The NZ Farm Pole Nursery Guide

Part 4 – Disease and Pests

Acknowledgments: Plant and Food Research Ltd and Colin Stace (HBRC)

THE NEW ZEALAND
POPLAR & WILLOW RESEARCH TRUST

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1. Diseases

The diseases identified below affect a wide range of poplar and willow species and hybrids. Unless the particular clone is exposed to the disease organism during the selection process, its relative resistance cannot be assured. Melampsora leaf rust fungus is probably the only disease organism that new hybrid seedlings are sure to be exposed to during selection.

Some diseases spread rapidly, in which case a canopy approach to control is warranted (e.g. rust management) or they may spread less rapidly, and the diseased sections of individual plants can be removed before widespread contamination (e.g. bacterial blast). Similarly, symptoms of some diseases are more evident and so control can be managed more effectively. Environmental stresses can add to plant susceptibility to disease organisms, and these vary from season to season.

Nurseries are vulnerable to rapid spread of disease so good nursery management requires both careful and frequent observation, cleanliness in operation and removal of diseased material, and routine spray application against prevalent disease organisms, e.g. Melampsora leaf rust.

1.1 Silverleaf

Silverleaf disease is caused by the fungus Chondrostereum purpureum. Unfortunately, poplars and willows are ready hosts of silver leaf fungus. While it more typically grows and feeds on dead wood, the silver leaf fungus does colonise live wood and so becomes parasitic and disease-causing. The fruiting bodies of the fungus produce spores that are carried by wind or splashed by rain and infect trees through wounds, mainly caused by pruning, but also insect wounds (e.g. cicadas) or natural openings.

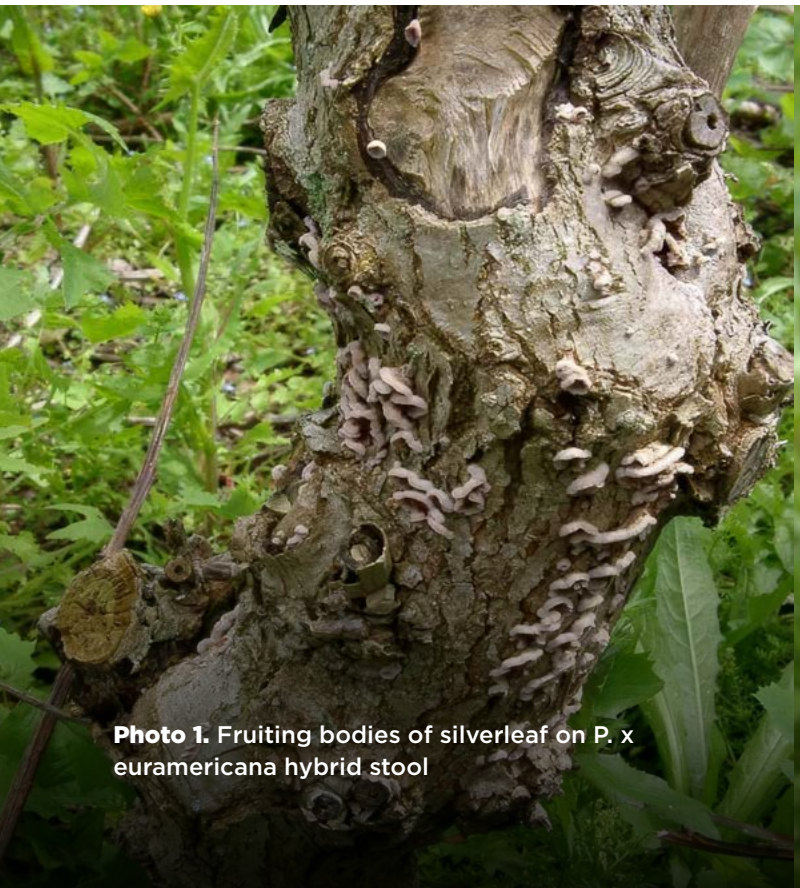

Photo 1. Fruiting bodies of silverleaf on P. x euramericana hybrid stool

Photo 2. Fruiting bodies emerging in an infected stem of a P. x euramericana hybrid

Most of the infectious spores are produced in autumn and winter, so are present when harvesting poles. This is the most susceptible time for the fungus to colonise stools in the nursery. Spores germinate on the freshly exposed sapwood. The disease is progressive and often fatal. Infected stools should be removed.

Once infected, the characteristic symptom of silver leaf disease is a silvery sheen on the foliage. This is often not apparent on stools in the nursery since lower branches are pruned off and the growth phase is rapid. The usual signs are seen in fruiting bodies emerging from the stool (Photo1). Unfortunately stools may be infected without the fruiting bodies being visible, so poles may be infected with the first indication being the appearance of fruiting bodies in dead or sick poles in the field (Photo 2). This will be detected through field auditing of pole survival. Symptoms may appear on the whole tree or only part of the tree depending on where the spores entered. Once the branches die, fruiting bodies grow on the dead wood and the cycle starts again. Any visible dieback of branches or shoots should be investigated for silver leaf infection. When branches are cut across, an irregular, dark stain may also be seen in the centre (as seen in Photo 3).

Good nursery hygiene can reduce the number of spores in the nursery, minimising the risk of infection. Dispose of pruning's promptly, and remove and burn infected stools before autumn (including the roots as far as possible) when fruiting bodies can develop and release spores. Spores need moisture to germinate and are generally released during periods of rainfall.

Harvesting cuts on the stool should be angled to the northern sky if possible, to assist quick drying. If silver leaf is a likely problem in the nursery, treating cuts with fungicide will assist control of germinating spores. Pruning cuts should result in a minimum exposure of unprotected wood and cuts should be cleanly made. Secateurs and saws need to be sharp. Avoid damage to the roots of stools as this can become an entry point for spores during wet conditions, and avoid unnecessary winter pruning.

Photo 3. Woodstain typical of silver leaf disease

Photo 4. Stem blackening typical for bacterial blast

1.2 Bacteria Blast

This disease is caused primarily by the bacterium Pseudomonas syringae. It affects both poplars and willows. Cankers form on twigs, branches, and stems of mainly 1- to 2-year-old plants with associated dieback. There is occasional death of whole-plant if cankers form low on the stem. The formation of cankers depends on high moisture levels. Severe outbreaks of the disease may occur when sudden frosts follow a warmer wet period.

Affected plants may suffer shoot and twig dieback with blackened dead foliage (Photos 4 and 5). Sometimes the whole stem is affected, killing the plant, but more often only the top one-third to one-half of the plant, or only lateral branches, are involved. If affected tissues are cut away cleanly, however, resprouting from below the damaged zone usually occurs.

Photo 5. Terminal and side shoot dieback of a P. Deltoides variety infected with bacterial blast

Photo 6. Bud and stem necrosis on a 1-year-old shoot of a P. deltoides x ciliata seedling after infection by P. syringae

Best management practice for nursery cultivation includes use of resistant clones and wider spacing (single rows) in stool beds. Using clonal mixtures and maintaining vigorous growth are not effective, since the pathogen is not host-specific and is favoured by high humidity.

Control of the disease involves cutting out and burning any infected material to remove the inoculum load. Copper-based sprays have been used to reduce bacterial populations, but with limited success. Antibiotic sprays can also be used to control infections of P. syringae.

1.3 Yellow Leaf Blister

This disease is caused by the fungus Taphrina populina. It is an obligate parasite of living tissue, and does not kill the plant tissues it infects. To reproduce, it requires a temperature of not more than 15–20°C and high atmospheric humidity, thus its attacks mainly occur in the spring. It is of concern in the nursery because it can take advantage of the density of juvenile stems and the microclimate this creates. The fungus overwinters both inside the preformed leaflets of poplar buds in a mycelial state, and outside them as sticky blastospores with a thickened cell wall. It is more common on Poplus nigra and its hybrids.

Infection results in the appearance of blisters on the leaf, concave towards the abaxial (under) side, isolated at first, then confluent, up to 3 cm in diameter. The leaf adaxial (top) side remains green for a long time(Photo 9), whereas the areas of the abaxial side corresponding to the concavities, derived from deformations of the mesophyll connected with hormonal disorders, turn bright yellow and then orange (Photos 6 & 7). This colour change is consequent to the reproduction stage of the parasite. At a late stage of the disease, large portions of the leaf necrotise and dry out, and holes are formed at the blisters.

Generally this disease has little effect on plant growth and is not of economic significance.

Photo 7. Early stage Yellow leaf blister

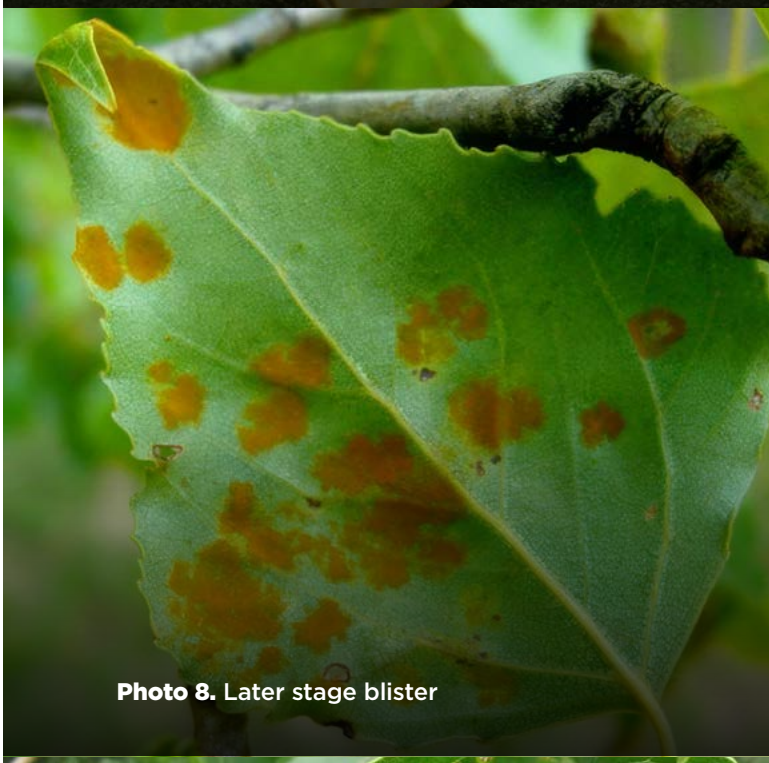

Photo 8. Later stage blister

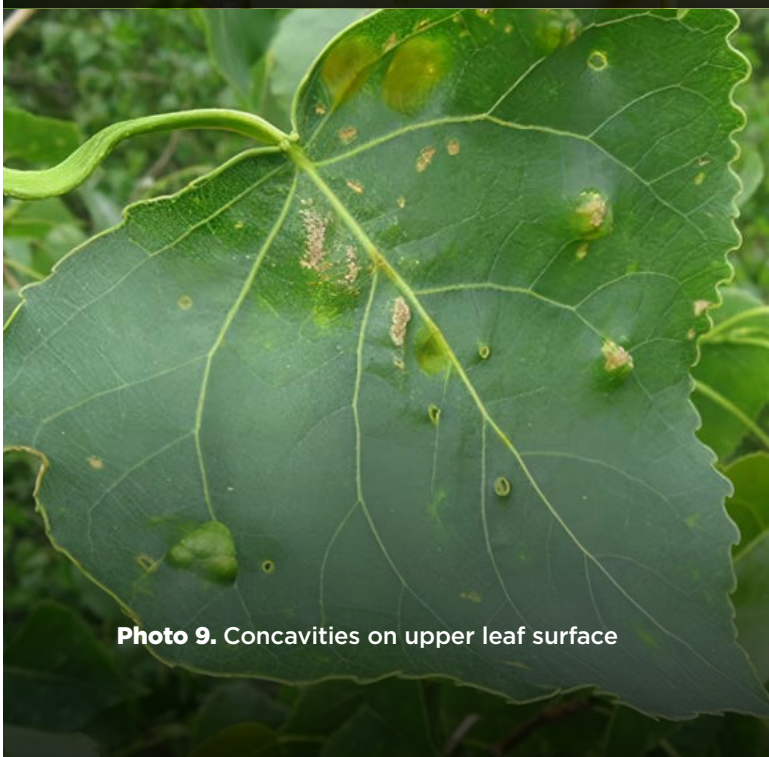

Photo 9. Concavities on upper leaf surface

1.4 Melampsora Leaf Rust

Leaf rust is the most widespread and serious disease of poplars and willows throughout the world. Species of Melampsora are specialised on either poplar or willow. Identification of species on the basis of urediniospore morphology alone is often difficult. Two willow rusts, M. epitea and M. coleosporioides are known in New Zealand. M. laricipopulina is the predominant poplar rust, with M. medusae also present.

Leaf rust can result in early leaf fall and significantly reduces tree health and growth, particularly with young trees in the highly humid environment of the nursery. Note that if Melampsora rust causes early defoliation, cuttings taken from plants in this weakened physiological state are more vulnerable to disease and high levels of mortality.

Uredinia commonly develop on the underside of leaves (Photo 10 & 12), giving rise to yellow or orange spots in late spring and throughout summer. The yellow / orange spots are ripe spores (Photo 11), are carried up the tree by wind in the nursery, so the disease moves up the tree as it grows. The spots emerge at the completion of the disease life cycle, and effective control needs to start before this stage.

Leaf rust is best treated with a regular spray programme through the growing season starting in early- to mid-November. Drip irrigation is preferable to overhead irrigation in that it generates less humid conditions for spore germination. There are no biocontrol agents in New Zealand that attack poplar or willow leaf rust.

Photo 10. Underside of a P. x euramericana leaf spotted with Melampsora laricipopulina rust uredinia

Photo 11. close-up of the individual spots, which are each a multitude of infective spores

Photo 12. Underside. of rust-infected willow leaf compared with an uninfected leaf.

1.5 Leaf Spot or Anthracnose Fungus

Leaf spot (Marssonina brunnea) ,also called leaf blight, is another fungal disease present in New Zealand. Nursery environments, with their close planting, high humidity and potentially high residual spore presence, are more vulnerable than open planted sites. While the breeding programme selects for disease resistance, it is not always possible to provide exposure so evaluate resistance to Marssonina brunnea. The fungi overwinter on fallen leaves and diseased shoots. A heavy infestation results in early leaf fall. Susceptibility of most New Zealand poplar clones is low.

Signs on poplar include small, round spots on leaves (Photo 13 & 14), premature defoliation and dieback, and black sections on leaf petioles and soft stems (Photo 15). Leaf spot will be managed at the same time as the application of treatment for melampsora leaf rust.

Photo 13. Poplar anthracnose leaf spot fungus on P. x euramericana leaf

Photo 14. Lesions on leaf underside & mid rib

Photo 15. Lesions on petioles

1.6 Leucostoma Canker

This is also known as Cytospora chrysosperma. It is an opportunistic pathogen, and enters through pruning wounds or accidental injury. Infection is associated with plant stress. Spores have exited the tree with ooze at numerous places (Photo 16).

Photo 16. Orange fruiting bodies of leucostoma canker on a dead 'Mapiu' pole in the field.

Photo 17. Septoria leaf spots on poplar leaf (Feau et al 20101)

Reports of its occurrence in dead first-year poles in the field are suggestive (though not evidence) of a nursery source. Nursery staff should be vigilant for possible sources of infection in the nursery, such as damaged and infected shelterbelt trees.

1.7 Septoria musiva

This leaf spot and canker causing disease is not widespread but is appearing more frequently in poplar and willow nurseries, possibly assisted by overhead irrigation. Spores overwinter on infected fallen leaves and symptoms include spots of dead leaf tissue, giving a blotchy appearance. Removal of low growth on the stool that might catch water splash reduces the chances of spores reaching new season's foliage from the ground. S. musiva can be controlled by copper oxychloride and other fungicide sprays applied for rust.

[1] *Feau N, Maire-Josse M, Hamlin R, Perinet P & Bernier, L. 2010 Recent advances related to poplar leaf spot and canker caused by Septoria musiva. Canadian Journal of Plant Pathology 32(2):122-134*

2. Pests

2.1 Giant Willow Aphid (GWA)

GWA is a very large aphid with a body length up to 5-6 mm. Willows are its only recognised host plant. Wingless individuals are mid-brown to dark brown with several rows of black 'skin patches'. The antennae are less than half the body length. Winged individuals (alates) have the forewing membrane unpigmented, but the wing markings and costal margin are dark brown.

This aphid feeds on larger stems (≥ 8 mm diameter) and colonies are a mix of ages and sizes. Waving a hand over an aphid colony prompts a collective lifting of the hind legs. Physical disturbance will quickly disperse the colony up and down the stem. Rubbing against an aphid colony releases a red body stain.

Adults give birth to miniature adults called nymphs. Each adult alate (winged adult, Photo 18) is reported to produce 34.3 nymphs on average. Maturation time for nymphs is 12-17 days. Both adult forms continue to survive post-breeding. Reproduction is parthenogenic and no males are known for this species. Their overwintering sites have yet to be determined. Some individuals overwintered on willow stems, although this behaviour is not typical.

Giant Willow Aphid colonises both tree and shrub willows. Colonies prefer stems 1-2 cm in diameter. The aphid has an adverse impact on the growth of the host trees and should be considered as a potential pest species in the context of willow as a production crop. Responses measured in the willow plant are both quantitative and qualitative, including

- increase in photosynthetic rate
- increase in leaf N
- increase in tree water use
- reduction in shoot and root biomass
- reduction in growth in the following year.

Photo 18. GWA winged adult

Photo 19. GWA overwintering on willow stem (photo Kevin Cash)

Photo 20. Favoured colony site in branch whorl

Photo 21. Ladybird predating GWA (photo Wayne Teal)

Giant Willow Aphid taps into the sugar flow in the willow stem and the pressure of sap through the aphid produces the honey dew. Wasps and ant trails up willow stems are likely indicators of aphid infestation, as are sticky wet patches under willow trees. Colonies are found on the trunks and larger stems, and the axil of /branches (Photos 19 & 20).

Chemical control using insecticides such as Mavrick (a.i. 240 g/L tau-fluvalinate) is successful and reliable. Natural predators include the parasitic wasp, Pauesia, and ladybirds (Photo 21), the harlequin ladybird in particular.

2.2 Willow Sawfly

Two types of sawfly attack willows in New Zealand. Pontania proxima typically forms reddish galls on the foliage of particular species of tree willows in mid-summer, but has a limited effect on tree health/ vigour.

Nematus oligospilus eats foliage (Photo 22) and where rapid expansions of this insect population occur in mid- summer, significant defoliation of established trees can result. Naturalised species such as the crack willow and the Golden Willow are severely affected. This insect arrived in NZ in the late 1990's and laboratory tests at that time indicated that most tree willows are generally palatable to this insect, while shrub willows showed varying degrees of resistance.

2.3 Other Insect Pests

Foliage of willows is sometimes damaged by Eucolapsis brunnea (bronze beetle) chewing the leaves causing a 'shothole' effect. The brown beetle Costelytra zelandica (grass grub beetle) damages the leaves by chewing from the edge into the mid-vein, often leaving the midrib only. Damage is generally sporadic and short-lived, and control methods such as insecticide spraying are generally not required.

The Hairy Poplar Sawfly (Cladius grandis) is a new arrival in New Zealand, and is so far confined to Otago. Overseas C. grandis has been described as an 'outbreak' pest where damage is usually low, but population densities can occasionally build to very high levels, causing severe defoliation (Photo 23) and even killing trees. Some varieties of poplar are more susceptible to infestation and damage than others, and these include Populus nigra, Populus deltoides, and their various hybrids which are commonly grown in New Zealand. Potential spread of this insect is currently subject to a monitoring programme (refer https://www.mpi.govt.nz/dmsdocument/40070/direct).

Photo 22. N. *oligospilus* larvae

Photo 23. C. *grandis* early stage larvae gregarious (group) feeding behaviour

More Information:

NZ Farm Pole Nursery Guide
Part 1 – Planning

NZ Farm Pole Nursery Guide
Part 2 – Management

NZ Farm Pole Nursery Guide
Part 3 – Annual Work Plan

Who We Work With...

Northland Regional Council – Te Kaunihera ā rohe o Te Taitokerau
Waikato Regional Council – Te Kaunihera ā Rohe o Waikato
horizons Regional Council
Environment Canterbury Regional Council – Kaunihera Taiao ki Waitaha
Bay of Plenty Regional Council Toi Moana
Greater Wellington – Te Pane Matua Taiao
Hawke's Bay Regional Council – Te Kaunihera ā-rohe o te Matau-a-Māui
Taranaki Regional Council
Te Kaunihera o Te Tairāwhiti Gisborne District Council
tasman district council – Te Kaunihera o te tai o Aorere
environment Southland – Te Taiao Tonga

Sally Lee
General Manager

Phone: 0274-924 751
Email: info@poplarandwillow.org.nz

Full information is available on our website
www.poplarandwillow.org.nz

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