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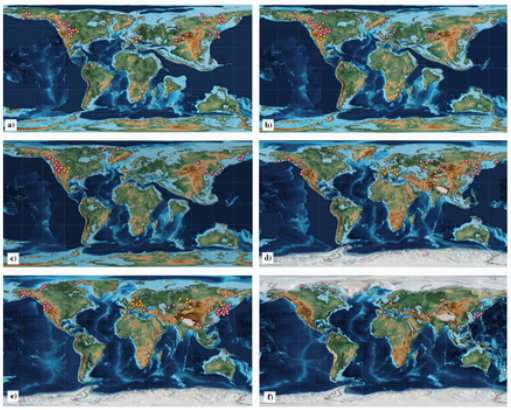
Highlighted Articles for November 2024

Reexamining climate niche conservation: Climate stories from living and fossil plants

The particular environmental and climate conditions that keep a plant confined to a specific geographic region is thought to have remained constant across the previous 100 million years or so. Quirk et al. tested this assumption of climatic niche conservatism by examining the past and present distributions and climates of fossil and modern plants, focusing on herbaceous ginger plants and the woody dawn redwood tree. Despite ginger plants being primarily in the tropics today, ginger fossils are largely found in higher latitudes of the Northern Hemisphere, which experienced very warm to cold climates in the past. In contrast, the distributions and climates of both the living and fossil dawn redwood trees matched—at mid-to-high latitudes in the Northern Hemisphere and cold climates. **These results suggest that climatic niches are not necessarily conserved on geological time scales, and they have important implications not only for future scientific analyses but also provide insights into how other extant plants may respond to current anthropogenic climate change.**



Zack J. Quirk, et al. 2024. Where did they come from, where did they go? Niche conservatism in woody and herbaceous plants and implications for plant-based paleoclimatic reconstructions. *American Journal of Botany* https://doi.org/10.1002/ajb2.16426

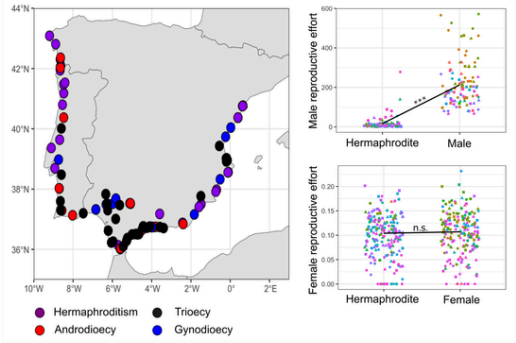
Understanding agricultural history provides important insights into plant phenotypic diversity

Jordan A. Dowell et al. 2024. Historic breeding practices contribute to germplasm divergence in leaf specialized metabolism and ecophysiology in cultivated sunflower (*Helianthus annuus*). *American Journal of Botany* https://doi.org/10.1002/ajb2.16420

The mid-20th-century Green Revolution was a transformative era in global agriculture, marked by unprecedented leaps in crop yields. This remarkable success was driven by the adoption of hybrid breeding techniques and increased agricultural industrialization. Since then, our collective grasp of the genetic basis of traits and their contributions to yield has advanced dramatically. These breakthroughs in genotype-to-phenotype predictions have redefined breeding goals, shifting from sheer yield maximization toward yield stability—a move aimed at ensuring consistent production across variable biotic and abiotic stresses. **Dowell et al. analyzed 288 lines of cultivated sunflower (*Helianthus annuus*) to examine the genomic basis of several specialized metabolites and agronomically important traits across major heterotic groups. The authors describe the impacts of agricultural history on shaping phenotypic and genomic diversity across cultivated sunflower, focusing on recent trends shifting growth-defense tradeoffs.**

The genetics, geographic distribution, and reproductive fitness estimation of trioecy in *Mercurialis annua*

Nguyen et al. investigate the occurrence of trioecy (the coexistence of males, hermaphrodites, and females) in the wind-pollinated herb *Mercurialis annua*. Trioecy is rare in plants, but it is common in hexaploid populations of *M. annua* in Spain and Portugal where the species is otherwise monoecious or androdioecious (in which only males coexist with monoecious hermaphrodites). **The authors combine assessment of sex-ratio variation with results from controlled crosses and fitness comparisons among the three sex morphs to suggest that trioecy is the outcome of both maternal and biparental inheritance of sex-determining factors.** Males are determined by a dominant allele on a Y chromosome shared with dioecious lineages in the genus and females result from the interaction of cytoplasmic male sterility mutations and nuclear restorers with likely Y linkage. Computer simulations of the model invoked for trioecy in *M. annua* predict sex ratios similar to those found in the field. **This study confirms a previous documentation of trioecy in *M. annua* and adds significantly to the knowledge of its geographic extent, its functional implications for fitness, and its possible genetic basis.**



Mai Thu Nguyen et al. 2024. Widespread male sterility and trioecy in androdioecious *Mercurialis annua*: Its distribution, genetic basis, and estimates of morph-specific fitness components.. *American Journal of Botany* https://doi.org/10.1002/ajb2.16429

Smells like fire: Pyrogenic flowering, bee pollination, and the weird fruiting biology of an ant-dispersed plant

Ian Kiepiel and Steven D. Johnson. 2024. Scent-mediated bee pollination and myrmecochory in an enigmatic geophyte with pyrogenic flowering and subterranean development of fleshy fruits. *American Journal of Botany* https://doi.org/10.1002/ajb2.16421

For the "Natal crocus," a Southern African geophyte whose leafless flowers emerge from the ground shortly after fire, timing is everything. **Using a multi-angled approach, Kiepiel and Johnson provide a first account of the reproductive biology of *Apodolirion buchananii*.** Its flowers, among the first to bloom in the post-fire landscape, make the most of the short window of opportunity, luring bees and other pollinators back into the charred grassland with their sweet fragrance and rewards of pollen. Unhindered by surrounding vegetation and in the absence of competition for pollinators, the striking white flowers of this small plant open for only a few days in the dry winter before withering back into the ashes. **After more than six months underground, the fruits emerge from the soil during the peak of the summer rains.** The scented fruits are rapidly stripped of their large fleshy seeds by ants. The ants then mysteriously carry the seeds back to their nests—even though they offer no apparent reward. Lacking in dormancy, seeds which are dropped by ants germinate within days, with seedlings establishing rapidly. **The unexpected observations of seed dispersal by ants raise new questions that will need to be answered to gain a deeper understanding of the unusual reproductive biology of *A. buchananii*.**