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PISOLITHUS TINCTORIUS, A GASTEROMYCETE,
ASSOCIATED WITH JEFFREY AND SIERRA LODGEPOLE PINE
ON ACID MINE SPOILS IN THE SIERRA NEVADA

R. F. Walker¹

ABSTRACT.—Basidiocarps of *Pisolithus tinctorius*, a gasteromycetous fungus adapted to harsh sites, were observed in association with Jeffrey and Sierra lodgepole pine on acid mine spoils in northeastern California. Subterranean mycelial strands were traced from these basidiocarps to the root systems of the two pine species, which had ectomycorrhizae characteristic of those formed by this fungus in symbiotic relationships with conifer hosts.

The ectomycorrhizal fungus *Pisolithus tinctorius* (Pers.) Coker & Couch occurs essentially worldwide in temperate, subtropical, and tropical zones and in symbiotic association with a wide variety of conifer and hardwood hosts (Marx 1977). In the United States its basidiocarps have most frequently been observed on harsh sites in the East, South, and Midwest associated with various pine species (Lampky and Peterson 1963, Schramm 1966, Hile and Hennen 1969, Lampky and Lampky 1973, Marx 1975). Prompted by these reports of the ability of this Gasteromycete to flourish on infertile and often toxic substrates, researchers have inoculated several southern pine species in forest nurseries with this mycobiont (Marx et al. 1984). Their efforts have resulted in substantial improvement in seedling performance upon outplanting on a variety of adverse sites (Berry and Marx 1978, Marx and Artman 1979, Walker et al. 1985). Current research efforts include identification of new tree hosts for inoculation trials and development of more effective inocula incorporating locally adapted *P. tinctorius* isolates.

Numerous basidiocarps of *P. tinctorius* were observed on spoils of the Leviathan Mine in Alpine County, California (38°42'30"N, 119°39'15"W), in mid-September 1988. This open-pit sulfur mine consists of approximately 100 ha at an elevation of 2,200 m and receives an average annual precipitation of about 50 cm, primarily as snowfall. Early attempts to revegetate the mine, inactive since 1962, failed. More recent efforts using woody and

herbaceous species were somewhat successful, and limited natural vegetation, comprised largely of woody species, has become reestablished near adjoining undisturbed forest and woodland. Nevertheless, vegetative cover is sparse over most of the site. A comprehensive examination of soil chemical properties by Butterfield and Tueller (1980) revealed that most of these spoils have a pH of 4.0 to 4.5, a deficiency of plant-available N, and potentially phytotoxic concentrations of Al.

A majority of the *P. tinctorius* basidiocarps observed were in close proximity to seedlings and saplings of Jeffrey pine (*Pinus jeffreyi* Grev. & Balf.), resulting from both earlier plantings and natural colonization of the mine spoils. Fewer basidiocarps were found near naturally invading seedlings and saplings of Sierra lodgepole pine (*Pinus contorta* var. *murrayana* [Grev. & Balf.] Engelm.). California white fir (*Abies concolor* var. *lowiana* [Gord.] Lemm.) and occasional singleleaf pinyon (*Pinus monophylla* Torr. & Frem.), Utah juniper (*Juniperus osteosperma* [Torr.] Little), and quaking aspen (*Populus tremuloides* Michx.) were also found growing in the mine, but no basidiocarps were observed in the immediate vicinity of any of these four species.

These basidiocarps, dark yellow to brown in color, matched the description of Coker and Couch (1928) for *P. tinctorius*, which is very distinctive due to the presence of peridioles in the upper portion of the gleba. Specimens examined on this site included those of the stipitate, substipitate, and sessile forms,

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which varied in size from 8 to 21 cm in height and from 3.5 to 8 cm in diameter. As many as five basidiocarps were observed encircling solitary Jeffrey pines, but no more than three were observed around isolated lodgepole pines. Clusters of either species tended to be accompanied by large numbers of basidiocarps, the total of which numbered several hundred over the entire site.

Removal of the soil from around individual basidiocarps exposed mycelial strands that were traced up to 1.5 m through spoil materials to root systems of both Jeffrey and lodgepole pine. With gold-yellow pigmentation, these mycelial strands compared favorably with the description of *P. tinctorius* rhizomorphs provided by Schramm (1966) and were joined at the root systems of both tree species with ectomycorrhizae closely resembling those Marx and Bryan (1975) identified as formed by this mycobiont. Subsequently, it is reasonable to conclude that the ectomycorrhizal root systems of Jeffrey and Sierra lodgepole pine on this site resulted from a symbiotic association with *P. tinctorius*.

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