

# The Advance of Trellis Rust Across Michigan

## Its Impact on Nurseries and Landscapes



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Dr. Roberts retired from Michigan State University in 2018 after committing four decades to advancing MSU's Land Grant Mission, originally signed into law by President Abraham Lincoln during the midst of the American Civil War. He has published hundreds of articles and has taught hundreds of lectures and workshops.

Dr. Roberts has researched many issues in Michigan's plant industry, including Oak Wilt, Dutch Elm Disease, Diplodia Tip Blight of Pines, along with a variety of cultural problems such as plant nutrition and herbicide toxicity. During his career, he has discovered a variety of new diseases and pests such as Phomopsis Canker of Spruce and the first bacterial wilt disease of turfgrasses in North America.

In the early 2000s, his research on Ash Decline in Southeast Michigan led to the discovery of the invasive Emerald Ash Borer in North America.

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### INTRODUCTION:

I have been reporting on Trellis Rust (a.k.a. European Pear Rust) since 2014. Trellis Rust is caused by the fungus, *Gymnosporangium sabiniae* (= *Gymnosporangium fuscan*), and is a relatively new disease in Michigan. Being very common in and probably having originated from Europe, Trellis Rust (TR) was found in portions of Canada since the 1960s and in the Pacific Northwest since the late 1990s. The disease was first reported in Ontario in 2007, in Michigan in 2009, in New York State in 2011, and more recently in Connecticut in 2012. Trellis Rust is only capable of attacking Pear (*Pyrus* sp.) and can cause extensive harm to both orchard-producing pears (*Pyrus communis*) and landscape ornamental pears (*Pyrus calleryana*) (Photos 1A and 1B). Unique among plant diseases that we manage in nurseries and landscapes, most rust diseases have an alternate host. For Trellis Rust, the alternate host is *Juniperus* sp. (Photo 2).

## Trellis Rust Disease/Life Cycle:

Trellis Rust has a similar disease cycle to native rust diseases caused by fungi that occur on the plant family Rosaceae. Cedar-Apple Rust (caused by *Gymnosporangium juniperi-virginianae*), Cedar-Quince Rust (caused by *Gymnosporangium globosum*), and Cedar-Hawthorne Rust (*Gymnosporangium clavipes*) are three native and common rust diseases that infect a deciduous host and juniper (*Juniperus virginiana*) as their alternate host. The Trellis Rust disease cycle is summarized in Figure 1. Briefly, the fungus survives overwinter on its conifer host (*Juniperus virginiana*). In the spring, overwintering galls “bloom” and release spores to infect its deciduous host, *Pyrus* sp. (Photo 2 Insets). Depending on



1A

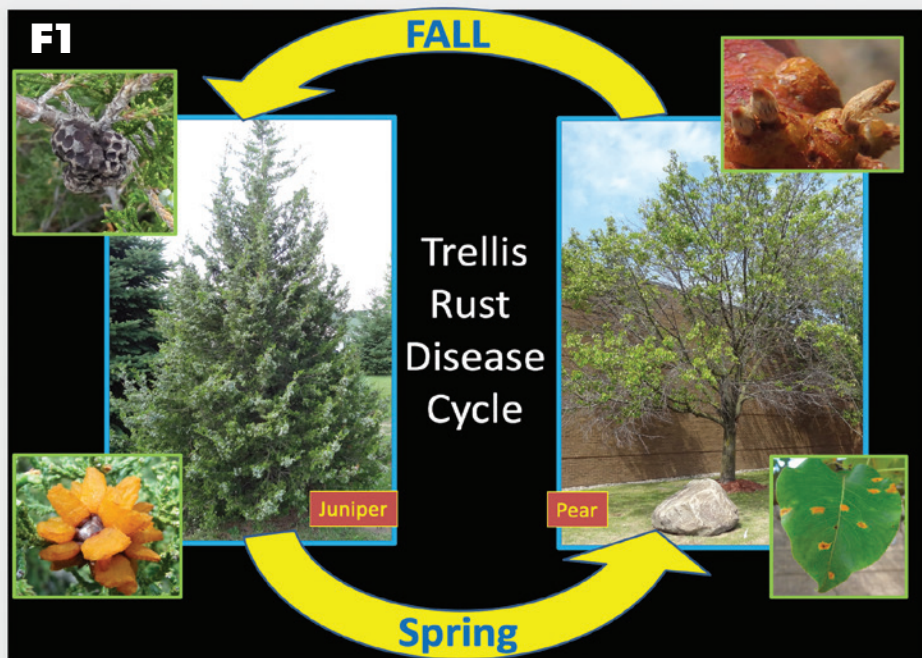
**P1**  
A&B Trellis Rust, an introduced disease, can decimate ornamental pear trees in the landscape. In Photo 1A, these three trees appear reasonably healthy in the spring even though their yellowish color indicates numerous yellow lesions of Trellis Rust on the foliage (Inset). Photo 1B depicts the same trees a couple of months later when the disease has caused severe leaf death (Inset) and drop.

**P2** *Juniperus virginiana* serves as the alternate host for Trellis Rust on *Pyrus* sp. The fungus overwinters on juniper as somewhat inconspicuous galls (center Inset); the galls blossom in the spring and may appear in different forms (Inset, Right & Left) as they produce spores that infect newly emerging pear leaves around the time of flowering.

**F1** In the Trellis Rust disease cycle, the fungus survives overwinter on its conifer host (*Juniperus virginiana*). In the spring, overwintering galls “bloom” and release spores to infect its deciduous host, *Pyrus* sp.



1B



2



the incidence of Trellis Rust infection on pear, trees may be debilitated by mid-summer; on trees that are severely defoliated, the Trellis Rust fungus (as an obligate parasite) dies with the leaves that drop. Less incidence of leaf drop results in survival of the fungus on leaves on the tree into the fall whence the fungus will produce spores to reinfest juniper for overwintering survival.

### Existing & New Locations of Trellis Rust:

For almost a decade, I have haphazardly monitored the Trellis Rust spread through large portions of Southeast Michigan, anticipating that it would eventually spread to other regions of Michigan. The disease has lived up to its promise. Existing and new locations of Trellis Rust are summarized as follows.



**Southeast Michigan:** This extensive region including Metro-Detroit became the initial epicenter for Trellis Rust in Michigan. Over the last eight years, Trellis Rust has been spreading through this region. Many of us witnessed the devastation this invasive disease has had on pear trees, especially ornamental flowering pears over the last decade (Photos 1A & 1B). The disease has become so severe in some locales that trees, even well established and mature ones, have been removed due to their decline and unsightly appearance in landscapes. While some of the sites listed in this article are technically located in Southeast Michigan, many are in the extreme reaches, where we might expect Trellis Rust to spread first.

**Holly, Michigan:** While visiting a private property near Holly, Michigan in 2020 to examine why spruce trees were



- P3** At this site near Holly, Michigan, fruit-bearing pears in a deer-proof garden are exhibiting symptoms of Trellis Rust (Inset).
- P4** At this nicely maintained landscape in Ypsilanti, Michigan, a fruit-bearing pear is showing infections of Trellis Rust (Inset), well outside the original Trellis Rust infestations in Southeast Michigan.
- P5** While driving down State Street in Ann Arbor, I noticed that these pear trees had orangish lesions typical of Trellis Rust (Inset). The disease had spread from the Metro-Detroit area, about a 20-30 mile distance.

declining even though they were being treated for various diseases and pest problems, I noticed this fruit-producing pear in this “deer-proof” garden afflicted with Trellis Rust (Photo 3).

**Ypsilanti, Michigan:** While visiting a nicely designed and managed landscape in Ypsilanti, Michigan to diagnose problems with a declining Japanese maple in 2022, I observed initial infections of Trellis Rust on a mature fruit-bearing pear (Photo 4).

**Ann Arbor, Michigan:** For those familiar with Ann Arbor, you know, the city whose colors are proudly pronounced “Maize and Blue”, this tree along South State Street exhibits early infections of a Trellis Rust that will likely build up over the coming years (Photo 5).

**East Lansing, Michigan:** The foliage of the tree in Photo 6 showed early indications of Trellis Rust. It is interesting that in this shopping mall (Frاندor) with little landscaping (only a few trees), there were no junipers visible in any direction. Note the rusty lesion on the foliage, right, and the “primordia” of the Trellis Rust Aecia (left-underside of leaf) that have not yet matured as of October 1, 2022 to release spores to overwinter on juniper (Inset).

**Grand Rapids, Michigan:** Andy Niemeyer with Oak Meadow Tree Service reported Trellis Rust infections on landscape pears in Southeast Grand Rapids (Photo 7). He noted extensive lesion development on these trees and is preparing for management options beginning in 2023.

**Western Michigan:** Dr. Roger May, Senior Technical Manager, Great Lakes Region, TruGreen, discovered Trellis Rust on some Bonsai pears at a well-known garden in Western Michigan (Photo 8). In this situation, which would be very interesting to study, we might wonder if the juniper alternate hosts resided in nearby landscapes or in Bonsai junipers. Good question!

### Identifying Trellis Rust:

Trellis Rust is an “Introduced” or “Invasive” rust disease with a similar disease or life cycle to the three native rust diseases discussed earlier. Trellis Rust and the three native rust diseases have several things in common. They all produce yellowish-orange lesions on the foliage of their rosaceous, deciduous hosts (Photo 1A), and all overwinter on their *Juniperus* alternate host (Photo 2).

While identification could be performed by DNA/PCR analysis, I think that understanding symptoms of the disease and the disease cycle plus identification of



**P6** I spied Trellis Rust on this pear tree in a mall (Frاندor) in East Lansing, Michigan. Pavement and cement dominate this mall with very little landscaping at this location; only a few trees reside here and there. In the Inset, note the orangish/rusty color of a Rust lesion (right) and the initials of the Aecia (left-undersides of leaf) that have not yet matured sufficiently to release spores to reinfect juniper for overwintering of the fungus on a live plant (Juniper) as of October 1, 2022. It is interesting that no junipers were visible in any direction.

**P7** Andy Niemeyer found this infestation of Trellis Rust in Southeast Grand Rapids. According to Andy, the pear trees showed many leaf infections (Inset) that will eventually cause defoliation and dieback on these trees in subsequent years as the disease builds up in the area. Photo Credit: Andy Niemeyer

**P8** Dr. Roger May was visiting a well-known garden in Western Michigan when he encountered Trellis Rust lesions on some Bonsai Pear trees (Inset). It would be interesting to know if the Trellis Rust fungus originated from junipers in nearby landscapes or from Bonsai junipers. Photos Credit: Dr. Roger May

the deciduous host can lead us to reasonable certainty of Trellis Rust. First and foremost, we don't see many native rust diseases on pear. Foliar symptoms of Trellis Rust on pear begin as yellow lesions on foliage in the spring (Photo 9A) and by late summer appear as darker, orangish/reddish lesions on foliage (Photo 9B). A unique characteristic about Trellis Rust that I have noticed is when the "Aecia Horns" are produced on the deciduous host for infection of the juniper host for overwintering of the fungus. On the three native rust diseases mentioned earlier, the "Aecia Horns", which produce spores to infect juniper for overwintering survival, are generally visible on the

undersides of the leaves in late July or August as tendrils (Photo 10A). For Trellis Rust, the "Aecia Horns", which resembled trellises to some individuals who provided the common name, Trellis Rust, do not mature on the undersides of leaves until September or later in the fall (Photo 10B). Furthermore, Aecia of Trellis Rust appear quite differently from Aecia on deciduous hosts of other rust diseases.

### Managing Trellis Rust:

Disease management is based on multiple fronts. These management procedures may involve eliminating one of the host species, separating the two host species (pear and juniper) by significant

distances (Photo 11), planting resistant species (i.e. there are resistant junipers and many deciduous plants that are not affected), pruning out overwintering galls on juniper (likely not practical), and specific treatments with fungicides. While fungicide treatments during a very narrow window at the time of flowering in the spring may arrest infections, fungicides can be harmful to the bee populations by interfering with the fermentation process performed by yeasts (fungi) for bee bread formation for larvae.

One aspect that we might want to reconsider is the replacement of ornamental pear with another member of the Rosaceae family. If Trellis Rust is a serious problem on ornamental pears in a specific neighborhood, then this indicates that a significant population of junipers is



likely to reside nearby. Due to the population of junipers, other native rust diseases are likely to develop to an increased incidence on replacement species such as crabapple, apple, hawthorn, etc. (Photos 12A & 12B).

**P9**  
A&B Foliar symptoms of Trellis Rust on pear begin as yellow lesions, gradually turning orangish (9A) in midsummer and eventually reddish/necrotic in late summer (9B).

**P10**  
A&B With native rust diseases such as Cedar-Apple Rust, "Aecia Horns" (tendrils) typically form in August on the underside of foliage (10A) and release spores that infect junipers for overwintering. With Trellis Rust, "Aecia Horns" (10B), which some folks believe look like trellises (hence the common name, "Trellis Rust"), form in the fall and release spores to infect junipers for overwintering of the obligate parasite fungus (none of the Rust Diseases can survive on dead plant material). The Aecial structures of Trellis Rust appear more like mini volcanoes to me. Shouldn't we call it "Volcano Rust"?

**P11** The "Perfect Storm" for Trellis Rust is junipers planted near flowering pears, especially beneath them as in this photo. Landscape architects will need to alter their designs to help mitigate Trellis Rust epidemics and plant loss. Photo Credit: Gary Olgart, Land & Lake Management, LLC

**P12**  
A&B Trellis Rust is so serious where it has become established that replacement trees are often incorporated into landscapes. In this case, ornamental pear trees were decimated by Trellis Rust (12A, winter) and replaced by Crabapples (12B). Unfortunately, because of large numbers of nearby junipers, Cedar-Apple Rust is now infecting the crabapples and will elevate in incidence with time. Photo credit: Gary Olgart, Land and Lake Management, LLC



11



12A



12B



13A



13B



14

## Trellis Rust Ramifications for Landscapes and Nurseries:

Interestingly, Callery Pear was undoubtedly the most common ornamental tree utilized after the Emerald Ash Borer decimated native Ash (*Fraxinus* sp.) tree populations in Michigan and beyond (Photos 13A & 13B). Who cannot be attracted to the early flowering of pear trees to bring us out of winter doldrums so prevalent in Michigan in anticipation of Spring (Photo 14). Unfortunately, flowering pear has probably been overplanted. Trellis Rust in nurseries has been very difficult to manage (Photo 15). And if we look at natural areas in the early spring, we are likely to witness the invasive potential of Callery Pears (Photo

**P13 A&B** Ornamental pear was likely the most common replacement tree for ash trees decimated by the Emerald Ash Borer (EAB). In Photo 13A around 2003, ash trees near a restaurant in Novi, Michigan exhibited serious decline from EAB infestations. At the same restaurant location 12 years later (13B), these pear replacements are now infected with Trellis Rust.

**P14** Our clientele loves the appearance of ornamental flowering pears as one of the first trees to flower after Michigan's long and bitter winters. They will likely continue to request pear trees be planted without realizing that a threat in the form of Trellis Rust looms around the corner.

**P15** This Pear tree was planted in August; the photo was taken in October. Did the Trellis Rust infection originate in the nursery or landscape? Based on what we know about the disease cycle (Figure 1), Trellis Rust infected the tree in the nursery, where the disease is extremely difficult to manage.

**P16** Invasive Callery Pears are conspicuous by their flowering in the early spring in this natural area.

16). As Trellis Rust continues to spread throughout Michigan and landscape trees are decimated by the disease, alternative tree species will be sought for their replacement. What this means in the short and long term is that nurseries need to be prepared to shift from pear to other species to meet the demand as pear trees may become untenable as frequently utilized landscape trees.

### Reporting Trellis Rust:

Please bear in mind that the examples of existing and “new” locations presented herein are by no means a complete listing of where Trellis Rust may be found in Michigan. I rely on my own observations and those from Arborists, Landscapers and Nurserypersons to determine where Trellis Rust may be found around the state.

Trellis Rust may be disseminated locally or distantly by wind-borne spores. Viable spores of some rust diseases have been found in the stratosphere; hence, it would not be surprising to find Trellis Rust eventually spreading throughout North America. However, a major means of spread of the disease over extensive geographical distances is in nursery stock, where control of the disease may be difficult (Photo 15). In this publication, I reported the spread of Trellis Rust from Southeast Michigan to Central Michigan to Western Michigan. It is likely that the transfer of Trellis Rust from east to west against prevailing winds occurred in nursery trees. Now that Trellis Rust is multiplying in Western Michigan, the dissemination of spores and the disease *eastward* through other central and northern Michigan locations with prevailing winds is more likely to occur, and more quickly. If anyone in Michigan encounters what appears to be Trellis Rust symptoms on *Pyrus* sp., please feel free to report these cases to me, and I'll keep the industry informed so local arborists and landscapers may be prepared for Trellis Rust epidemics in their area. 🍃



**Dave Roberts is a  
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