Yellow Laminated Butt Rot

Yukon Forest Health — Forest insect and disease

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Yukon
Energy, Mines and Resources
Forest Management Branch

Introduction

Yellow laminated butt rot is a fungal pathogen affecting poplars (*Pholiota populnea*). Damage has not been mapped in Yukon but it is assumed to be present throughout the range of black cottonwood (*Populus tricocarpa*) and balsam poplar (*Populus balsamifera*). Though not a recognized pathogen of trembling aspen (*Populus tremuloides*), it has recently been found in that species at Haines Junction. The disease is generally more prevalent in riparian and wet areas. The fungus colonizes living trees and in British Columbia it has been known to cause substantial volume loss. Currently, little information is available about the disease.

Host Range for Yellow Laminated Butt Rot

(Source data: Yukon Government Forest Inventory Data [2008] and U.S. Geological Survey [1999] Digital representation of "Atlas of United States Trees" by Elbert L. Little, Jr. (http://esp.cr.usgs.gov/data/little/)
Disclaimer: The data set for historic incidence is likely incomplete and only extends from 1994–2008. Endemic or outbreak populations may have occurred or may currently exist in non-mapped locations within the host range.

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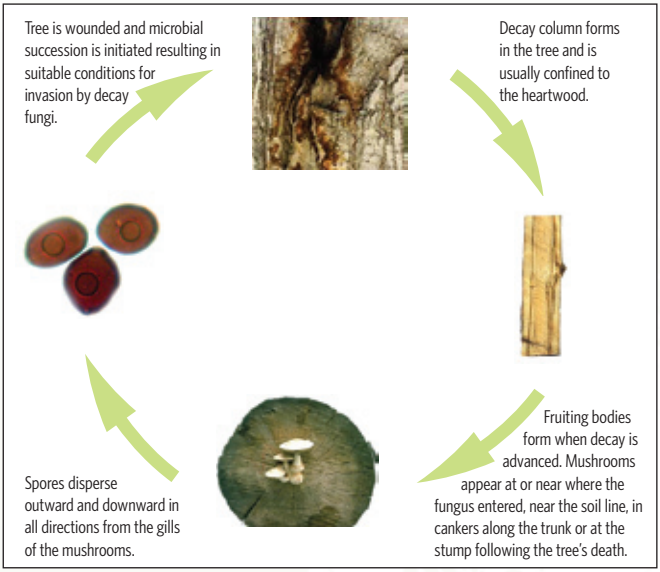
Disease Cycle



The disease cycle of *Pholiota populnea* is not well known but it is thought to be similar to other hardwood butt rots in the basidiomycota:

1. Tree is wounded and oxidative processes begin to discolour the exposed wood. This discoloured area where oxidative processes occur is referred to as the 'reaction zone.'
2. Pioneer invaders (bacteria and non-decay fungi) invade the wound and feed on the cells in the reaction zone, breaking down parts of the cell walls and causing further discolouration. This process increases the moisture content of the wood and can reduce the wood's resistance to decay fungi. The advance of these organisms causes expansion of the 'reaction zone' away from the original wound.

Definition:

Basidiomycota: *a fungal group known for the production of large fruitbodies such as mushrooms, puffballs, brackets, etc.*

3. The action of pioneer invaders eventually results in a chemically suitable, adequately moist, non-living substrate that can be colonized by the decay fungi. This process is referred to as 'microbial succession.' The decay fungi can then digest cell walls of the wounded tissue and grow inside the wood cells. The decay fungus, following the path prepared by the pioneer invaders, penetrates the sapwood and then continues to the heartwood.
4. The decay column formed by yellow laminated butt rot generally remains confined to the heartwood and the fungi are unable to attack the new growth.
5. On infected trees, the vegetative or decaying stage of the rot fungi gives rise to fruiting bodies. The mushrooms of the butt rot appear at or near where the fungus entered; ie. near the soil line; in cankers; at decayed branch stubs or swollen knots; along the trunk or branch of living trees; or at the stump or along the trunk following the tree's death.
6. Spores are dispersed outward and downward in all directions from the gills of the mushrooms. The spores are windborne and infect exposed tree wounds.

Host Species Attacked and Damage

Tree species attacked in Yukon: Yellow laminated butt rot attacks trembling aspen, black cottonwood and balsam poplar. Decay fungi are typically more prevalent in older, decadent stands or extensively wounded stands (due to abiotic disturbance).

Yellow laminated butt rot of poplars is a white rot, meaning that lignin is digested more rapidly than cellulose. The final colouration of decayed wood is whitish-yellow. Decay is usually confined to the woody tissue present at the time of wounding. Wounds that occur below diameter at breast height are more commonly infected. Depending on the success of the tree's defence mechanisms at compartmentalising the damage, the decay column may be restricted to a few inches in diameter or may include the entire heart wood. Vertically, the decay column may extend a few centimetres or metres from the wound. Volume losses

and growth reduction can occur as a result of infection and the fungus is most damaging in living trees, only remaining active in dead stumps or logs for a few years. Yellow laminated butt rot is recognized as the most damaging pathogen of black cottonwood.

Diseased trees are weakened and susceptible to breakage. Falling trees can strike and damage adjacent trees, creating new wounds that may facilitate infection. Generally, yellow laminated butt rot results in individual trees breaking over time, rather than causing extensive canopy gaps.

Key features for identification:

Indicators of butt rot include fruiting bodies (mushrooms), old wounds, abnormal swellings or butt bulge, broken boles and forked tops. Trees that are hollow at the base can sometimes be detected by "sounding" the bole with an axe. The mushrooms of the butt rot appear at or near where the fungus entered; ie. near the soil line; in cankers; at decayed branch stubs or swollen knots; along the trunk or branch of living trees; or at the stump or along the trunk following the tree's death. It is common to see fruiting bodies at the cut end of large, infected cottonwood logs.

Yellow laminated butt rot fruiting bodies are relatively large, gilled mushrooms. When fresh, the cap is light brown and covered with white scales. As the mushroom ages, the cap may lose its scales and become sticky. The gills are white when immature, becoming dark brown as spores mature. The stem is fibrous strong, white to light brown, 5–15 cm long, 1–3 cm thick and may be covered with white scales; a white ring or annulus may be present on the mushroom stem just below the cap. The mushrooms are abundant from midsummer to late autumn and occur either singly or in clusters with the oldest mushroom on top **(photo 1)**.

In the early stage the decay appears as buff to dark brown streaks in the heartwood. Later, white patches form giving the wood a faint mottled appearance. In the final stage, the wood becomes uniformly yellow to tan and laminate in texture. Strands of yellow-brown mycelium occur along the grain. If the strands are pulled away from the wood, irregular channels, resembling insect tunnels, remain. Mushrooms on a living tree indicate extensive decay.

Definition:

Bole: *the main stem of a tree.*

Photo number:

1. ***Pholiota populnia* fruiting bodies on cut logs.**
   Citation: Al Funk, Natural Resources Canada, Canadian Forest Service.

Similar damage

Yellow laminated butt rot damage may be confused with other trunk rots affecting Populus species. Fruiting bodies are the most effective indicator to distinguish between decay fungi. The fruiting bodies of *P. populnea* are fleshy gilled mushrooms as opposed to the woody conks produced by other common pathogens. For exact determination of any specific specimen, a key should be used or a sample should be sent to an expert diagnostician.

Risk Assessment

The following tables summarize the likelihood of occurrence and magnitude of impact of an outbreak at the stand level. These tables are a coarse guide for estimating the risk of an outbreak when populations are at endemic levels.

Likelihood of Occurrence

Tree Infection Hazard:	High → Low	
Site moisture[1]	Riparian/wet	Dry
Tree health[2]	Wounded	Non-wounded
Stand health[3]	Stressed/Decadent	Vigorous

Notes:

1. Yellow laminated butt rot prefers stands on wet sites.
2. Wounds are the main source of entry for the disease into new hosts.
3. Older trees are more likely to be infected due to exposure over time.

Magnitude of Consequence

The magnitude of consequence is a subjective assessment of the potential consequences of an outbreak. This list is not exhaustive and is intended to stimulate thought on potential impacts to consider over time.

Value	Impact							
	-							+
Traditional Use[1]								
Comment:	No impact anticipated							
Visual Quality[2]								
Comment:	No impact anticipated							
Timber Productivity[3]								
Comment:	Not applicable							
Wildfire Hazard[4]								
Comment:	No impact anticipated							
Public Safety[5]								
Comment:	Hazard trees (-)							
Hydrology[6]								
Comment:	No impact anticipated							
Time Scale (years)	20+	15	10	0-5	0-5	10	15	20+
Comment:	Impact refers to a predicted, substantial positive (+) or negative (-) impact on a value for an estimated time period							

Notes:

1. In this context, traditional use values considered are hunting, trapping and understory shrub/plant use. Given that this butt rot causes gradual and limited mortality, no impact is anticipated.

2. Given that yellow laminated butt rot causes gradual and limited mortality, no impact is anticipated.
3. There is no commercial harvesting of poplars and aspen in Yukon and timber productivity is not considered applicable.
4. Given that laminated butt rot causes gradual and limited mortality, no impact is anticipated.
5. Yellow laminated butt rot infection is likely to create hazard trees by weakening tree stems and making stems more prone to breakage.
6. Given that yellow laminated butt rot causes gradual and limited mortality, no impact is anticipated.

Implications of Climate Change

General Circulation Model (GCM) results in the 2007 Intergovernmental Panel on Climate Change (IPCC) report indicate that warming in northern Canada is likely to be greatest in winter (up to 10°C) and warmer by 3–5°C in summer. Mean annual precipitation is also predicted to increase (particularly in fall and winter). More rainfall is expected on windward slopes of the mountains in the west, therefore the rain shadow effect of the St. Elias Mountains may mean that southern Yukon does not experience increased rainfall. High temperatures will increase levels of evaporation and transpiration, and ultimately lower soil moisture levels. Therefore, even if summer rainfall is maintained at current average levels, higher temperatures would result in limited soil water availability and cause moisture stress in trees. Currently, climate scenarios suggest that Yukon will experience a warmer climate that will be wetter or drier in the future depending on the region.

The spores of *Pholiota populnea* are windborne; therefore, dispersal is unlikely to be impacted as a direct result of a warmer/wetter or warmer/drier climate. However, spore germination is partially dependent on an adequately moist substrate, therefore a warmer/drier climate could potentially reduce spore germination success. It is also possible that warmer, drier temperatures will increase drought stress in host trees, rendering them less susceptible to butt rot decay fungi. If a warmer/wetter climate occurs in the future, host trees would not generally be moisture stressed but spore germination may be more successful.

Management Options

Monitoring

Yellow laminated butt rot is not readily identified from the air. Due to the limited extent of the current disease levels, this disturbance agent is best monitored with annual ground surveys. The best time of year for monitoring is midsummer to late autumn when fruiting bodies are most likely to be present.

Direct Control

Direct control methods are not suitable for yellow laminated butt rot of poplars. No known biological or chemical control agents exist. Since all infections occur through bark wounds, injury prevention is the most practical approach stopping disease spread. For high value, urban trees that have suffered bark or wood injuries, cut away all loose or discoloured bark; remove splintered wood; clean, shape, and smooth the wound into a streamlined oval or vertical ellipse; then swab the surface liberally with an antiseptic such as 70 percent alcohol or shellac. This may minimize the damage and spread of the disease within the tree.

References

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