

Ecological effect of evolution in pitcher plant rotifers as a response to temperature stress

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Microevolutionary processes play an important role in altering ecological effects and hold potential for expanding our understanding of ecology in natural communities.^{1–4} My goal is to examine how trait evolution over short time scales in response to stressful conditions associated with climate change may alter how organisms interact with other species in the community. Aquatic invertebrates with short generation times are ideal for studying this question because they evolve over many generations in only a few weeks.^{4,5} The cup-shaped rainwater-filled leaves of the purple pitcher plant, *Sarracenia purpurea*, harbor a diverse phytotelmic community ranging several trophic levels^{6–8}. The conditions inside these leaves can be replicated in laboratory microcosms that mimic ecological dynamics observed in nature.^{9,10} The bacterivorous rotifer *Habrotrocha rosa* is a member of this phytotelmic community and has a generation time of 1–3 days.¹¹ Additionally, *H. rosa* is obligately parthenogenetic, meaning clonal cultures can be established from single individuals.¹² This project will address (1) the potential for microevolution in *H. rosa* by examining genotype-specific responses to stressful temperature, and (2) the effect of evolutionary change in *H. rosa* populations on interactions with competitors.

Leaf water samples will be collected from *S. purpurea* in the Apalachicola National Forest. Thirty clonal families of *H. rosa* will be established, each seeded by a single rotifer. Cultures will be maintained in 50 mL centrifuge tubes and fed a natural community of bacteria.¹³ Preliminary work has successfully resulted in isolation of 15 distinct clones of *H. rosa*.

(1) Each experimental culture will be inoculated with cohorts of 50 rotifers from a single clone ($n = 30$ clones). Cultures will be replicated three times per treatment per clone and exposed to one of two temperatures: ambient (25°C) and stressful (37°C)—the latter of which is predicted by near-future climate projections in the southern range of *S. purpurea*.¹⁴ Abundance will be measured daily to estimate population growth rate. After 15 days of temperature exposure, the mass and respiration rate of a sample of individuals from each replicate will be measured.¹⁵ (2) In a separate experiment, mixed cultures of all clones will be exposed to ambient or stressful temperature for 60 days, during which selection for particular clones, and thus evolution, can occur. Populations with different evolutionary histories will then experience resource competition via the addition of the bacterivorous protozoa *Tetrahymena thermophila*. Size, population growth rate, and respiration rate of each population will be measured post-exposure.

(1) I expect clones to respond differently to increased temperature, indicating potential for selection on these traits in pitcher plant communities. This affects not only the fitness of rotifers themselves, but may also affect other species with whom they compete. (2) Selection for traits that are more successful in stressful temperatures may alter the competitive ability of populations of *H. rosa*. A difference in competitive ability would indicate an ecologically relevant impact of microevolution. Because of this, considering eco-evolutionary dynamics may prove essential to the conservation and restoration of fragile natural communities as they experience environmental change.

Project Budget

Item (Description)	Quantity	per Unit	Cost	Funded	Requested
Travel					
Flight (LAX to TLH)	1 RT ticket	\$580	\$580	\$580	\$0
Ride-share (FSU to/from lodging)	8 trips	\$16	\$128	\$20	\$108
Lodging					
Tallahassee, FL	6 nights	\$56	\$336	\$0	\$336
Shipping					
Overnight, 2lbs via FedEx (Tallahassee, FL, to Northridge, CA)	1 package	\$70	\$70	\$0	\$70
Total			\$1,114	\$600	\$514

Budget Justification

The total cost for this project is \$1,114, \$600 of which has been secured via the Thesis/Project/Dissertation Support Program from the Office of Graduate Studies, California State University, Northridge. I am requesting \$514 from the Sigma Xi Grants-in-Aid of Research to cover the cost of (1) ride-share transportation from lodging site to Florida State University (FSU), (2) lodging in Tallahassee, Florida, and (3) overnight shipping of pitcher plant leaf water samples from Florida State University to California State University, Northridge.

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