Calophya terebinthifolii (Hemiptera: Calophyidae), A Candidate for Biological Control of Schinus terebinthifolius (Sapindales: Anacardiaceae): Feeding Preferences and Impact Studies

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CALOPHYA TEREBINTHIFOLII (HEMIPTERA: CALOPHYIDAE), A CANDIDATE FOR BIOLOGICAL CONTROL OF *SCHINUS TEREBINTHIFOLIUS* (SAPINDALES: ANACARDIACEAE): FEEDING PREFERENCES AND IMPACT STUDIES

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Brazilian peppertree, *Schinus terebinthifolius* Raddi, is a perennial woody plant native to Brazil, Argentina, and Paraguay (Barkley 1944, 1957) that has become one of the most invasive weeds in Florida (Cuda et al. 2006). Brazilian peppertree out-competes native species by exhibiting fast growth, prolific seed production, vigorous re-sprouting, and tolerating a wide range of growing conditions (Ewel 1979). A leaflet galling psyllid *Calophya terebinthifolii* Burckhardt & Basset (Hemiptera: Calophyidae) may be a potential biocontrol agent for Brazilian peppertree due to its narrow host specificity (Burckhardt & Basset 2000).

The developing psyllids form pit galls on the leaflets of Brazilian peppertree in its native range (Burckhardt & Basset 2000; Mckay et al. 2009). The rationale for using *C. terebinthifolii* as a biocontrol agent is based on an unintentional introduction of a closely related species into California (Downer et al. 1988). In California, *Calophya schini* Tuthill (Hemiptera: Psyllidae) attacked only Peruvian peppertree, *Schinus molle* L., causing extensive damage. Without endemic natural enemies to control the psyllid during the initial outbreaks, the development by *C. schini* on infested trees caused extensive defoliation (Downer et al. 1988). Assuming *C. terebinthifolii* would respond similarly on Brazilian peppertree if it were introduced into Florida, this psyllid could be an effective biocontrol agent for this invader.

In this study, we examined the extent of damage caused by *C. terebinthifolii* on Brazilian peppertree leaflets and its preliminary feeding preferences. Field research, greenhouse and growth chamber experiments were conducted at the Laboratory of Monitoring and Forest Protection (LAMPF) of the Regional University of Blumenau, Santa Catarina, Brazil from Jan-Dec 2003. All psyllids used in the experiments were collected on the property of LAMPF.

The 6 test plants used for multiple-choice tests belong to the family Anacardiaceae: cashew (*Anacardium occidentale* L.), bugreiro (*Lithraea brasiliensis* Marchand), mango (*Mangifera indica* L.), Hawaiian neleau (*Rhus sandwicensis* A. Gray), Peruvian peppertree, and Brazilian peppertree. Cashew and mango have economic importance as food crops in the U.S. The ornamental Peruvian peppertree is closely related to Brazilian peppertree. Hawaiian neleau is a native anacard in Hawaii and bugreiro is a common plant used by the timber industry in Brazil. Plants were purchased either from a local nursery in Blumenau or grown from seeds. Brazilian peppertree seedlings used in the experiments were approximately 30 cm in height and had at least 3 fully expanded compound leaves.

Potted Brazilian peppertree seedlings (control plants) and the other 5 anacard species were systematically arranged on the floor of a greenhouse in a configuration resembling the spokes of a wheel; a distance of 0.5 m separated the pots in a line with the Brazilian peppertree control seedlings placed in the center. Replicates consisted of 6 plants in 6 lines radiating out from the center (n = 36 plants, 6 plants of each species). *Calophya terebinthifolii* adults were released in the center of the array on the control plants. Ten releases totaling 460 adults occurred from Aug-Dec 2003. The plants were examined every 15 d for the presence or absence of leaf galls.

For the field multiple-choice test, the same 6 plant species were placed near an existing stand of 9 Brazilian peppertrees naturally infested with psyllids. Except for Brazilian peppertree, 2 potted plants of each species were placed between the established Brazilian peppertrees. Four potted Brazilian peppertree plants served as controls. The plants were examined every 15 d for the presence or absence of leaflet galls from Jan-Dec 2003.

Seven Brazilian peppertree seedlings from the same mother tree were used in the feeding impact experiment. The plants were washed and weighed with a precision scale to the nearest hundredth of a gram. Plants were repotted and placed individually inside clear ventilated plastic cages kept in a growth chamber (20°C, 80% RH, 12:12 h L:D photoperiod) from Aug-Nov 2003. Two plants were randomly designated as controls and the other 5 plants each received 54 psyllid adults. The total number of galls and plant biomass were recorded when the experiment was terminated in Nov.

Data were analyzed with SAS© software (SAS 2002). The data collected from the 3 experiments

were checked for normality by Proc Univariate in SAS with a Shapiro-Wilk test and QQ plots. All data satisfied normality assumptions. The means from the experiments (number of galls and change in biomass) were compared by Proc TTest with a significance level of $\alpha = 0.05$ for all statistical analyses.

Development of pit galls on leaflets was observed only on all Brazilian peppertree and Peruvian peppertree plants (Fig. 1) in the greenhouse test. In total, 522 psyllid galls were formed on both *Schinus* spp. with significantly more galls produced on the insect's natural host plant Brazilian peppertree ($n = 6$ plants, 61.33 ± 27.24 galls/plant) than on Peruvian peppertree ($n = 6$ plants, 25.67 ± 21.85 galls/plant) ($t = 2.50$; df = 10; $P = 0.0313$).

In the field multiple-choice test, a total of 692 galls formed on Brazilian peppertree ($n = 5$ plants, 173 ± 25.15 galls/plant), which was significantly more ($t = 6.36$; df = 4; $P = 0.0031$) than the 100 galls on Peruvian peppertree ($n = 2$ plants, 50 ± 9.90 galls/plant) (Fig. 1). None of the other plants species were attacked.

All Brazilian peppertee plants ($n = 5$) from the feeding impact test exposed to the psyllids developed leaflet galls. Psyllid damage resulted in a 40% overall reduction in biomass accumulation compared to the controls ($n = 2$). Over a 3-month period, plants exposed to the psyllids produced significantly less biomass (biomass increase 0.68 ± 0.17 g) when compared to the control plants (biomass increase 1.14 ± 0.06 g) ($t = 3.46$; df = 5; $P = 0.0181$).

Overall, our results suggest *C. terebinthifolii* is a feasible candidate for classical biocontrol of Brazilian peppertree in Florida. However, additional tests should be conducted before the insect can be approved for field release. Future studies on *C. terebinthifolii* will focus on the insect's life history, mass rearing of the psyllid, and extensive host range testing. Additional plant species to be tested include ecologically and economically important species of the family Anacardiaceae native to the continental U.S. and Caribbean as well as the different Brazilian peppertree genotypes found in Florida (Williams et al. 2005, 2007).

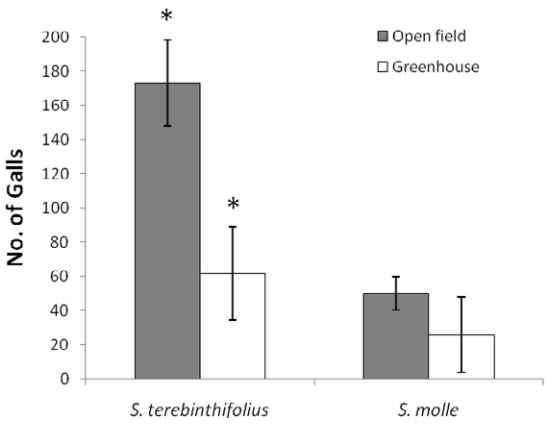

Fig 1. Number of galls that formed on *S. terebinthifolius* and *S. molle* plants exposed to *Calophya terebinthifolii* psyllids in greenhouse and field multiple choice tests. Asterisks indicate statistical differences between plant treatments ($P < 0.05$).

Summary

A leaflet galling psyllid *Calophya terebinthifolii* (Burckhardt & Basset) has been identified as a potential biological control agent for the invasive weed Brazilian peppertree. Preliminary field and laboratory research conducted in Santa Catarina, Brazil suggest the psyllid is a *Schinus* specialist and is capable of reducing the growth of Brazilian peppertrees. Further host range testing is needed to determine if *C. terebinthifolii* is sufficiently host specific for release in Florida.

References Cited

Barkley, F. A. 1944. *Schinus* L. Brittonia 5: 160-198.

Barkley, F. A. 1957. A study of *Schinus* L. Lilloa Revista de Botonica. Tomo 28. Universidad Nacional del Tucumen, Argentina. 110 pp.

Burckhardt, D., and Basset, Y. 2000. The jumping plant-lice (Hemiptera, Psylloidea) associated with *Schinus* (Anacardiaceae): Systematics, biogeography and host plant relationships. J. Nat. Hist. 34: 57-155.

Cuda, J. P., Ferriter, A. P, Manrique, V., and Medal, J. C. [eds.] 2006. Florida's Brazilian Peppertree Management Plan, 2nd edition: Recommendations from the Brazilian Peppertree Task Force, Florida Exotic Pest Plant Council, April 2006. http://www.fleppc.org/Manage_Plans/BPmanagPlan06.pdf.

Downer, J. A., Svihra, P., Molinar, R. H., Fraser, J. B., and Koehler, C. S. 1988. New psyllid pest of California USA pepper tree. California Agric. 42: 30-32.

Ewel, J. J. 1979. Ecology of *Schinus,* pp. 7-21 *In* R. Workman [ed.], *Schinus*- Technical Proceedings of Techniques for Control of *Schinus* in South Florida: A Workshop for Natural Area Managers, 2 December 1978. The Sanibel Captiva Conservation Foundation, Inc., Sanibel, Florida.

Mckay, F., Oleiro, M., Walsh, G. C., Gandolfo, D., Cuda, J. P., and Wheeler, G. S. 2009. Natural enemies of Brazilian peppertree (Sapindales: Anacardiaceae) from Argentina: Their possible use for biological control in the USA. Florida Entomol. 92: 292-303.

SAS. 2002. SAS System for Windows. Cary, North Carolina, USA.

Williams, D. A, Muchugu, E., Overholt, W. A., and Cuda, J. P. 2007. Colonization patterns of the invasive Brazilian peppertree, *Schinus terebinthifolius*, in Florida. Heredity 98: 284-293.

Williams, D. A., Overholt, W. A., Cuda, J. P., and Hughes, C. R. 2005. Chloroplast and microsatellite DNA diversities reveal the introduction history of Brazilian peppertree (*Schinus terebinthifolius*) in Florida. Molec. Ecol. 14: 3643-3656.