Title: Technical support of weed biocontrol research in Volcano, Hawaii
Organization: USDA Forest Service
Award: $45,500

Introduction: The USDA Forest Service Institute of Pacific Islands Forestry researches natural enemies of invasive plants for their potential use in management of Hawaiian forest weeds. *Miconia calvescens* has been a high priority target of our work over the last 13 years, including exploratory studies in Costa Rica and Brazil and host specificity testing of selected agents in our Volcano quarantine facility. Collaborating with the Hawaii Department of Agriculture, we also have released a promising biocontrol for strawberry guava and begun detailed post-release monitoring. USFS base funding for this program is roughly $250K per year; and this HISC award represents approximately 15% of our total funds over the last year.

Achievements in FY13

Miconia biocontrol: This year we have begun detailed host specificity testing of *Euselasia chrysippe*, a butterfly whose larvae defoliate miconia leaves (Figure 1). This potential biocontrol agent has been well-studied in its Costa Rican native range but remains challenging to rear in captivity. Our work therefore has focused on tests with field-collected larvae, both in Costa Rica and with insects imported to our Volcano quarantine facility. Results so far indicate that larvae are adapted to feed on a broad range of melastomes, but not on species outside this plant family (Figure 2). Melastomes in Hawaii include miconia, clidemia and other invasive alien species, but no native plants. Our findings support the expectation that this butterfly would use only miconia and perhaps a few other weeds here, without affecting any native or otherwise valued species.

Figure 1. Euselasia chrysippe larvae feed on miconia leaf.

Strawberry guava biocontrol: The Brazilian scale insect *Tectococcus ovatus* was released in demonstration plots at two sites on Hawaii Island during 2012. Populations are established and growing, with insects spreading gradually within individual trees. These sites are serving to demonstrate the impacts and specificity of the biocontrol agent, which will next be released within native forest sites to slow the spread of strawberry guava. (Attached: summary presented as poster at the 2013 Hawaii Conservation Conference)

For more information, please contact: Tracy Johnson, tracyjohnson@fs.fed.us

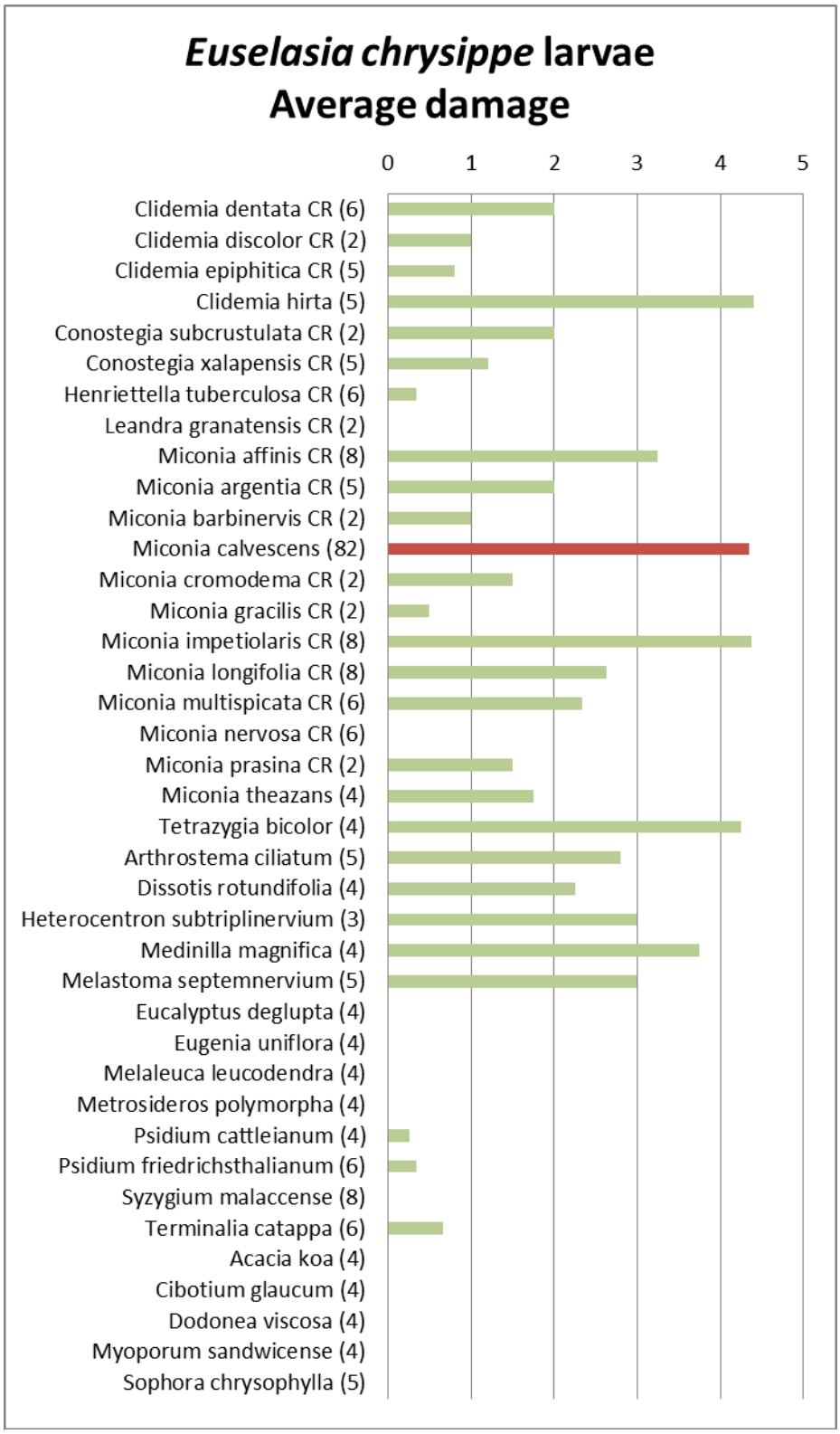


Figure 2. Feeding damage by Euselasia chrysippe larvae in 3-day, no-choice tests (scale from 0=no damage to 5=severe damage). Number of replicates of each plant species is indicated in parentheses.

Update on Establishment of a Biocontrol Agent Released for Strawberry Guava in Hawai'i

Nancy Chaney & M. Tracy Johnson
USDA Forest Service, Pacific Southwest Research Station, Institute of Pacific Islands Forestry

Strawberry Guava in Hawai'i

The Brazilian tree *Psidium cattleianum* (strawberry guava) is one of the worst invasive weeds in Hawai'i. Spread by pigs and alien birds, its fruit also serves as a host for pest fruit flies. Over the two centuries since its introduction, strawberry guava has invaded and degraded many tens of thousands of acres of native forest and agricultural lands. Widespread at low and mid elevations, it is now expanding its populations into our high elevation rainforest watersheds.

Strawberry guava's natural enemy *Tectococcus ovatus* is native to southern Brazil. This insect is highly host-specific, using only strawberry guava and its close relative *Psidium spathulatum,* which occurs only in Brazil. This insect has never been recorded as a pest of any agricultural or ornamental plants, and has never attacked common guava which grows throughout its native range. Extensive testing in Brazil, Hawai'i and Florida has demonstrated that this biocontrol agent will affect only strawberry guava in Hawai'i.

Expected Impacts of Biocontrol

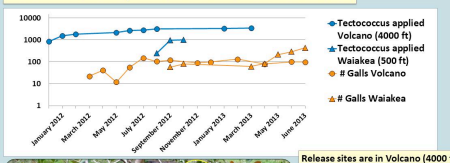
Tectococcus produces galls on young leaves; existing wood will not be affected.

Trees will NOT be killed, but should grow more slowly.

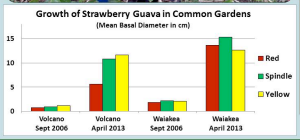
Seed and fruit production is expected to decrease gradually.

Low dispersal ability limits this insect's potential to reach backyard trees far from forests.

Gall Development at Release Sites

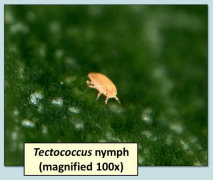



Galls spreading within tree at Waiakea



Release sites are in Volcano (4000 ft) and Waiakea (500 ft). Biocontrol release plots are paired with untreated plots to measure impacts on growth and reproduction over time. Plots include three varieties of strawberry guava found in Hawai'i: Red, Yellow and Spindle fruited. The biocontrol has increased much more rapidly at the warmer Waiakea site, where the trees also grow faster. In half the time and with lower release effort compared to Volcano, insect populations at Waiakea have increased to several hundred galls. In addition to cool temperatures, vog-induced leaf drop has delayed spread of the insect at the Volcano site.

Initial application of *Tectococcus* using Direct Transfer Method


Tectococcus nymph (magnified 100x)

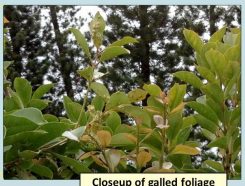

Applying nymphs by hand


Gall development using Direct Transfer Method

Passive Transfer Method for applying *Tectococcus*

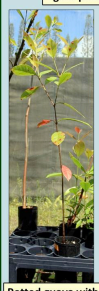
Tested at Waiakea site beginning April 2013


Potted strawberry guava with galls placed in ungalled tree

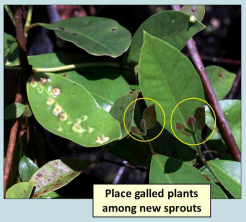

Closeup of galled foliage nestled among new leaves


Gall development using Passive Transfer Method

Method for establishing *Tectococcus* at future field sites


Potted guava with mature galls


Strawberry guava stems cut to generate new sprouts


Place galled plants among new sprouts


Nymphs spread to new leaves and form galls

Many thanks to Eddie Bufil and Lori Bothwell for assistance at field sites!