Ministry of Agriculture and Food

X-disease (Western X)

September 2024

Introduction

X-disease, also called Western X, is caused by a phytoplasma and has become increasingly problematic in cherries and other stone fruit in the Pacific Northwest. It has been detected throughout North America for decades but is suspected to be increasing due to changing pathogen strains, presence of vectors and tree stressors. To date, there have been several cases of X-disease in the Pacific Northwest, including interior British Columbia (B.C.).

Causal Agent

X-disease is caused by the phytoplasma '*Candidatus* Phytoplasma pruni'. Phytoplasmas are single celled organisms that are closely related to bacteria but have no cell wall. There are 5 major strains of '*Ca*. P. pruni' in the Pacific Northwest. These strains cause primarily fruit symptoms which makes it challenging to identify diseased trees before or after harvest.

Figure 1. X-disease on sweet cherry cv. 'Sweetheart' (photo credit: BCMAF)

Symptoms

On cherries, the symptoms of X-disease are similar to Little Cherry Disease, caused by Little cherry virus 2. The X-disease phytoplasma is often considered to be one of the pathogens responsible for Little Cherry Disease. X-disease infected cherry fruits are small and misshapen, pale in colour (Figures 1 & 2) and taste bitter. X-diseased cherries will taste bitter whereas cherries with Little cherry virus 2 infection will taste of little flavour.

Figure 2. X-disease on sweet cherry cv. 'Cristalina' (photo credit: BCMAF)

On peaches, nectarines and plums, leaves will look yellow and curled with shot holes (Figure 3). Fruit will be small and deformed and may drop prematurely.

On all stone fruit, the symptoms will get increasingly worse year by year. In the first stages of infection (1-2 years), the symptoms may be restricted to one branch. In the following years, symptoms may be more pronounced, affecting multiple limbs and the tree may start to show dieback. Symptom progression may be cultivar dependent.

Figure 3. X-disease on nectarine (photo credit: T. DuPont, WSU Extension)

Host Range

The X-disease phytoplasma can infect most *Prunus* species including cherry, peach, nectarine, plums, apricots, choke cherry and ornamental cherry (Harper et al., 2023). It has also been recently documented in a survey in Washington State, U.S.A. that 52 of the 77 weed species tested were positive for the same phytoplasma, all of which are commonly found in orchards. These include broad leaved species including dandelion, lambsquarters, wild carrot, and plantain.

Transmission

Grafting: '*Candidatus* Phytoplasma pruni' is easily transmitted by all types of grafting including root grafting between neighbouring trees and propagation of infected material.

Vector: Leafhoppers are the only known vectors of '*Ca*. P. pruni'. In Washington State, seven leafhopper species *Colladonus reductus*, *C. germinatus*, *C. montanus*, *Euscelidius variegatus*, *Fiebriella florii*, *Scaphytopius acutus* and *Paraphlepsius irroratus* are known to transmit the X-disease phytoplasma with the most common vectors being *C. reductus*, *C. germinatus* and *E. variegatus*. The B.C. Ministry of Agriculture and Food (BCMAF) identified *C. reductus*, *C. germinatus*, *E. variegatus*, *F. florii* and *Scaphytopius* sp. in surveys conducted in the Okanagan, Similkameen and Creston valleys from 2021 to 2023. From work done at Washington State

University, the leafhoppers transmit the phytoplasma in various levels depending on the species, number of leafhoppers and trees infected in an orchard.

X-Phytoplasma Life Cycle

The phytoplasma survives and replicates in the phloem of the tree. Phytoplasmas can only reproduce and survive in the phloem of their host plants and, for a short time, in their insect vectors. '*Candidatus* Phytoplasma pruni' is present in varying concentrations throughout the tree and overwinters in the tree roots. In the spring, the pathogen moves up through the phloem and re-infects various parts of the tree. Recent research from Washington State University has shown that the phytoplasma titer is higher in the lower limbs in older, wood tissue (Wright et al., 2022).

Vector Life Cycle

Leafhoppers can be found in orchards from June to October. They may overwinter as adults, nymphs, or eggs depending on the species. There may be multiple generations per year. *Colladonus reductus* may have three generations with peak adult numbers occurring in June, August and September/October (after harvest).

Vector Identification

It is important to identify the vector species before applying controls because of the presence of other leafhopper species in orchards. Leafhopper vectors are small, about 3 - 5mm in length. *Colladonus reductus* is black or brown with a bright yellow stripe across the shoulder (Figure 4a), *C. germinatus* is yellowish brown and has a smiley face or what appears to be a face with a pirate hat, sunglasses, and handlebar mustache on the back (Figure 4b), and *Euscelidius variegatus* is light brown to black with black spots and white veins (Figure 4c).

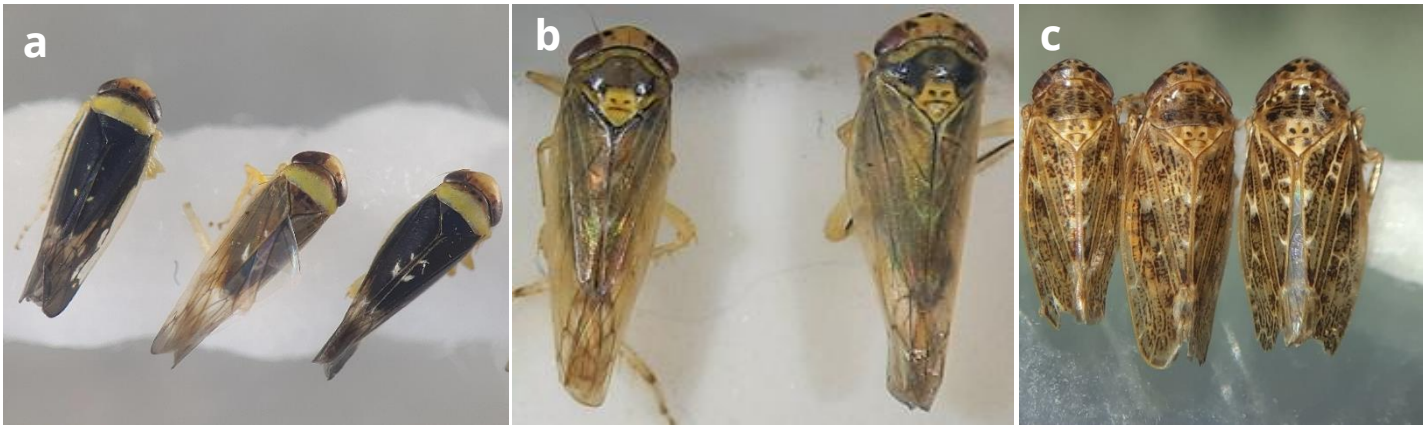

Figure 4. Leafhopper vectors of 'Ca. P. pruni' a) Colladonus reductus, b) Colladonus germinatus, c) Euscelidius variegatus (photo credit: BCMAF)

Distribution

The pathogen has been reported across North America but has been mostly reported in the last decade in Washington State. In B.C., X-disease was first confirmed in 2022 in Cawston and has since been detected in Kelowna in 2023 and Osoyoos in 2024.

Management

1. **Plant pathogen free material**: Trees may not show symptoms of disease when they are purchased, therefore use certified stock and if in doubt, get plant material tested. Nurseries should test the mother plant material prior to propagation and follow up with customers as symptoms can be delayed (latent).
2. **Remove infected trees**: Due to the presence of vectors in orchards, infected trees will serve as an inoculum source and spread the disease to healthy trees. If suspicious trees are seen, get them tested at an accredited diagnostic laboratory. When confirmed, remove the tree and others with the same symptoms in the block as soon as possible.
    a. Ensure that there is no living tissue left from infected trees in the orchard as the pathogen can be harboured in the tree roots. Best management is to treat the stump with systemic herbicide (glyphosate) immediately (within 5 minutes) after cutting. Full tree removal by digging up the stump is also an option, and the only option for organic growers as there is no organic herbicide registered for this use.
3. **Monitor Leafhoppers:** Use yellow sticky traps or sweep nets to monitor leafhoppers. Hang traps 2 to 4 feet (60 to 120 cm) from the ground. Use 1 trap/two acres and check traps every 1 to 2 weeks. Identify X-disease vectors and use a threshold of 1 leafhopper/trap for management. Monitor after harvest because leafhopper numbers are usually higher after harvest.
4. **Control leafhoppers**: Control leafhoppers after harvest. There are currently no registered insecticides for the control of X-disease leafhopper vectors in stone fruits in Canada. Post-harvest sprays applied for other insect pests may provide some control.
5. **Remove alternative hosts**: Grassy plants seem to be a non-host for the pathogen and leafhoppers. Many broadleaf weeds have been shown to be infected by '*Ca*. P. pruni', therefore controlling these weeds on the orchard floor can help reduce the pathogen inoculum.

How to Sample

What: Submit four five-inch (13 cm) cuttings from the diseased limb(s) including leaves, and fruit stems (Figure 5). Woody material should be from the previous season or older as current season growth can have variable pathogen concentrations. Remove fruit from the sample but

leave the fruit stems. Fruit often becomes secondarily infected with fungi and can contaminate the sample.

Where: When trees have symptoms, sample from symptomatic limbs. If trees have no symptoms, sample from each leader.

When: The week before harvest to mid-August. The phytoplasma moves into the roots of the trees as they enter dormancy and makes detection from above ground tissue less likely.

Sample condition: Keep samples moist and cool (package with a cold pack). The pathogen is harder to detect in old and dried samples.

Send samples to the BCMAF Plant Health Laboratory in Abbotsford, B.C. or any other accredited laboratory. Visit the BCMAF Plant Health laboratory's webpage for more information: [Plant Health Laboratory - Province of British Columbia (gov.bc.ca)]

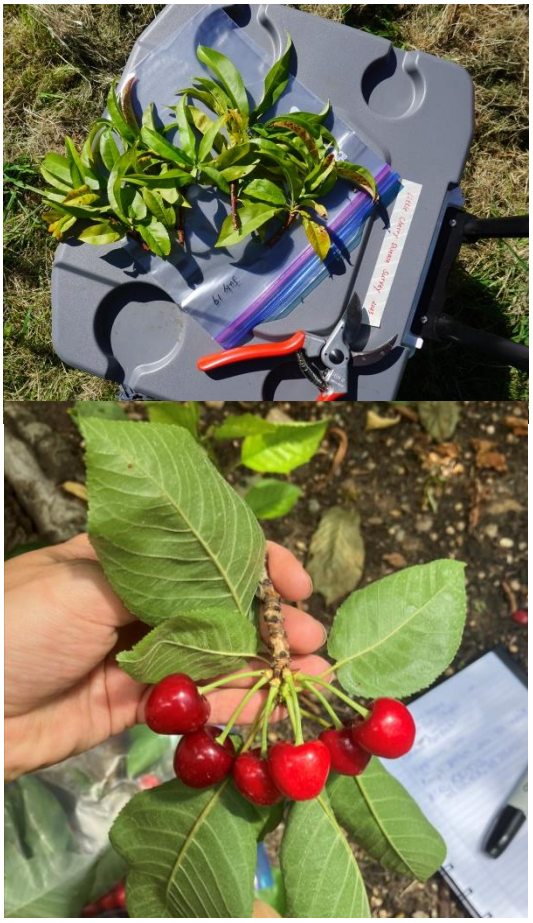

Figure 5. Examples of samples for X-disease lab testing (photo credit: BCMAF).

Summary

X-disease (Western X) is a disease of many stone fruit. If infected trees are not removed, X-disease can spread to the rest of the orchard and beyond. Know the disease symptoms, identify and test suspicious trees and remove them as soon as possible. Control leafhopper vectors when present. Reach out to your local horticulturalist and the BCMAF for more information and guidance.

Additional Resources

1. Washington State University: [X-disease phytoplasma (Western X) | WSU Tree Fruit | Washington State University]
2. Ontario Crop IPM: [Ontario Crop IPM - Peaches and nectarines (gov.on.ca)]
3. B.C. Tree Fruit Production Guide: [Pests | BC Tree Fruit Production Guide (bctfpg.ca)]

References

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3. Wright, A.A., Shires, M.K., Molnar, C., Bishop, G., Johnson, A., Frias, C., and Harper, S.J. (2022). Titer and distribution of '*Candidatus* Phytoplasma pruni' in *Prunus avium*. Phytopathology 112: 1406-1412.

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