

Mountain Pine Beetle – A Threat to Pines in Western Canada

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Mountain pine beetle (*Dendroctonus ponderosae*) is a small black insect, about 0.5 cm long and is native to western North America. It is one of a number of bark-feeding beetles, so-called because of its burrowing habit into the bark of pine trees, and is the most important insect affecting mature pines in western Canada. Infestations of this insect have commonly occurred, almost since the turn of the century, throughout the southern two-thirds of British Columbia, and only during two known periods has it reached damaging population levels in Alberta. The first occurred during 1940 to 1944 in Banff National Park. The second outbreak commenced about 1976 in southwestern Alberta, probably as an extension of existing outbreaks in progress immediately to the west in B.C. and in Montana. Small pockets of beetle-killed trees were first noted in Waterton Lakes National Park and along the Castle and Carbondale river drainages. These infestations have since intensified and expanded, and in 1979, covered an area in excess of 2600 ha of mature pine forest in the Bow-Crow Forest alone. Since then new infestations were discovered throughout the Porcupine Hills, along the eastern escarpment of the mountains to the west of these hills and, surprisingly, throughout pine stands in the Cypress Hills of the southern Alberta-Saskatchewan border. Its sudden appearance and spread in the Cypress Hills and other locations in southwestern Alberta are now of considerable concern to National and Provincial parks personnel,

forest managers, timber companies as well as members of the general public. A recent finding of beetle-killed trees in a prominent park in Lethbridge illustrates an important area of urban and homeowner concern.

In its natural range, three native pine species are primary hosts in Canada and include western white, ponderosa and lodgepole pines. Scots pine, an exotic species often planted on the Canadian prairies, is reported to be highly susceptible to beetle attack and was the target host infested in Lethbridge. Travellers along the highway through the Crowsnest Pass may also observe beetle-killed timber pine occurring naturally on rock outcrops.

The conditions which lead to mountain pine beetle outbreaks or epidemics are generally understood. Epidemics in general occur where mature pine forests over 80 years of age are extensive and contain trees of average diameter greater than 20 cm. Trees of this size usually have a bark thickness greater than 1.5 mm. All these components are necessary to provide adequate food and breeding material that ensure good survival of beetle broods and allow their populations to expand. In addition, climate, especially in the northern and eastern limits of the beetle's range, often becomes an overriding factor in determining beetle survival and development. Relatively mild winters in recent years have no doubt helped to enhance outbreak development. Trees younger than 80 years or smaller than 20 cm are also attacked, especially when beetle populations are very high. However, trees less than 10-12 cm in diameter are rarely attacked.

The first indications of attacked trees are resinous cream to reddish-brown colored "pitch tubes" exuded on the trunks of living trees, or brownish boring sawdust around the tree base. These signs mostly appear after mid-July as a result of the female beetle's boring into the bark.

Resin is the tree's main form of defense against attack; its quantity and flow characteristics at the time of attack determine, in large measure, the amount of tree resistance. Trees, in general, are most resistant when young, and after age 60 years the level of resistance to attack may decline rapidly.

Once under the bark the female is mated and then begins to excavate a

gallery upward on the stem for about 30 cm depositing 60-80 eggs along its length. These hatch into small, white, grub-like larvae that burrow in the bark laterally from the main gallery. The larva is the main feeding stage and remains in the galleries throughout winter. Feeding resumes in the spring and is followed by a resting stage when larvae transform to pupae and then to adults by about mid-July, completing a one-year life cycle. At this time the new adult beetles must vacate their "brood" tree and fly to seek out new living host trees in which to colonize.

In successfully attacked trees, blue-stained sapwood appears shortly after beetle attack. This occurs as a result of colonization of a group of closely associated fungi in the bark and sapwood, the spores of which are carried from tree to tree on the beetle's body and become dislodged when the gallery is excavated. It is believed that death of the tree is ensured and hastened by the successful colonization of the blue-stain fungi. Wood products cut from beetle-killed trees are sometimes downgraded or reduced in value because of the blue-stain colouration.

Outbreaks of the mountain pine beetle characteristically begin from a single attacked tree or from small groups of infested trees. These become "active centers" from which the beetles progressively spread outward to attack more trees in subsequent years. Each tree successfully attacked dies shortly after and exhibits a colour change in foliage, commencing in the spring following attack. The needles fade to a yellow, then yellow-brown and eventually to a red-brown. The dead needles remain on the tree for 2-3 years before dropping and can increase the risk of forest fires. Since beetle-killed trees are usually of merchantable size for lumber and other wood products, their death in large numbers can help to deplete the forest inventory, force changes in forest management plans through extensive salvage logging and create stand openings. The discoloured foliage may also reduce the aesthetic appearance of forest landscapes.

The longevity of outbreaks is variable and difficult to predict. Some outbreaks may run a natural course for several consecutive years, resulting in smaller and smaller trees being attacked, while at the same time effecting a gradual decline in populations. A number of natural controlling factors also contribute in different ways to reduce beetle populations. These include a variety of insect predators and parasites, tree

October 1980, Volume 2, No. 5

Features

Olds College Hort Week — a blossoming success

The 16th annual Hort Week was held in Alberta this summer and the theme "Growing Together" brought nearly 450 participants to the three-day event 8

Chemical Pruning of Nursery Stock with Atrinal

Gail Johnson and Glen P. Lumis of the University of Guelph discuss the results of their trials with a new chemical being considered for registration in Canada 10

Nursery Marketing Council Update

Your efforts are being well rewarded. Karl Stensson brings us up to date 14

Production Planning (or a Shot in the Dark)

Bill Stensson dusts off his crystal ball and explains how to come up with a reasonably accurate picture of what the future will hold in the way of plant requirements. 16

Getting to Know Your Customer

Garden Centres Canada present one good idea on nursery garden centre marketing for a profit 22

Mountain Pine Beetle — a threat to pines in western Canada

Herbert F. Cerezke, a forest entomologist with Environment Canada discusses the most important insect affecting mature pines in western Canada 24

Plus

Coming Events	4
Guest Editorial by Robert Lederer	6
Regional News	20
Industry Activities	28
New Products	30
Classified	32
Advertiser's Index	34

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Our cover photo

Shown here is a field of young, grafted evergreens that are two years away from harvesting. Varieties right to left are: Mountbatten Juniper, Blue Haven Juniper and Skyrocket Juniper. (photo credit: William Kuryluk of London, Ontario.)

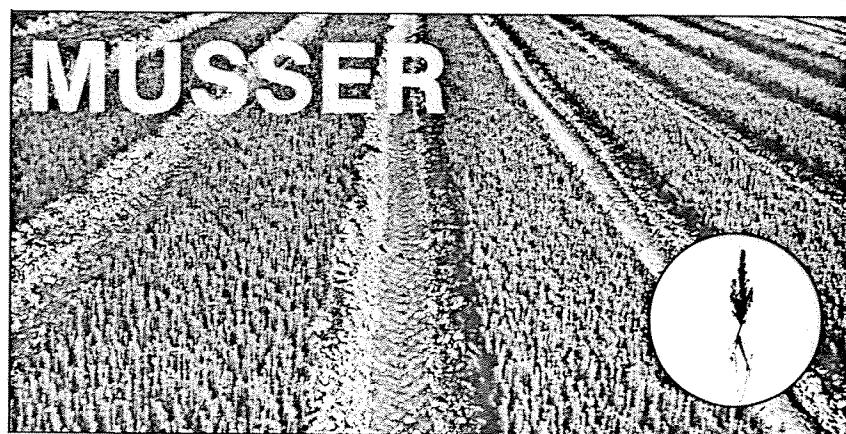
resistance, competition with other bark-feeding insects, birds, especially woodpeckers, and cold temperatures. In areas considered marginal to the range of the mountain pine beetle such as in north-central B.C. and southern Alberta, temperatures below -38 degrees C during winter can cause extensive mortality to larval and adult stages and help bring about early collapse of outbreaks.

The current outbreak in southern Alberta and Cypress Hills has other disturbing side aspects. Foremost is the question of the origin of the beetles found attacking trees in such localities as Lethbridge, Cypress Hills and possibly other points in southern Alberta far removed from known sources of populations. This aspect makes it difficult to predict how far eastward the beetles may disperse. The Cypress Hills support the most easterly range of natural lodgepole pine while plantings of native and exotic pines are relatively few and scattered across the southern prairies. Because of the tree size preference for beetle attack, the risk to planted pines would appear to be minimal, and pose little if any threat to the nursery industry. This is further supported by the low probability of such widespread outbreaks recurring.

Control options available are limited, often costly and not always successful. In forested areas control methods may include cultural procedures such as thinning, selective salvage logging or stand conversion to a non-host tree species. Direct chemical controls are generally too costly and risky to apply in forested areas. However, on high-value trees

where application is on an individual tree basis, chemicals such as lindane (registered for bark beetle control) can be successful in protecting them against attack. The timing and method of appli-

cation should be made first through provincial environmental and agricultural authorities or through federal and provincial forestry personnel. □



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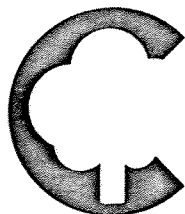
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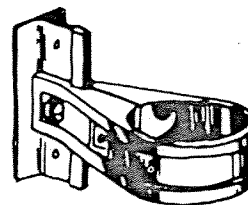
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