

OBSERVATIONS ON THE MYCORRHIZA OF *PINUS RADIATA*.

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The absorbing roots of many forest trees and also of a number of shrubs and herbs are characterised by the possession of a fungal mantle. Anatomical study of such roots has shown that the enveloping fungus usually not only surrounds the roots, but penetrates its tissues. Here it is either restricted to a position between the cell walls or may enter the cells themselves. To this association of root and fungus Frank (1885) applied the name "mycorrhiza."

Various roles have been assigned to mycorrhiza, such as that the fungus facilitates the absorption of mineral salts, that it has the power of fixing atmospheric nitrogen, etc. Melin (1925), who has carried out considerable research on the mycorrhiza of forest trees, concluded that there was a metabolic exchange between the fungus and the higher plant, the fungus facilitating the absorption of ammonium salts and of the more complex nitrogenous compounds, e.g., nucleic acid, and receiving in return from the plant supplies of such carbon compounds as glucose; also, that the plant roots excreted phosphatids which stimulated fungal activity. This worker (1923) was successful in identifying some of the fungi forming mycorrhiza.

Observations were carried out by the author on the mycorrhiza of *Pinus Radiata*, one of the chief exotic timber trees of New Zealand. Collections of mycorrhiza were made in various localities in the Nelson and Canterbury districts. Mycorrhiza of various types—simple, coraloid and tuberculate—and of different colours, were found near or on the surface of the ground on all the trees examined. Such typical mycorrhiza-forming fungi as *Boletus luteus* and *B. granulatus* were found growing fairly consistently beneath the trees, and also *Rhizopogon roseolus* Hollos, so possibly these three are among the fungi forming mycorrhiza on *P. radiata*. The only possible way of proving the identity of the mycorrhizal fungi of *P. radiata* is by the "synthesis" method of Melin, which entails:

1. Raising pure culture seedlings of **Pinus radiata** and maintaining them under strictly aseptic and controlled conditions for a period sufficiently long to permit adequate observation of their behaviour.

2. Isolating the fungi present in the roots of **P. radiata** and maintaining them in **pure** culture apart from their hosts.

3. Testing the identity of these fungi by bringing them into contact with **P. radiata** under **pure** culture conditions, observing the behaviour of the latter with or without infection.

Attempts were made to do this and "pure culture" seedlings of **P. radiata** were inoculated from pure cultures of **Boletus luteus** and **B. granulatus**. Only in the latter case was success attained; one of the inoculated seedlings developing a swollen white tip which anatomical investigation proved to be due to the presence of a mycorrhizal mantle.

Attempts were also made to isolate the fungi from the mycorrhiza of **P. radiata**. Pure cultures were obtained, but with the absence of fructifications there was no proof of identity. The only way of identifying such cultures would have been synthesis with "pure culture" seedlings, but this was impossible in the limited time available.

Anatomical study of the mycorrhiza of **P. radiata** showed various stages in the infection of the fungus, both intercellular and intracellular being observed. In the latter case, stages in the digestion of the fungus by the host were found in a number of the sections examined. In no instance did the fungus penetrate further than the innermost layer of the cortex.

If mycorrhiza is of advantage to forest trees, as according to the majority of workers, it is, the extent to which **P. radiata** is grown throughout New Zealand fully warrants research into the nature and identity of its mycorrhizal-forming fungi. Considerable difficulty in establishing seedlings in certain localities in Western and South Australia was found to be due to the absence of a suitable mycorrhizal fungus. Such difficulty has not been experienced so far in New Zealand, but it is possible that there are localities to which the distribution of such fungi does not extend or where conditions are unsuitable for their growth.