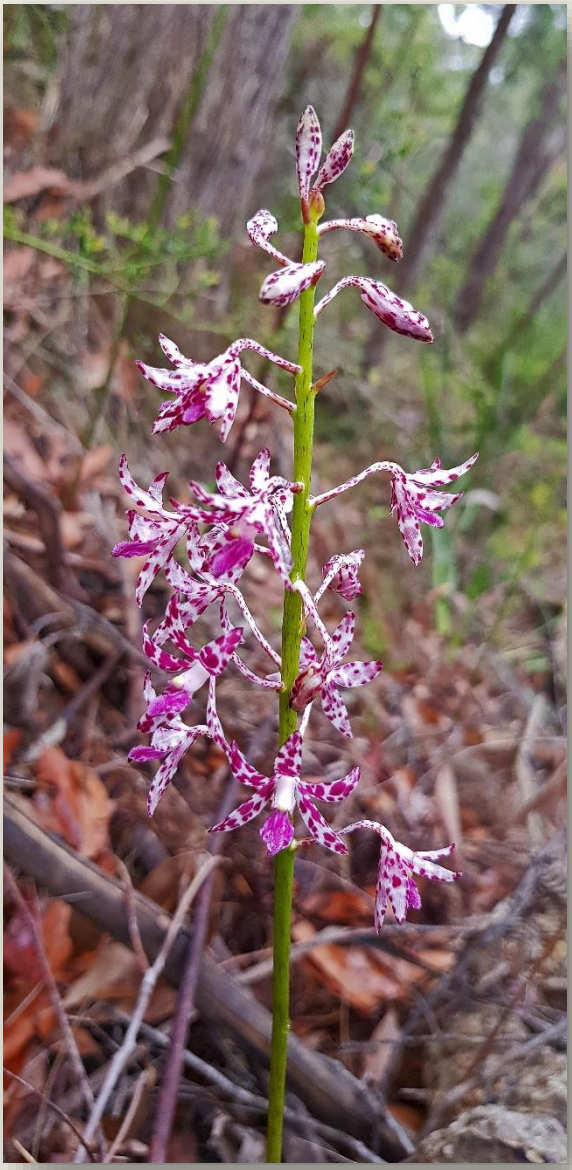
Slender Hyacinth Orchids

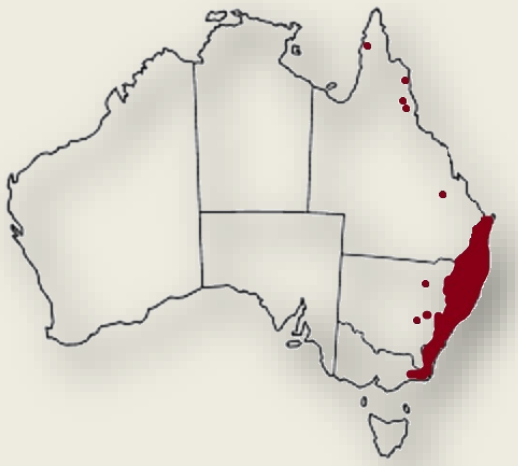
Dipodium variegatum

Beautiful parasites?



Hyacinth Orchids - *Dipodium* species - have been conspicuous in Sydney bushland earlier this year. The Slender Hyacinth Orchid, *Dipodium variegatum*, is a perennial terrestrial herb but most of its life is spent underground, only surfacing from its dormant state when it flowers. So how does it survive? From where does it source the carbohydrates and minerals necessary for survival? For these orchids, and many others, symbioses (relationships between dissimilar organisms) are essential for survival.

Perhaps we should start at the beginning! Seeds of orchids are dust-like, smaller than those of any other plant. They are essentially an embryo lacking in starchy endosperm, or any other significant food reserves to support the germinating seedling. Hence, they cannot germinate without the help of a fungus – or sometimes a number of species of fungi – referred to as *mycorrhizae* (fungus-root symbiosis). So, in their youngest stages, all orchid plants can be deemed to be *parasitic.*



Dipodium variegatum – Slender Hyacinth Orchid

Eventually many/most orchid species will develop green stems and leaves, and like most land plants with fungal partners, will share carbohydrates with their underground fungal partners in return for water and minerals. These relationships have long been referred to as *mutualistic* (where both partners benefit from a symbiotic relationship). The shift from *parasitism* to *mutualism* is often referred to as: *take now, pay later*!

However, the Slender Hyacinth Orchid has minimal or no development of green, chlorophyll-rich leaves or stems, and therefore cannot share sugars with fungal partners: in this case the concept becomes *take now and continue to take later*! So Slender Hyacinth Orchids that are virtually parasitic for their whole existence are referred to as *mycoheterotrophs* — these are *heterotrophs* (non-autonomous feeders) that specifically depend upon fungi (*myco*) for their nutrition.

Many sources refer to *mycoheterotrophic* orchids as *saprophytes* – living on dead materials – but recent references indicate that they may have associations with fungi that colonise rotting logs for example, but also with other fungi that have associations with living plants. The Slender Hyacinth Orchid is often seen growing in close proximity to *Eucalyptus* trees, so it is possible that it has a close relationship with mycorrhizal fungi associated with those trees. In other words, sugars produced by photosynthesis in eucalypts may end up in the orchids. Future studies may be able to confirm a three-way interaction between this opportunistic Hyacinth Orchid and more than one soil mycorrhizal fungus species acting as the transport system to deliver resources from *Eucalyptus* trees to parasitic orchids. This *take now and continue to take later* strategy could only work for niche species but it does provide a much larger and more reliable source of nutrients for the orchid, and allows it to thrive underground where it is protected from fires.

Bougoure J J., Dearnaley, J D W. 2005. The fungal endophytes of *Dipodium variegatum*. *Australasian Mycologist* 24(1): 15-19.

Ogura-Tsujita Y, Yukawa T, Kinoshita A. 2021. Evolutionary histories and mycorrhizal associations of mycoheterotrophic plants dependent on saprotrophic fungi. *Journal of Plant Research* (2021) 134:19–41

Sheldrake M. 2020. *Entangled Life – how Fungi Make Our Worlds, Change Our Minds and Shape Our Futures.* The Bodley Head, London.

Weston P H, Perkins A J, Entwisle T J. 2005. More than symbioses: orchid ecology with examples from the Sydney Region. *Cunninghamia* 9(1): 1-15.

Wikipedia: https://en.wikipedia.org/wiki/Dipodium_variegatum

Distribution map: Modified from *Atlas of Living Australia*: https://biocache.ala.org.au/occurrences/search?q=lsid:https://id.biodiversity.org.au/name/apni/79611#tab_mapView

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