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Resistance of Sitka spruce (*Picea sitchensis* (Bong.) Carr.) to white pine weevil (*Pissodes strobi* Peck): characterizing the bark defence mechanisms of resistant populations

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Summary

It has long been known that strong expressions of resistance to the white pine weevil (*Pissodes strobi* Peck) exist in certain Sitka spruce (*Picea sitchensis* (Bong.) Carr.) populations, particularly among trees originating from the Fraser Valley and the Qualicum area of British Columbia (BC). In this paper, we characterize how resistance is manifested in these known resistant populations. Specifically, using cloned individuals, we investigated resistant traits associated with repellency, constitutive resin canals (CRC) and sclereid or stone cells. Results indicate significant population differences in the level of these traits between these two populations and susceptible populations. Fraser Valley populations had four times the sclereid density of susceptible populations. Although the Big Qualicum (East Vancouver Island) population had the same high resistance as the Haney (Fraser Valley) population, it was expressed primarily through increased CRC. Sclereid cell density had the strongest correlation to weevil attack followed by CRC. We discuss pathways by which two distinct resistant populations may have developed in this high weevil hazard region of south-west BC.

Introduction

White pine weevil (*Pissodes strobi* Peck) is one of the most devastating pests of young spruce (*Picea* spp.) and pines (*Pinus* spp.) in North America (Alfaro *et al.*, 2002). This weevil is a native insect that occurs across Canada and the northern United States. In eastern North America, it is a major pest of eastern white pine (*Pinus strobus* L.) and introduced Norway spruce (*Picea abies* (L.) Karst.), but in the west it mainly attacks spruce species (Humble *et al.*, 1994). In Sitka spruce (*Picea sitchensis* (Bong.) Carr.), a particularly susceptible species, damage is so severe that young plantation trees often become stunted and bushy as terminal leaders are repeatedly killed and young trees fail

to achieve apical dominance. This damage and lost productivity result in significant economic losses (Heppner and Turner, 2006).

In spring, adult weevils emerge from overwintering in the forest floor, climb to the top of young saplings, feed, mate and oviposit in the bark of the upper section of the previous year's terminal shoot. The larvae then mine down under the bark, consuming the phloem, severing the cambial layer and girdling and eventually killing the leader. Larvae pupate in chambers excavated in the xylem and emerge as adults to feed in the summer and autumn, returning to the forest floor to overwinter (Silver, 1968).

In Sitka spruce, strong phenotypic expressions of resistance to the white pine weevil in some populations were first