

A phylogenetic test of the Red Queen Hypothesis: the evolution of outcrossing and parasitism in the Nematode phylum



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Parasitic nematodes are more likely to be outcrossing than their free-living relatives

WHAT USE IS SEX?

Outcrossing is **costly**, yet outcrossing is **ubiquitous**

THE RED QUEEN HYPOTHESIS

Outcrossing is maintained by **antagonistic coevolution** between **hosts** and **parasites**

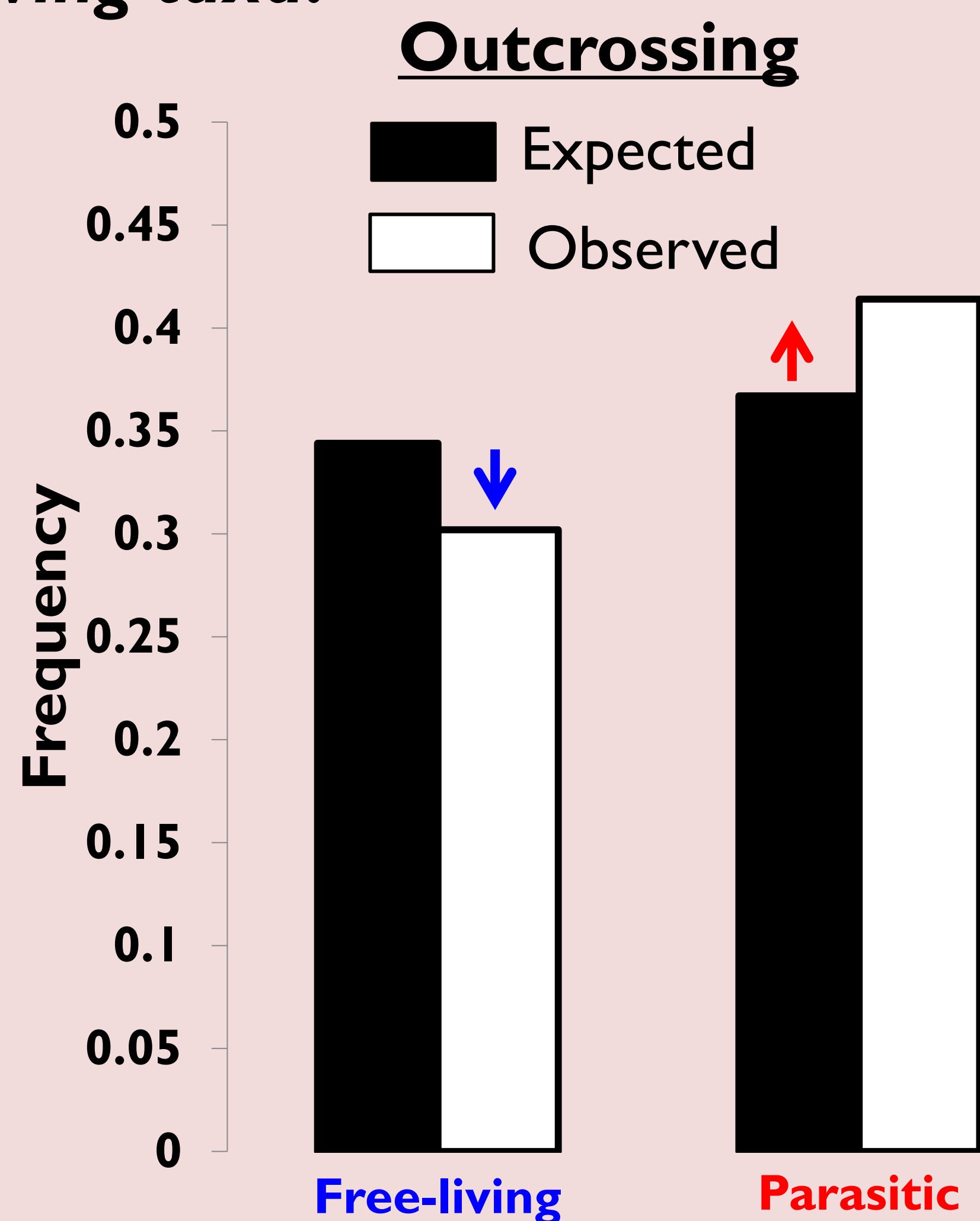
Prediction of the Red Queen: Outcrossing should be more common in **parasitic** species than in **free-living** relatives

We test this prediction in the Nematoda



Nippostrongylus brasiliensis
Claire Hoving

Is outcrossing more frequent in parasitic vs. free-living taxa?



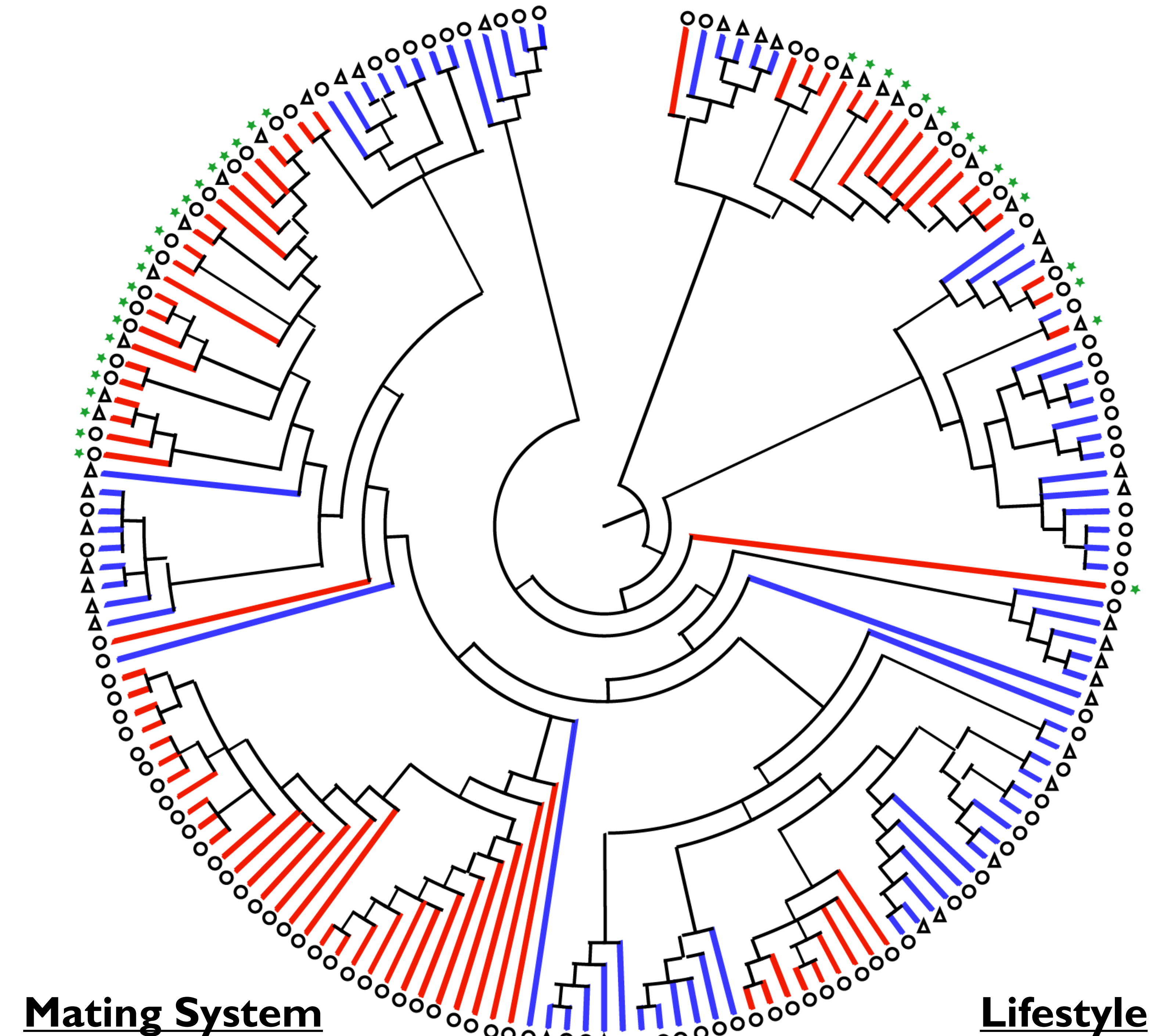
YES

162 taxa: frequency of outcrossing in parasitic species significantly exceeds expectation

Consistent with findings by G Bell in 1982 *Masterpiece of Nature*

The Nematode Phylum

Consensus of 2700 Bayesian-inferred trees: 162 species
Modified from Meldal et al. 2007



Does the association of parasitism and outcrossing remain when we account for phylogeny?

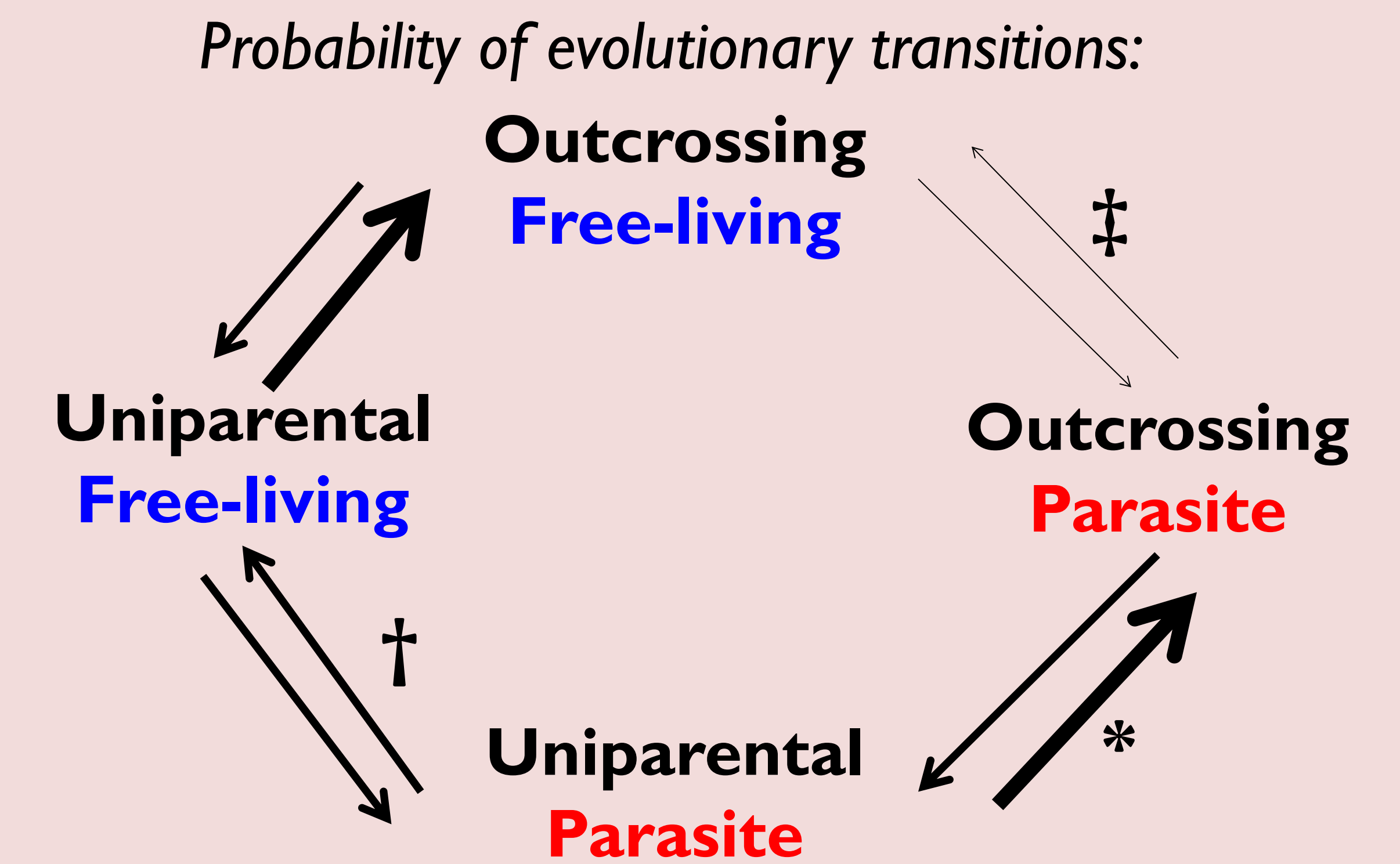
Test of phylogenetic association:		MATING SYSTEM	
		Outcrossing	Uniparental
LIFESTYLE	Parasite	+	-
	Free-living	-	+

YES

Significant correlation between parasitism and outcrossing

How does the association of parasitism and outcrossing arise?

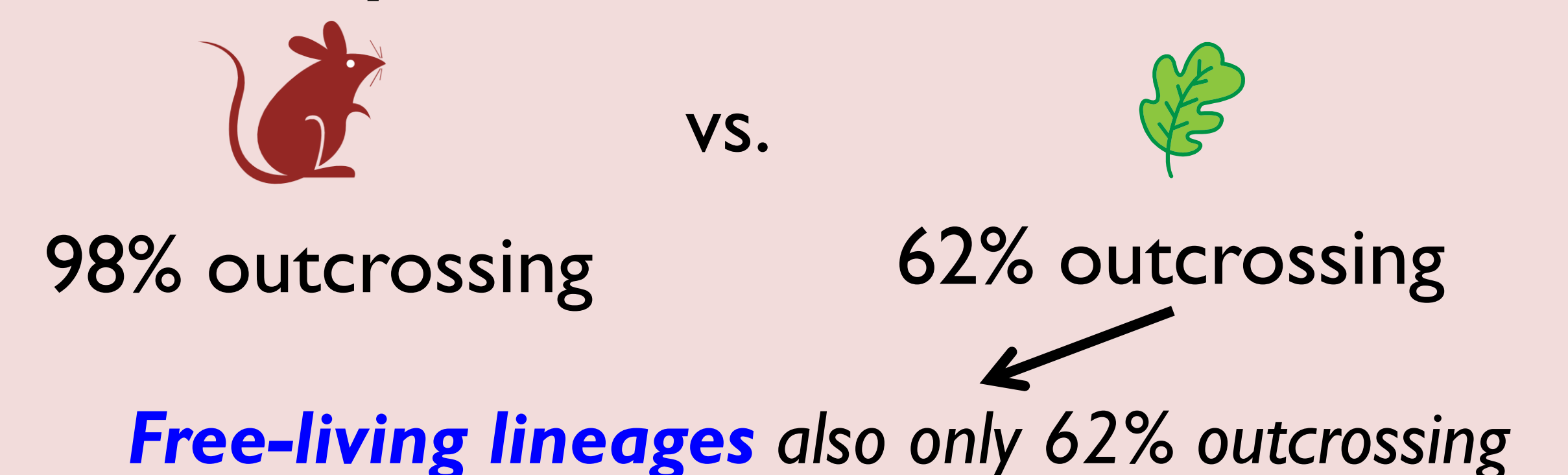
Transitions between parasitic and free-living lifestyles depend upon mating system



Loss of uniparental parasites: lineages transition to free-living[†] more frequently than do outcrossing parasite lineages[‡]

Gain of outcrossing parasites: uniparental parasite lineages transition more frequently to outcrossing* than to free-living[†]

But not all parasites outcross:



Future Directions

- Contrast extinction rates in uniparental vs. outcrossing lineages
- What is unique about plant parasites? Degree of host-parasite coevolution?
Investigate: specificity; ecto- vs. endoparasitism

List of works cited: Bell, *Masterpiece of Nature* 1982; Maynard Smith, *The Evolution of Sex* 1978; Jaenike, *Evol Theory* 1978; Blaxter et al, *Nature* 1998; Meldal et al, *Mol Phyl Evol* 2007; Bollback, *Bioinformatics* 2006; Huelsenbeck et al, *Syst Biol* 2003; Pagel, *Proc Roy Soc B* 1994; Pagel and Meade, *Am Nat* 2006.