



Honey Fungus - Armillaria

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Honey fungus, *Armillaria* also known as shoestring root rot, is one of the most common root diseases of trees and shrubs in the world. It is known to attack a wide range of plants, being primarily of concern in parks, orchards and gardens.

While not generally a major problem in natural woodlands, it can kill young conifers on sites that once were woodlands. In conifer plantations up to 15 years old, honey fungus may devastate large groups of trees.

Tree species vary in susceptibility. Conifers, with the exception of fir and Douglas fir, are generally more susceptible than broadleaf species. Common landscape plant species and their susceptibility to *Armillaria* infection are listed in Table 1. Only three tree species are known to be immune to *Armillaria*. These can be planted in areas that are heavily infected with the fungus.

Table 1.

<u>Susceptible</u>	<u>Immune</u>	<u>Resistant</u>
<i>Acer</i>	<i>Acer negundo</i>	<i>Abies</i> species
<i>Araucaria</i>	<i>Juglans hindsii</i>	<i>Ailanthus alanthus</i>
<i>Betula</i>	<i>Taxus baccata</i>	<i>Buxus sempervirens</i>
<i>Cedrus</i>		<i>Calocedrus decurrens</i>
<i>Chamaecyparis</i>		<i>Catalpa bignonioides</i>
<i>Cryptomeria japonica</i>		<i>Crataegus</i> species
<i>x Cupressocyparis</i>		<i>Fagus sylvatica</i>
<i>Juglans regia</i>		<i>Fraxinus excelsior</i>
<i>Ligustrum</i>		<i>Ilex aquifolia</i>
<i>Malus</i>		<i>Juniperus</i> species
<i>Picea</i>		<i>Larix</i> species
<i>Pinus</i>		<i>Liquidambar styraciflua</i>
<i>Prunus</i>		<i>Nothofagus</i> species
<i>Salix</i>		<i>Platanus x hispanica</i>
<i>Rhododendron</i>		<i>Prunus laurocerasus</i>
<i>Sequoiadendron</i>		<i>Prunus spinosa</i>
<i>Thuja</i>		<i>Pseudotsuga menziesii</i>
<i>Tsuga heterophylla</i>		<i>Quercus</i> species
<i>Ulmus</i>		Robinia pseudoacacia
		<i>Tilia</i> species

CAUSAL AGENT

Armillaria is both a plant pathogen, killing roots, and a wood decay fungus, causing living or dead trees to blow over. It lives saprophytically on stumps and buried wood for years when no susceptible tree roots are near. Most plants are more susceptible to the honey fungus when young, becoming more resistant with age. Once diseased, trees cannot be cured; however, larger ones can survive for many years.

Until recently, the causal fungus was regarded as just one species, *Armillaria mellea*, but great variation in mushrooms and rhizomorph appearance and in pathogenicity, has led scientists to decide that there are at least five distinct species in Europe. Species vary in their ability to cause disease.

Identifying the various species is usually not possible in the field and differences in pathogenicity among the species are not fully understood. It is best to assume that if any plants have died or are dying from the honey mushroom, further deaths of nearby susceptible plants are likely. If, however, the only evidence of the fungus is the toadstools or rhizomorphs, and there are no declining plants nearby, then action against the fungus may not be needed.

SIGNS & SYMPTOMS

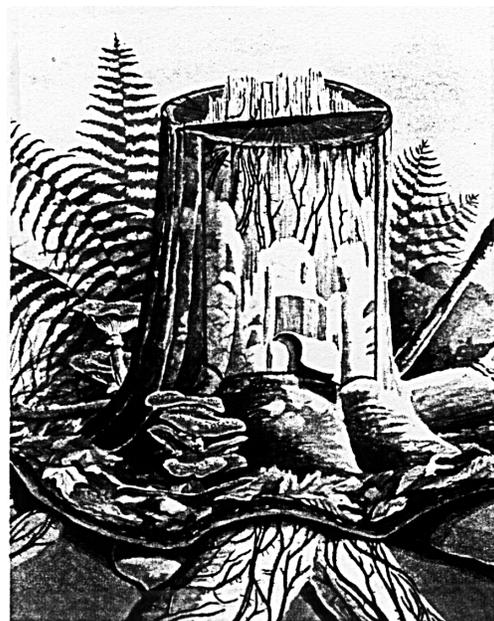
Symptoms of root attack can be expressed in several ways. A tree may die after a period of increasing ill health or show a general deterioration in crown condition indicating root or root collar problems. Other trees exhibit no outward symptoms, but simply blow over due to rotted roots. This is typically the case with oak, while rarely killed by the fungus; it is subject to windthrow from rotted roots. The recent death of

other trees and shrubs in the immediate area may be a symptom.

A qualified arborist can probe the roots of trees, which are suspected of having severe root rot to determine the presence of extensive decay; the rot caused by *Armillaria* is stringy and wet. Resin, gum or watery liquid may bleed from the lower stem of affect plants. In the autumn, clumps of honey-brown toadstools, similar in appearance to the cultivated mushroom, appear near or at the base of infected plants.



Clumps of honey mushrooms growing at the base of tree stumps indicate their role as a saprophyte. Toadstool stems are white and their spore prints white or cream.



A fan-like, whitish mat of fungal tissue (mycelium) is often found under the bark of *Armillaria* infected trees. Rhizomorphs, which resemble black shoe strings, may also be present.

These function to carry water to the wood from the soil to aid in decay. The best evidence that the honey mushroom is the primary cause of death, and not just present as a secondary attacker, is the presence of mycelial fans under the bark of roots or root collar of dying, but not completely dead trees.

CONTROL

Sanitation

The most effective method of control is to remove from the site all sources of infection. This usually means removing infected stumps, including major roots as thoroughly as possible. Methods that claim to destroy the stump by burning, rotting or dissolving is not effective. Small stumps can be dug out by hand, while larger ones may need to be removed with winches or power equipment.

Where stumps cannot be dug out, chipping or grinding is an option. Follow up by digging out large unchipped pieces. Replace with disease-free topsoil. Replanting can usually be safely done immediately. If chippings are left in the soil, delay replanting for about a season. Honey fungus may be present on plants that don't show any symptoms or signs. Therefore, if woody plants are removed for any reason, it is best to remove the stump as well so the fungus will not build up on it and attack other nearby plants.

Restriction

If for some reason infected stumps and roots cannot be removed, efforts using physical barriers to prevent the spread of the fungus have been successful. It is possible to separate the source of infection from healthy plants by installing a Deep Root barrier vertically between

the two. The barrier should extend from just above the soil to at least 45 cm (18 inches) below the ground. Keep in mind that the rhizomorphs may grow down below a shallow barrier.

Cutting of rhizomorphs is another method that may successfully protect nearby susceptible plants. Separate the diseased from the healthy plants by digging a trench, as deep as possible, between the two several time a year. In shallow soils it may suffice to insert a spade periodically along a line between diseased and healthy plants. This will cut off the food supply of the fungus. This should be continued until the stump rots away and the danger of spread has passed. Restriction may not be a practical solution except in extreme cases.

Chemical Control

No type of chemical application has been found to be effective in either the eradication or suppression of *Armillaria* root rot.

Plant Resistance

Plant vigor is an important factor in increasing resistance to attack by some strains of *Armillaria*. The fungus is often referred to as "a pathogen of opportunity." Trees are predisposed to attack by factors such as damage from construction, defoliation, and drought. Over-mature trees are also more prone to attack due to their slow growth and low vigor. Keep vigor high by preventing these stress factors, and increase resistance in stressed trees by fertilization, watering and mulching.

When losses occur and the area is to be replanted, replace plants with only resistant species. Refer to the list in Table 1.