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Highlighted Articles for April 2023

An improved phylogeny clarifies the parallel evolution of organ fusion in honeysuckles

In honeysuckles (*Lonicera*) leaves, bracteoles, ovaries, or sometimes even whole flowers may be fused. Species differ greatly in terms of which organs they fuse and to what degree. In some species all the bracteoles subtending a pair of flowers are fused into a "cupule" that completely encloses the two flowers to form a false fruit at maturity. Understanding the evolution of such fused structures has been hindered by uncertainties in species relationships. **Srivastav et al. inferred species relationships with high confidence using a large, nuclear DNA dataset for the first time, which then enabled them to trace the evolution of organ fusions.** The authors found that highly derived fused structures, such as cupules, evolved multiple times in parallel and, surprisingly, directly from free bracteoles rather than from partially fused ones. Also unexpectedly, they found that species that evolved leaf fusion rarely have fused ovaries and bracteoles. **Their work lays the foundation for more detailed studies of the genetic and ecological drivers of organ fusion and makes a major advance in *Lonicera* phylogeny reconstruction that will impact future classifications.**

Mansa Srivastav et al. 2023. A phylogenomic analysis of *Lonicera* and its bearing on the evolution of organ fusion. *American Journal of Botany* https://doi.org/10.1002/ajb2.16143

Fire may improve pollination outcomes in species with fire-stimulated flowering

Lea K. Richardson et al. 2023. Fire effects on plant reproductive fitness vary among individuals, reflecting pollination-dependent mechanisms. *American Journal of Botany* https://doi.org/10.1002/ajb2.16160

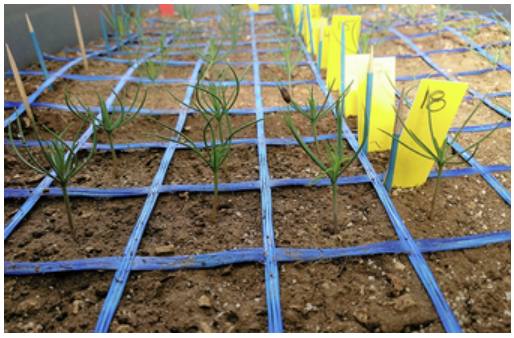
Fires induce flowering in many plant species worldwide. **More resources are available right after a fire, so more plants flower. However, it is unclear if this increase in flowering actually leads to more seeds.** It could be that post-fire increases in resources lead to more flowers and seeds at the end of the season. Alternatively, if fire synchronizes flowering such that plants have more mating opportunities, increased seed production may result from improved pollination. **Richardson et al. investigated this multi-component question in three tallgrass prairie perennials.** Their results confirm that post-fire resources promoted flowering in two of the three species and, surprisingly, that pollination substantially improved seed yield above and beyond the resource effect. The findings suggest that both fire and flowering time play important roles in pollination. **The study also highlights the different responses to fires among species, which could impact the broader plant community.**

The life of a leaf: Investigating the temporal coordination and optimization of leaf function in a tropical fern species

Ecological and evolutionary forces have generated extraordinary variation in plant form and function. Economic and physiological theory agree that the integration and optimization of plant traits is a key driver of biodiversity in land plants. However, few studies have examined how developmental processes impact the timing and optimization of key plant traits thought to drive species ecology, especially in seed-free plant lineages like ferns. **This paper by Krieg et al. examines how key metrics of physiological performance change over the course of the life of a frond in the tropical fern species, *Saccoloma inaequale*, and tests hypotheses about the coordination of traits as predicted by economic theory.** The data demonstrate that middle-aged fronds maximized efficiency of photosynthetic returns on nitrogen and carbon investments compared to older fronds, and maximized water-use efficiency relative to younger fronds. **This study provides some of the first evidence of when relative physiological trait efficiency is maximized in this tropical fern species and highlights the critical importance of considering developmental constraints on trait coordination and optimization to improve our understanding of the processes that drive variation in plant form, function, and ecology.** *[Photo credit: Deedra McClearn]*

Christopher P. Krieg et al. 2023. Functional traits and trait coordination change over the life of a leaf in a tropical fern species. *American Journal of Botany* https://doi.org/10.1002/ajb2.16151

Can trees adapt to soil heterogeneity under gene flow?



Azucena Jiménez-Ramírez et al. 2023. Microgeographic variation in early fitness traits of *Pinus sylvestris* from contrasting soils. *American Journal of Botany* https://doi.org/10.1002/ajb2.16159

Forest tree species clearly exhibit adaptive trait variation over geographical scales of hundreds of kilometers. However, far less is known about the lower spatial boundary of tree adaptive divergence, despite its practical implications in forest management and conservation. Evidence of tree microgeographic adaptation (under gene flow) is restricted to steep temperature and precipitation gradients found along elevational clines, or to extreme but relatively rare (e.g., serpentine or waterlogged) soils. **Jiménez-Ramírez et al. focused on a less severe but more frequent kind of soil variation in a first attempt to test for local adaptation to calcareous versus siliceous soil types in tree populations connected via pollen flow.** The authors measured variation in performance among Scots pine (*Pinus sylvestris* L.) seedlings originating from two edaphic provenances when experimentally grown on both types of natural local substrate. Although seedlings clearly showed lower performance on the calcareous substrate, neither performance nor plasticity among substrates varied significantly with edaphic provenance. **The results call for additional longer-term studies that could reveal a potentially delayed expression of local edaphic adaptation under gene flow in trees.**