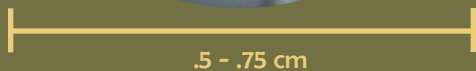


Spruce beetle *Dendroctonus rufipennis*, is the most destructive pest of mature spruce in western North America. In the Yukon, spruce beetles can be found in stands throughout the range of white spruce, *Picea glauca*. The beetle normally has a two-year life cycle but it can vary from one to three years depending upon elevation, aspect and local climatic conditions. Infestations historically have lasted up to four years before collapsing, due to a combination of climatic stresses, predation and host resistance. A notable exception to this is the recent infestation in the southwest Yukon, which, in 2005 is in its 15th year, due to ongoing stress caused by climate moderation.

Under normal conditions populations remain low, surviving in severely stressed or recently killed trees and slash. Outbreaks occur when favorable climatic conditions coincide with a large volume of susceptible host suddenly becoming available, which happens most frequently following an environmental event such as a flood, drought or windstorm. The current outbreak began around 1990, arising simultaneously in stands adjacent to the Alsek River within Kluane National Park and Bear Creek summit area, north of Haines Junction. These stands had been under drought stress induced by warmer than normal temperatures during the growing season. At the same time, spruce beetle population growth was enhanced by milder winter temperatures and an unusually high incidence of one-year cycling.



Dendroctonus rufipennis



.5 - .75 cm



Boring dust at the base of a recently attacked tree

Pitch Nodules (tubes) on recently attacked tree

Evidence of predation by woodpeckers

Yellow - red crown of tree attacked the previous year

Natural Controls

CLIMATIC: Temperatures of -40°C for a week or more will kill most larvae above the snow line. Larval mortality also occurs with the early onset of cold before the progeny have fully "hardened off" with glycol.

WOODPECKERS: Woodpeckers can significantly reduce beetle populations during outbreaks. They can also be instrumental in controlling populations during an incipient outbreak by targeting scattered infested trees.

INSECT PARASITES AND PREDATORS: Though always present, parasites and predators have little effect when beetle populations are high. Like woodpeckers they have a more important role in managing low populations.

Applied Controls

LOGGING: Sanitation logging is the most common method of managed beetle population control, through the harvest and speedy processing of infested timber.

TRAP TREES: Conventional trap trees are green trees felled in the winter or spring to attract beetle populations. Following the beetle flight these trees are removed and milled to kill the broods. Lethal trap trees are treated with a systemic insecticide such as monosodium methane arsenate (MSMA) before felling. Both methods are most effective in the control of small outbreaks and absorbing populations arising from right-of-way clearing and logging slash.

SPRUCE BEETLE IN THE YUKON

History of Yukon Manifestations

As mentioned, the current infestation began in the southwest Yukon around 1990. At over 350 000 ha in size, it is by far the largest and most intensive spruce beetle outbreak ever recorded in Canada, and 15 years later there is no end in sight. In 2004, nearly 100 000 ha of recent mortality was mapped during aerial surveys; the second largest since aerial surveys began in 1994. Prior to the current out-break, only two outbreaks had been recorded; both in the southwest, and both directly associated with industrial activity. In the early 1940s, approximately 50 000 ha was infested around Dezadeash Lake. Though there is conflicting information regarding the cause, it was thought to have been associated with the building of the Haines Road in 1942. During construction many trees were felled and left, providing ideal conditions for a rapid increase in populations. Another infestation in the late 1970s was linked to the Aishihik power project and diversion canal. This infestation lasted two years and affected only about 100 ha of mature spruce..



Tree Mortality In Klane National Park

Description



EGG

pearlywhite, oblong
.75 - 1.0 mm in length.
Laid in galleries a
bout 13 cm long.



LARVA:

stout cylindrical, legless &
wrinkled, 6-7mm long fully
grown; pale tan head;
creamy white body.



PUPA:

creamy white becoming pale
tan near maturity; 6mm
long with visible wings,
legs and antennae

ADULT:

PALE yellow when immature
darkening to black, often
with reddish-brown wing
covers; 6mm long.



Life History

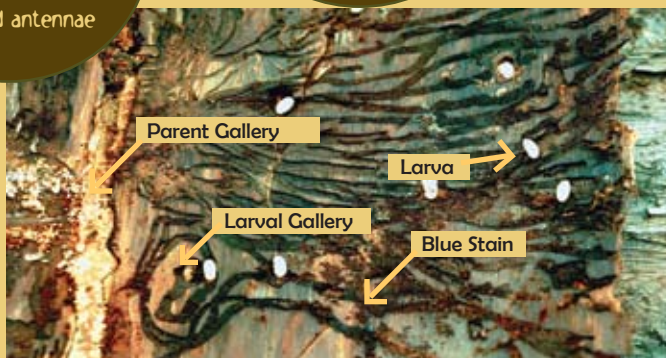
Beetles emerge from the trees in late May/early June and fly up to four km in search of a suitable host. When populations are high, their search criteria expand to include healthy green trees. Attack densities usually range between 40 and 80 beetles per square metre of stem surface at breast height on standing trees. When a female selects a tree, she lands on the bark and releases a pheromone to attract other females and initiate the mass attack necessary to overcome the tree's defenses. Another pheromone attracts a male and, after mating, the female commences to bore a vertical tunnel (adult gallery) under the bark at the interface of the cambium layer and the sapwood, etching the sapwood in the process. In response to this irritant, healthy trees flood the beetle galleries with resin in an attempt to seal the wound and flush the beetles from the tree. When the tree is successful, and the beetles are pitched out, they can often be found entombed within the pitch nodule that forms on the outer bark at the entry hole. Stressed trees however, have limited energy reserves and produce little or no pitch.

Successful beetles bore upward an average of 13 cm within the cambium, laying clusters of eggs on alternating sides of the gallery. After about 10 days, the eggs hatch, and the larvae commence feeding within the phloem.

As the larvae feed they radiate laterally around the tree, interrupting the flow of nutrients. When overlapping larval galleries completely encircle the stem, the tree dies.

In its evolutionary past, the beetle developed a mutually beneficial relationship with a fungus, *Ceratocystis* sp., which it carries from tree to tree in special receptacles called mycangia. Once introduced the fungal mycelium grows within the phloem, aiding the beetle to overcome tree resistance and causing the characteristic blue stain in the sapwood.

Larvae pass through four distinct growth stages (instars) before they mature. In the normal two-year cycle they enter the first winter in an early instar, protected from all but the most severe winter cold by glycol (anti-freeze) which they manufacture within their cells. Development is completed during the next growing season and they enter the second winter as immature adults. In response to cool fall temperatures however, the young beetles bore out of the tree and crawl to the root collar where they re-enter. There they are protected from severe cold by the insulating snow. Adults emerge in late May or early June of the following year to repeat the cycle.



Beetle galleries under the bark

Detection

Woodpeckers:

Debarking by woodpeckers is an obvious but not infallible indication of beetle attack. Most often seen in the spring following the first winter, the main indicators are the red-brown color of the inner bark, the exposed beetle galleries and the bark flakes around the base of the tree.

Pitch Tubes:

or pitch nodules may be visible at the beetle entrance hole on the stem, but are often absent, especially in situations where host trees were under stress.

Foliage colour:

Approximately a year following attack, the tree crowns begin to fade, eventually turning to a bright yellow/red before the needles fall. There are many variations to this pattern, however, both in timing and degree of color change. In many cases trees do not fade but drop their needles while green.

Boring Dust:

is the most important means of detection in the months following attack. It is light brown in color and coarse, like handsaw dust. When fresh it can be found in bark crevices, but more significant and enduring accumulations encircle