Is It Possible to Root American Chestnut Cuttings?

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GENETICS AND BIOCHEMISTRY

Introduction

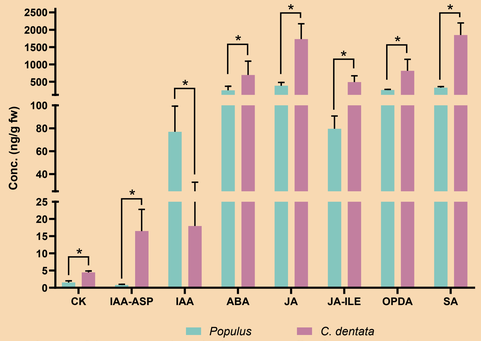
Cutting propagation preserves genotypes and ensures uniform plant production by bypassing seed dormancy. Adventitious roots (ARs) are essential for water and nutrient uptake. While poplar (*Populus*) and willow (*Salix*) root easily, chestnuts (*Castanea* spp.) are recalcitrant even with auxin, restricting their use in conservation and disease-resistance studies.

Chestnuts are nutritious, rich in vitamins, minerals, fiber, and antioxidants, with fewer calories but more carbohydrates than other nuts, boosting consumer demand. The American chestnut (*C. dentata*), once dominant in eastern North America, supported ecosystems and rural economies before being decimated by blight and root rot. Its durable, straight-grained wood was highly valued. This project aims to investigate the physiological and molecular factors underlying the poor rooting ability of American chestnut cuttings.

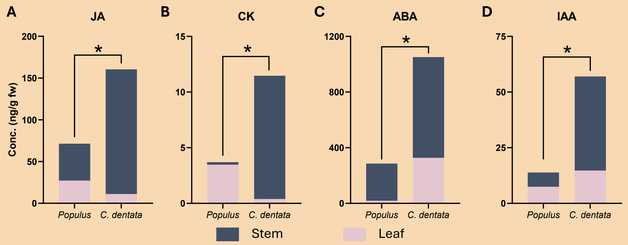
Objectives

- ✓ Identifying physiological barriers limiting adventitious root formation in American chestnut cuttings.
- ✓ Characterizing hormone signaling underlying rooting recalcitrance.
- ✓ Developing improved propagation strategies to enhance rooting success and support conservation and research use.

Results: Phytohormone profiles are not favorable in *C. dentata* adult cuttings.



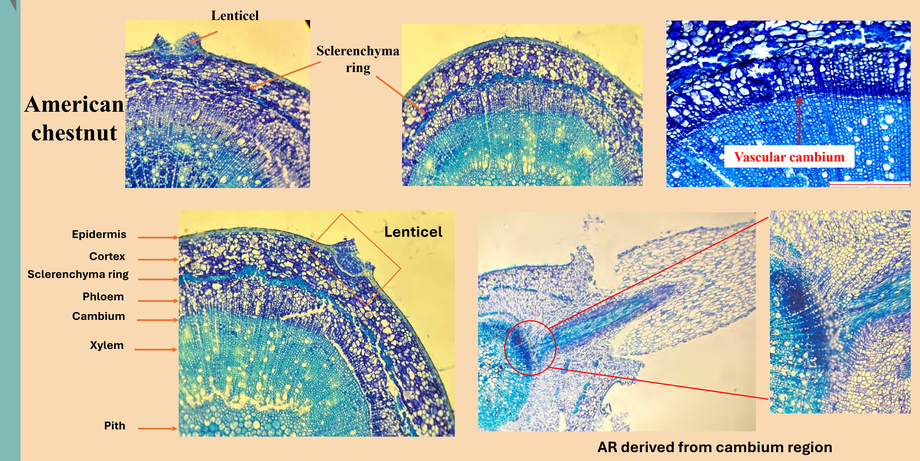
Comparison of hormone levels between *C. dentata* and easy-to-root *Populus* stem cuttings. A significant difference was found between *C. dentata* and *Populus* for all the surveyed hormones at P<0.05.

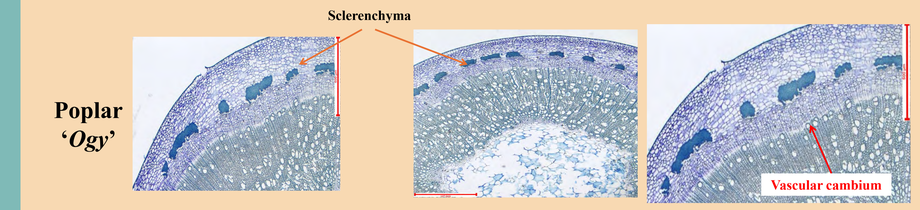


Stem/leaf ratios of JA, CK, ABA, and in *Populus* and *C. dentata*. A significant difference was found between *C. dentata* and *Populus* for all the surveyed hormones at P<0.05.

IAA: indole-3-acetic acid; IAA-ASP: IAA amino acid conjugate aspartate ; JA: jasmonic acid ; JA-IIE: JA- Isoleucine; CK (cytokinin): t-Zeatin, c-Zeatin, dihydrozeatin (DHZ), and trans-zeatin riboside (t-ZR) ; ABA: abscisic acid; OPDA: oxylipin 12-oxo-phytodienoic acid, a biosynthetic precursor of JA; SA: salicylic acid.

Results: Root primordia penetrates the closed sclerenchyma ring in *C. dentata* cuttings.





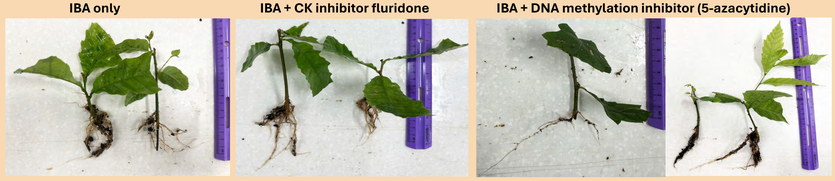
Results: *C. dentata* adult cuttings require longer time to root.

2~3 months

4 ~ 5 months

Adult cuttings rooting percentage ~50%

~1.5 months



Young cuttings (< one-year-old) rooting percentage ~86%

Ongoing directions

- ✓ RNA sequencing: Identifying key genes and pathways regulating adventitious rooting in *C. dentata*.
- ✓ Metabolite profiling: Quantifying metabolites (e.g., sugars, amino acids, and organic acids) linked to root initiation.

Recourses:
Lu, X., Pluchinsky, A., Herren, A., Islam, R., Whitehead, D. C., & Liang, H. (2025). Histology of adventitious root formation in four woody species and the effect of an auxin conjugate. Journal of Environmental Horticulture.
Lu, X., Cuarto, M., & Liang, H. (2023). Histology of adventitious root formation and phytohormone analysis of American chestnut cuttings. Journal of Environmental Horticulture.