

Reproductive biology of a mutualist-vectored parasitic plant differs with host species

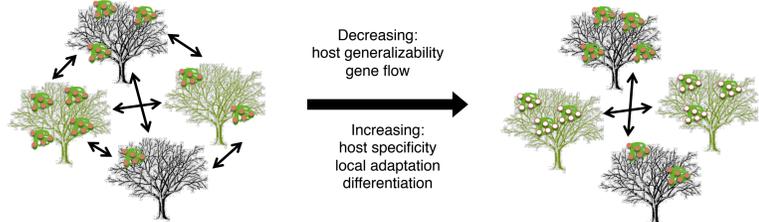
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Introduction

- Many parasites and pathogens are capable of parasitizing **multiple host species**, yet some degree of **host specificity** is also common.



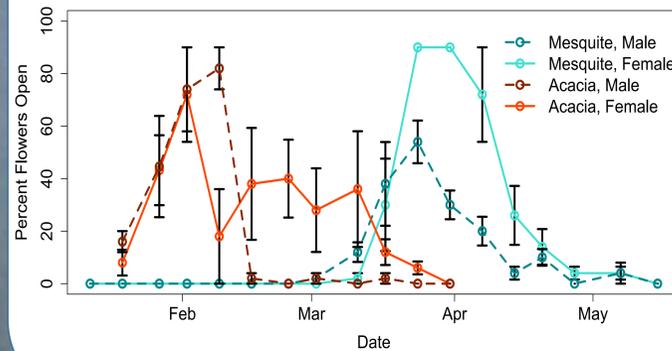
- A mechanism of **diversification** of parasites, **host race formation** occurs when subpopulations of parasites specialize on host species and may lead to sympatric or parapatric **speciation**.
- Differences in **flowering phenology** for parasitic plants on different host species can allow for a **reduction in gene flow** and, potentially, **local adaptation** to hosts.
- When reproduction depends upon mutualist partners, the timing of **mutualist activity** will also influence the **relationship between fitness and phenology** of the parasite.

Question: How do **reproductive timing and output** of desert mistletoe subpopulations differ with host species?

Flowering phenology differs with host species

Site	Host species	Sex	Jan	2	3	4	Feb	2	3	4	Mar	2	3	4	Apr	2	3	4	May	2		
Tumamoc Hill	Acacia (<i>Acacia greggii</i>)	Male																				
		Female																				
	Palo verde (<i>Parkinsonia floridum</i>)	Male																				
		Female																				
Santa Rita Experimental Range	Acacia (<i>Acacia greggii</i>)	Male																				
		Female																				
	Mesquite (<i>Prosopis velutina</i>)	Male																				
		Female																				

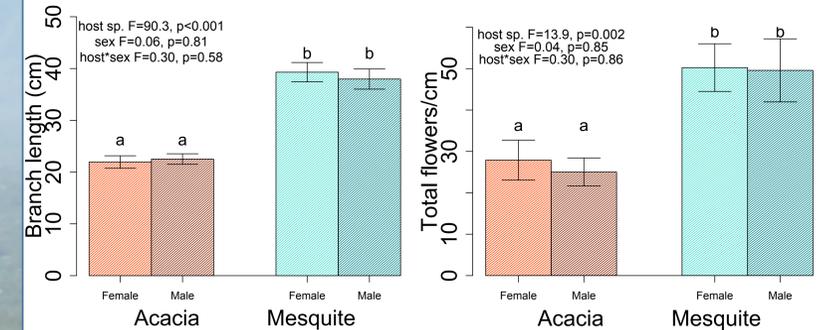
Percentage flowers open per mistletoe (mean ± se) by sex and host species at Santa Rita Experimental Range.



- Mistletoe on **mesquite** flowers **later** than mistletoe on **palo verde** and **acacia**.
- The flowering curve of mistletoe on **mesquite** **overlaps** little with that of mistletoe on **acacia**.
- Males initiate flowering slightly earlier than females.
- Differences in phenology are **consistent across sites**.

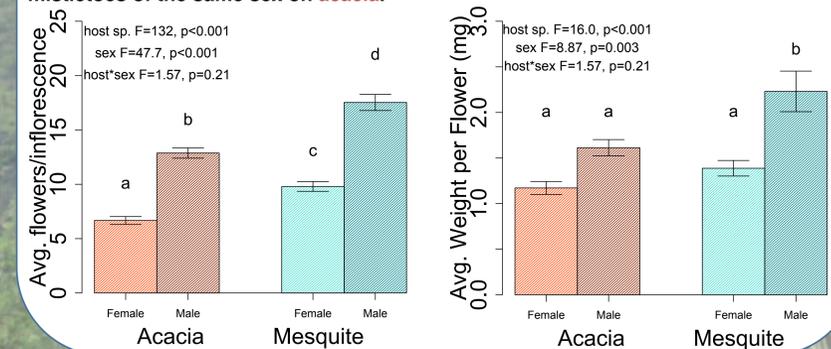
Reproductive output differs with host species and sex

Mistletoes on **mesquite** are larger on average than mistletoes on **acacia**... and mistletoes on **mesquite** produce more flowers/cm of branch than those on **acacia**.



Males produce more flowers/inflorescence than females, and mistletoes on **mesquite** produce more flowers/inflorescence than mistletoes of the same sex on **acacia**.

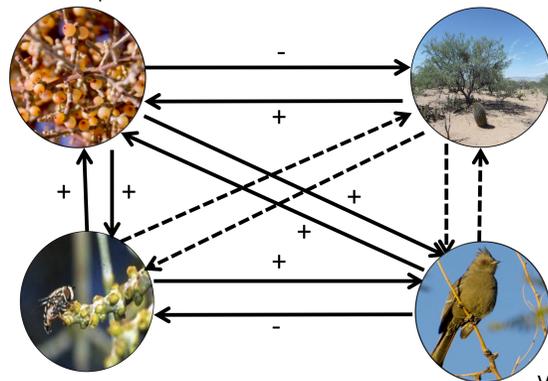
Male mistletoes on **mesquite** produce inflorescences with the greatest mass per flower.



Methods

Parasite:
Desert mistletoe
(*Phoradendron californicum*)
Diocious, aerial hemiparasite

Hosts:
Primarily dominate legumes, trees/shrubs
Mesquite (*Prosopis* spp.), Acacia (*Acacia* spp.), Palo verde (*Parkinsonia* spp.), Ironwood (*Oleña tesota*)



Vector:
Various pollinating insects
Diptera, Hymenoptera, Lepidoptera
Community does not differ with host species

Vector:
Phainopepla
(*Phainopepla nitens*)
specialist, territorial
seed-dispersing
mutualist

Weekly censuses from January 12 to May 15, 2013.

Tumamoc Hill:

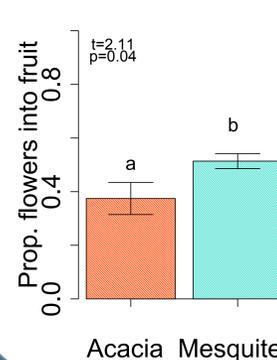
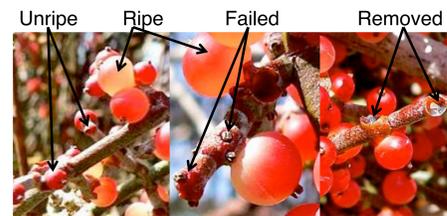
- Followed 3 mistletoes per host over the entire flowering season.
- 5 velvet mesquite, 5 Blue palo verde, and 5 catclaw acacia
- Recorded presence/absence of open flowers, ripe and unripe fruit

Santa Rita Experimental Range:

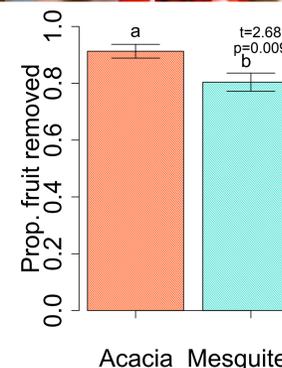
- Collected 1 branch/mistletoe for 5 male and 5 female mistletoes per host species (acacia and mesquite) each census
- Branch photographed, length measured
- Recorded number of buds, open flowers, ripe/unripe/removed/failed fruit
- The success of flower to fruit conversion is estimated from the sampled branch as: (ripe + removed) / (ripe + removed + failed + unripe)

Female reproductive success differs with host species

At the Santa Rita Experimental Range, female mistletoes on **mesquite** successfully mature a greater proportion of their flowers into fruit than those on **acacia**. Therefore, mistletoes on **mesquite** may be better at attracting pollinators...



...**HOWEVER**, mistletoes on **acacia** may be better at attracting dispersers. This pattern is supported the greater proportion of ripe berries removed from mistletoes on **acacia** than from mistletoes on **mesquite**. Also, **acacia** hosts have more intense mistletoe infections (>40 individuals) on average than mesquite hosts (<10 individuals).



Conclusions and Future Directions

Hosts are not interchangeable.

- Consistent differences between the size and reproductive output of mistletoes on different host species may be the result of host resources or local adaptation.
- Preliminary evidence suggests that the mutualist vectors of mistletoe (pollinators and dispersers) are not equally attracted to mistletoes on different host species.
- The relationship between host species and mistletoe fitness is not yet clear, and host identity likely plays an integral role in the dynamics of the interaction network as a whole.

Differentiation may be occurring.

- Although several host species occur in sympatry, differences in flowering time limit the potential for gene flow between populations of this dioecious parasitic plant on some host species.

Future work will examine...

- ...the differentiation between putative host races with reciprocal transplant and genetic studies
- ...the relationship between characteristics of mistletoe infections (host species, intensity, sex ratio) and the strength of interactions with mistletoe pollinators and dispersers.

Acknowledgements

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