SELECTION ON PHYSIOLOGY IN THREE TALLGRASS PRAIRIE SPECIES WITH CONTRASTING FLOWERING TIMES.

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There are several different strategies of coping with drought stress. Species that avoid dehydration lower their metabolism and growth rate during periods of drought to reduce resource demand. Conversely, species that escape drought increase metabolism under drought stress to complete their life cycle before the onset of severe water limitation. As a result, species with contrasting strategies should experience differing natural selection on their underlying physiology in response to drought. We tested whether selection on physiology differs in three species with contrasting flowering times and drought tolerance; *Tradescantia bracteata* (early flowering, low tolerance), *Heliopsis helianthoides* (intermediate flowering and tolerance), and *Panicum virgatum* (late flowering, high tolerance). We measured height, chlorophyll content, leaf florescence, and specific leaf area on 125 individuals per species in two soils with contrasting water holding capacity. We estimated selection as the relationship between each trait and relative height. Preliminary results suggest that selection for increased capacity for photosynthesis is strongest in the earliest flowering species (*T. bracteata*) and weakest in the latest flowering species (*P. virgatum*). This may suggest that high metabolism and rapid development have more adaptive value in early flowering tallgrass prairie species. We are currently measuring selection on photosynthesis and specific leaf area in *H. helianthoides* and *P. virgatum* to better test this hypothesis.

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PHENOTYPIC VARIATION: MORPHOLOGICAL DIFFERENCES AMONG POPULATIONS OF THE FIDDLER CRAB *Uca rapax* FROM THE WESTERN ATLANTIC OCEAN.

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In the course of evolution, phenotypic variation underscored by genetic diversity is a primary ingredient for adapting to environmental change. As climate and terrain are altered, natural selection proceeds and species can change in many ways over time. A clear understanding of the mechanism(s) underlying adaptation is needed to fully appreciate the impact of organic evolution. One species of semi-terrestrial fiddler crab, *Uca rapax* (Smith 1870), inhabits intertidal regions along the coast of the western Atlantic Ocean from Texas, Louisiana, and Florida in the USA to Santa Caterina in southern Brazil. Its larvae are dispersed by tides and ocean currents. Over a 28.8° latitude range on either side of the equator, *U. rapax* was found previously to express three geographically distinct forms in carapace shape. In the present study we used regression analysis to examine allometric variation in growth of the large cheliped in males from more than 30 populations around the Gulf of Mexico, Caribbean and Atlantic Ocean. An un-regenerated claw can appear short (i.e. brachychelous) or elongated (i.e. leptochelous). The onset of a leptochelous condition in adult crabs varies geographically among the populations. Between Ocean Spring, MS and Port Aransas, TX the transition from a brachychleous state occurs earlier in development than in males from populations in Mexico, the Yucatan, Florida and the northern Caribbean. Since the large cheliped is used by males in courtship and territorial defense, a more leptochelous large claw would appear to confer several selective advantages. Consequently, ontogenic differences among populations may confer significant differences in male reproductive fitness. Based on several morphological differences, *U. rapax* can be considered a "polytypic" species. At this time, it is not clear which environmental or social factors are driving selection and/or accelerated development.

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LEAF DEVELOPMENT AND VEIN HOMOLOGY OF MORNING GLORY *(IPOMOEA)*.

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Ipomoea is the largest genus in the flowering plant family Convolvulaceae, with over 500 species. The great variation in the Ipomoea genus can be partially attributed to the Japanese cultivation of the morning glory, beginning in the late Edo period. This horticultural success produced such varying mutations in both flowers and leaves, that the morning glory has become a perfect specimen in which to study leaf development-- specifically lobe development and vein homology. To study leaf development and vein homology, we investigated five different morning glory species: Tokyo Standard (TKS 1065), Delicate Maple (dlm 620), Yellow Maple (ym 1018), Maple Willow (mw 646) and the double delicate mutant willow (dlmw 603). All five morning glory species possess different numbers of lobes and primary veins. Seeing that these variations are so drastic, we asked the question: how and when do these morphological changes occur during leaf development? To answer this question, plants were grown from seed and observed macroscopically and well as microscopically. We found that leaf shape differentiation occurs very early in the development of the morning glory leaf species.

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USING SEED RECOVERY METHODS TO DETERMINE CAUSES OF FAILED GERMINATION IN FOUR NATIVE PRAIRIE SPECIES.

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Prairie restorations are expensive and emergence rates as low as ten percent are often observed. This could be because seeds are exposed to dangers from microbial and fungal attack, as well as predation from granivores after planting. Our experiment aimed to determine the post-dispersal seed fates of four native prairie species after they had been planted in the soil and covered with an exclosure to limit vertebrate predation. We coated five sets of 100 seeds of each species (*Elymus canadensis, Oligoneuron rigidum, Eryngium yuccifolium*, and *Desmodium canadense*) with fluorescent Glogerm™ dye and planted them at a depth of five millimeters in four rows (one row of 100 seeds per species, per exclosure) inside five wire mesh exclosures. After five weeks, seedling emergence data was collected and the top layer of soil from each row was excavated from the exclosures. Collected soil was examined under a UV lamp and recovered seeds were tested for viability. We hypothesized that a majority of the seeds planted would be recovered and that out of those recovered most would be viable. Seed fates differed among the four species and were identified as emerged in the field, died during emergence, viable, and non-viable. Only 10-27% of the seeds we planted were accounted for and the majority tested were non-viable. This suggests that rapid loss of viability could be a cause for low seedling emergence rates. It is evident that finding seeds after planting is still an obstacle that must be overcome in order to better understand post-dispersal seed fates.

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A STUDY OF *TFL1* AND *LFY* AS AGENTS IN THE DIVERGENT EVOLUTION OF *ARABIDOPSIS THALIANA* AND *CARICA PAPAYA*.

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In *Arabidopsis thaliana*, the genes *TFL1* and *LFY* are responsible for the development of the plant's racemose inflorescence. Homologs of these sequences have been found in many other flowering species, including *Carica papaya*, a relative of *Arabidopsis* that has instead evolved to produce a cymose inflorescence. A comparison of these genes between the species will explain differences in the evolution of the floral development patterns observed. In this study, papaya DNA was extracted and purified, then the polymerase chain reaction (PCR) was used to amplify the coding sequences of possible *TFL1* homologs. For homologs with known coding sequences, restriction digest reactions were run in preparation for a nested PCR designed to elucidate both gene-coding and regulatory DNA. Degenerate primers used in standard PCR produced a single band in gel electrophoresis. This product will be gel extracted, cloned, and will then be applied to the nested PCR.

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EFFECTS OF FLOODING ON THE FLORA AND FAUNA OF A RECONSTRUCTED TALLGRASS PRAIRE.

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The University of Northern Iowa's Tallgrass Prairie Center is exploring the use of prairie biomass as a sustainable biofuel. In 2009, 48 research plots on three soil types at the Cedar River Natural Resource Area were seeded with one to 32 species of prairie plants. The plant, bird, and butterfly communities at the site have been monitored annually to assess the prediction that more diverse biofuel crops will support more abundant and diverse wildlife communities. In 2013, the Cedar River reached flood stage four times. Flooding severity and frequency varied greatly among soil types, allowing us to conduct a "natural experiment" on the effects of floods on bird and butterfly communities. We conducted visual surveys of birds and butterflies, and compared their abundance to the 3-year average for each plot. Both bird and butterfly abundance declined significantly in 2013; however, the magnitude of decline was greatest on the severely flooded clay loam plots and lowest on the unflooded sandy loam. Bird community composition changed significantly following floods. Dickcissel, the dominant species from 2010-2012, declined by 80% in 2013; however, declines were more evident (98%) in the severely flooded clay loam plots compared to the unflooded sandy loam plots (53% decline). Flooding drastically altered vegetation structure and reduced forb abundance in some plots. Continued monitoring and additional analyses will explore the long-term effects of plant community alteration on butterfly and bird community dynamics.

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THE ROLE OF KNOX GENES DURING SIMPLE AND COMPOUND LEAF DEVELOPMENT IN THE GENUS *AMPELOPSIS (VITACEAE).*

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The genus Ampelopsis, a member of the Vitaceae (grape) family, encompasses species that exhibit a wide range of mature leaf shape that vary from simple (undivided single blade) to compound (subdivided multiple blade unit). The purpose of this study was to investigate the involvement of KNOX-genes, specifically KNOX1 (Knotted1 like homeobox), in the development of *Ampelopsis*, and how this gene controls leaf morphology. During simple leaf development, KNOX is required for the initiation of leaf primordia in the shoot apical meristem, but is downregulated after emerging from the apex allowing the blade to remain undivided. However, in some species, KNOX1 may be recruited back into young developing leaves to form leaflets, therefore, playing a role in leaf compounding. Since virtually nothing is known about leaf development in the genus *Ampelopsis*, and Vitaceae as a whole, five species with various leaf shapes (simple, lobed, dissected and compound) were selected for the study: *Ampelopsis aconitifolia, Ampelopsis arborea, Ampelopsis cordata, Ampelopsis glandulosa,* and *Ampelopsis humulifolia*.

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LATITUDE AND ENVIRONMENTAL PRESSURE: THEIR IMPACT ON CARAPACE SHAPE IN THREE SPECIES OF FIDDLER CRABS FROM DIFFERENT REGIONS ACROSS THE ATLANTIC OCEAN.

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The Atlantic Ocean was formed by tectonic movement approximately 130 million years ago. Since geographic isolation is expected to produce divergence among populations, species trapped on these plates appear to have evolved by vicariance processes. Among semi-terrestrial fiddler crabs, three species from the subgenus *Uca (sensu stricto*) appear to be basal in the phylogeny of the genus: *Uca major* (Herbst 1782-1804), *Uca maracoani* (Latreille 1802-1803) and *Uca tangeri* (Eydoux 1835). Currently, the three species, found in Africa, South America and the Caribbean, exhibit a high affinity for their respective tectonic plates. The three appear to have evolved as a result of geological plates drifting over the last 35 million years. Inter- and intra-specific variation in carapace shape was assessed using geometric morphometrics to analyze 12 surface landmarks in the three species. In 314 female specimens, surficial coordinates were standardized and subjected to canonical variance (CVA) and principal component (PCA) analysis. In morphospace, the three species form distinct clusters. Within each species, there are clear differences among populations from the northern and southern latitudes. In addition, for *Uca maracoani* there is a significant correlation between carapace shape and certain environmental factors, such as salinity, substrate, and biotope. As it has not been demonstrated that there is extensive, structured geographic variation in the population genetics for *Uca*, the polymorphism is likely a result of environmental pressures, i.e., ecophenotypy.

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DYNAMICS OF ANDROGEN RECEPTOR/TESTOSTERONE SIGNALING IN MACROPHAGES INFECTED WITH THE PARASITIC PROTOZOAN LEISHMANIA CHAGASI.

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Leishmaniasis is a parasitic disease affecting millions of people. The causative agent, *Leishmania spp.*, are protozoa endemic in over 90 tropical and subtropical countries. Transmission occurs through the bite of an infected sand fly whereupon they are internalized by macrophages. In the macrophage, the parasites replicate, spread and cause disease. Leishmaniasis is a challenging disease in which the pathogen subverts the macrophage, a cell of the innate immune system, to disseminate infection. Children and the immunocompromised are at greater risk of developing active disease. There is also a male bias, but the reasons for this trend are unclear. To investigate the survival mechanisms of *Leishmania spp.* we examined the gene expression patterns of susceptible (BALB/c) mice macrophages infected with *L. chagasi,* the agent for Visceral Leishmaniasis in Brazil. L. chagasi infected macrophages showed modest changes in the expression of immunomodulatory molecules. An unexpected result was the increase in Androgen Receptor (AR), the receptor for Testosterone. The increase in AR was confirmed at the mRNA and protein levels. Furthermore, addition of physiological levels of Testosterone to *in vitro* macrophage cultures increased the levels of *L. chagasi* infection for up to 96 hours. Taken together, these results support a model in which the parasite-driven increase in AR and Testosterone signaling exacerbate infection and underlies the basis for the increased susceptibility observed in adult males.

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