

WHEN ARE PRUNED OAK TREES MOST AT RISK OF INFECTION IN ONTARIO?

*For some years now, Ontario's arborists have been on the lookout for the serious fungal disease known as Oak Wilt (*Bretziella fagacearum*)*

by Sharon Reed, Jen Llewellyn, and Sylvia Greifenhagen

THE DISEASE HAS NOT BEEN DETECTED IN CANADA, BUT INFECTED TREES ARE PRESENT IN MICHIGAN AND NEW YORK, VERY CLOSE TO THE ONTARIO BORDER.

A recent detection of this pathogen's DNA on beetles caught in traps at the Michigan-Ontario border is a reminder for us all to be vigilant in preventing the spread of this serious disease.



Figure 2: Nitidulid beetles crawling across a 72-hr old wound on the trunk of a red oak. The wound is 5 cm wide.

Though the disease is spread mainly through the grafts between root systems of oak trees, Oak Wilt can also occur overland when native sap beetles (Nitidulidae) carry spores of the invasive fungus from diseased trees to recently wounded, healthy trees (Fig. 2). Oak Wilt spores contact the healthy tree's xylem through the wound, providing a direct entry point into the tree's vascular system. From there, the fungus will grow and colonize the outermost xylem tissue, leading to plugging and eventually dieback and mortality of the tree. Once a tree is killed, the fungus travels from the roots of the diseased tree outwards through the root grafts to the roots of nearby healthy oaks. All oaks are affected by Oak Wilt, but trees in the red oak group are most susceptible.

Decreasing the overland spread of the disease by sap beetles can be an effective method of reducing new oak wilt infections.

This three-year study has been focused on determining the time period when the beetle vectors are most active, known as the "High-Risk Period". Being able to accurately pinpoint the phenology and infective life stages of these organisms, we can then designate certain time periods as "Do Not Prune" for this susceptible genus in Ontario.

Fig 1: Photo of a symptomatic oak tree. Photo Credit: Joseph OBrien, USDA Forest Service, Bugwood.org

IN 2018, ONTARIO MNRF STARTED TRAPPING SAP BEETLES TO DETERMINE THE SPECIES MOST LIKELY TO TRANSMIT OAK WILT AND THE CORRESPONDING TIME OF YEAR THESE SPECIES WERE ACTIVE (FIG. 3).

Additionally, researchers created degree day models, based on heat accumulated over time, to predict flight periods. Degree day models take advantage of the link between temperature and insect development and are reliable, even in abnormally warm or cool years. In 2019, the project expanded across Ontario, Manitoba and New Brunswick with the assistance of staff and scientists at OMAFRA, Manitoba Agriculture and Resource Development, NRCan-Atlantic Forestry Centre, Canadore College, the City of Ottawa, Northumberland County, Essex Region Conservation Authority, Upper Thames River Conservation Authority, St. Clair Regional Conservation Authority, and the Sault Ste Marie Region Conservation Authority. The project was partially funded by the International Society of Arboriculture - Ontario Chapter, Manitoba Agriculture and Resource Development, and the Canadian Food Inspection Agency.



Figure 3: Beetles were collected from 2018 to 2020 using wind-vane traps baited with bread dough bait and pheromones.

that 90% of their flight occurs between April and August. There were also some regional differences in the start of the flight period within Ontario, with flight typically starting around April 1st along Lake Erie, mid-April in south-east Ontario and late April in northern Ontario. The model also indicated that flight could start in March in exceptionally warm years (e.g. 2012).

90% of their flight occurs between April and August

OAK WILT INFECTIONS CAN OCCUR ANYTIME IN THE GROWING SEASON, BUT EARLY AND LATE SEASON INFECTIONS ARE REPORTED LESS FREQUENTLY IN THE UNITED STATES.

This Ontario study found that the risk of infection in Ontario is greatest between April and August since important beetle vectors are most active at this time. Another important finding was that several additional species of sap beetles that visit oak wounds in Canada fly earlier and later than the main known vectors, *Colopterus truncatus* and *Carpophilus sayi*. These additional species, found in the genus *Carpophilus* and *Epuraea*, are not considered important vectors in the United States but they have been collected from oak wilt fungal mats or reported carrying fungal spores. Future research aims to determine if these sap beetles could play a meaningful role in oak wilt transmission in Canada.

If you suspect oak wilt in your area, report to the CFIA cfia.surveillance-surveillance.acia@canada.ca.

Since 2018, the project has identified 12 sap beetle species attracted to fresh oak wounds.

Two species (*Colopterus truncatus* and *Carpophilus sayi*) that were collected throughout Ontario, New Brunswick, and Manitoba are well-known vectors of the disease in the United States. Reports of sap beetles feeding on the pathogen fruiting bodies, or carrying spores on their bodies, were found in the scientific literature for these and another six of the species that were collected in Ontario. Little is known about the four other species.

More than 40,000 sap beetles were collected in flight traps in the three provinces. Temperature and weekly flight data were used to create models for the eight most abundant sap beetles that also visited wounds. We then applied these models to 30 years of historical weather data for each species to determine when these species are typically active during the average calendar year.

Particular attention was paid to *Colopterus truncatus* and *Carpophilus sayi* since they are well known vectors of oak wilt (Fig. 4).

Colopterus truncatus emerged earlier than *Carpophilus sayi*. This finding was similar to flight studies in Wisconsin and New York. The Canadian research team found that these beetles are active from March to November but



Figure 4: *Caropophilus sayi* (left) and *Colopterus truncatus* (right) are the main vectors of oak wilt in the midwestern United States and are present throughout Ontario. Nitidulids are less than 7 mm long.