BIOLOGICAL CONTROL OF TROPICAL SODA APPLE (SOLANACEAE) IN FLORIDA: POST-RELEASE EVALUATION

J. MEDAL[1], N. BUSTAMANTE[1], W. OVERHOLT[1], R. DIAZ[1], P. STANSLY[1], A. RODA[2], D. AMALIN[1], K. HIBBARD[3], R. GASKALLA[3], B. SELLERS[1], S. HIGHT[4] AND J. CUDA[1]
[1]University of Florida, Entomology and Nematology Department, FL, USA

[2]USDA-APHIS-PPQ-CPHST, Subtropical Horticulture Research Station, Miami, FL, USA

[3]Florida Department of Agriculture & Consumer Services, Division of Plant Industry, Gainesville, FL, USA

[4]USDA-ARS-CMAVE, Tallahassee, FL, USA

Foreign exploration to search for natural enemies of the invasive plant tropical soda apple, *Solanum viarum* Dunal (Solanaceae) were conducted initially in 1994 by University of Florida researchers in collaboration with Universidade Estadual Paulista, Jaboticabal campus, Brazil. Sixteen species of insects were found associated with tropical soda apple in Brazil and Paraguay (Medal et al. 1996). A biological control program was initiated by the University of Florida in 1997 with funds provided by the United States Department of Agriculture, Animal and Plant Health Inspection Service, and the Florida Department of Agriculture & Consumer Services. Explorations in the place of origin (southern Brazil, northeast Argentina, south Paraguay, and Uruguay) of the target weed were conducted in collaboration with Brazilian university researchers, and the USDA-Agriculture Research Service Biological Control Laboratory in Hurlingham, Argentina. During exploratory surveys, the leaf beetle *Gratiana boliviana* Spaeth (Coleoptera: Chrysomelidae) was found on tropical soda apple plants in southern Brazil. A high level of specificity and significant defoliation of tropical soda apple were demonstrated in host-specificity tests conducted at the Florida Biological Control Laboratory quarantine facilities in Gainesville, the USDA-ARS (Agriculture Research Service) South American Biological Control Laboratory in Argentina, and the USDA-ARS quarantine facilities in Stoneville, Mississippi, as well as in extensive field surveys and open-field tests conducted in South America. After five years of intensive plant feeding and oviposition tests, the South-American leaf beetle *G.boliviana* was the first biological control agent approved for field release (7 May 2003) by the USDA-APHIS-PPQ in the southeastern United States to join the battle against tropical soda apple also known by the nickname the 'plant from hell' (Coile 1993). This exotic weed has invaded over half a million hectares of grasslands and natural areas in at least 6 states (Florida, Alabama, Georgia, Mississippi, South Carolina, and Texas). Intensive host-specificity tests including 126 plant species in 35 families were conducted with *G. boliviana* from 1998 to 2001 (Medal et al. 2002, 2003, 2004). Initial releases of *G. boliviana* in Florida began in summer 2003, and currently approximately 200,000 *G. boliviana* immature and adults have been released in 37 Florida counties, 14,000 in 2 counties in Georgia, 18,000 in 3 counties in Alabama, and 825 in 1 county in Texas. In this article we report the establishment, post-release monitoring, and initial impacts of *G. boliviana* on tropical soda apple plants in Sumter County, Florida.

A field release of *G. boliviana* was made in a dense patch of tropical soda apple plants of varied sizes in an approximately 2-hectares semi-dense pine-tree area in the summer 2005 in Sumter County (N 28°47'01", W 82°11' 62"). The beetles (500) were recently emerged from pupae (50% females, 50% males) in the University of Florida Entomology & Nematology Department rearing colony located in Gainesville, Alachua County, Florida. These beetles were descendent from adults collected in Misiones province, Argentina in 2004. Before release, the beetles were sexed and checked for pathogens and parasites. Post-release monitoring was conducted from Feb 2006 to Oct 2007. Twenty medium to large tropical soda apple plants within 100 m of the initial release site were marked with orange tape and permanent water-proof black markers. Evaluations of beetle feedings on the tropical soda apple plants (% defoliation, number of fruits/plant) and changes in the beetle population were made every 8 to 10 weeks. Percentage defoliation was visually estimated by 2 field technicians.

Mean defoliation of the 20 marked plants and the number of beetles recorded during 2006-07 are shown in Fig. 1. The estimated (visual) defoliation increased on average from 20% in Mar 2006 to 75% in Oct of the same year, and from 10% in Apr 2007 to 90% in Aug of the same year. Defoliation was directly associated with the increase in number of *G. boliviana* adults and immatures recorded on plants during the same periods. In 2007, most of the tropical soda apple plants had been replaced by *Paspalum notatum* Fluegge, other grasses, and broadleaf plants including *Rubus* sp., *Commelina diffusa* Burm., *Urena lobata* L., *Quercus* sp., and *Eupatorium capillifolium*

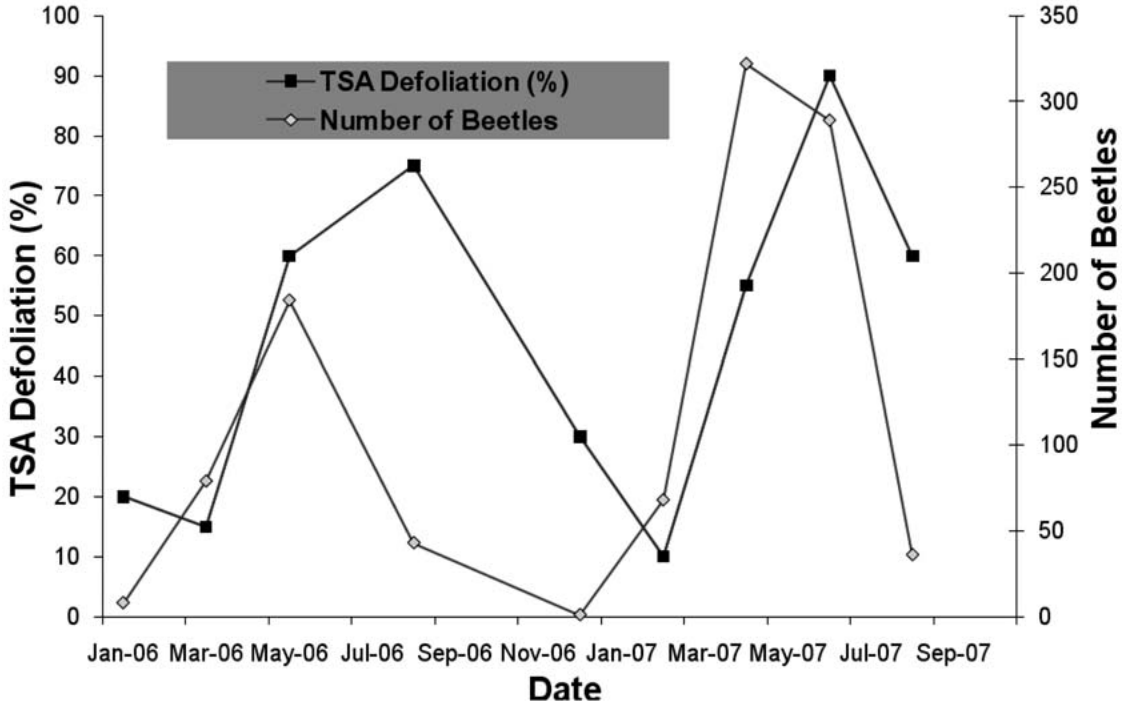

Fig. 1. Mean Defoliation (%) of 20 tropical soda apple plants and total number of *Gratiana boliviana* (Chrysomelidae) in Sumter County, Florida 2006-07.

(Lam.) Small (Medal et al. 2008). The number of fruits produced per tropical soda apple plant defoliated by the beetles significantly decreased with an average of 4 fruit per plant in Oct 2007 compared with the large number (36) of fruits observed on plants in Oct 2006 (Fig. 2). Annual beetle dispersal has been from 1.6 to 3.2 km/year from the initial release site. Beetles caused significant defoliation and became well established at this release site. Field releases of beetles and post-release monitoring is continuing in Florida.

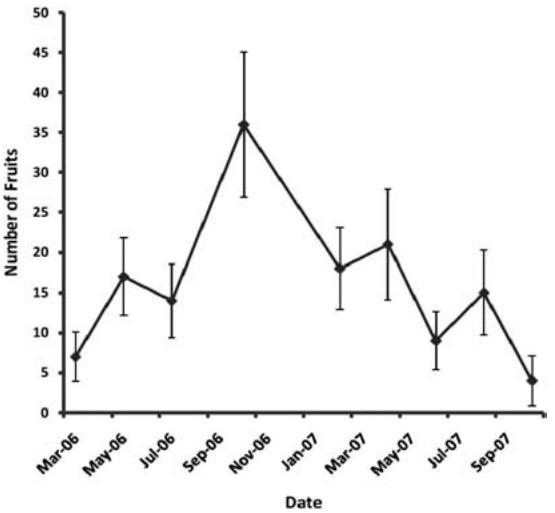

Fig. 2. Mean Number and standard deviation (bars) of fruits in 20 tropical soda apple plants in Sumter County, Florida 2006-07.

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Summary

The leaf feeding beetle *Gratiana boliviana* was released on tropical soda apple plants in Sumter County, FL., in 2006. The beetles significantly defoliated the plants over the period of the summers of 2006 and 2007, and became well established in the area.

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