INTRODUCTION

Armillaria mellea is found throughout southern California in all regional areas. It is prevalent in many species of trees and woody shrubs that have grown native here for centuries.

Armillaria mellea is one of the most widespread species of fungus and one of the most common factors contributing to the death of trees.

The fungi attacks about 700 species of mostly woody plants. Herbaceous plants that are susceptible include blackberry, flowering bulbs, potato, raspberry, and strawberry.

Woody plants that have previously been weakened by drought, flooding, poor drainage, frost, repeated defoliation by insects or diseases, other poor soil conditions, excessive shade, polluted air or other chemical injury, or mechanical injury are most susceptible to attack. The loss of fine feeder roots from this disease deprives affected plants of sufficient nutrients and water.

SYMPTOMS AND SIGNS

Generally speaking, trees that are infected with Armillaria decline slowly over a period of years, and in some cases decades.

The above ground symptoms cannot be differentiated easily from those produced by other root or trunk injury.

The most noticeable external symptoms are premature autumn coloration and leaf drop, stunting of growth, yellowing or browning of the foliage, a general decline in the vigor of the plant, and twig, branch, and main stem dieback. Such a decline usually occurs over several years but may appear to progress very quickly as the tree shows advanced symptoms of decline and death. As decline progresses, decay of the buttress roots and the lower trunk is evident. Small plants die quickly after the first symptoms appear with large trees surviving for a number of years.

The Armillaria fungi have a strong mushroom odor.

With time, diseased wood becomes light yellow to white, soft and spongy, often stringy in conifers and marked on the surfaces by black zone lines.

The following are a more complete list of the symptoms that may indicate an Armillaria infection, or conditions often associated with one:

1. Reduced or stunted shoot growth.
2. Smaller leaf size.
3. Chlorotic foliage
4. Terminal tip and crown dieback.
5. Thinning of foliage canopy.
6. Sudden wilting or collapse
7. Development of many suckers on major branches of trunk.
8. Presence of cankers or vertical cracks at or just above the root collar.
9. Development of darker adventitious roots (called shoestrings) from buried trunk.
10. Stress induced reproduction such as heavy flowering or fruiting preceding death.
11. Loosening or separation of bark from trunk.
12. Severely infected trees exude Bleeding (fermenting watery liquid), resin, or gum secretion from bark (lower trunk).
14. Detection of rhizomorphs (slender, rootlike dark brown to black “shoestrings” with a white interior) on surface of roots or in root collar region.
15. Presence of white or creamy white, paper-thick, fan-shaped sheets of Armillaria mycelium or hyphae in cambium or sapwood tissues.
16. History of other plants in vicinity dying suddenly.
17. Progression of dying plants down a hedgerow.
18. Absence of any root flare where the trunk enters the ground- often an indication of a change in grade level.
19. Obvious over-watering
20. Planting of moisture loving plants under the drip line.

Some of the Plants infected by Armillaria sp. in southern California:

Alder
White Birch
Camellia
Deodar Cedar
Italian Cypress
Fortnight Lilly
Eucalyptus
Indian Laurel Fig - Ficus
Ash
Privet - Ligustrum
Olive
California Sycamore
Pyracantha

California Live Oak
Valley Oak
India Hawthorn
Rose
Weeping Willow
California Pepper
Brazilian Pepper
Coast Redwood
Queen Palm
American Elm
Chinese Elm
Viburnum
How to reduce chance your tree/shrub will contract Oak Root Fungus (Armillaria)
OR
How to slow down Oak Root Fungus (Armillaria) if your tree has it.

**MOST IMPORTANT – KEEP TRUNK DRY!**

1. Do not raise the soil level around trees/plants.
2. Where the soil level around a tree has been raised, expose the root crown and construct a tree well to keep the soil from direct contact with the trunk.
3. Do not water frequently within the drip line of valuable trees.
4. Do not plant water-loving plants within the drip line.
5. Do not allow water from sprinkler heads to strike the trunk.
6. Do not plant grass or ground covers under susceptible trees.
7. Mulch the area within the drip line of oak trees in infested areas. But, do not let the mulch touch the base (trunk) of the tree.
8. If you must plant under trees, use only drought-tolerant plants.
9. Examine the roots and root crown of trees in known affected areas for signs of oak root fungus every two or three years.
10. In known oak root fungus infected sites, leave the root crown area exposed.
11. Keep trees strong and healthy by sound fertilization, irrigation and pest control procedures appropriate for that species.
12. Provide for adequate soil drainage in heavy, poorly drained sites.
13. When removing a plant killed by oak root fungus, remove as much of the stump and root system as possible.
14. Dispose of the stump and wood chips off-site. Do not incorporate them as organic matter. All wastes should be burned on site instead of transported to a dump if possible.
15. Replace as much as possible of the contaminated soil with Armillaria free soil.
16. Do not plant replacement trees in the same spot as a dead tree.
17. Select replacement plants from a list of tree species considered resistant.
18. Consider planting replacement trees/plants in protective containers.
19. Consider installation of root barriers for trees in known infected areas.
20. Recently cleared areas should be planted with non-susceptible crops such as corn, small grains, and grasses for a few years to help eliminate the fungus. Another possibility: use the infested area for lawn, vegetable garden, rockery, or for annual and biennial flowers.
21. Fungicides applied to infected trees are not recommended.

If you suspect your tree may have Armillaria, it is important to have it inspected by a knowledgeable person. Since this disease can reduce the stability of a tree’s roots, this can be a precursor to a destabilized and more hazardous tree.

This information is general in nature. If you are concerned, have your tree inspected.
Additional Information on how to Control the disease

**Severely affected and dying plants.** There is no cure for severely affected plants. They should be removed and destroyed as soon as possible. Control is directed toward stopping further spread of the disease, or protecting the replacement planting from infection.

It is important to remove and destroy (by burning, if possible) all of the stump and root system, even small roots, because the fungus can live on and in the infected stump and roots for many years. Using this wood as a food source, the shoestrings of the fungus (Figs. 1 and 3) grow through the soil and can infect adjacent plants. Healthy appearing plants growing near obviously diseased plants may already be infected. *Armillaria* is common when forest lands have been recently cleared and infected stumps and roots are buried. New plantings in the vicinity of infected debris are likely to become diseased. Shovels, axes, and other tools used to cut up and dig up the plant should be cleaned and/or sterilized after use to avoid spreading the fungus.

In certain situations, soil fumigation can help in controlling the spread of the disease, especially in lighter soils. Fumigation should be done by a licensed pesticide applicator. To be effective, the roots must be removed prior to treatment. Roots of adjacent plants can be injured by this treatment, so fumigation is not advised when adjacent healthy plant roots are in the area to be treated. If fumigation is not used, it may be beneficial in limited situations to replace the contaminated (fungus-infested) soil with fresh soil. Avoid moving contaminated soil to uncontaminated areas, since this may spread the fungus. Clean contaminated tools as mentioned above.

**Slightly affected plants.** Trees and shrubs which are not seriously affected may be helped. The soil should be removed from around the rotted parts of the trunk and larger roots to allow them to air dry. The infected areas should be cut out down to the healthy tissue and diseased tissues destroyed. Wash cutting tools in soap and water and sterilize them in rubbing alcohol afterward. Roots should be left exposed during summer, but covered over before freezing fall weather. The plant should be given proper fertilization and watering to promote good growth; however, avoid watering the exposed trunk and larger roots to keep this area of the plant as dry as possible. Whether or not the trunk and larger roots have been exposed for drying, always avoid watering trees and large shrubs where the trunk enters the ground.

If a plant is moderately affected and of special value to the owner, follow the above procedure. However, the greater the area of infection, the less chance the plant has of surviving.

**New plantings for affected areas.** Because *Armillaria* infects about 700 different plant species, planting new plants in areas where infected ones have been removed may be risky. If such planting is done, the possibility of infection of the new plants should be considered. The more thorough the removal of the infected plant (including its root...
system) and associated fungus structures, the better chances will be for the health of the second plant. Be sure to give the new plant good cultural care.

Information regarding plants resistant (meaning they don't often get the disease) to this disease can sometimes be misleading since there are several different species of Armillaria that vary in the plants they can attack. In addition, the soil type and the environment can influence how a plant will react to disease pressure. Keeping that in mind, the following plants have been reported to be resistant to Armillaria root rot. However, this information should only be used as a general guideline.

Many common herbaceous plants (annuals, bulbs, etc.) can be rotted by Armillaria, but lawn grasses common to our area are not reported to be affected by it. If a resistant woody plant cannot be found, extending the lawn to cover the affected area would seem to be a suitable option.

**Resistance or Susceptibility to Armillaria Root Rot of Certain Woody Plants**

**COMMON NAME**

**Immune or Highly Resistant**
- Abutilon or flowering maple
- American sweet gum
- American holly
- American plum
- American chestnut
- American or sweet elder
- Amur cork tree
- Austrian pine
- Bald cypress
- Bayberry
- Big-leaf maple, Oregon maple
- Black cherry
- Boxelder
- Boxwood
- Callery pear
- Japanese pagoda tree
- Japanese maple
- Japanese flowering crabapple
- Maidenhair tree
- Mock-orange
- Modesto ash
- Mulberry
- Pecan
- Planetrees or sycamore
- Rose of Sharon

**Armillaria Somewhat Resistant Plants**
- Jacaranda
- Liquidambar
- Tuliptree
- Mayten Tree
- Canary Island Pine
- Monterey Pine
- Chinese Pistache
- Sycamore
- Cherry Laurel
- Arbutus – Strawberry Tree
- California Redbud
- Leyland Cypress
- Gingko
- Ash
- Redwood
- Chinese Elm

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