

Visual Identification Series

# Wood Decay Fungi

Common to Urban Living Trees  
in the Northeast and Central United States



**Christopher J. Luley, Ph.D.**



Urban Forestry LLC

# Table of Contents

	Preface	iv
	Introduction	v
	How to Use This Manual	v
<b>Section I:</b>	<b>Introduction To Urban Wood Decay Fungi</b>	<b>1</b>
	Causes of Wood Decay	2
	Naming and Types of Wood Decay	4
	Significance of Conks	8
	Useful Taxonomy	10
	Life Cycle	14
	Making the Most of This Manual	16
	Photo Key to Decay Fungi	17
	Literature Cited	20
<b>Section II:</b>	<b>Visual Identification Guide</b>	<b>21</b>
	<b>Root and Butt Rots</b>	
	<i>Armillaria</i> spp.	22
	<i>Grifola frondosa</i>	24
	<i>Ganoderma lucidum</i>	26
	<i>Inonotus dryadeus</i>	28
	<i>Ustulina deusta</i>	30
	<i>Xylaria polymorpha</i>	32
	<b>Trunk and Butt Rots</b>	
	<i>Laetiporus sulphureus</i>	34
	<i>Ganoderma applanatum</i>	36
	<b>Trunk, Stem and Heart Rots</b>	
	<i>Pleurotus ostreatus</i>	38
	<i>Polyporus squamosus</i>	40
	<i>Schizophyllum commune</i>	42
	<i>Climacodon septentrionalis</i>	44
	<i>Cerrena unicolor</i>	46
	<i>Daedalea quercina</i>	48
	<i>Phellinus robineae</i>	50
	<i>Fomes fomentarius</i> , <i>Perenniporia fraxinophilia</i> and <i>Phellinus ignarius</i>	52
	Common Sap Rots	54
	<i>Armillaria</i> spp. supplemental photos	56
	<i>Ganoderma lucidum</i> supplemental photos	57
	<i>Ganoderma applanatum</i> supplemental photos	58
	Index	59

## Causes of Wood Decay

In 1874 Robert Hartig, the father of forest pathology, proved that decay did not cause fungi! In fact, all decay of living trees of any consequence is caused by fungi belonging to one of two taxonomic groups – the Basidiomycota (basidiomycetes) and Ascomycota (ascomycetes).

### Basidiomycetes

The basidiomycetes are easily the largest, most important, and common group of fungi that cause wood decay. Most arborists know them as the mushrooms and conks that grow on living or dead trees, and people have written volumes on wood decay caused by members of this group of fungi. It would be easy to leave the discussion of urban wood decay fungi to the basidiomycetes alone.

Volumes I and II of *North American Polypores* by Gilbertson and Ryvarden (1986, 1987) identify nearly 500 different basidiomycetes responsible for decaying wood of living and dead trees. This list does not include the extensive group of gilled mushrooms and other types of basidiomycetes that also decay wood. Fortunately, only a relatively small group of decay fungi are commonly found on living trees in urban environments.

### Ascomycetes

A second large group of fungi but with only a few significant wood rotters is the ascomycetes. These fungi are more commonly known as the cause of leaf diseases and cankers on urban trees. The fruiting structures of the ascomycetes are much less conspicuous than those of the basidiomycetes. The ascomycetes are included in this VIS manual because of two significant root and butt rot fungi.

### Definitions of Disease, Symptom and Sign

**Disease:** A progressive disruption in the normal functioning of a plant that is caused by a pathogen. Fungi are the only pathogens that cause decay of any consequence in living trees. Decay is a disease because cell walls are altered, wood strength is affected, carbohydrate storage can be reduced, and living cells present in sapwood may be killed.

**Symptom:** The effect of the pathogen on the host. Some wood decay symptoms include discoloration of wood, alteration of the strength properties of wood, and the formation of cavities.

**Sign:** Visible evidence of the actual causal agent, such as wood decay conks, mycelial fans (vegetative growth sometimes seen under the bark on infected trees), or rhizomorphs (See *Armillaria*).

## Basidiomycetes and Ascomycetes



Photo 1a. All decay of any consequence in living trees is caused by fungi.



Photo 1b. The basidiomycetes are the largest group of fungi that decay wood. Most arborists are familiar with conks, common fruiting structures of basidiomycetes.



Photo 1c. Basidiomycete conks vary in appearance as evidenced by this example of another type of wood decay conk produced by *Cerrena unicolor*.



Photo 1d. Some species of wood decay basidiomycetes fruit as mushrooms.



Photo 1e. Ascomycetes are better known as the cause of leaf and canker diseases such as anthracnose of sycamores.



Photo 1f. Only a few ascomycetes cause tree decay. Their fruiting structures are less conspicuous than those of most basidiomycetes.



White Rot, Brown Rot, Soft Rot



Photo 2a. White rot of an oak. White rot fungi decay the lignin and secondarily the cellulose components of wood. Significant strength loss in wood may develop only in the more advanced stages of decay.



Photo 2b. White rot of a beech. White rot is considerably more common than brown rot.



Photo 2c. Brown rot of a larch. Brown rot fungi cause a substantial loss in wood strength even in the initial stages of decay, and are more common on coniferous trees.



Photo 2d. Brown cubical rot. Brown rot fungi decay primarily the cellulose component of wood leaving the brown, brittle lignin as a residue.



Photo 2e. Black zone lines formed by a wood decay fungus. Many different decay fungi form these zone lines as they decay wood. Therefore they are not diagnostic for any particular species.



Photo 2f. Soft rot of a linden caused by *Ustilina deusta*. Soft rot decay causes a substantial loss in wood strength similar to brown rot.

## Photo Key to Tree Decay Fungi

The key is based on type of spore layer and whether the conk or mushroom is annual and fleshy or tough or woody and perennial.

### Annual, fleshy mushrooms with gills



Photo 7a. See *Pleurotus ostreatus*, page 38.



Photo 7b. See *Armillaria* spp., page 22.

### Annual, tough with gills



Photo 7c. See *Schizophyllum commune*, page 42.

### Annual, soft and fleshy with pores



Photo 7d. See *Polyporus squamosus*, page 40.

### Annual, soft and fleshy with pores



Photo 7e. See *Grifola frondosa*, page 24.



Photo 7f. See *Laetiporus sulphureus*, page 34.

<b>Scientific Name</b>	<i>Ganoderma lucidum</i>
<b>Other Name</b>	<i>Polyporus lucidus</i>
<b>Common Names</b>	Reishi, Ling zhi, ling chi, lin zi
<b>Common Hosts</b>	Oaks, maples, honey locust, most hardwoods
<p><b>Habitat</b></p> <ul style="list-style-type: none"> <li>Near or at the base, at the soil line, or attached to roots of living trees</li> <li>On stumps and bases of dead trees, and sometimes from buried wood residues where trees have been removed</li> </ul> <p><b>Fruiting Time of Year</b></p> <ul style="list-style-type: none"> <li>Summer through fall, turning black and persisting through to the following year</li> </ul> <p><b>Fruiting (Hymenial) Surface</b></p> <ul style="list-style-type: none"> <li>White with small pores, 4-5 per mm, changing to brown with age</li> </ul> <p><b>Type of Decay</b></p> <ul style="list-style-type: none"> <li>White root and butt rot</li> </ul> <p><b>Mode of Action</b></p> <ul style="list-style-type: none"> <li>A moderately fast progressing root and butt rot The fungus can also kill cambial tissues and cause root death</li> </ul> <p><b>Frequency</b></p> <ul style="list-style-type: none"> <li>Very common</li> </ul>	<p><b>Tree Health Symptoms</b></p> <ul style="list-style-type: none"> <li>Thin crowns</li> <li>Dead branches</li> <li>Yellowing leaves</li> <li>Overall poor vigor</li> <li>Some trees show no apparent health impacts from infection</li> </ul> <p><b>Edibility/Medicinal</b></p> <ul style="list-style-type: none"> <li>Medicinal; used as an anti-inflammatory treatment</li> <li>Sold in teas and pills in most oriental stores</li> <li>Documented health benefits in medical literature</li> </ul> <p><b>Identifying Features</b> <i>(see adjacent photos)</i></p> <ul style="list-style-type: none"> <li>Single or clusters of round to half-moon shaped conks usually attached directly to wood but occasionally with a lateral or central stem</li> <li>10 cm (4 in) up to 35 cm (14 in) across and 2.5 cm (1 in) or more thick</li> <li>Cap or the top of the conk “varnished” red to mahogany with or without a white margin</li> <li>Reddish-brown zonate interior or context</li> <li>White pore surface that edges brown when fresh</li> </ul>
<p><b>Importance</b></p> <p>This is number two of the “Big Three” of the common tree decay fungi. It is a very common cause of root and butt rot on urban trees. It can also kill cambium of roots and contribute to a decline in the health of urban trees. The presence of fruiting bodies alone is usually not reason for removal. However, infected trees often eventually fail as the decay progresses.</p>	
<p><b>Notes</b></p> <p>This is one of the most common, easy to identify and important root and butt rots in the urban environment. There is a wide variation in the appearance of the conks. However, there are no other fungi on hardwoods that have the varnished mahogany, annual fruiting body of <i>Ganoderma lucidum</i>. <i>Ganoderma lucidum</i> is likely a complex of species that will be separated taxonomically into a number of different species.</p>	



***Ganoderma lucidum*** (See supplemental photos on page 57)



Photo 1. *Ganoderma lucidum* on a white oak. Note old fruiting bodies from the previous year (arrow). (MD, Sept.)



Photo 2. *Ganoderma lucidum* on a Norway maple. (NY, Aug.)



Photo 3. Norway maple roots infected with *Ganoderma lucidum*. (NY, Aug.)



Photo 4. Close-up of *Ganoderma lucidum* conks on a red oak. Note brown basidiospores on the bark. (DC, Sept.)



Photo 5. Reddish brown zonate context or interior of *Ganoderma lucidum*. (NY, Sept.)



Photo 6. Pore surface and context (top conk) of *Ganoderma lucidum*. (NY, Sept.)



<b>Scientific Name</b> <i>Inonotus dryadeus</i>	
<b>Other Name</b> <i>Polyporus dryadeus</i>	
<b>Common Names</b>	
<b>Common Hosts</b> Oaks and other hardwoods; reported on conifers on the West coast	
<p><b>Habitat</b></p> <ul style="list-style-type: none"> <li>• At ground level attached to the base and larger roots of living trees</li> <li>• On stumps or dead trees</li> </ul> <p><b>Fruiting Time of Year</b></p> <ul style="list-style-type: none"> <li>• Summer through fall</li> </ul> <p><b>Fruiting (Hymenial) Surface</b></p> <ul style="list-style-type: none"> <li>• Small pores and gray-brown or darker</li> </ul> <p><b>Type of Decay</b></p> <ul style="list-style-type: none"> <li>• White root and butt rot with most of the decay concentrated in larger roots</li> </ul> <p><b>Mode of Action</b></p> <ul style="list-style-type: none"> <li>• Moderately slow progressing root rot eventually leading to root failure</li> </ul> <p><b>Frequency</b></p> <ul style="list-style-type: none"> <li>• Common</li> </ul> <p><b>Tree Health Symptoms</b></p> <ul style="list-style-type: none"> <li>• Often none other than the appearance of the fruiting bodies and extensively decayed root when a tree fails</li> </ul> <p><b>Edibility/Medicinal</b></p> <ul style="list-style-type: none"> <li>• None</li> </ul>	<p><b>Identifying Features</b> <small>(see adjacent photos)</small></p> <ul style="list-style-type: none"> <li>• Irregular shaped, large (25 cm or 10 in or more across) masses of yellow-brown conks at the base of large trees. Sometimes joining together to form large masses</li> <li>• Clear to yellow drops on the top surface of the conk, drying to leave shallow depressions</li> <li>• Dried, brown to black masses of old conks often adjacent to fresh fruiting bodies.</li> <li>• Yellow-brown to reddish context or interior, often with a thin yellowish layer right under the top crust</li> <li>• Grayish-brown pore surface</li> </ul>
<b>Importance</b> Sometimes an indicator of extensive root and butt decay and reason for immediate removal. Trees eventually become susceptible to wind throw. However, some trees may still be sound enough to retain and have to be tested. Periodic retesting of infected trees is recommended.	
<b>Notes</b> A difficult fungus to have to deal with in risk analysis because of the localization of decay in the undersides of roots and eventual, likely end-result of failure. I have seen “healthy” trees that were nearly engulfed on all sides with conks, but I could not detect decay in the butt region and the trees remain standing. The decay was likely concentrated in the roots. Note that <i>Inonotus dryophilus</i> is a similar appearing fungus. However, <i>Inonotus dryophilus</i> fruits well above the ground-line on the trunk whereas <i>Inonotus dryadeus</i> is almost always found at the soil-line or on roots.	

*Inonotus dryadeus*



Photo 1. *Inonotus dryadeus* on a willow oak. (DC, Sept.)



Photo 2. *Inonotus dryadeus* on an oak. (DC, Sept.)



Photo 3. Habitat of *Inonotus dryadeus* on a red oak with previous year's black, dried conk. (DC, Sept.)



Photo 4. Close-up of interior and section through the pore layer. Note thin yellowish layer under the top crust (arrow) and bleeding or guttation from the center of the conk. (DC, Sept.)



Photo 5. Top of conk with guttation or water-like exudate. The drops are often yellowish-brown in color. (DC, Sept.)



Photo 6. Close-up of the top of a conk. (DC, Sept.)