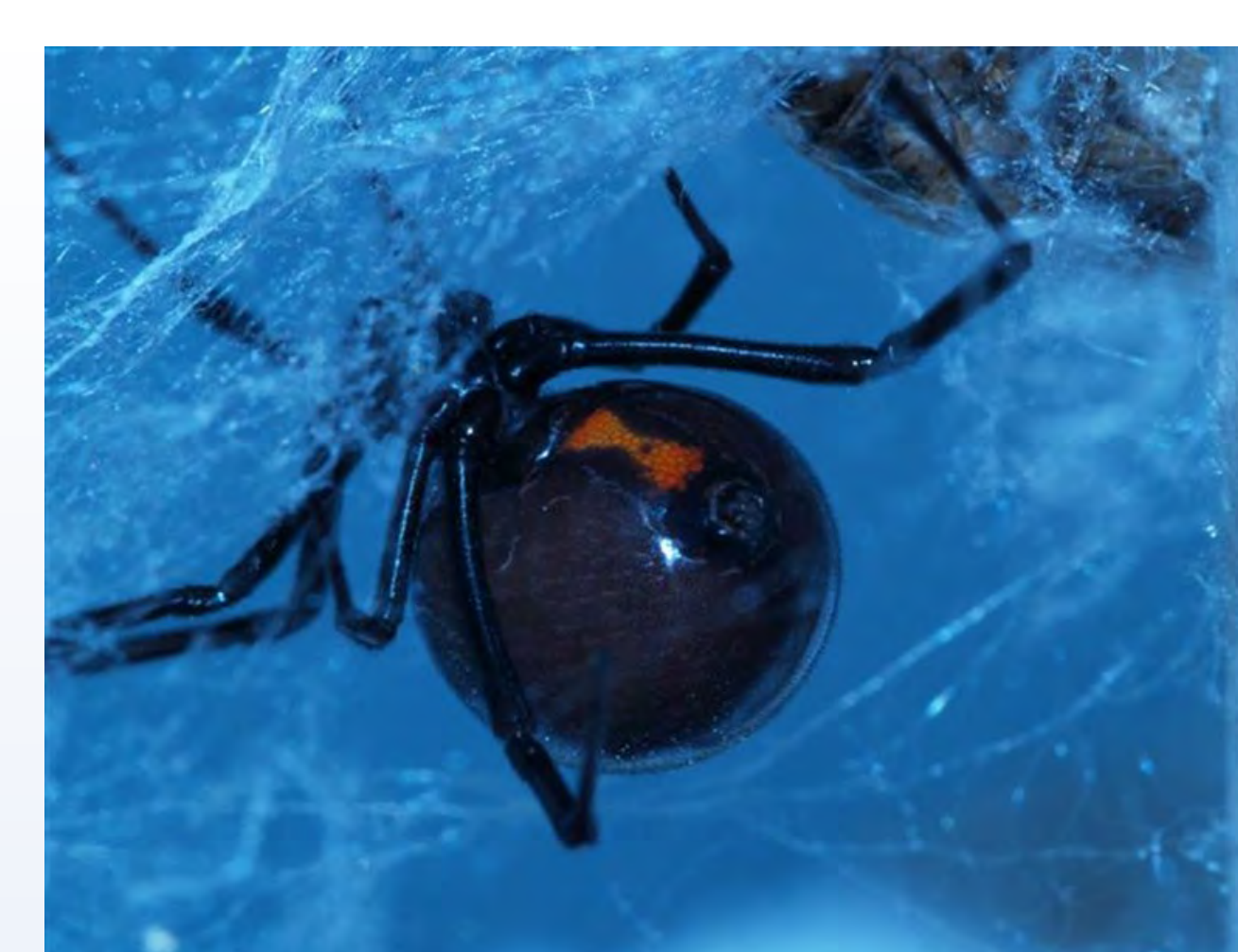


# The Effect of Urban Heat and Food Availability on Black Widow Spiders

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## Introduction

- Urbanization creates unique ecosystems, and can alter species diversity and organismal life history [1].
- The Urban Heat Island (UHI) effect results from using heat retentive building materials and causes elevated temperatures [2].
- Urbanized deserts often have a higher resource and prey availability than desert areas [3].
- Black widow spiders (*Latrodectus hesperus*) are a medically-important species [4] that often infest urban habitats [5].
- Urban black widow microclimates are 6°C hotter than desert areas. In the lab, this UHI hurts longevity, growth, and mass [6].
- We predicted that combining urban prey availability and elevated UHI temperatures would favor longevity, growth, and mass.

## Methods

- Adult female spiders were collected from urban habitat across Maricopa county.
- Egg sacs were collected from 16 of these spiders, and 100 eggs from each egg sac were weighed ( $\mu\text{g}$ ) and imaged ( $\text{mm}^2$ ).
- Individual eggs were placed in transparent boxes (4x4x5cm), and reared at 24°C until hatched.
- At day 30, hatched spiderlings from each family were divided between temperature treatments (27°C =desert; 33°C=UHI).
- Half of the spiderlings from each temperature treatment were fed 8 flies per week (low food), and half were fed 16 flies per week (high food).
- Survival, development speed, mass at day 105, and the sex of each spiderling were included as measures in our analyses.

## Results

- Family had a significant effect on both longevity and developmental speed (see Figure 1).
- Food and temperature each independently affected developmental speed, but we found no interaction between these variables (see Figure 2).
- Food and temperature each independently affected body mass, but we found no interaction between these variables (see Figure 3).
- Food had a significant effect on longevity. A high food diet resulted in an increase in longevity of an average of 2.375 days (see Figure 4).
- The sex of a spiderling did not have a significant effect on any of the variables analyzed.

## Discussion

- UHI temperatures and low food each hurt development, mass, & longevity.
- However, we did not find the predicted interaction where UHI conditions favor black widows when food is abundant.
  - We still have no explanation for why UHI conditions in the laboratory limit black widows that clearly thrive under urban field conditions.
- Perhaps the spatial and/or temporal complexity of urban habitat provides a buffer from extreme temperatures not seen from laboratory protocols.
- Family of origin continues to be an important variable in predicting the black widow's life history.
  - Despite manipulation of both temperature and food availability, variation within sibships continues to be smaller than between sibships.

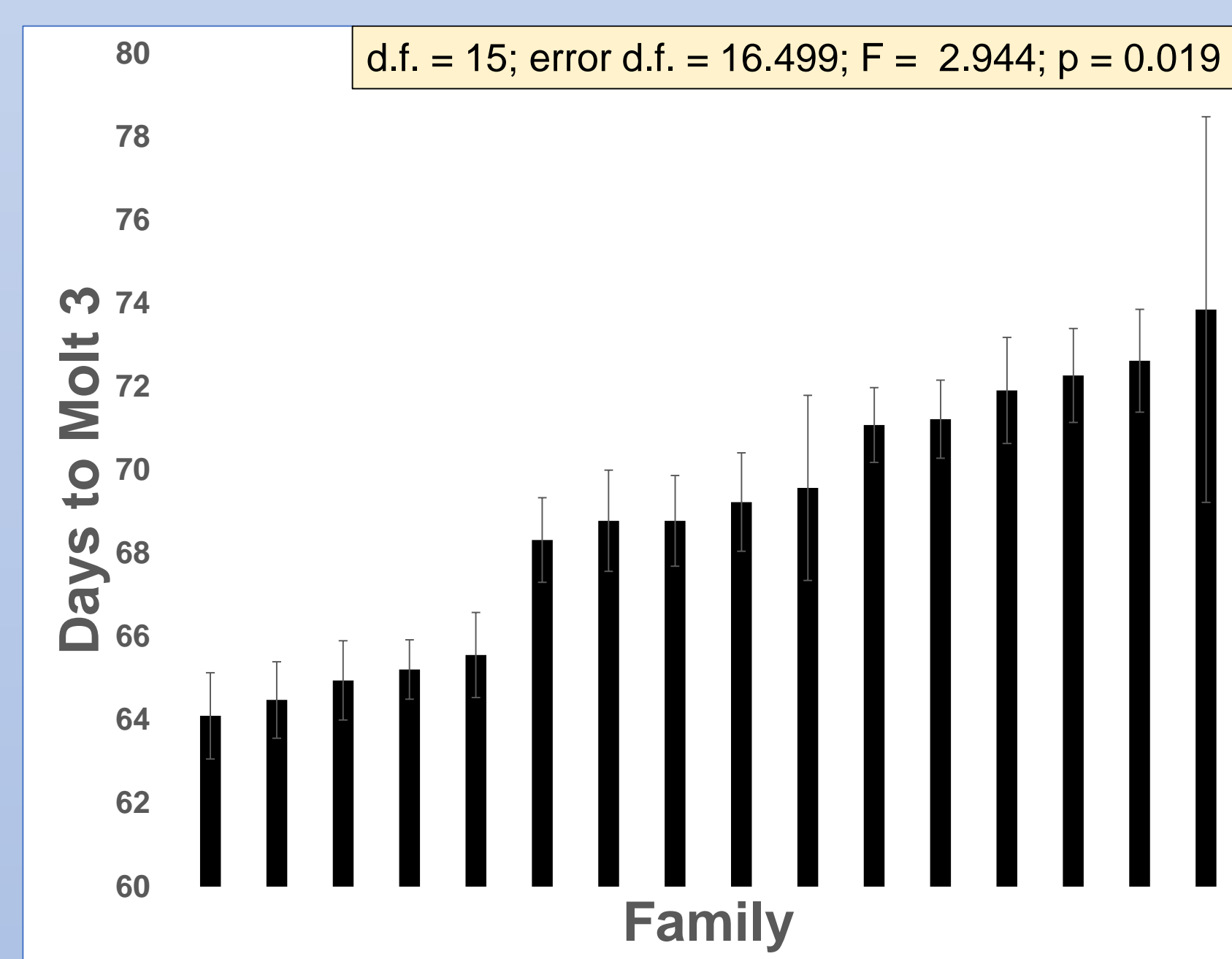


Fig. 1 Family Affects Development

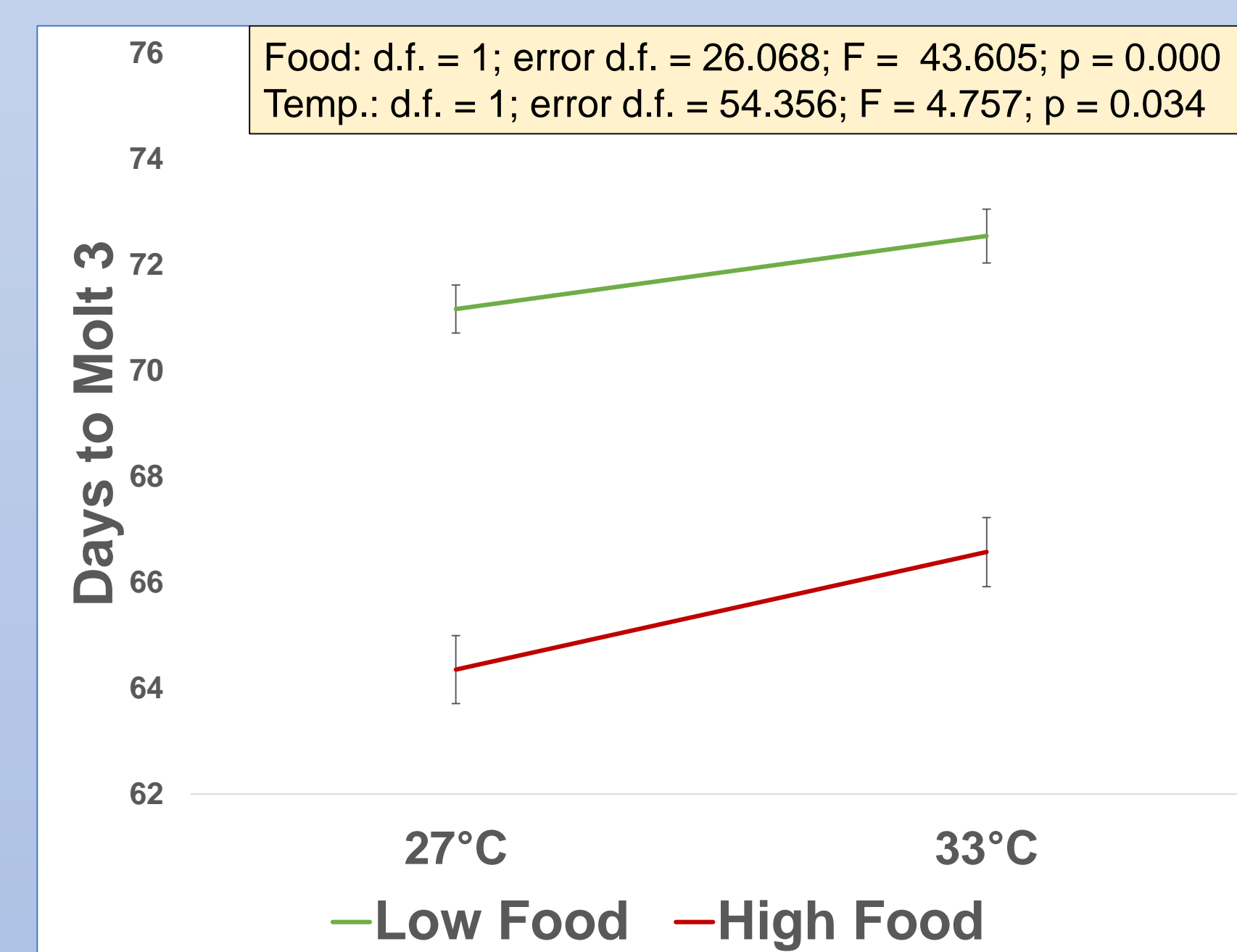


Fig. 2 Food & Temperature Affect Development

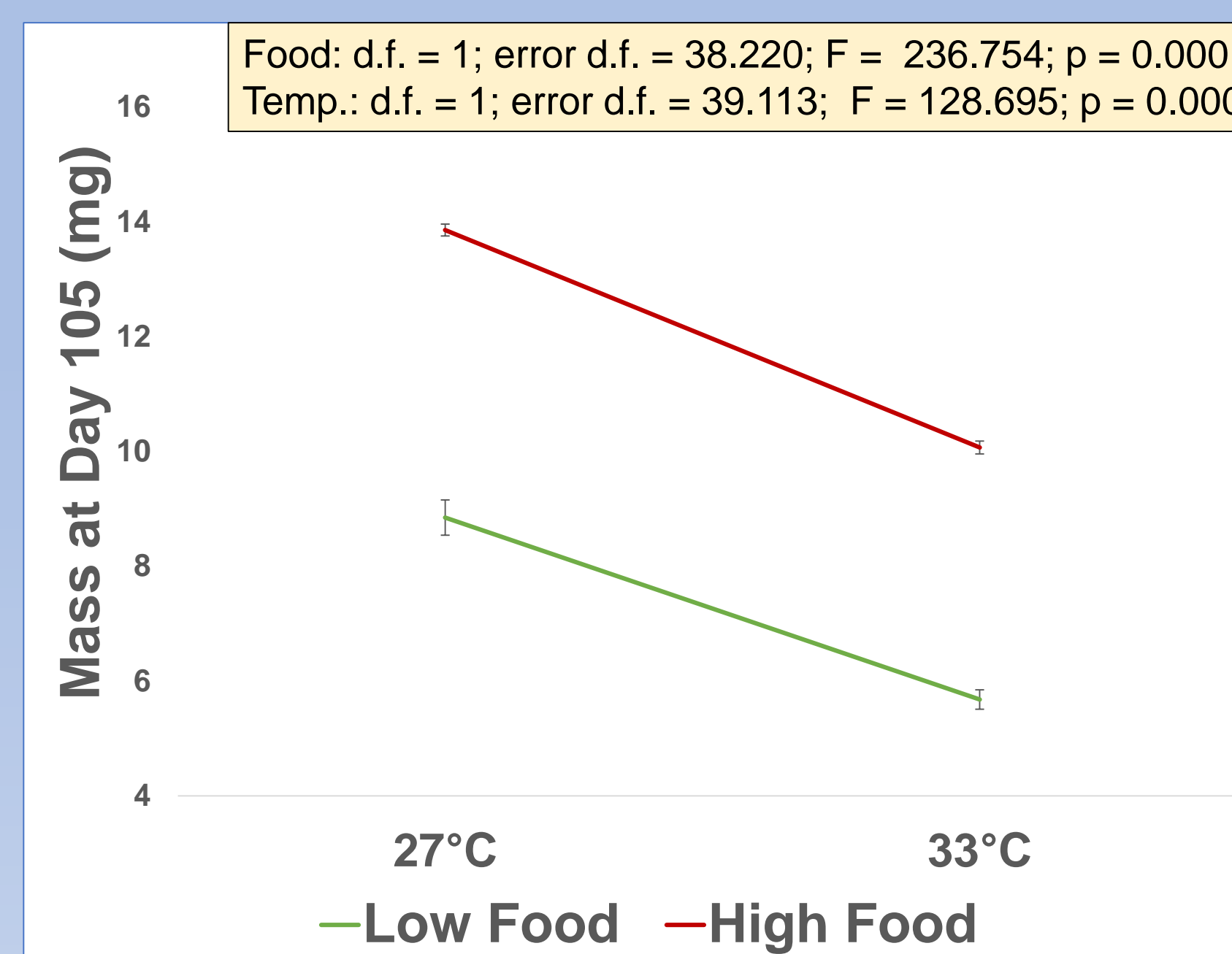


Fig. 3 Food and Temperature Affect Mass

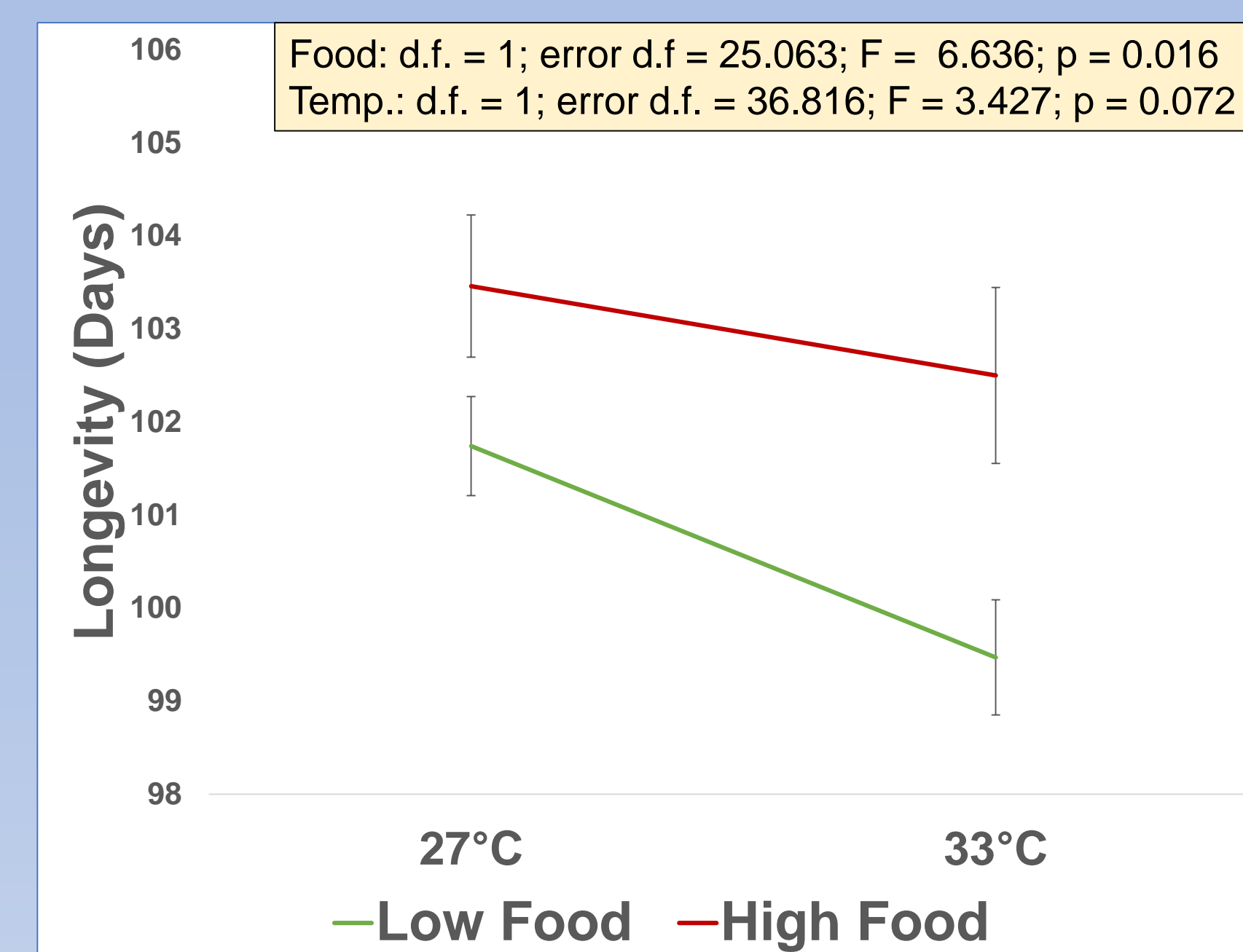


Figure 4. Food Affects Longevity

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