



**University
of Victoria**

Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Science

of

DEBRA WERTMAN

BSc Honours (University of Victoria, 2014)
BFA, Honours (University of Victoria, 2008)

**“The Light at the End of the Tunnel: Photosensitivity in Developing
Mountain Pine Beetle (*Dendroctonus ponderosae*)”**

Department of Biology

Wednesday, October 18, 2017
1:30 P.M.
Hickman Building
Room 120

Supervisory Committee:

Dr. Steve Perlman, Department of Biology, University of Victoria (Co-Supervisor)
Dr. Kathy Bleiker, Pacific Forestry Centre, UVic (Co-Supervisor)
Dr. John Taylor, Department of Biology, UVic (Member)

External Examiner:

Dr. Ward Strong, Kalamalka Forestry Centre, BC Ministry of Forests

Chair of Oral Examination:

Dr. Thomas Pedersen, School of Earth and Ocean Sciences, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

This research explores the capacity for functional photoreception in larvae of the mountain pine beetle (*Dendroctonus ponderosae*), an extremely important forest pest insect that is well adapted for development beneath the bark of pine trees. Phototaxis tests, gene expression analysis and development experiments were integrated to assess mountain pine beetle larvae for light sensitivity. When presented with a phototaxis choice test, larvae preferred dark over light microhabitats, revealing that larvae sense and respond behaviourally to light. Long wavelength opsin transcription was identified in all life stages, including eggs and larvae, suggesting that *D. ponderosae* possesses extraretinal photosensitive capabilities across its life cycle. The long wavelength opsin could function in phototaxis or the development phenology of immature beetles, while the ultraviolet opsin, only found to be expressed in pupae and adults, is likely to function in dispersal via the compound eyes. Results from two development experiments reveal an effect of photoperiodic treatment on beetle development rate when reared from the egg stage, but not when reared from mature larvae, indicating that a critical photosensitive life stage(s) must occur in *D. ponderosae* prior to the third larval instar. An effect of photoperiod on adult emergence rates, however, appears to be independent of larval rearing conditions. The discovery of opsin expression and negative phototaxis in eyeless mountain pine beetle larvae, in addition to an effect of photoperiod on immature development and adult emergence rates, suggest that light and photoperiodism likely function in survival and life cycle coordination in this species.