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Mountain Pine Beetle Ecology Program Quicknote #8

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Introduction

The mountain pine beetle (*Dendroctonous ponderosae*) (MPB) is a native North American bark beetle capable of infesting and killing large numbers of mature pine trees over widespread areas. Outbreaks most commonly occur in even-aged lodgepole pine dominated stands that are between 800 m and 1400 m in elevation and are > 80 years old. While the dramatic expansion of the mountain pine beetle into northern Alberta and British Columbia and eastward into the boreal forest has garnered the majority of attention, sustained outbreaks at high altitudes in other parts of its range are equally novel and potentially devastating. Of particular concern is how the MPB will affect whitebark pine (*Pinus albicaulis*), a high-elevation five-needle pine recently listed as endangered in Canada.

This note summarizes the findings of a graduate thesis undertaken to better understand how the MPB will impact white bark pines, which are important components of high elevation forests in Alberta. The complete thesis can be found at the link below[1]. Because important aspects of MPB performance can differ between the host pine species, we conducted experiments that compared host nutritional quality, MPB phenology, susceptibility to MPB attack and the MPB-associated invertebrate fauna between whitebark and lodgepole pines in subalpine forests.

Host Nutritional Quality

To compare the nutritional quality of whitebark and lodgepole pines for the MPB, we allowed beetles to initiate galleries and complete development of one generation under laboratory conditions in freshly cut, uninfested logs of each species. One pine species was not better for the MPB in terms of all life history characteristics measured. MPBs were more likely to establish galleries on lodgepole pine logs, and beetles that developed in lodgepole pine had higher fat contents, indicating superior host quality; however, MPB survival was better in whitebark pine. Interestingly, the relationship between host quality and phloem thickness differed between tree species for some of the MPB life history characteristics we measured, suggesting that variation in individual tree quality may have more of an effect on the beetle than does tree species. We observed that when phloem was thin (<0.15 mm) MPBs emerging from whitebark pine logs were fewer (per gallery), smaller and lighter (in weight) than from lodgepole pine logs (see below). However, when phloem was thick (>0.15 mm) MPBs from whitebark pine logs were larger and heavier than MPBs from lodgepole pines of similar phloem thickness, while emergence per gallery was similar between the two species. These data suggest that white bark pines with thin phloem will be relatively poor hosts for the MPB while whitebark pines with thick phloem will be as good as and, in some aspects, better hosts for the MPB than lodgepole pines. In our study 34 cm was the average DBH of a whitebark pine with 0.15 cm thick phloem. This could be a meaningful threshold for prioritizing which whitebark pines should be selected for MPB management operations.

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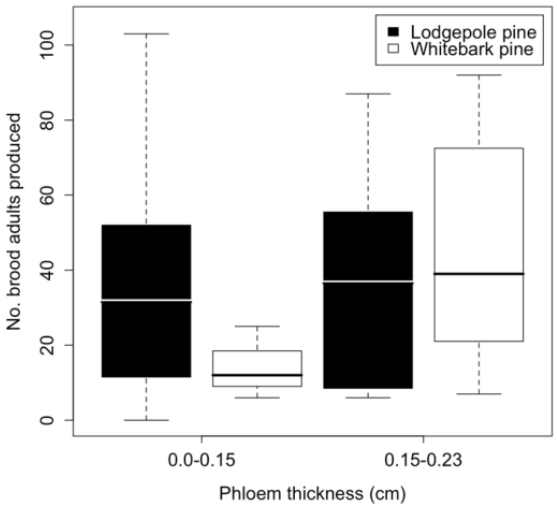
[1] *Interactions between the mountain pine beetle (Dendroctonus ponderosae Hopkins) and whitebark pine (Pinus albicaulis Engelmann). March 29, 2012.* http://hdl.handle.net/10402/era.25980



These data reflect conditions in a single stand in southern Alberta (49°N, 1950 M) and it is possible that host quality will vary with climate, stand structure and/or region.

MPB Phenology

MPB phenology was compared between pairs of simultaneously attacked whitebark and lodgepole pines in two sites in the central Rockies of Alberta (54°N, 1500-1650 m) and two sites in the southern Rockies of Alberta (50°N, 1920-2060 m) between 2008 and 2010. Overwinter mortality was very high these years and it was not possible to determine if there were differences in emergence phenology between these two host species. However, we did observe that part of the MPB cohort was capable of completing its development in 1-year in both of these regions. These latitudes and elevations are outside the historically normal range for a 1-year life cycle for the MPB. The MPB´s ability to complete a 1-year life cycle with synchronous mass emergence is a major contributing factor to the transition from endemic to epidemic population levels. Consequently, even though MPB populations have largely collapsed in these regions, MPB populations should continue to be monitored carefully on the east slopes of the Rockies.

Host Susceptibility

Inoculating trees with MPB-associated blue-stain fungi is commonly used to assess the susceptibility of trees to MPB colonization, as fungus success directly impacts MPB success. We inoculated 10 whitebark and 10 lodgepole pine trees in the same stand with three species of MPB-associated blue-stain fungi. For two of the three fungus species there was no difference in lesion length (an indicator of susceptibility) between the two pines. For *Ophiostoma montium*, lesions were shorter in whitebark pines, suggesting that whitebark pines are less susceptible to MPB colonization than lodgepole pines. We note that these data reflect conditions in a single stand in southern Alberta (49°N, 1950 M) and it is possible that host susceptibility will vary with climate, stand structure and/or region.

MPB-Associated Fauna

We compared the MPB-associated beetles inhabiting recently killed whitebark and lodgepole pines to determine if the competitors of the MPB did equally well in both hosts, and to identify if there are any potentially unique species inhabiting whitebark pines that may be adversely impacted by MPB control operations. We found that the bark beetle, *Ips pini*, the main competitor of the MPB, was less likely to be found in whitebark than in lodgepole pines. We did not find conclusive evidence that there were dead wood inhabiting beetles that lived exclusively in whitebark pines. We suggest that the removal of MPB infested whitebark pines will not have a substantial, negative impact on the community of dead wood inhabiting beetles in Alberta.

Future Outlook

These results indicate that whitebark pines, unlike limber pines, are not substantially better hosts for the MPB than lodgepole pines in the regions we investigated. Consequently we can expect MPB outbreaks to behave in similar ways in whitebark pine containing stands as they would in high elevation lodgepole pine stands. However, the observation of a 1-year life cycle in regions that were previously climatically unfavorable for the MPB demands careful attention and likely indicates we will see more frequent and more severe outbreaks in areas where the MPB was not a problem previously.

For more information on this or other Mountain Pine Beetle Ecology publications, please contact: Keith McClain, Foothills Research Institute, Email: kmcclain@foothillsri.ca or visit www.foothillsresearchinstitute.ca.