



Controlling Strawberry Guava's Invasion

Green mountains wrapped in clouds are a reassuring sight on islands across the Pacific. These forested highlands catch the water that humans depend on, and can preserve a rich diversity of life. Sadly, although green, many island forests are far from healthy. Among the greatest threats to native forests in Hawaii is the invasive tree, strawberry guava.

Native to Brazil, strawberry guava (*Psidium cattleianum*) was brought to Hawaii in 1825 for its tasty fruit, distinctive smooth bark, and evergreen leaves. Now widespread, this tree penetrates native wet forests statewide, its seeds scattered by non-native birds and pigs. Nearly 300,000 acres of conservation lands are affected by this plant on Hawai'i island alone. While roughly one tenth of this area has been lost to thick stands containing few other species, most Hawaiian rainforests invaded by guava remain in relatively good condition – for now. But with annual growth rates exceeding 10%, strawberry guava is rapidly taking over.



Strawberry guava grows rapidly, creating dense thickets and squeezing out native vegetation.

J. Jeffrey

Hawai'i Volcanoes National Park has been a leader in developing mechanical and herbicidal techniques for removing strawberry guava. But these costly methods have been focused on the park's most precious areas, small hotspots of endemic biodiversity, and it has not been possible to extend control over the vast landscape threatened by strawberry guava.

For many years, biological control has been recognized as the only hope for limiting the destructive spread of strawberry guava in Hawaii. Biocontrol is practiced worldwide and is based on the principle that specialized insects or diseases that keep a plant species in check in its

native range can be used to help restore balance where the plant has become invasive. Biocontrol is increasingly applied to manage wildland weeds in the US, with recent successes including the control of *Melaleuca* in the Everglades.

Research on natural enemies of strawberry guava in Brazil over the last twenty years led to the selection of a leaf-galling scale insect, *Tectococcus ovatus*, as a promising and highly specific biocontrol agent. *Tectococcus* does not kill strawberry guava, but rather reduces plant vigor and fruit production, limiting the plant's ability to spread and overwhelm forest areas.



Galls form around *Tectococcus ovatus* as it feeds on the leaves of strawberry guava, sapping the plant's energy for growth and reproduction.

T. Johnson, USDA Forest Service

Testing by the US Forest Service has shown that *Tectococcus* can survive only on strawberry guava and does not pose a risk to related plants in Hawaii. Guava relatives in the Myrtle family, including the islands' dominant native 'ōhi'a lehua (*Metrosideros polymorpha*), and a broad selection of other test plants have been shown to be safe from attack by this insect. Strawberry guava's closest relative in Hawaii, common guava (*Psidium guajava*), is also left untouched by *Tectococcus* in lab tests and in Brazil, where the two guavas grow side by side. Such high specificity may seem surprising, but is not unusual among plant-feeding insects, particularly gall-formers which must live in intimate contact with their host plants.

In addition to protecting remaining native forests from invasion by strawberry guava, *Tectococcus* is expected to benefit agriculture by reducing numbers of pest fruit flies that emerge from wild strawberry guava to attack neighboring fruit crops.

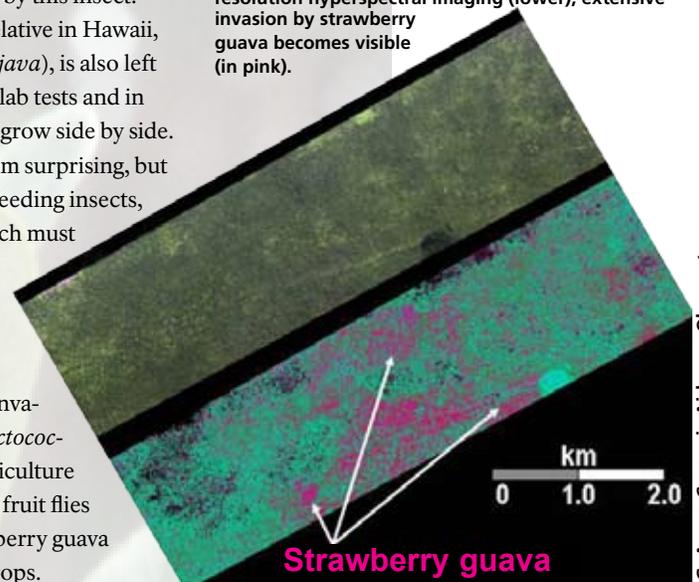
Biocontrol also is expected to increase the effectiveness of other weed control methods since the insect can reduce strawberry guava's ability to resprout and reseed after cutting and herbicide treatment.

Permits for release of *Tectococcus* were issued in April 2008 by the Hawaii Department of Agriculture and the USDA, following scientific and regulatory reviews begun in 2005. Initial field release is planned on Hawai'i island in 2009 following completion of a state Environmental Assessment. The insect is expected to be used for control of strawberry guava on Maui and other islands within a few years. Since the flightless *Tectococcus* must disperse from one strawberry guava to another by wind and crawling, natural spread of this biocontrol is expected to be gradual, moving outward from release sites over a period of decades.

Although this carefully chosen biocontrol agent is not a cure for all problems associated with strawberry guava, it is a critical tool for long term management on an island-wide scale, including remote areas of severely threatened Hawaiian rainforest.

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Not all green is good: Forest cover appears healthy from an aerial view (upper) near Hawai'i Volcanoes National Park, but using high resolution hyperspectral imaging (lower), extensive invasion by strawberry guava becomes visible (in pink).



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