



Oak Wilt Fungus in the Park?

Current research underway from UW-Madison student, Stephanie Jagemann

The answer to the above question may be more interesting than you might think.



Graduate Student
**Stephanie
Jagemann** at work
recording weekly
data from a beetle
trap in Peninsula



A close-up of Oak Wilt fungus
found under the bark of a Red
Oak tree at Governor Knowles
State Forest.

Oak wilt is a **serious disease** of native Oak trees caused by the fungus *Ceratocystis fagacearum*. In the United States it affects most northeastern states, including Minnesota and Wisconsin but also Texas. All species of Oak are susceptible and at risk. White Oak species are affected, but the disease is most serious in Red and Black Oak species. Oak Wilt is spread in two ways - underground through root grafts between closely located trees and overland by insect vectors. The primary vectors are 'sap beetles' in the family Nitidulidae. These beetles are attracted to decaying fruit, plant saps, and fungi. (*Jagemann*)

See attached report for more information.

Jagemann's research is from the University of Wisconsin-Madison, Department of Entomology, Professor Kenneth Raffa. Central grant support from the Wisconsin DNR in addition to the Friends of Peninsula State Park. Our Park is one of twelve sites under study.



A tree at Governor Nelson State Park that died of Oak Wilt Disease last year (2014). This dead tree is currently a fungal mat producing a tree that insect vectors can enter and spread fungus from.



Jagemann's traps have Data Loggers which record temperature and are downloaded every four weeks.



Each year, The Friends of Peninsula State Park Research Committee meets to review all applications and set topical priorities. Grant applications are welcomed from any Wisconsin college or university student at any time of the year. Students must have academic sponsorship. Awards are for expenses for one year. Further information at; www.peninsulafriends.org

Past Research Projects

Sponsored by the Friends of Peninsula State Park

- *Forest Understory Change in Response to Altered Deer Pressure-* Sabo/Frerker, UW-Madison, Forestry, 2011
- *A Compositional Analysis of Ceramic Material from Shanty Bay (partial) -* Blrnbaum. UW- Milwaukee, Anthropology, 2012
- *Assessment of Reptiles and Amphidians/ Focus Rare or Endagered Species-* Siddons, Rucker, Steckert, UW-Stevens Point, Biology, 2012-14
- *Baseline Survey of Iris Lacustris (Dwarf Lake Iris)-* Perrigoue, UW-Stevens Point, Biology, 2013-14
-

Other Research News;

The Friends also awarded a grant to Megan Sprovach, UW- Green Bay, Environmental Science and Policy. Her proposal titled; *The effect of the invasive herb Alliaria petiolata (garlic mustard) on spider (Araneae) community structure in northeastern Wisconsin forest understories at Peninsula State Park.*

Upon receipt of the grant, Megan and her faculty sponsor, Professor Michael Draney, visited the Park searching for appropriate plot sites to conduct her research. After searching recommended locations, Sprovach and Draney concluded **the Park did not contain enough garlic mustard** to satisfy their research requirements. They have taken their research to another location.



This is an interesting development for our Park. We have fought garlic mustard for years! We were surprised that these researchers could not find it present in abundance. As one Research Committee member remarked; *“WOW – who would have thought most places in Peninsula do not have a dense enough infestation of garlic mustard to conduct research. **That’s what persistence, consistency and a good management plan can do – and support from managers for 15 years in working on invasive species. Not just verbal support, but FTE staff time and funds”.***



Peninsula State Park is **not** free of garlic mustard and a host of other invasive plants. However at this moment, we may just be winning one small battle!!

Friends of Peninsula State Park are committed in helping control invasive species.

Why?

Because we are trying to keep this Park as native as possible and if left uncontrolled future generations will visit a totally different Peninsula State Park.

Now, more than ever before, we need help from all our “Friends”. Your time and money are what makes all these victories happen. Can you contribute?

visit; peninsulafriends.org

Quarterly Report 1

7/23/2015

Prepared for Friends of Peninsula State Park

by

Stephanie Jagemann

Department of Entomology, University of Wisconsin-Madison

Introduction

Oak wilt is a serious disease of native Oak trees caused by the fungus *Ceratocystis fagacearum*. In the United States it affects most northeastern states, including Minnesota and Wisconsin, and also Texas. All species of Oak are susceptible and at risk. White Oak species are affected, but the disease is most serious in Red and Black Oak species. Oak Wilt is spread in two ways - underground through root grafts between closely located trees and overland by insect vectors. The primary vectors are 'sap beetles' in the family Nitidulidae. These beetles are attracted to decaying fruit, plant saps, and fungi.

Previous studies have identified which species of Nitidulid are most predominantly associated with Oak Wilt fungal mats in Minnesota, Wisconsin, and Illinois, of which six species are predominant. Relative abundances vary among states. Also, different species come to different ages of Oak Wilt mats. Some Nitidulids may have greater ecological specialization in their association with the Oak Wilt fungus than others. The two species being sampled in this study arrive at the fungal mats first and for longer periods of time, making them the primary vectors of the Oak Wilt fungus.

Although much work has been being done on Oak Wilt vectors in Minnesota and Illinois, little has been done in Wisconsin since McMullen et al published in 1955 and 1960. More than 60 years later forest composition, and other relevant variables have changed in Wisconsin. To remain up-to-date in controlling Oak Wilt, we need to conduct another survey of Nitidulid presence in Wisconsin, including stands containing Oak Wilt fungus in living and logged stands, as well as control stands without Oak Wilt present. Our objective is to better quantify the prevalence of Wisconsin's two main Oak Wilt vectors, and at what times they occur throughout the state. Surveying will take place from late March through September, to ensure all flight times are included in the trapping period. Six traps will be placed at each site, approximately 30 feet from a tree with Oak Wilt fungal mats in a circular fashion or in a row along a ridge with Oak Wilt infested trees on both sides of the traps. Traps will be checked at one week intervals to allow us to see the change in species composition over a field season.

Along with wind-oriented funnel traps, HOBO Data Loggers will be placed at each site. This will give valuable information for degree day calculations. Degree day calculations are especially important for control of vectoring insects. It allows for agencies, such as the DNR, to make more accurate estimations of when the high priority Nitidulid vectors will be present in Oak stands. This also leads to more informed instruction on pruning methods, helping the general public protect valued Oak trees in neighborhoods or parks.

Methods

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Field collections will take place in three types of forest stands, all containing predominantly Oak species – stands that contain Oak Wilt fungus, control stands such as Peninsula State Park that are not known to contain Oak Wilt fungus, and logged stands that contain Oak Wilt fungus, including working state forests. There are 8 stands located inside of state parks containing Oak Wilt fungus, 2 stands located in working state forests that contain Oak Wilt fungus, and 2 control stands that do not contain Oak Wilt fungus. These 12 plots are located as evenly as possible throughout Wisconsin. Each plot has 6 wind-oriented funnel traps, for a total of 72 traps, baited with chemical baits (attractive pheromones) purchased from Great Lakes IPM, and homemade dough bait composed of flour, sugar, yeast, and water. The wind-oriented funnel traps will be either be placed around a tree or two trees containing Oak Wilt fungal mats in a circular fashion, or in a row along a ridge of tree infected with Oak Wilt fungus on one of both sides of the traps – all traps will be evenly spaced from one another. Wind-oriented funnel traps will be checked and emptied every week from March through September. Homemade dough bait will be changed weekly, and pheromones are changed every 4 weeks. HOBO Data Loggers at each site record temperature, and are downloaded every four weeks.

All plots are on state lands. This study will not interrupt public or private use of the land. However, sampling equipment such as the HOBOS and wind-oriented funnel traps should not be touched or interfered with. Also, pruning, logging, and planting should not occur in the stand during the testing interval. Other non-invasive activities, such as hiking or hunting, are fine for the study. This study should have no negative impacts on flora or fauna in the stands.

Anticipated Results

The results of this study would broaden our understanding of how prevalent the main Nitidulid vectors are, if they are currently present in stands containing Oak Wilt fungus, and at which times of the year they are present in Wisconsin. Since the last time studies of this nature have taken place in Wisconsin was over 60 years ago, it is very likely we will find different species compositions and possibly different flight times. This will give the DNR and scientific community valuable information that could lead to better preventative, or even invasive measures to help eradicate the beetles or the fungus. The calculation of degree days will also be very helpful in determining when beetles will arrive, allowing for better pruning guidelines that would help the public to aid in the prevention of spreading Oak Wilt Fungus. Olfactory bioassays will allow us to measure how associated these Nitidulids really are to Oak Wilt fungus, the results of this study could prove to be greatly influential if Nitidulids are actually more attracted to yeasts or fermenting fruit matter. This could also lead to better preventative measure by creating traps to lure Nitidulids away from fungal mats to prevent spreading.

Results to Date at Peninsula State Park

To date, I have visited Peninsula State Park 11 times this year and plan on collecting at least 5 - 6 more times, depending on how long the beetles continue flying (based on trap catches). At each of my field sites, including Peninsula, I have six wind oriented funnel traps hanging 1.5 - 3 m off of the ground. Each of the six traps has a pheromone (3 have *Colopterus truncatus* pheromones and 3 have *Corpophilus sayi* pheromones) and homemade dough bait. The dough bait consists of flour, sugar, yeast, and water and is made to a toothpaste consistency. Previous research by Dr. Jennifer Juzwik

(USDA FS, St. Paul, MN) has shown that this combination of dough bait and pheromone has led to trapping the most beetles. On the bottom of the trap is a funnel that leads to a collection vial filled with shredded paper and a kill strip. The shredded paper is to stop the beetles from rolling around together at the bottom, so that when I go back to do fungal cultivation the beetles have not been touching and transferring fungal spores to one another. Fungal cultivation is to show what percentage of beetles caught actually carry viable Oak Wilt propagules. Hopefully, Peninsula State Park will not have any viable growing fungus because Oak Wilt is not known to be present.

Peninsula is a unique field site, in that out of my 12 total sites, it is one of the 2 sites that does not have Oak Wilt present. Although it is still early in the processing stage, we have started to work on samples received from Peninsula State Park. The most interesting thing to note is that we are capturing *Colopterus truncatus* and *Carpophilus sayi* (the two main vectors of Oak Wilt in Wisconsin) even though Oak Wilt is not present in the park. This means that the vector is present in the park, and in average numbers compared to other parks with Oak Wilt, but the fungus is not present. Total numbers for season are not in yet, so I cannot speculate too far, but I do find this really interesting and it may help in my later olfactometer studies to determine what these beetles are actually attracted to - the Oak Wilt fungus *Ceratocystis fagacerium*, or another fungus, sap, or fermenting food it prefers more.

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Photographs

Left: A tree at Governor Nelson State Park that died of Oak Wilt Disease last year (2014). This dead tree is currently a fungal mat producing tree that insect vectors can enter and spread fungus from. By the end of this field season the tree will be too dry to produce fungal mats and will no longer vector disease through insect vectors, but could still vector disease through root grafts underground. Photograph by Stephanie Jagemann, 2015.



Right: A close-up of Oak Wilt fungus, *Ceratocystis fagacerium*, found under the bark of a Red Oak tree at Governor Knowles State Forest. The large portion in the middle is referred to as an asexual pressure pad, and is produced by the fungus to push the bark up causing cracking. These cracks allow the beetles to get into the tree. Beetles then walk around and eating the fungus. If they walk on the flat portions of the fungus, they pick up fungal spores and get “dirty feet”. If they beetles then fly to a healthy Oak tree with a fresh wound the fungus will enter the Oak tree through the wound. Photograph by Stephanie Jagemann, 2015.



Left: A photograph showing what cracking looks like on a Red Oak tree in Governor Knowles State Forest. Cracking is caused by an asexual pressure pad, and allows beetles to enter and feed on the fungus. Pressure pads form to eventually cause the bark to fall off of the tree for better chances of reproduction in healthy trees. Photograph by Stephanie Jagemann, 2015.