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Duckweeds as models for understanding evolution in ecological communities and floral diversity

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Duckweeds combine ecological importance with remarkable evolutionary and morphological diversity. In this talk, I will first present our recent work using Spirodela polyrhiza to investigate evolution in complex ecological communities. I will then introduce our ongoing efforts to establish Lemna aequinoctialis as a model for studying the evolution and development of highly reduced flowers. Evolutionary ecology has often simplified the ecological conditions under which evolution occurs. In nature, however, organisms live and evolve within communities composed of complex networks of species interactions. Using S. polyrhiza, we have shown that direct herbivory by snails and indirect effects mediated through algal competition jointly shape duckweed population dynamics and evolution (Böttner et al. 2025, Schäfer et al. 2025). Because these interactions vary over time, they can generate strongly fluctuating selection and make short-term evolutionary outcomes difficult to predict. These findings demonstrate that duckweed is a power system for revealing evolutionary principles in nature. At a broader evolutionary scale, duckweeds display striking variation in body plans and reproductive structures. Our recent comparative analysis suggests that duckweed reproductive structures evolved through progressive reduction and compression of the ancestral aroid spadix-spathe system (Siadjeu et al. 2026). To investigate the mechanisms underlying this diversity, we are developing Lemna aequinoctialis as a functional evo-devo model. A single-nucleus transcriptomic atlas and stable genetic transformation now provide tools for identifying cell-type-specific regulatory programmes and experimentally testing their roles in floral development.

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