Efficacy and Plant Response to *Ralstonia solanacearum*, a Potential Bioherbicide for Control of Kahili Ginger (*Hedychium gardnerianum*)

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*Ralstonia solanacearum* was tested for its efficacy as a bioherbicide for the alien kahili ginger (*Hedychium gardnerianum*) in Hawaiian forests. This weed was inoculated with an aqueous suspension (1 x 10⁶ cells/ml) of the ginger-infecting strain of the bacterium, combined with an organosilicone surfactant, in 10 x 10 m² plots in heavily invaded *Metrosideros* wet forests of Hawai‘i Volcanoes National Park. Treatments consisted of spraying mechanically wounded and non-wounded rhizome mounds and shoots in both winter and summer. Controls were wounded only. In addition, half of the wound treatments received a second application of the potential bioherbicide on regrowth after 6-8 weeks. No infections were observed in non-wound treatments. In the wound treatments, both rhizome and stem infections were observed in both the surfactant and non-surfactant based inoculum within 6-8 weeks. Shoot symptoms included interveinal chlorosis, water soaking, and epinasty. Rhizome symptoms included water soaking and decay of infected tissues. Seedlings germinating in treatment plots were also affected by the bacterium, causing death and stunting. Following inoculation, the number of stems produced on rhizome mounds varied within treatments. Some mounds had no regrowth, while others resprouted similarly to the non-treated controls. Many surviving shoots were much reduced in height and failed to mature or flower. Average infection rates of emerging shoots following the second application with and without surfactant were 35% and 2%, respectively. Although treatment responses were inconsistent, preliminary results suggest that effective control of kahili ginger can be accomplished using *R. solanacearum* as a bioherbicide with limited wounding assistance to enhance spread of the bacterium and build up inoculum levels in the soil. The use of *R. solanacearum* as a bioherbicide is a possible alternative to existing control strategies that are not practical on a large scale. However, application in areas where water runoff could occur to commercial edible ginger (*Zingiber officinale*) plantings should be avoided.

Biological Control of the Weed Hemp Sesbania with *Colletotrichum truncatum*

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Hemp sesbania (*Sesbania exaltata*) is a problematic weed in row crops throughout much of the southeastern U.S. An isolate of the fungal pathogen *Colletotrichum truncatum* (NRRL Accession No. 18434) was discovered on the Southern Weed Science Laboratory Experimental Research Farm and has been extensively evaluated over the past several years for use as a bioherbicide against this weed. Various invert and vegetable oil emulsion formulations developed in our laboratory eliminated or greatly reduced free moisture requirements, and have consistently provided 85-95% control of weeds in field trials. Granular formulations (“Pesta”) have also provided similar levels of control in replicated field tests. Inoculum consisting of fungal conidia and microsclerotia produced on various crop grains remained viable for at least seven years when stored under refrigeration.

### Assays for Predicting Mycoherbicide Formulation Compatibility

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Formulation is one of the major factors that determine mycoherbicide effectiveness and marketability. There are many choices for formulation components, ranging from registered agricultural products to novel substances such as sunscreens, humectants, and starches. Generally the first step in developing a mycoherbicide formulation is compatibility screening with the agent. Compatibility testing of these products, alone and in combinations, can consume a great deal of time and resources. If a rational approach to screening, based on adjuvant chemical structure, were developed, formulation development could be accelerated significantly. The objectives of this research are to examine the relationship between adjuvant chemistry and biocontrol agent species, and to identify a rapid, accurate laboratory screening assay. Thirty-three commercial and experimental adjuvants were used with four *Alternaria* species in this study. Three assays were compared: 1) a standard germination assay was performed by inoculating adjuvant-incorporated water agar plugs with spores briefly submerged in water, and assessing percent germination after 8 hours incubation; 2) a hydrated germination assay was performed by hydrating spores for 8 hours in the formulation before inoculating plain water agar plugs; 3) a radial growth rate assay was conducted by measuring the fungal growth rate on adjuvant-incorporated PDA. The four species reacted similarly to the adjuvants, and discreet responses to different chemical classes were observed. However, the correlation of results between the three assays was inconsistent. To determine which laboratory assay best predicted actual performance, select adjuvants were tested further by rating disease development of a single *Alternaria* agent in the presence of the adjuvants on Canada thistle (*Cirsium arvense*). Preliminary results suggest that a reliable and quick laboratory assay can be developed.