Title: Evaluating an insect agent for biological control of Christmas berry (*Schinus terebinthifolius*) in Hawai`i
Organizations: USDA Forest Service, USDA Agricultural Research Service
Award: $25,000

Introduction: The USDA Forest Service Institute of Pacific Islands Forestry researches natural enemies of invasive plants for their potential use in management of Hawaiian forest weeds. We were awarded funds by HISC and the Hawaii Watershed Partnerships Program for host specificity testing of a potential natural enemy for Christmas berry (*Schinus terebinthifolius*). Christmas berry is a major pest of mesic ranchland, natural areas and archaeological sites, and a high priority target for biological control in Hawai`i. Dr. Gregory Wheeler of the USDA-ARS Invasive Plant Research Laboratory (IPRL) in Fort Lauderdale, Florida has been contracted to test a Brazilian thrips insect, *Pseudophilothrips ichini,* to determine if it will be safe for release in Hawai`i for control of Christmas berry (also called Brazilian pepper in Florida). The IPRL is testing approximately 35 species of crop plants, native plants and culturally important plants that occur in Hawai`i, mostly within the order Sapindales, to which Christmas berry belongs.

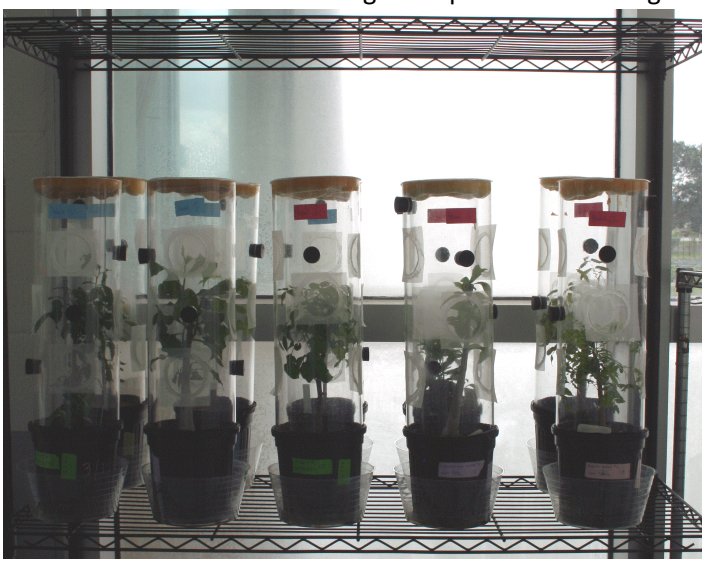
Pseudophilothrips ichini larvae and adults feed on Christmas berry stems and leaves

Achievements in FY13

Feeding and reproduction of the *P. ichini* thrips has been evaluated on 29 plant species of importance to Hawai`i, and most tests are complete with 4 or 5 replicate plants tested (Table 1). The test plant list includes the closest relatives of the weed that occur in Hawai`i. Tests are under no-choice conditions (insects faced with starvation): 20 adult thrips are allowed to feed and reproduce on each test plant, and the next generation of adults are counted. Our results indicate that, besides the weed *S. terebinthifolius*, no adults were produced on exposed test plant species, with one exception on the species *Dodonaea viscosa*, where there was a low level of reproduction on one of the replicate plants (Table 1).

To examine this result under circumstances with greater ecological relevance, we conducted a choice test where the adults were provided simultaneously both the weed and *D. viscosa*. Additionally we tested in a choice test the only Hawaiian native species of Anacardiaceae, *Rhus sandwicensis*, as this familial relative is expected to be the most vulnerable. Our results to date indicate that when the thrips have a choice, they reproduce on the weed but not on the non-target species (Table 2). This choice test is still in progress with additional replicates.

Additional plant species are still needed to complete the testing (Table 3). These species are not available on the mainland US so we are working to ship seeds or cuttings from sources in Hawai`i.



Quarantine testing at IPRL in Florida with Hawaiian plant species: no-choice (starvation) tests with the thrips, *Pseudophilothrips ichini*.

Pseudophilothrips ichini adults feed on and kill Christmas berry leaf tips.

Table. 1. Plant species tested in No Choice bioassays to determine the safety of the thrips, *Pseudophilothrips ichini*

Order	Family	Species	Number of Replicates	Mean F1 Adults
Sapindales	**Anacardiaceae**	***Schinus terebinthifolius***	36	136
Sapindales	Anacardiaceae	*Rhus sandwicensis*	4	0
Sapindales	Anacardiaceae	*Mangifera indica* (common mango)	2	0
Sapindales	Anacardiaceae	*Mangifera indica* (Ice Cream)	2	0
Sapindales	Anacardiaceae	*Mangifera indica* (Carrie)	5	0
Sapindales	Anacardiaceae	*Mangifera indica* (Haden)	5	0
Sapindales	Meliaceae	*Azadirachta indica* (neem)	4	0
Sapindales	Meliaceae	*Entandrophragma caudatum*	4	0
Sapindales	Meliaceae	*Sandoricum koetjape*	4	0
Sapindales	Meliaceae	*Swietenia mahogany*	4	0
Sapindales	Meliaceae	*Swietenia macrophylla*	4	0
Sapindales	Meliaceae	*Toona ciliata #1*	1 [a]	0
Sapindales	Rutaceae	*Casimiroa edulis* (Redlands)	4	0
Sapindales	Rutaceae	*Citrofortunella microcarpa*	4	0
Sapindales	Rutaceae	*Flindersia brayleyana*	4	0
Sapindales	Rutaceae	*Murraya paniculata*	1 [a]	0
Sapindales	Rutaceae	*Zanthoxylum fagara*	4	0
Sapindales	Sapindaceae	*Dimocarpus Longan/Biew Kieuw*	4	0
Sapindales	Sapindaceae	*Dodonaea viscosa*	5	1[b]
Sapindales	Sapindaceae	*Filicium decipiens*	4	0
Sapindales	Sapindaceae	*Harpullia pendula*	4	0
Sapindales	Sapindaceae	*Majidea zanguebarica*	4	0
Sapindales	Sapindaceae	*Sapindus oahuensis*	2 [a]	0
Sapindales	Sapindaceae	*Sapindus saponaria*	4	0
Sapindales	Zygophyllaceae	*Guaiacum sanctum*	4	0
Sapindales	Zygophyllaceae	*Tribulus cistoides*	4	0
Fabales	Fabaceae	*Acacia koa*	4	0
Fabales	Fabaceae	*Sophora chrysophylla*	4	0
Myrtales	Myrtaceae	*Metrosideros polymorpha* (ohi'a)	4	0

[a] Additional replicates still in progress

[b] 1 rep had 5 adults

Table. 2. Plant species tested in Choice bioassays to determine the safety of the thrips, *Pseudophilothrips ichini*

Order	Family	Species	Reps	Reps Larvae Present	Mean F1 Adults
Sapindales	Anacardiaceae	*Schinus terebinthifolius*	5	5	34.4
Sapindales	Anacardiaceae	*Rhus sandwicensis*	2 (1 complete, 1 in progress)	1	0
Sapindales	Sapindaceae	*Dodonaea viscosa*	3 (2 in progress)	0	0

Table. 3. Plant species still needed for testing to determine the safety of the thrips, *Pseudophilothrips ichini*

Order	Family	Species	Number needed to complete testing	Comments
Sapindales	Meliaceae	*Aglaia odorata*	4	Plants treated with pesticide
Sapindales	Meliaceae	*Cedrela odorata*	4	
Sapindales	Meliaceae	*Khaya*	4	
Sapindales	Meliaceae	*Lansium domesticum*	4	Plants too small
Sapindales	Meliaceae	*Toona ciliata*	3	
Sapindales	Rutaceae	*Fortunella/Citrus japonicum*	3	Testing now
Sapindales	Rutaceae	*Melicope spp.*	4	Seedlings did not transplant well
Sapindales	Rutaceae	*Platydesma spp.*	4	
Sapindales	Sapindaceae	*Alectryon sp.*	4	
Sapindales	Sapindaceae	*Koelreuteria elegans*	4	Plants too small
Sapindales	Sapindaceae	*Nephelium ranboutan-aka*	4	Have one or two small plants
Sapindales	Sapindaceae	*Sapindus oahuensis*	1	
Cyatheales	Cibotiaceae	*Cibotium sp.*	4	
Ericales	Sapotaceae	*Planchonella sandwicensis*	4	Plants too small
Lamiales	Myoporaceae	*Myoporum sandwicensis*	4	