**UNDERSTANDING THE METABOLIC INTERPLAY BETWEEN SYMBIONTS OF THE LICHEN *Endocarpon pusillum* THROUGH DEVELOPING A CORE METABOLIC NETWORK MODEL**

Hadi Nazem-Bokaee1,2\*, Oliver Mead1,2, Cecile Gueidan1\*

1 CSIRO Australian National Herbarium, Centre for Australian National Biodiversity

Research, National Research Collections Australia, NCMI, Canberra, Australia; 2 CSIRO Synthetic Biology Future Science Platform, Canberra, Australia; \*E-mails: Cecile.Gueidan@csiro.au, Hadi.Nazem-Bokaee@csiro.au

Lichen symbiosis represents a complex multi-species association of fungi, algae, and other bacteria. Through this symbiosis, unique self-sustained miniature ecosystems are formed in a broad range of habitats. In such multi-symbioses, each partner contributes to the whole: the primary mycobiont provides shelter and minerals, the primary photobiont fixes atmospheric carbon dioxide and nitrogen (if it is a cyanobiont) to provide carbon and nitrogen source, respectively, and other auxiliary bacteria and/or fungi serve specific functions. However, the majority of functions and interactions in these highly inter-connected environments are poorly understood. Here, we aim at elucidating some of the key metabolic interactions and functions between the primary mycobiont and photobiont of a model lichen, *Endocarpon pusillum*. For that, we take a systems-level approach, by which we can simulate core metabolic networks of both symbionts using a constraint-based modelling framework. The core metabolic model of the mycobiont *E. pusillum* contains over 100 genes, 330 reactions, and 240 metabolites and predicts growth of the fungus on glucose and sorbitol, *in silico*. The core metabolic model of the photobiont, *Diplosphaera* sp., encompasses over 120 genes, 350 reactions, and 250 metabolites predicting carbon fixation by the alga and provision of sorbitol and glucose to the mycobiont. Next, we develop a community metabolic model of the lichen by combining the core metabolic models of the mycobiont and the photobiont. Using this community model, we are able to estimate, for the first time, theoretical limits of carbon fixation, growth, and energy requirements of the lichen *E. pusillum* during its symbiosis. This work provides important new insights on the interacting metabolic pathways during the lichen symbiosis.