

Pacific Southwest Research Station

Institute of Pacific Islands Forestry

Biological control of weeds in Hawai'i: History and Prospects

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Controlling weeds in wildlands. Invasive plants are a major source threat of damage to native Hawaiian ecosystems and species. Miconia, strawberry guava, christmasberry, fountain grass, kahili ginger and clidemia compete with native species and alter ecosystem processes. The scale of these invasions makes their control using only mechanical and chemical tools risky and prohibitively expensive. Carefully chosen biological agents can provide long-term weed control island-wide, reaching even poorly accessible areas. Deliberate introduction of natural enemies—insects, mites and pathogens—can reduce the density and spread of an exotic plant where it has become invasive. While biological control can effectively reduce the impact of an invasive species, it rarely results in its eradication. Instead biocontrol agents reduce the rate of spread, abundance and range of the weed, while improving the effectiveness of other forms of control such as herbicide application.

Past successes in Hawai'i. Biocontrol of weeds has been practiced successfully for over a century in Hawai'i. Formerly extensive infestations of prickly pear cactus, lantana, Hamakua pamakani, emex and St. John's wort have been brought under long-term control in Hawai'i by biocontrol agents introduced by scientists for the Territory and State of Hawai'i. Recent introductions of biocontrol agents appear to be successfully reducing infestations of banana poka and ivy gourd.

Pre-release evaluation of potential biocontrol agents. Biological control research involves exploration for natural enemies that affect the weed where it is native. This is followed by evaluation of the effectiveness of potential agents against the target plant as well as their risks to other plants. The most promising agents are brought into a secure quarantine facility in Hawai'i where they are carefully tested for potential impacts on native or economically important plants and screened to eliminate hitch-hiking parasites or diseases. Agents are carefully scrutinized by state (Hawaii Dept. of Agriculture) and federal (USDA-Animal and Plant Health and Inspection Service (APHIS), US Fish and Wildlife Service) regulatory agencies and must pass public review before release.

Concern has been expressed over the use of biocontrol agents because of their potential to cause harm when they feed on other plant species. However the historical record shows that risk of direct impacts on plants other than the target host is greatest in closely related species. Agents released following standard screening procedures and review processes rarely affect non-target species.



Prickly pear cactus on Mauna Kea following release of biocontrol agents around 1950. Photos taken in 1954 and in 1958.

IPIF Program in the Biological Control of Forest Weeds

Successful biological control of weeds depends upon a network of international cooperators, sustained funding of projects for up to 10 years or more, and the commitment of trained personnel and specialized quarantine facilities. The Institute of Pacific Islands Forestry operates the Hawai'i Volcanoes National Park Quarantine Facility, one of only two USDA-APHIS-certified insect containment laboratories for biocontrol in the state. Our ability to develop safe, effective agents is strengthened by partnerships with the National Park Service, US Geological Survey—Biological Resources Division, University of Hawai'i, Hawai'i Department of Agriculture, Hawai'i Division of Forestry and Wildlife, the US Fish and Wildlife Service, and the Hawai'i Invasive Species Council. We also collaborate with researchers outside Hawai'i, including scientists working where our target weeds are native.

Target weeds

The Institute's biological control program currently focuses on three highly invasive plant pests threatening native Hawaiian forests:

Strawberry guava or waiawi (*Psidium cattleianum*, Myrtaceae) infests thousands of acres of native rain forest. Its dense thickets suppress native species, provide a major food source to fruit fly pests of Hawaiian agriculture and cost taxpayers and landowners millions of dollars in damage and control expenditures annually. We have proposed field release of *Tectococcus ovatus* (Homoptera), a scale insect from Brazil that creates galls on young leaves. Our quarantine testing in Hawai'i and observations in Brazil demonstrate that *T. ovatus* is highly host specific, attacking strawberry guava, but not its relative, common guava, or other members of the family Myrtaceae in Hawai'i. This insect is expected to reduce fruit production and slow the spread of strawberry guava, providing major long term benefits to the environment and economy of Hawai'i.

Cane tibouchina (*Tibouchina herbacea*, Melastomataceae) also native to Brazil, is a growing threat to rain forests on Maui and Hawai'i. This weed thrives in wet areas such as bog habitats that are home to many endangered species. A leaf beetle, *Syphraea uberabensis* (Coleoptera), has been identified as the most promising of several potential agents. Larvae and adults of this species eat the leaves, and heavy feeding has been shown to kill tibouchina plants in the field. Quarantine testing of this species is in progress.

Miconia (*Miconia calvescens*, Melastomataceae), a tree native to tropical America, has spread alarmingly in Hawaii since its introduction in 1959. In addition to current efforts to control miconia with herbicides, biocontrol will be necessary for long term management of this rapidly spreading and ecologically dangerous tree. With collaborators in Brazil and Costa Rica, we are developing a suite of biocontrol agents that attack miconia plants in a variety of ways to supplement a fungal agent already introduced. Our goal is to reduce seed production, slow growth, and increase mortality of immature and mature trees.

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