Battling the fragrant invader: mass production, application, and implementation of biological control for kahili ginger (Hedychium gardnerianum)

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Kahili ginger (Hedychium gardnerianum) is one of the world’s 100 worst invasive species, invading tropical and sub-tropical wet forests in areas where it has been introduced as an ornamental plant. The wilt-causing bacterium Ralstonia (=Pseudomonas) solanacearum has been demonstrated as a viable biological control agent for this weed and has recently been established in the field. This bacterium has significant potential in controlling this weed if effective application and mass production methodology can be developed. To address this need, research into the development of mass-production methodology and field-testing of new application techniques for the biocontrol of kahili ginger with R. solanacearum have been initiated in the wet forests of Hawai’i. Three objectives are being investigated in this study: 1) develop and enhance methodology for mass-production of the biocontrol agent; 2) evaluate host resistance among local and international populations of kahili ginger; and 3) evaluate the efficacy of R. solanacearum-encapsulated alginate beads and bioherbicide spray. An overview of the kahili ginger biocontrol program, and the results of these investigations, are discussed. In addition, information on technology transfer and implementation is presented.

Using ecological models to assess the efficacy of weed-control measures

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Plant and herbivore population models can be used as decision-making tools to enable weed managers to implement successful control measures for troublesome weed populations. Using models we can explore complex interactions within and between populations and incorporate environmental effects inherent in ecological systems, leading to management solutions that were perhaps not intuitively obvious at the beginning of the process. Models of populations of St John’s wort (Hypericum perforatum), Paterson’s curse (Echium plantagineum) and scentless chamomile (Tripleurospermum perforatum) are used to explore the dynamics of weeds and biocontrol agents and the impacts of various management strategies on the weed population. The importance of density dependence, both its presence and timing, in weed and herbivore dynamics is assessed for both E. plantagineum and for the weed alone in T. perforatum populations. A complex model can encompass more aspects of the ecology of a particular situation, but it is important that the elements of the model are readily interpretable in terms of the biology of the system; this point is emphasised with reference to a complex individual-based model of H. perforatum. Ecological models act as a useful framework for the synthesis and application of our knowledge of population dynamics and interactions of a weed and its management.