THE EVOLUTION AND BIOGEOGRAPHY OF AUSTRALIAN ASPARAGALES

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Asparagales comprise one third of all monocots (14 families, 1,122 genera, ca. 36,205 species) including Orchidaceae and economically important taxa (e.g. asparagus, onion and many ornamental plants). Despite the significant non-Orchidaceae diversity in Australia (9 families; 48 genera; ca. 327 species), phylogenetic studies to-date have neglected sampling of Australian taxa, including only placeholder genera. As a result, understanding of the evolution of the extreme morphological heterogeneity present within asparagoid families is limited. Australian Asparagales taxa are found across a striking range of habitats. A phylogenetic study of character evolution among genera holds potential to provide insights into the evolution of habitat-associated adaptive traits, such as the evolution of desiccation-tolerance strategies and geophytism.

Phylogenetic relationships of Australian Asparagales were inferred to provide a context for understanding the morphological and ecological diversity of the order. All native Australian genera were sampled and species level diversity was represented by 200 individuals. Genome skimming libraries were generated and high throughput sequencing technology (Illumina 2000) was used to generate sequence data. Whole chloroplast genomes were de-novo assembled, mapped to reference and aligned, and the phylogeny was inferred using the maximum likelihood criterion in RAxML. Data for key morphological and ecological characters were reconstructed onto the phylogeny using Fitch parsimony.

The asparagoid phylogeny we have generated based on genomic data supports monophyly of existing Asparagales subfamilies and, for the first time for many genera, has allowed assessment of the monophyly and relationships of Australian taxa. Morphological and ecological diversity of Australian genera will be examined in a phylogenetic context, towards assessment of taxonomic status, focusing on genera with putatively overlapping boundaries and those containing extreme morphological heterogeneity. Character evolution in Australian Asparagales and implications for evolution of Asparagales-dominated vegetation will be discussed in light of these results.

Dr Joanne L. Birch holds a teaching and research position in the School of BioSciences at the University of Melbourne and is the Curator of the University of Melbourne Herbarium (MELU). Her research investigates of evolution and diversification of plant lineages from the Australasian and Pacific floras. Current studies focus on monocotyledon systematics and biogeography including of Australian Asparagales and Australasian Poa (Poaceae–Poeae).

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AUSTRALASIAN SYSTEMATIC BOTANY SOCIETY 2018 CONFERENCE

3-7 December 2018

Brisbane Botanic Gardens Mt Coot-tha, Australia

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