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Then and Now

THEN AND NOW:

Ten Years of Pollen Production to Help Restore the American Chestnut

Few restoration projects have bridged plant biotechnology with ecology like restoring the American chestnut (*Castanea dentata*). The once iconic tree of eastern North America has been reduced to a few lone trees and shrub-like shoot clusters across its historical range due to chestnut blight (*Cryphonectria parasitica*), introduced around the turn of the twentieth century. For the past thirty years, a research group at the State University of New York, College of Environmental Science and Forestry (SUNY-ESF) has been studying chestnuts (*Castanea*) with the goal of developing blight-tolerant American chestnut trees. Through hard work and perseverance, the blight-tolerant Darling 58 cultivar is now a reality.[1] Darling 58 is a big step towards restoring a socially and ecologically valuable tree. The American chestnut provides habitat and stimulates forest biodiversity, is a delicious source of food and protein, has prized timber, and grows rapidly, sequestering carbon from the atmosphere in the process.[2-4]

Today's challenges include regulatory approval and bolstering broad public support of releasing transgenic blight-tolerant material into the wild. Fortunately, transgenic chestnut trees have so far not shown any non-target effects in any of the ecological interactions SUNY-ESF has investigated.[5-7] After regulatory approval, the next step is to incorporate blight tolerance into the remaining populations of American chestnut. Incorporating blight tolerance into the remaining pools of genetic diversity will facilitate successful re-introduction, establishment, and resiliency against future threats.[8] As the approval process continues, SUNY-ESF researchers are preparing to hit the ground running with the help of citizen scientists. The restoration plan aims to cross Darling 58 with 677 wildtype parents over five generations.[8] First, pollen was collected from Darling 58 in BioChamber's high-light growth chamber and used to pollinate surviving wild-type trees at permitted field sites. Unique transgenic progeny are then chosen to further outcross with wild-types, and the process continues.[8] One day blight-tolerant mother trees may be planted in the backyards of chestnut enthusiasts and citizen scientists who will continue the restoration plan. To help ensure success of restoration efforts by citizen scientists, SUNY-ESF has provided standardized methods for collecting, storing, and using pollen to fertilize backyard trees.[9] The end goal is to produce blight-tolerant seeds (chestnuts) to eventually plant and re-introduce into natural forests where they can re-establish themselves and grow into mature trees.

In addition to reducing blight risk in the initial wild mother trees, crossing trees in a BioChambers high-light growth chamber can be done year round, expediting the restoration effort. The challenge of using growth chambers to cross trees is that seeds (embryos) must be rescued before they are fully mature; potted trees do not have the carbohydrate sinks to form mature chestnuts. Hannah Pilkey embraced this challenge for her graduate work and developed an embryo rescue method for chestnuts.[10] Around 2012 SUNY-ESF serendipitously discovered chestnuts can be induced to flower and produce viable pollen inside a BioChambers high-light growth chamber.[11] Currently, this high-light growth chamber is primarily used to generate and collect blight-tolerant pollen, in addition to making controlled crosses all year round using embryo rescue. Then and now, BioChambers is honored to help restore the American chestnut.

References

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