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# Technical Bulletin

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## **WHY *PISOLITHUS TINCTORIUS* AND *SCLERODERMA* AND NOT *RHIZOPOGON***

Our competitors are marketing ectomycorrhizal fungal products containing spores of *Rhizopogon*, as well as, *Pisolithus tinctorius*. Their claim is that these *Rhizopogon* species are highly infective on a broad range of tree hosts and, additionally, are very tolerant to cold soil temperatures. For most competitors the species (usually four) of *Rhizopogon* in their products represents only 10% of the total spore count. *Pisolithus* spores usually represent 90% of the mix.

The following is a brief ecological and physiological summary of published information on *Rhizopogon*, *Pisolithus* and *Scleroderma* species.

- ♦ Species of *Rhizopogon* are classified by scientists as ectomycorrhizal fungi with narrow tree host ranges. Many of these fungi are specific to only one tree species like *R. vinicolor* to Douglas-fir and *R. occidentalis* to lodgepole pine in the Pacific Northwest (PNW) of the US. Publications on field observations and controlled seedling inoculations show that this genus of puffball-producing fungi have tree hosts restricted mainly to fir, spruce, western hemlock and a few western pine species that have narrow geographic ranges within the PNW. I have found no published reports of any PNW (where these *Rhizopogon* spores are collected) *Rhizopogon* species forming ectomycorrhizae on any oak, hickory, beech, birch, basswood, *Eucalyptus*, most pines or other ectomycorrhizal tree species.
- ♦ The physiographic region where these *Rhizopogons* are collected in natural forest of the PNW have winters that are no more severe or longer in duration than the winters where our *Pisolithus* and *Scleroderma* are collected in the eastern US. *Pisolithus*

also occurs naturally in OR and WA as well as ID, UT, CA, NV, WY, MT, CO, Canada, Mexico and most of Europe (see Technical Bulletin # 27). *Pisolithus* and *Scleroderma* exist, thrive and survive on roots of trees in soils that may freeze (especially exposed coal spoils) for several weeks nearly every winter in the cold northern and eastern states (PA, OH, WVa., IL, WS, MI, MN and RI) and Canada and in the warmer environments of the southeastern and southwestern US, Mexico and Central and South America. There is no published data on the effects of soil temperature on ectomycorrhizal development by *Rhizopogons* on any tree species. There is information published on *Pisolithus* and soil temperature. However, there are only a few publications on the effects of different temperatures on ectomycorrhizal development by any fungus. There are many publications on the effect of temperature on vegetative growth of numerous ectomycorrhizal fungi in the lab in pure cultures, but that has little bearing on their ability to form ectomycorrhizae. The tree host controls a lot of the temperature response since it must produce roots at this temperature before mycorrhizae are formed. A 1970 publication shows that *Pisolithus* forms abundant ectomycorrhizae on loblolly pine at soil temperatures as low as 14<sup>0</sup> C (53<sup>0</sup> F), the lowest temperature tested. Other reports found that *Pisolithus* formed ectomycorrhizae at soil temperatures in excess of 55<sup>0</sup> C (130<sup>0</sup> F). It also survived prolonged freezing and, after thawing, formed abundant ectomycorrhizae once roots were present. It should, because that's how it exists in nature. All species of fungi form ectomycorrhizae best at temperatures between 10<sup>0</sup> and 30<sup>0</sup> C (50-85<sup>0</sup> F)...which is the range of soil temperatures during the main growing season in 95% of the world and the best temperatures for new root growth (a prerequisite to mycorrhizal development) for 95% of all trees.

- ♦ *Pisolithus* and *Scleroderma* species are classified by scientists as very broad tree host range ectomycorrhizal fungi, i.e. they form ectomycorrhizae with most species of pine, spruce, fir, oak, hickory, beech, birch, *Eucalyptus*, basswood, etc. that have been tested. This also means these fungi occur in many physiographic regions (cold and warm) of the US and the World since their many tree hosts occur naturally in these regions. Much of our arboricultural and forestry sales are for established or transplanted trees and for seedling nurseries. There is no published information that these *Rhizopogons* will form ectomycorrhizae on any established older tree or on

large transplanted trees. All of the tree seedling research on *Rhizopogon* was done in the Pacific Northwest on their tree species.

### Summary

1. *Rhizopogon* spores for commercial sales are collected mostly from Oregon, Washington and Idaho.
2. These *Rhizopogon* spp have narrow tree host ranges. They occur naturally under only a few tree species in limited geographic areas of the PNW.
3. Much research on the ecology and physiology of these *Rhizopogons* has been published allowing us to come to these conclusions. Dr. Amaranthus has published some of these articles.
4. *Pisolithus tinctorius* is also part of their products and is used at a rate usually 9 x more than *Rhizopogon*. They obviously aren't betting on the *Rhizopogon* and are using them as a "cold weather" marketing gimmick.
5. Competitors know the nearly unlimited tree host range of *Pisolithus*, it's natural worldwide distribution, it's ability to be infective and effective under a broad range of soil and weather conditions and the fact that we know more about *Pisolithus* than any other ectomycorrhizal fungus.

A list of scientific references to support the above summary is available if you so desire.