

## Albizia biological control project overview - FY2017

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*Albizia (Falcataria moluccana)* is one of the most economically menacing and environmentally destructive tree species to be introduced to Hawaii and several other Pacific Island nations. Despite several million dollars expended annually on mechanical and chemical control, invasions across Hawaii and the Pacific are already so widespread that long term management will depend on biological control using host-specific natural enemies. Albizia biocontrol has been prioritized by the interagency Hawaii Invasive Species Council and been supported by the US Forest Service, USFS – International Programs Office and the State of Hawaii.

In FY2017, Dr. Puliafico and our US Forest Service albizia biological control project collaborators and volunteers conducted three exploratory surveys for new potential biocontrol agents. USFS – International Programs sponsored two trips to eastern Indonesian's Maluku, Papua and West Papua provinces, and a brief visit to East Timor, while Hawaii State funds were used to explore Papua New Guinea's Bismarck Archipelago. The results of these surveys have allowed us to identify and prioritize potential biological control insect and mites as candidate agents for future host specificity and herbivore efficacy studies.



The five arthropod species prioritized for further study include (a) shoot mining moth caterpillars (inset: adult moth), (b) stem boring weevils, (c) leaf feeding flea beetles, (d), leaf blotch miner flies, and (e) gall forming eriophyid mites. These enemies belong to taxonomic groups that tend to be highly specific in their feeding behavior, and therefore more likely to pass upcoming screening to determine risk to nontarget plants.



Surveying albizia trees with researchers and students from (a) Universitas Pattimura, Ambon, Maluku, Indonesia, (b) Universitas Papua, Manokwari, West Papua, Indonesia, and (c) Warea Orapa (PNG – National Agriculture Quarantine Inspection Agency) and Tiberius Jimbo (PNG Forest Research Institute) and staff.

During this past year, two experiments investigating the insect community colonizing young albizia trees were completed in the native range and near agroforestry plantations in West Java. Master's degree students from Bogor Agricultural University (IPB) and Universitas Pattimura (Ambon, Maluku) grew plants in a large experimental arrays and monitored the herbivorous insects feeding on albizia every two weeks. Almost 100 insect species were recorded from these saplings, with marked differences between the two ranges. Yendra Setyawan, whose Master's degree project focused on these experiments, was the first student associated with this albizia biological control project to graduate in mid-September from the IPB Department of Plant Protection under the supervision of Dr. Purnama Hidayat. His paper and poster "Herbivorous insects associated with albizia (*Falcataria moluccana*) saplings in Bogor" presented in August 2017 won the first prize for student posters at the 2nd International Conference on Biosciences (ICoBio 2017). He also is first author on the scientific publication "Diversity and abundance of insect herbivores on Hawaiian and Indonesian albizia, *Falcataria moluccana*, in a Java common garden" for the Journal of Asia-Pacific Entomology (in review).



Insect colonization experiments involved (a) planting seedlings in polybags (Rick Warshauer - US Forest Service Volunteer, Dr. Audrey Leatemia and staff at Universitas Pattimura), (b) observing insect species and abundance every two weeks (Yendra Setyawan, Master's student at IPB), and (c) harvesting trees to determine insect herbivore impacts on tree biomass (Mr. Setyawan, IPB).





Falcataria Gall Rust forms on (a) seed pods, (b) leaves, and (c) tree stems.

Among the early biological control candidates is a gall rust fungus, *Uromycladium falcatarium*, which galls new growth and is a major problem for albizia plantations in the Philippines and Indonesia. Relatives of this fungus have been successfully used for biological control of invasive acacia species in South Africa. Dr. Sri Rahayu at the Forestry Department, Universitas Gadjah Mada (UGM) in Yogyakarta tested albizia from Indonesia and Hawaii along with several related tree species with spores of this fungus in a number of experimental settings. Early evaluations of this fungus suggest careful screening of different genetic strains will be necessary to avoid possible impacts on *Acacia koa* and other native Hawaiian plants that are related to albizia.

#### Future work

In the next year (FY2018) two trips to Indonesia and Papua New Guinea are planned to continue and expand on the experimental work started in 2017. The recently signed MOU's with Universitas Gadjah Mada and Bogor Agricultural University will help with securing permits to export live natural enemies from Indonesia. While awaiting export permits, testing each of the five new candidate biological control species identified from our surveys will begin with collaborators in Indonesia and Papua New Guinea. Graduate students are being recruited to develop methods for rearing and testing these candidates. At the end of the year the most promising insects will be brought to the US Forest Service Insect Containment laboratory in Hawaii for further evaluation. Additional surveys to find the insects that specialize on feeding on the flowers, fruit and seeds of albizia will be emphasized. We will also continue to look for new strains of the Falcataria gall rust fungus in albizia's native range in a new joint project with plant pathologists from Universitas Gadjah Mada and Universitas Pattimura. In addition, we will begin examining the leaf samples of albizia taken from each field site using molecular techniques to identify the populations in the native range with the same genetic profiles as our trees in Hawaii, in order to focus further research to the most appropriate sites within the native range. Our Indonesian and PNG collaborators will continue to be essential for the development of a successful biological control program for Hawaii's invasive albizia trees.