



## Root Mealybugs of Quarantine Significance in Hawaii

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Seven species of root mealybug are found in Hawaii, and three of them are of quarantine significance. These root mealybugs are a serious problem for Hawaii's export potted-plant industry because root infestations are not easily detected unless the plants are removed from their pots. Potted palms and other slow growing plants are more susceptible to infestation by root mealybugs because they require lengthy bench time to attain marketable size.

Damage caused by root mealybugs is not specific. The most common plant symptoms are slow growth, lack of vigor, and subsequent death. Unless the infesta-

tion is unusually heavy, it is not evident until the plant's pot is removed and the root ball is examined. A white, waxy substance and adult female mealybugs will be noticeable, especially between the pot and the root ball. Plants that are growing slowly, root-bound, or under environmental or nutritional stress are more susceptible to root mealybug infestation.

Due to their cryptic habit (preference for dark, hidden places), little is known about root mealybug biology. In general, depending on the species, the adult females (Figures 1–3) live from 27 to 57 days. White, cottony masses containing egg-laying females and/or eggs

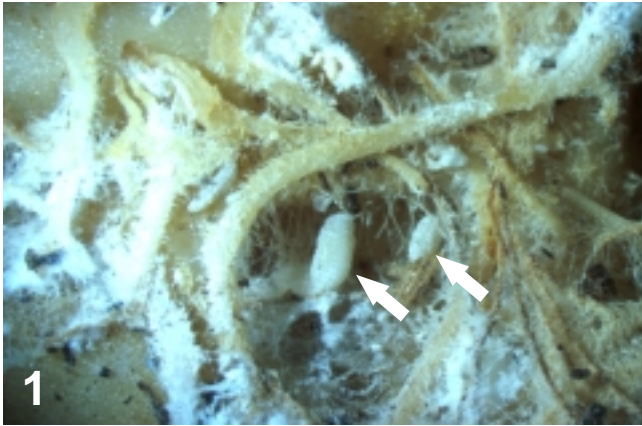
### Mealybug Quarantine Pests

- The rhizoecus root mealybug<sup>z</sup>, *Rhizoecus hibisci* Kawai & Takagi (Figure 1), was discovered in Hawaii in 1992 and has since spread to the state's major potted foliage plant production areas. This mealybug has been found on palms, calathea, *Serrisa* spp., and 'Tifdwarf' bermudagrass.
- The coffee root mealybug, *Geococcus coffeae* Green, was discovered prior to 1908. It has a very wide host range, including aglaonema, citrus, cacao, coffee, croton, cyperus, dieffenbachia, ferns, mango, oleander, palms, philodendron, pineapple, schefflera, and syngonium.
- The pineapple mealybug, *Dysmicoccus brevipes* Cockerell<sup>y</sup> (Figure 2), was first mentioned as occurring in Hawaii in 1910. It can be found on the lower stem or stalks and exposed roots of pineapple and other bromeliads, as well as on coffee, banana, caladium, sugarcane, canna, citrus, eggplant, and palms.

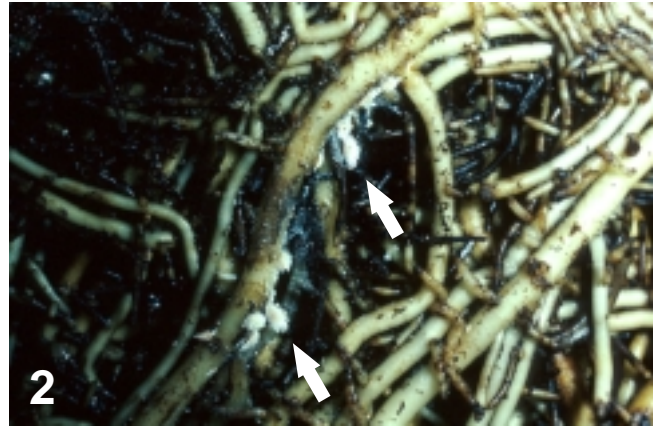
The rhizoecus root mealybug is widely distributed in East and Southeast Asia and has also been found in Puerto Rico and Florida. The coffee root mealybug occurs throughout the tropics and subtropics, including Central America, South America, Africa, Micronesia, India, Sri Lanka, Philippines, and Florida. The pineapple mealybug is found in South America, Africa, Jamaica, Madagascar, the Dominican Republic, Florida, Louisiana, and Massachusetts.

The adult female rhizoecus root mealybug is snow-white and has an elongated oval shape up to about 2.35 mm long. The adult female coffee root mealybug is also a snow-white, elongated oval shape varying from 2 to 2.5 mm in length; it can be distinguished from other root mealybug species by the presence of anal hooks, which are prominent, stiff, up-turned spines at the tip of each anal lobe. The adult female pineapple mealybug is pale pink or white, broadly oval, and approximately 3 mm long.

<sup>z</sup>Although six species of *Rhizoecus* are known in Hawaii, in this publication we use the common name, rhizoecus root mealybug, to refer only to *R. hibisci*. <sup>y</sup>Formerly called *Pseudococcus brevipes* Cockerell.



**1** Rhizoecus root mealybugs on palm roots.



**2** Pineapple mealybugs on palm roots.

are normally visible on the outside of the root mass when an infested plant is lifted from its container. Males of the three species discussed here have not been observed in Hawaii, although male pineapple mealybugs have been collected in Madagascar, Martinique, and the Dominican Republic. The newly hatched, immature crawlers (nymphs) are the dispersal stage and are highly mobile. Once crawlers find a suitable site, they settle down and begin to feed on roots with their sucking mouthparts. The entire life cycle of a root mealybug ranges from one to four months, depending on the species, climatic conditions, and availability of a food source.

Root mealybugs can be spread by irrigation water, re-use of previously infested pots, re-use of contaminated media, and crawlers moving from infested plants to other plants. Infestation of greenhouse bench plants by root mealybugs can occur by introducing nursery stock that was already infested when purchased or from crawlers that move in from host plants near the greenhouse.

**Pest management**

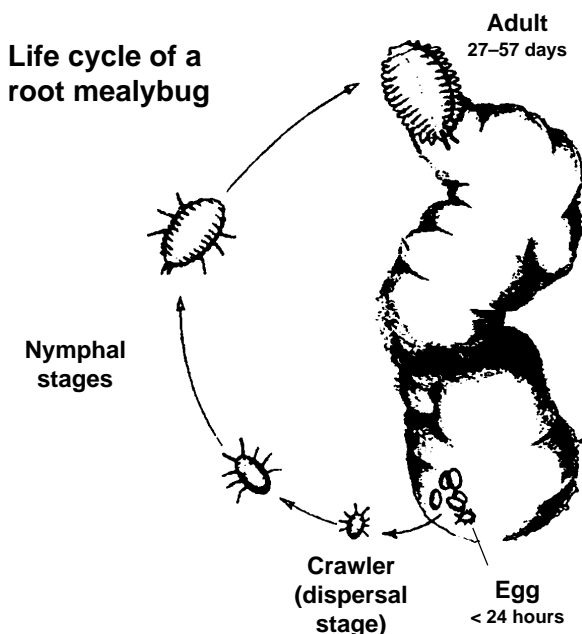
**Biological control**

Hawaii has no known natural predators or parasites that are specific to rhizoecus and coffee root mealybugs. Natural predators and parasites of the pineapple mealybug in Hawaii include several encyrtid (parasitoid) wasps and lady beetles.

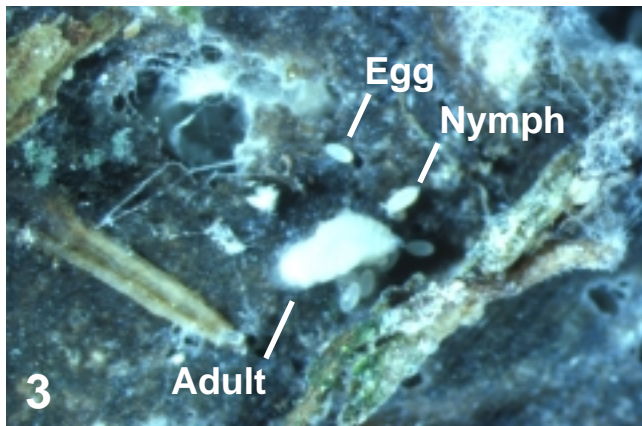
**Cultural control**

Because root mealybugs are very difficult to detect and control, every effort should be made to prevent their spread and establishment. The following practices are recommended:

- Inspect roots of newly purchased plants by removing them from their pots.
- Inspect roots of suspected plants, especially slow growing ones.
- Avoid pot-bound plants by re-potting when necessary.



Drawing by James Baker, NCSU; photos by Julie Ann Yogi-Chun and A. Hara.



3 Life stages of the rhizococcus root mealybug.

- Use pots with inner coatings of copper hydroxide (Spinout®), which prevents root matting and thereby minimizes root mealybug infestations (Figure 4).
- Separate pots from the ground on raised benches or with plastic film over the soil.
- Do not allow water from infested areas to run onto clean areas.
- Remove alternate host plants from around the greenhouse, or control mealybugs on them.
- Use clean pots and soil; if infested, wash pots with soap and water.
- Keep the growing area clean of plant debris.

Pineapple mealybug populations are tended by several species of ants, and ant-control measures (physical barriers, ant bait or spray) help prevent serious mealybug infestations.

#### **Biorational control**

CTAHR research has demonstrated that hot-water dips are as effective as insecticides against mealybugs. Experiments showed that submerging potted rhapsis palms in water held at 120°F (49°C) until the internal root ball temperature reached 115°F (46°C) was 100 percent effective in killing root mealybugs. Only minor phytotoxicity to rhapsis was observed, a chlorosis (yellowing) of older leaves. Drenching potted palm roots in hot water at 120°F for 15 minutes will not only control mealybugs but will also eliminate burrowing nematodes.



4 Palm roots in the pot not treated with copper hydroxide (right) are more compacted and infested with mealybugs.

#### **Chemical control**

Chemical control of root mealybugs requires saturation of the root ball and potting medium to a degree that allows the pesticide to penetrate the pests' white, waxy secretion. Research has demonstrated that dipping or drenching with liquid insecticide is more effective than applying a granular formulation. Dursban® Turf & Nursery Product applied twice as a drench or dip at two-week intervals controls coffee root mealybug; however, it may take four to six months before the cottony, waxy secretions deteriorate completely, making it difficult to determine treatment efficacy. This may pose a potential risk of shipment rejection by quarantine inspectors.

Research trials ranked Dursban® 50 WP and Dursban® Turf & Nursery Product as the least phytotoxic to palms and indicated that watering palms prior to drenching application significantly reduced phytotoxicity. A small group of plants should be treated at the recommended rate under the anticipated growing conditions and observed for phytotoxic symptoms for at least 14 days before a large number of plants are treated.

In the dip method, research findings indicated that submerging the plant's entire root ball *without* the pot in a diluted Dursban solution (1 pint per 100 gallons) for about 30 seconds with slight agitation is nearly twice as effective as dipping the plant while still in its pot. In the drench method, after premoistening with irrigation or rainfall, the diluted Dursban solution is poured into each potted plant container (without removing pots from

plants) to saturate the soil at a rate of 10–12 fluid ounces of solution per gallon of container size.

Marathon® 60 WP is applied only as a drench and can be incorporated with a surfactant or wetting agent to ensure thorough distribution of solution in the potting medium. Drench rates are determined by plant container size. Over 95 percent control was observed for up to 12 weeks in manufacturer's trials. Residual activity of Marathon should control most emerging mealybug nymphs.

Follow safety precautions given on the product labels. Used drench solution should be disposed of by applying it to approved crops and sites in accordance with the pesticide label directions.

### Precautionary statement

Pesticide use is governed by state and federal regulations. Read the pesticide label to be sure that the intended use is included on it, and follow all label directions. Consult a chemical sales representative, the Hawaii Department of Agriculture, or the University of Hawaii Cooperative Extension Service for updated information on available formulations. The pesticide user is responsible for the proper use, application, storage, and disposal of the pesticide.

### Disclaimer

Mention of a product name does not imply endorsement or recommendation by the Cooperative Extension Service, College of Tropical Agriculture and Human Resources, University of Hawaii or the United States Department of Agriculture and does not imply its recommendation to the exclusion of other products that may be suitable.

### References

- Baker, J.R. (ed.) 1978. Insect and related pests of flowers and foliage plants. North Carolina Agric. Extension Service, AG-136.
- Beardsley, J.W., Jr. 1965. Notes on the pineapple mealybug complex, with descriptions of two new species (Homoptera: Pseudococcidae). Proc. Hawaiian Entomol. Soc. 14(1):55–68.
- Beardsley, J.W., Jr. 1966. Hypogaecic mealybugs of the Hawaiian Islands (Homoptera: Pseudococcidae). Proc. Hawaiian Entomol. Soc. 14:151–155.
- Beardsley, J.W., T.H. Su, F.L. McEwen, and D. Gerling. 1982. Field investigations on the interrelationships of the big-headed ant, the gray pineapple mealybug, and the pineapple mealybug wilt disease in Hawaii. Proc. Hawaiian Entomol. Soc. 24(1):51–68.
- Beardsley, J.W., Jr. 1995. Notes on two *Rhizoecus* species new to the Hawaiian Islands, with a revised key to Hawaiian hypogaecic mealybugs (Homoptera: Pseudococcidae:Rhizoecinae). Bishop Museum Occasional Papers No. 42, pp. 28–29.
- Dekle, G.W. 1965. A root mealybug (*Geococcus coffeae* Green) (Homoptera: Pseudococcidae). Florida Dept. of Agric., Div. of Plant Industry, Entomology Circular No. 43.
- Hara, A. 1988. Control of the coffee root mealybug in potted plants. University of Hawaii at Manoa, College of Tropical Agriculture and Human Resources, Horticulture Digest, No. 86.
- Kuiter, L.C. and G.W. Dekle. 1966. Control of root mealybug, *Geococcus coffeae* Green. Proc., Florida State Horticultural Society 79:484–488.
- Linquist, R.K. 1991. Identification of insects and related pests of horticultural plants. Ohio Florists' Association, Columbus.
- Merrill, G.B. 1953. A revision of the scale-insects of Florida. State Plant Board of Florida, Gainesville, Bulletin 1.
- Poe, S.L. 1973. Infestation and spread of root mealybugs in container-grown ornamentals. Institute of Food and Agricultural Sciences, University of Florida, Florida Foliage Grower 10(2):1–4.
- Snetsinger, R. 1966. Biology and control of a root-feeding mealybug on Saintpaulia. J. Econ. Entomol. 59:1077–1078.
- Williams, D.J. 1996. Four related species of root mealybugs of the genus *Rhizoecus* from east and southeast Asia of importance at quarantine inspection (Homoptera: Coccoidea: Pseudococcidae). J. Natural History 30:1391–1403.
- Zimmerman, E.C. 1948. *Pseudococcus brevipes* (Cockerell). In: Insects of Hawaii; a manual of the insects of the Hawaiian Islands, including enumeration of the species and notes on their origin, distribution, hosts, parasites, etc. Volume 5. (Homoptera: Sternorrhyncha), pp. 189–201.