

Mountain Pine Beetle Ecology Program Quicknote #8

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Mountain Pine Beetle in Whitebark Pine Project - Differences in condition and reproductive success of the mountain pine beetle developing in whitebark and lodgepole pines in Alberta

Introduction

The mountain pine beetle (MPB) is capable of killing and reproducing in 13 species of pine found in western North America; lodgepole pine being the most abundant and economically important of these in Alberta. In recent decades, increasing amounts of MPB attacks have been observed on whitebark pines. This is unusual since whitebark pines grow at high elevations in forests that have historically been too cold for the MPB to cause substantial damage. This is of particular concern because whitebark pines are a unique and essential component of our sub-alpine forests that have recently been listed as endangered. Whitebark pines have declined largely because of the accidental introduction of an exotic fungal disease. This problem is now being compounded by the MPB and a changing climate. Because the province of Alberta is committed to protecting whitebark pines, we endeavored to help them by conducting research that will let us better understand how the MPB will spread through the whitebark pine containing stands of Alberta. By comparing the quality of whitebark pines as hosts for the MPB relative to lodgepole pines, we will be able to provide recommendations that will maximize the effectiveness of the management tools used to mitigate the spread of the MPB. A number of laboratory and field experiments were conducted between 2008 and 2010. From these experiments we can conclude that it is not a simple case of one host being better than the other for MPB reproduction, but that the suitability of whitebark pine as a host for the MPB varies dramatically with the physiological condition of the host tree and taking this information into account will greatly increase the effectiveness of MPB control operations.

Results

In the first of our experiments we collected fresh, uninfested logs from both whitebark and lodgepole pines. In the laboratory we created 'artificial' MPB attacks under controlled conditions and followed beetle development to completion. We found that the beetles were significantly more likely to establish galleries on lodgepole pine logs than whitebark pine logs. MPB's did well, in terms of the number of offspring emerging per gallery, offspring size and offspring fat content, in logs of all phloem thicknesses while host quality varied markedly with phloem thickness in whitebark pine logs. Whitebark pine logs with thin phloem tended to be much worse hosts for the MPB while logs with thicker phloem tended to be much better hosts relative to lodgepole pines of comparable phloem thickness. We hypothesize that these differences were related to the different life history strategies of the two pine species. These results suggest that decadent whitebark pine stands will contribute significantly to MPB population growth, possibly more so than decadent lodgepole pine stands, while younger whitebark pines will contribute little to MPB populations.

A second experiment was conducted in the field to look at MPB survival and phenology in the two hosts. Sites were selected in Willmore Wilderness Park and the Crowsnest Pass, representing the northern and southern limits of whitebark pine's distribution in Alberta, respectively. Adjacent pairs of trees, one whitebark one lodgepole, were baited the MPB pheromone to induce simultaneous attack, during the 2008 and 2009 MPB flight seasons. Winter temperatures were extremely cold during these study years and consequently MPB's experienced total mortality in most of our experimental plots. This prevented us from determining if reproductive rates or phenology differed significantly between the two host species. However, we did observe that the MPB's were capable of completing their life cycle in one year at the high latitude and altitude of Willmore Wilderness Park, an observation outside the historic climatic envelope for the species. This will likely mean more MPB activity in whitebark pines in the near and distant future.