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Proceedings Introduction: Phylogeny and Ecological Diversification in *Carex*

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Seven papers in this quarter's issue of *Systematic Botany* come from a symposium on phylogeny and ecological diversification in sedges (*Carex* L., Cyperaceae) convened at the Botany 2015 meetings in Edmonton. The symposium was timely, as the genus had recently been circumscribed to include the four segregate genera *Cymophyllus* Mack., *Kobresia* Willd., *Schoenoxiphium Nees*, and *Uncinia* Pers. (Global *Carex* Group 2015). Irrespective of this recircumscription, *Carex* is an impressively diverse genus. At approximately 2,000 species, *Carex* is the second largest genus of the temperate zone (after *Astragalus* L., Zarre and Azani 2013; though cf. Frodin 2004, at which time *Carex* was considered the largest). It is cosmopolitan in distribution (including the Antarctic archipelagos; Burton 2012) and ecologically important in habitats that range from tundra and dry sand prairies to open wetlands and bottomland forests (Suttie et al. 2005). *Carex* is an important food source for waterfowl (Sedinger 1984; Gadallah and Jefferies 1995) and ungulates (Uresk and Paintner 1985; Fortin et al. 2003; Evans et al. 2004; Shrestha et al. 2012), and several species have medicinal or nutritional properties for humans as well (Fiorentino et al. 2008; Li et al. 2009; Roy et al. 2012). Given its importance for ecosystems and thus also humans, *Carex* ought to be a well-understood genus from an evolutionary and ecological standpoint.

Yet due in part to the taxonomic difficulties that the genus presents, its utility as a model for understanding ecological diversification and niche evolution is not fully realized (Waterway et al. 2009). This is unfortunate, as high species number and rapid diversification of sedges make it ideal for clade-based studies of biodiversity patterns. Numerous studies have addressed phylogenetic relationships within the Cyperaceae at both broad and fine scales (reviewed in Global *Carex* Group 2016a, this issue). In recent years, several studies have used the phylogeny of *Carex* or Cyperaceae to investigate patterns and timing of lineage diversification (Gehrke and Linder 2009, 2011; Escudero et al. 2012a; Escudero and Hipp 2013; Spalink et al. 2016a, 2016b), the interaction between ecological and chromosomal evolution (Hipp 2007; Hipp et al. 2010; Chung et al. 2011, 2012; Escudero et al. 2012b, 2013a, 2013b), the understanding of biogeographic patterns (King and Roalson 2009; Escudero et al. 2010; Jiménez-Mejías et al. 2012; Villaverde et al. 2015a, 2015b), and patterns of community assembly (Slingsby and Verboom 2006; Dabros and Waterway 2008; Waterway et al. 2009; Elliott et al. 2016). Considering the diversity of the genus, its ecological importance in the temperate zone, and the promising findings of these first studies, *Carex* provides ample but largely untapped opportunity to plant evolutionary biologists and ecologists to understand fundamental processes of lineage and ecological diversification.

Our symposium investigated the ecological dimensions of *Carex* diversification in the context of a global revision of *Carex* classification by The Global *Carex* Group (http://systematics.mortonarb.org/cariceae). The symposium featured six talks on phylogenetic and ecological diversification of sedges. Seven papers on this theme are presented here. Two are foundational, providing a global phylogeny that serves as the underpinning of our work (Global *Carex* Group 2016a) and addressing a fundamental terminology issue in the genus (Jiménez-Mejías et al. 2016). Two are methodological, introducing approaches to linking NCBI data back to specimens for analytical purposes (Global *Carex* Group 2016b) and using *Carex* morphological diversity as a subject of collaborative research with K-12 students (Hahn et al. 2016). Three use phylogenetic data to investigate ecological diversification, focusing on trait evolution (Hoffmann and Gebauer 2016), community assembly (Waterway et al. 2016), and the effects of holocentry on lineage diversification (Escudero et al. 2016).

This set of symposium papers only scratches the surface of what is possible with a densely sampled phylogeny of a large genus such as *Carex*. Deeper sampling of the genus aimed at a more comprehensive phylogenetic hypothesis is ongoing as are additional studies relating ecological differentiation, biogeographic patterns, and chromosomal evolution to phylogenetic relationships. We expect that the phylogenetic work being conducted by the Global *Carex* Group will set the stage for expanded and more refined studies of lineage diversification and ecological adaptation in this challenging genus, building in part on the work published here.

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