

Euselasia chrysippe as a potential biocontrol for *Miconia calvescens* in Hawai'i

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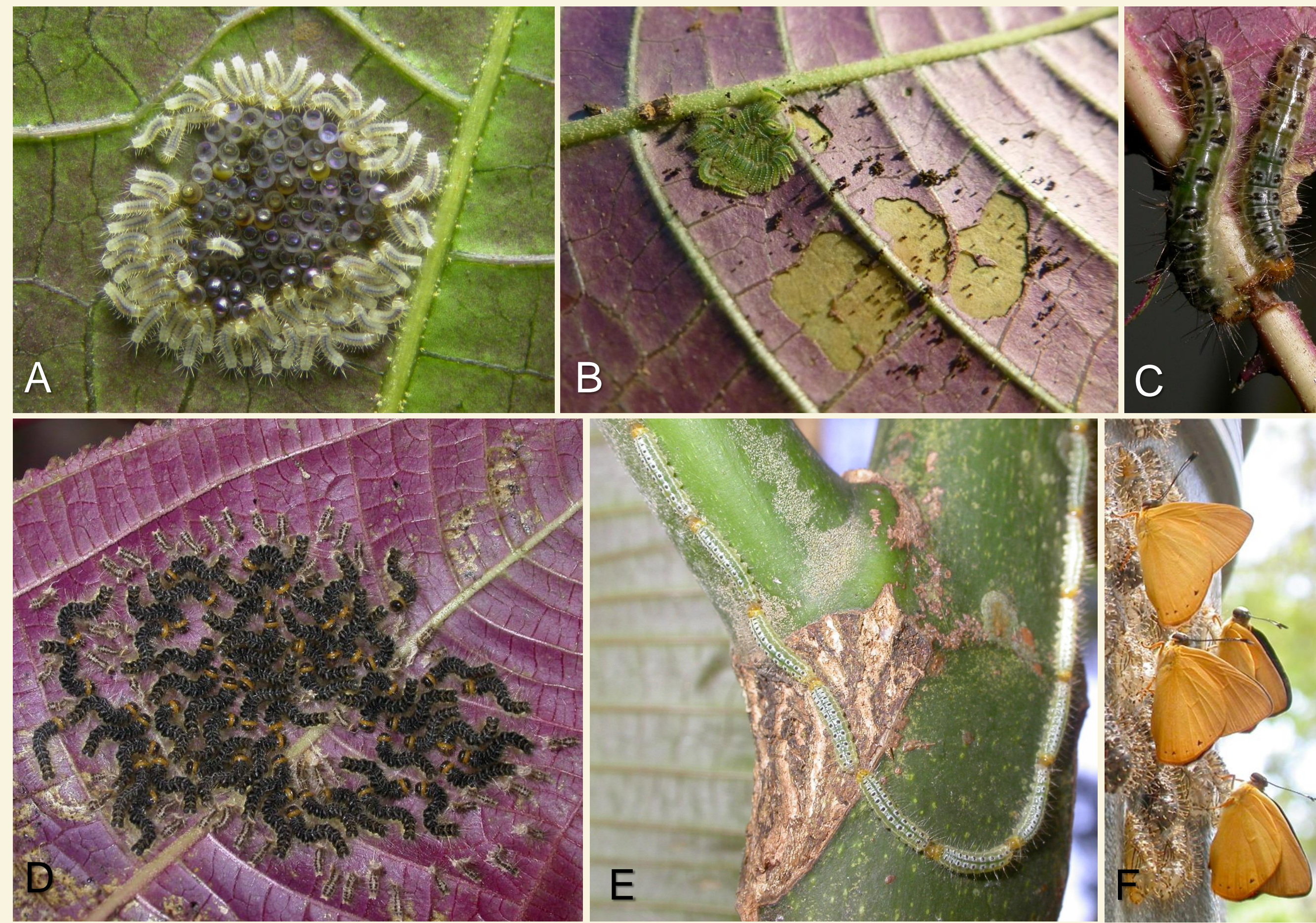


Biology and Rearing

Euselasia chrysippe (Lepidoptera: Riodinidae) is a small butterfly whose caterpillars feed on several *Miconia* species in its native Costa Rica. Larvae hatch from large egg masses (up to 115 eggs) (A), feed (B,C) and molt (D) in unison, moving between feeding sites in single-file processions (E). This gregarious behavior is thought to improve feeding on tough leaves, optimize foraging, and deter enemies. After 6 instars, larvae move off the plant to pupate in smaller groups. Development from egg to adult is completed in about 2 months, and adult females emerge one day prior to males from the same cohort (F). Butterflies live up to 2 months along forest edges and gaps where *Miconia calvescens* occurs.

Euselasia eggs from Costa Rica were hatched and larvae reared on *Miconia* plants in the Hawai'i Volcanoes National Park Quarantine facility. Pupae were held in sleeve cages until adult emergence. Sexed adults were released in a large walk-in cage (approx. 3x3x4m, G) with overhead mist irrigation and potted *Miconia* plants and shade cloth along one side to simulate the edge of a rainforest gap. Butterflies were offered nutrients in the form of watermelon, banana, *Néktar+* hummingbird food, wet clay soil from Mauna Kea, bird droppings and canned tuna, which were refreshed every 2-3 days.

Adults generally survived only 1-2 weeks – hand feeding with *Néktar+* and mashed banana appeared to prolong survival. Although males were seen performing morning spiral mating flights, copulation was not observed. Three sets of caged adults laid egg masses on the undersides of leaves of caged *Miconia*: in total 200+ eggs in May/14 (in a 2x2x2m cage), 181 eggs in Dec/14, and 60+ eggs in Feb/15. Only 2 egg masses from Dec/14 appeared to be fertile, with 66 larvae hatching – the first successfully lab-reared *Euselasia chrysippe*.



Miconia Biocontrol

Biological control is considered a critical tool for long term management of *Miconia calvescens*, a neotropical tree that is a major threat to Hawaiian forest ecosystems. Explorations in Costa Rica and Brazil yielded several promising natural enemies which are being evaluated now for host specificity. Our strategy is to develop a suite of biocontrol agents attacking stems, leaves and fruits of miconia.



Euselasia is our most promising leaf-feeding enemy of miconia, because of its gregarious habit and potential to avoid the parasitoids that commonly suppress other lepidopteran weed biocontrol agents in Hawaii. Results of our specificity testing indicate that *E. chrysippe* is suitable for introduction to our state. Mass rearing this species in containment remains a significant challenge, in spite of our recent breakthroughs.

Future work with *Euselasia chrysippe* may involve exploring additional adult foods to improve butterfly survival, and limited testing of adults for ovipositional specificity.

Host-specificity

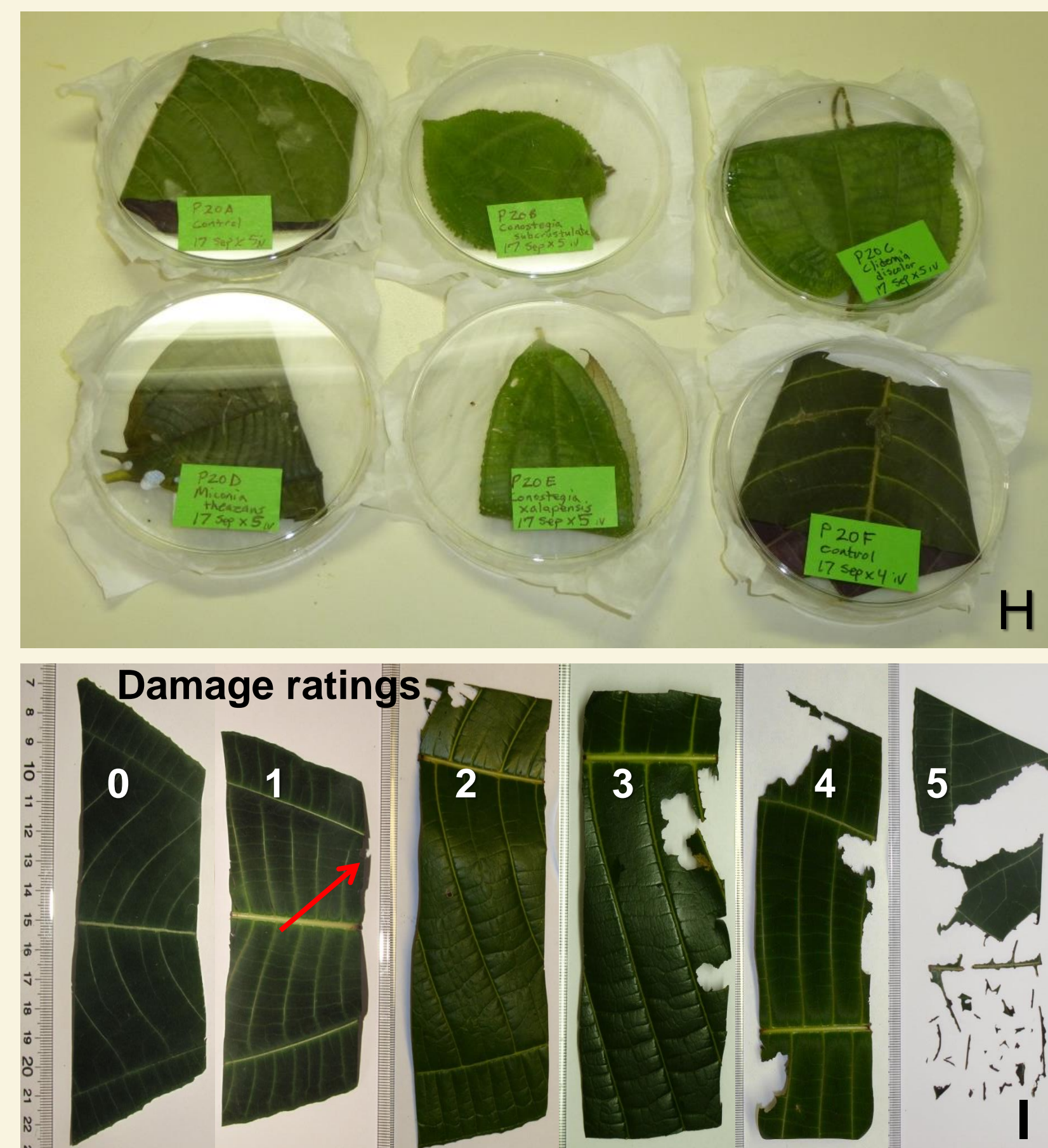
Methods: No-choice feeding test

- 73 plant species from Hawaii and Costa Rica
- Whole or cut leaves in 90mm Petri dishes (H)
- 4+ replicates per species, *M. calvescens* as control.
- 10 early or 5 late instar larvae per dish exposed for 3 days
- Feeding assessed from 0 (no damage) to 5 (severe) (I)

Results (Figure 1)

- Varying levels of feeding on many Melastomataceae. (No melastomes are native in Hawaii).
- *M. calvescens* and *Tetrazygia bicolor* most damaged of melastomes occurring in Hawaii.
- No sustained feeding outside Melastomataceae. Limited "tasting" (damage rating 1) of some Myrtales.

Figure 1, below. *Euselasia chrysippe* average feeding damage from no-choice tests conducted for 3 days in 90mm Petri dishes. Replicate numbers along top axis. Plant species arranged phylogenetically. *Miconia* species in dark green are Costa Rican hosts. * Native Hawaiian plants.



Methods: No-choice survival test

- 8 species of Melastomataceae from Hawaii.
- 10 first instars in 90mm Petri dishes or 13 first instars on potted plants (J), leaves replaced as necessary
- 3+ replicates per species, *M. calvescens* as controls (K).
- Observed every 2-4 days until pupation or larval mortality.
- Number larvae surviving and time to pupation recorded.



Acknowledgements: Thanks to Paul Hanson, Kenji Nishida and Pablo Allen (photos A, C-F) (Univ. of Costa Rica); J. A. González-Ramírez (OTS La Selva Biological Station, Costa Rica). KUPU-Hawaii: Aunty Gina Carroll, Kim Matsukawa and HYCC Program Coordinator Malia Heimuli. Funding from USDA Forest Service, Hawaii Invasive Species Council, and Hawaii Watershed Partnerships Program.

Results (Figure 2)

- Survival to pupation only on *M. calvescens* and *Tetrazygia bicolor* in whole plant experiments.
- No-choice survival to pupation restricted primarily to tribe Miconieae.
- One larva (out of 40) survived to pupate on *Heterocentron subtriplinerivum* and needed 10 additional days to develop.

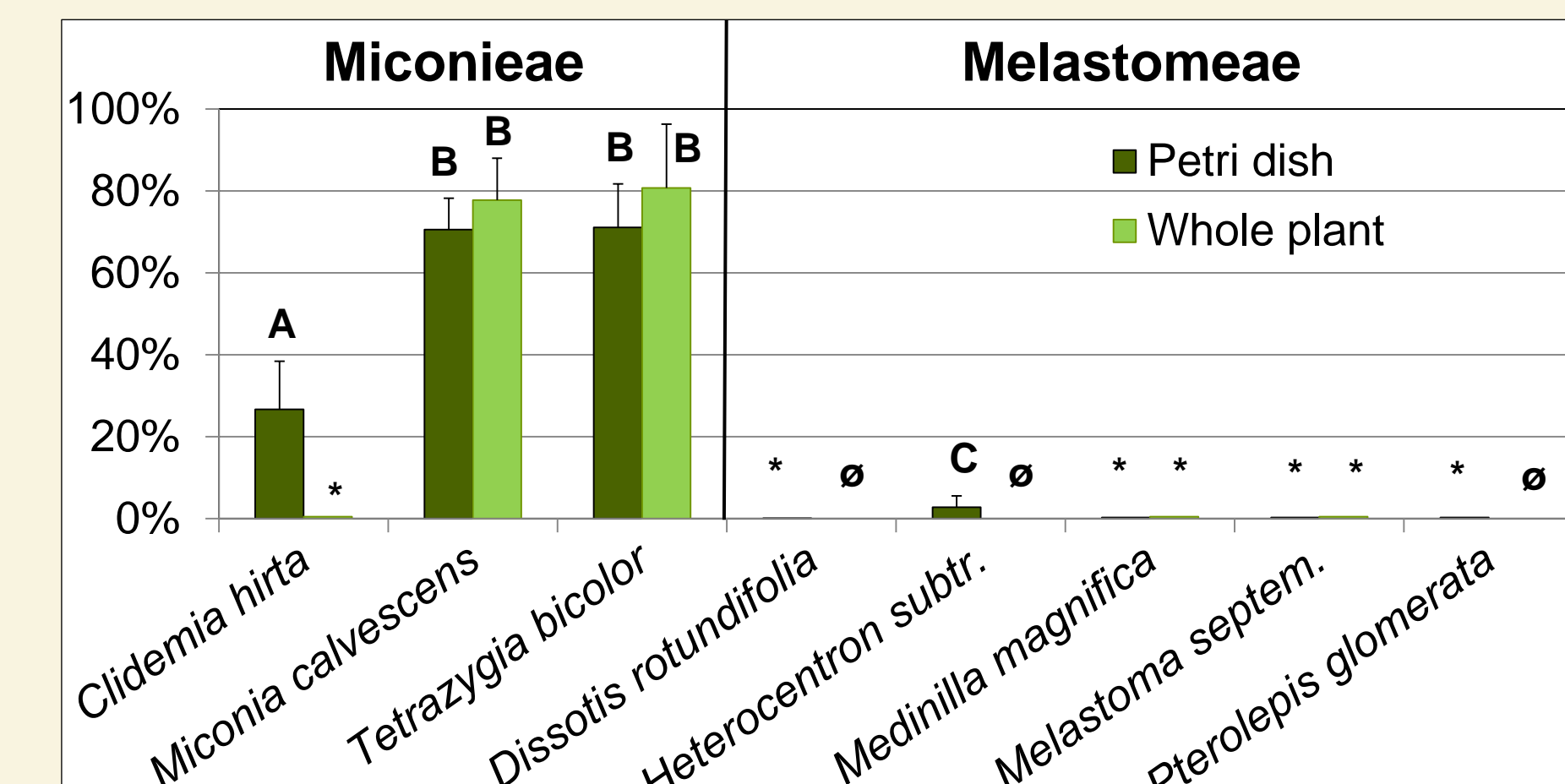


Figure 2. Survival to pupation for *Euselasia chrysippe* larvae on leaves in Petri dishes versus potted plants. Shared letters not significantly different. Species arranged by tribe. (*) No pupation found. (ø) Not tested on potted plants.

