BARTLETT TREE RESEARCH LABORATORIES
CHARLOTTE, NC
Technical Report

Root Collar Disorders

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A tree's root collar is the area where the roots join the main stem or trunk. This area is typified by a flare leading to the major roots (Figure 1).

The root collar is part of the tree's trunk. Unlike roots, the trunk is not specialized to resist constant soil moisture. The movement of oxygen and carbon dioxide in and out of the phloem (inner bark) is inhibited by this water. Over a period of years the lack of gas exchange will kill phloem cells. This interferes with the downward movement of food (photosynthate) to the roots, eventually leading to root dieback and reduced water uptake.

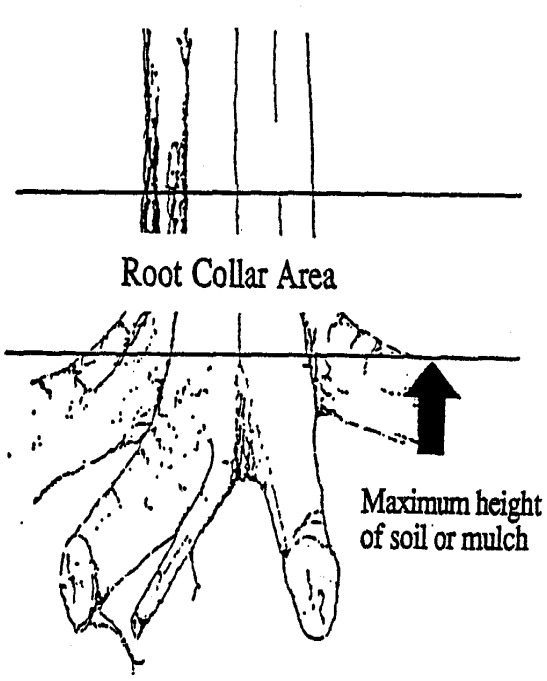

Figure 1. Typical root collar

Root collars with declining phloem are more susceptible to infection and disease caused by certain pathogenic fungi, especially *Phytophthora*, *Leptographium* and *Armillaria.*

Often root collars are buried during landscaping projects when fill soil is distributed around the tree. When trees are transplanted, they may settle in the planting hole or be set too deeply. Some trees arrive from the nursery with excess soil against the root collar.

Excessive mulch may also lead to death of the root collar. Mulch layers should not exceed four inches in thickness and should never be placed against the root collar.

SYMPTOMS

Symptoms of root collar disorders are often first evident as foliage yellowing, early leaf coloration and drop, and dieback in the upper crown. Some trees will show no symptoms at all prior to their death during a hot dry period of the summer. Secondary invaders such as canker fungi and insect borers often invade trees stressed by root collar problems. These cankers may cause sunken areas near the soil line.

Since a disruption of translocation has occurred, some of the growth regulators responsible for hardening off in preparation for winter may not have reached the above ground portion of the tree. Dieback due to winter injury thus may also be a symptom of a root collar problem, which becomes apparent in the spring.

Most tree and shrub species can develop problems from root collar burial. Very sensitive plants include sugar maple, California live oak, dogwood; Japanese black pine and Eastern white pine.

DIAGNOSIS

The easiest way to check a tree for a root collar disorder is to look for natural root flare. If flare is present, the problem is most likely elsewhere. If no root flare is present, an excavation should be made or the soil should be probed with a stiff wire to locate the buttress roots. This should be done within two to four inches of the trunk. Care should be taken not to damage the bark.

To determine if the soil or mulch against the collar has started to cause problems, remove a small amount of bark and sapwood from the trunk just above the roots. If the inner bark is reddish brown and moist, and the sapwood is creamy white, the phloem dieback is due to abiotic (noninfectious) factors. *Phytophthora* produces a reddish brown color in the phloem, which progresses into the sapwood where a black stain is produced. Infection may also extend above the soil line. *Armillaria* produces a white spongy rot of the phloem and sapwood accompanied by a white fungal mycelium fan and black shoestring-like rhizomorphs. *Leptographium also* kills the phloem and stains pine wood bluish black.

TREATMENT

If a tree is severely declining from a root collar disorder, removal is recommended before it becomes hazardous. If decline symptoms are detected early, remedial actions can be taken which may save the tree.

First, all soil or mulch in contact with the root collar must be removed. Root collar excavations can be done by carefully using small digging tools and a brush.

An alternative for excavating a large number of trees is a compressed air device or high-pressure water. Whichever method is used, great care must be used next to the tree to avoid more injury.

Soil should be removed from an area as large as possible around the trunk. A radius of six inches is the minimum excavation, which should be done. It is best if the slope angle of the excavated area is not more than 20°. Excavations should not injure roots over 1/4" in diameter. Adventitious roots over 1/4" should not be removed from the trunk since they may be providing substantial amounts of water and nutrients to the tree.

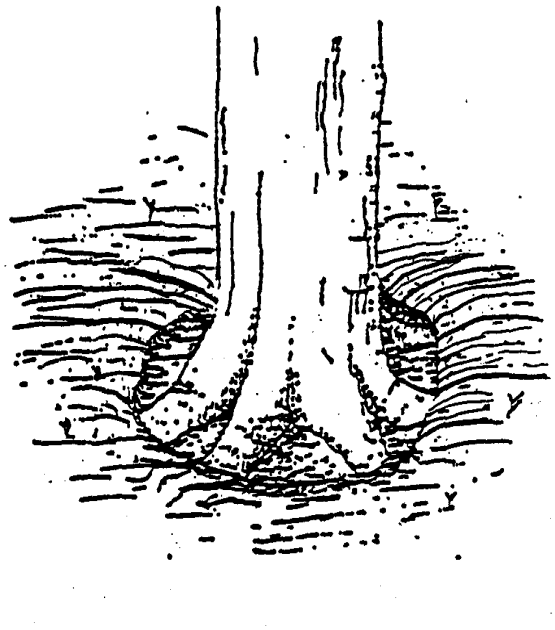

Figure 2. Excavated root collar

The well, which is created by this excavation, may either slope to the original grade (Figure 2) or be lined with treated wood, brick or stone (Figure 3). A layer of mulch up to four inches thick is appropriate on top of the soil, but not against the bark. If it is not practical to leave the well open, it can be filled with coarse gravel. Dirt will need to be removed from the gravel every four or five years.

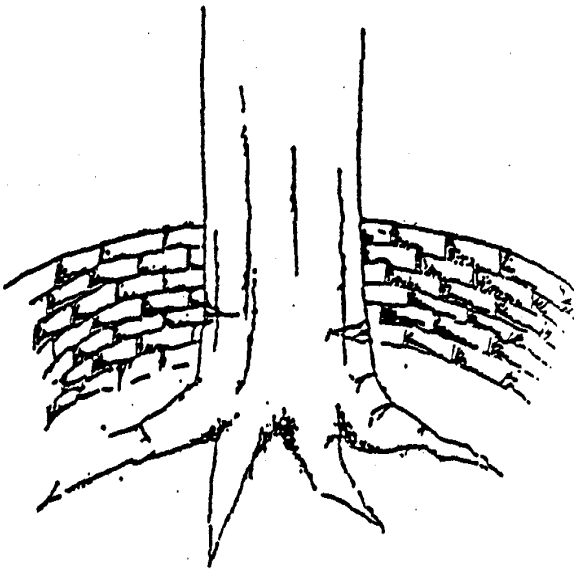

Figure 3. Excavated root collar with retaining wall

The second action to be taken is fertilization. Recommendations should be based on soil analysis.

The third action is to provide appropriate irrigation during dry periods. Most tree species require one inch of water per week during the growing season. Care should be taken not to over water. Irrigation water should never be applied directly to the trunk or root collar area.

In summary, trees and shrubs with buried root collars may decline and are more susceptible to attack by secondary pests. It is best to treat the situation as soon as it is discovered by means of a root collar excavation. Other actions such as fertilizing and mulching will promote tree health, thus improving chances for recovery.

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Drawings by: Mary McKay, Bartlett Tree Research Laboratories