A Prickly Situation: Contrasting frequency and morphological measures in three cactus species

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Question

What physiological characteristics determine ecologically functional differences in three species of cacti?

Double Mutualism & Facilitation

- Positive interactions drive ecosystem infrastructure[1]
- Birds are nectarivores and frugivores of cacti[2, 3]
  - Double mutualism: two positive interactions between interspecifics[4]
  - Harsh environments promote double mutualism[5]
- Cacti are desert foundational species[6]

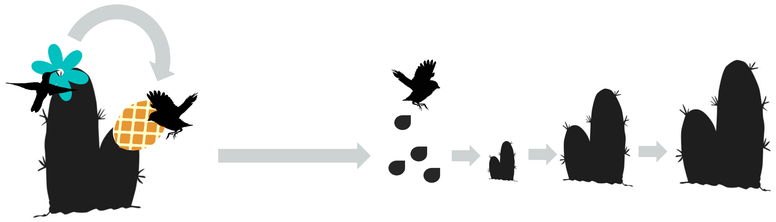

Figure 1: Do birds pollinate and disperse seeds of foundational plants?

Hypotheses and Predictions

Different species of cacti occupy different ecological and facilitating niches.

- *Different cactuses will have different sizes and health which will impact interactor visitation at different phenological lifestages.*

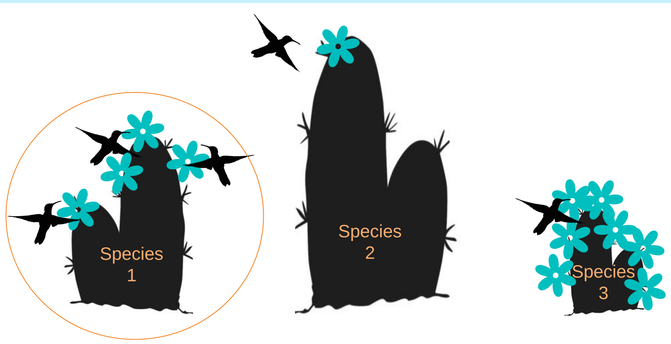

Figure 2: Avian interactors visit higher and showier reproductive displays.[7] Do these characteristics differ between cactus species?

Methods

- Transects or haphazard sampling
- Major axis, minor axis, vertical axis
- Health index 1-5
  - Scarification, rot, branch death

Results

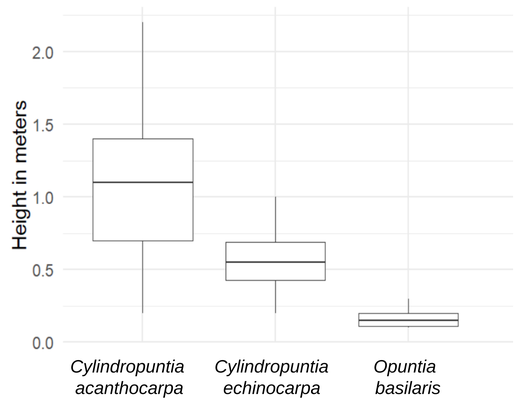

Figure 4: *C. acanthocarpa* (1.04 meters) > *C. echinocarpa* (0.55 meters) > *O. basilaris* (0.17 meters)

Each cactus species had significantly different mean heights (*Kruskal-Wallis*, Chi-square = 3.71, p > 0.0001, df = 52).

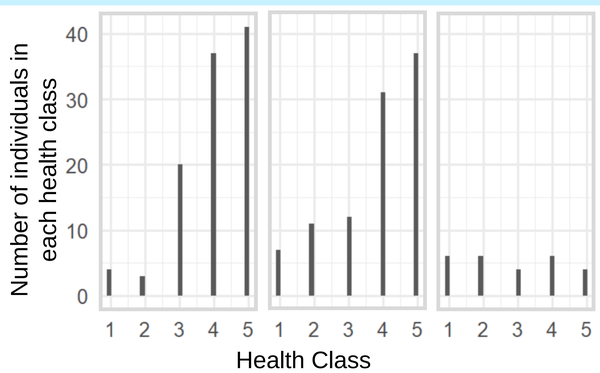

Figure 5: *C. acanthocarpa* and *C. echinocarpa* had more individuals with health scores of 4 or 5, whereas *O. basilaris* had a even distribution of health scores.

C. acanthocarpa and *C. echinocarpa* are healthier than *O. basilaris (Pearson's Chi-squared Test,* X-squared = 27.325, df = 8, p > 0.001).

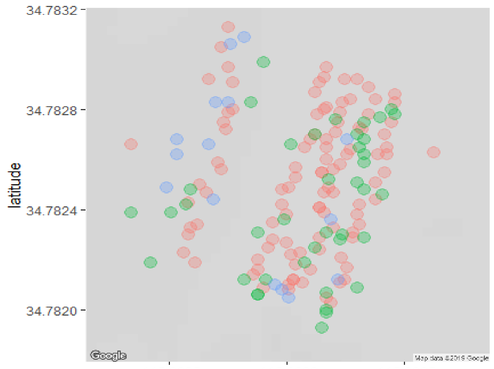

Figure 3: *C. acanthocarpa* was the most abundant and *O. basilaris* was the least abundant

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Table 1: C. acanthocarpa had the largest size class bins.

Species	Small	Medium	Large
Cylindropuntia acanthocarpa	<85cm	86cm - 152cm	>153cm
Cylindropuntia echinocarpa	<45cm	46cm - 72cm	>73cm
Opuntia basilaris	<15cm	16cm - 22cm	>23cm

Conclusions & Future Research

Because health and size may be strong predictors of reproductive output, all three cactus species will likely fulfill different ecological interaction niches. Additional studies surveying reproductive outputs against these traits will provide further insight into the way phenotypical differences impact positive interactions, mutualism, and eventual facilitation. These easily reproducible studies can be expanded upon by monitoring nectarivorous and frugivorous interactors at different phenological stages.

Works Cited

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