

EVIDENCE OF FRASER FIR PARTIAL RESISTANCE TO THE BALSAM WOOLY ADELGID

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The balsam woolly adelgid, *Adelges piceae* (BWA), was first reported on Fraser fir, *Abies fraseri*, on Mount Mitchell in 1955. A novel herbivore in North America, BWA was responsible for sharp declines in wild Fraser fir populations in the 1960's and 70's. Tree mortality is thought to be the result of systemic rotholz formation. Rotholz is dense and resinous wood that restricts water transport throughout the tree. Fraser fir is the premier Christmas tree species in North Carolina and plantations require frequent pesticide applications to prevent BWA related damage and mortality. Breeding Fraser fir for BWA tolerance or resistance traits may lessen or eliminate the need for pesticide treatments in the future. In this genetic study we evaluated 37 clones of improved Fraser fir for increased tolerance or resistance to BWA using tree growth, gouting, loss of apical dominance, systemic rotholz formation, and mortality as performance metrics. Additionally, we evaluated the lateral bud transcriptome and foliar terpenoid expression of select clones in response to BWA feeding. We found a broad range of responses among clones ranging from extreme susceptibility to significant levels of resistance. Increased foliar concentration of several terpenoid compounds in response to BWA feeding were observed across all clones but this response did not correlate with clone performance. Significant upregulation of genes related to plant defense, lignin synthesis, and traumatic resin duct formation observed in high performing clones, however, does suggest a targeted defensive response to BWA feeding. We believe these data provide strong evidence that some degree of BWA resistance is present in Fraser fir populations which could be further enhanced through selective breeding.