Tissue Damage During Cold Exposure in the Sugarbeet Root Maggot, *Tetanops myopaeformis*

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Background

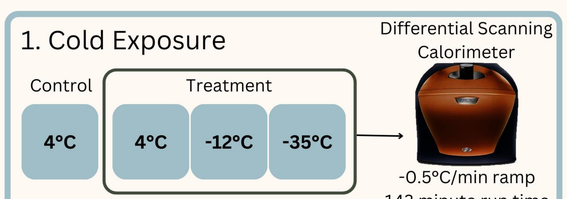
Sugarbeet root maggots (SBRM) feed on sugar beets, decreasing production and agricultural profits in the Red River Valley.
SBRM are freeze tolerant, surviving damage after freezing.
Previous work in Drosophila show that fat body damage develops immediately after freezing.[1]
It is unclear in which tissues or how much damage occurs post-freezing in SBRM.

Hypothesis: Cold temperatures will cause non-lethal tissue damage to the fat body, Malpighian tubules, and midgut.

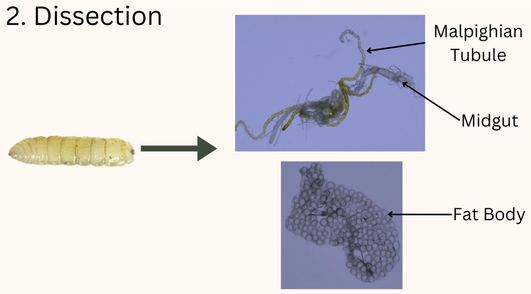
Goal:
Determine the proportion of live and dead cells in the fat body, Malpighian tubules, and midgut at decreasing temperature treatments.

Methods

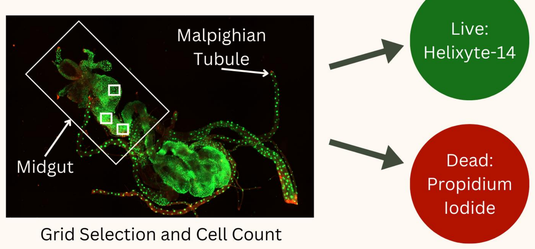
1. Cold Exposure



2. Dissection

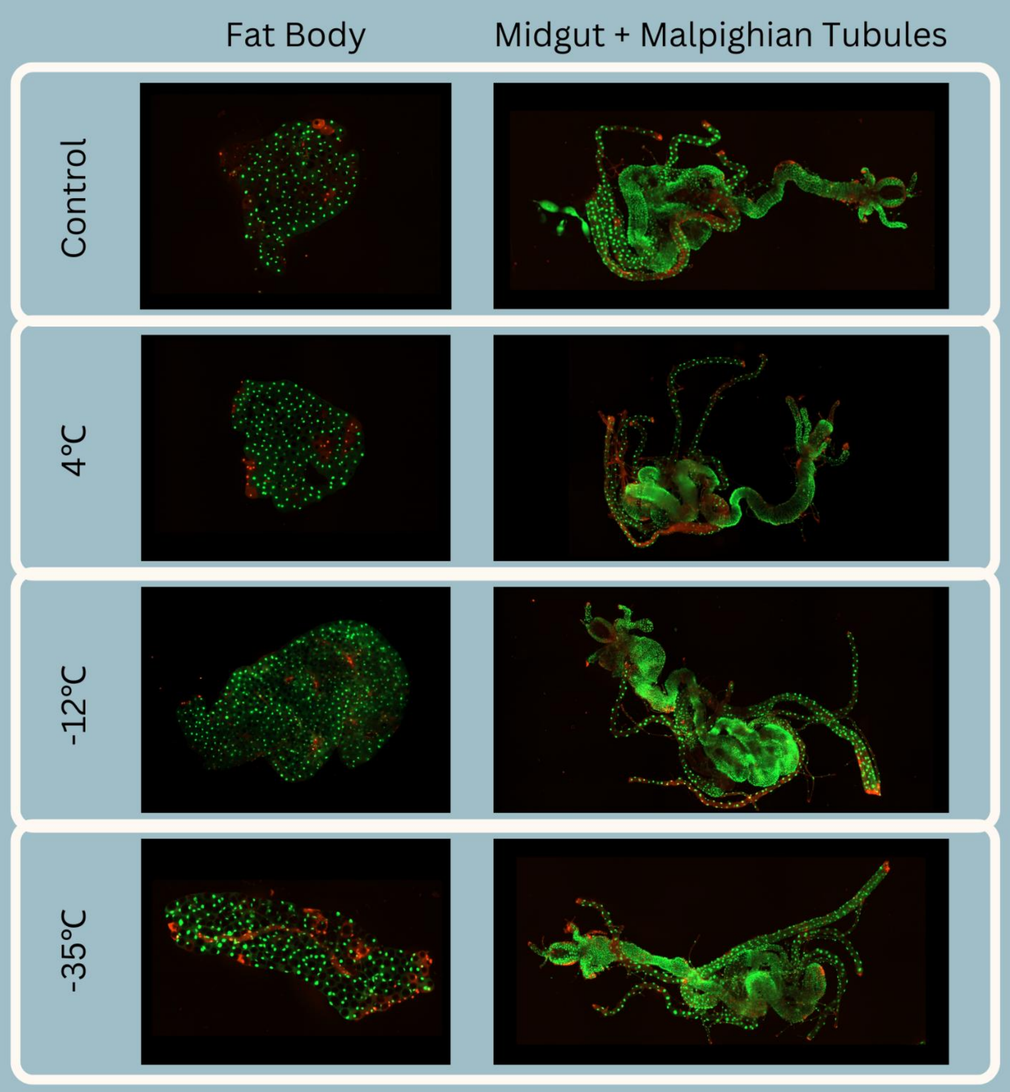


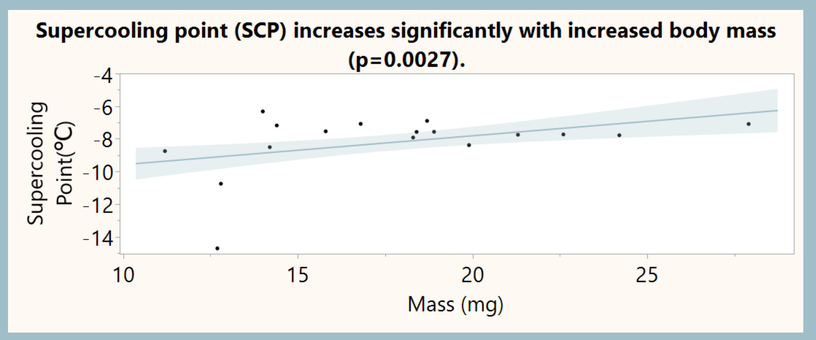
3. Live/Dead Stain

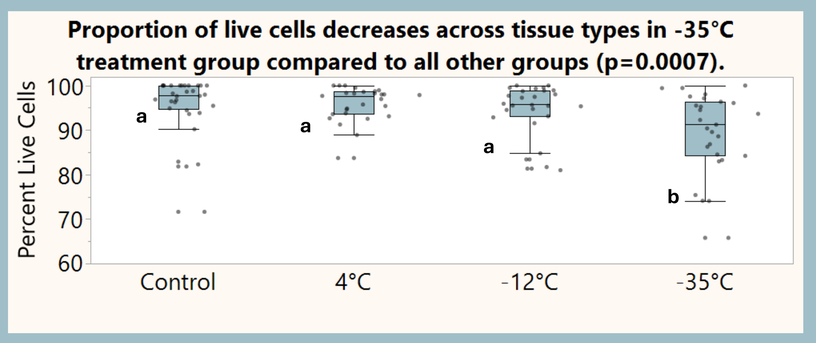


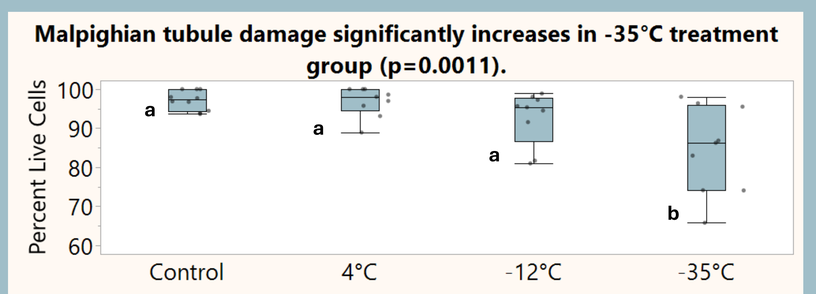
Grid Selection and Cell Count

Results









Conclusions

There was a significant decrease in cell survival at 35°C, signifying that damage occurs immediately after extreme cold exposure.

The difference in cell survival was driven by significant damage to the Malpighian tubules, which may impact osmoregulation during thawing.

Individuals in the -35°C treatment group had an overall higher body mass than other groups. SCP increased with higher body mass, so large individuals may be more prone to tissue damage.

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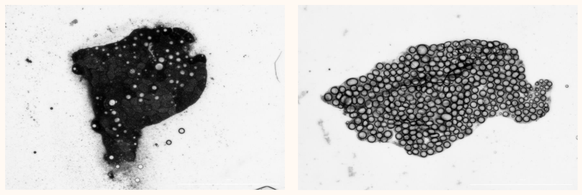
References:

1. Rozsypal, Jan, Jantina Toxopeus, Petra Berková, Martin Moos, Petr Šimek, and Vladimír Koštál. "Fat Body Disintegration after Freezing Stress Is a Consequence Rather than a Cause of Freezing Injury in Larvae of Drosophila Melanogaster." *Journal of Insect Physiology* 115 (May 2019): 12–19.

Future Directions

Investigate visible change to fat body tissue that occurred in individuals that froze.



Brightfield image of fat body in control (left) and in -35°C treatment (right)

Assess recovery of tissue over time post-freezing event.

Continue experimentation at lower temperatures or longer exposure times.