Duling Grant Recommendation:

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"A Three Pronged Approach to understanding the defensive mechanisms in Green Ash (Fraxinus. pennsylvanica) resistant to Emerald Ash Borer (*Agrilus planipennis*)"
Request: $25,000

Project Summary
Emerald ash borer (EAB, *Agrilus planipennis*), an accidentally introduced Asian beetle, poses an acute threat to the native Fraxinus species in North America. Mass mortality in green ash (*F. pennsylvanica*) and white ash (*F. americana*) affects broad swaths of the landscape, from forests and farmland to urban streets. Urban foresters and communities are fighting this spread which cost upwards of 1.7 billion dollars in 2011 alone. While some communities like Naperville (a suburb of Chicago) maintain their trees by spending almost 900,000 dollars a year on chemical treatments, American ashes are being functionally removed from every other landscape.

This annihilation is due to the lack of base resistance against the invasive EAB, as American ashes never acquired necessary protections through co-evolution. However, a few green ash (<1%) termed "lingering" have been noted to survive for years after all other local green ash have died. Our collaborators collected these trees, and after challenging them with directly applied EAB, have confirmed defensive responses (killing some EAB larvae or slowing their growth) in clonally replicated studies. Because these trees appear to use different methods of resistance, these multiple traits can be 'stacked' or pyramided in a selective breeding program to produce trees with greater long-term resistance to EAB.

We propose a multi-faceted, interdisciplinary approach to examine the functional basis for resistance to EAB in lingering green ash. We will employ transcriptomics, proteomics and metabolomics to examine differences in gene expression, proteins and secondary metabolites in susceptible green ash vs lingering green ash. We will apply this analysis to 200 progeny from lingering x lingering and susceptible x susceptible crosses in twelve different families. We propose to analyze these samples to find indicators and mechanisms of resistance. From this, we can create a test that allows us a strong prediction of resistance from a small tissue sample. This allows for a higher throughput in collecting new potential lingering trees from the wild to increase the genetic diversity in the breeding pool. By increasing the rate at which defensive traits in ash can be selected for in a targeted breeding program, we can produce an ash with enough resistance that EAB becomes a pest instead of a deadly plague. Therefore, once we can understand the defensive mechanisms, we can better guide the breeding program, vastly increasing the pace to restore green ash on the landscape and in our cities.