QuickNotes

Science summaries from fRI Research

Introducing: The physiological costs and consequences of overwintering in Mountain Pine Beetle

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This research aims to deepen our understanding of Mountain Pine Beetle (MPB) winter biology to better understand the risks they pose to eastern boreal forests. For mountain pine beetle, success in a reproductive season is depends on conditions in the prior winter, and we lack a clear understanding of how and why winter climate conditions impact these beetles. Because of this, we lack the context needed to predict how climate variability or change will alter the course of MPB spread which limits informed management decisions. From other insect species, we know overwintering "success" is highly complex, and not just dependent on whether individuals survive a winter, but also includes what tissue damage they suffer and how much energy they consume during this critical non-feeding period.

Objectives

1. Determine the impacts of winter temperatures on MPB metabolism and energy status.
2. Characterize whether/how chilling affects MPB ion balance, tissue damage and survival.

Expected Outcomes

Like other insects, we expect MPB metabolic rate to be sensitive to temperature and that MPB will have considerable energy savings when sthey experience lower temperatures, such that they can emerge with greater energy stores (and be more likely to survive and reproduce). If temperatures get too low, we expect non-freezing cold injury occurs before MPB freeze. If this is the case, ionoregulatory collapse (an inability to maintain salt and water balance) is a likely cause.

Federal-Provincial MPB Research Partnership

Mountain Pine Beetle remains a severe threat to Alberta's pine forests despite the province making positive progress in controlling its spread within the province and reducing the risk to the rest of Canada.

Natural Resources Canada and Alberta Agriculture and Forestry have provided funding to a suite of projects with the goals of limiting the spread of Mountain Pine Beetle and mitigating damages where it has already invaded.

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Implications for management decisions

With the need to inform and revise risk management plans comes the requirement to incorporate new knowledge into revised estimates for spread-risk. The proposed research will fill critical knowledge gaps in the effects of climate on MPB physiology and fitness, and the mechanisms through which climate impacts MPB spread. This information will then be essential for provinces east of Alberta to develop informed risk response and risk management plans should MPB spread into their respective jurisdictions.

Value of Research

The expansion of the Mountain Pine Beetle range into Alberta has already cost the province hundreds of millions of dollars. This research will provide important economic benefits by identifying the causes and consequences of changes in beetle overwintering success, and by extension population size. This knowledge can help to realize significant cost savings to MPB management and control operations in future years.

Expected Completion Date

August 2023

For more information on this project, contact Dr. Heath MacMillan at heathmacmillan@cunet.carleton.ca