Executive Research Summary 2008

Cues for attracting and trapping western conifer seed bugs

Western conifer seed bugs, *Leptoglossus occidentalis*, have long been the bane of conifer seed orchards in British Columbia and elsewhere. Seed bug populations are difficult to monitor and manage, in part because there is no effective bait.

Collaborative research between scientists of the BC Ministry of Forests and Range (Drs. Ward Strong and Robb Bennett) and the Gries-laboratory at Simon Fraser University (with Dr. Stephen Takács, Tracy Zahradnik, Hannah Bottomley, and Dr. Gerhard Gries as team members in this project) has revealed how seed bugs forage for cone-bearing trees. Cones emit strong infrared (IR) radiation that foraging seed bugs perceive through special infrared receptors on the ventral side of their abdomen. Occluding these receptors completely impairs the bugs' ability to find cones.

Recording the infrared radiation from cones and foliage every hour for 24 hours revealed that cones were generally warmer than foliage between 7:00 and 18:30, with a peak difference in temperature of 21°C at 11:30 (white pine) or 9°C at 16:30 (Douglas fir). White pine cones were distinguishable from foliage throughout the entire day and night, but Douglas fir cones were distinguishable only between 5:30 and 23:30. Surprisingly, at night cones appear colder than foliage. These results imply that other seed predatory insects, like nocturnal cone moths, could also exploit cone-derived IR cues to locate oviposition sites.

Our IR recordings further revealed that clones differ in the IR profile of their cones, which could contribute to the seed bugs' preference for specific clones. This line of research will be expanded in 2009.

With evidence emerging that a combination of IR radiation and visible-light wavelengths might attract seed bugs more strongly than IR radiation alone, we have begun to investigate the retinal response profile of the bugs' compound eyes. Exposing eyes of females and males to 31 Light Emitting Diodes emitting light at peak wavelengths in range of 370 to 670 nm revealed that wavelengths in the blue and green range elicit the relatively strongest retinal responses (voltages). Moreover, relatively strong retinal responses to wavelengths of 390 nm (UV), 433 nm (violet), 470 nm (violet/blue), 480 nm (blue), 567 nm (green), 592 nm (green), and 621 nm (yellow) suggest that seed bugs have different types of photoreceptors to perceive light stimuli from cones. All these photoreceptors are present in dorsal, equatorial and ventral sections of the compound eyes.

This year's research will (*i*) determine the behavioral response of seed bugs to key wavelengths of visible lights; (*ii*) investigate interactions between IR radiation and specific wavelengths of visible light for the strongest possible attraction of seed bugs; and (*iii*) determine optimal trap size or type for trapping seed bugs. Our overall objective is to develop an effective trap for (mass) trapping seed bugs in seed orchards.