Rated R: Reproduction in rust fungi

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Rust fungi are a paradox: they have complex but plastic life cycles, and are highly host specific yet alternate between unrelated taxa. The evolutionary mechanisms behind life cycles and host ranges of rust fungi are long-standing knowledge-gaps. Our research provides knowledge for these long-standing biological questions and focuses on the evolution, reproduction and life cycles of rust fungi. We aim to resolve the systematic relationships of rust fungi and determine which characters are ancestral in their evolution. A robust taxonomy hinges on sampling from species that represent the types of genera and families and especially from taxa that have an ambiguous placement in current taxonomies.
We study the life cycles of tropical rust fungi, such as myrtle rust, which was thought to have a life cycle homologous to temperate rusts. Myrtle rust reproduces sexually and is another example in a list of fungi that were once thought ‘strictly clonal’. Genomics may provide answers to the life cycle traits and host ranges of rust fungi, however, they have the largest genomes of all fungi, DNA is a limiting factor, and they have a high content of transposable elements, all of which are challenges for genome assembly. We have sequenced genomes of six rust fungi in Australia that may shed light on the evolution of life cycles.