Forest Insect and Disease Notes

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Contents

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Canada

Something New

Forest Insect and Disease Notes has changed! You will notice beginning with this issue that FID Notes is no longer in the Technology Transfer Note series, but is now a series on its own. Our intention still is to publish these notes it three times per year, March, July, and December. We have attached a mail back sheet concerning FID notes. Please take time to fill it out and let us know if you want to receive FID notes and pass on any comments you have.

Atropellis Canker
by
Ken Mallett

One of the most important diseases of lodgepole pine of the Rocky Mountain eastern slopes is Atropellis canker. This disease is found in B.C., the eastern slopes of the Rocky Mountains and in the Cypress Hills (Fig. 1). It has been recorded on other pine species but appears to be most destructive on lodgepole pine, especially in Alberta. The disease is caused by a fungus, Atropellis piniphila (Weir) Lohman & Cash . The fungus causes elongated, resinous cankers to form on the stems and branches of trees. The wood underneath the canker is stained bluish-black and is resin soaked. Growth, tree form, and wood quality can be affected, and in some cases mortality can occur.

According to Hopkins (1985) ascospores (sexual spores) of the fungus start infections on undamaged bark near branch whorls. The fungus first penetrates the intact bark. The resin drops that are subsequently produced in response to the infection are the first visual symptom of the disease. The fungus then quickly grows through the sapwood producing a bluish-black stain in the wood. It can grow in the heartwood but at a much slower rate. The canker grows more quickly up and down than to the sides thus giving it an elongated appearance. Hopkins (1985) estimated that a canker's circumferential growth was approximately 0.6 cm per year whereas longitudinal growth was 4.7 cm per year. Cankers are more common on the northern aspects of tree stems than on the southern. Resin is produced at the margins of the canker on the outer surface of the tree. Vigorous trees often produce deep furrows in their stems. Many trees develop multiple cankers on their stems and some stem cankers have been estimated to be as old as 40 - 50 years (Hopkins 1985).

The fungus reproduces by black apothecia (sexual fruiting bodies) in the sunken areas of the cankers. Black conidial bodies (asexual fruiting structures) may precede apothecia on branch cankers but both can often be found together in a single canker. Spores are released from fruiting bodies

soon after being moistened. Hopkins (1985) estimated that wind-blown ascospores probably travel distances of about 100 m (some may travel further). The role of conidia is not well known but may be important in sexual fertilization.

Although the disease can kill trees, it often reduces growth, causes deformities, and can reduce wood quality by stain and resin soaking. Baranyay et al. (1973) found that the disease reduced the volume of infected trees by up to 56% in Alberta. They also found that some wood properties were adversely affected. The debarking process for pulp production was difficult with cankered trees. There was also a loss in pulp yield, and bleaching was more difficult. Nevill et al. (1989) found that the disease caused an increase in the volume of lumber being graded as Utility grade and that the losses in wood volume and grade decreases amounted to a 33% reduction in value. Hopkins (1985) noted that mortality usually occurred in very dense stands and to those trees with multiple cankers. An 8 year study in the Coalspur - Robb region of Alberta showed that the average number of cankers per tree increased from 3 to 5 and that the average amount of mortality was 22% (Baranyay and Bouchler 1962).

The following control recommendations come from Hopkins (1985).

1) Remove all old infected trees near regeneration because young trees become susceptible at age 15.

2) A buffer of at least 100 m should be maintained between old infected trees and regeneration.

3) Thinning dense stands will reduce infections

and should be done before 15 years of age. diseased trees should be removed.

4) Prescribed burning may be warranted in some stands.

Literature Cited

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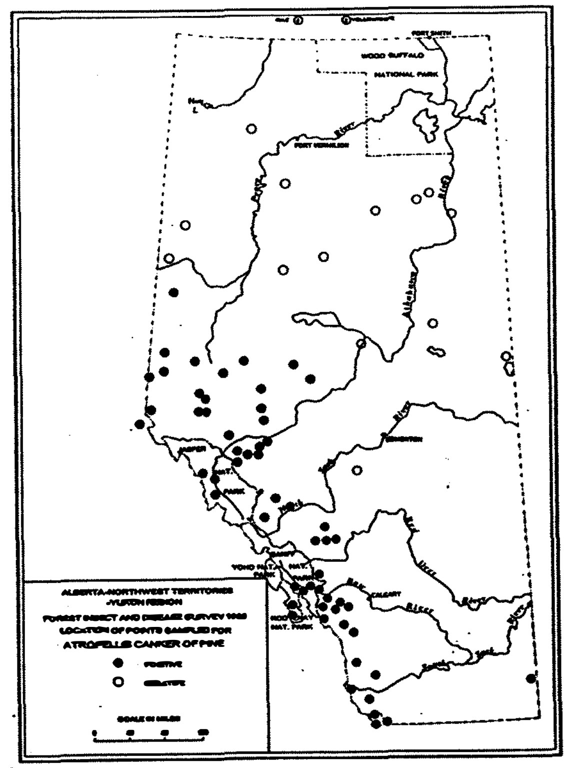
Fig. 1



Taxonomic Research on Forest Insects and Diseases at the Northern Forestry Centre: Part 1, Introduction to Taxonomy

by
David W. Langor

What Is taxonomy?

One of most striking characteristics of nature is the stunning diversity and complexity of living organisms. To date, about 1 million different species have been described and it is believed that there are several million others waiting to be discovered and described. This is mainly the job of taxonomists. Simply put, the purpose of taxonomy is to study and describe the variation of life; to subdivide that variation, using accepted scientific protocols, into units [=taxa(pl.), taxon (sing.)] such as species; and to name and classify taxa.

The beginnings of taxonomy were likely rooted in our most ancient history. Perhaps the first taxonomic concepts had an ecological basis, such as 'tastes good' compared to 'tastes bad' and 'animals that man eats' compared to 'animals that man does not eat'. The science of taxonomy can be traced to the studies of Aristotle in about 300 BC. Taxonomy blossomed in the 18th century, culminating in the remarkable, comprehensive classifications of Carolus Linnaeus which our present day system is based on. The Darwin-Wallace theory of evolution, Mendel's studies on genetic inheritance, and the work of others in the 19th century now allow us to place taxonomy into an evolutionary framework [=the science of systematics]. The most recent advances in taxonomy (and systematics) have been in the discovery of new kinds of characters to better allow us to describe and discriminate among taxa, interpret data, and make inferences about relationships among taxa and the evolution of lineages (groups of related taxa).

Tools of Taxonomy

Taxonomists have at their disposal a wide variety of tools (character systems) to aid in delimiting species boundaries and to help discriminate among species:

Morphology - The most commonly used characters in taxonomic studies are morphological (=structural) characters. When studying morphology taxonomists look for presence or absence of characters, number of structures, color, and pattern.

Ecology - There are many examples where two or more species are virtually identical in morphology but have different ecological characters such as life cycle, behaviour, and ability to grow under various environmental conditions.

Reproductive compatibility - Cross-breeding of organisms often provides insights into taxonomic problems. One would expect inter-specific matings to be unsuccessful (because of incompatibilities in behaviour, structure, or physiology) or less productive, in terms of number and fertility of offspring, than intra-specific matings.

Biochemistry - Different species usually differ in chemistry. Taxonomists often look at variation in hydrocarbons (e.g. surface waxes of insects) and proteins (e.g. enzymes) using chromatographic, spectrophotometric, and electrophoretic techniques.

Genetics - All of the character systems mentioned thus far are determined and controlled by genetic factors (genes composed of DNA). Because most of the variation that we see in organisms stems from variation in DNA structure, it seems that the next logical step is to analyze the primary structure of DNA. Recent technological developments (restriction fragment length analysis, polymerization chain reaction, sequencing) now allow us to do this. The ability to analyze DNA structure combined with appropriate data analysis and interpretation is potentially a very powerful taxonomic tool. This technology is still being refined to improve resolution, increase speed of data accumulation, and reduce cost.

The character systems chosen by a taxonomist will depend on the question that must be answered. However, it is prudent for the taxonomist to use as many character systems as possible to solve a taxonomic problem.

Results of taxonomic research

One result of taxonomic studies on a particular group of organisms is to delimit species boundaries. To do this one must use the character systems studied for that group to determine how many species are present and to define each species using the different combinations of character states. Once species have been established (and new species named) they are classified in an hierarchial system based on relationship to other taxa. The major divisions of our classification system in descending order are (classification of humans is provided in parentheses): Kingdom (Animalia), Phylum (Chordata), Class (Mammalia), Order (Primates), Family (Homonidae), Genus (Homo), and Species (sapiens). In this system each species has a unique name which incorporates the use of the genus (capitalized) and species (uncapitalized) names, e.g. Homo sapiens, which are italicized or underlined. Once species have been delimited we can then determine the distribution and ecological requirements (e.g. hosts) of each species.

A second result of taxonomic research is the construction of identification keys for diagnostic purposes. These keys incorporate the character states used to originally define the species and are used to identify unknown specimens of the group of organisms (e.g. a genus) for which the key was constructed. Here is a simple key to help discriminate among a spider, a forest tent caterpillar moth (FTC), and a mosquito:

1. Has 8 legs............Spider
1'. Has 6 legs............(go to 2)
2. Has 2 pairs of wings....FTC moth
2'. Has 1 pair of wings....Mosquito

A third result of taxonomic research is to infer something about the origin of taxa and the evolutionary relationships among taxa. An understanding of the evolutionary history (phylogeny) of forest insects and diseases and their hosts can sometimes provide valuable insights into herbivore-plant relationships and epidemiology.

Forest insect and disease research at NoFC

NoFC has an extensive and intensive forest protection program which includes research and surveys of forest insects and diseases (fungi). A thorough understanding of insect and fungus species boundaries and a means of discriminating among species is essential to most other research on these organisms and allows for accurate surveys. Confusion about taxonomy usually results in ambiguity in other research and surveys.

There are two ongoing projects on the taxonomy of forest insects and diseases at NoFC. Dr. David Langor is investigating the taxonomy of Pissodes weevils. Several species of this genus are important pests because they attack and kill terminals of many conifer species, resulting in stem deformation. The taxonomy of this genus is in a state of confusion. The goal of this project is to determine the number and distribution of species and develop diagnostic keys to aid researchers and forest managers. Taxonomic research is linked to other work on ecology and control. Dr. Yasu Hiratsuka is investigating the taxonomy of rust fungi. This group of fungi contain many important pests of trees (e.g. western gall rust). In cooperation with scientists in Japan, Dr. Hiratsuka is investigating the taxonomy of pine stem rusts.

These two studies and there importance to forest pest mangagement will be summarized in future issues of FID Notes.

Synopsis of Major Pests in the Region - 1990

by

Jim Emond

FOREST TENT CATERPILLAR
(Malacosoma disstria Hubner)

Forest tent caterpillar infestations showed a marked decline in 1990 but continued to be one of the major defoliators of trembling aspen in the Northwest Region. The total estimated area of defoliation in 1990 was approximately 885 372 ha as compared to 2 295 585 ha reported in 1989.

In **ALBERTA**, the estimated total area of aspen forests moderately-to-severely defoliated by the forest tent caterpillar was 609 272 ha in 1990 as compared to 1 179 800 ha reported in 1989. The largest area of defoliation continued to occur in the east-central part of the province where moderate and severe defoliation was reported in the Cold Lake - Iron River - St. Paul area, extending south to Vermilion - Wainwright and Provost. East of this general area, populations collapsed and only isolated patches of defoliation were evident. Moderate and severe defoliation was again reported in the Peace River Block in the Saddle Hills north of Grande Prairie and along the Peace River valley between Grimshaw and Peace River.

In **SASKATCHEWAN**, the total estimated area of defoliation in 1990 was approximately 260 922 ha as compared to 790 740 ha reported in 1989. Moderate and severe defoliation was reported in the Cold Lake area between the Beaver and Martineau rivers extending east of the Alberta border to the vicinities of Lac des Isles, Loon Lake and Steeles Narrows. In some of the previously reported (1989) infestation areas, population levels of the forest tent caterpillar were significantly decreased.

In **MANITOBA**, a significant decrease of trembling aspen defoliation was also recorded in 1990. Moderate and severe injury was reported over a total of 15 178 ha of aspen forests compared to 325 045 ha reported in 1989. Localized pockets of defoliation were evident in the Jenpeg Road and Devils Lake areas as well as in the St. George-Fisher Bay districts and near Camperville.

SPRUCE BUDWORM
(Choristoneura fumiferana Clem.)

In 1990, spruce budworm infestations increased somewhat in northern Alberta and in the Northwest Territories. In Saskatchewan and Manitoba some decrease in infestation area and levels of defoliation were reported.

In **ALBERTA**, the infestation along the Chinchaga River in the Footner Lake Forest has increased in size and intensity where moderate-to-severe defoliation was reported over an area of approximately 95 000 ha. Three smaller outbreak areas, encompassing approximately 3100 ha, were reported along the Amber, Hay and Steen rivers. In the Grande Prairie Forest, the outbreak previously reported near Eaglesham continued unabated and some "top-kill"is now evident. In the Peace River Forest, moderate-to-severe defoliation was evident over an area of 1000 ha in the Hawk Hills. In the Lac la Biche Forest, the infestation along the House River increased in size from 4230 ha in 1989 to approximately 11 800 ha in 1990. In the Athabasca Forest, moderate-to-severe defoliation was evident over an area of 800 ha along the Athabasca River between Buffalo Creek and Brule Rapids. In the Bow-Crow Forest, approximately 20 ha of moderate-to-severe defoliation was reported in the Eagle Hill area northeast of Sundre. Light defoliation was reported in native spruce stands at Big Knife Provincial Park and near Castor and Millet in the central part of the province.

In **SASKATCHEWAN**, moderate-to-severe defoliation was reported over 18 730 ha of spruce forests in 1990 as compared to 31 600 ha in 1989. This reflects a substantial decline in most of the previously recorded infestation areas, especially in the Red Earth and Porcupine Hills. Similar defoliation was evident in spruce-fir stands in the Delaronde and Taggart lakes' areas. Several new smaller infestations were reported in farmlots near Norquay and Prairie River and also in the west block of the Cypress Hills.

In MANITOBA, spruce budworm infestations previously reported in eastern Manitoba decreased in size and intensity. Moderate and severe defoliation occurred in spruce-fir forests over an area of 18 985 ha in 1990 as compared to 58 016 ha of forest defoliation recorded in 1989. Similar injury was reported in Nopiming, Whiteshell and Hecla Island provincial parks. Some infestations increased in the Grindstone, Black Island, Spruce Woods Provincial Forest areas and in Birds Hill Provincial Park.

In the NORTHWEST TERRITORIES, moderate-to-severe defoliation of white spruce forests continued in the Liard River area where a total of 97 800 ha of damage was mapped. Smaller infestations were evident along the Mackenzie River between Fort Simpson and Fort Norman (4500 ha) and between Camsell Bend and Bulmer Lake (325 ha). In the Slave River outbreak areas, light, moderate and severe defoliation was mapped over an area of 11 000 ha.

BRUCE SPANWORM
(Operophtera bruceata Hulst)

Defoliation of aspen forests and parklands by this insect increased significantly in many areas of Alberta in 1990. Moderate and severe defoliation was evident in the Claresholm - Rocky Mountain House - Castor "triangle". Within this general area approximately 652 346 ha of defoliation was reported. Several other infestations sustaining similar injury were reported in the Hinton - Obed area (53 175 ha); north of Edson (13 257 ha); south and west of Grande Prairie (25 081 ha); in the Manning - Keg River area (72 872 ha); and near Whitecourt (2 673 ha). Stands with varying degrees of injury were noted between Ponoka and Rimbey, near Winfield, Buck Lake, Breton, Warburg, and Camrose.

In SASKATCHEWAN, low populations were present in many areas where forest tent caterpillar infestations occurred.

GRAY WILLOW LEAF BEETLE
(Tricholochmaea decora Say)

Moderate and severe skeletonizing of willow foliage, resulting in extensive discolouration and browning, was very common throughout the west-central and northern half of Alberta in 1990. Similar injury was noted in many areas of central and northern Saskatchewan and in some areas of the Northwest Territories.

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