

Best Practices for Managing Douglas-fir Beetle

Introduction and Biology

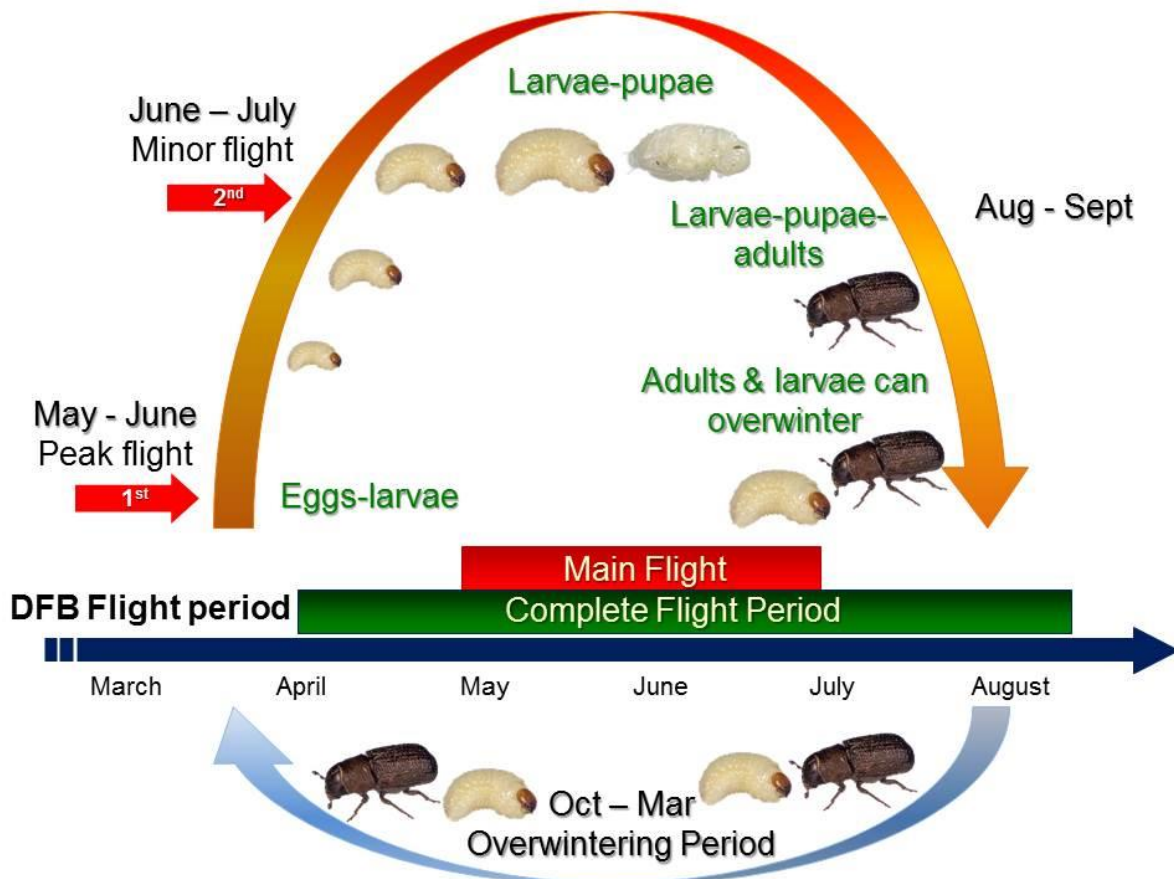
Douglas-fir beetle (*Dendroctonus pseudotsugae*; DFB) populations periodically reach outbreak levels in southern and central British Columbia (B.C.) throughout the range of its primary host Douglas-fir (*Pseudotsuga menziesii*). DFB outbreaks are usually sporadic and of short duration, however outbreak populations are capable of killing large numbers of trees, and in the current outbreak cycle, areas of attack are larger and more severe. DFB normally attacks small groups of trees, but 100 or more trees in a stand may be affected at the same time during significant outbreaks.

DFB generally prefer Douglas-fir that:

- are over-mature (i.e. veterans)
- have fallen, been blown down in storms (recent windthrow) or have top breakage
- have been injured (by fire or by machine damage)
- are stressed (drought, defoliation, root disease, fire scorch)

DFB also occasionally attacks western larch (*Larix occidentalis*). It usually attacks trees with a diameter over 20 cm, but will attack smaller trees when the beetle population is high or there is an abundance of highly stressed hosts (e.g. post-wildfire). The beetles are attracted to high stumps, slash piles and debris from road building and fire-fighting activities.

The life cycle of DFB is usually one year and two broods may be produced. Typically, the main flight period occurs in May and June; a second flight in July and August may occur by adults that have developed from overwintered larvae or by adults re-emerging after the earlier flight in the spring.



Douglas-fir beetle life history.



Douglas-fir beetle galleries

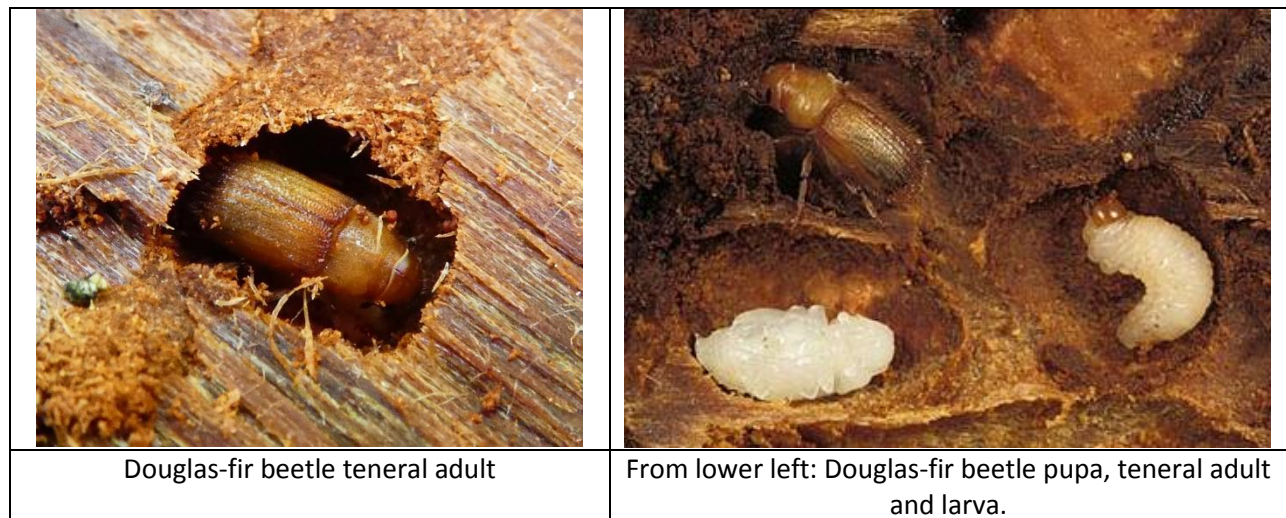


Frass on attacked tree

Life History

DFB overwinters primarily as new adults or as mature or nearly mature larvae. The adults typically fly and attack susceptible trees in the spring, shortly after daytime temperatures exceed 18°C. The major flight period occurs in May or June. Larvae that have overwintered complete their development and emerge in mid-July or August. The parent beetles occasionally re-emerge for a second flight or “summer flight”, and then attack fresh material and establish a second brood.

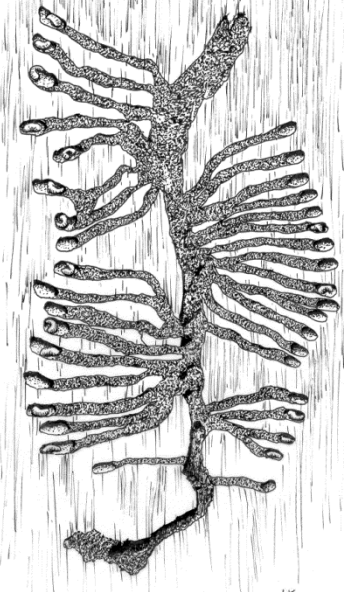
DFB adults are stout, brown to blackish-brown beetles with reddish elytra, 4 to 7 mm long. Parent adults often make “ventilation” holes along the length of the egg gallery to moderate the micro-climate within the gallery. Although new (teneral) adults may be present as early as late July, none will emerge until the following spring. Females initiate attack and excavation of galleries. A male follows the female into the gallery; although he does no excavating, he helps initially in pushing boring dust out of the entrance and later in packing the boring dust in the part of the gallery closest to the entrance. This reddish-brown frass and boring dust is diagnostic of DFB attack.



DFB larvae are white, legless grubs with a pale brown head, about 6 mm long when mature. Pupae are white to light tan, about 6 mm long, with adult features visible (legs, wings etc.).

The gallery system is located in the inner bark (phloem) next to the sapwood. The egg galleries made by the parent adults are parallel to the grain of the wood, usually with a slight hook or curve at the beginning. Approximately 50 eggs are laid in little groups. The maximum length of parent galleries is about 75 cm, with an average of 25 cm. Larval galleries diverge from the egg clusters in fan-shaped groups, which alternate from side to side of the egg gallery. Most of the egg gallery and the entire larval gallery are packed with boring dust. The larval mines frequently disappear from the inner surface of the bark since the larvae, when nearing maturity, often bore into the inner bark. Pupal cells are constructed at the end of the larval mines.

The action of larval feeding in the phloem and fungal colonization of the sapwood completely blocks all translocation tissues and kills the infested tree. In some cases only one side of a tree will be successfully attacked and this is termed a “strip attack”. A tree that is strip attacked will survive unless the living portions are re-attacked later in the summer or in subsequent years. Often conks of the pouch fungus, *Cryptoporus volvatus* (Peck) Shear, form on the outer bark the year following attack.

		
<p>Douglas-fir beetle gallery</p>	<p>Resin streaming on attacked Douglas-fir</p>	<p><i>Cryptoporus</i> fungi on attacked Douglas-fir</p>

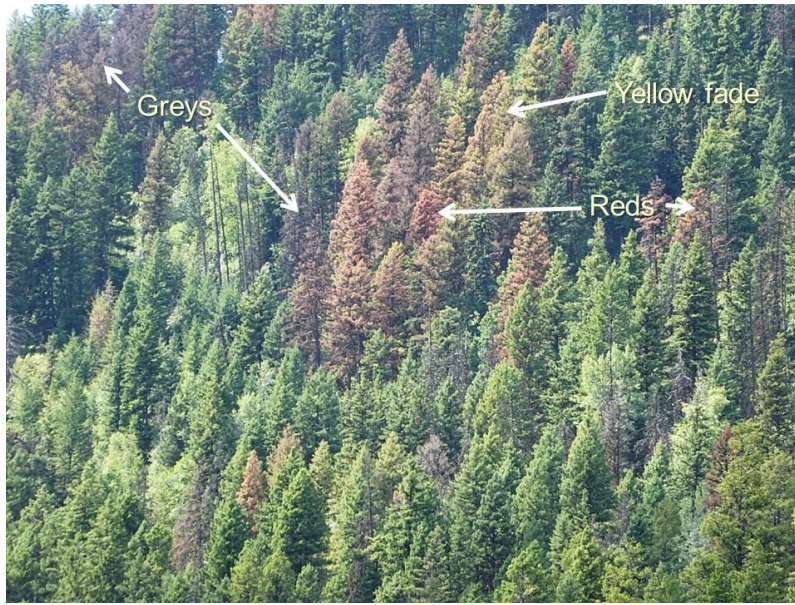
Detection

The first obvious evidence of attack in a stand is the presence of trees with discolored foliage. These external symptoms are utilized in ground and aerial surveys. However, early detection must be done on the ground by examining individual tree boles for reddish brown boring dust located in the bark crevices at entrance holes and at the base of trees. No pitch tubes are formed, such as those associated with other *Dendroctonus* species, although clear resin (pitch) exuding from entrance holes at the upper limit of attack on the bole has been noted. This examination should be done in late June through August. Foliage fades from yellow to bright red to a dark rust colour by spring of the year following attack. Although some infested trees may become discoloured as early as August, others may remain green until the following June, when the beetles are ready to leave attacked trees or, have already left to attack new host material (standing or down trees). The time of year when discolouration becomes noticeable varies with the tree's location, date of attack, intensity of infestation, elevation and seasonal weather.

Other bark beetle species, such as *Pseudohylesinus nebulosus* and *Scolytus unispinosus*, may also be found under the bark of attacked trees. Identification of these usually lesser important beetles is done by examining egg gallery patterns and adult morphology, which differ significantly from DFB. These secondary bark beetles typically attack the topside (exposed) of down trees or between DFB galleries on standing trees. If high levels are found in downed trees (trap trees), a declining DFB population may be indicated. Woodborer larvae and adults may also be found under the bark or on the boles of trees. DFB typically attacks high (above 2 meters) on the bole; therefore, if woodborers are observed in the lower portions of trees displaying external symptoms of attack, it is probable that DFB will be found higher up the bole.



Insects associated with Douglas-fir beetle



Foliage fade in Douglas-fir attacked by Douglas-fir beetle.



Douglas-fir beetle red attack.