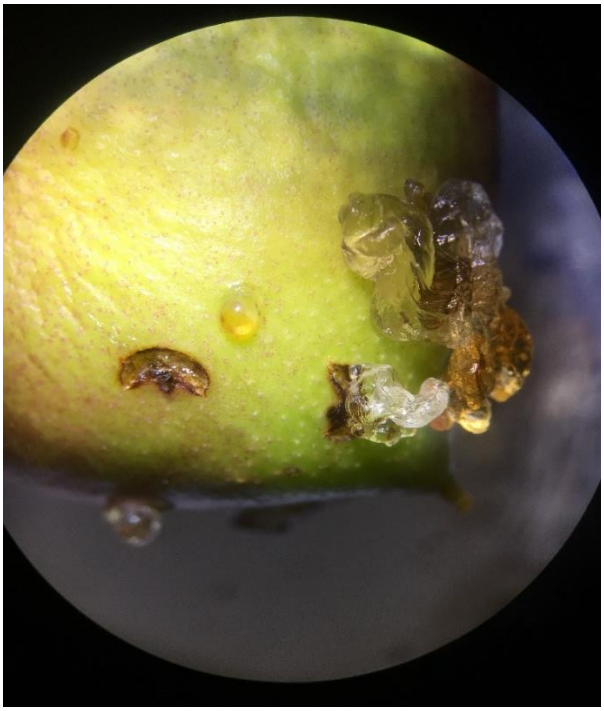

**Figure 1.** Plum curculio damage to a developing nectarine from NATL. The crescent shaped scar represents the oviposition site and is a tell-tale sign of plum curculio injury.

## Borer Traps

The lepidopteran family Sesiidae, also known as the clearwing borers, contains several economically important pest species. Several of these likely use native hosts in addition to their agricultural hosts. Wing traps were deployed at several locations in NATL, with traps containing one of two lures (Figure 2). The first lure is a general clearwing borer lure, attractive to multiple species. The second lure is specifically attractive to the lesser peachtree borer, a major pest of peaches in the southeast. Large numbers of clearwing borers were trapped, including several known pest species (Table 1).

**Figure 2.** A "wing trap" deployed in NATL during the study period. The trap is lined with a removable sticky card. A borer lure is placed in the center of the trap to attract target moths.

**Table 1.** Quantity of *Synanthedon* spp. from pheromone baited traps during the study period of summer 2018.

| Species | Common Name | Total Collected |
|---|---|---|
| *Synanthedon pictipes* | Lesser peachtree borer | 211 |
| *Synanthedon exitiosa* | Peachtree borer | 18 |
| *Synanthedon sapygaeformis* | Florida clearwing borer | 139 |

## Stink Bug Traps

Stink bugs, from the family Pentatomidae, contain several economically important species that affect a wide range of crops, including tree fruit, soybeans and other agronomic crops, and fresh market vegetables. Many stink bug species are polyphagous, and thus can survive outside the cropping area on non-crop hosts. In several systems it appears that stink bugs invade the agricultural areas from the field margins, and thus their use of non-crop areas such as NATL is of interest for management of stink bugs.

Several yellow pyramid traps were deployed in NATL (Figure 3). This trap design is effective at collecting stink bugs, weevils and several other taxa. The addition of a multi-species pheromone lure increased trap capture.

**Figure 3.** A yellow pyramid trap used to capture stink bugs. The trap is deployed in a field of hairy indigo.

Several species of stink bugs were collected, as well as some non-target insect species (Table 2). The brown stink bug *Euschistus servus* was the most abundant stink bug species, followed by the green stink bug, *Chinavia hilaris.* All species in Table 2 are known pests. The most significant finding from this trapping study was the detection of four specimens of the brown marmorated stink bug, *Halymorpha halys,* a major invasive pest not known to be established in Alachua County. The only known reproducing population of *H. halys* in Florida is in Lake County.

**Table 2.** Summary of major stink bug species collected from pheromone baited pyramid traps in NATL during part of summer 2018.

| Species | Common Name | Total Collected |
|---|---|---|
| *Euschistus servus* | Brown stink bug | 53 |
| *Euschistus quadrator* | (Not yet named) | 3 |
| *Euschistus tristigmus* | Dusky stink bug | 10 |
| *Halyomorpha halys* | Brown marmorated stink bug | 4* |
| *Nezara viridula* | Southern green stink bug | 11 |
| *Chinavia hilaris* | Green stink bug | 26 |
| *Murgantia histrionica* | Harlequin bug | 6 |

**Figure 4.** An adult brown marmorated stink bug, *Halyomorpha halys,* collected from a trap in NATL. *This species is not known to be established in Alachua County.

## Fruit Fly Traps

Both the Caribbean fruit fly, *Anastrepha suspensa* and the spotted wing drosophila (SWD), *Drosophila suzukii*, are important agricultural pests known to reproduce in non-crop areas. Traps designed for fruit flies were deployed in NATL (Figure 5). A torula yeast bait was used to lure the target specimens. A total of 61 Caribbean fruit flies and 84 SWD were trapped during the study period of summer 2018, indicating that both these species are abundant in natural areas in Gainesville.

**Figure 5.** A modified fruit fly trap, similar in design to a McPhail trap. A torula yeast and water mixture was used as a bait.

## Nematodes

Soil samples were collected from various areas of NATL. Each sampled plot was assigned a plot number. The habitat associated with the plot number was as follows:

Plot 1: old field succession (mostly ragweed)
Plot 2: upland pine (recently burned; palmetto, pine)
Plot 3: no burn (hackberry, upland pine)
Plot 4: hammock (sweet gum, muscadine grape, palmetto)
Plot 5: upland pine (recently burned; palmetto, pine)

Soil samples were brought to the nematode diagnostic laboratory at UF for identification. Figure 6 shows the plant parasitic nematodes found in the various sample sites.

Nematode Counting Data Sheet

Brandon

NAME B / C

TEST PPM samples NATL

LOCATION

PLANT

DATE RECEIVED

DATE COMPLETED 8/3/18

| Plot | Block | *Meloidogyne* Root-knot | *Belonolaimus* Sting | *Pratylenchus* Lesion | *Hoplolaimus* Lance | *Helicotylenchus* Spiral | *Peltamigratus* Spiral | *Trichodorus* Stubby Root | *Nanidorus* Stubby Root | *Tylenchorhynchus* Stunt | *Mesocriconema, ete* Ring | *Hemicycliophora* Sheath | *Hemicriconemoides* Sheathoid | *Dolichodorus* Awl | *Xiphinema* Dagger |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 5 | 1 | | 7 | 7 | 25 | | | | 28 | | | | |
| 2 | | 72 | | | | 195 | | | | | 23 | | | | |
| 3 | | 66 | | | | 27 | | | | | 9 | | | | |
| 4 | | 68 | | | | 42 | 1 | | | | 5 | | | | |
| 5 | | 4 | | | 1 | 1 | 12 | | | | 12 | | | | |

**Figure 6**. The report provided by the nematode diagnostic service at UF. Plot numbers refer to different areas of NATL.

## Plant Diseases

Scouting for diseases occurred during the project period. Suspect samples were submitted to the plant disease clinic at UF for diagnosis. Several leaf spot symptoms were observed and submitted as samples (Figure 7). We found several plant pathogens associated with these leaf spots, several of which are known to effect agricultural crops (Table 3).

**Table 3.** Summary of plant pathogens collected in NATL and identified by the plant disease clinic at the University of Florida.

| Disease name | Pathogen scientific name | Host plant common name | Host plant scientific name |
|---|---|---|---|
| Leaf spot | *Colletotrichum* | Spiderwort | *Tradescantia* |
| Leaf spot | *Colletotrichum* | Virginia creeper | *Parthenocissus quinquefolia* |
| Leaf spot | *Mycosphaerella* sp. | Wild cherry | *Prunus serotina* |
| Leaf spot | *Botryosphaeria* and *Colletotrichum* sp. | Wild grape | *Vitus* sp. |
| Leaf spot | *Phyllosticta* sp. | Rusty black-haw, southern black-haw | *Viburnum rufidulum* |

**Figure 7.** Leaf-spot type symptoms caused by plant pathogens collected on plants in NATL. Identified pathogens shown here include *Mycosphaerella* sp. on wild cherry (left) and *Botryosphaeria* and *Colletotrichum* sp. found on wild grape (right).

## Trap Day

On May 30th, 2018 a "trap day" event was held at the NATL pavilion. Due to heavy rain the event was moved to the overhang of the entomology loading dock. The goal of the trap day was to provide participants with instruction on various insect traps used in pest surveys. Presentations were given by individuals with ample experience using the traps. Speakers included Gabrielle LaTora from the Liburd Lab, who presented trapping for spotted wing drosophila, Brad Danner from FDACS-Department of Plant Industry (DPI), who presented various traps used by the cooperative agricultural pest surveys (CAPS), and DPMSO members Cory Penca (presenting weevil traps) and Sage Thompson and Morgan Pinkerton (presenting on stink bug trapping). Approximately 11 students attended this event.

**Figure 8**. A selection of the traps demonstrated at the NATL trap day event, along with participants.

## Summary

This project successfully demonstrated that natural areas such as NATL provide habitat for a diverse array of organisms, including some that can become important in agricultural systems. A variety of trapping and sampling methods revealed the presence of many herbivorous insect species, as well as beneficial predatory insects, plant pathogens, and plant-feeding nematodes. This project also served as an educational opportunity for University of Florida students who carried out the sampling, scouting, and species identification. Organisms considered pests in agricultural systems may go largely unnoticed in nearby natural areas where the ecological community is dynamic and resilient, but the role of natural areas to serve as reservoirs of these species should be better understood.

## Poster/Brochure

In Development