

Role of Tyloses in the Natural Durability of a White Oak Species

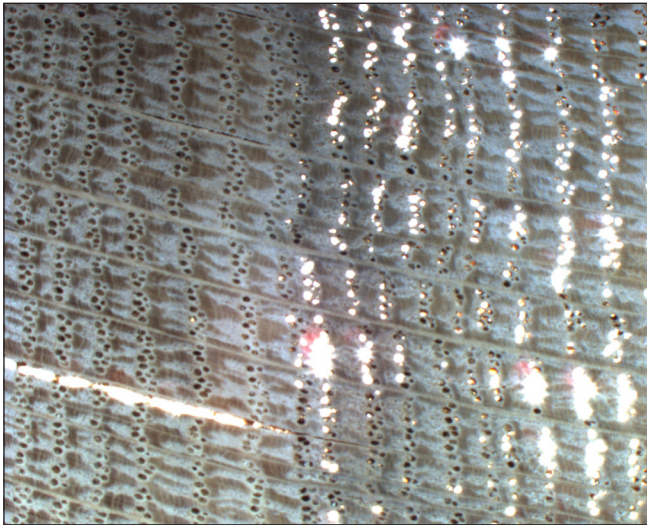


Figure 1. Chestnut oak sapwood–heartwood transition showing vessels and tyloses. Light transmission in the heartwood vessels is blocked by the presence of tyloses. Photo credit: Adam Taylor.

White oak is a major component of hardwood forests in the eastern United States, being second only to red oak in volume of hardwood sawtimber (Cassens 2011). The heartwood of white oak species, including chestnut oak, is generally naturally durable (Scheffer and Morrell 1998), and this property is an important component of its suitability for some applications (such as railway crossties). One possible reason for white oak’s durability is the presence of tyloses. Tyloses are blockages of the lumens of wood cells that result from the extrusion of the cell contents of adjacent parenchyma cells (Fig. 1). The purpose of tyloses in the living tree is not known but it has been suggested that they serve to impede the penetration of fungal hyphae and other organisms. However, natural durability of white oaks can be highly variable.

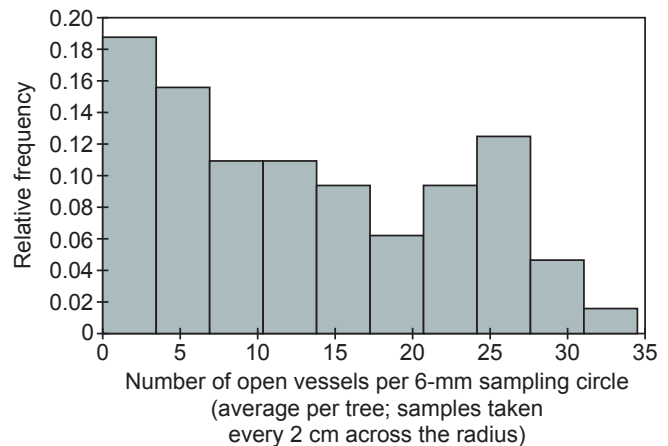


Figure 2. Occurrence of tyloses in chestnut oak.

Although some variation in natural durability is attributable to extractive types and concentrations, the role of anatomical variability—including tyloses—is poorly understood.

Background

Chestnut oak (*Quercus prinus*, aka *Q. montana*) is a member of the white oak group that is abundant and widespread across the eastern hardwood forest. Chestnut oak is excluded from use in barrel manufacture because of the inconsistent occurrence of tyloses, which could result in leakage of whiskey or wine during aging. An initial study found large variation in the frequency of tyloses within and especially between trees of chestnut oak (Fig. 2). However, at least one study (Scheffer and others 1949) reported that chestnut oak is among the most durable of white oak species despite the inconsistent presence of tyloses. This indicates that the role of tyloses in white oak durability warrants further investigation.

Objectives

The principal objectives of this project are to

- quantitatively characterize the occurrence of tyloses in chestnut oak and
- determine associated property characteristics that could impact durability, such as extractive content and moisture responses.

Approach

Samples of chestnut oak from a wide geographical range will be examined for prevalence of tyloses, extractive content, rate of wetting, and natural durability. Natural durability testing will include solid and wood-flour forms with the intent to control for the influence of wood anatomy.

Expected Outcomes

This research will provide a better understanding of the role of tyloses and other wood properties in the durability of chestnut oak. An improved understanding of causes of variation in durability may lead to more efficient use of white oak in durable applications.

Timeline

The project began in June 2019. The bulk of the laboratory research will be completed within the first year. Results will then be analyzed with the intent of providing a report and research publication for presentation to an appropriate professional organization.

Cooperators

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