



Genomics and American Chestnut Restoration: New Tools to Identify and Increase Disease Resistance

When: Friday, October 28, 2016, 1:00 – 3:30 pm

Where: Blacksburg Library Community Room, 200 Miller Street Blacksburg, VA

The Virginia Chapter

***Restoration of American chestnut: A marriage of breeding and biotechnology* - Jared Westbrook, PhD**, Director of Science, The American Chestnut Foundation, Quantitative Geneticist

For three decades, TACF has pursued backcross breeding to generate hybrids that combine the pathogen resistance of Chinese chestnut (*Castanea mollissima*) and the timber-type growth form of American chestnut (*Castanea dentata*). The backcross method to introduce blight resistance from Chinese chestnut into American chestnut was first proposed by one of TACF's founders Dr. Charles Burnham, a renowned maize geneticist. Burnham's rationale for backcrossing was based on the hypothesis that a few genes from Chinese chestnut are responsible for its blight resistance. Thus, it should be possible to dilute out most of the genes inherited from Chinese chestnut except for those involved in blight resistance and recover hybrids that are morphologically indistinguishable from American chestnut. This presentation will deconstruct the backcross method for the non-geneticist and provide a progress report on its use to incorporate blight resistance into a genetically diverse population of American chestnut.

***Early screening of chestnut hybrid seedlings for resistance to chestnut blight and Phytophthora root rot* - Anna O. Conrad**, Ph.D., Post-Doctoral Associate, University of Kentucky College of Agriculture, Food and Environment

By screening American chestnut backcross hybrids for resistance to chestnut blight and *Phytophthora* root rot prior to planting, fewer trees with higher average resistance may be planted in seed orchards at wider spacing. Reduced competition may facilitate earlier flowering and greater seed production. Seedling inoculations and infrared spectroscopy are currently being tested as methods to screen large numbers of American chestnut backcross hybrid seedlings for blight resistance prior to planting in seed orchards. Infrared spectroscopy measures the absorbance of specific wavelengths of light as it passes through tissue samples. The absorbance spectrum is correlated with concentration of metabolites in tissues. Infrared spectroscopy may be used to predict blight resistance if the concentration of specific metabolites is correlated with disease resistance. Compared with seedling inoculation, infrared spectroscopy has the advantage of being non-destructive to seedlings. This talk will highlight efforts to pioneer the use of infrared spectroscopy to screen chestnut seedlings for disease resistance prior to planting.

***Genomic selection for disease resistance in American chestnut backcross hybrids* - Jason Holliday**, PhD, Assistant Professor of Forest Genetics and Biotechnology, Forest Resources and Environmental Conservation Department, Virginia Tech

Scientists from The American Chestnut Foundation and Virginia Tech are collaborating to develop methods to predict resistance to the chestnut blight fungus based on DNA sequence. This method, called genomic selection, is potentially a rapid and accurate assessment of whether or not American chestnut backcross hybrids inherited genetic variants that confer blight resistance from their Chinese chestnut parents. To develop genetic tests for resistance to both chestnut blight and *Phytophthora* root rot, we are mapping regions of the genome inherited from Chinese chestnut by American chestnut backcross hybrids. We are also scanning the chestnut genome for correlation between DNA sequence variants and disease resistance. Genomic selection holds potential to circumvent the time-consuming and laborious process of inoculating progeny of selection candidates with the chestnut blight fungus to infer their genetic resistance.

***Where do we go from here? Potential for collaboration with Virginia Forestry Professionals and TACF Volunteers* – Jared Westbrook**

Restoration of American chestnut hinges on producing hybrids that grow like American chestnut, are genetically diverse and adaptable to a changing world, and have sufficient resistance to chestnut blight and *Phytophthora* root rot. The ultimate objective is to create a population of American chestnut trees capable of reproducing in forests throughout native range of the *Castanea dentata*. This talk will highlight where we go from here after 30 years of backcross breeding. The potential integration of transgenic American chestnut with a gene from wheat that enhances blight resistance will be discussed. Recurrent selection and alternative breeding strategies to enhance disease resistance will also be discussed. Finally we will discuss how genomics may be used to characterize and conserve the genetic diversity in TACF's breeding program relative to the diversity that remains in sprout populations in the forest.