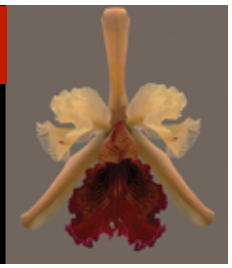

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Understanding the distribution of three species of epiphytic orchids in temperate Australian rainforest by investigation of their host and fungal associates

Understanding the environmental constraints affecting species' distributions are critical to their survival. Among epiphytic orchid species, abundance is a direct consequence of the availability and distribution of suitable host substrates (phorophytes) and their orchid mycorrhizal fungi (OMF). I sought to ascertain the nature of the relationship between three closely related, co-occurring species of epiphytic Aeridinae (= Sarcanthinae) orchids, their OMF, and their phorophytes. The orchid study species: *Sarcochilus hillii, Sarcochilus olivaceous* and *Plectorrhiza tridentata* are all small, monopodial epiphytes found on trees and shrubs in temperate rainforest gullies. Four sites in temperate south-eastern Australia were surveyed and the associations of these three orchid species with their OMF and phorophytes determined. *Backhousia myrtifolia* was the dominant host tree for all three orchid species, and all three preferred a host with moderate to high moss cover. Despite these similarities distinct patterns of host association were detected, for example in their proximity to moss and location on their host. Additionally they differed in their association on potential phorophytes: *S. hillii*'s distribution reflecting that of the rainforests tree species composition; *P. tridentata* exhibiting a strong bias towards *B. myrtifolia*, although was otherwise on the broadest range of phorophytes species; *S. olivaceous* had the narrowest distribution exhibiting clear preferences for and against particular phorophyte species. Despite the apparent randomness of *S. hillii*'s phorophyte association, the size and inflorescence number of this orchid species was strongly influenced by characteristics of its host. Endophytic fungi isolated from each orchid species and identified genetically using the nuclear ribosomal internal transcribed spacer (ITS) and mitochondrial large subunit (ML) all belonged to two distinct clades within the genus *Ceratobasidium*. Germination trials verified these isolates as OMF. All three orchids species associated with clade K, but only *S. hillii* was found with clade L, despite both clades being present on the common host. In chemotropism trials clade K grew towards aliquots of seed and water equally, whereas clade L was actively attracted to *S. hillii* seed, but not towards *S. olivaceous*' seed. Thus despite exposure to multiple potential phorophytes and OMF each of these three epiphytic orchid species utilises a distinctive subset of those available. Furthermore, the nature of these associations differs for each orchid species with the species and attributes of the phorophyte affecting different fitness characteristics; and one OMF clade actively seeking one of the orchid species.