

*Some Probable Mycorrhizal Associations
in the Pacific Northwest. III.*

JAMES M. TRAPPE

*Pacific Northwest Forest and Range Experiment Station,
Forest Service, U.S. Department of Agriculture,
Portland, Oregon*

CONTINUING observations indicate the following fungus-tree associations to be mycorrhizal (locations cited are from observations based on criteria listed by Trappe, 1960):

Amanita muscaria (L. ex Fries) Pers. ex S. F. Gray: *Pinus ponderosa* (previously reported by Rawlings, 1951, for New Zealand), *Pinus contorta*, *Populus trichocarpa*, and *Pseudotsuga menziesii* var. *glauca*—east slope of the Cascade Range in northern Washington from 1,200 to 2,000 ft. elevs.

Amanita pantherina (D.C. ex Fries) Secr.: *Picea engelmannii*—west slope of the Cascade Range in southern Washington at 1,000 ft. elev.

Amanita vaginata (Bull. ex Fries) Quél.: *Picea sitchensis* and *Tsuga heterophylla*—coastal fog belt of northern Oregon at 150 ft. elev.; *Pseudotsuga menziesii* var. *menziesii*—Willamette Valley of northern Oregon at 400 ft. elev.

Boletus edulis Bull. ex Fries: *Abies grandis*—east slope of the Cascade Range in northern Washington at 1,500 ft. elev.; *Pinus ponderosa*—east slope of the Cascade Range in central Oregon at 4,300 ft. elev. and in northern Washington at 1,500 ft. elev.; *Populus trichocarpa* and *Pseudotsuga menziesii* var. *glauca*—east slope of the Cascade Range in northern Washington at 2,000 ft. elev.

Boletus pulverulentus Opat.: *Pseudotsuga menziesii* var. *menziesii* and *Tsuga heterophylla*—west slope of the Cascade Range in southern Washington at 1,500 ft. elev.

Cantharellus cibarius Fries: *Picea sitchensis* and *Tsuga heterophylla*—coastal fog belt of northern Oregon at 200 ft. elev.

Cantharellus subalbidus A. H. Smith: *Pseudotsuga menziesii* var. *menziesii*—west slope of the Cascade Range in southern Washington at 1,500 ft. elev.

Cortinarius croceofolius Peck: *Pinus contorta*—west slope of the Cascade Range in northern Oregon at 3,000 ft. elev.

- Gomphidius rutilus* (Schaeff. ex Fries) Lund. & Nannf.: *Pinus contorta* (previously reported by Singer, 1949)—west slope of the Cascade Range in northern Oregon at 3,000 ft. elev.; *Pinus monticola*—east slope of the Cascade Range in northern Washington at 2,000 ft. elev.
- Hebeloma crustuliniforme* (Bull. ex Fries) Quéf.: *Populus trichocarpa*—east slope of the Cascade Range in northern Washington at 1,200 ft. elev.
- Hydnum repandum* L. ex Fries: *Pseudotsuga menziesii* var. *menziesii*—west slope of the Cascade Range in southern Washington at 1,500 ft. elev. and Willamette Valley of northern Oregon at 400 ft. elev.
- Inocybe lacera* (Fries) Quéf. (identification by Dr. D. E. Stuntz, University of Washington): *Pinus radiata*—in a greenhouse experiment at the University of Washington at Seattle.
- Lactarius deliciosus* (L. ex. Fries) S. F. Gray: *Picea sitchensis* and *Tsuga heterophylla*—coastal fog belt of northern Oregon at 100 ft. elev.; *Pinus lambertiana* and *Pseudotsuga menziesii* var. *menziesii*—west slope of the Cascade Range in southern Oregon at 3,000 ft. elev.
- Lactarius sanguifluus* (Paulet ex) Fries: *Pseudotsuga menziesii* var. *menziesii*—Willamette Valley of northern Oregon at 400 ft. elev. and west slope of the Cascade Range in southern Oregon at 3,000 ft. elev.; *Abies amabilis* and *Pinus lambertiana*—west slope of the Cascade Range in southern Oregon at 3,000 ft. elev.
- Russula delica* Fries: *Pinus contorta*, *Pinus ponderosa*, *Pinus lambertiana*, *Pinus monticola*, *Picea engelmannii*, *Picea sitchensis*, *Pseudotsuga menziesii* vars. *menziesii* and *glauca*, *Tsuga heterophylla*, *Abies amabilis*, *Abies grandis*, *Abies lasiocarpa*, *Abies procera*—common and abundant throughout conifer forests of Oregon and Washington from sea level to at least 4,500 ft. elev.
- Russula emetica* (Schaeff. ex Fries) Pers. ex Fries: *Picea sitchensis*—coastal fog belt of northern Oregon at 100 ft. elev.
- Russula foetens* Pers. ex Fries: *Corylus cornuta* var. *californica*, *Pseudotsuga menziesii* var. *menziesii*, and *Tsuga heterophylla*—west slope of the Cascade Range in southern Washington from 1,000 to 2,000 ft. elevs.
- Russula xerampelina* (Schaeff. ex Secr.) Fries: *Pinus monticola* and *Pseudotsuga menziesii* var. *glauca*—east slope of the Cascade Range in northern Washington at 2,000 ft. elev.; *Pseudotsuga menziesii* var. *menziesii*—Coast Ranges in northern Oregon at 1,500 ft. elev., Willamette Valley of northern Oregon at 400 ft. elev., and west slope of the Cascade Range in southern Oregon at 3,000 ft. elev.

Suillus granulatus (L. ex Fries) O. Kuntze: *Pinus lambertiana*—Willamette Valley of northern Oregon at 300 ft. elev.; *Pseudotsuga menziesii* var. *menziesii*—west slope of the Cascade Range in southern Washington at 1,500 ft. elev. and in southern Oregon at 3,000 ft. elev.

Suillus piperatus (Bull. ex Fries) O. Kuntze: *Picea sitchensis*—coastal fog belt of northern Oregon at 50 ft. elev.

Suillus subaureus (Peck) Snell: *Pinus monticola*—east slope of the Cascade Range in northern Washington at 2,000 ft. elev.

Suillus subluteus (Peck) Snell: *Pinus monticola* (previously reported by Singer, 1945b)—east slope of the Cascade Range in northern Washington at 2,000 ft. elev.

Tricholoma flavovirens (Pers. ex Fries) Lund.: *Pinus contorta*—west slope of the Cascade Range in northern Oregon at 3,000 ft. elev.; *Pinus monticola*—east slope of the Cascade Range in northern Washington at 2,000 ft. elev.

Truncocolumella citrina Zeller: *Pseudotsuga menziesii* var. *menziesii*—west slope of the Cascade Range in southern Washington at 2,000 ft. elev.

Xerocomus subtomentosus (L. ex Fries) Quél.: *Pseudotsuga menziesii* var. *menziesii*—west slope of the Cascade Range in southern Washington at 1,500 ft. elev., in northern Oregon at 2,500 ft. elev., and in southern Oregon at 3,000 ft. elev.

Xerocomus zelleri (Murr.) Snell: *Picea sitchensis*—coastal fog belt of northern Oregon at 100 ft. elev.; *Pseudotsuga menziesii* var. *menziesii*—west slope of the Cascade Range in southern Washington from 1,000 to 2,000 ft. elevs., northern Oregon coast at 400 ft. elev., and Coast Ranges in northern Oregon at 1,500 ft. elev.

Inocybe lacera was observed with *Pinus radiata* in a greenhouse experiment. The pine seedlings were grown in jars of soil inoculated with freshly gathered, chopped mycorrhizae of Douglas-fir and ponderosa pine. Four months after the pine seed germinated, the *Inocybe* was found fruiting near the rim of the jar. Examination revealed several dozen *Inocybe* primordia just under the surface of the soil, all connected to pine mycorrhizae by a dense mycelial network. Primordia were also found attached directly to upper mycorrhizae. The mycorrhizae themselves were dichotomous or coralloid, with a whitish, waxy-appearing mantle.

Russula delica, as noted in the preceding list, is a very common associate of conifers (and perhaps broadleaves) in the Pacific Northwest. It is often found in autumn in large numbers in stands of *Pseudotsuga*, *Pinus*, *Picea*,

Abies, or *Tsuga*. In Europe it has been reported to form mycorrhizae with *Picea* (Colla, 1931); *Pinus Fagus*, and *Quercus* (Kalmár, 1950 and 1954); and *Populus* (Peyronel, 1921). The author found it on the coast, on both sides of the Cascade Range from northern Washington to southern Oregon, and in the Blue Mountains of northeastern Oregon. In northern Oregon it appears in abundance at 4,500 feet, so it probably occurs well above that elevation. In any event, it tolerates a wide variety of soils, climates, and host trees.

Suillus granulatus is usually considered as a mycorrhizal associate of pines only. However, Singer (1945a) reports it to occur with *Abies* and *Tsuga*, and in the Pacific Northwest it occurs occasionally with *Pseudotsuga*. It appears, however, to have an ecological advantage with pines as compared with other species. In the ponderosa pine provenance plantation at Wind River Experimental Forest, *S. granulatus* mushrooms may be found in great numbers in autumn. Sample counts in October 1958 indicated some 10,000 to 20,000 mushrooms of this species per acre. At the same time, a search of adjacent mixed stands of *Pseudotsuga*, *Tsuga*, *Abies*, and *Pinus* of similar density, soil, and aspect turned up only two specimens of *S. granulatus* that were not fruiting near pine roots.

Acknowledgment

The Foundation for American Resource Management supplied equipment for microtechnique through the auspices of the University of Washington.

Literature Cited

- Colla, S. 1931. Relazioni tra alcuni basidiomiceti e le radici di alberi ed arbusti di foreste (nota preventiva). Soc. Ital. di Sci. Nat. Atti, 70: 164-167.
- Kalmár, Zoltán, 1950. Kalapos gombáink (Hymenomyces) mykorrhiza kapcsolatai. Magyar Agrár. Egyetem, Erdöm. Kar. Evkón, 1(1): 157-187.
- . 1954. A kalaposgombák mykorrhiza-kapcsolatainak gyakorlati jelentősége. Erdesz. Tud. Int. Evkón., 1952(2): 277-292.
- Peyronel, B. 1921. Nouveaux cas de rapports mycorrhiziques entre phanerogames et basidiomyces. Soc. Mycol. France Bul., 37: 143-146.
- Rawlings, G. B. 1951. The mycorrhizas of trees in New Zealand forests. New Zeal. Forest Res. Inst. Forest Res. Notes, 1(3): 15-17.
- Singer, Rolf. 1945a. Notes on Farlow's Agaricales from Chocorua. Farlowia, 2(1): 39-51.
- . 1945b. The Boletineae of Florida with notes on extralimital species II. The Boletaceae (Gyroporoideae). Farlowia, 2(2): 223-303.
- . 1949. The genus Gomphidius Fries in North America. Mycologia, 41: 462-489.
- Trappe, James M. 1960. Some probable mycorrhizal associations in the Pacific Northwest. II. Northwest Sci., 34: 113-117.