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The morphological and ecological variation of *Arctostaphylos* (Ericaceae) fruit

A link between plant ecology and animal foraging behavior

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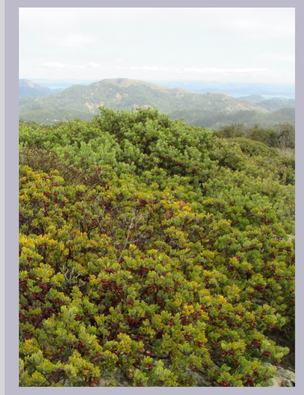
Introduction



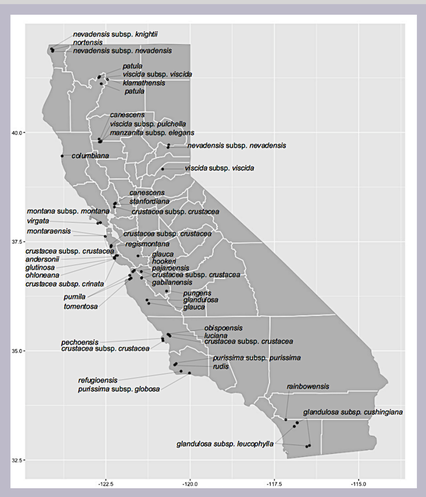
- Propagule dispersal, the movement of seeds and/ or fruit away from the parent plant, is a significant part of a plant's life history and critical to the dynamics of plant communities
- Plants and animals (=dispersal agents) have diffusely co-evolved and this interaction influenced seed and fruit morphology
- Fruit and seed morphology give insight into the traits that may be under selection by dispersal agents
- Fire-stimulated, persistent soil seeds banks are characteristic of *Arctostaphylos* in the Mediterranean-climate California Floristic Province
- Scatter-hoarding rodents help build the unusually large seed banks of *Arctostaphylos*
- Rodents assess and respond to size of rewards, we investigated potential ways that rodent behavior may be manipulated by *Arctostaphylos*

Methods

Determined potential drivers of differences in seed endocarp fusion and viability:

Does the anticipated effect of a given variable on fusion or viability promote viable seed remaining in the soil or promote rodents wanting to consume seeds? Or help seeds survive fire?

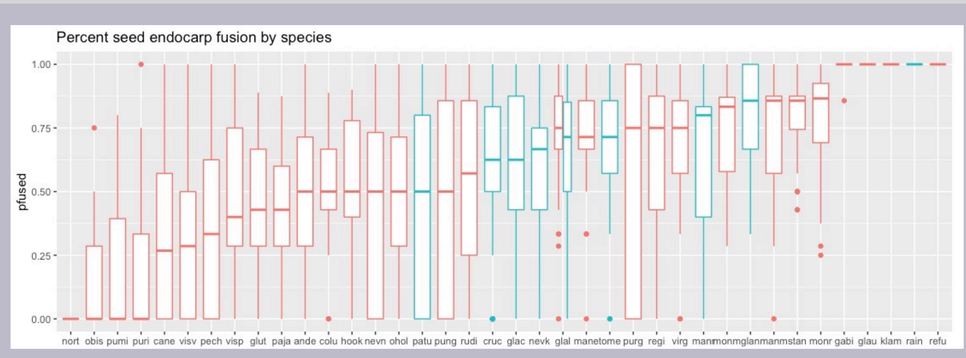
- **Morphology**: fruit size, shape
- **Environment:** elevation, latitude, precipitation, maximum temperatures, "droughtiness"
- **Species-level factors:** ploidy, phylogenetic position, life history, species identity



- **Collected 30 fruit from 37 *Arctostaphylos* taxa**
- Explored fusion and viability data with plots, which revealed non-normal distribution, non-independent obs., and heterogeneous variance = GLMMs
- Generated two sets of candidate models and used BIC to select the best model

Measured fruit height, width, degree of fusion and for a subset of 15 taxa, seed viability

Results

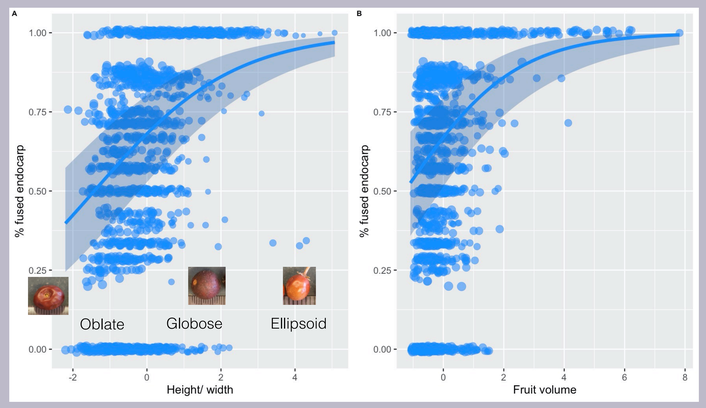


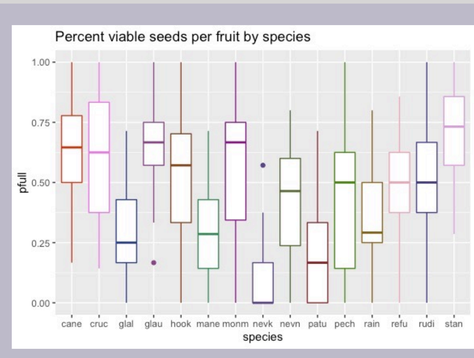
1. **We determined that differences in seed fusion are greatest at the among species level** (species variance = 3.990, SD= 1.998; individual plant variance = 0.621, SD= 0.788). For species level deviations from the intercept, *A. nortensis* was the most negatively different, and *A. refugioensis* the most positively different from the overall average for all species. Orange boxes indicate species that do not re-sprout after fire and teal boxes indicate species that re-sprout after fire.

2. **Fruit endocarp fusion is predicted to increase with both shape and volume.**

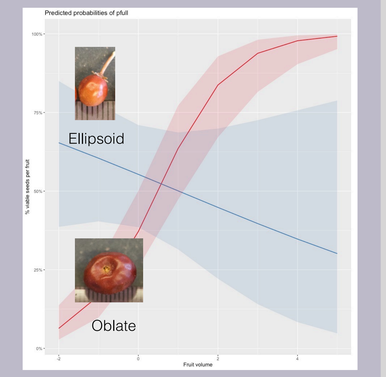
A. Predicted probability of % fused endocarp, per fruit, by fruit shape ratio (in log-odds). Low H/W values = oblate shaped fruit, low-medium values = depressed globose fruit, medium values = globose fruit, and high values = ellipsoid fruit. Ribbon = 95% confidence interval.

B. Predicted probability of percent fused endocarp per fruit by fruit volume (in log-odds). Gray ribbon = 95% CI.





3. **Variation in fruit viability was similar among species and between plants.**



4. **The combined effects of fruit volume and shape have the largest influence on fruit viability.** Patterns are different for different fruit shapes.

Objective and Aims

Objective: to determine if fruit variation in *Arctostaphylos* influences seed bank dynamics associated with scatter-hoarding

Specific Aims

1. Assess differences in seed endocarp fusion among plants and species
2. Determine the extent to which seed fusion is influenced by morphology, environmental factors, life history characteristics, and species identity
3. Assess differences in fruit viability among plants and species
4. Determine the factors that influence fruit viability

Conclusions

In *Arctostaphylos* endocarp fusion and seed viability are adaptive traits; we presume these are originally historic patterns that arose early

- Probably before the obligate seeding life history
- This is suggested by the absence of a relationship with elevation, latitude, precipitation, maximum temperatures, droughtiness, ploidy, phylogenetic position, and life history

Interactions between scatter-hoarding rodents and *Arctostaphylos* selected for fruit traits that manipulate seed predator behavior, thus permitting the sustainability of their seed banks. Fruit traits of *Arctostaphylos* are consistent with selection manipulating scatter-hoarding rodent behavior.

% endocarp fusion and % viable seeds act to vary reward size