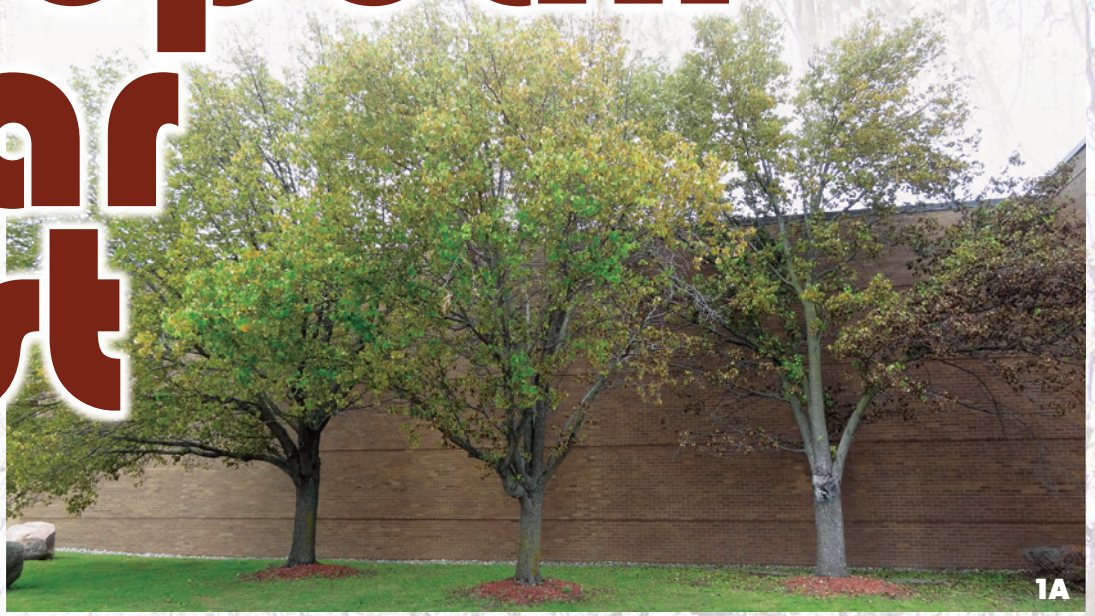
European Pear Rust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The management of Trellis Rust, as with any heteroecious, macrocyclic rust disease, can be challenging.

Introduction:

Trellis Rust (European Pear Rust), caused by the fungus ***Gymnosporangium sabinae (= Gymnosprangium fuscan),*** is a relatively new disease in Michigan (Photos 1A and 1B). Having been introduced into North America 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. TR is capable of attacking all Pear (*Pyrus* sp.) types found in the U.S. and can cause extensive harm to both fruit-producing pears ***(Pyrus communis)*** and ornamental pears ***(Pyrus calleryana),*** whether found in nurseries, orchards or landscapes. As with many native rust diseases (Cedar-Apple, Cedar-Hawthorn, Cedar-Quince), Trellis Rust is a heterocyclic rust, meaning that it requires two (alternate) hosts to complete its life/disease cycle: Juniper *(Juniperus virginiana)* and Pear *(Pyrus sp.)*.

1A&B The decline of these pear trees by Trellis Rust over a couple-of-month period is rather alarming.

2 Initial symptoms of Trellis Rust are these rather "pretty" orange-yellow lesions on foliage.

3 Extensive lesion development often results in necrotic foliage. Such extensive lesion development by the fungus not only kills the foliage, but also kills the fungus – as if by suicide.

4 As summer progresses, the infection by Trellis Rust causes leaves, petioles and stems to become deformed and swollen with wart-like protrusions.

5A&B Of particular concern is the fact that the Trellis Rust fungus can attack shoots (A), later causing cankers (B) and the subsequent death of twigs and branches.

6A&B Galls induced by Trellis Rust form on juniper twigs (A) and overwinter in this manner. During the warmth and moisture of Spring (typically around early May), these galls "bloom" (B) to release microscopic teliospores.

7 Later in the fall, Trellis Rust induces the formation of Aecia on stems and the underside of foliage (note small volcano-like projections) that release spores that infect junipers. This stage of the disease is rather UGLY!

Symptoms of TR:

Initial symptoms of TR include yellow lesions on pear leaves (Photo 2). In severe cases, leaves are literally plastered with these lesions. With such severe cases, leaves may die (Photo 3). Interestingly, because TR is caused by an obligate parasite, dead leaves also kill the fungus – a suicide of sorts. Less severe cases of leaf lesions result in larger orangish lesions later in the season. Nonlethal but severe infections also result in severe deformities of leaves, petioles and twigs (Photo 4). Of considerable importance is the fact that the TR fungus is also capable of attacking shoots (Photo 5A), eventually resulting is stem and branch cankers (Photo 5B), which in turn may result in twig and branch death. The fungus apparently causes little if any harm to junipers.

Disease Cycle:

TR overwinters on juniper plants as galls on twigs (Photo 6A). In the spring during warm, wet weather, overwintered and maturing galls on the *Juniperus* host "grow" gelatinous horns (Photo 6B) called Telia. These Telia horns release teliospores that are wind-borne to the deciduous host, in this case pear. If pear leaves are wet, spores will germinate on the leaf surface and penetrate the cuticle and epidermis, eventually creating a lesion. As the initially tiny lesions expand in size through the early summer, their coalescence may cause the leaf to become necrotic and drop from the tree (Photo 3). This defoliation can weaken trees. If defoliation is extensive, the tree may attempt to re-foliate. Later emerging foliage will not be infected by the fungus due to the relatively narrow window of spore release by the short-lived Telia horns on the juniper. Later in the fall (early October), aeciospores will be produced from aecia emanating from grotesque-appearing wart-like growths (Photo 7) on the undersides of green, viable pear leaves or stems (aeciospores will not be produced on necrotic leaves whether fallen or hanging on the trees); these aeciospores will be wind-borne to the juniper host where galls will form (Photo 6A) and overwinter, thus repeating the cycle.

Management of Trellis Rust:

The management of Trellis Rust, as with any heteroecious, macrocyclic rust disease, can be challenging. Following are some tips that may be helpful.

Plant Diversity: For landscape areas, it is always wise to utilize diversity. With the decimation of American elm trees by Dutch Elm Disease, ash trees (*Fraxinus* sp.) were often planted abundantly as replacements. With the introduction of the Emerald Ash Borer, pear trees were often installed excessively as replacement monocultures in landscapes (Photos 8A-D).

Resistant Plants: Where abundant Trellis Rust (or other rust diseases) is prevalent, it may be wise to avoid planting susceptible species of plants. For example, arborvitae may make a viable alternative for juniper, and Linden may be an acceptable replacement for pear; neither linden nor arborvitae is susceptible to Trellis Rust.

Elimination of One Host: To break the disease cycle of a multi-host (heteroecious) rust disease, one of the most effective methods is to eliminate one of the host plants. In some fruit growing states, laws have been adopted allowing the destruction of junipers from natural areas and landscapes, causing some consternation (ever hear of "Stand Your Ground!"?) from some juniper owners. In the case of landscape situations, the proposed or actual destruction of one host can be a source of some serious neighbor (hood) disputes. The elimination of a nearby alternate host can

drastically reduce, but not necessarily eliminate, the incidence of rust infections, depending on distance. Juniper-derived teliospores have been known to be wind-blown for many miles.

Eliminate Infected Plant Material: Perhaps an effective but difficult strategy in this category is to locate and remove rust galls (Photo 6A) from the juniper host ***before*** they open and produce teliospores in the spring. Simply discard the galls in the trash or compost pile (or burn the dastardly creatures!). This technique is very labor intensive and may not be practical because many juniper galls are practically inconspicuous before they "bloom" in the spring. Because rust diseases are caused by fungi which are obligate parasites, raking and destroying pear leaves in the fall ***will not*** reduce the incidence of Trellis Rust the following year.

8A-D The transition of this landscape from devastation by the Emerald Ash Borer through the establishment of a monoculture of pear, which is under attack by Trellis Rust. A) In 2002, these ash trees are under attack by EAB. B) One year later (2003), the ash trees have been killed by the EAB. C) Two years later (2005), Bradford pears have been established as another monoculture. D) By 2015, the pears have grown rather nicely, but are now under attack from Trellis Rust (Inset).

Fungicidal Sprays: Broad-spectrum fungicidal sprays to pears during the infection period in the spring can reduce the number of lesions on pear leaves. The fungicide must be present before the rust spores are deposited on leaves by the wind. Theoretically, spraying the junipers in the late summer or fall when aeciospores are capable of infecting junipers should be helpful as well. Please be cognizant of the fact that applications of fungicides during pear flowering (when rust spores infect pear foliage) can cause harm to bee pollinators. Applications of fungicides *before* flowering may allow sufficient carryover to protect foliage from rust infections.

For more information on Trellis Rust or other problems, please feel free to contact Dr. David Roberts at: 248-320-7124, email: robertsd@msu.edu, web: treedoctor.anr.msu.edu

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The author and MSU do not endorse any particular products. If using pesticides, be sure to read and follow label directions.

ABOUT THE AUTHOR

David L. Roberts, Ph.D is a Senior Academic Specialist at the College of Agriculture and Natural Resources, Michigan State University, with B.S. and M.S degrees in Plant Pathology from The Ohio State University and a PhD in Botany and Plant Pathology from Michigan State University. Dr. Roberts was the Director of MSU's Plant & Pest Diagnostic Clinic from 1984-1998. His current position is Senior Academic Specialist in the Deans Office at MSU's College of Agriculture and Natural Resources serving Michigan's Nursery and Landscape Industry.

Dr. Roberts has worked on many plant issues for more than 30 years. In the 1980s, his research led to the discovery of the first bacterial wilt disease of turfgrasses in North America. Subsequently, his discovery of a *Xanthomonas* bacterium that controls the weed grass, annual bluegrass, on golf courses resulted in several patents with MSU. His research interests also include Dutch Elm Disease, Oak Wilt and a number of other diseases such as Phomopsis canker on spruce, which he discovered in the late 1980s. In 2001, Dr. Roberts began work on ash decline in southeast Michigan. His research led to the discovery of the Emerald Ash Borer. He has published hundreds of articles in peer-reviewed journals, trade magazines and MSU Extension publications. As part of his Michigan State University duties, Dr. Roberts presents many lectures and workshops around Michigan and nationally.