

For all islands, please report any new infestations to the Hawai'i Department of Agriculture's Pest Hotline: 643-PEST (7978)

Additional contact information:

BIG ISLAND

Hawai'i Dept. of Agriculture: 808-974-4145
Big Island Invasive Species Committee: 808-961-3299

MAUI

Hawai'i Dept. of Agriculture: 808-873-3962
Maui Invasive Species Committee: 808-573-6472
Moloka'i Invasive Species Committee: 808-553-5236

O'AHU

Hawai'i Dept. of Agriculture: 808-973-9538

KAUAI

Hawai'i Dept. of Agriculture: 808-241-7132
Kauai Invasive Species Committee: 808-821-1490

Watch a video on "Best Management Practices" to control coqui frogs for plant growers and shippers (scan QR code or go to the link below)



www.ctahr.hawaii.edu/haraa/videos.asp

Coqui Frog Control for Homeowners

Methods To Stop the Spread of Coqui Frogs in Hawai'i



PLEASE REMEMBER!

It is illegal in Hawai'i to import, export, breed, or sell coqui frogs, or keep them as pets.

WEBSITES

University of Hawai'i at Mānoa, CTAHR
www.ctahr.hawaii.edu/coqui
Hawai'i Department of Agriculture
<http://hdoa.hawaii.gov/pi/ppc/coqui-information>
Hawai'i Ecosystems at Risk
www.hear.org/AlienSpeciesInHawaii/species/frogs/
As of 2008, the coqui frog has been declared an "agricultural pest" by the Hawai'i Department of Agriculture. Any person or organization that intentionally transports, harbors or imports with the intent to propagate, sell, or release the coqui is in violation of State law and may be charged with a class C felony and subject to a minimum fine of \$50,000 and maximum fine of \$200,000, plus 3 years in prison.

Produced by the Coqui Frog Working Group

UNIVERSITY OF HAWAII AT MĀNOA
College of Tropical Agriculture and Human Resources (CTAHR)
UNIVERSITY OF HAWAII AT HILLO
College of Arts and Sciences, College of Agriculture, Forestry and Natural Resource Management (CAFNRM)
HAWAII DEPT OF AGRICULTURE Plant Industry Division
HAWAII DEPT OF LAND AND NATURAL RESOURCES
Division of Forestry and Wildlife
COUNTY OF HAWAII, Office of the Mayor
U.S. DEPT OF AGRICULTURE Animal and Plant Health Inspection Service, Wildlife Services, National Wildlife Research Center
U.S. FISH AND WILDLIFE SERVICE
BIG ISLAND INVASIVE SPECIES COMMITTEE
HAWAII ISLAND ECONOMIC DEVELOPMENT BOARD

Editors: Dr. Arnold Hara and Ruth Niino-DuPonte (UH Mānoa CTAHR)

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Nonchemical Control of Coqui Frogs

INSPECT for frog eggs, juveniles, and adults regularly. Male frogs can usually be located by their calling. Shortly after sunset, take a flashlight and scan over and between leaves, checking folded or curled leaves, leaf axils, dead leaves hanging from plants, and leaf litter beneath plants for adults as well as eggs. The frogs prefer broad-leaved plants but will perch on any leaf that will support their weight and provide cover. One or more silent females are often found near a calling male. Treat infested plants before moving them from or to your property. Carefully inspect building and gardening materials before bringing them onto your property. Inspect your vehicle (tire wells, truck beds) for hitchhiking frogs after leaving infested areas.

ELIMINATE frog-friendly habitats in your yard. During the day, coqui frogs retreat under leaf litter or other moist shelter, including piles of building material or empty pots. At night, they emerge to feed, and males climb and perch on vegetation to call. Remove dead leaves, prune and thin shrubs, and clear debris under plants to reduce frog habitats. Dispose of green waste by composting or mulching (or treat with hot water or citric acid) to kill any frogs or eggs. In dry weather, frogs can be attracted to standing or dripping water, so fix any leaky faucets and empty any containers that accumulate rainwater. If possible, avoid landscaping with broad-leaved plants preferred by coqui frogs.



"tube tool"

HAND-CAPTURE frogs by grabbing them quickly. They do not bite and are not poisonous. Or use a short length of clear plastic tubing with a plastic bag taped over the upper end. Place the open end of the "tube tool" over the frog, and it will climb up the tube and into the bag. (See instructions on how to make a "tube tool" at <http://everyfroghasastory.tripod.com>)

SHOWER landscape plants with hot water (113–115°F) and collect frogs flushed from plants. Potted plants can be placed in a sink or tub and showered with 113°F water for 5 min (or 115°F for 3 min), followed by 1 min of cold water to cool off the plant. This treatment will kill any frogs or eggs in the plant. Verify water temperature with a thermometer, because cooler water is not effective, and hotter water may damage plants.

SET OUT LURE TRAPS to take advantage of the coqui frog's "nesting" behavior and remove brooding males and egg clusters from areas with relatively high populations. Since the frogs can freely come and go from these artificial nesting sites, the traps must be checked and emptied at least every 2 weeks, before eggs can hatch. Traps can be made from various materials, such as PVC (polyvinyl chloride) pipe or bamboo.

To make a PVC trap, place a T-joint at the top of an 8-inch length of ¾-inch diameter PVC pipe. The traps are more effective after weathering by exposure to the sun and rain to dissipate the PVC odor. Trap efficiency in tests at Lava Tree State Park (Pāhoa, Hawai'i) is 28–40%, depending on weather conditions.

Bamboo, ¾–1 inch in diameter, can be also used; however, field trials indicate that the frogs prefer PVC to bamboo. Cut the bamboo between nodes to make a cylinder (8–10-inch length) with one open (top) and one closed end (bottom). Drill a 1-inch-diameter hole along the side, about 4 inches from the closed end, to serve as an entrance to the trap. Partially cover the open end of the bamboo cylinder with black plastic to provide protection for the frogs seeking refuge while allowing rain to collect in the trap, making it more attractive to the frog.

Affix traps about 2–3 ft above the ground at 2-ft intervals in heavily infested areas or along a border between infested and non-infested areas. Check the traps during the day at least every 2 weeks (eggs hatch in 14 days), and remove any adults and eggs you find into a plastic bag or container with a lid.

Apply any of the following treatments to kill the adults and prevent the eggs from hatching:

- fill the container with hot, soapy water (at least 113°F for 5 min), OR
- refrigerate for 24 hours, then freeze for at least 3 hours, OR
- thoroughly spray with 16% citric acid solution.

Make sure that frogs and eggs are dead before disposal to avoid accidentally infesting dump sites.



PVC trap



Bamboo trap



Chemical Control of Coqui Frogs

Currently, only citric acid is available for homeowners to control coqui frogs in Hawai'i. Since citric acid is primarily used as a food additive, it is listed as a non-restricted chemical. As of April 26, 2008, it is illegal to use hydrated lime to control coqui frogs in Hawai'i. It is not illegal to purchase hydrated lime, nor is it illegal to continue to use hydrated lime as a soil amendment for pH adjustment.

HOW IT WORKS: Citric acid is corrosive and burns the skin of the frog, interfering with its ability to breathe. The solution requires direct contact with frogs or eggs and does not have significant residual (long-lasting) effects. Frogs and froglets usually die within a few minutes; treated eggs absorb the chemical and do not hatch.



6 days after treatment: eggs sprayed with 16% citric acid (left) have died and are covered with mold, compared to untreated eggs (right) with visible embryos developing normally.

SAFE FOR MOST PLANTS: The citric acid solution can burn sensitive plants, especially (but not limited to) ferns and orchids and new growth. To avoid damage (phytotoxicity) to valuable or delicate plants or flowers, thoroughly rinse the treated plants with fresh water to completely remove citric acid residue about an hour after spraying. Pre-testing on a small section of a plant is always recommended. After spraying and/or rinsing, observe the section for a few days for discoloration before spraying valuable plants or a large number of plants.

PRECAUTIONS: Use protective clothing and equipment while handling citric acid to avoid personal injury. **The label is the law.** The user is responsible by law to read and follow all current label directions for proper use, application, storage, and disposal of pesticides. Consult a chemical sales representative, the Hawai'i Department of Agriculture, or the University of Hawai'i Cooperative Extension Service for guidance.

What do I need to do?

Step 1: Scout and identify location of coqui frogs.

In daylight, walk through suspected area; identify hazards, environmental concerns (water sources), and navigational landmarks. Clear paths through overgrown vegetation. After dusk, listen for calling males, and mark locations with flagging tape.

Step 2: Read label directions carefully before preparing chemical solution.

Mix citric acid with water to make a 16% solution (2½ cups or 1 lb, 5 oz per gallon) and apply as a foliar spray. Pre-mix citric acid in small batches before pouring into 100-gal sprayer tank to prevent settling. Citric acid should not be inhaled as powder or spray. See label for detailed precautions at www.ctahr.hawaii.edu/coqui/spray.asp

Step 3: Spray the previously marked areas.

Night spraying: Spray after dark on humid nights, avoiding heavy rains or dry periods or drought when frogs remain hidden and call less frequently. Thoroughly spray to cover the vegetation where frogs are perched, including undersides of leaves, and a wide area beneath the vegetation. Frogs will be actively calling, mating, or foraging.

Day spraying: Spray to cover the vegetation where frogs may be hiding and a wide area below, saturating any crevices where the frogs are taking refuge.

Step 4: Clean-Up

Drain solution; flush sprayer thoroughly with water (nozzle and other metal fittings) to prevent corrosion. Rinse all protective equipment and clothing.

Step 5: Follow-Up

Subsequent sprays every 2 weeks may be needed for frogs that were missed (estimated to be up to 20%, including females, juveniles, and recently hatched froglets). Continue to monitor for calling males for at least a year to determine if there are any remaining frogs. If conditions are favorable, and if they are left unchecked, coqui frogs will reproduce rapidly. A female can lay a clutch of 34–75 eggs every 2½ weeks, resulting in 1,400 eggs per year. Eggs are often laid in leaf litter in rolled or folded leaves.

DISCLAIMER: Pesticide recommendations in this publication are subject to change at any time. If any information in these recommendations disagrees with the product label, the recommendation MUST be disregarded. The authors assume no liability resulting from the use of these recommendations.

What you should know before using citric acid.

CHARACTERISTICS	CITRIC ACID
Safe to use on food crops	Yes
Cost	\$90–\$100 per 50 lb bag (powder, food grade)
Available pre-mixed	Yes, concentrated liquid
Can be stored for later use once mixed with water	Yes, for up to 3 weeks
Requires constant agitation for proper application	No, only initial mixing required to dissolve powder
Requires personal protection equipment and clothing	Yes, use a mask to avoid inhalation during spraying, protect skin from spray
Apply as foliar spray	Yes, but cost-prohibitive for treating large areas
Concentration	16% (2½ cup or 1 lb, 5 oz per gallon of water)
Spray coverage	Not restricted
May cause burning on plants	Yes, test new growth and sensitive (ferns, orchids, etc.) or valuable plants; rinse off spray 1 hour after application
Has long-lasting (residual) activity	No

If coqui frogs are well established in your area:

- **AVOID PROVIDING SHADE AND MOISTURE TO COQUI FROGS BY:**
 - CUTTING BACK vegetation
 - THINNING OUT thick understorey
 - AVOIDING landscaping with plants that hold water (such as bromeliads), broad-leaved tropical foliage, and thick groundcover
- **SPRAY** all landscape and potted plants with citric acid or hot water.
- **MOW** a buffer zone around your house to remove excess vegetation and keep frogs at a distance.



Female (left) and male (center) coqui frogs compared to adult greenhouse frog (right).



Photo: Hawai'i Department of Agriculture

Underside of coqui frog: female with eggs (white contents along sides of abdomen), feet have toe pads for climbing.



The vocal sac of a calling male inflates and acts as a resonating chamber, amplifying its "ko-kee" call.

Coqui Frog Life Cycle



Coqui eggs: incubation 14–17 days; clusters of 34–75 eggs can be laid every 2–4 weeks by adult females; no free-swimming tadpole stage



Newly hatched froglet: approximately 8–12 months to maturity (capable of reproduction)



Adult coqui: entirely terrestrial; adults may live as long as 4–6 years; males guard eggs to prevent desiccation and predation until hatching