FOREST PEST SPECIES PROFILE

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Armillaria mellea (Vahl) P. Kumm.

Other scientific names: *Agaricus melleus* Vahl; *Agaricus sulphureus* Weinm.; *Armillaria mellea* var. *glabra* Gillet; *Armillaria mellea* var. *maxima* Barla; *Armillaria mellea* var. *minor* Barla; *Armillaria mellea* var. *sulphurea* (Weinm.) Fr.; *Armillariella mellea* (Vahl) P. Karst.; *Clitocybe mellea* (Vahl) Ricken; *Lepiota mellea* (Vahl) J.E. Lange
Phylum, Order, Family: Basidiomycota: Agaricales: Marasmiaceae
Common names: Armillaria root disease; honey mushroom; shoestring root rot

Armillaria mellea is a common worldwide pathogen of trees, woody shrubs and herbaceous plants causing root rot, root-collar rot and butt rot. A natural component of forest ecosystems, it can cause wood decay, growth reduction and even mortality, particularly in trees stressed by other factors, or in young trees planted on sites from which infected hosts have been removed.

***Armillaria mellea* fruiting bodies (Photos: USDA Forest Service - Northeastern Area Archive)**

DISTRIBUTION

Global – found throughout temperate and tropical regions of the world.

IDENTIFICATION

The following description refers to *Armillaria* species in general (Williams *et al.*, 1986). *Armillaria* can be detected by removing the bark covering an infected area to expose characteristic, fan-like sheets of white mycelium or rhizomorphs that grow between the wood and the bark. The hyphae grow together in bundles that give this mycelial mat a striated appearance. The bundles can enlarge, darken and harden into rhizomorphs. The rhizomorphs are flat, black to reddish brown in colour, up to 5 mm in width with an outer layer of dark mycelium and an inner core of white mycelium. Rhizomorphs can also grow through the soil although these tend to be more cylindrical than and approximately half as wide as those produced beneath the bark. The rhizomorphs and mycelial fans can leave impressions on the inner bark, allowing diagnosis even after they decompose.

Mushrooms growing in clusters around the bases of infected trees or stumps may indicate the presence of *Armillaria*. These short-lived mushrooms, produced sporadically in late summer or autumn, are most abundant during moist periods. They are approximately 5 cm tall with yellow or brown stalks and a ring around the stalk just below the gills is sometimes evident. The caps are honey-yellow or tan-brown in colour, 5-12.5 cm in diameter with slightly sticky, brown tufted hairs and light-coloured gills beneath which produce millions of white to light yellow basidiospores.

HOSTS

Armillaria mellea has a very wide host range of both broadleaf and conifer trees and also herbaceous plants.

BIOLOGY

The following description refers to *Armillaria* species in general (Sinclair and Lyon, 2005). The fungus survives as rhizomorphs and vegetative mycelium on and in the dead wood of tree stumps and roots. It has sometimes been found living several feet above the soil line on the trunk of trees several years after they are killed by *Armillaria*.

In late autumn, mushrooms may arise from the rhizomorphs and release millions of basidiospores which are carried by the wind to dead stumps or injured bark on living plants. Under favourable conditions of moisture and temperature, the basidiospores germinate and produce a mycelium that first infects the bark and then the sapwood and cambial regions. White mycelial mats develop on the sapwood, followed by the formation of rhizomorphs which can grow for distances of up to 3 m through the soil. Infection occurs when the mycelium comes in contact with and adheres to the roots of a susceptible host by means of a gelatinous secretion. The rhizomorph penetrates the root by a combination of mechanical pressure and enzymes that partially digest the root's cell walls and then grows into the root tissue between the cells. Once a host tree or plant has been invaded, the fungus continues to spread through the root and trunk tissues even several years after it has died; a large stump can support the growth of rhizomorphs for decades. Depending on environmental conditions and vigour, host trees or shrubs may die one to several years after the initial infection.

Peeling back the bark of infected trees exposes mycelial fans (L) and rhizomorphs (R) (Photos L-R: USDA Forest Service, Ogden Archive; R.L. Anderson, USDA Forest Service, Bugwood.org)

SYMPTOMS AND DAMAGE

Since *Armillaria mellea* commonly inhabits the roots of host trees and plants, detection of this species and differentiation of aboveground symptoms from other root and trunk fungi is difficult. However the presence of characteristic mushrooms growing around the bases of host trees or obvious symptoms in the crown or on the lower stem help to identify this pathogen (Williams *et al.*, 1986).

Symptoms of *A. mellea* infestation include premature autumn colouration and leaf drop, stunting of growth, yellowing or browning of the foliage, a general decline in the vigour of the host tree or plant, and dieback of twigs, branches and main stems (University of Illinois Extension, 2000). Large, vigorous or lightly infected trees can develop crown symptoms over a number of years until the trees die while small, extensively infected or low vigour trees develop symptoms rapidly, foliage quickly discolours and the host tree often dies within a year (Williams *et al.*, 1986). Conifers frequently produce a larger cone crop (stress cones) shortly before they die. As host tree decline progresses, rotting of the buttress roots and the lower trunk becomes evident and severely infected trees exude resin, gum or a fermenting watery liquid from the lower trunk (University of Illinois Extension, 2000).

On conifers, lower stem infections appear as enlarged areas with large amounts of resin flow while on broadleaved trees they sometimes develop as sunken cankers covered with loose bark or a combination of bark, gum and other resins (Williams *et al.*, 1986). Root infections are frequently heavily coated with resin, soil and sometimes fungal tissue.

DISPERSAL AND INTRODUCTION PATHWAYS

Armillaria can live for decades in suitable live host material, stumps and root fragments, and can disperse naturally through the spread of rhizomorphs in the soil (Williams *et al.*, 1986). The movement of infected plants, trees and soil can spread the pathogen to new areas.

CONTROL MEASURES

Due to the worldwide distribution and wide host range of *Armillaria mellea*, eradication is not feasible. Control measures focus on limiting the buildup of the disease or reducing its impact (Williams *et al.*, 1986). Cultural practices, such as reforesting stands with a mixture of suitable, *Armillaria* free species, maintaining vigorous tree growth, minimizing tree stress, preventing tree damage, and reducing the availability of food by uprooting and burning infected or susceptible root systems and stumps, may help with managing *Armillaria* in commercial forests and urban landscapes (Williams *et al.*, 1986). Individual high value trees can be treated with chemical pesticides around the base of infected stems or in holes left after trees have been uprooted (Williams *et al.*, 1986).

References

Sinclair, W.A. & Lyon, H.H. 2005. *Diseases of Trees and Shrubs*. Ithaca, NY, Cornell University Press, 660 pp.

University of Illinois Extension. 2000. *Armillaria* root rot of trees and shrubs. Report on Plant Disease (RPD) No. 602. Chicago, College of Agricultural, Consumer and Environmental Sciences, University of Illinois (also available at: web.aces.uiuc.edu/vista/pdf_pubs/602.pdf)

Williams, R.E., Shaw III, C.G., Wargo, P.M. & Sites, W.H. 1986. *Armillaria root disease*. Forest Insect & Disease Leaflet 78, USDA Forest Service. (also available at: www.na.fs.fed.us/spfo/pubs/fidls/armillaria/armillaria.htm)