

SCREENING FOR GENETIC RESISTANCE TO THE HEMLOCK WOOLLY ADELGID

Ben C. Smith¹, Scott A. Merkle², and Fred P. Hain³

The exotic hemlock woolly adelgid (HWA) (*Adelges tsugae*) has caused widespread decline and mortality in natural-occurring and ornamental eastern (*Tsuga canadensis*) and Carolina (*T. caroliniana*) hemlocks native to the Eastern United States. The Forest Restoration Alliance (FRA) seeks to develop and produce hemlocks resistant to or tolerant of HWA that are suitable for both species restoration and ornamental uses. FRA strategies include the identification of resistant and tolerant genotypes of native hemlocks for inclusion in a resistance breeding program, and creation of interspecific hybrids between native and HWA-resistant or tolerant exotic hemlocks. In June 2017, 2-year-old cuttings propagated from 24 candidate trees were intentionally infested with HWA using a rain-down technique of crawlers hatching from suspended HWA-infested cut branches. Rooting success among clones was highly variable, so the number of ramets per clone ranged from 1 to 16 in the infested treatment ($n = 271$ plants) and 1 to 20 in the non-infested control treatment ($n = 118$ plants). We evaluated the trees in July 2018 for adelgid presence, total height, growth of the dominant terminal branch, branch tip dieback, and overall plant vigor. Height and growth differed significantly among clones, but no measured trait was significantly affected by infestation. HWA survival and reproduction was poor over time, so additional artificial infestation and evaluation are needed to accurately assess levels of resistance. Through the *in vitro* propagation technique of somatic embryogenesis (SE), we have successfully produced somatic seedlings from eastern, Carolina, and hybrids between Carolina and Chinese (*T. chinensis*) hemlock and Carolina and southern Japanese (*T. sieboldii*) hemlock, verified by chloroplast DNA markers. We are utilizing SE to accelerate clonal replication for resistance/tolerance screening and deployment of tested genotypes. We have also attempted, without success yet, to create novel interspecific hybrids incorporating eastern hemlock using embryo rescue.

¹Forest Restoration Alliance, Department of Entomology and Plant Pathology, North Carolina State University, Waynesville, NC 28786, (bcsmith6@ncsu.edu).

²Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA 30602.

³Forest Restoration Alliance, Department of Entomology and Plant Pathology, North Carolina State University, Raleigh, NC 27695.

Citation for proceedings: Nelson, C. Dana; Koch, Jennifer L.; Sniezko, Richard A., eds. 2020. Proceedings of the Sixth International Workshop on the Genetics of Host-Parasite Interactions in Forestry—Tree Resistance to Insects and Diseases: Putting Promise into Practice. e-Gen. Tech. Rep. SRS-252. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 170 p.