

Final report (2007-2008 fiscal year)

Cone-derived Infrared (IR) foraging cues for the Western

Conifer Seed Bug, *Leptoglossus accidentalis*

Progress

The following list describes our main findings:

- 1) In surface temperature measurements and thermographs of cones and needles, using respectively a thermocouple and Thermovision camera, cones were up to 15 °C warmer than needles and emitted significantly stronger mid-range (3,000-5,000 nm) IR radiation;
- 2) Near IR (1000-2500 nm) spectra from cones and needles were similar but their visual and very-near IR spectra (300 – 1000 nm) differed;
- 3) In two-choice laboratory experiments, both male and female seed bugs preferred stronger IR radiation (emitted by a Pyrex® flask containing water at 42 °C) over weaker IR radiation (emitted by a Pyrex flask containing ice water);
- 4) In a two-choice field experiment with 10 replicates, 35 out of 36 captured seed bugs were retained on adhesive-coated pipe traps emitting the stronger IR stimulus than on adhesive-coated cold traps with which they were paired;
- 5) Scanning electron micrographs of the seed bugs' body surface revealed a pair of IR receptor sites on each abdominal segment 1-4;
- 6) Exposing an IR receptor site to intermittent IR radiation elicited changes in receptor potentials of > 5 mV;
- 7) Microsurgical removal of fat body and muscles in dissections of seed bugs, and staining of neurons with methylene-blue, revealed the innervation of IR receptor sites;
- 8) Seed bugs with occluded (silica-painted) IR receptors were incapable of responding to the stronger IR cue in two-choice experiments, whereas control insects which were silica-painted near, but not over, IR receptor sites were strongly attracted to the stronger IR cue;
- 9) More seed bugs were captured in green traps than in yellow, white or black traps, suggesting that colour – in addition to IR radiation – constitutes a foraging cue;

- 10) Small green traps were more effective than large green traps, suggesting that trap size affects trap efficacy.

Predictions

We predict that:

- (1) specific wavelengths of visible light reflected from cones constitute foraging cues for seed bugs;
- (2) optimal trap size must not greatly exceed natural cone size; and
- (3) IR, visible-light wavelength(s) and specific cone (trap) size are synergistic cues for attracting seed bugs.

Research Objectives

We plan to:

- (1) conduct electro-retinograms with specific wavelengths of visible light;
- (2) determine behavioral responses of seed bugs to key wavelengths of visible lights;
- (3) investigate interactions between IR radiation and specific wavelengths of visible light for attraction of seed bugs; and
- (4) determine optimal trap size.

Overall Goal

Our overall objective is to develop an effective trap for (mass) trapping *Leptoglossus* seed bugs in seed orchards.