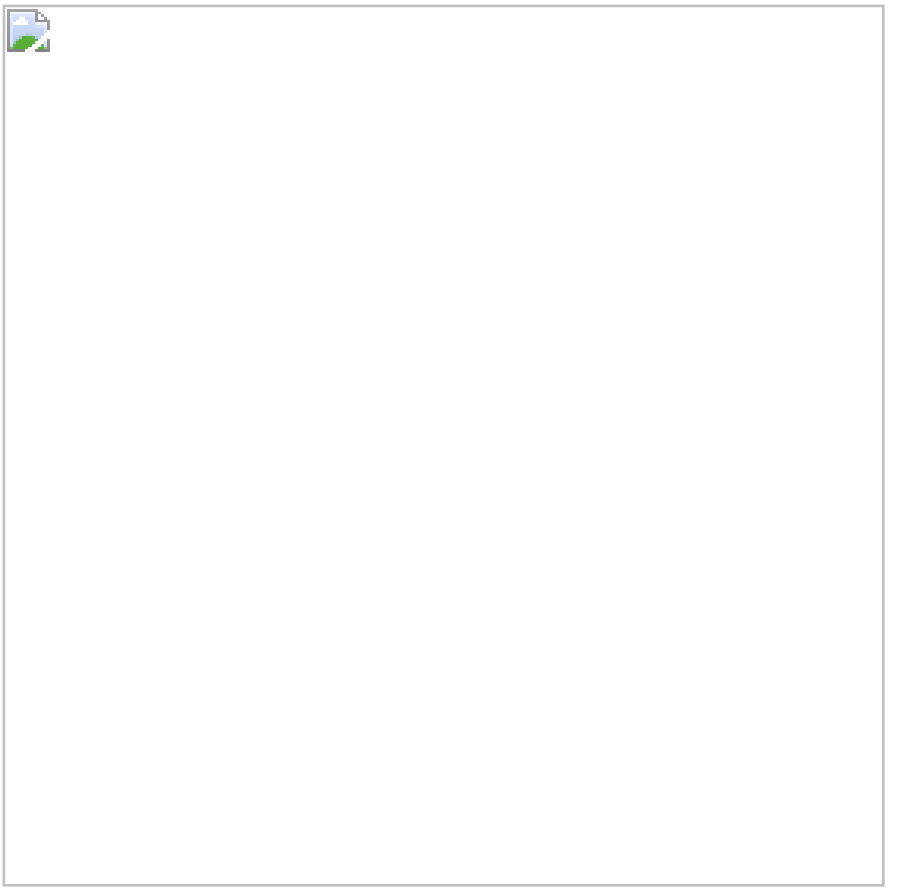

Gratiana boliviana (Coleoptera: Chrysomelidae) Does Not Feed on Jamaican Nightshade Solanum jamaicense (Solanaceae)

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GRATIANA BOLIVIANA (COLEOPTERA: CHRYSOMELIDAE) DOES NOT FEED ON JAMAICAN NIGHTSHADE *SOLANUM JAMAICENSE* (SOLANACEAE)

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Jamaican nightshade, *Solanum jamaicense* Mill., is an exotic weed of pastures and rangelands and is native to the Caribbean, Central America, and tropical South America (D'Arcy 1974). Jamaican nightshade is listed as a Category II invasive plant by the Florida Exotic Pest Plant Council (FLEPPC 2007), and has been in Florida since at least 1930 when a specimen was collected near Saint Cloud in Osceola Co. (NYBG 2007). The weed is currently reported from Osceola, Highlands, Saint Lucie, and Orange counties (Wunderlin & Hansen 2007), and although the plant is considered to be rare (Wunderlin & Hansen 2003), locally dense populations have been observed in oak/cabbage palm hammock areas in Saint Lucie and Osceola counties (W. A. O., unpublished data). A related species, *Solanum viarum* Dunal (tropical soda apple), invaded Florida in 1988 (Mullahey et al. 1993), and quickly spread through Florida and into several other states in the southeastern USA. A chrysomelid leaf feeding beetle, *Gratiana boliviana* Spaeth, was first released in Florida in 2003 as a classical biological control agent of tropical soda apple, and has now been released at more than 160 locations in the state. Before the release of *G. boliviana*, Medal et al. (2002) conducted host range tests on 123 plants, including 26 species of *Solanum*. In no-choice tests, *G. boliviana* adults caused minor feeding damage to a few non-target *Solanum* (*S. capsicoides*, *S. melongena*, and *S. torvum*), but laid eggs only on *S. viarum*. Jamaican nightshade is in the same subgenus (*Leptostemonum*) as the species on which feeding occurred, but was not included in pre-release host range tests. The objective of the present study was to determine whether *G. boliviana* would feed on Jamaican nightshade, and thus provide some level of biological control of this plant.

Jamaican nightshade seeds were collected in 2005 from plants growing in a hammock area (N27.44156, W80.5894) on a ranch in Saint Lucie Co., and planted in potting soil as needed in 6- or 8-L pots. No-choice feeding trials were conducted in the laboratory by placing 3 adults of *G. boliviana* in a Petri dish (9 × 1.5 cm) containing a 41-cm^2 leaf section of Jamaican nightshade or tropical soda apple. After 4 d, adult survival and total leaf area consumed were recorded. The experiment was replicated 10 times. Leaf sections were scanned with a HP Scanjet 4070 scanner and analyzed in Scion Image (www.scioncorp.com) following the methodology outlined by O'Neal et al. (2002). Choice feeding trials were conducted by placing 4 adults in clear acrylic boxes (14 × 10.5 × 20 cm) containing a leaf section (41 cm^2) of each plant species. This experiment was replicated 20 times. Data were collected in a manner similar to that of the no-choice trial. Feeding damage and colonization of *G. boliviana* on tropical soda apple and Jamaican nightshade also were evaluated in a large outdoor screen cage (2.5 m × 2.5 m × 2.5 m) by placing 6 approximately 20-cm-tall test plants of each species in a large *G. boliviana* rearing cage. The cage contained 30 tropical soda apple plants infested with all stages of *G. boliviana*. Test plants were recovered after 3 weeks. Variables recorded included plant height, *G. boliviana* density and feeding damage (scale 0 = no damage, 10 = total defoliation). Finally, an open field test was conducted by placing Jamaican nightshade and tropical soda apple plants in an oak hammock area inside a pasture in Saint Lucie Co. on May 29, 2007. The hammock was heavily infested with tropical soda apple. *Gratiana boliviana* had been released in the hammock in Jul, 2006, and was established with an average density of 14.4 ± 2.5 (adults+pupae+larvae ± SE) beetles per plant at the beginning of the trial. The test plants were placed in their pots in the ground such that the tops of the pots were at soil level, and planted in pairs (1 tropical soda apple and 1 Jamaican nightshade each) along an east/west transect through the hammock. Replicate pairs (9) were separated by approximately 10 m along the transect, and plants in pairs were separated by about 1.5 m. After 4 weeks, the above-ground parts of all the plants were clipped off, placed in paper bags and transported to the laboratory where the numbers and stages of *G. boliviana* per plant were counted. The pots with the basal stem and roots were transported to the laboratory to insure that Jamaican nightshade was not introduced to a previously non-infested area. The data from all experiments were analyzed with one-way ANOVA.

In both the no-choice and two-choice laboratory feeding bioassays, *G. boliviana* consumed

TABLE 1. FEEDING OF *G. BOLIVIANA* ON TROPICAL SODA APPLE AND JAMAICAN NIGHTSHADE IN NO-CHOICE AND CHOICE LABORATORY TRIALS.

Plant species	Adult *G. boliviana*		Leaf area (cm^2)		Damage scale[1]
	Initial	Final	Initial	Final	
		No-choice test			
Tropical soda apple	3	2.1 ± 0.27 a[2]	41.0	28.0 ± 2.6 a	2.5 ± 0.3 a
Jamaican nightshade	3	1.4 ± 0.20 a	41.0	41.0 ± 0.0 b	0.0 ± 0.0 b
		Choice test			
Tropical soda apple	4	3.0 ± 0.20 a	41.0	33.6 ± 0.9 a	2.5 ± 0.2 a
Jamaican nightshade		0.0 ± 0.00 b	41.0	41.0 ± 0.0 b	0.0 ± 0.0 b

[1]0 = no foliar damage, 10 = complete defoliation.
[2]Means followed by the same letter in the same column for each trial are not significantly different ($P < 0.05$).

TABLE 2. FEEDING AND OVIPOSITION OF *G. BOLIVIANA* ON TROPICAL SODA APPLE AND JAMAICAN NIGHTSHADE IN SCREEN CAGE AND OPEN FIELD TRIALS.

Plant species	Plant height (cm)	Damage scale[1]	*G. boliviana*			
			Adult	Pupae	Larvae	Eggs
			Screen cage			
Tropical soda apple	44.2 ± 2.7 a[2]	0.75 ± 0.3 a	0.17 ± 0.17 a	0.0 ± 0.0 a	0.0 ± 0.0 a	0.5 ± 0.2 a
Jamaican nightshade	43.5 ± 4.3 a	0.00 ± 0.0 b	0.00 ± 0.00 b	0.0 ± 0.0 a	0.0 ± 0.0 a	0.0 ± 0.0 b
			Open field			
Tropical soda apple	51.6 ± 4.3 a	2.9 ± 0.2 a	1.7 ± 0.6 a	0.44 ± 0.2 a	7.8 ± 1.5 a	20.9 ± 2.0 a
Jamaican nightshade	25.1 ± 2.2 b	0.0 ± 0.0 b	0.0 ± 0.0 b	0.00 ± 0.0 b	0.0 ± 0.0 b	0.0 ± 0.0 b

[1]0 = no foliar damage, 10 = complete defoliation.
[2]Means followed by the same letter in the same column for each trial are not significantly different ($P < 0.05$).

leaf tissue of tropical soda apple, but there was no feeding on Jamaican nightshade (Table 1). Similarly, in the large screen cage trial, there was no evidence of feeding on Jamaican nightshade, whereas the tropical soda apple plants were fed upon. Additionally, *G. boliviana* eggs were found on the tropical soda apple plants, but not on Jamaican nightshade (Table 2). In the open field trial, tropical soda apple plants were damaged, and all stages of *G. boliviana* were found on the plants, but there was no damage or infestation on Jamaican nightshade (Table 2).

SUMMARY

Jamaican nightshade has been in Florida for at least 77 years, but is considered rare and only found in 4 counties in the central peninsula. However, there are many examples of long lag periods between the time an exotic plant arrives at a new location, and the time it spreads and becomes highly invasive (Sakai et al. 2001). Locally dense populations of Jamaican nightshade in hammock areas in Saint Lucie and Osceola counties suggest that the plant is adapted to at least some habitats in Florida, and could eventually spread to similar habitats and become a serious exotic invader. The current study demonstrated that *G. boliviana*, a biological control agent established in Florida for control of tropical soda apple, does not utilize Jamaican nightshade for feeding or oviposition. If Jamaican nightshade becomes a more serious invasive weed in the future, it may be possible to identify host specific natural enemies from its native range.

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