Spruce Declining Rapidly Around Michigan

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Last fall we were asked to take some time to visit a tree farm in central Michigan and take a look at their blue spruce planting which was experiencing what we thought at the time was a unique problem. We were told the trees had been diagnosed with Phomopsis canker and the owner wanted to know where the disease came from, why it was so severe on his trees, and what he could do about it.

Fig 1: Spruce with die back around skirt.

Fig 2: White spruce with dead branches from bottom to top.

After a trip to the tree farm, we saw at first what appeared to be extremely healthy spruce trees with some die back around the skirt of the trees rising up two or three whirls of branches in some cases (Figure 1). He had already culled many trees. It certainly could have been caused by Phomopsis canker based on the symptoms, and since the MSU Diagnostic Laboratory had already nailed down the pathogen we began to focus on the three major questions confronting the grower: Where did it come from? Why is it so severe? And, what can be done?

A lot has transpired between that fall day last year and this past summer. More calls came in regarding this problem at other tree farms as well as in the landscape (Figure 2). Was it becoming more widespread? While we still don't know why Phomopsis canker started infecting trees around the state, we have now confirmed that Phomopsis canker is wide spread on all ages and species of spruce trees in Michigan and is causing major dieback and even death to landscape spruce trees. But it isn't only cankers caused by Phomopsis causing branch death and needle loss, although *Phomopsis* appears at this point the most frequent cause. We are finding cankers initiated by other common fungal pathogens.

We are beginning to think that we are going to need a program or playbill in order to tell all of the players and cast of characters apart. We now know that *Phomopsis* is probably the star of the show, but we also know that *Cytospora* and *Diplodia* (formerly *Sphaeropsis*) can be found on dead and dying spruce branches around the state. We also know that two needlecasting problems, one caused by

Fig 3: Spruce showing symptoms of decline.

Fig 4: Typical Phomopsis symptoms on spruce.

Rhizosphaera and the newly invasive fungus that grows on the needles called *Stigmina* are also involved. We also know that, again like any good story or play, the characters are not who they first seem to be. Thanks to DNA analysis, we have found that the new fungus we have been calling *Stigmina* for the past several years is probably another species and is more closely related to the species of fungi causing brown spot needlecast of Scotch pine or Swiss needlecast of Douglas fir. We are also wondering if *Phomopsis* itself is the same *Phomopsis* we have seen before, or if it has changed and become more aggressive.

Just as we were making some progress on this dieback disease of spruce, a news article began circulating through various media sources suggesting a link between spruce dieback and the use of a new DuPont herbicide Imprelis®. How are landowners going to separate this widespread Phomopsis canker problem from this reported herbicide injury? We were afraid this new herbicide injury would overshadow the more widespread serious decline of spruce occurring throughout Michigan. Therefore, we began a series of articles on on the MSU Extension news website.

Today we are witnessing the branches of spruce trees – Colorado blue, Englemann, white (inlcuidng Black Hills), and Norway – drop needles and die (Figure 3). Is this due to just one of these pathogens, the interaction of all of these fungi, or the interaction of more than one pathogen or fungal infection? *Phomopsis* normally requires stress events for infection, but now we are finding it all trees throughout the state even in what one might consider good sites. Could the stress be brought on by weather, the amount of inoculum (spores), or other diseases?

Thanks to MSU Project GREEEN funds (Generating Research and Extension to meet Economic and Environmental Needs) received this year, we now know that many of the dying branches are infected with *Phomopsis*. However, *Phomopsis* is normally a stress pathogen causing light, moderate or sometimes severe infection depending on weather, planting density, age of tree (worse on young trees in nurseries), and overall health of the tree. Why are we finding so much *Phomopsis* and on trees of all ages including older landscape trees? Could it be due to additional stresses caused by the new spruce infecting fungi, such as the occurrence of *Stigmina*, which has not officially been proven to be a pathogen on spruce, yet? Or can it be blamed on the weather? We know there has been too much rain in the spring and often times too dry or too wet in the summer. Could it be there are just too many spruce trees in the landscape and it is building up inoculm like a monoculture tree farm?

One thing is certain: It is getting worse and it can be found throughout the state. There are still plenty of healthy spruce trees, but mixed among them are spruce trees declining in front of us. Using Project GREEEN funds, we have developed DNA

Fig 5: Symptoms can be found progressing toward the crown of the tree.

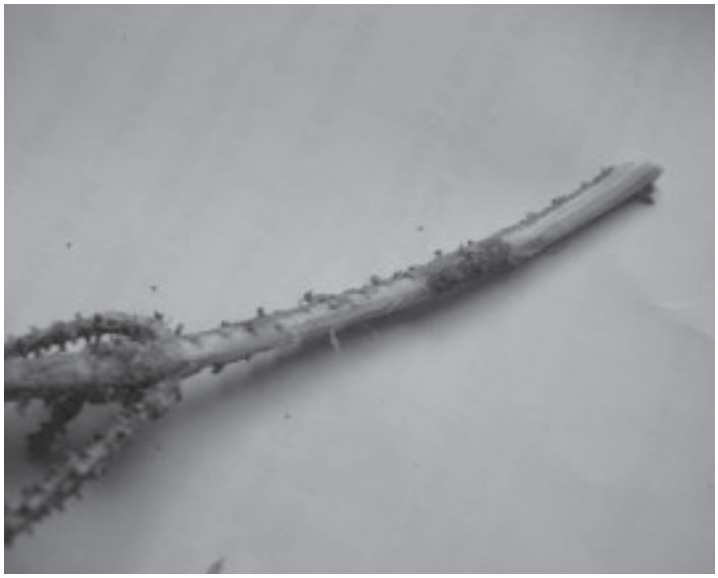

Fig 6: Canker on small branch needs to be taken back to the laboratory to determine which pathogen is causing the infection. It could be Phomopsis, Cytospora or Diplodia. Until cultured it is difficult to say and it could be anyone of these. So far, the odds are that it is Phomoposis. The infection is already killing the branch.

markers to detect the fungi, find which pathogens are present and which pathogens are required for symptom expression and tree death. We will begin management studies once we know what pathogens need to be managed.

Symptoms generally start in *Phomopsis* fashion, at the bottom of the tree, killing current year growth. The dead branch tips turn downward (Figure 4). These branches will die. What appears to be unusual, and gives us thoughts that other pathogens may be involved is that only needlecasting can take place on other branches and the last tissue of the branch to die is the terminal bud. The symptoms appear to follow a needlecast-like progression being found where moisture stays the longest on the tree including the base of the tree where branching is thickest and rain and dew remain the longest. Other locations for infection include the north side of the trees, for the same reasoning as above. In that sense, it appears that spores requiring free moisture for infection and disease expression. But it does not stop there.

Perhaps the most surprising situation is that the symptoms (dead branches) continue to progress toward the top of the tree (Figure 5). Generally, the crown is the area where needles and branches dry the fastest and therefore, much less disease is found near the crown. However, we have been able to find *Phomopsis* from the lower branches to the top of the tree. We have also been able to find *Diplodia* and *Cytospora* infections, too (Figure 6). At this point, we cannot walk up to a tree with branch death and determine by observation, which pathogen is present—we must take samples back to the lab. This makes it troublesome for treatment as both *Phomopsis* and *Diplodia* can normally be managed by chemical application, but *Cytospora* has recalcitrant to chemical application. This is not saying that this new decline is manageable at all.

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At this early stage only time will tell. There is only one thing we can say with some certainty—there are going to be a lot of disappointed people when they see their spruce trees next year.