

Grasshoppers on the College of Wooster Campus: Abundance & Environmental Conditions



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Background

- Urbanization is a global anthropogenic phenomenon causing significant land-use change¹
- Orthoptera may be sensitive to large-scale urbanization effects since they are mobile, dispersive, and ectothermic^{2,3,4}



Figure 1. *Dissosteira carolina* or Carolina Grasshopper

Study Aim: to determine the environmental factors that affect grasshopper presence on the urban CoW campus

Methods

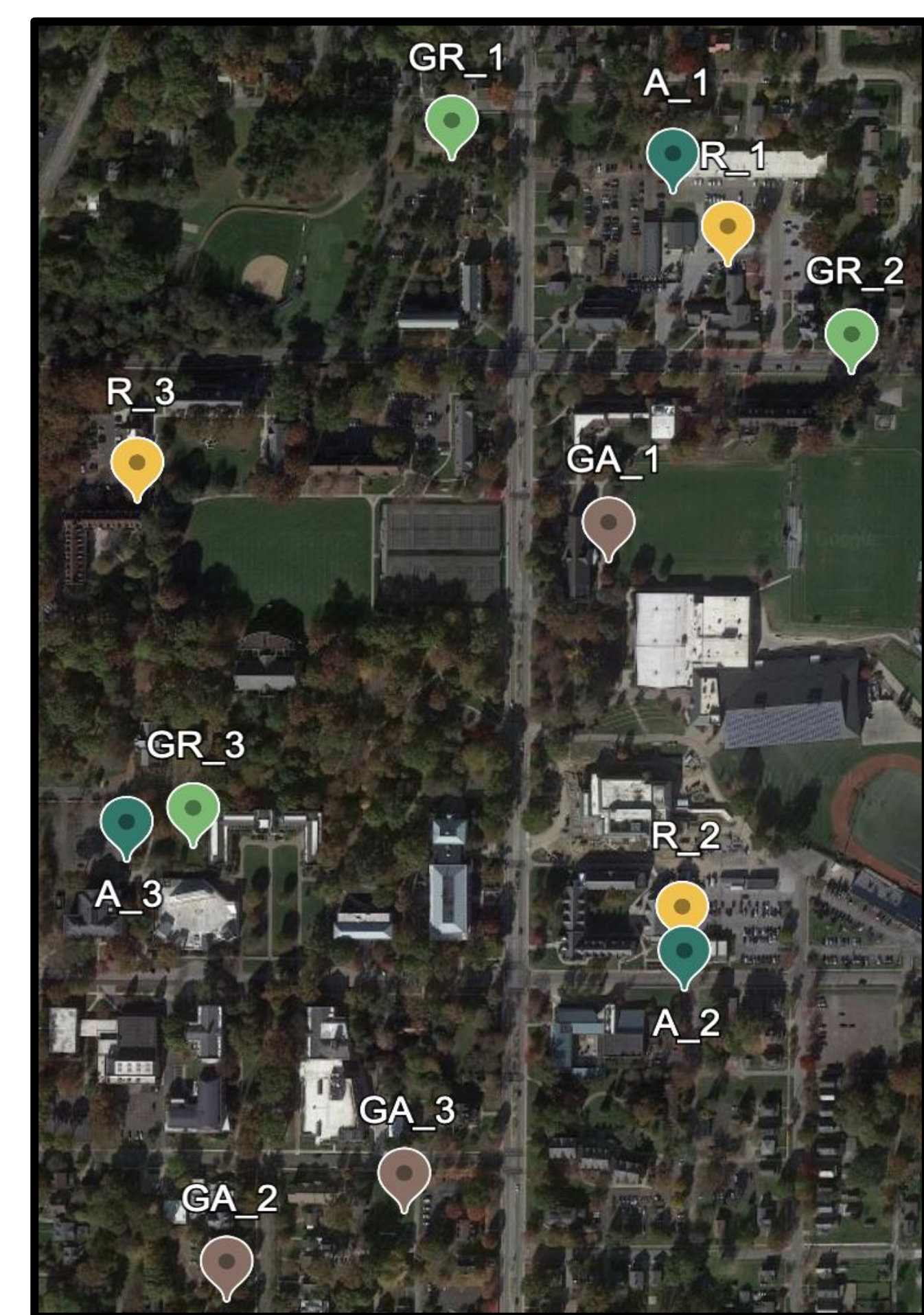


Figure 2. Map of plot locations around the CoW campus.

12 plots & 4 substrate types:

- Asphalt, campus gardens, grass, rocks

Surveys (N = 19):

- 12:00 - 18:00
- September - November 2023
- Ideal conditions (no rain, not cloudy)

Measurements:

- GH abundance & diversity
- Surface temperature
- Ambient temperature
- Humidity

Data Analysis:

- ANOVA⁵ and Post-Hoc Dunn tests⁶
- Two-tailed t-test⁵
- Binomial linear modeling⁵
- Correlation test⁵

Discussion

- Conditions most likely to predict grasshopper presence
 - Shade cover, surface temperature, time of activity
 - Relate to effective behavioral thermoregulation in local thermal climates
- 92% of GH were *D. carolina*, suggesting biotic homogenization
 - Nymphs observed until November – why?
- Ambient temperature comparison indicates CoW is likely a UHI
- Urban spaces may be able to sustain high levels of biodiversity by maintaining multiple habitat types⁷

Results - Abiotic

Grasshopper-abundant plots:

asphalt I (A_1), garden III (GA_3), rocks II (R_2)

- 92% of all GH observed (N = 44)
- 93% of all *Dissosteira carolina* observed (N = 41)

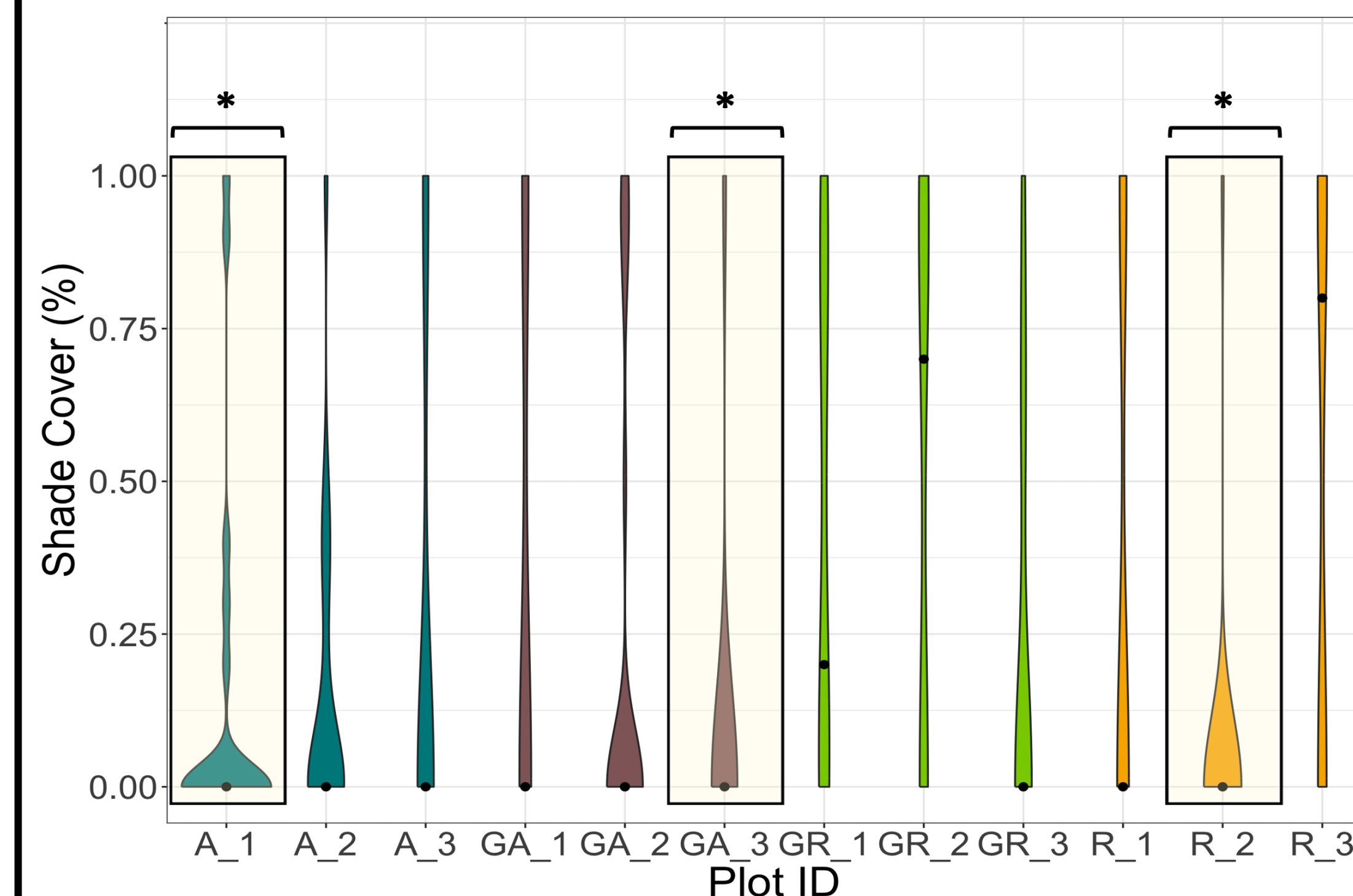
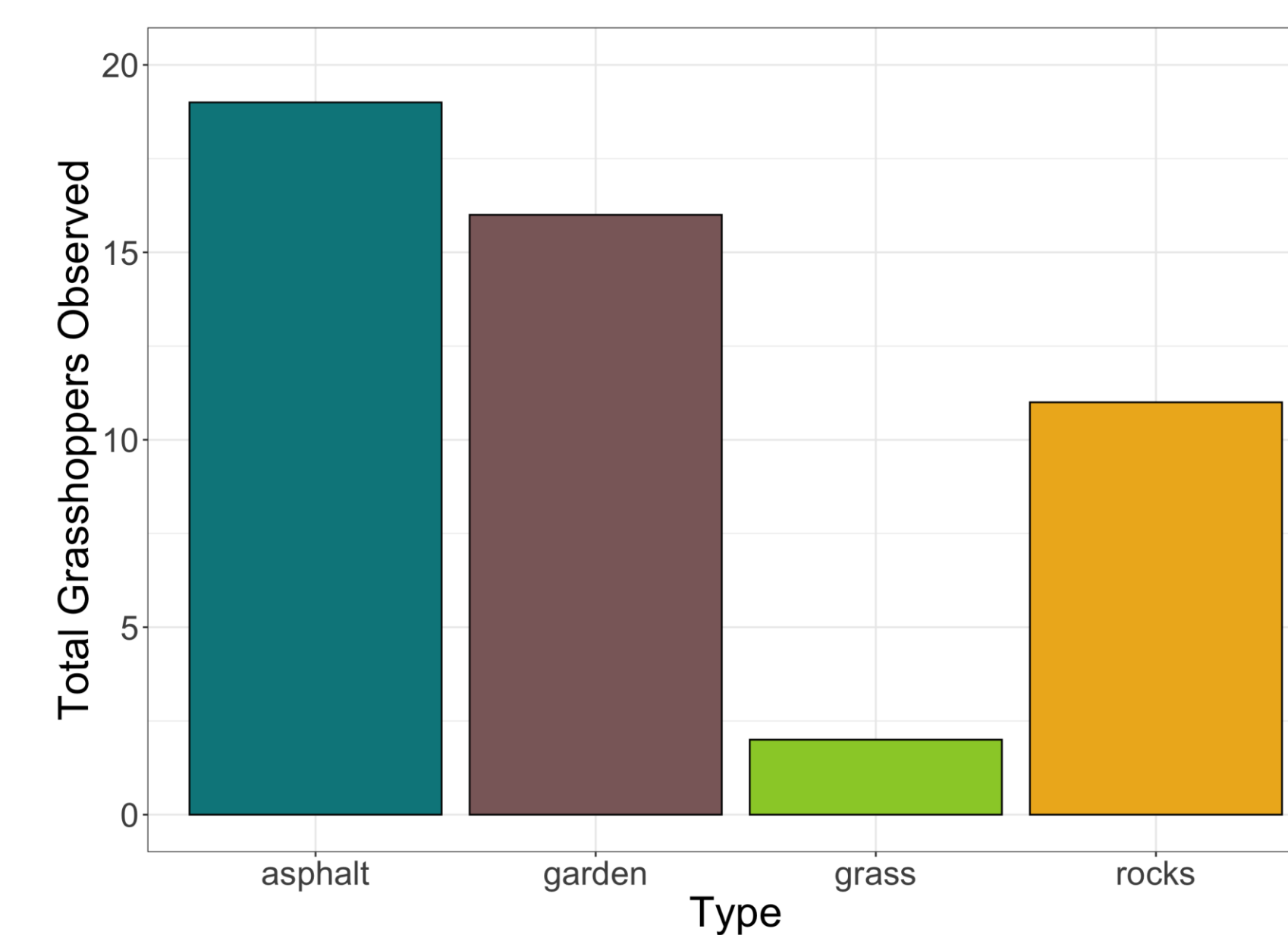


Figure 3. Violin plot of daily shade coverage at each plot (N = 12). **Emphasized boxplots had significantly lower average shade coverage compared to the other plots, indicated by asterisks.** Black points indicate median values.

Results - Biotic

Figure 5. Total grasshoppers observed at each substrate type (N = 48), including asphalt (n = 19), campus gardens (n = 16), grass fields (n = 2), and rock beds (n = 11).



Binomial Linear Modeling for Predicting Grasshopper Presence

Most parsimonious model variables (total probability):

- Surface temperature (99%) → + 98.00 °F (25.88 °F)
- Time of day (96%) → + 16:10 (109 minutes)
- Date (73%) → + September 20 (13 days)

Sources

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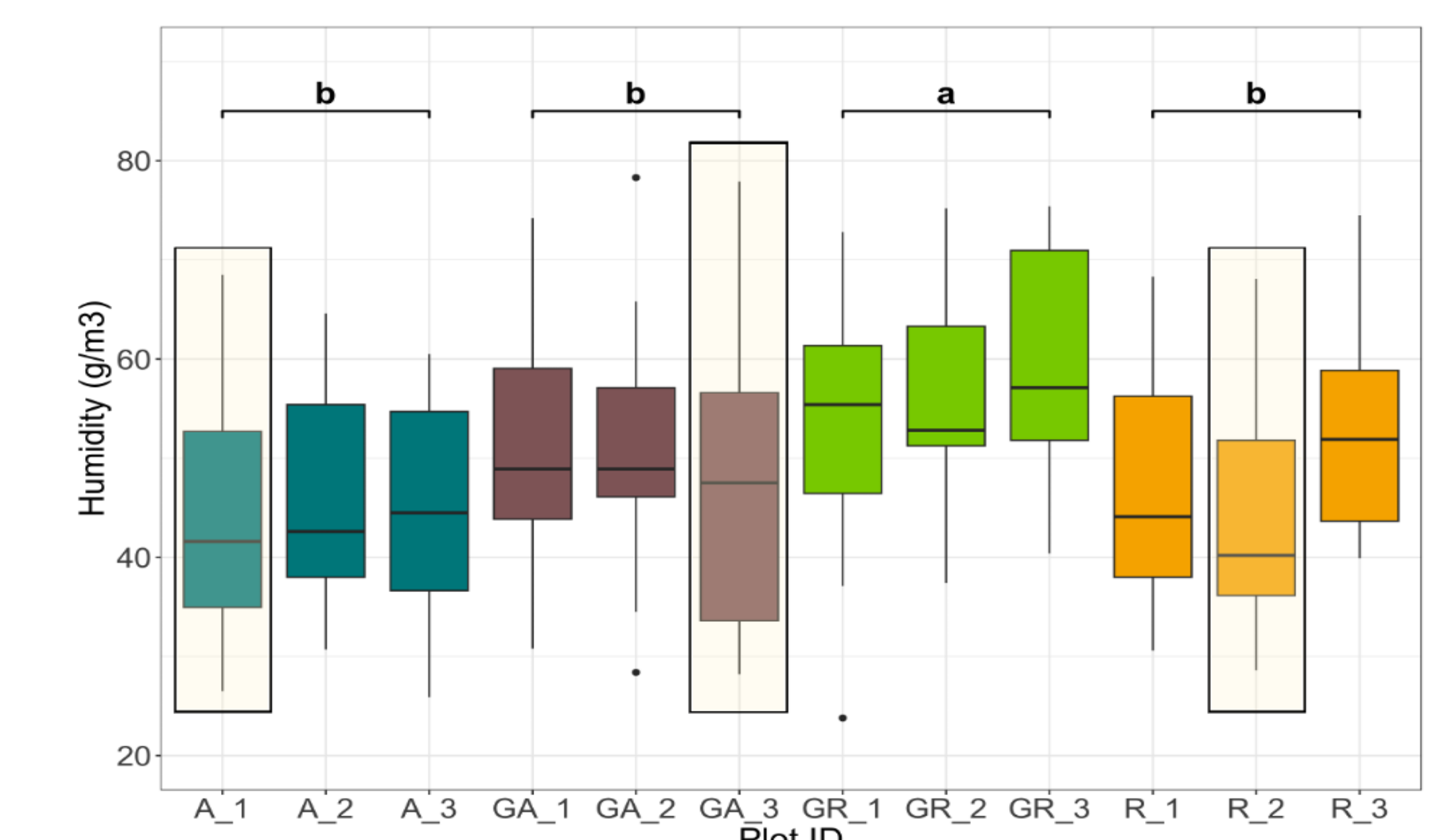
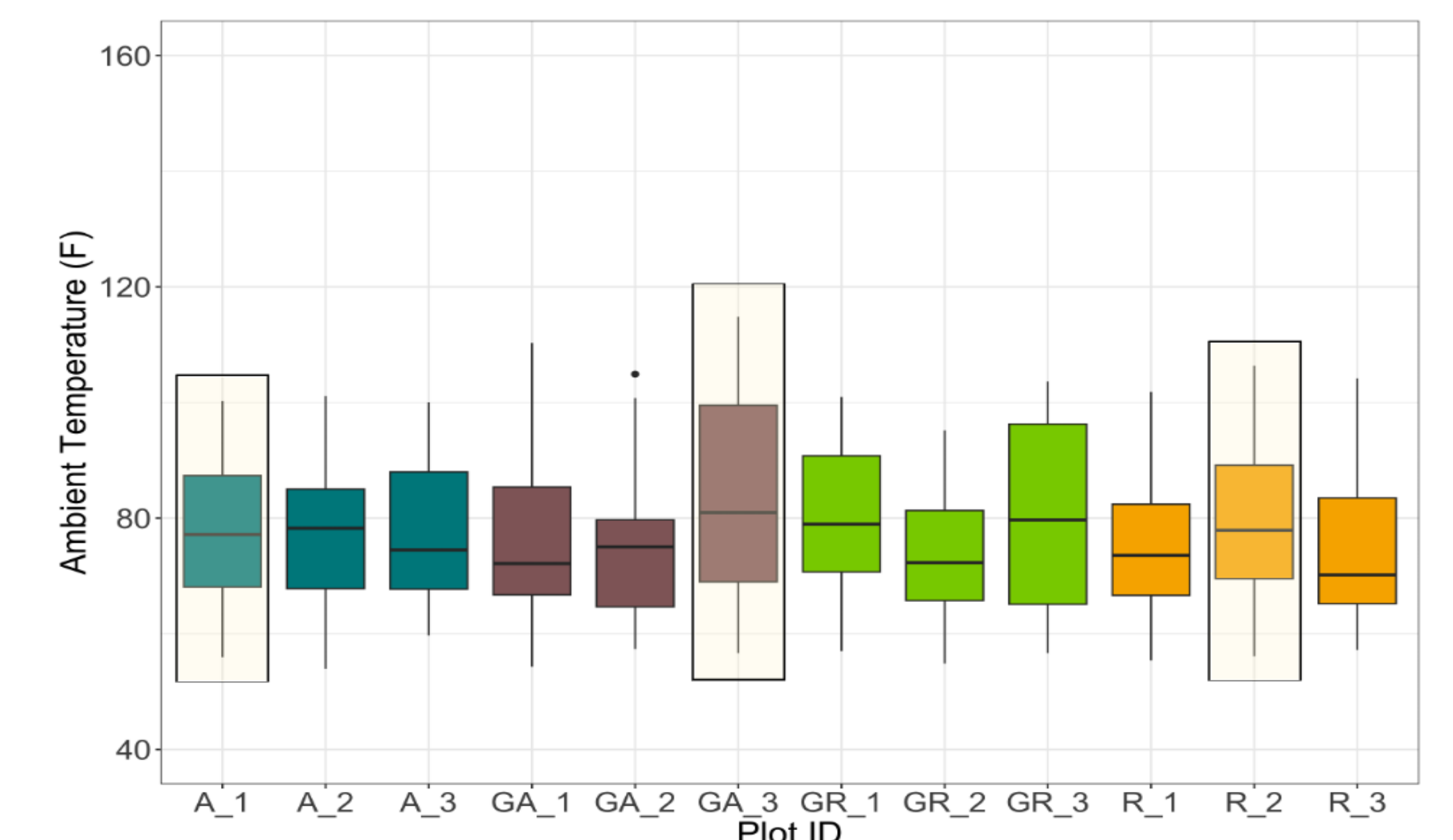
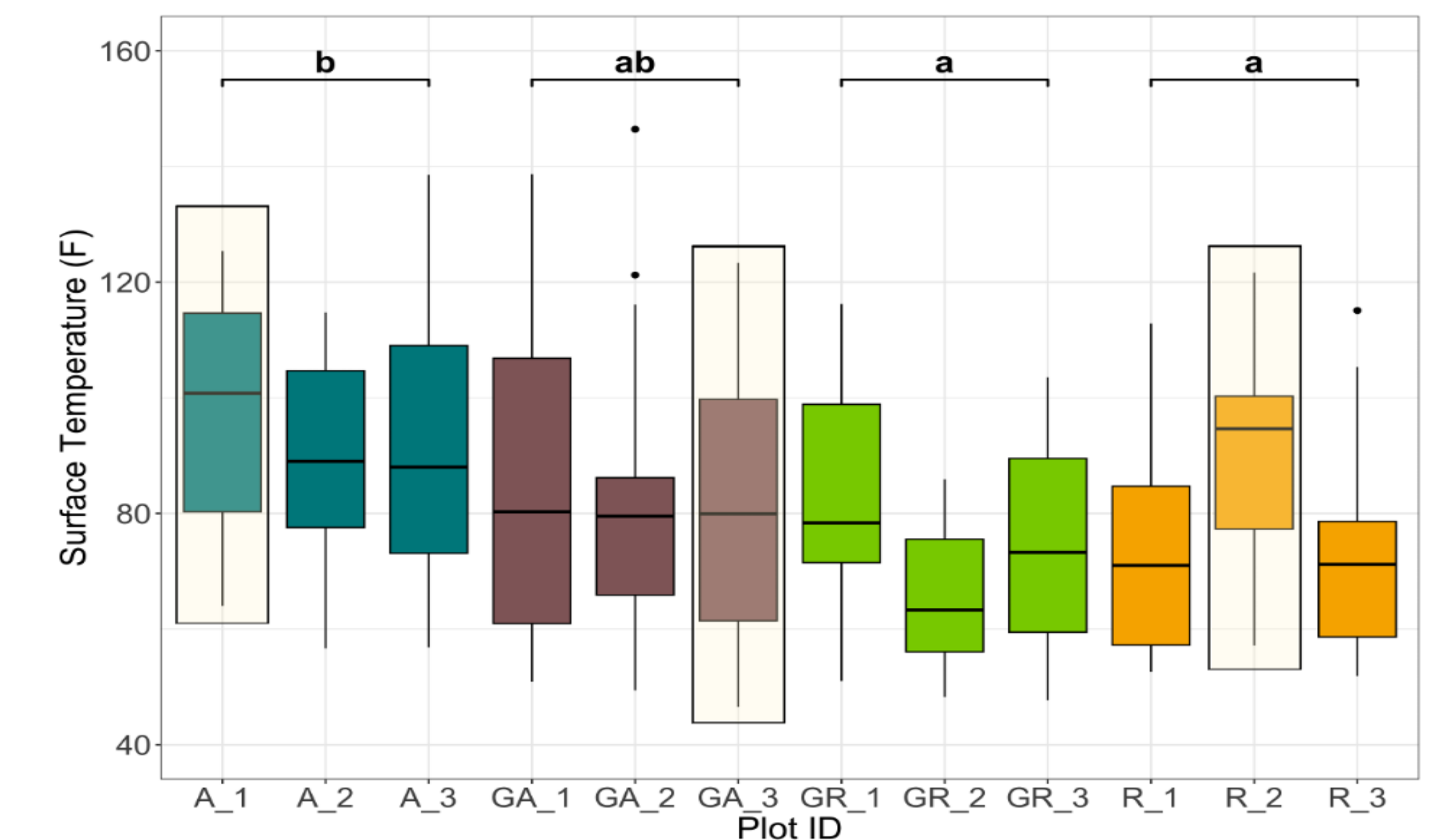


Figure 4. Grouped boxplots of daily abiotic conditions at each plot. A) **Asphalt had a higher log surface temperature than other types, but no significant difference between plots.** B) No significant differences between types and plots for log ambient temperature. C) **Grass had higher humidity than other types, but no significant difference between plots.** Letter labels indicate Tukey post-hoc test results.