Root Decay in Urban Trees – Part 2

Ganoderma sessile (aka Ganoderma lucidum) – An Important Root Disease and Butt Decay by Any Name

This is the second article in a series from Christopher J. Luley on decay fungi species found in urban trees that will run in TCI Magazine *this year. The first part, "Berkeley's Polypore," ran in the March 2017 issue.*

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You may not recognize the name, just don't forget the face (Photograph 1). The name has changed, but the widespread occurrence east of the Rocky Mountains and damage caused by this pathogen remains the same. *Ganoderma sessile* (formerly one of many species labeled under the name '*Ganoderma lucidum'*) is a common root and butt decay pathogen in urban trees. It's one of the "Big Three" that we recommend arborists become familiar with because it has a wide host range, it is relatively easy to identify in the field and it can be important to a tree's biological health and mechanical stability (Photograph 2).

Photograph 1, left. The name of the widely known and important root and butt rot fungus* Ganoderma lucidum *has changed. The fungus is now named* Ganoderma sessile*. Fruiting on the base of this Norway maple developed in early September in New York. All images courtesy of the authors.

Photograph 2.* Ganoderma sessile *on a red oak. The fungus is relatively easy to identify in the field given the varnished red color of the top of an annual conk, absence of a stem, and growth on hardwood tree species. Fresh conks also usually have a white margin. Note the brown spores on the root below the fruiting.

Identification

Mycologists recently went back to the older name of *G. sessile,* which was described in 1902 from collections made in New York, for the fungus in North America that previously has been widely labeled under the name '*Ganoderma lucidum'*. *G. lucidum* is the correct name for a similar fungus found in Europe and probably parts of Asia. The genus *Ganoderma* contains species commonly referred to as "reishi" (Japanese) or "lingzhi" (Chinese) that are highly prized and have been used medicinally in Asia for centuries.

Arborists need to be aware that the similar-appearing "laccate" (those with a red to mahogany varnished-appearing top) *Ganoderma* species are not all one species. However, in most cases, the species fruiting from the base or roots of

Photograph 3. Developing conks of* G. sessile *from the same Norway maple as in Photograph 1. Note these conks lack the varnished red color when very young.

living hardwoods in urban environments in the Eastern U.S. is the widespread *Ganoderma sessile*. We highly recommend you see the Extension publication on this group of fungi by Loyd and others (http://edis.ifas.ufl.edu/pp333) for identification of similar-appearing *Ganoderma* species on other hosts such as palms and pines.

The common *G. sessile* on hardwoods has the following visual characteristics:

- Annual conk that is tough and leathery and lacking a stem or stipe (more rarely, some conks have short stem or stipe)
- Single or clusters of round to half-moon-shaped conks attached to woody roots or the base of deciduous trees (Photograph 2).
  - Similar conks fruiting from woody roots of oaks or other hardwoods with a stem are probably *G. curtsii* (see below).
- Individual conks are usually 4 to 10 inches across and 1 to 2 inches thick.
- The top of the conk has a thin crust that is red or mahogany to ocherous (varying from light yellow to brown) in color and varnished-appearing when fresh. Fresh conks may also have a white margin (Photograph 2).
- Developing conks are initially light colored and may lack the varnished red (Photograph 3).
- Interior of the conk is initially cream colored but becomes darker brown with age and has conspicuous concentric zones (Photograph 4).
- Pore surface is initially white, and darkens to brown with age and handling (Photograph 4). Pores are small and are barely visible to the naked eye.
- Brown basidiospores may be seen on the surface of the conk or on wood below conks as a "coat" of dust (Photographs 2 and 5).

Photograph 4. White pore surface, brown zonate interior and varnished top of* G. sessile*. The interior or context is lighter cream colored when the conk is young.

Photograph 5. Annual conks of* G. sessile *around a declining hickory. Note the dark, previous year's conks close to the soil line and the brown spores on the top of the conks on the far right.

Conks of *G. sessile* begin to develop in the warmer months of the year, which in southern latitudes could be as soon as early spring, while in northern latitudes it is more commonly observed fruiting in the latter portion of the summer. Although the fruiting bodies are annually produced, conks from previous years can often be found together with fresh conks on some trees (Photograph 5). The lacquered or varnished appearance fades greatly on old conks, but the dark red or mahogany color can often still be detected. Conks may appear in multiple, consecutive years with new fruiting mixed in with older, faded conks.

A very similar-appearing decay fungus named *Ganoderma curtsii* typically has an off-centered stem or stipe that generally distinguishes it from *G. sessile* (Photograph 6). *G. curtsii* has been associated with decay, decline and death of landscape oaks and other hardwood species, but will

Photograph 6.* Ganoderma curtsii *is a similar-appearing species that has a stem or stipe and is commonly found fruiting from the woody roots of oaks. Other species that appear similar to* G. sessile *may be found on palms, pines and dead hemlocks.

Photograph 7. Ganoderma sessile *fruiting at the base of a crabapple. The fungus has a very wide host range and is common on maples, oaks, beech, honeylocust, hickory and many other hardwoods.*

not be discussed further here.

Biology and importance

Infection by *G. sessile* probably occurs mostly by spores that infect wounds on the lower trunk or woody roots. The pathogen has a wide host range that includes many deciduous species including oaks, maples, beech, hickory, honeylocust, sweetgum, poplars and even crabapple (Photograph 7). Stressed trees appear to be more susceptible to infection and subsequent damage from *G. sessile*.

The fungus has the ability to both kill and decay woody roots and decay the wood in the base or butt of infected trees. It is not unusual to find urban maples, honeylocust and other tree species with *G. sessile* fruiting that are exhibiting decline symptoms, such as a thinning crown and crown dieback (Photographs 8A-C). However, in some cases, some tree species such as infected oaks may have normal crowns with varying amounts of decay and remain stable biologically and mechanically for longer periods of time (Photograph 9).

Decay from *G. sessile* develops in both the roots and base of infected trees, and therefore, consideration

Photograph 8A. A declining Norway maple infected with Ganoderma sessile. *Note dead branches at various locations in the crown (see Photograph 1 for fruiting at the base and on the roots of this tree).*

Photograph 8B. A pignut hickory infected with Ganoderma sessile. *Note the low-density crown and small dead branches (see Photograph 5 for fruiting at the base of the tree).*

Photograph 8C. A dying honeylocust infected with Ganoderma sessile. *Honeylocust is reported to sometimes die relatively rapidly when infected by the pathogen.*

Photograph 9. A swamp white oak with a large and healthy crown. The oak is infected with Ganoderma sessile. *Oaks may have few crown symptoms as decay develops in the base and roots.*

Photograph 10A. Ganoderma sessile *is a well-adapted saprophyte and can fruit for an extended period of time on stumps after infected trees are removed.*

needs to be given to tree stability and the extent of decay in both these parts of the tree even if conks are just present on the lower trunk. I have observed trees fail with *G. sessile*, but the appearance of fruiting bodies of this fungus does not necessarily mean that a tree should be removed.

Managing infected trees

In many cases, trees infected with *G. sessile* are removed because the trees are in poor condition and the decline in biological health creates other issues such as unattractive trees or elevated risk from dead or dying branches. Trees with advancing decline symptoms and infection by *G. sessile* will almost never recover, and the presence of *G. sessile* will only exacerbate decline symptoms, leading to hazardous trees. In these cases, expectations and management should be approached accordingly.

The risk of failure from roots or the trunk base from *G. sessile* decay must also be considered, but not all infected trees have to be removed immediately. In some cases, trees could have limited amounts of decay in the base and buttress roots even though *G. sessile* is observed fruiting near these locations. Decay assessments of the trunk base and exposed buttress roots should be performed at least by common decay testing methods such as sounding with a hard plastic mallet and/or probing when fruiting bodies of *G. sessile* and/or other decay fungi are observed fruiting in

Photograph 10B. **G. sessile** ***fruiting from a buried root after a tree was removed and young tree was planted.*** **G. sessile** ***can be transmitted by root contact, but there is no evidence young or vigorous trees are infected or damaged via root contact.***

these locations.

Advanced testing methods for root and decay in the base may be warranted in some cases for trees with long-standing infections, or with cavities, or concern about decay in roots, or where elevated risk is present because of high-occupancy or high-value targets. Decay testing of an infected root system is more difficult to perform and evaluate, and some trees will require soil excavation to adequately test for root decay.

G. sessile is a very good saprophyte (lives on dead or decaying wood), and can also be commonly observed fruiting on stumps or from buried roots of trees that were previously removed (Photograph 10A & 10B). Stump grinding, as well as grinding as many of the larger diameter roots as possible, is recommended to reduce or eliminate fruiting after tree removal. Spread of *G. sessile* by root contact is known, but it appears that infection of young vigorous trees via root contact is not a significant means of spread (Photograph 10B).

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Andrew Loyd received his master's degree from North Carolina State University. His M.S. research focused on the aquatic niche Phytophthora species in North Carolina watersheds, and the potential risks involved with using source water that is infested with Phytophthora to irrigate ornamental nursery plants. Loyd is employed by the F.A. Bartlett Tree Experts Company and is pursuing his Ph.D. in the Forest Pathology Lab at the University of Florida. His research is working on the clarification of Ganoderma species diversity and function in the Southeastern U.S.