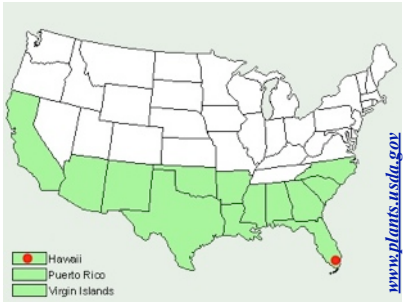
Early Detection Pest Risk Assessment
Erythrina Gall Wasp

R5-FHP-2007-01
February 2007

INTRODUCTION

The nonnative erythrina gall wasp (EGW), *Quadrastichus erythrinae* Kim (Hymenoptera: Eulophidae), was detected in south Florida in October 2006. EGW infests *Erythrina* (coral trees), which are prized for their ecological, cultural and ornamental value. They are the only known hosts for EGW. In the continental United States *Erythrina* occur in warm southern environments from Florida to California. There are two native species (*E. herbacea* and *E. flabelliformis*) along with countless high-value ornamentals cultivated for their visual appeal. Though information is limited, both native and nonnative *Erythrina* on the U.S. mainland appear to be susceptible to EGW.



EGW is currently established in the U.S. in Hawaii and Florida. States known to have *Erythrina* are shaded.

EGW was first identified in 2004 and its origin remains unknown. In less than two years it was detected in numerous locations throughout the Pacific from China to Hawaii. EGW's short life-cycle (~20 d), high fecundity, tiny size and effective dispersal promote its rapid invasion. Adults attack soft tissues, primarily young leaves and stems, causing swelling (galls) and physiological disruption. Severe infestations result in complete and repetitive defoliation and host mortality. In Hawaii, the continued existence of the endemic wiliwili tree (*E. sandwicensis*), a species that is cherished for its ecological and cultural importance, is in question as seed crops fail and trees die. In addition, just a year and a half after detection of EGW, thousands of hazardous and dying ornamental *Erythrina* trees were removed in downtown Honolulu at a cost exceeding half a million dollars.

EGW adults (above) and host injury (below).

Control measures are not currently available. Eradication attempts have been unsuccessful, as have silvicultural treatments (e.g., pruning host branches). Chemical controls, viewed as stop-gap measures, are being evaluated and have produced mixed results; imidacloprid has promise when applied (usually injected) under environmental conditions that are conducive for uptake and distribution. Limited foliar applications with imidacloprid have also shown promise. Long-term strategies (e.g., biological control) are early in development and may or may not prove effective. In Hawaii, significant mortality of

wiliwili is expected regardless. This document combines the Forest Service Individual Pest Risk Assessment (IPRA; Orr et al. 1993) and the goals of the EDRR program to assess the status of this pest, predict its future in North America and advise about the utility of a rapid response.

PEST ASSESSMENT OF THE ERYTHRINA GALL WASP (Continental United States)

1. Probability of pest establishment: ESTABLISHED in Florida

2. Spread potential: HIGH (reasonably certain)

EGW has spread at an extremely rapid rate through the Pacific. Since first identified in Taiwan (2004), it has moved >10,000 miles to other locales including China, Guam, American Samoa, Hawaii and Florida. Presumably movement is by human transport combined with natural events such as wind. Through spread and new introductions, we expect that EGW will expand its range to that of its host.

3. Consequences of pest establishment:

Economic Damage Potential: **MODERATE (reasonably uncertain)**. Cultivated *Erythrina*, highly valued in cities and gardens as ornamentals, are typically very susceptible to EGW (especially *E. variegata*). Economic damage will result primarily from mortality of high value ornamental and shade trees and from effects on their horticultural industries. The San Diego Zoo is home to the largest collection of *Erythrina* in North America and *Erythrina* are the official Flowering Trees of Los Angeles. Hazard tree removal, lower property values, tree replacement and regulatory actions are important factors in determining costs. To date, the EGW infestation of Hawaii has cost in excess of $1.5 million.

Erythrina variegata **in downtown Honolulu defoliated by EGW.**

Environmental Damage Potential: **HIGH (reasonably uncertain)**. The native species in the continental U.S. are *E. herbacea* and *E. flabelliformis*. *E. herbacea* is found throughout the Southeast (North Carolina to TX), occurring commonly but sparsely. *E. flabelliformis* is found in the southern part of New Mexico and Arizona. In Hawaii, EGW causes galls on both species. Lack of year-round host material in populations of native *Erythrina* will likely affect EGW survival. The level of environmental damage will be based on injury and the importance of the host in its native community.

Erythrina herbacea**, a popular shrub for hummingbird gardens, is native to the southeastern U.S.**

Wasp populations on the continental U.S. may facilitate introductions into the Caribbean, Central and South America and Mexico, home to about 70 *Erythrina* species (nearly 2/3 of those in the world). Once infested, these areas may be a source of new introductions into the U.S.

Perceived Damage Potential: **HIGH (reasonably certain)**. High-value cultivated *Erythrina* trees (street trees, parks, etc.) are very likely to be severely injured and potentially killed by EGW. These trees are highly visible, will be noticed and will be expensive to remove. On the contrary, damage to native plant communities may go largely unnoticed by the general public.

Erythrina variegata **uninfested in Antigua. (photo by C. Pratt)**

It is unknown whether trade will be affected; this will depend upon regulatory responses to the horticultural threat. The insect poses no threat to

human health and is unlikely to cause public concern as a direct nuisance.

4. Pest Risk Potential: Moderate

Effects of EGW on *Erythrina* are likely to be severe, but host quality and preferences for species native to the continental U.S. are uncertain. Consequences for more tropical regions in Central and South America and Mexico are even more likely to be severe. Their native species are predominantly susceptible to EGW (when known) and they are centers of endemism for *Erythrina*. Commonly known as immortelle, coral tree, coralbean, or bucare (among others), *Erythrina* in the neotropics serve as important shade trees, windbreaks, living fences and a source of nutrient enrichment for plantation crop systems. Movement away from the equator will be limited by cold temperatures and a consequent lack of hosts.

The neotropics are a center of endemism for *Erythrina*, being home to 70 species, most of which are susceptible to EGW. (map from Neill 1993)

5. Management Options:

Limiting new introductions

Introductions of EGW have probably occurred from wind events, human transport and movement of infested material. Some reduction in the number of new introductions may be realized through regulatory actions. Outside of the regulatory arena, however, public education may prove to be the only tool of consequence. Outreach should inform cultivators and traders of *Erythrina*, along with nursery employees, about the risks of movement of infested material, mechanisms by which it may be inadvertently moved (e.g., in containers with other plants) and consequences of EGW.

Yellow sticky traps may be used to monitor EGW adults.

Early detection

Airports and botanical gardens (primarily those trading *Erythrina* specimens) appear to be high-risk areas for EGW introductions and should be targeted for early detection. Yellow sticky traps can be deployed at these locations to capture adults; however, in the absence of traps, host injury will be more apparent. Following detection, rapid response options, likely very limited, should be based on the results of delineation surveys.

Limiting spread of established populations

Limiting the spread of EGW (e.g., in Florida), once established, is unlikely due to a lack of effective management tools and inadequate knowledge of EGW biology and ecology.

Individual tree protection

Insecticides are likely to be the best option for protecting high-value trees. Imidacloprid and other insecticides are currently being evaluated in Hawaii. Imidacloprid may be applied as a foliar spray, soil drench or via stem injection. It appears to be toxic to EGW but significant hurdles remain in identifying the conditions necessary for sufficient uptake, the duration of protection, the costs and efficacy.

6. Recommendations

- Communicate with nursery personnel, arborists, urban foresters, managers of botanical gardens, homeowners, land managers, etc. to build awareness of EGW, potential introductory pathways and EGW injury identification skills (a Pest Alert and web-based publication are being prepared and will be available in Spanish and English versions by April 2007).

- Monitor high-risk areas for EGW.
- Initiate insecticide trials in the continental U.S.
- Keep abreast of developments in ongoing biological control efforts for EGW.
- Position ourselves to better predict environmental and economic impacts of EGW, including host inventories, pre-introduction observations (e.g., leaf phenology), and susceptibility evaluations where possible.

7. Author Contact Information

Sheri L. Smith
Regional Entomologist
Forest Health Protection
2550 Riverside Drive
Susanville, CA 96130
(530)252-6667
ssmith@fs.fed.us

Brian L. Strom
Research Entomologist
Southern Research Station
2500 Shreveport Highway
Pineville, LA 71360
(318)473-7235
brianstrom@fs.fed.us

James R. Meeker
Entomologist
Forest Health Protection
2500 Shreveport Highway
Pineville, LA 71360
(318)473-7284
jrmeeker@fs.fed.us

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