photo 7A

Pine Conundrum
PART 2: TRUNK AND ROOT MALADIES

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ABOUT THE AUTHOR

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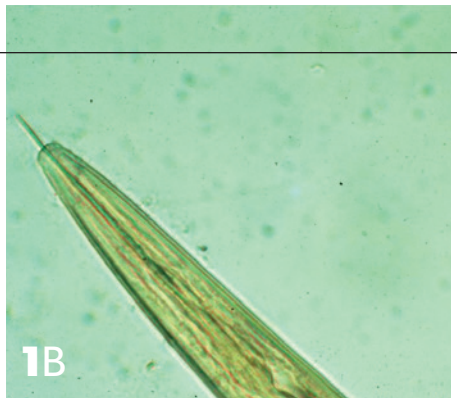
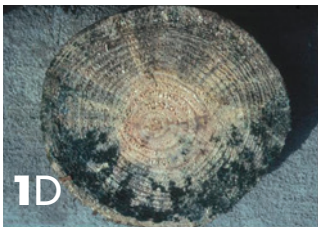
Pines (*Pinus* sp.) consist of a diversity of conifers that represent very valuable components of the nursery and landscape industries in Michigan. As with spruce trees (*Picea* sp.), certain species of pines are undergoing some rather startling decline issues in Michigan landscapes (Photo 1A). Pine Conundrum Part 1 (see *The Michigan Landscape*, Volume 60, No.4, Pages 37-41) covered some of the more common needle and shoot issues. In Part 2, I'll try to convey some of the major trunk and root maladies. When examining declining pine trees, it is not uncommon to encounter several causal factors affecting each tree (Photo 2).


1A


1B


1C


1D


2

Contributors to Pine Decline:

Pine Wilt: Pine Wilt (PW) is a lethal disease, particularly of Scots pine (Photo 1A), caused by the Pine Wood Nematode, *Bursaphelenchus xylophilus* (Photo 1B).The nematode is spread from tree to tree by the Pine Sawyers Beetle (Photo 1C), which are attracted to stressed or declining trees. Pines affected by PW often die rather quickly. A blue-stain fungus is usually visible in cross sections of wood from trees declining from PW (Photo 1D). Management involves keeping pines in good health and prompt sanitation (removing and destroying infested trees by burying, burning, etc.). Some plant health care providers claim they are getting good control with trunk injections of insecticides.

Rust Diseases: In addition to needle rusts discussed in Part 1, pines are susceptible to a variety of rusts that attack branches and trunks. These include, for example, gall rusts and white pine blister rust. All are caused by fungi. Scots pine, for example, is susceptible to both Eastern and Western Gall Rusts (Photos 3A & 3B). These rust galls are characterized by globose knobs along the branches of affected pines. On really old infections, the main trunk may exhibit a gall the size of a basketball. Some of the rust diseases require alternate hosts to complete their disease/life cycle. For example, Eastern Gall Rust requires oak as its alternate host (Photo 3A), while Western Gall Rust does not require an alternate host plant (Photo 3B). The potentially lethal and introduced White Pine Blister Rust (Photo 4A) requires the presence of wild currant (*Ribes* sp.) as its alternate host (Photo 4B). It is interesting that during the Great Depression, hoards of people were hired (remember the CCC, Civilian Conservation Corp?) to eradicate *Ribes* from our northern forests to save the valuable natural resource, Eastern White Pine, from destruction by this introduced fungus. This is one government program that was highly successful!

Collar Weevils: A variety of root/collar weevils such as Pales Weevil, Northern Pine Weevil and the Pine Root Collar Weevil (PRCW) may attack pine. PRCW is perhaps one of the most common and destructive insects among the collar weevils. White pine appears to be encountering greater decline issues from PRCW around Michigan. Above ground symptoms of PRCW may include off-color foliage and a slowing of growth over several years (Photo 2 and 5A). There are often stress or other predisposing factors associated with collar weevil attack (photo 2). At and below ground symptoms include

1A Many species of pines in Michigan are declining at a rather alarming incidence. The decline is representative of a host of conundrum issues.

1B The Pinewood Nematode is a microscopic worm-like "creature" that becomes systemic within pine trees, causing water/nutrient conducting vessels to become clogged, resulting in "wilt". Scotch pines are most commonly affected in Michigan. Note needle-like stylet extended from the nematode head; the stylet is used to pierce plant cells to gain nutrients.

1C The Pinewood Nematode is transmitted from tree to tree by the Pine Sawyers Beetle. Two are seen here in an apparent "mating dance".

1D Along with the nematode, the blue stain fungus (*Ceratocystis*) is often transmitted to trees. The blue stain fungus is sometimes seen in the 2X4 lumber that is purchased at your local lumber yard. The presence of the blue stain fungus in lumber often signifies that the harvested tree was in decline.

2 This White pine collapsed from a variety of factors: wire basket, Pine Root Collar Weevil and Bark Beetles.

3A Eastern Gall Rust on Scots pine requires the alternate host Oak (*Quercus* sp.) to complete its disease/life cycle.

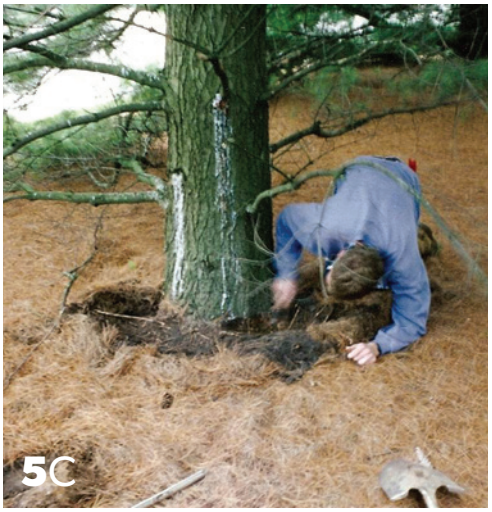
3B Western Gall Rust on Scots pine does not require an alternate host.

4A White Pine Blister Rust, an introduced disease, is lethal to Eastern white pine. Note pustule (blisters) canker on the trunk of this white pine. Also, note the required alternate host *Ribes* adjacent to the trunk.

4B Here, *Ribes* (wild currant) exhibits an orangish lesion of White Pine Blister Rust.


5A


5B

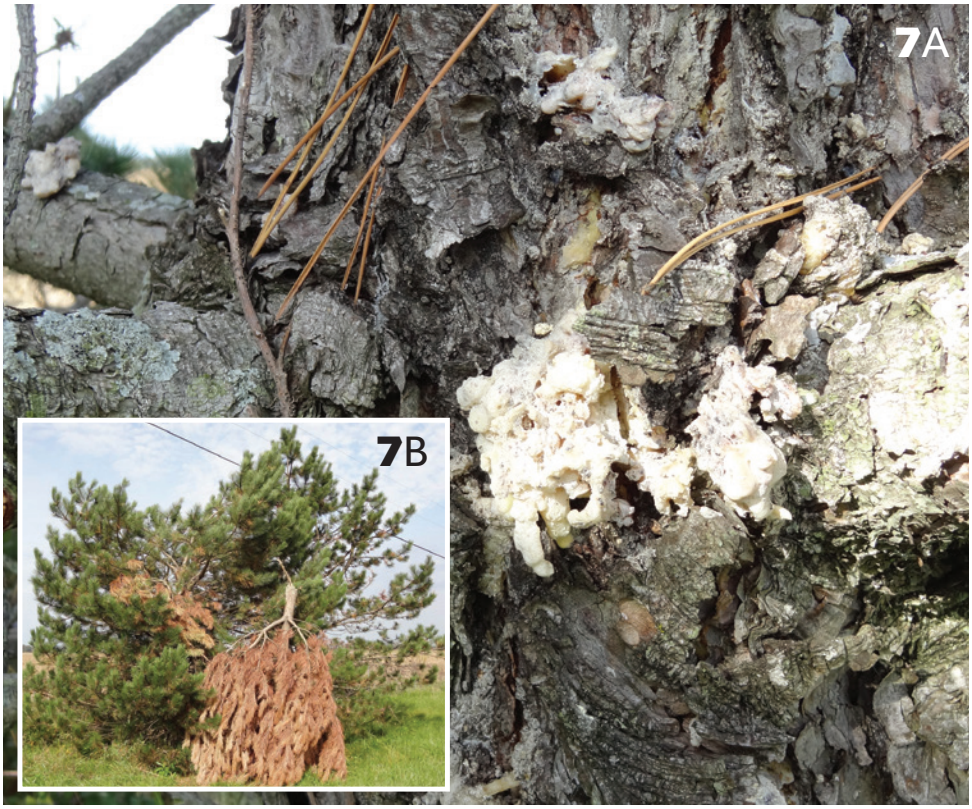

5C


5D


5E


5F


5G



disruption of the vascular tissue in the root collar region (Photos 5B, 5C & 5D). PRCW infestations in dense stands may lead to lodging (toppling-Photo 5E and Inset). Small pine trees are also affected by PRCW and other species of weevils (Photo 5F and Inset). Weevils are identified by their characteristic Jimmy Durante style proboscis (Photo 5G).

White Pine Weevil: White Pine Weevil (WPW) may attack a variety of conifers including pines and spruces. White pine, Norway spruce and Colorado Blue spruce are especially susceptible. Generally, WPW attacks the terminal leaders of trees. Control of the pest includes prompt sanitation (removal of infested leaders) and possible treatments in the spring with an insecticide before eggs are laid.

Bark Beetles: Bark beetles are generally very small insects that are usually considered "secondary". Bark beetles often attack trees affected by other issues, such as Pine Root Collar Weevil and factors related to stress or site problems. Unknowing individuals often blame bark beetles for the death of pine trees because their damage is the first and most obvious symptom observed. Bark beetle attack is characterized by the presence of small holes (pencil lead-sized) peppered over the trunk of afflicted trees. The insect may also be observed kicking out chips from these holes (Photo 6). As populations of bark beetles increase in declining, dead trees, they may begin attacking somewhat healthier trees.

Zimmerman Pine Moth: Zimmerman Pine Moth (ZPM) affects certain pines much like the Pitch Mass Borer attacks spruce trees. Symptoms on affected trees usually include secretions of pitch on the main trunks, often in the vicinity of the branch whorls (Photo 7A). Continued attack and infestation over years may result in weakened trunks to the point that structural failure may occur (Photo 7B).

5A Typical of Pine Root Collar Weevil is off-color (pale green, yellowish) and slowing of growth.

5B Above ground symptoms of PRCW may include a restricted trunk and sap exudations.

5C Checking for PRCW may require some investigative work!

5D Below ground symptoms of PRCW usually include a disruption in the root collar area from tunneling and feeding by larvae.

5E Old stands of monoculture pines such as these from the CCC days often attract PRCW, which may cause pines to topple (Inset).

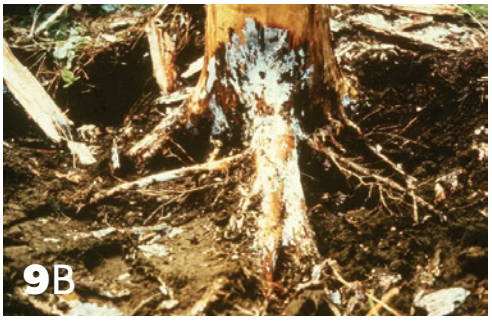
5F Small pines whether in the landscape or nursery are affected by PRCW and other weevils. See close up of damage (Inset).

5G Weevils are readily identified by their prominent snout. Photo credit: Alton N. Sparks, Jr., from Invasive.org.

6 Bark beetles tend to attack trees under stress from other factors. Their damage is characterized by small, pencil lead-sized holes. They also kick out small chips through these holes.

7A Zimmerman Pine Moth (ZPM) tends to attack pines at the branch whorls. Austrian pine is particularly attractive to this pest. Note globs of pitch exudates from this branch whorl.

7B Attack from ZPM may be so severe that the tops of trees may break off.



Pitch Mass Borer: Although Pitch Mass Borer (PMB) is often identified in association with spruce trees, it is also known to attack some pines, especially Eastern white pine (Photo 8). Because ZPM and PMB are both in the Lepidoptera family, standard beetle (Coleoptera) treatments with insecticides such as Imidacloprid will not be effective. Properly timed sprays with insecticides that control "Leps" will be necessary, generally during the egg laying stages of the insect life cycle. Some arborists have reported good control with trunk injections.

Root Rots: A variety of root rotting organisms attack pines. One of the most common is *Armillaria* root rot (Photo 9A). *Armillaria* species may possess a broad host range and attack a variety of conifers and deciduous trees. *Armillaria* is distinguished from other root diseases and problems by the presence of white mycelial (fungal body) mats beneath the bark (Photo 9B). Rhizomorphs ("fungal roots") are also often present beneath the bark and/or embedded in the white fungal mat (Photo 9C). Annosus (*Fomes*) and other root rot organisms may also attack pines, but may be somewhat more difficult to diagnose.

Cultural and Environmental Factors: Pines in urban landscapes are frequently affected by some of the common cultural and environmental problems (Photo 10). Over-watering, over-fertilization, soil compaction, soil disturbance, "fill dirt", herbicide toxicity, ice damage and a host of other issues may contribute to pine decline. It is not uncommon for some urban factors to predispose pine to attack by the various pests and diseases.

Management of Pine Decline:

Occasionally, one or two issues may be the primary factors causing debilitating health of pines in a particular landscape. Often however, several factors may contribute to Pine Decline. Obviously, accurate diagnosis of the problem(s) is the essential first step to managing the declining health of pine trees. It is important to consider all factors involved. For example, the Eastern White Pine in Photo

2 had outgrown its wire basket, in which the tree had been planted approximately 20+ years ago. The stress attracted the PRCW which caused further restriction of the vascular system in the root collar region. Bark beetles subsequently began attacking the severely stressed tree and have helped to finish off the tree in their natural ecological progression. The presence of bark beetles will usually be the first evidence the public or professional will witness; hence, bark beetles are often blamed for the decline/death of pine trees when other factors are likely the primary culprit(s). The presence of bark beetles often indicates other problems such as PRCW, root rot, compaction or excesses or deficiencies of water and nutrients. When attempting to treat for pests and diseases with pesticides, it is vitally important to identify the causal agent before any pesticides are applied. Furthermore, to obtain the most efficacious treatment, it is important to mitigate as much as possible any of the cultural and environmental issues. Once the problem or contributing issues are identified, inputs to correct the decline are fairly straightforward.

Please feel free to contact the author if assistance is needed in addressing pine decline in your area.

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8 Although Pitch Mass Borer is usually known to attack spruce trees, it is also capable of attacking Eastern white pine. Note sap flowing down the trunk of this white pine.

9A *Armillaria* species are capable of attacking a broad host range of trees. The entire disease cycle of *Armillaria* is summarized in this picture. The spruce tree on the left has been killed. The fungus has migrated along the root system to the spruce on the right where it has produced its reproductive structure known as "the honey mushroom". Yes, these mushrooms are edible if you feel like some sort of revenge!

9B Very diagnostic for *Armillaria* is a white fungal mat with the appearance of latex paint beneath the bark at the soil line of infected trees.

9C *Armillaria* is also known to produce "rhizomorphs" which are analogous to fungal roots. These rhizomorphs are often found beneath the bark of diseased trees, sometimes in conjunction with the white fungal mat. These are magnified somewhat in this photo.

10 It is not uncommon for stabilizing (guy) wires to be left in landscape trees….after companies that installed the trees are no longer retained for maintenance. This wire restriction may not only attract a host of pests and diseases, but may be mistaken for maladies such as Zimmerman Pine Moth or Pitch Mass Borer.