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Modeling evolutionary diversification of plant-pollinator trophic networks

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Mutualism is recognized as a major driver of biodiversity by enabling widespread cospeciation in terrestrial communities. An important case is that of flowering plants and their pollinators, where the convergent selection of plant and pollinator traits combines with their divergent selection, which minimizes niche overlap within each group. In this article, we study cospeciation in communities structured trophically: plants are primary resource producers, required by primary consumers, the servicing pollinators. We model the natural selection of traits affecting resource consumption, competition between pollinators, and competition between plants. We show that species diversification is favored by broad plant niches, suggesting that bottom-up trophic control leads to cospeciation. We demonstrate that mutualistic generalism, i.e., tolerance of trait differences, promotes plant speciation, but it is also unfavorable for pollinator speciation. Evolved communities display skewed distributions of interaction effects, with proportional dominance of weak effects. Overall, we conclude that the trophic hierarchy of plant–pollinator communities is of utmost importance for the evolution of complex, richer, and diverse mutualistic networks.