

Grasshoppers in Wood River: A relic population of the presumed extinct Rocky Mountain Locust?

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Abstract

Locust plagues used to sweep across the western United States, and caused immeasurable damage to agriculture. When the Rocky Mountain Locust, *Melanoplus spretus*, seemed to go extinct at the turn of the 20th century, a huge economic pressure on landowners was relieved. A resurgence of plague locusts in North America could prove disastrous if not properly anticipated and addressed.

Landowners in Wood River, AK reported an outbreak of unusual grasshoppers on their homestead. They asked UAM (Univ. Alaska Museum) for help and we determined that these grasshoppers, with their dark coloration and long elytra, were unlike any other specimens collected around Alaska. **Due to their superficial resemblance to the extinct *M. spretus*, we decided that the taxonomic identity of these grasshoppers was of great importance and opted to explore the morphometric relationships between the wood river hoppers, *M. sanguinipes* (extant migratory grasshopper and close relative of *M. spretus*), and *M. spretus*.**

Tegmina length was measured for all Wood River hoppers, and a random sample of *M. sanguinipes* from the UAM collection. Measurements of *M. spretus* from Lockwood 1989 were used for comparison.

Preliminary results indicate that there is a statistically significant difference in tegmina length between the two populations, with Wood River hoppers having longer, “spretus-like” tegmina. Genomic analysis would provide greater insight into the relationship between these animals.

Background

- Locusts (*Melanoplus spretus*) once plagued the Western U.S. and Canada, went extinct at the turn of the 20th century¹
- Largest grouping of any land animal ever (200,000 mi² of insects, trillions of individuals)²
- Extinction poorly understood, mechanism unresolved - some argue *M. spretus* is migratory phase of extant *M. sanguinipes*³
- Locust swarms rare in Alaska, first recorded in 1951 and virtually absent since 1992⁴
- Homesteaders reached out about rural outbreak of grasshoppers near Wood River, AK in 2023
- Outbreak hoppers with long, dark tegmina (resembling *M. spretus*)
- Lockwood 1989 argues that tegmina length distinguishes *M. sanguinipes* from *M. spretus*⁵
- UAM Entomology investigates!

Methods

Collection (Bruce & Bonni Burnell):

- Homesteaders in Wood River, AK reached out about outbreak of grasshoppers on their land. They were instructed to keep as many specimens as they could until they could be delivered to the University of Alaska Museum.
 - Outbreak took place in July of 2023, specimens were collected and kept until November 2023
 - Samples were stored dry and kept in freezer.



Outbreak hoppers seen on wooden fence post in Wood River, AK (cred. Bruce & Bonni Burnell)

Lab Work (Luke Lawson, Derek Sikes):

- Wood River specimens pinned and sorted by sex (immatures excluded)
 - Wood River collection event yielded 10 male and 14 female specimens
- 25 specimens of *M. sanguinipes* of each sex randomly selected from UAM collection
 - Two full drawers were used for sampling
 - 5 random unit trays were selected per drawer, 5 random specimens were selected per unit tray
- Tegmina of all specimen were measured from tubercle (Gurney & Brooks 1959) to apex
 - Each specimen was measured under microscope to ensure accuracy
 - Measurements were taken with digital calipers from the junction of the subcostal and radial veins to the apex of the elytra
 - Measurements then entered into Excel spreadsheet



Left: Outbreak hoppers with long, dark tegmina. Right: *M. sanguinipes* from UAM collection. (cred. Derek Sikes)

Statistical Analysis (Luke Lawson):

- Data prepared for use in R
 - Converted Excel spreadsheet to CSV, loaded into R script
- Two sample t-test
 - Tested both samples against each other for each sex
 - Alpha initially 0.001, adjusted to 0.0005 after two test Bonferroni correction
- Graphing
 - Box and whisker plots produced using R and ggplot2 package
 - Plot created for each sex including overlaid dot plot on box and whisker

Results

Statistical analysis shows a significant difference between the Wood River hoppers and randomly sampled UAM specimens of *M. sanguinipes*.

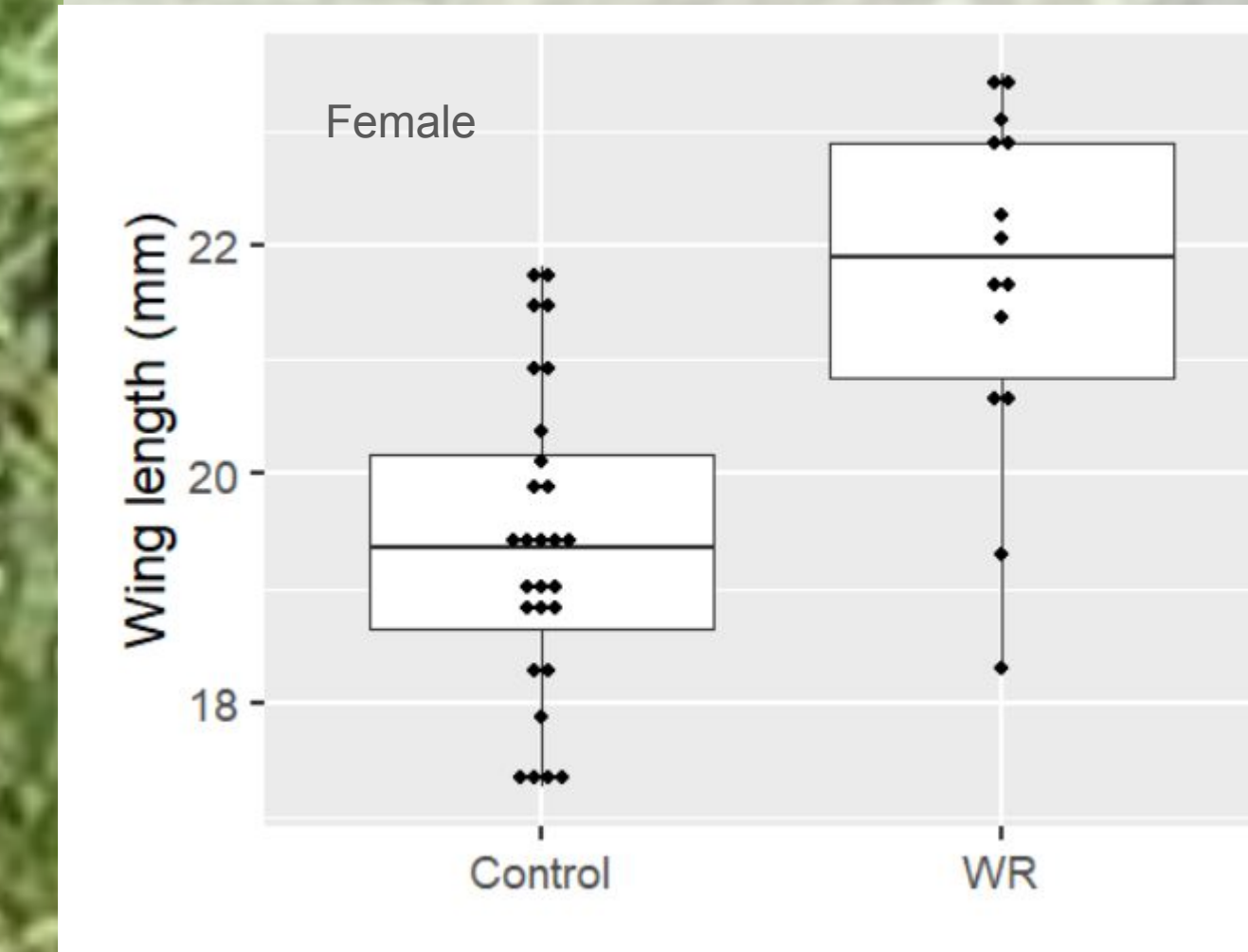


Figure 4. Box plots showing difference in wing length distribution between female *Melanoplus sanguinipes* specimens in UAM (n=25, ‘Control’), and Wood River, AK outbreak specimens (n=14 ‘WR’). T-test of the means p=0.0000862

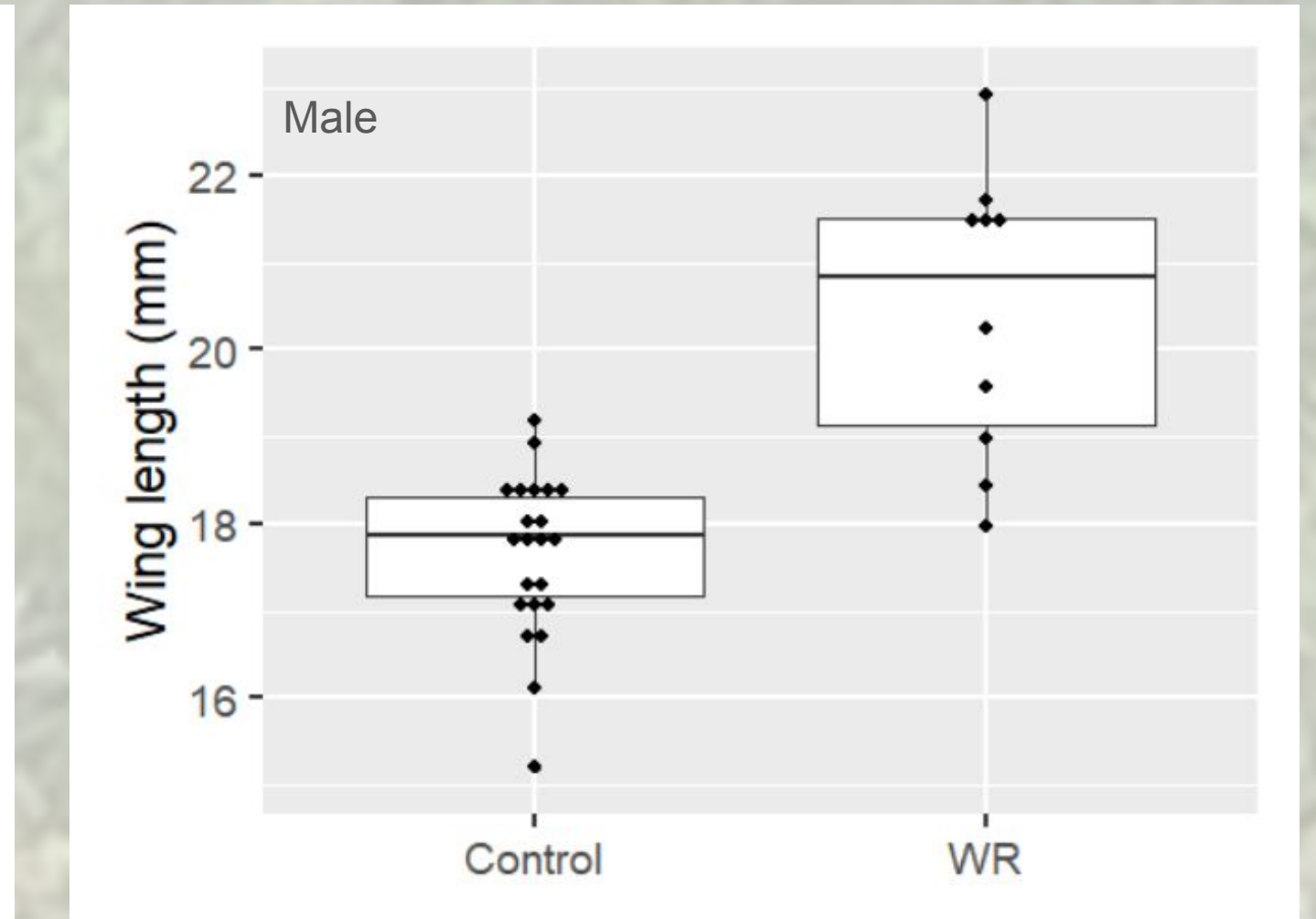


Figure 4. Box plots showing difference in wing length distribution between male *Melanoplus sanguinipes* specimens in UAM (n=25, ‘Control’), and Wood River, AK outbreak specimens (n=14 ‘WR’). T-test of the means p=0.0000862

Lockwood (1989) found no statistically significant difference in tegmen length between solitary and migratory *M. sanguinipes*, with both being significantly shorter than *M. spretus*.⁵

Broader Impacts

In the event that climate change leads us into a new era of locust outbreaks in North America, it would save landowners and agencies potentially millions of dollars to identify and get ahead of the problem. Locust plagues like the ones of history can literally wipe out all crops in a given area as the swarm moves across the landscape.

This research also represents the first summary of grasshopper outbreaks in Alaska in several decades, and the first inquiry into the potential for a relic population of *M. spretus* in Alaska.

References and Acknowledgements

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