

The Effects of Diet Size on Supercooling Point and Water Content in *Megachile rotundata*

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Introduction

- *Megachile rotundata* is an effective pollinator of alfalfa, increasing seed production.
- Insect adult size is directly related to the provision size provided during the larval phase.
- Overwintering success is affected by an insect's supercooling point and free water content.
 - **Supercooling Point (SCP):** temperature at which a liquid spontaneously freezes.
 - **Free water content:** Water that is not bound with macromolecules.

Purpose

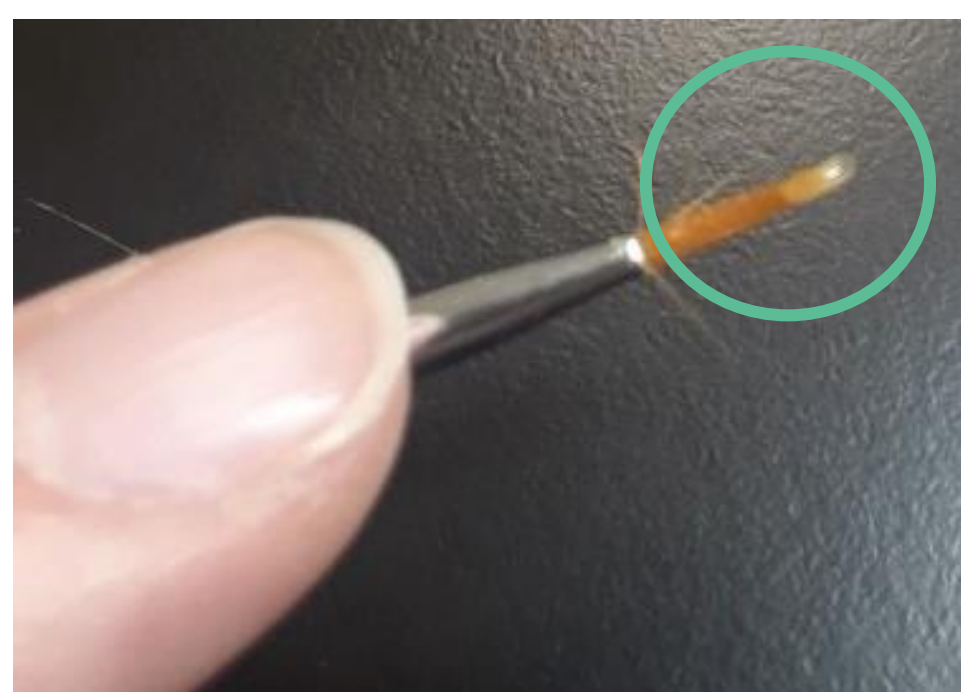
- Understanding how prepupa mass affects supercooling point and free water content is important because they can predict the bees' future overwintering success; this could provide future insights into diapause preparation at a cellular level.

Hypothesis

- Provision size large (150mg = L) or small (50mg = S) will affect prepupa mass.
- Supercooling point will not be affected by provision size.
- The percent free water will not be significantly different between provision sizes.

Methods

Collect eggs from the field



Place eggs on diet provisions

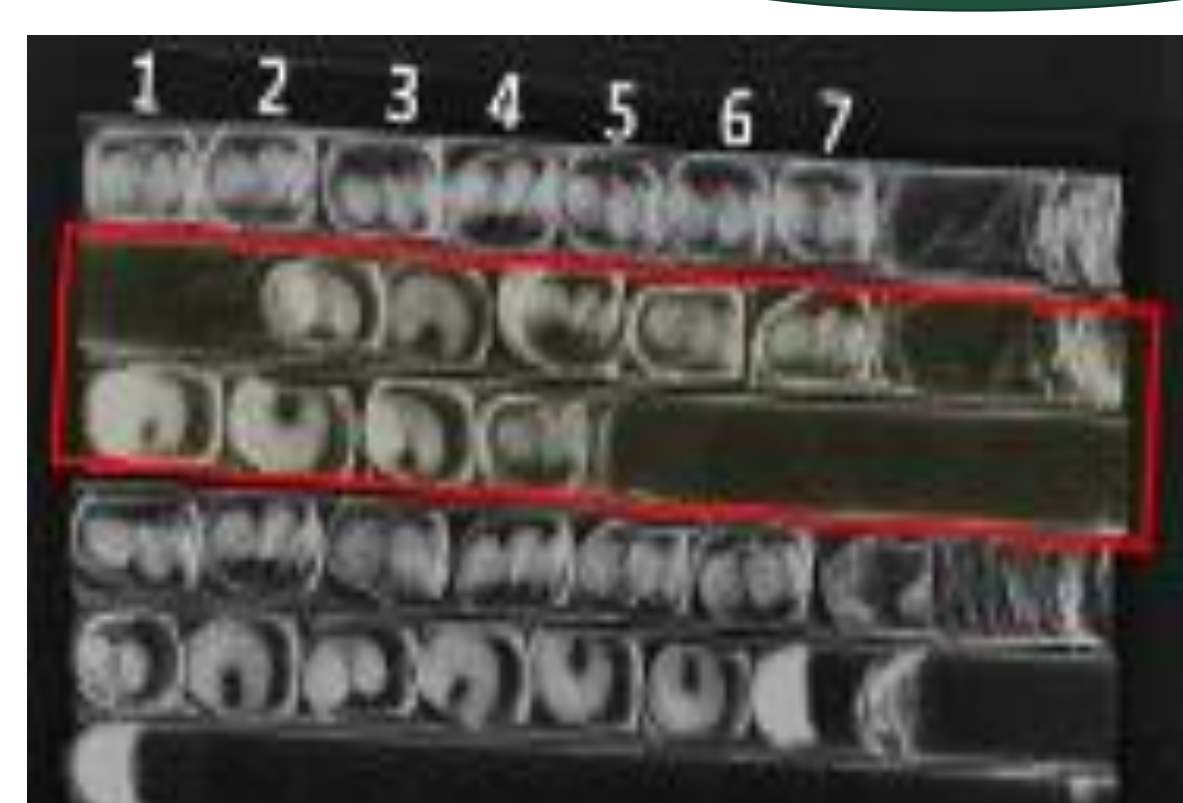


Record the SCP for each prepupa

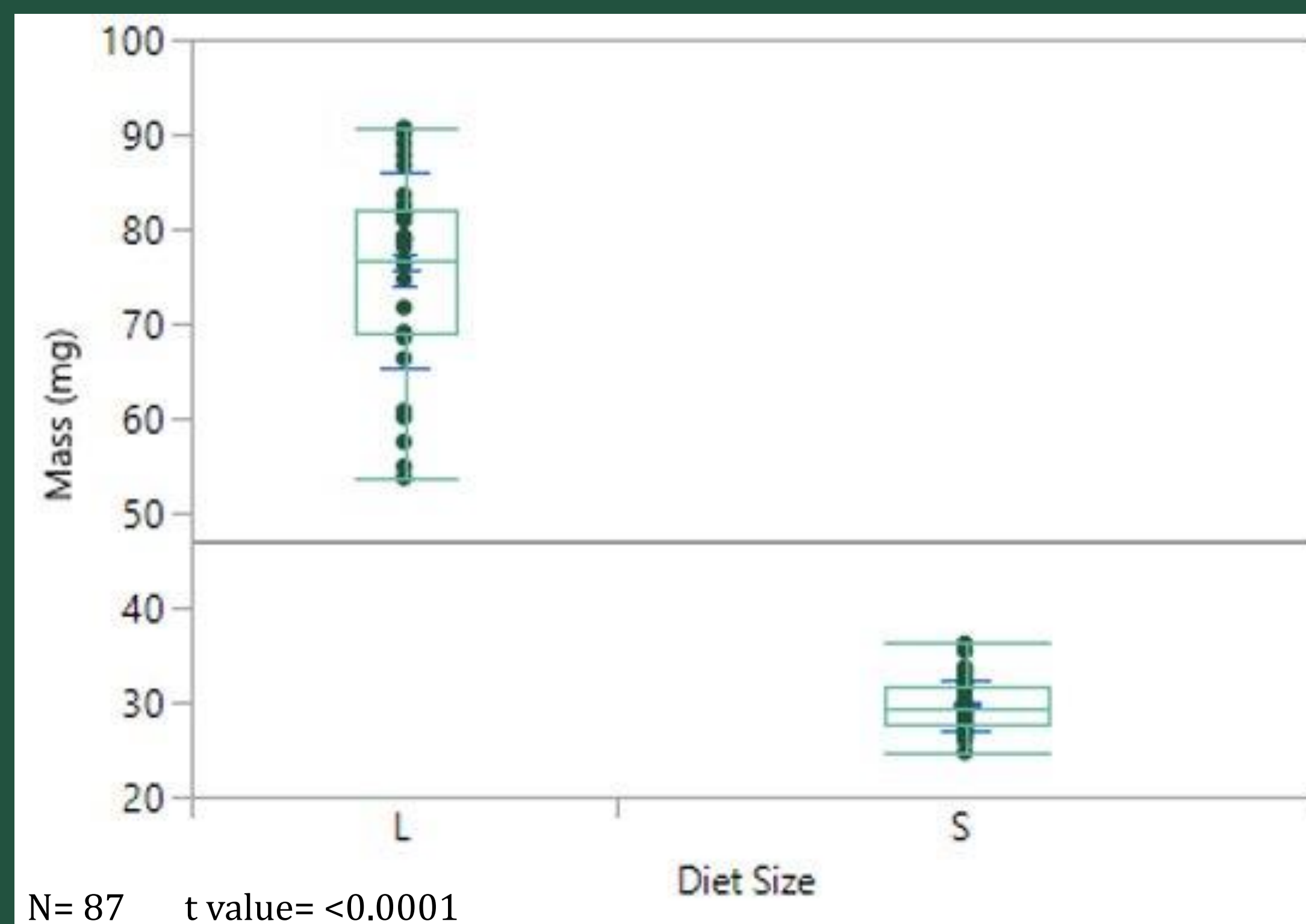


Select random bees for water content

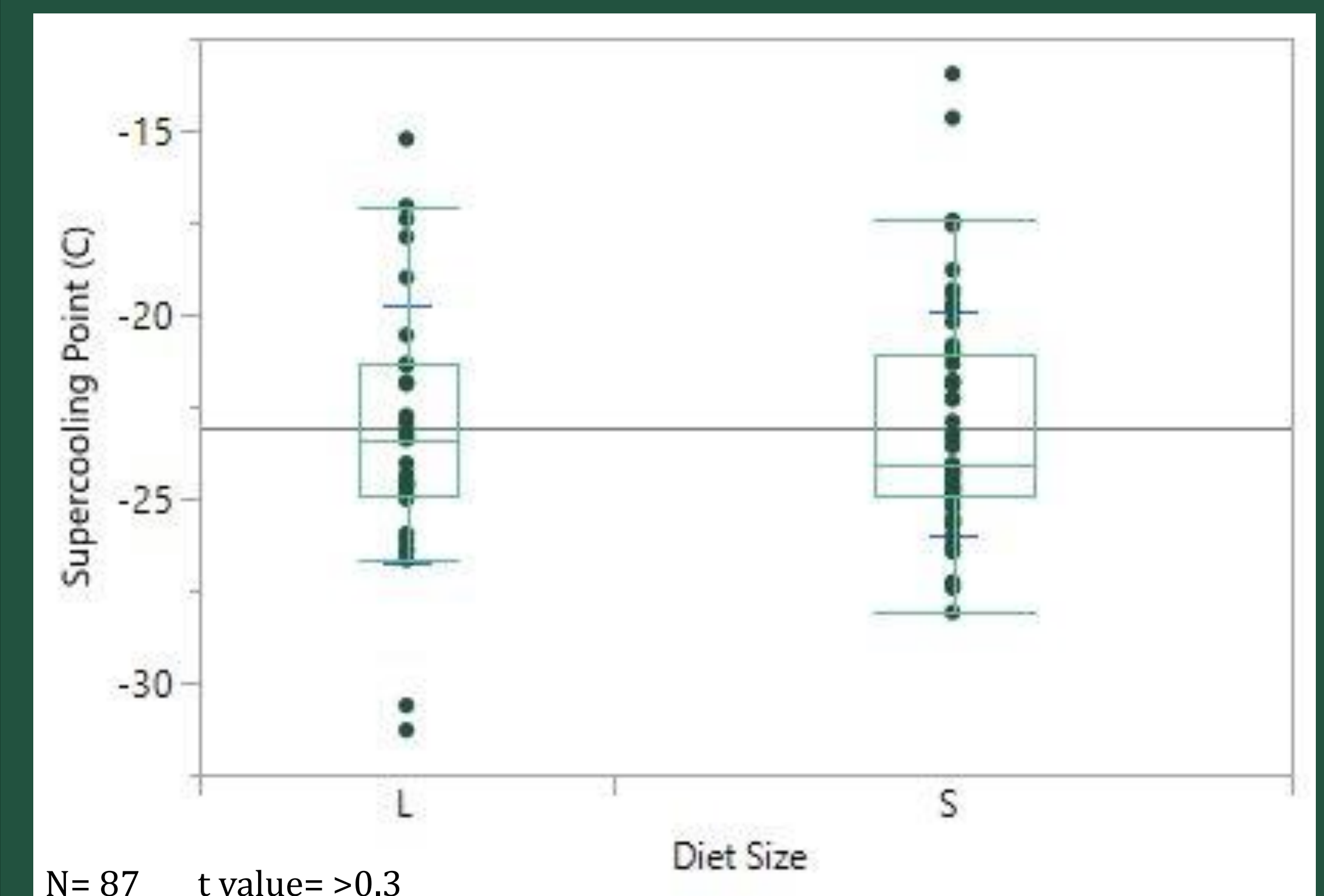
X-ray siblings for diapause status



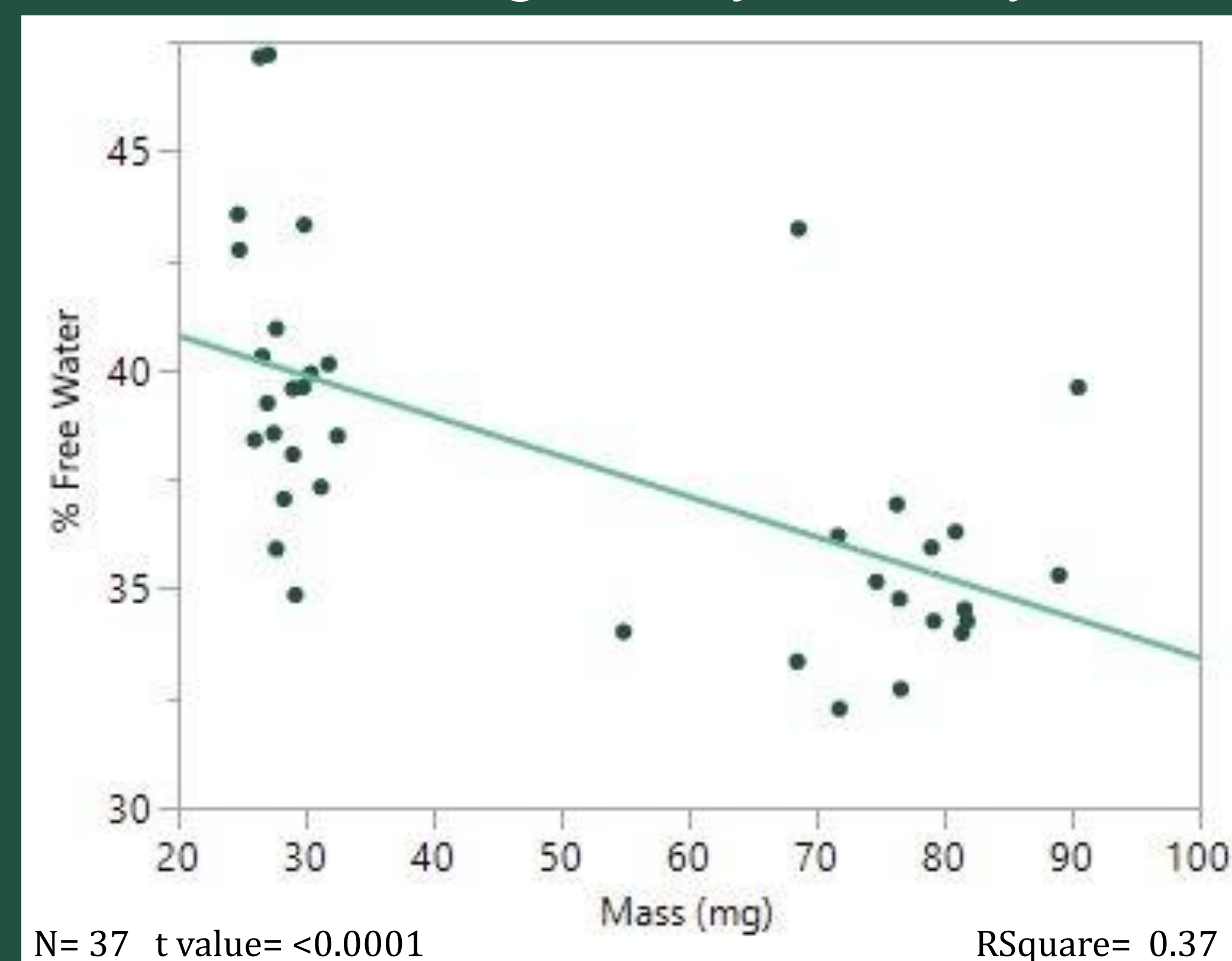
Provision size significantly affects mass.



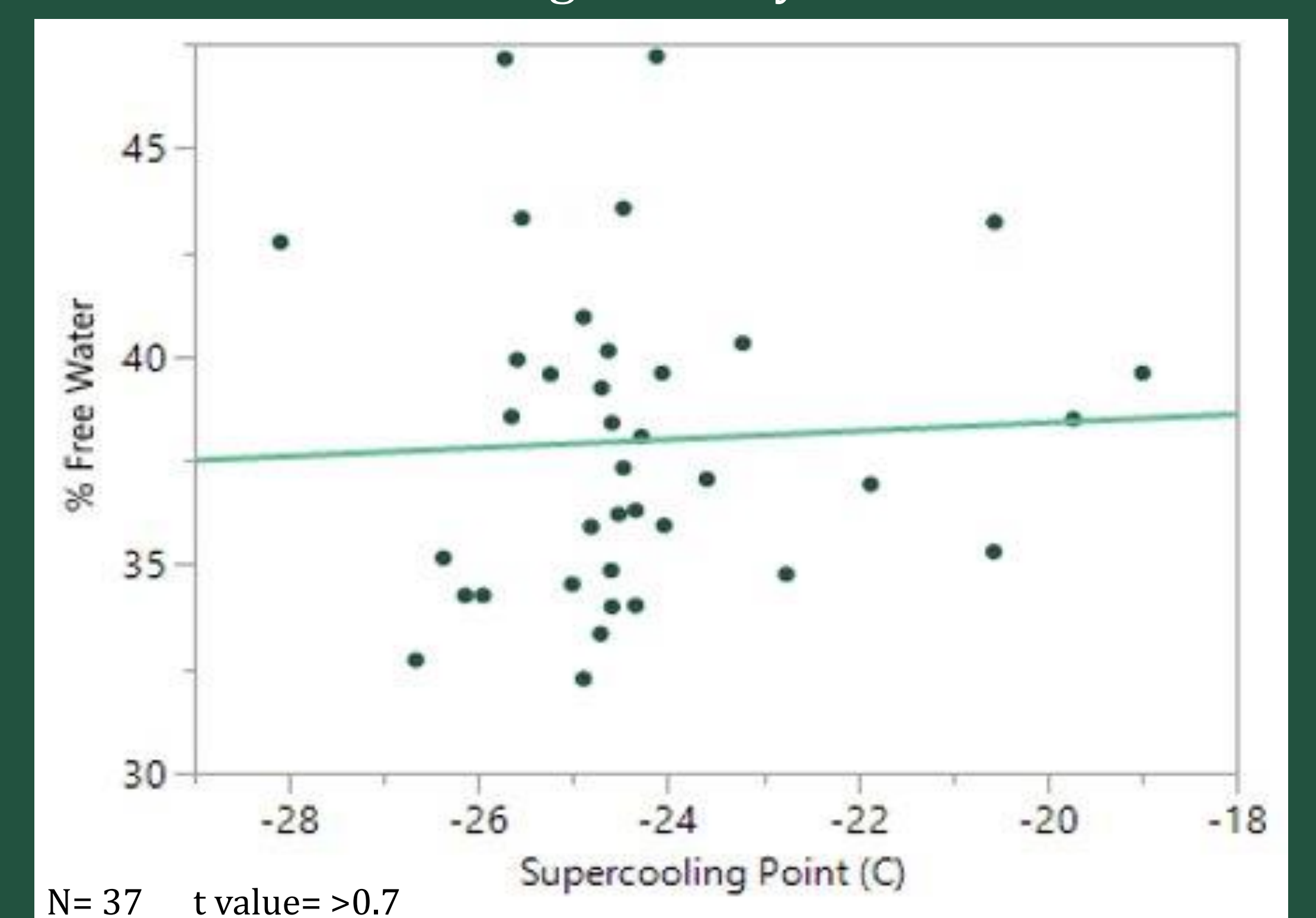
Provision size does not significantly affect SCP.



Free water is significantly affected by mass.



Free water is not significantly correlated to SCP.



Conclusion

- From the data collected, *M. rotundata* prepupa have a SCP between -11°C and -33°C, and a free water content that varies from 33% to almost 50%.
- Prepupa mass does not affect the bees' supercooling points, however the free water content is affected.
- The bees collected were diapausers, which will overwinter, therefore a decreased and consistent SCP is beneficial.
- A potential reason for there to be a relationship between percentage of free water and prepupa mass, is that the larger bees have a higher lipid content and because of that a higher proportion of water is isolated between and within fat bodies.
- There was a difference in the amount of free water present when compared to mass, however this did not lead to a significant difference in SCPs between diet sizes. The SCP is likely being affected by other things such as lipid content, as well as the presence of cryoprotectants, such as glycerol.

Future work

- Compare lipid content between different provision sizes.
- Compare glycerol, a known cryoprotectant, amounts in large and small diet bees.
- Repeat this experiment with non-diapausing bees.

Acknowledgments

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Sources and References

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