Forest Insect and Disease Notes

Northwest Region

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Canada

WHITE ROT OF ASPEN

by
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White rot of aspen is the most serious decay problem of trembling aspen and balsam poplar in western Canada. It is found throughout North America wherever trembling aspen and balsam poplar grows. It is also found in Europe on Aspen poplar (*Populus tremulae* L.).

The decay is caused by the false tinder fungus *Phellinus tremulae* (Bond.) Bond. & Bor. (= *Fomes ignarius* L.:Fries). This fungus can be recognized by the distinctive conks (fruiting bodies) that it produces on the outside stem of the tree. These conks are hard, leathery structures that resemble a horse's hoof. Their upper surface is blackened, the underside is brown or grey. The fungus causes a white spongy rot of the wood. A distinct black line often surrounds the decayed area, (see Hiratsuka *et al.* 1990). Not all trees that have white rot produce conks, but generally those trees with advanced decay will have some conks on the main stem.

White rot is rarely found in poplar less than 40 years old but incidence increases with age (Basham 1993). Aspen clones have unique decay patterns in their stems (Walls 1971); however, Basham (1993) found little genetic resistance in aspen to infection by *P. tremulae.*

The biology of *P. tremulae* is not well understood. Little is known about the epidemiology of the disease. It is thought that spores released from the conks are primarily responsible for spread. Sporulation can occur from April to November and is frequent following rainy periods. It has been assumed that the fungus enters through branch stubs and wounds; however several researchers have been unable to experimentally demonstrate this. Basham (1993) believes that large branch stubs and wounds are the major entry points for the fungus.

Hiratsuka *et al.* 1990 have produced a classification system for defect in aspen wood. White rot is classified as Type A defect. This type of defect results in losses to kraft and chemi-thermomechanical pulping (CTMP), oriented strand board production, and to lumber and other solid wood products. Pulping losses due to white rot result from the loss of fines (very small particles) due to the rot and the subsequent loss of yield, as well as the additional cost to bleach the pulp and the loss in fibre strength.

Basham (1993) suggested three ways of minimizing losses to white rot: avoid wounding of trees, promote faster stem growth so that the desired diameter is reached when the tree is young, and avoid thinning until trees are 15- to 20-years-old; thinned trees develop larger branches and hence larger branch stubs that may be a point of entry for the fungus.

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BIRCH-LEAFMINING SAWFLIES

by
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Distribution and hosts

Three species of birch leafmining sawflies attack birch in the prairie provinces. These are the ambermarked birch leafminer, *Profenusa thomsoni* (Konow), the birch leafminer, *Fenusa pusilla* (Lepeletier), and the late birch leaf edgeminer, *Heterarthrus nemoratus* (Fallen). All three species were accidentally introduced from Europe to North America early this century. These species are now widely distributed in Canada and the northern United States. In the prairie provinces, *P. thomsoni* is the most common species and *F. pusilla* is also abundant; however, *H. nemoratus* is rare. All native and exotic birches are susceptible to damage by at least one species of birch leafminer.

Description and life history

Adults of all three species of birch leafmining sawflies are small, stout, black insects, 3-4 mm long, with a wingspan of 6-7 mm. The adults are difficult to identify without expert assistance. The larvae are whitish, slightly flattened in appearance, and 6-7 mm long when fully grown. Variation in the black marks on the underside of the larvae may be used to discriminate among the three species (see Ives and Wong 1988 for photographs). The life history of only the two common species will be discussed.

The first species to attack birch in the spring is *F. pusilla*, which occurs in newly formed leaves in the exposed crown of the tree. In mid- to late-May, females each lay up to 20 eggs in slits near the midribs on the upper surfaces of young leaves. Larvae hatch from the eggs in early June and feed on the tissue between the leaf surfaces. Mature fifth instar larvae do not feed, but emerge from the leaves in late June to mid-July and drop to the ground where they construct earthen cells (cocoons) beneath the soil surface. The majority of the larvae likely remain in the earthen cells to overwinter, with pupation occurring the following spring. However, a small apparent second generation sometimes occurs, which indicates that some first generation larvae may pupate immediately and emerge about one month later as adults to oviposit. Larvae of this second generation fall to the ground in late August.

Profenusa thomsoni has one generation per year. The parthenogenetic females emerge in July and lay eggs along the veins in the basal and central area of the upper surface of the leaves. There are five feeding larval instars and a sixth non-feeding instar. Sixth instar larvae emerge from leaves in late August and drop to the soil to construct small earthen cells in which they overwinter. Pupation occurs in early summer of the following year.

Symptoms and damage

The first signs of damage become noticeable in early June, when small, light green or gray spots appear on the leaves where eggs were deposited. When eggs hatch and larvae commence feeding, these spots develop into brown blotches that continue to increase in size and eventually merge, covering most of the leaf. Although most of the inner leaf tissue may be destroyed, tree health is not usually affected, since a vigorous tree can withstand many years of light-to-moderate damage. Leafmining damage can stress the birch, however, and that, combined with lack of adequate moisture and attack by other insects or diseases, may cause branch and top dieback. This dieback, combined with leaf browning, reduces aesthetic value of birches in ornamental plantings.

Prevention and control

Healthy trees are better able to withstand attack. Tree health may be maintained by watering the roots in the fall before frost sets in, applying a suitable fertilizer each spring, and watering during dry periods in the summer (birches are shallow-rooted).

Pesticide application is the most common method of leafminer control on ornamental trees. Chemical control in forest stands has not been necessary because of low leafminer population densities and because birch is not an important commercial tree species. Several insecticides are registered for birch leafminers, but systemic insecticides such as Cygon are most commonly used. These may be painted on stems or applied as a soil drench in late May, after leaves are fully opened. Often these pesticides are ineffective because of incorrect application. Pesticide application may be considered undesirable because of unpleasant odour and potential impacts on environmental and human health. There is a need to develop alternative management practices for birch leafminers.

Research

Personnel at the Northern Forestry Centre and the University of Alberta (Dept. of Entomology) are cooperating in a large study of birch leafminer biology and management. The biological research is concentrating on assessing sawfly phenological variation, understanding population structure and dispersal, and assessing impacts of natural enemies. This information will be used to develop strategies for management of birch leafmining sawflies. Research into management of sawflies will concentrate on several novel techniques:

(1) augmentation of native natural enemies, especially predators which may feed on overwintering larvae in the soil.

(2) alteration of substrate beneath birches to decrease survival of overwintering larvae. For example landscape fabric or a sandy substrate may adversely affect larvae.

(3) Inoculation of soil beneath birches with parasitic nematodes that will destroy overwintering larvae.

(4) trapping of adults during flight and oviposition period using sticky traps placed in the tree crown.

(5) introduction of exotic parasitoids into Alberta to increase larval mortality. These parasitoids are native to Europe and cause high mortality among *F. pusilla* larvae there. We will attempt to establish these parasitoids on local populations of *F. pusilla.* Attempts will also be made to locate parasitoids of *P. thomsoni* in Europe and import them to Alberta. We expect that at least some of these strategies will be successful and can be widely applied for management of birch leafmining sawflies in the prairie provinces.

Further reading

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BRUCE SPANWORM

by

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The Bruce spanworm, *Operophtera bruceata* (Hulst), is native to North America. It is distributed throughout Canada from coastal British Columbia to Newfoundland. It has been recovered from New England to the Lake States in the United States of America and has been reported from Greenland. The winter moth, *Operophtera brumata* (Hulst), which was accidentally introduced to the east and west coasts of Canada, is easily confused with the native Bruce spanworm, with which it seems to hybridize.

At least nineteen genera of woody plants have been listed as hosts of the Bruce spanworm. In the prairie provinces the principal host is trembling aspen, but willows, balsam poplar, Manitoba maple, choke cherry, saskatoon, currants and wild roses are also hosts. Although sporadic outbreaks of the Bruce spanworm have occurred in various regions of Canada, large outbreaks have occurred on trembling aspen in western Alberta in 1903 and 1913. More recently, outbreaks have been recorded toward the end of each of the last 4 decades. At its peak, the outbreak in 1958 covered 130 000 km^2 of aspen forest. This outbreak began with a build up of populations in 1951 but had declined by 1960. In general, severe defoliation of aspen forests lasts 2 to 3 years.

The male moth has a light brown body with brown and grey banded semi-transparent wings. The body is 7 - 10 mm long and the wing span is 25 - 30 mm. By contrast, the female is flightless because her wings are reduced to small pads. Her body is covered with dull brown scales. These scales are large, thus the female has a rough appearance.

Eggs are laid individually in bark crevices and in lichens on trees in the fall. They overwinter and hatch in the spring when aspen buds begin to swell. The larvae spin down from the branches and if they do not encounter a suitable feeding site, they may be carried off by the wind. This is the only means of dispersal. Larvae have been recovered 'ballooning' 800 m away from the nearest host trees.

The larval stage lasts for 5 - 7 weeks, moulting 3 times before pupating. The first instar is 2 mm long and its body is pale yellow. All instars have 2 pairs of abdominal prolegs and the larvae move by alternatively arching the abdomen, moving the prolegs up to the thoracic legs, straightening the body by moving the thoracic legs forward and repeating the process; hence the name spanworm. The second instar may be one of two colour phases, both of which can be found in a single population. This colour difference becomes more and more pronounced as the larvae mature. At maturity, in the fourth instar, one phase is light green with thin white longitudinal lines on the body, or dark brown with the same striped pattern. At this stage the head capsule is 1.25 - 1.70 mm wide and the body is 18 mm long.

Pupation occurs in the latter half of June after the larvae fall to the ground and spin a light silken cocoon in the duff. In the late fall after frosts have occurred, adults emerge from these cocoons in the late afternoons and early evenings on warm days. Females climb the trunks of trees and males are capable of flight at low temperatures. (*O. bruceata* and *O. brumata* are known as winter moths for this reason, although the specific common name only applies to the latter.)

The female moths release a scent (pheromone) which attracts males for mating.

Eggs are laid shortly afterwards to complete the one-year life cycle.

The Bruce spanworm begins feeding by mining the developing aspen buds in the spring. When the leaves expand, this damage appears as holes in the leaves. As the leaves expand, the larvae feed on the leaves openly. In some cases they roll leaves or web them together while feeding. If they destroy the entire leaf crop, they leave the tree on silk strands. The result of this is that trees appear festooned with a silken shroud. This silk is also found on the understorey vegetation.

Damage to trees, in addition to the loss of foliage, is reflected in reduced tree growth. However, outbreaks are short-lived and tree mortality is seldom a consequence of these outbreaks. Bruce spanworm outbreaks may coincide with outbreaks of other aspen defoliators. Under these conditions, it may be possible to see tree mortality if the duration of severe defoliation is prolonged for several years.

There are many natural enemies that affect Bruce spanworm populations. It is thought that the parasites are important in controlling populations between outbreaks. In the case of the winter moth, a parasitic insect was introduced both to Nova Scotia and Vancouver Island. In both cases the parasite was effective in reducing and maintaining populations to non-damaging levels. This is one of the best documented cases of successful biological control in forestry.

The native enemies seem ineffective in regulating populations of the Bruce spanworm in the west, once an outbreak has begun. A nuclear polyhedrosis virus (NPV) which was associated with collapsing populations was discovered in Quebec. This NPV was unknown in the West. It has since been introduced to a small population as an experimental control agent with moderate success. The relatively high cost of producing the virus, which is specific to the host, has precluded its development for commercial application. A problem arises because the virus is very specific in its host requirements. The material to be used in controlling outbreaks must be grown in Bruce spanworm larvae; however, these larvae are small and no economical way of increasing production has been sought.

Historically, Bruce spanworm outbreaks have not lasted more than two years, and there was no documented tree mortality. At this time there does not seem much value in controlling this insect in forest situations

MAJOR FOREST PESTS IN THE NORTHWEST REGION - PREDICTIONS FOR 1994

by

James Brandt

SPRUCE BUDWORM
***Choristoneura fumiferana* (Clem.)**

In Alberta, Land and Forest Services deployed pheromone-baited traps at many locations throughout the administrative forests to monitor spruce budworm population levels. Moth counts greater than 500 moths/trap were observed at nine locations in Athabasca, Footner Lake, Peace River, and Slave Lake forests. Second instar larval (L_2) surveys were conducted in Footner Lake and Athabasca forests. Results indicate that from light to severe defoliation will occur along the Chinchaga River and east along Highway 58 in Footner Lake Forest in 1994. Light and light-to-moderate defoliation is expected in Lac la Biche Forest in 1994.

In Saskatchewan, 408 pheromone-baited traps were deployed at 136 sites by Saskatchewan Environment and Resource Management. Trap catches indicated relatively high population densities throughout Saskatchewan's commercial forests, and helped to identify areas of concern for follow-up L_2 surveys. The L_2 surveys were conducted in Hudson Bay, Meadow Lake, and Prince Albert regions. Light defoliation is expected in Hudson Bay Region and at most locations in Meadow Lake and Prince Albert regions in 1994. At one location in each of Meadow Lake and Prince Albert regions moderate defoliation is expected. These forecasts are based on an average number of larvae per Universal Transverse Mercator (UTM) cell.

In Manitoba, surveys used to forecast 1994 spruce budworm populations and predict defoliation levels in some administrative sections were completed by Manitoba Natural Resources. Light and light-to-moderate defoliation is expected in 1994 in Abitibi-Price F.M.L. and in Nopiming, Whiteshell, and Duck Mountain provincial parks.

JACK PINE BUDWORM
***Choristoneura pinus pinus* Free.**

Jack pine budworm has not caused significant defoliation to pine stands in the Northwest Region since the last major outbreak that collapsed in 1987. Monitoring of jack pine budworm populations has been ongoing through the efforts of FIDS in Alberta and Saskatchewan and of Manitoba Natural Resources in Manitoba. Detection surveys have concentrated on pheromone traps for male moths and egg-mass surveys. Jack pine budworm populations are anticipated to remain low across the Northwest Region and very little defoliation is expected.

ASPEN DEFOLIATORS
Forest tent caterpillar,
Malacosoma disstria Hbn.
Large aspen tortrix,
***Choristoneura conflictana* (Wlk.)**
Aspen leafroller,
***Pseudexentera oregonana* (Wlsm.)**

In Alberta, forest tent caterpillar egg-band surveys were conducted at 19 locations around infested areas. Severe defoliation can be expected in 1994 just north and south of Cooking Lake. Light defoliation is expected at Tofield, Miquelon Lake Provincial Park, Elk Island National Park, and north of Peace River townsite. South of the townsite along both sides of the Peace River to the Shaftsberry Ferry, defoliation will range from moderate to severe. Moderate-to-severe defoliation is expected north of Guy.

In Manitoba, forest tent caterpillar egg-band surveys were conducted at 8 locations. Light defoliation is expected in 1994 near Manigotagan and Lake St. George.

No defoliation is expected in Duck Mountain Provincial Park, Riding Mountain National Park, Mafeking, Big Whiteshell Lake, Landry Lake, or Flin Flon

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This note, if cited, should be referred to as a personal communication with the author(s).

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