Florida's Established Arthropod Weed Biological Control Agents and Their Targets[1]

J. P. Cuda and J. H. Frank[2]

Nonnative invasive weeds are considered to be one of the most important threats to biodiversity, second only to habitat destruction (Randall 1996; Pimm and Gilpin 1989). They interfere with crop and pasture production in agroecosystems or alter the composition, structure, and function of natural ecosystems and waterways (Pimentel et al. 2000; Pimentel 2005). The losses in productivity and associated costs of controlling invasive weeds are staggering. Pimentel et al. (2000, 2005) estimate the total cost of invasive weeds to the US economy is $34 billion annually.

Compared to the rest of the continental United States, Florida is more prone to the introduction, eventual establishment, and subsequent invasion of natural communities by invasive weeds because of its unique geographic and environmental characteristics (Simberloff 1997). South Florida's extensive tropical and aquatic habitats, for example, are conducive to the establishment of nonnative terrestrial and aquatic ornamental plants. The Florida peninsula, which is bounded on three sides by water and the fourth by a freeze line, is essentially a subtropical "island" habitat that predisposes this region to nonnative plant invasions. Florida also is dominated by novel habitats created by intense human disturbance because of its popularity as a vacation destination. In FY 2017–2018, government agencies in the state of Florida spent approximately $14 million to control invasive plants (FWC 2018).

Approximately 1,200 out of an estimated 25,000 plant species (~ 5%) deliberately introduced into Florida for crop production and horticultural uses have invaded sensitive aquatic and terrestrial natural areas as well as improved pastures (Pimentel et al. 2005; Rogers et al. 2011). One of the reasons these nonnative plants become invasive is they are introduced into an environment in which they did not evolve and, therefore, lack the natural enemies that limit their reproduction (Williams 1954). Biological control reunites these natural enemies (usually arthropods) with their host plants to selectively weaken and suppress the invasive weeds.

In Florida, arthropod biological control agents currently are established on ten invasive weeds: air potato (*Dioscorea bulbifera* L.: Dioscoreaceae), alligatorweed (*Alternanthera philoxeroides* (Mart.) Griseb.: Amaranthaceae), Brazilian peppertree (*Schinus terebinthifolia* Raddi: Anacardiaceae), hydrilla (*Hydrilla verticillata* (L. f.) Royle: Hydrocharitaceae), melaleuca (*Melaleuca quinquenervia* (Cav.) S.T. Blake: Myrtaceae), Old World climbing fern (*Lygodium microphyllum* (Cav.) R. Br.: Lygodiaceae), tropical soda apple (*Solanum viarum* Dunal: Solanaceae), waterhyacinth (*Eichhornia crassipes* (Mart.) Solms: Pontederiaceae), salvinia (*Salvinia* spp.: Salviniaceae) and waterlettuce (*Pistia stratiotes* L.: Araceae) (Table 1).

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2. J. P. Cuda, professor and Fulbright Scholar; and J. H. Frank, professor (retired); Entomology and Nematology Department, UF/IFAS Extension, Gainesville, FL 32611.

Various resources on Florida's weed biological control programs are available to county faculty. Extensive reviews have been published on the biological control programs of the aforementioned invasive weeds (Buckingham 1994, Center 1994, Van Driesche et al. 2002). Also, up-to-date information on Florida's weed biological control programs can be found on several websites: the aquatic weeds alligatorweed, hydrilla, waterhyacinth, waterlettuce (http://plants.ifas.ufl.edu/manage/control-methods/biological-control/), air potato (http://www.fleppc.org/Manage_Plans/AirpotatoManagementPlan_Final.pdf), Brazilian peppertree (http://ipm.ifas.ufl.edu/pdfs/BPmanagPlan.pdf, http://www.fleppc.org/Manage_Plans/2006BPmanagePlan5.pdf, Cuda et al. 2019, melaleuca (http://tame.ifas.ufl.edu), Old World climbing fern (http://www.fleppc.org/Manage_Plans/Lygo_micro_plan.pdf), and tropical soda apple (http://plants.ifas.ufl.edu/node/426, http://freshfromflorida.s3.amazonaws.com/tsa-management-plan-01-12.pdf).

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Table 1. Established arthropod biological control agents of invasive weeds in Florida. For higher classification and authors of scientific names of the natural enemies, see Julien and Griffiths (1998), Cuda et al. (2006, 2007), and Frank and McCoy (2007).

Weed	Agent	Type	Origin	Date[1]	Impact
Air potato	*Lilioceris cheni*	Beetle	China	2011	Widespread
Alligatorweed	*Agasicles hygrophila*	Beetle	Argentina	1964	Widespread
	Amynothrips andersoni	Thrips	Argentina	1967	Local
	Arcola (= Vogtia) malloi	Moth	Argentina	1971	Local
Brazilian peppertree	*Megastigmus transvaalensis*	Wasp	South Africa	Adventive	Widespread
	Pseudophilothrips ichini	Thrips	Brazil	2019	Local
Hydrilla	*Hydrellia pakistanae*	Fly	India	1987	Widespread
	Cricotopus lebetis	Midge	Louisiana	Adventive	Local
	Bagous hydrillae	Weevil	Australia	1991–1996	None
Melaleuca	*Oxyops vitiosa*	Weevil	Australia	1997	Widespread
	Boreioglycaspis melaleucae	Psyllid	Australia	2002	Widespread
	Lophodiplossis trifida	Fly	Australia	2008	Local
Old World climbing fern	*Neomusotima conspurcatalis*	Moth	Australia, Southeast Asia	2008	Local
	Floracarus perrepae	Mite	Australia, Southeast Asia	2008	Local
Salvinia	*Cyrtobagous salviniae*	Weevil	Brazil	Adventive	Widespread
Tropical soda apple	*Gratiana boliviana*	Beetle	Argentina	2003	Widespread
Waterhyacinth	*Neochetina bruchi*	Weevil	Argentina	1974	Widespread
	Neochetina eichhorniae	Weevil	Argentina	1972	Widespread
	Niphograpta albiguttalis	Moth	Argentina	1977	Local
	Orthogalumna terebrantis	Mite	--	Native	Local
	Megamalus scutellaris	Bug	South America	2010	Local
Waterlettuce	*Neohydronomus affnis*	Weevil	Brazil	1987	Local

[1]Date of first release or discovery. Adventive means that the species arrived in Florida from somewhere else by any means. Others were introduced (deliberately).