

Proposal Title: Biocontrol of melastomes and other high priority invasive plants

Content area: Research

Project Period: Mar 1 2024 – May 31 2025

Applicant:

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Partners:

Universidad Costa Rica, Universidade Regional Blumenau (Brazil), USDA-EBCL (France), CABI (UK), Manaaki Whenua (Landcare, New Zealand), Queensland Dept of Agriculture (Australia)

Total Request: \$182,000

Executive Summary: (791/800 characters)

We will continue developing biocontrols for melastomes, including miconia, clidemia and tibouchina, and other high priority invasive plants. We will rear and test gall wasps that attack fruits and disrupt seed development in clidemia and miconia. We will support release and monitoring of a butterfly agent for miconia and a beetle for tibouchina, and new release proposals for tested agents of Christmas berry and devilweed. Pathogens for clidemia and miconia and natural enemies of other high priority weeds, including fayatree, Himalayan ginger and Himalayan raspberry, will be evaluated through international partners. These projects depend on having support to foster joint studies with foreign collaborators, and for staff to maintain and study insects and their host plants in Hawaii.

Project Deliverables:

FY23 Deliverables achieved

- Assessed impact of fruit moth released against clidemia in 1990s, for inclusion in pending assessments of prospective new biocontrol agents
- Prepared for release and monitoring of miconia and tibouchina agents including permitting and coordination with foreign and Hawaii partners
- Rearing and evaluation of gall wasps and other melastome enemies by Brazilian collaborators; export permit secured
- Rearing and initial testing of Chromolaena gall fly in Volcano quarantine

Project Overview: (4886/5000 characters)

Following surveys for natural enemies in Costa Rica and Brazil in the 1990s and early 2000s, our biocontrol program has focused on developing selected agents which appear to

hold the greatest promise for impacting miconia and other weedy melastomes. Initial studies by teams of students and post-docs in the native range generated a wealth of information on biology, host range and impact of agents on miconia and other melastomes. As resources and knowledge of each species' biology have allowed, agents have been brought to Hawaii for evaluation in quarantine facilities managed by the Forest Service or the Hawaii Department of Agriculture. Having completed testing and now under review for release in Hawaii is a leaf-feeding butterfly species of miconia. A fruit galling wasp, discovered in Brazil in 2007 by a HISC-funded post-doc, is under study by colleagues at Universidade Regional de Blumenau. A promising fungus, *Coccodiella miconiae*, awaits further development in Costa Rica. Our overall strategy for miconia biocontrol is to develop a suite of agents that attack different parts of the plant, with the goal of damaging miconia in multiple ways to lower its overall fitness.

Clidemia, another invasive melastome of major importance in Hawaii, has been a target of biocontrol efforts since the 1970s, but remains poorly controlled in Hawaiian forests. A project with Clemson University found limited genetic variation in the shoot galling nematode *Ditylenchus gallaeformans* across different melastome hosts, indicating that the same organisms will utilize both clidemia and miconia. Further documentation of host range of this nematode is planned in Costa Rica. We also are studying a clidemia fruit galling wasp discovered in Brazil in 2015. These little-known wasps (*Allorhogas clidemiae* and, in miconia, *Allorhogas granivorus*) open an opportunity for managing a critical life stage of invasive melastomes – their bird-dispersed seeds.

Our past work also included studies of a Brazilian flea beetle, *Syphraea uberabensis*, which defoliates and is host-specific to *Tibouchina herbacea* and a few closely related weeds. This agent will be collected by collaborators and re-established in quarantine in advance of its proposed release in 2023.

In 2024 we hope to complete evaluations of the fruit gall wasps for clidemia and miconia. These insects are likely to be very host-specific. Their galling deforms fruit and disrupts normal seed production, with potential to significantly reduce spread. The miconia wasp has been technically challenging to rear because it requires fruiting trees, which are difficult to grow in quarantine. However our success rearing the clidemia wasp on potted clidemia has yielded important insights that will help with the miconia wasp. Studies in Blumenau, Brazil, where both wasps is readily available on the university campus, also are improving our progress with these agents.

Additional studies targeting other important weeds are possible with agents under development elsewhere around the world. In 2022 we began quarantine testing a stem galling fly for *Chromolaena*, in collaboration with researchers in Queensland, Australia. A fly that attacks Himalayan ginger is under study by partners in the UK and New Zealand and may be available for quarantine study in Hawaii in 2024. New prospective agents for biocontrol of *Morella faya* were identified in the Canary Islands in 2019, along with potential university collaborators, and now we are developing plans to return to this project with scientists at the USDA European Biological Control Lab. Our collaborators in

Blumenau, Brazil discovered some promising natural enemies of *Tibouchina urvilleana*, in addition to their work on other melastomes.

All of this work is dependent on having support for foreign collaborations and sufficient staff to maintain insects and their hosts and test plants in quarantine. Continuing HISC support of research technicians and/or student assistants will enable us to pursue multiple ongoing projects in Hawaii. HISC funds will facilitate foreign efforts continuing development of the gall wasps in Brazil; the nematode gall-former on clidemia and a leaf fungus on miconia in Costa Rica. International travel, disrupted in recent years, has returned as a critical component of our biocontrol program in 2023, strengthening our foreign partnerships and our ability to import new biocontrol agents. We expect to begin releases of two agents in 2023-24: the Brazilian beetle for control of cane tibouchina and relatives, and the Costa Rican butterfly for miconia.

Budget Request:

Budget Category	Item	HISC Funds Requested
Salaries & Fringe	2 FTE technicians, 12 months	110,000
Equipment & Supplies	Quarantine facility, plant nursery, collecting supplies	5,000
Contractual Services	Brazil collaborators	20,000
	Costa Rica collaborators	16,000
	USDA-EBCL collaborators	16,000
	Kupu internship	20,000
Travel	3 trips by PI Johnson to native range (1x Brazil, 1x Costa Rica, 1x Canary Islands); Interisland travel for biocontrol releases (x6)	22,000
Utilities		
Other		
Overhead	USDA Forest Service (20% in-house waived)	0
	Total Requested	209,000

Existing or anticipated funds and sources (including in-kind services):

Source of Funds	Existing or Anticipated?	Match Required?	Amount
USDA Forest Service (60%FTE of PI Johnson; 40%FTE quarantine specialist)	Existing	no	160,000
USDA Forest Service quarantine maintenance and other overhead	existing	no	30,000
Army Natural Resources Management for Chromolaena	existing		25,000

Priority 4 - Increasing Pacific Regional Biocontrol Research and Capacity

Justification:

This project supports development of new biocontrol agents; and testing, release and monitoring of known biocontrol agents.

FY2 Deliverables

- New agents for biocontrol of Miconia, Clidemia, Tibouchina, Morella faya, and Chromolaena odorata collected from their native range and reared and tested in quarantine or by collaborators outside Hawaii
- New agents released against miconia and tibouchina
- Feasibility assessments of potential new target weeds for biocontrol in Hawaii, to be shared with management partners to facilitate long term planning and capacity building