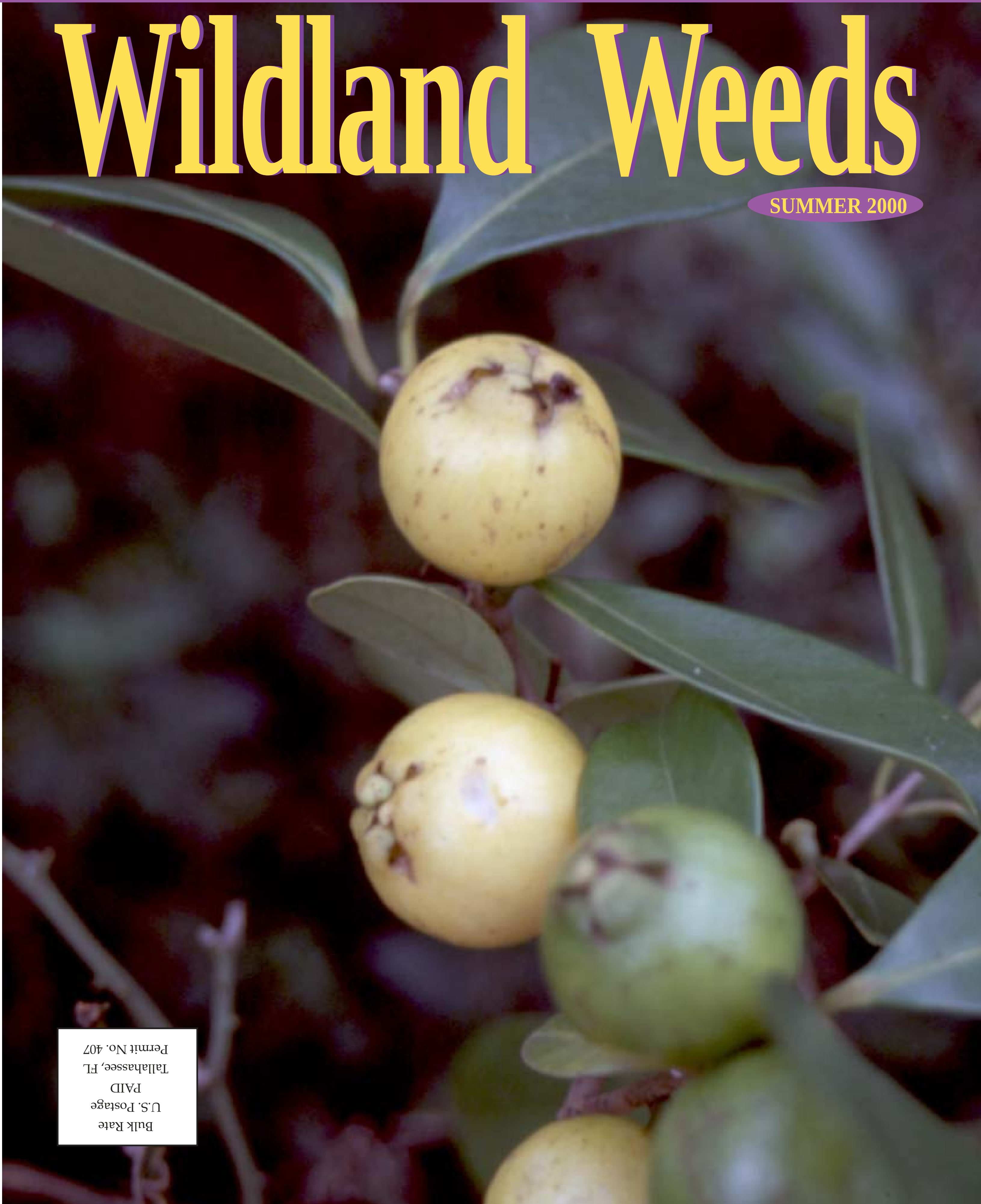
Guavas Gone Global

Wildland Weeds

SUMMER 2000



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SUMMER 2000, Volume 3, Number 3

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Wildland Weeds (ISSN 1524-9786) is a quarterly publication of the Florida Exotic Pest Plant Council (EPPC)

Wildland Weeds is published to provide a focus for the issues and concerns regarding exotic pest plant biology, distribution and control. To become a member of the Florida EPPC and receive the Council newsletter and *Wildland Weeds* Magazine, contact the Treasurer.

About the cover:
The yellow variety of strawberry guava (Psidium cattleianum) forms dense thickets along the Little Manatee River in Florida and is considered one of Hawaii's worst weeds.

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editor's note

Some weeds are harder to hate than others. The guavas for instance - they're almost too tasty to condemn. Guava jelly, guava jam, guava shakes.... Read about guava's gastronomical attributes and astronomical spread in two articles in this issue. Ken Langeland and David Hall detail two species (*Psidium guajava* and P. cattleianum) in Florida (below) and Charles Wikler describes strawberry guava (*P. cattleianum*) in Hawaii where researchers are hoping to introduce South American biocontrol agents soon.

Find out about the prospects for biocontrol of Chinese privet (*Ligustrum sinense*) in the Southeast on page 17, and saddle up for the wildly-successful "Great Air Potato RoundUp" on page 20. Too bad air potatoes aren't as tasty as guavas. But then again, "Dioscorea shake" doesn't exactly have an appealing ring. -Amy Ferriter

Common guava (*Psidium guajava*)

Exotic Guavas in Florida: so delicious **but—**

By Ken Langeland and David Hall

The guavas belong to the genus Psidium (Myrtaceae, Myrtle Family), which comes from the Greek, meaning edible fruit. *Psidium* is a tropical American genus with approximately 100 species of evergreen trees and shrubs, some with edible berries. Common guava, *Psidium guajava* L., strawberry or Cattley guava, *Psidium cattleianum* Sabine [P. littorale Raddi] (Schroeder 1946, Wunderlin 1998), and Costa Rican guava, *Psidium friedrichsthalianum* (O. Berg) Niedenzu, occur in Florida as landscape plants (Dehgan 1998). *Psidium longipes* (O. Berg.) McVaugh, mangrove berry, is native to Florida. The guava fruit, especially that of *Psidium guajava* cultivars that have been developed with superior taste qualities, is highly regarded for its edible qualities, eaten fresh and used in jellies, jams, drinks, pies, ice cream, etc. Cultivars of *P. guajava* are grown commercially for their fruit. Common guava, and strawberry guava are known to have escaped cultivation and included on the "Florida Exotic Pest Plant Council's (FLEPPC) 1999 List of Invasive Species". Both are listed under Category I, which means they are considered by FLEPPC as invasive exotics that are altering native plant communities.

Strawberry guava has characteristic gray-brown to reddish bark that peels off in irregular patterns.

Common Guava

Common guava (*Psidium guajava* L.) is a shrub or small tree, usually under 15 feet tall (rarely to 30 feet), with scaly bark. Branches are 4-angled and hairy. The opposite leaves have a short stalk/petiole and elliptic to oblong leathery blades. The lower blade surface is covered with soft hairs, contains numerous glandular dots and has very noticeable riblike lateral veins. Inflorescences are usually 1-flowered in leaf axils. The five sepals are united. The five petals are white, showy, rounded and just under 1 inch long. Stamens are numerous. The ovary is imbedded below the rest of the flower parts (inferior). The usually dull yellow fruits are rounded or pear-shaped, manyseeded berries about 1 to 2 1/2 inches long with pink or yellowish flesh. Reproduction is by seeds. Blooming occurs all year.

Common guava has been cultivated and distributed by man and animals for so long that it is difficult to be certain of its place of origin but it is believed to be from an area extending from southern Mexico into or through Central America (Morton 1987). It is now cultivated and escaped throughout the New and Old World tropics. In addition to its value for edible fruit, the wood is valued in some parts of the world, tannin is extracted for use in tanning and for dyes and, in addi

Psidium cattleianum, Deliciously dangerous in Hawaii

By Charles Wikler

Eating the delicious red or yellow fruits of strawberry guava (*Psidium cattleianum*) we would never imagine how big the problem caused by these plants is in many tropical regions. This species is invading extensive areas, dispersing into important natural habitats, ecologically disrupting them. In addition, this plant is host to several species of fruit flies.

Introduced to Hawaii about 1825, strawberry guava quickly escaped from cultivation. It has become the most important forest weed in Hawaii (Smith, 1985) due to suitable soil and climatic factors, the absence of natural enemies, and effective dispersal by several different agents. Initially, birds disseminated seeds. Feral pigs, relatively recent invaders of the Hawaiian ecosystem, have since become the most important dispersal agent of strawberry guava seeds (Diong, 1982).

Strawberry guava possesses several of the characteristics of an opportunist invasive species, but it seems that its ability to grow clonally is the main reason for its successful invasion and domination of intact native forests in the Hawaiian archipelago (Huenneke, 1991). This plant is an excellent example of a plant once confined to a small region but now a widespread problem throughout the tropics and subtropics.

From the beginning, studies about this plant generated considerable debate over which scientific name was published correctly for *Psidium cattleianum*. Sabine (1821) named the plant in honor of William Cattley, the first person to successfully cultivate the species in Britain. Some authors considered Raddi as the first to describe the plant, also in 1821, but in the literature search, Raddi's description refers to the plant as Psidium littorale in 1823. Thus, the name Psidium littorale is usually considered a junior synonym, as the original descriptions of both represent the same species.

According to Fosberg (1941) in Ellshoff et al. (1995), the common name used for strawberry guava is "araca" in Brazil, "waiwai" in Hawaii, and "Cattley guava" among some American horticulturists. Strawberry guava is also mentioned in the literature as "goiave de L'Afrique", in the Dominican Republic, "araca-saiyu" and "guayabo amarillo" in Argentina, "araza" in Uruguay, "Calcutta-guava" in India, "china-guava" for the British,

Rodeo Ad

"goyavier of St. Martin" in Guadeloupe, "goyavier fraise" for the French, "goyavier prune" in Martinique and "purple-guava" in Jamaica.

Hoehne (1946) mentioned that the diKerentiahon between the species becomes complicated for what is called "araca." Although the exact origin of the type specimen is not known, it seems that the plant was cultivated in Asia and America. However, the type locality of *P. Iittorale* is cited by Raddi (1823) as the coasts of Brazil.

Two botanical forms of strawberry guava tree are recognized based on fruit color. They are the red fruit *P. cattleianum f. cattleianum* (*P. Iittorale var. Iongipes*) and the yellow fruit *P. cattleianum f. Iucidum* (*P. Iittorale var. Iucidum*).

Geographical distribution in the area of origin

In Brazil, the genus Psidium is represented by 9 species, including P. cattleianum. The plant occurs from the South of Espirito Santo State in Brazil to Uruguay, (from 20° and 32° S). Strawberry guava is a characteristic bush of the "restinga," typical vegetation of the Atlantic Rain Forest, where it is widely dispersed. Although present, it is not too frequent in the first plateau. The species occurs in humid soils, in small woods (capoeiras), and the border of creeks and semi-devastated forests. It is also quite frequent in the coastal swampy fields along the littoral zone of the southern states of Santa Catarina and Rio Grande do Sul. It can be found in and around the southern plateau, occurring in the ciliary forests, as well as in disturbed fields (Reitz, Klein & Reis, 1983).

Morpholog of the varieties of *Psidium cattleianum*

According to Wikler (1999), the main differences between the yellow and red forms of strawberry guava are:

- *P. cattleianum var. Iucidum* (yellow form)

It is commonly a shrub in the coast, as part of a vegetation formation called "restinga", where a wide variety of plants grow on the sandy substrate with a high water table. The climate in the coast is hot and humid with temperatures between 18 and 22 ℃ and annual rainfall between 1430-2450 mm. Its height varies between 2.5 and 4 meters, rarely exceeding 5 m high. The trunk is tortuous and with very characteristic grayish-brown coloration, being unmistakable in the places where it is found. Its crown is round and quite dense. The fruits are yellow, as well as the endocarp that ranges from light yellow to white. In Parana State it is distributed along the coast, and on the first and second plateaus.

Psidium cattleianum var. Iucidum

- *P. cattleianum var. cattleianum* (red form)

The red form is a tree, with heights from 2.5 meters up to 20 meters. Its trunk has the same color of the yellow form although it differs in shape being straight and cylindrical with a larger diameter. Its crown is slightly elongated and quite dense. Its fruit and its endocarp are red colored. In the Araucaria Forest it is found inside the woods but exclusively in the first plateau, ranging from 6501100 m. The climate is hot and humid, with temperature between 15 - 19 ℃ and 1250 - 2500 mm annual rainfall.

Psidium cattleianum var. cattleianum

Biocontrol in Hawaii

Unable to control strawberry guava by mechanical and chemical means in Hawaii, the U.S. National Park Service initiated efforts to find biological control agents against this weed. A cooperative program between the Cooperative National Park Resources Studies Unit, University of Hawaii at Manoa, and the Parana Forest Research Foundation and the Federal University of Parana was established in March 1991.

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“Nautique”

tion to other medicinal uses, the roots, bark, leaves and immature fruits are used to halt gastroenteritis, diarrhea and dysentery throughout the tropics (Morton 1987). In Mexico, the tree may be parasitized by mistletoe that causes rosette-like formations called wood flowers, which are sold as ornamental curiosities (Morton 1987).

According to P. W. Reasoner, common guava was introduced to Florida from Cuba in 1847 (Popenoe 1920). However, it was already reported as naturalized in 1765 (DeBrahm 1773). The 1887-1888 Catalog and Price List for Royal Palm Nurseries states: "The guava has become a necessity to South Florida; is to South Florida what the peach is to Georgia". It has been grown successfully as far north as the Pinellas peninsula [sic] on the west coast and Cape Canaveral on the east coast (Popenoe 1920) and was grown commercially at Palma Sola, Punta Gorda, Opalacha, Indiantown, and other localities (Barrett 1956). Three cultivars are now grown commercially, Homestead and two private selections. About 225 acres are in production in Dade (90%), Lee, Broward, and Palm Beach Counties (Jonathan Crane, personal communication). This acreage has been expanding since 1992 and has greater potential due to expanding Asian and Latin markets. The crop is worth in excess of $3,000,000 annually. In Hawaii, 7,000 acres are grown. While available in the horticultural trade, common guava is relatively insignificant in the current ornamental grower and landscape market and a phase-out of production and sale by Florida ornamental growers is encouraged by an agreement between the FLEPPC and the Florida Nurserymen and Growers Association (Aylsworth 1999).

Common guava grows and fruits under unfavorable conditions, spreads rapidly by seeds and has become a weed in many areas (Popenoe 1920). In fact, it is present as a weed in 27 countries and considered a common to serious pest in nine of these (Holm _ aL 1979). It forms thickets and has a serious impact on native forests and open woodlands (Cronk and Fuller 1995). Small, in 1933, reported it in hammocks, roadsides, pinelands, and old fields of peninsular Florida and the Keys, and it was further reported spreading into hammocks and pinelands in 1971 (Long and Lakela). It now ranges from Pinellas and Brevard Counties south to the Keys (Nelson 1994) and has been reported from Florida parks and preserves in Broward, Collier, Dade, Highlands, Lee, Martin, Osceola, Palm Beach, and Sarasota Counties (FLEPPC 2000). In Jonathon Dickinson and Seabranch State Parks alone 1,163 stems were treated in 1998-99 (Florida Park Service). Trees are controlled by basal bark applications of Garlon 4, cut stump applications of Garlon 4 or 3A, and hand pulling of seedlings.

Strawberry Guava

Strawberry guava [P. cattleianum Sabine] is a shrub or small tree to 25 feet tall with smooth, gray-brown to reddish bark that is inclined to peel off in irregular patterns. The slick, leathery, evergreen, opposite leaves are elliptic to somewhat broader towards the tip and up to 3 inches long with a short stalk/petiole. The lateral nerves in the blades are ascending and curve forward without forming a distinct marginal nerve. The inflorescence is stalked and 1-flowered from the leaf axils. Flowers have five united sepals. The five petals are white, showy, rounded and about 1 inch wide. Stamens are numerous and anthers are attached in the center and split longitudinally. The ovary is imbedded below the rest of the flower parts (inferior). The red-purple or yellow fruits are almost

A survey identified potential biological control agents from which the impacts of seven insect species and their effects on *Psidium cattleianum* are discussed by Wickler et al. (1999): a lead gall produced by *Tectococcus ovatus* (Homoptera, Eriococcidae), bud galls formed in response to *Dasineura gigantea* (Diptera, Cecidomyiidae), a shoot gall produced by *Eurytoma* sp. (Hymenoptera, Eurytomidae), a seed gall induced by *Sycophilia* sp. (Hymenoptera, Eurytomidae), another leaf gall formed in response to an unknown species of Psyllidae, the sawfly, *Haplostegus epimelas* (Hymenoptera, Pergidae), and the chrysomelid *Lamprosoma azureum* (Coleoptera, Chrysomelidae).

The author gratefully acknowledges Dr. Clifford W. Smith for all his assistance since the beginning of these studies, Dr. Simon Elliot and Milton Mendonça Jr. for their helpful comments in the draft manuscript and Dr. J.H. Pedrosa-Macedo and the Biological Control of Weeds group from the Laboratory of Forest Protection of UFPR for their further assistance. Funding from the U.S. Na-

round, many-seeded berries about 1 and 1/ 2 inches long with white flesh. Reproduction is by seeds. Blooming usually occurs in early summer. Native to southeastern Brazil, it is planted in the subtropics and tropics. Strawberry guava can survive temperatures as low as 22 F (Morton 1987) and is grown as far north as Alachua County.

P. cattleianum occurs as two distinct botanical varieties. The common redfruited variety is called Cattley guava or strawberry guava, *P. cattleianum* Sabine var. *cattleianum* [*P. littorale* Raddi var. *longipes* (O. Berg) Fosberg] (Fosberg 1941). This variety is a small dense tree. It makes a nice ornamental with the copious array of dark shiny green leaves and bright red fruits. The fruit is sweet and obviously eaten and spread by wildlife and cattle. As an escape, strawberry guava has been found on floodplains and in oak hammocks and cattle pens from Osceola County south into Lee County (Wunderlin *et al*. 1995). The common name, strawberry guava, comes from the flavor of the fruit, which tastes like a strawberry. The fruits are eaten fresh or used for making jelly, drinks and other culinary uses, however, it is not grown commercially for its fruit in Florida. It is an attractive dooryard tree, presenting "_____ an almost exotic or Japanese picture as an accent" and used as a hedge (Stressau 1986).

The less frequent yellow-fruited variety is called yellow Cattley guava or yellow strawberry guava, *P. cattleianum* Sabine var. *lucidum* Hort. [*P. littorale* Raddi var. lucidum (Degener) Fosberg] (Fosberg 1941). This variety is a loosely branched small tree said to be useful for reforestation (Staff, Hortus Third 1976). The fruit is sulphur-yellow, translucent and somewhat acid when ripe. Yellow Strawberry guava forms dense thickets along the margin of the Little Manatee River in Hillsborough County. This variety has also been listed [sic] as *P. lucidum* Hort., *P. chinense* Lodd. ex Lodd. and *P. sinense* (not a valid name, probably a misspelling of *chinense*) (Popenoe 1920).

Strawberry guava forms thickets and shades out native vegetation in forests and open woodlands (Cronk and Fuller 1995). It has had catastrophic effects on native habitats of Mauritius, and it is considered among the worst pest plants in Hawaii (see Wikler, this issue), where it has invaded a variety of natural areas (Cronk and Fuller 1995). It has become dominant in native forests of Hawaii, including in two national parks, where its clonal spread is enhanced by activities of feral pigs (Huenneke and Vitousek 1990).

Strawberry guava first appeared in the horticulture trade in Florida in the 1887-1888 Catalog and Price List for Royal Palm Nurseries. However, it was not included in southeastern flora by Small (1933). It was noted as "often growing wild" in 1956 by Barrett (1956). It has been reported in Florida parks and preserves in Pinellas, Hillsborough, Martin, and Palm Beach Counties (FLEPPC 1996). In Jonathan Dickinson State Park and Seabranch Preserve alone, 2,087 Strawberry guava stems were controlled in 1998-99 (Florida Park Service). Where possible, stems are cut and treated with Garlon 3A. In Jonathan Dickinson State Park, it was necessary for DEP to bulldoze and restore a three acre site (Richard Roberts, personal communication). At Seabranch, up to seven guava plants per square meter occur and 5-15% of vegetation has consisted of Strawberry quava in various sites in 35 acres John Griner, personal communication). Twenty acres have been restored by selective removal of this pest plant and planting of native vegetation.

In summary, the guavas have provided us with delicious desserts, ornamental plantings, and commercial income. On the other hand, common and Strawberry guavas have escaped cultivation and are weeds in natural areas requiring expenditure of public funds to protect native plant communites. This is an example of the dilemma we face with many introduced plants that are both commercially valuable and natural area weeds.

Acknowledgements

Thanks to Hillary Cherry for library assistance and Bob Pemberton for supplying information from the Royal Palm Nursery catalogue.

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tional Park Services and the University of Hawaii (CA80xx2-9004) supported this study.

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Herbicide Screening Results for Two Common Exotic Grass Species in Florida

by Dan Thayer

Two invasive exotic grass species are abundant and unwanted features of the 21,875 acre DuPuis Reserve, just east of Lake Okeechobee in South Florida. They are torpedograss (Panicum repens) and bahiagrass (Paspalum notatum). In the past decade, there has been an increasing number of products marketed as grass specific herbicides. The purpose of the screening was to evaluate these new products, along with a few standard grass herbicides, for efficacy against these grasses and selectivity for the native flora at three test sites within the DuPuis Reserve. The herbicide rates, and the adjuvants used in this study, were recommended by the manufacturer or their local distributor. These preliminary tests will be used to shortlist products for further study.

METHODS: Torpedograss plots were established in a seasonal wetland dominated by torpedograss, and in anassociated drainage ditch heavily invaded with torpedograss. The torpedograss marsh and ditch were dry at the time of herbicide application. Surrounding the torpedograss invaded wetland is an established stand of bahiagrass. Bahiagrass plots were placed adjacent to the torpedograss test site. The torpedograss marsh plots were virtually a 100% cover of torpedograss. Scattered throughout was a light cover of pickerelweed (Pontederia sp.) and broom grass

HERBICIDE TREATMENTS:

Treatment		Rate (oz.)			Rate (oz.)	
Number	Herbicide	Acre	Plot	Surfactant	Acre	Plot
1	Envoy	34	2.55	SunWet	4	.3
2	Envoy	17	1.27	SunWet	4	.3
3	Arsenal	40	3.0	Dynamic	6.7	.5
4	Rodeo	128	9.6	Dynamic	6.7	.5
5	Roundup Pro	128	9.6	Cohere	6.7	.5
6	Poast	40	3.0	SunWet	4	.3
7	Poast	80	6.0	SunWet	4	.3
8	Fusilade	24	1.8	Dynamic	6.7	.5
9	Plateau	8	.6	Dynamic	6.7	.5
10	Plateau	12	.9	Dynamic	6.7	.5
11	Vantage	46.3	3.47	Dynamic	13.3	1.0

Torpedograss Marsh Plots
Six-Months Post-Treatment

Treatment Number	Herbicide	Bahiagrass Effect	Comments
1	Envoy	No Effect	
2	Envoy	No Effect	
3	Arsenal	100% Kill	100% on all other vegetation.
4	Rodeo	80% Kill	Minor effect on pickerelweed.
5	Roundup Pro	20% Kill	Minor effect on pickerelweed.
6	Poast	No Effect	
7	Poast	No Effect	
8	Fusilade	No Effect	
*9	Plateau	No Effect	
*10	Plateau	No Effect	
11	Vantage	No Effect	

*In ditch plots, Plateau at both rates killed pickerelweed but had no effect on maidencare.

(*Andropogon virginicus*). The ditch plots were a mix of torpedograss, maidencane (*Panicum hemitomon*), and pickerelweed. In the ditch plots, torpedograss was not consistent throughout, so evaluations focused on treatment effects to native species. The bahiagrass plots contained broom grass and yellow-eyed grass (Xyris sp.). With the exception of the ditch site, the test plots were burned on June 15th, 1999. Herbicide applications were made on August 2nd, 1999. Fire was used to reduce the existing thatch and to break apical dormancy. Previous studies indicate an increase in efficacy for herbicides applied to perennial grasses following fire.

Torpedograss marsh plots and bahiagrass plots were applied from an ATV using an electric powered sprayer with a boom arrangement of flat-fan nozzles (6505s). The ditch plots were sprayed with the same ATV and a Boom Buster nozzle which delivered 1.5 GPM. All herbicides were applied at a total spray volume of 40 gallons per acre. Each plot was 0.075 acres in size. Permanent photo locations were established to monitor each treatment plot through time. Visual ratings of herbicide efficacy were conducted at three and six months post-treatment. Where applicable, visual ratings were made for nontarget vegetation treatment effects. The Six month evaluations are presented here. The weather conditions on August 2nd, at 1200, were clear to partly cloudy skies, 94°F, 66% RH, and winds from the west at 3 mph.

Many thanks to Trace Wolfe, Bo O'Neal, Jackie Smith and Steve Smith for their help with this trial.

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Bahiagrass Plots. Pre-treatment, Plot #5

Bahiagrass Plots. 6-months Post-treatment' Plot #5.

Bahiagrass Plots
Six-Months Post-Treatment

Treatment Number	Herbicide	Bahiagrass Effect	Comments
1	Envoy	No Effect	
2	Envoy	No Effect	
3	Arsenal	100% Kill	100% Kill of pickerelweed.
4	Rodeo	95% Kill	No effect on yellow-eyed grass.
5	Roundup Pro	99% Kill	No effect on yellow-eyed grass.
6	Poast	No Effect	
7	Poast	No Effect	
8	Fusilade	No Effect	
9	Plateau	100% Kill	No effect on broomgrass.
10	Plateau	100% Kill	No effect on broomgrass.
11	Vantage	Indeterminable	

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Figure 1. Chinese privet growing in a conservation area in north Florida.

Chinese privet, *Ligustrum sinense:*

Prospects for Classical Biological Control in the Southeastern United States

By J. P. Cuda and M. C. Zeller

Chinese or hedge privet, *Ligustrum sinense* (Oleaceae), is a semi-deciduous shrub or small tree of Asiatic origin that is commercially available from the nursery industry as an omamental or border plant (PlantFinder 1999). After its introduction into the United States in 1852 (Dirr 1983), this woody shrub eventually escaped cultivation, and by 1932 had become naturalized across the southeastern United States (Small 1933). It is now considered an invasive weed in many areas of the Southeast (Dirr 1983, Nelson 1996).

In its introduced range, Chinese privet is a common component of the understory vegetation of forests in north Florida (Fig. 1), Alabama, Georgia (Godfrey 1988), Kentucky, North and South Carolina (Radford *et al.* 1968), Mississippi (Goddard 1992), Oklahoma (Taylor *et al*. 1996), Tennessee (Radford *et al*. 1968, Faulkner et al. 1989) and Texas (Correll and Johnston 1970). This woody shrub also is an invasive weed in Australia (Burrows and Kohen 1986) and Argentina (Montaldo 1993). While primarily a woody invader of abandoned or disturbed areas (Godfrey 1988), Chinese privet readily invades natural areas adjacent to disturbed sites, and is especially abundant along stream banks. The present distribution of naturalized populations of Chinese privet in Florida is shown in Fig. 2 (Wunderlin *et al*. 1995).

Chinese privet can grow to a height of 10 m. The plant is characterized by its numerous leafy pubescent branchlets, and its small, simple, deciduous to semi-deciduous leaves are elliptic in shape (Fig. 3). The leaves are green (variegated in cultivation), opposite, have short pubescent petioles, and are attached at right angles to the stems. In bloom, the branchlets bear numerous, many-flowered panicles. Flowers (Fig. 3) are white and malodorous; the corolla tube is shorter than the spreading lobes, and the stamens are exserted. The fruits (Fig. 4) are blue, fleshy drupes that are ingested by birds (McRae 1980, Buchanan 1989, Montaldo 1993). New infestations probably develop from bird-dispersed seeds (Montaldo 1993).

Figure 3. Branchlet of Chinese privet with leaves and flowers.

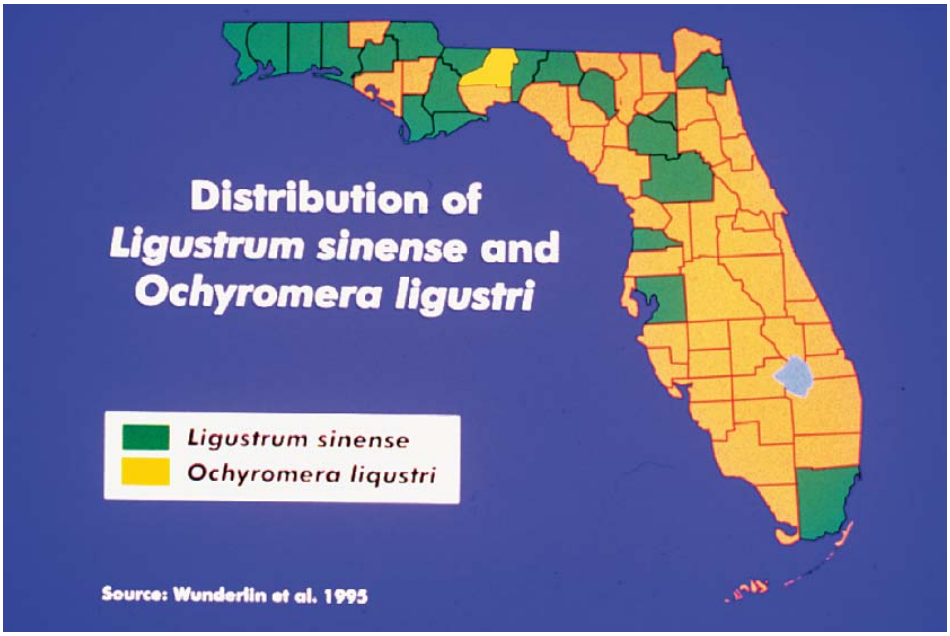

Figure 2. Current distribution of naturalized populations of Chinese privet and the ligustrum seed weevil *Ochyromera ligustrl* in Florida. Adapted from Wunderlin etal. (1995).

Figure 4. Berry-like fruits of Chinese privet.

The Florida Exotic Pest Plant Council lists Chinese privet as a Category I invasive species (FLEPPC 1996). The shrub disrupts native plant communities in riparian and upland habitats by competing for the available light and space. The federal- and state-listed endangered Miccosukee gooseberry, *Ribes echinellum*, is on the verge of being displaced in Florida by encroaching stands of Chinese privet (Langeland and Burks 1998). Moreover, nutrient cycling in natural areas can be disrupted by the presence of Chinese privet. Faulkner *et al*. (1989) observed that dense thickets of Chinese privet in Tennessee produce large quantities of litter, and act like umbrellas by preventing the infiltration of leaf litter from the native tree canopy. Agriculture and public health also can be impacted by the presence of Chinese privet. Dense stands of this invasive shrub can serve as alternate host plants for the citrus whitefly, *Dialeurodes citri* (Hicks and Oliver 1987), and are conducive to infestations of the hard tick *Ixodes scapularis*, a suspected vector of Lyme disease in the southern United States (Goddard 1992).

Where it displaces native vegetation, Chinese privet may not have an adverse impact on wildlife populations because of its nutritional value. The plant serves as food source for the bobwhite quail, *Colinus virginianus*, and the white-tailed deer, *Odocoileus virginianus*, when more desirable forage plants are scarce (McRae 1980, Stromeyer *et al*. 1998a,b).

From a management perspective, mechanical control methods such as cutting and prescribed burning are ineffective against Chinese privet (Faulkner *et al*. 1989). The plant resprouts rapidly from the cut stumps, and its affinity for low-lying damp areas does not allow fire to carry well. The moist conditions in the bottom litter layer also reduce the effectiveness of the fire by not allowing temperatures to become hot enough to kill the root crowns. A1though the herbicide glyphosate will severely damage or kill Chinese privet, chemical control is impractical and too expensive for large areas with dense growth (Faulkner et al. 1989). Since conventional methods are inappropriate for selectively controlling large infestations of Chinese privet in natural areas, biological control with natural enemies from the plant's native range should be considered.

Chinese privet would be a good candidate for classical biological control because the environmental risks associated with the importation and release of host specific natural enemies would be low. There are no native congeners in the genus *Ligustrum* occurring in the United States (Pemberton 1996). Therefore, the level of host specificity required for candidate natural enemies may be quite broad yet still not pose a risk to non-target native or economically important plant species. The nursery industry would probably object to the introduction of insects that feed on the foliage or girdle the branches or stems of Chinese privet and would be fearful of attacks on the widely used *Ligustrum japonicum* (Japanese privet) and the also popular *L. Iucidum* (wax privet). This conflict of interest could be resolved by selecting only those insects that attack the plant's flowers or seeds. According to Harley (1986), suppression of reproduction is important for controlling woody weeds (a) that reproduce by seed; (b) where existing plantings provide some benefit, e.g., ornamental value; and (c) when herbicide applications provide only temporary control and retreatment is uneconomical or environmentally disruptive. Chinese privet meets all of these criteria.

Biological control of Chinese privet already maybe occurring in some areas, although not as a result of any purposeful introductions. The seed weevil *Ochyromera ligustri* was recently found attacking Chinese privet in Leon County, Florida (Fig. 2) (Cuda and Zeller 1998). This immigrant natural enemy of Ligustrum spp. maybe capable of reducing the spread of Chinese privet into new areas and/or the densities of existing stands. However, field and laboratory studies will be required to determine to what extent this insect can control the growth and spread of Chinese privet populations in natural areas.

Ochyromera ligustri was first discovered in 1959 on Japanese privet, L. japonicum, in Wake County, North Carolina (Warner 1961, Wray 1961), and is believed to have immigrated from the Orient in nursery stock imported into the United States. Since then, the weevil has been found in Florida, Georgia, North and South Carolina, and Virginia, as well as North and South Dakota (O'Brien and Wibmer 1982, Johnson and Lyon 1988). Considering that Leon County is the only locality in Florida where Japanese privet (the principal host plant for *O.*

Figure 5. Ligustrum seed weevil Ochyromera ligustri, an insect natural enemy of Chinese privet.

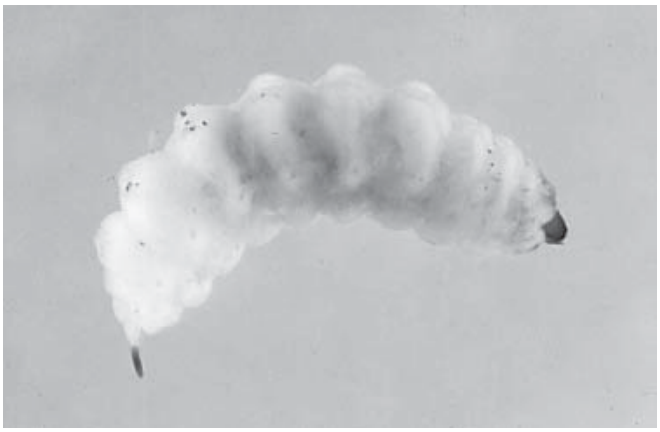

Figure 6. Mature larva of the ligustrum seed weevil *O. ligustri.*

ligustri) is documented as naturalized (Wunderlin et al. 1995), it is not surprising that the weevil has adapted to Chinese privet in this region of north Florida where the two species of *Ligustrum* have overlapping distributions. The weevil also has been collected from wax-leaf ligustrum, *L. Iucidum*, common privet, *L. amurense*, lilac, *Syringa* spp., and grape, Vitis spp., in North Carolina (Warner 1961, Wray 1961). However, it is not clear from the literature whether lilac or grape are legitimate host plants in that they are capable of supporting complete development of the weevil.

The biology of *O. Iigustri* on Japanese privet was reviewed by Johnson and Lyon (1988). The weevil is 3-5 mm long and is shiny brown with golden yellow hair like scales (Fig. 5). The adults feed on the foliage by making small perforations in the interior of the leaf blade, and drop to the ground when disturbed. In North Carolina, adults are active from late June to early July. Females deposit their eggs in the seed or in the mature fleshy fruits. The larvae (Fig. 6) feed inside the fruits and destroy the seeds as they complete their development to the adult stage. New adults emerge from the seeds (one weevil per seed) in mid-May, and there is only one generation per year.

We thank M. C. Thomas for identifying the insect, J. F. Butler and K. C. Burks for the photographs of the insect and plant, respectively, and J.H. Frank and N.C. Coile for reviewing the manuscript. Florida Agricultural Experiment Station Journal Series No. N-01574.

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The Great Air Potato RoundUp

To encourage participation and increase motivation, recognition was given to the individual and group with most tubers collected, the largest tuber collected, and the most unusual tuber collected.

By Steven Vann

The Great Air Potato RoundUp was an invasive nonnative plant awareness festival held by the City of Gainesville, Florida's Nature Operations Division on February 5th, 2000. The focus of the event was to help the public recognize that they play an integral role in the management of their local nature parks. An educated public is one of the most effective and powerful tools for a land manager. Most of our parks have residential borders and are connected to other neighborhoods by the many creeks that flow through Gainesville. For the last eighteen months, the City has been developing a public education campaign to help people understand how landscaping decisions they make at home can affect the natural communities in their parks.

The initial campaign consisted of nativescape workshops, a corresponding brochure, and guided nature waLks. The program enjoyed limited success. Our message was getting through, but we often had low attendance, and many of the participants were already aware of the problems of non-native invasive plants. We were failing to attract a large portion of our target audience - the public who had little or no knowledge of the issue. Then one afternoon, while brainstorming in the office, it came to us. We needed to have one large, full-scale education event, disguised as a volunteer exotic plant removal day and celebration. To make the event fun for everyone, we decided to have prizes, competitions, and of course, a free Tshirt for participants, the "lure." Once we came up with a catchy name, The Great Air Potato RoundUp was on its way.

Why Air Potato?

We chose air potato (Dioscorea bulbifera) for three reasons. First, air potato's prevalence in Gainesville helped volunteers recognize the plant during and after the event. The plant has large populations established along most of Gainesville's creeks; it is a menace to both public nature parks and private landowners. Second, picking up tubers that resemble baking potatoes involved little training for volunteers. Having a one day event did not allow time to train volunteers in plant identification, mechanical removal, and herbicide application.

Lastly, air potato tuber removal allowed us better scheduling opportunities. The spring and fall in Gainesville are booked with festivals, plant sales, and football games and the summer is just too hot to attract many people outside. That left winter, when the plant is dormant and most of the tubers have descended, blanketing the ground...perfect.

Organization

The Great Air Potato RoundUp was modeled after popular litter cleanups, with participants collecting tubers instead of trash. We targeted areas in nature parks or properties that have direct creek connections to nature parks. Prospective volunteers were asked to call prior to the event to pre-register. The volunteers were assigned sites and asked to meet their site leader at the site on the morning of the event. The site leaders were key. In addition to orientating and supervising volunteers, they had the most important task of the day, education. We asked persons who were knowledgeable in ecology, Florida's Natural Communities, and invasive nonnative plant ecology to volunteer as site leaders. Armed with pressed plant samples, line drawings, photos, maps, and fact sheets, our site leaders gave short presentations prior to letting the volunteers loose to collect tubers. To encourage participation and increase motivation, recognition was given to the individual and group with most tubers collected, the largest tuber collected, and the most unusual tuber collected. These awards were presented at the celebration following the event. The celebration also offered educational displays, food, and live music from the local acoustic duo Trail Ridge, who performed their new tune, *Air Potatoville*. The event culminated with a prize drawing for several great prizes, including a new mountain bike (another great lure).

Sponsorship

Prior to the event, one of our goals was to obtain sponsors. The more money we had, the more we could do. We sent out several letters to businesses and organizations, and followed up with phone calls. Whenever the opportunity presented itself, we took our show on the road, and gave several presenta-

tions about the event. The old saying, "persistence does pay off," is true. The donations came pouring in. The Florida Exotic Pest Plant Council (EPPC) and the Payne's Prairie Chapter of the Florida Native Plant Society (FNPS) enthusiastically supported us. They were followed by donations from Dow Agrosciences, Brewer International, Monsanto, and Water and Air Research. In addition to monetary sponsorships, several sponsors donated services or products. Full Circle Solutions helped us with the logistics of disposing of the tubers once collected, and a localbicycle shop, Spin Cycle, donated a mountain bike for the raffle. In addition, many local businesses donated several prizes that included movie and restaurant gift certificates, birdhouses, native plants, gym memberships, and much more.

The Power of Advertising

Now we had to get volunteers. Instead of depending on a single advertising method, we developed a multi-media approach. A radio ad ran twenty times in the week prior to the event, posters were put up in business windows around town, small signs were placed at strategic intersections, and we bought ad space on the side of two buses from the local public transit. We also took advantage of several free advertising sources. The local public radio station played public service announcements daily about the event, and local newspapers ran articles before and after. We put listings in local volunteer announcements, and wrote articles for several local newsletters. We then began targeting groups such as local clubs and organizations, Boy Scout and Girl Scout troops, neighborhood associations, and two great volunteer resources in Gainesville, The University of Florida and Santa Fe Community College. We used the same persistent approach as obtaining sponsors; starting with letters, followed by phone calls, more phone calls, and then a traveling slide show to meetings.

Success!

Thanks to a creative idea, aggressive advertising, and generous sponsors the event was a success. When first discussing the idea, we imagined getting 150 volunteers and decided to shoot for 300. Then the phone began to ring nonstop, and two weeks prior to the event we topped the 300 person goal. We added new sites daily to handle the increasing number of people. The final tally on the day after the event was staggering. 675 volunteers participated at 21 sites around Gainesville, collecting a total of 11,748 pounds of tubers, almost 6 tons! The success went well beyond the numbers. The event included knowledgeable volunteers, (the choir) and the general public. This mix had volunteers learning from other volunteers. An article in the local student newspaper, The Alligator, captured the real success of the event. The article quoted a mother explaining how she and her children were headed home to remove air potato in their yard, and a teacher who was saving some tubers to show to her class on Monday morning. We are still receiving calls from people who are removing air potato form their yards, and from others that are organizing small roundups with their neighborhood associations. These types of results are too valuable to measure.

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Internodes

XenoNET

Biological control on the Web

So, you say your favorite filth is infested with filth flies? Is your greenhouse so loaded with *Lygus* bugs that your specimen plants are withering away? What's to be done, especially if you'd like to avoid using chemical control methods? Sounds like biological control's for you. And there's more to biological control than you might think. Many question the soundness of biological control, some argue its effectiveness, and others may just want to try and save their filth. A little bit of surfing may well settle all these issues.

Several websites might need visiting before you'll be able care and feed for some biological controls like filth fly parasites or pathogens of Lygus bugs. The National Biological Control Institute is run by USDA and their website (www.aphis.usda.gov /nbci. / noci. html) provides some general information on biological control. Most of its information, though, has to do with the agency, their mission, etc., not biological control itself. But it does provide links to sites that truly inform about the subject.

If you want to be theoretical, the website (www.ruwpa.st-and.ac.uk/ projects/other/locust.html) of the applied mathematicians at St. Andrews University (Scotland) offer things like spatially-modeled grasshopper pathogen interactions. Their model illustrates what might happen when a biocontrol agent induces change in the population of a pest. Their work illustrates population interactions and the complexities affecting whether biocontrol initiatives will succeed.

Sometimes websites disappoint, like one maintained by the Association of Natural Biocontrol Producers (www.anbp.org). It provides only thumbnails sketches of biological control information and doesn't really live up to its stated intent of sharing producers of natural biocontrols in the marketplace. When you click on the "hotspots" for sources of specific control agents, none appear for any of the agents listed. Maybe the site is simply under development.

So, government websites sometimes lose their focus, private sector sites may not have resources available to construct a really complete website. Yet, biological control is really well represented by at least one website, called the Biological Control Virtual ~formation Center (lpmwww.ncsu.edu/ biocontrol/ biocontrol.html). Entomologists and others at North Carolina State University took the time to provide very instructive text on wide-ranging examples of biocontrol along with links to other useful biocontrol sites.

Mark Your Calendar

Third lnternational Weed Science Congress. Foz do lguassu, Parana, Brazil. **June 6-11, 2000**. Contact: P. J. Eventos 55/41/372-1177, pj@datasoft. com.br.

International Meeting for the Society of Conservation Biology. University of Montana, Missoula. **June 9-12, 2000**. Contact Fred Allendorf 406/243-4184, darwin@se]way. umt.edu, www.umt.edu/scb2000.

The Urban Forestry Institute: The Wildland-Urban Interface, Balancing Growth with Natural Resource Management and Conservation. The Plaza Hotel, Daytona Beach, FL. **June 25-30, 2000**. Contact: Mary Vuryea 352/846-0896, mld@ gnv.ifas.ufl.edu.

40th Annual and International Meeting, Aquatic Plant Management Society. Hanclerly Hotel and Resort, San Diego CA. **July 16-20, 2000**. Contact Jim Schmidt 800/ 5585106, jimschmidt@appliedbiochemists.com.

American Society of Horticultural Scientists, Building a Bright Future for Horticulture. Coronado Springs Resort, Orlando FL. **July 23-26, 2000**. Contact: www.asks.org

85th Annual Meeting of the Ecological Society of America. Snowbird Utah. **August 6-l0, 2000**. Contact ESA 202/833-8773, esahq@esa.org.

International Conference of the Society for Ecologial Restoraton. Liverpool England. **September 4-9, 2000**. Contact: SER 608/265-8557, ser@macc.wisc.edu, www.ser.org.

27th Annual Natural Areas Conference. Regal Riverfront Hotel, St. Louis, MO. **October 16-20, 2000**.

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