

LEPTO-CAMS AND THERMOCOUPLES: WHY DO INSECT BAGS PREVENT AUGUST Pii SEED LOSS IN THE INTERIOR OF BC?

Lodgepole pine (*Pinus contorta* var. *latifolia*) seed orchards in the Southern Interior of BC have suffered from low seedset for many years. The causes largely remain a mystery, despite years of research. In 2011 and 2012, it was discovered through bagging studies that much of the seed loss occurred in August. The August seed loss is entirely preventable by enclosing the cones in mesh bags, while seed loss earlier in the season was not affected by mesh bags.

Only two theories exist as to why mesh bags prevent seed loss. One is that the bags alter the microclimate, protecting the cones from, for example, extreme heat events. The other is that the bags exclude *Leptoglossus occidentalis*, the western conifer seedbug, which might feed on seeds during August. Both theories were tested during the summer of 2013.

The microclimate theory was tested by choosing 4 cones on each of 10 lodgepole pine trees in commercial seed orchards in Vernon, BC. Cones were close together, with similar aspect and tree height. A one millimetre hole was drilled into the base of each cone, and a small K-type thermocouple was inserted and held in place with zip-ties. All four thermocouples on each tree were connected to a 4-channel datalogger that recorded the internal cone temperatures at 5 minute intervals. Two of the cones on each tree were enclosed in a mesh bag; the other two were left unbagged. Internal cone temperatures were compared between bagged and unbagged cones, examining maximum temperatures and times spent above various temperature thresholds.

The seedbug theory was tested by installing one time-lapse camera in each of the 10 trees used in the thermocouple experiment. Each camera was aimed at a cluster of 3–4 cones and set to take photos at 5 minute intervals. A similar cone cluster on a nearby branch, with the same aspect and tree height, was enclosed in a mesh bag. Photos were examined for the presence of seedbugs, which were categorized by activity: feeding, walking, mating, etc. At season's end, bagged and unbagged cones will be harvested and seeds extracted to determine the extent of filled seed loss.

As of July 3, 79,206 cone temperature measurements had been taken. Mean cone temperatures were always slightly higher in bagged than in unbagged cones. Bagged cones also had more hours above any given threshold temperature, such as 35°C. There is more variation in cone temperatures between trees and between cones within a treatment, than between treatments. No statistical analysis has been conducted yet, but it appears that cone temperatures are unlikely to be the cause of the August seed loss.

By July 3, 81,425 images had been collected and examined. Of these, 1,703 images showed seedbugs on or near the cones. Feeding was a dominant activity. Each cone cluster was fed upon from 0 to 19.7 hours. Seedbugs were never observed feeding on two cone clusters. These sightings confirm previous evidence that there is a clonal difference in seedbug host preference. It also confirms the likelihood that seedbugs are responsible for the August seed loss.

However, these data only record events up to July 3. Things might change during the month of August. Bags might shield cones from extreme heat events not experienced during May or June. Seedbugs may not feed upon cones during August. Though this evidence is suggestive, we must wait until our August data have been collected before drawing conclusions.

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