Volume 24: Number 3 > Summer 2007

The Quarterly Journal of the Florida Native Plant Society

Palmetto

Micropropagation of Florida Ziziphus • Laurel Wilt • Fox-tail Millets

Encyclopedia of Life Launched

May marked the launch of the *Encyclopedia of Life* (EOL), an unprecedented effort to document all 1.8 million named species of animals, plants, and other forms of life on Earth. The Encyclopedia will give scientists, students, and citizens multi-media access to all information on all known living species, even those that have just been discovered.

The Field Museum of Natural History, Harvard University, Marine Biological Laboratory, Smithsonian Institution, and Biodiversity Heritage Library joined together to initiate the project. The Missouri Botanical Garden has also become a full partner, and an international advisory board of distinguished individuals will help guide the Encyclopedia.

"*The Encyclopedia of Life* will provide valuable biodiversity and conservation information to anyone, anywhere, at any time," said Dr. James Edwards, EOL Executive Director. "Through collaboration, we all can increase our appreciation of the immense variety of life, the challenges to it, and ways to conserve biodiversity."

Over the next 10 years, EOL will generate Internet pages for all currently named species, and will expedite the classification of the millions of species yet to be discovered and catalogued. Pages will include written information as well as photographs, video, sound clips, location maps, and other available multimedia materials.

While initial work will emphasize species of animals, plants, and fungi, the design can be extended to encompass microbial life.

To provide depth behind the portal page for each species, the Biodiversity Heritage Library (BHL), a consortium that holds most of the relevant scientific literature, will scan and digitize tens of millions of pages of the scientific literature that will offer open access to detailed knowledge.

"I dream that in a few years wherever a reference to a species occurs on the Internet, there will be a hyperlink to its page in the *Encyclopedia of Life*," concluded Edwards.

To view sample pages, visit www.eol.org and click the "Demonstration Pages" link.

Source: http://www.eol.org/resources.html

Sign up today for the FNPS Member's Retreat

Pine Lake Retreat near Clermont, Florida will host the Florida Native Plant Society Member's Retreat on October 5–7, 2007. Join FNPS members from around the state for an opportunity to mingle, learn, and enjoy field trips showcasing ecosystems of Central Florida.

Members and Chapter officers will have an opportunity to participate in an Advocacy Workshop and a Chapter Success Stories and Resources Workshop. Fun activities will include hiking, paddling, workshops, guest speakers, nature crafts and family programs.

The cost is $60 plus lodging ($10 to $40 per night depending on lodging location).

Contact Karina Veaudry at executivedirector@fnps.org or 407.895.8446 if you would like to sign up or assist with the retreat.

For information about Pine Lake Retreat, visit their web site at www.pinelakeretreat.com.

Palmetto is in need of articles on native plant species and related conservation topics, as well as high-quality botanical illustrations and photographs.Contact the editor for guidelines, deadlines and other information at pucpuggy@bellsouth.net, or visit www.fnps.org and follow the links to Publications/Palmetto.

Letters to the Editor Column to Debut

Soon, *Palmetto* will contain a new "Letters to the Editor" feature where readers will have a forum for comments on topics of general interest.

Letters must the writer's original work, no longer than 300 words, and should include the writer's name, e-mail address, telephone number and mailing address.

Letters will be printed at the Editor's discretion, and will be reviewed and edited.

E-mail letters to pucpuggy@bellsouth.net and include "Letters" in the subject line. Or mail to: Letters, Palmetto. 855 N.E. Stokes Terrace, Jensen Beach FL, 34957

The purpose of the Florida Native Plant Society is to preserve, conserve, and restore the native plants and native plant communities of Florida.

Official definition of native plant: For most purposes, the phrase *Florida native plant* refers to those species occurring within the state boundaries prior to European contact, according to the best available scientific and historical documentation. More specifically, it includes those species understood as indigenous, occurring in natural associations in habitats that existed prior to significant human impacts and alterations of the landscape.

Organization: Members are organized into regional chapters throughout Florida. Each chapter elects a Chapter Representative who serves as a voting member of the Board of Directors and is responsible for advocating the chapter's needs and objectives. See **www.fnps.org**.

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Features

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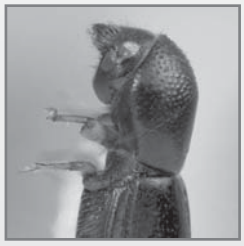
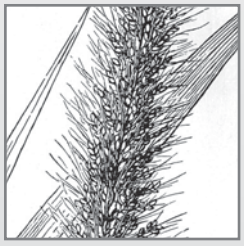
Laboratory techniques can be used to aid in the recovery efforts of many endangered plant species. Researches at the University of Florida explore the possibilities with *Ziziphus celata*, an extremely rare species endemic to the Lake Wales Ridge.



8 Laurel Wilt: A Serious Threat to Redbay and Other Related Native Plants

Laurel wilt has resulted in epidemic levels of redbay mortality in several states, including Florida. Learn about the insect vector that distributes a previously undescribed vascular fungus to redbay sapwood.



12 Fox-tail Millets – Bristly Foods

Regardless of whether you call the plants bristle-grasses, fox-tails, millets or fox-tail millets, remember that the seeds are edible when you see any of Florida's 4 native and 10 introduced *Setaria*. Dr. Dan Austin shares his knowledge of these "bristly foods" including how they taste.

Images, top to bottom: Ziziphus celata – photo by Shirley Denton. *Xyleborus glabratus* – photo by Michael C. Thomas. *Setaria macrosperma* – drawing by Edna May Whitehorn.

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Laurel wilt has resulted in epidemic levels of redbay mortality in a variety of habitats, including hardwood hammocks.
Photo by Albert (Bud) Mayfield, Florida Department of Agriculture and Consumer Services, www.forestryimages.org.

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Editorial Content: We have a continuing interest in articles on specific native plant species and related conservation topics, as well as high-quality botanical illustrations and photographs. Contact the editor for submittal guidelines, deadlines and other information.

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Printed on recycled content paper

By Christine Wiese and M.E. Kane

Environmental Horticulture Department
University of Florida, Gainesville

A New Method of Propagation for *Ziziphus celata* (Florida ziziphus), a Florida Endangered Species

Ziziphus celata photos (above and right) by Shirley Denton

About the authors
Dr. Michael Kane, Professor and Assistant Chair of Environmental Horticulture at the University of Florida, is director of the Plant Restoration, Conservation and Propagation Program. His research involves application of eco-physiological, genetic diversity, and *in vitro* propagation techniques for the reintroduction of native plants.

Christine Wiese received a Bachelor of Science in Public Horticulture from Purdue University in 1999 and completed a Master of Science in Environmental Horticulture from the University of Florida in 2002. She is a biologist in the Environmental Horticulture department at the University of Florida. She remains interested in Florida's native plants and is currently a member of the Florida Native Plant Society, Paynes Prairie Chapter.

Florida ziziphus (*Ziziphus celata* Judd and D. Hall) is a federally endangered shrub found only in two counties in central Florida (USFWS, 1999; Weekley et al., 1999). This deciduous shrub grows to 2 m tall and produces solitary and axillary flowers bearing greenish sepals and five white petals (Delaney *et al.*, 1989; Judd and Hall, 1984; Weekley *et al.*, 1999). Leaves are alternate, oblong-elliptical to slightly ovate and less than 25 mm long (Judd and Hall, 1984). Fruits are ellipsoid drupes of 10-20 mm in length and turn yellowish when ripe (Delaney *et al.*, 1989; Weekley *et al.*, 1999). [Fig.1]

Florida ziziphus is one of an increasing number of rare plant species found only along the Lake Wales Ridge. The Lake Wales Ridge is a remnant sandbar isolated by water from what is now the United States landmass during the Pleistocene age (Myers, 1990; Webb, 1990). Due to its isolation, unique ecosystems have developed along this sandy ridge. The Lake Wales Ridge is comprised of mostly high pine ecosystems including sand pine scrub (Myers, 1990). Florida ziziphus is found in the southern portion of the Lake Wales Ridge in a matrix of high pine and sand pine scrub ecosystems (USFWS, 1999; Weekley *et al.*, 1999).

Fig. 1 – Mature *Ziziphus celata* specimens, Bok Tower Gardens *ex situ* collection.

Florida ziziphus may have a significant ecological role in the high pine and sand pine scrub community. Rabbits have been observed eating fallen fruits, which may also be a food source for gopher tortoises and small rodents. Evidence of herbivory has been seen on stems and leaves, which also act as cover for small animals and birds (T. Race, Curator of Endangered Plants, Historic Bok Sanctuary, personal communication, 2000; USFWS, 1999).

Florida ziziphus populations have been reduced to just five sites most of which consist of only a few individuals (USFWS, 1999; Weekley *et al.*, 1999). Most individuals in the wild do not produce viable seed and populations are genetically isolated (Godt *et al.*, 1997). Genetic analyses using both allozyme electrophoresis and RAPDS techniques indicated that four of the five Florida ziziphus populations consist of a single genotype while the fifth population consists of seven genotypes (Godt *et al.*, 1997; C. Weekley, Archbold Biological Station, personal communication, 2001). Breeding studies conducted at Historic Bok Sanctuary, using plants propagated from root cuttings, indicate that Florida ziziphus is self-incompatible and crossing within a genotype does not occur (Burkhardt *et al.*, 1997).

Management tasks are currently undertaken by staff at Historic Bok Sanctuary (Lake Wales, FL) and Archbold Biological Station (Lake Placid, FL) to keep wild populations from declining further (Weekley *et al.*, 1999). However, in order for stable populations to be restored, sexually reproducing populations must be established. Cross-compatible genotypes must be established within populations. Currently however, the only method for propagating a specific genotype of Florida ziziphus is by root cutting, which is destructive to the donor plant. Application of more efficient propagation methods needs to be explored. One such method is micropropagation.

Micropropagation is the rapid *in vitro* production of plants on a sterile defined culture medium under controlled conditions of light and temperature. This technology has been applied to the efficient production of many plant species. One key advantage is that production can

Florida ziziphus populations have been reduced to just five sites most of which consist of only a few individuals.

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be initiated from very small pieces of initial plant material which results in little or no damage to the donor plants and produces plantlets that are genetically identical to the donor plant. In this study we explored the use of micropropagation as a potential method for generating specific genotypes of Florida ziziphus for use in producing sexually reproducing wild populations.

Successful plant micropropagation requires completion of several successive stages (Stages 0 - IV) (Kane, 2000b). The first stage (Stage 0) involves selecting and preparing the donor plant to increase the probability of establishment in culture. The plant material used to establish plant cultures varies. Excised embryos or seedlings are often used because frequently it is easier to remove potential bacterial and fungal contaminants from them that can affect plant culture growth. With *Ziziphus celata*, 1-year old seed produced in the Historic Bok Sanctuary Center for Plant Conservation's *ex situ* collection of endangered plants were used. Seeds were cleaned of their fruit, dried and then stored in brown paper bags at room temperature until experimentation commenced. [Fig. 2]

The next micropropagation stage (Stage I) requires establishment of aseptic (sterile) plant tissue in culture vessels on a defined medium. The culture medium usually consists of mineral salts, vitamins, and sucrose. Media are typically gelled with agar (a sea weed extract). Plant growth regulators are frequently incorporated into the medium. Many of these growth substances are naturally produced by plants and promote physiological responses like shoot growth or root growth when added to culture media.

We developed procedures to establish cultures of *Z. celata* using surface sterilized nodal sections excised from seedlings grown under greenhouse conditions. In March, 2001, 150 seeds were germinated in a soilless potting mix and maintained under greenhouse conditions until seedlings had produced approximately 10 nodes. The upper 6-7 nodes were removed from each seedling and cut into 2-node sections. Nodal sections were surface sterilized in dilute bleach (1.5% sodium hypochlorite), and then rinsed three times in sterile water. The nodal sections were placed on a sterile establishment medium consisting of Woody Plants Medium (WPM) mineral salts and vitamins (McCown and Lloyd, 1981), sucrose, supplemented with the plant growth regulator benzyladenine (BA) and solidified with 7g/L TC agar.

Shoot production occurred from axillary buds. These Stage I cultures were indexed for the presence of bacterial and fungal contaminants using Leifert and Waites sterility test medium (Phytotechnology Laboratories, cat. #L476, Shawnee Mission, KS) and procedures as described by Kane, (2000a).

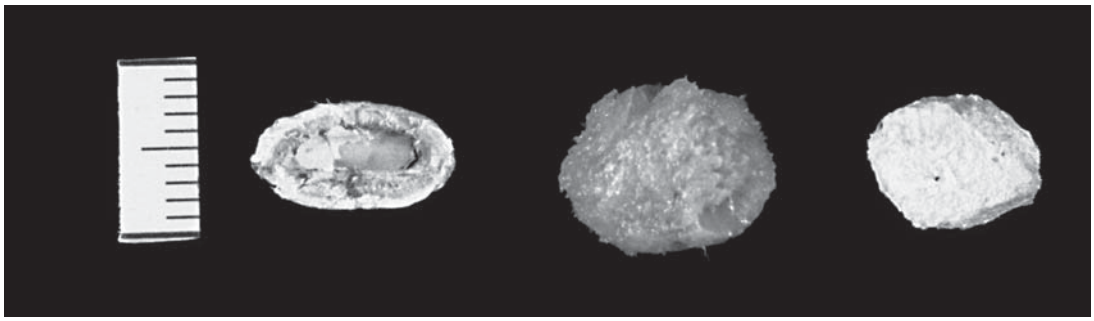

Fig. 2 – Cleaned *Ziziphus celata* seed. Scale bar = 10 mm.

Glossary

***Ex situ* ("off-site") conservation** A conservation method which entails the actual removal of germplasm resources (seeds, pollen, sperm, individual organisms) from the original habitat or natural environment.

In vitro (Latin for "in glass") Living in test tubes, outside the organism or in an artificial environment, typically in glass vessels in which cultured cells, tissues, organs or whole plants may reside.

Ex vitro (Latin for "from glass") Organisms removed from tissue culture and transplanted; generally to soil or potting mixture.

Source:
Food and Agriculture Organization of the United Nations –
Glossary of biotechnology and genetic engineering
www.fao.org/biotech/index_glossary.asp

Fig. 3 – Stage II shoot production of *Ziziphus celata* cultured on media supplemented with 0.25 µM BA and 14.4 µM GA_3 after 28 days culture.

After 28 days, indexed cultures determined to be contaminated were discarded.

The goal of the next micropropagation stage (Stage II) is rapid clonal shoot multiplication. Consequently, to achieve this, a series of experiments were conducted to optimize the culture medium, particularly the type and concentration of growth regulators, to promote maximum shoot production. Preliminary experiments indicated that, compared to BA, the plant growth regulators 2iP, kinetin, or zeatin did not promote shoot production (data not shown). However, the presence of BA alone in the medium promoted growth of very short shoots. Since the growth regulator gibberellic acid (GA_3) typically promotes shoot elongation, effects of lower BA levels (0, 0.25, 0.50, 0.75, or 1 µM) with and without GA_3 were evaluated. Explants consisted of a three node stem segment. The apical tip of each stem segment was removed before being placed horizontally on the medium surface. After 28 days, cultures were transferred onto fresh media with BA and GA_3 at the same concentrations and combinations. After 56 days, shoot number and shoot length were recorded.

Establishment of cultures using nodal sections from seedlings proved to be an efficient method of culture initiation. Contamination rates were low as based on culture indexing procedures. Maximum shoot production (8 shoots /nodal section) was observed on medium containing 0.5 µM BA and 15 µM GA_3. Stage II cultures consisted of clusters of small axillary shoots. [Fig. 3] These shoot cultures were separated into individual unrooted shoots called microcuttings. These microcuttings are typically rooted in culture or, preferably, directly under greenhouse conditions.

Results of preliminary experiments indicated that shoot microcuttings of *Z. celata* could not be rooted *ex vitro* (Stage IV). Consequently, attempts were made to induce microcutting rooting in culture (Stage III). The medium components were modified in an attempt to induce root formation. Various plant growth regulators called auxins were added to the medium. Although a few rooted plantlets were infrequently observed *in vitro* [Fig. 4], attempts to define a medium for *in vitro* rooting were unsuccessful. These results serve as the basis for future research including *in vitro* rooting by subculturing microcuttings onto a medium without growth regulators for several weeks prior to transfer onto rooting medium. Extremely infrequent rooting of microcuttings may be due to a number of factors, including genetic factors and should be evaluated further. Clearly, further experimentation needs to be completed to establish Stage II rooting and Stage IV acclimatization procedures for the micropropagation of *Z. celata*.

Although very high *in vitro* shoot multiplication rates were not achieved for *Z. celata*, the rates achieved on medium supplemented with the 0.5 µM BA (8-fold monthly increase) were acceptable to fulfill the objectives of this study. Mass production of the species on a scale required for most horticultural or agronomic crops is not required. With *Z. celata*, all that is required is that the generation of plant numbers of each genotype sufficient for restoration projects with little or no damage to the parent plant.

These experiments have provided important information about the challenges and potential to propagate *Z. celata* using micropropagation procedures. Currently, there are limitations using this method due to difficulties with rooting microcuttings. Uncertainties also remain regarding acclimatization procedures once microcuttings have been rooted. Currently, the only method other than micropropagation for propagation of a specific genotype of *Z. celata* needed for restoration purposes is by root cutting. Taking root cuttings is destructive to the host plant from which they are removed. Since so few individuals of *Z. celata* remain, root

Fig. 4 – *Ziziphus celata* microcuttings very rarely rooted. Microcutting shown rooted after 56 days culture in the presence of 5 µM indolebutyric acid (IBA), a plant growth regulator. Scale bar = 10 mm.

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Laurel Wilt: A Serious Threat to Redbay and Other Related Native Plants

By Albert E. Mayfield III

Introduction

Like many other ecosystems, our nation's forests are increasingly threatened by invasive exotic insects and disease-causing pathogens. To read even an abbreviated list of forest trees that have sustained substantial negative impacts due to these non-native pests is disheartening. Such a list would include American chestnut (ravaged by chestnut blight), American elm (Dutch elm disease), ash (emerald ash borer), American beech (beech bark disease), eastern hemlock (hemlock wooly adelgid), butternut (butternut canker), flowering dogwood (dogwood anthracnose), and white pine (white pine blister rust), to name a few. Unfortunately, one of the southern coastal plain's most common, attractive, and ecologically important tree species has become a recent addition to this growing list of native trees under siege by foreign invaders.

Redbay (*Persea borbonia* (L.) Spreng.), an aromatic, broadleaved evergreen found in woodland hammocks, on bluffs and coastal dunes, and in residential landscapes (Nelson 1994),

Figs. 1 and 2 – Lateral and dorsal view of adult *Xyleborus glabratus* Eichhoff beetles. The redbay ambrosia beetle (or RAB), a native of Asia, was first detected in the U.S. in 2002. The RAB introduces spores of a lethal wilt fungus into the sapwood of redbays and other host trees. Photos by Michael C. Thomas, Florida Department of Agriculture and Consumer Services, www.forestryimages.org

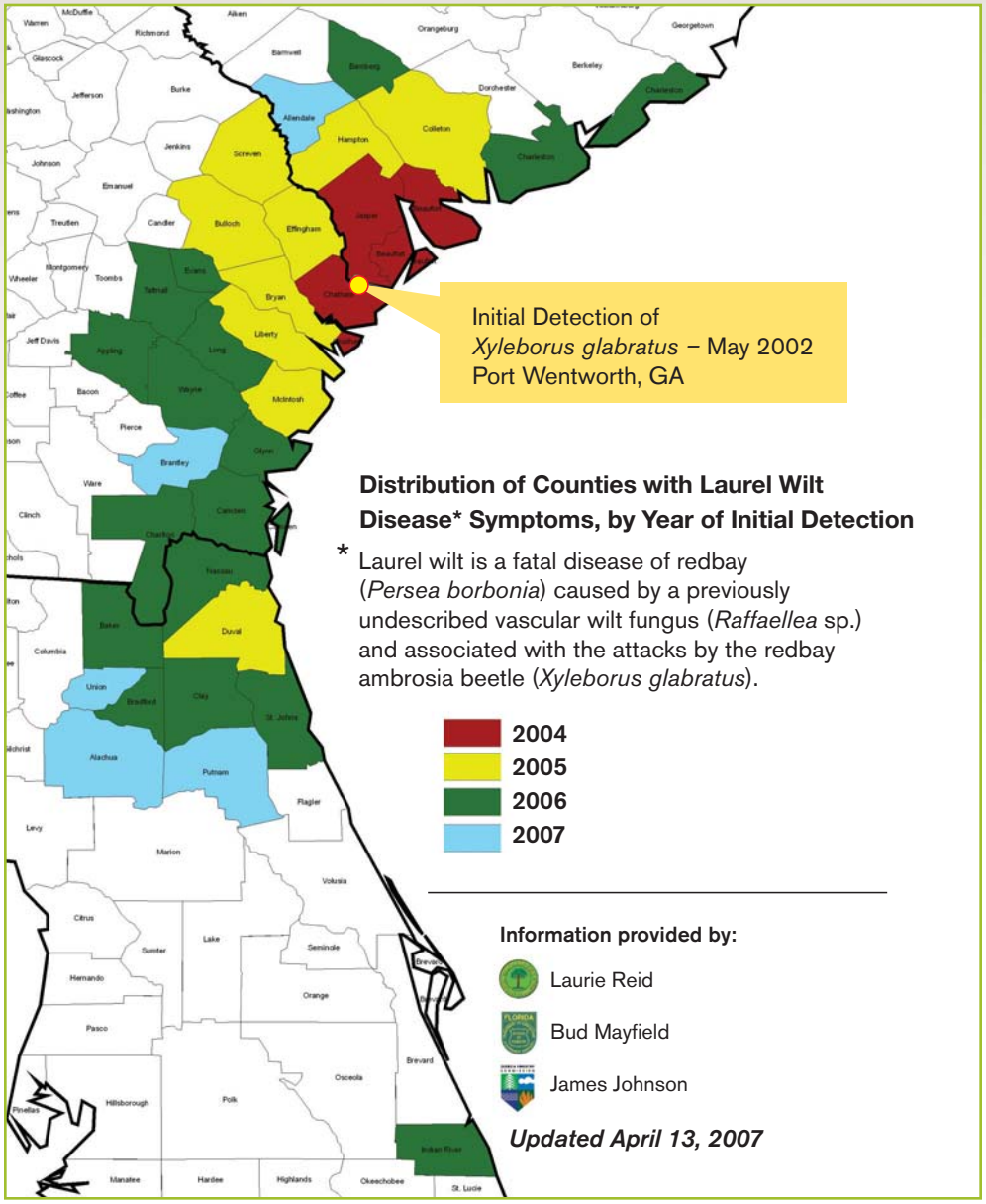

Fig. 3 – Counties in which trees with laurel wilt symptoms have been observed, by year of initial detection, as of April 2007.


Fig. 4


Fig. 5


Fig. 6


Fig. 7

Fig. 4 – Trees diseased with laurel wilt initially exhibit drooping foliage with a reddish or purplish discoloration.

Figs. 5 and 6 – Trees affected by laurel wilt exhibit a dark, blackish stain in the sapwood.

Fig. 7 – As the tree dies from fungal infection and is colonized by more ambrosia beetles, toothpick-like tubes or piles of fine sawdust may be observed on the bark.

Photos by Albert (Bud) Mayfield, Florida Department of Agriculture and Consumer Services, www.forestryimages.org.

is being severely impacted by a new disease called laurel wilt. Laurel wilt is caused by a previously undescribed vascular fungus (*Raffaelea* sp.) that colonizes the sapwood of its host tree, restricting water flow and causing the tree to wilt and die. This fungus is vectored by an Asian wood-boring insect, the redbay ambrosia beetle (*Xyleborus glabratus* Eichhoff), or "RAB". [Figs. 1 and 2] The RAB was first detected in a survey trap at Port Wentworth, Georgia (near Savannah) in 2002, but its association with the unusual and excessive redbay mortality occurring in that region was not recognized until late 2004 (Fraedrich *et al.* 2006). Since then, laurel wilt and associated redbay mortality has been detected in more than 33 counties in South Carolina, Georgia, and Florida. The distribution of this lethal disease is likely to continue to expand. [Fig.3]

Trees become infected with the laurel wilt fungus when RABs bore into the sapwood. In general, ambrosia beetles are fungus farmers: they create tunnels in the wood of host trees, inoculate those tunnels with fungal spores they carry on their bodies, and propagate the fungus as food. Most native ambrosia beetles are limited to dead, injured, or weakened trees (Wood 1982) and generally are not known to be disease vectors or pests of healthy trees. As an exotic insect in North America, however, the RAB is colonizing apparently healthy redbay trees in a wide variety of habitats, and its associated wilt fungus is functioning as an aggressive plant pathogen. The RAB is one of at least 25 new species of bark and wood-boring beetle species introduced into the U.S. since 1985, most of which are believed to have arrived accidentally in untreated solid wood packing material, such as crates and pallets used in international trade (Haack 2006).

Symptoms

Trees diseased with laurel wilt initially exhibit drooping foliage with a reddish or purplish discoloration. [Fig 4] This discoloration may occur in a portion the crown at first, but gradually the entire crown wilts and reddens. The foliage eventually turns brown and may remain on the branches for up to a year or more. Stem cross sections and removal of bark from wilted trees reveals a dark, blackish stain in the sapwood. [Figs. 5 and 6] The extent of this black staining (a response of the tree to the fungal infection) varies depending on how long the tree has been infected.

In the early stages of disease, an affected redbay may not show any obvious signs of ambrosia beetle attack, even though the tree has already been attacked and inoculated with the wilt fungus. Presumably, very few RABs are needed to successfully inoculate the tree; these early attacks are inconspicuous and may happen on branches in the crown or on the stem. Eventually, as the tree dies from fungal infection and is colonized by more ambrosia beetles, toothpick-like tubes or piles of fine sawdust may be observed on the bark. [Fig. 7] This dust is produced by the RAB and multiple other species of ambrosia beetles that colonize the dead tree.

Impact on Redbay

In areas where the RAB has been established for several years, the impact of laurel wilt on populations of mature redbay trees has been devastating. In plots monitored on Fort George Island, Duval County, Florida, redbay mortality associated with laurel wilt increased from 10% to 92% in just

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Fig. 8 – Leaves of redbay and other *Persea* species are the primary food source for larvae of the palamedes swallowtail butterfly.
Photo by Johnny N. Dell, Retired, www.forestryimages.org

15 months, including the death of all redbays over four inches in diameter (A.E. Mayfield and J.M. Eickwort, Florida DACS, unpublished data). Similarly high levels of redbay mortality from other areas of coastal South Carolina and Georgia have been reported by state forest health staff (J. Johnson, Georgia Forestry Commission, and L. Reid, South Carolina Forestry Commission, personal communication). Interestingly, seedling-sized redbays appear to be less affected by the disease, presumably because they are not as readily colonized by the RAB. Whether this will continue to be the case, or whether there will be any natural disease resistance in mature redbay populations, remains to be seen.

Although not prized for its timber, redbay is a species of notable ecological, cultural, and aesthetic value. Redbay produces annual crops of berry-like drupes that are eaten by songbirds, wild turkeys, quail, rodents, deer, and black bear (Brendemuehl 1990, Coder 2006). In addition to serving as winter browse for deer, leaves of *Persea* species are the primary larval food source for the palamedes swallowtail butterfly (*Papilio palamedes* (Drury)) (Hall and Butler 2005). [Fig. 8] Cultural uses of redbay have included its wood for trim on boats and cabinets, its leaves for flavoring teas and gumbos, and various plant parts for the medicinal purposes of Native Americans (Coder 2006). Although commonly a small to medium-sized understory tree, redbay can reach 70 feet in height (Brendemuehl 1990) and is an important shade tree in some residential neighborhoods, parks, and recreational areas. The visual impact of laurel wilt in a forest or neighborhood where redbay is abundant is striking. Although difficult to quantify, the losses associated with widespread mortality of redbay due to laurel wilt are numerous and diverse.

Other Host Species

In addition to causing epidemic levels of redbay mortality, laurel wilt has also been confirmed in the field affecting other species in the family Lauraceae, including sassafrass (*Sassafras albidum* (Nuttall) Nees), pondspice (*Litsea aestivalis* (L.) Fernald), and the endangered pondberry (*Lindera melissifolia* (Walter) Blume) (Fraedrich et al. 2006). Laboratory tests have also demonstrated the pathogenicity of the wilt fungus on spicebush (*Lindera benzoin* (L.) Blume) and swamp bay (*Persea palustris* (Raf.) Sarg.) (Fraedrich et al. 2006). In addition, both the RAB and the laurel wilt pathogen have been recovered from diseased avocado (*Persea americana* Mill.) seedlings planted near Jacksonville for monitoring purposes. What the impact of laurel wilt will be on these and other Lauraceous species is uncertain, but the growing list of hosts seems to warrant concern for other members of this important and diverse plant family.

Management

Unfortunately, management options for laurel wilt are very limited, and at this time there are no strategies that have actually been demonstrated as effective in preventing or reducing disease impact. The following are suggested as potential management tactics, based on approaches employed for similar wilt diseases of other trees (e.g., Dutch elm disease):

Avoid transport of infested wood. Perhaps the best short-term option for reducing (or at least delaying) the impact of laurel wilt is to help limit its spread, particularly by preventing human-aided transport of wood infested with the RAB. Although the RAB is undoubtedly spreading naturally via flight, geographically isolated occurrences of the disease (like the discoveries in Duval County in 2005 and Indian River County in 2006) suggest that the beetle may also be reaching new, distant areas via human-aided travel. Firewood, logs, other intact wood, or nursery stock of wilted Lauraceous trees should not be transported to unaffected areas. [Fig. 9]

Sanitation. The goal of sanitation is to destroy infected host trees before brood populations of the RAB emerge from them and spread to new host trees, thereby reducing or delaying the overall mortality level in a local area. This treatment would involve cutting and burning, burying, chipping, or tightly covering wood from wilted trees. Although individual beetles may theoretically be able to survive a standard chipping process due to their small size (about 2 mm in length), chipping might sufficiently dry out the wood to prevent ambrosia beetle survival, development and subsequent dispersal.

Diseased trees that are cut but cannot be destroyed or covered should be left on-site or disposed of as locally as possible. To my knowledge, very few sanitation efforts for laurel wilt have been attempted. Sanitation likely has the best chance of being effective if it is pursued very early and diligently, when only one or a few wilting trees are present in a given area. Sanitation treatments in areas where large percentages of redbay trees have already died are probably of little value toward delaying or preventing additional mortality.

Chemical control. As yet, there are no pesticides specifically labeled or recommended for use against the laurel wilt fungus or the RAB, or that have been demonstrated to prevent laurel wilt disease. Research trials evaluating the efficacy of certain fungicides and insecticides in protecting individual trees have been initiated.

Germplasm conservation. In light of the possibility of drastic reductions or complete loss of redbay populations in the Southeast, redbay seed collection efforts are being initiated by the USDA Forest Service National Seed Laboratory. Redbay seed will be placed in long-term cold storage for the purpose of potentially reintroducing the species at a future date, if and when the disease vector and pathogen are eliminated or controlled. This type of seed collection and conservation is already underway for other tree species threatened by exotic pests (e.g., see www.ashseed.org).

Biological control and development of genetically resistant hosts are among the potential long-term management strategies that could eventually be developed to battle laurel wilt, but such programs are very costly and take years or decades to develop.

In summary, laurel wilt is a deadly disease of redbay and other valuable native trees in the family Lauraceae. Unfortunately, it appears that laurel wilt is here to stay, and has the potential to spread throughout the range of redbay, which includes virtually all of Florida. As exemplified by the current laurel wilt epidemic, by the time exotic pests are detected and identified, they are often already established and "off and running" in their new environments to an extent that precludes their eradication. If we are to be even mildly successful in protecting our native forest ecosystems from exotic pests, we must prevent introductions rather than merely responding to them. Given the interconnected global economy in which we find ourselves, this is a daunting task. Real success will require international cooperation and commitment to the shipment of pest-free commodities, strict enforcement of effective phytosanitary standards, and serious consequences for non-compliance. Otherwise, the list of native forest trees under siege will continue to grow.

Fig. 9 – Posters cautioning campers not to transport redbay firewood have been posted at campgrounds within the range of laurel wilt. Photo by Albert (Bud) Mayfield, Florida Department of Agriculture and Consumer Services

Florida plants in the family Lauraceae:

- Redbay*– *Persea borbonia*
- Silk bay – *Persea borbonia* var. *humilis*
- Swamp bay– *Persea palustris*
- Avocado*– *Persea americana*
- Sassafras*– *Sassafras albidum*
- Pondspice*– *Litsea aestivalis*
- Pondberry*– *Lindera melissifolia*
- Northern Spicebush – *Lindera benzoin*
- Lancewood – *Ocotea coriacea*
- Love vine, Devil's gut – *Cassytha filiformis*
- Pepperleaf sweetwood – *Licaria triandra*

** indicates a confirmed host of laurel wilt in the field.*

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References:

Brendemuehl, R.H. 1990. *Persea borbonia* (L.) Spreng. Redbay. Pp. 530-506. *In*: R.M. Burns and B.H. Honkala (eds.). Silvics of North America, Volume 2, Hardwoods. Agriculture Handbook 654, USDA Forest Service, Washington, DC.

Coder, K.D. 2006. Identifying characteristics of redbay (*Persea borbonia*). Outreach publication SFNR06-4, Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA. 5 p.

Fraedrich, S.W., T.C. Harrington, and R.J. Rabaglia. 2006. An *Ophiostoma* species and *Xyleborus glabratus* threaten red bay (*Persea borbonia*) and other members of the Lauraceae in the southeastern USA. Poster presented at the conference: Advances in Threat Assessment and Their Application to Forest and Rangeland Management, July 18-20, Boulder, CO. Accessed 27 April 2007 at http://www.urbanforestrysouth.org/Resources/Library/.

Haack, R.A. 2006. Exotic bark- and wood-boring Coleoptera in the United States: recent establishments and interceptions. Canadian Journal of Forest Research 36: 269-288.

Hall, D.W., and J.F. Butler. 2005. Palamedes Swallowtail, *Papilio palamedes* (Drury). University of Florida, Institute of Food and Agricultural Sciences Extension, Document EENY-060. 2 p.

Nelson, G. 1994. The trees of Florida: a reference and field guide. Pineapple Press, Inc. Sarasota, FL. 338 p.

Wood, S. L. 1982. The bark and ambrosia beetles of North and Central America (Coleoptera: Scolytidae), a taxonomic monograph. Great Basin Naturalist Memoirs 6: 1-1359.

Fox-tail Millets ~ Bristly Foods

Daniel F. Austin

Ray Miller once wrote of me in The Palmetto, "he doesn't do grasses." Well, that has changed!

It seems that growing up in the swamps of western Kentucky and then slogging through the Everglades and Big Cypress for 31 years made a permanent impression on me. Although now I live in a desert grassland in southern Arizona, there is a *ciénega* (marsh) about 30 miles south of my home. Often I find myself there, looking at the plants and mentally comparing the flora with that of Florida. One of the plants in the Arivaca Ciénega is the grass *Setaria parviflora*, long called *S. geniculata*. That plant is so common on disturbed sites in Florida that I rarely paid attention to it. Here in Arizona it is notable, first because it is here (after all, it is not a desert plant), and second because it is shared with Florida. The Florida plants of *S. parviflora* grow in disturbed areas of flatwoods, hammock margins, marshes (brackish and fresh water), and coastal dunes and swales.

The Florida plants of *Setaria parviflora* grow in disturbed areas of flatwoods, hammock margins, marshes, and coastal dunes and swales.

To many people Florida's *S. parviflora* is knot-root fox-tail or *rabo de zorro* (fox-tail, Spanish). Others say the grass is *cepillo de fregar botellas* (bottle brush, Puerto Rico), *deshollinador* (the husker, Puerto Rico), *pajita cardosa* (little thistle grass, Chihuahua), *rabo de gato* (cat tail, Cuba), or *zacate amarga* (bitter grass, Mexico).

Wunderlin and Hanson's *Guide to the Vascular Plants of Florida* calls *S. parviflora* yellow bristle-grass. The similar *S. pumila*, native to the Old World, they call yellow bristle-grass or yellow fox-tail. Names of those two fox-tails are used interchangeably by many people because the plants are incredibly similar. These two have even been considered the same species in spite of originally growing on different sides of the Atlantic Ocean.

"Fox-tail" was used in the 1300s for the appendage of the European mammal called the red fox, *Vulpes vulpes*. Then in the middle 1500s, the name "fox-tail" was applied to grasses, alluding to the flower and fruit clusters that are long, slim, and resemble that mammal's long brush. Originally, "fox-tail" was used for *Alopecurus pratensis*. By the 1700s, meadow fox-tail

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Dan has a Ph.D in Botany from Washington University, St. Louis, Missouri. He is a Fellow of the Linnaean Society of London and a member of the International Association of Plant Taxonomists and the Society for Economic Botany.

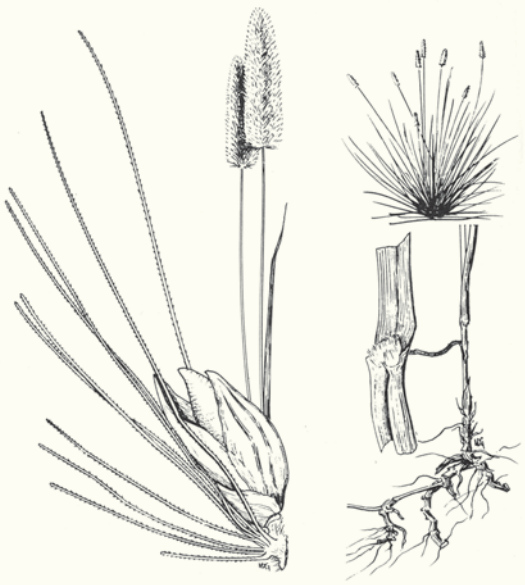
Dan resides in Arizona where his current research focuses on the ethnobotany of plant species shared between the Caribbean and northwestern Mexico and adjacent United States, and on the systematics and evolution of the Convolvulaceae.

(*A. pratensis*) and rough eared fox-tail (*Setaria italica*) were recognized. Although "fox-tail" is often applied as a single word, with modifiers added the name now includes several species of the grasses *Alopecurus*, *Bromus*, *Hordeum*, *Muhlenbergia*, *Setaria*, and *Vulpia*. Japanese use the word *enokoro* for all *Setaria*. *Enokoro* may be a corruption of *inu*, dog, and *koro*, diminutive where "*inu*" refers to both dogs and foxes. Even the Maya of Yucatán make the mammal comparison by saying *ne-kuuk-suuk* (*neh*, animal's tail, *k'uk'uk*, young part of a plant, *sak*, white). So do the Huastec of San Luis Potosí with *ehtill week ok* (like [a] fox tail) and the Fulani of Mali, who call it *laki davangel* (dog's trail).

Other people combine two names and call *Setaria* "fox-tail millets." *Setaria* is included with ten other genera (*Brachiaria*, *Digitaria*, *Echinochloa*, *Eleusine*, *Eragrostis*, *Panicum*, *Paspalum*, *Pennisetum*, *Sorghum*, *Urochloa*) that collectively are called "millets." The name "millet" (from Middle French *millet*) was in English by about 1425 when it was used for *S. italica*. "Millet" is ultimately from Latin *millium* (having a thousand grains), a word that also left cognate names in Italian *miglio*, Portuguese *milho*, and Spanish *millo* [*mijo*]. The combination "fox-tail millet" was not applied to *S. italica* until about 1929. Later, the name was expanded to all of the species in *Setaria*.

"Bristle-grass" was applied to *Setaria* by 1840. That name refers to the bristly awns that extend out from below the seeds. Germans make the same comparison, saying *Borstenhirse* (bristle grass). Some of the Old World species have such sharp bristles that flower or fruit clusters are put in granaries to discourage rodent predation. By the 1850s, "species" names were being applied to distinguish different kinds, as in "rough bristle-grass" for *S. verticillata*.

Not long after moving to Arizona in 2001 I began studying a canyon in the



Setaria parviflora **(Poiret) Kerguélen.**
Artist: unknown. From Leithead, H. L., L. L. Yarlett, and T. N. Shiflet. 1971. 100 Native Forage Grasses in 11 Southern States. USDA, Soil Conservation Service, Agriculture Handbook 389, Washington, DC.

Baboquivari Mountains southwest of my home. As I climbed up the canyon, I would pass two overlapping zones of fox-tails. Between about 3,800 and 4,200 feet were patches of *S. macrostachya* (plains bristle-grass, *zacate tempranero* [early grass]). Above 4,200 feet that fox-tail disappeared, but still with me was *S. grisebachii* (Grisebach's bristle-grass, *cola de ardilla* [squirrel tail]), just as it is lower in the Altar Valley where I live at 3,200 feet.

People have eaten the seeds (caryopses) of Old World *S. italica* for over 8,000 years and I started wondering again if anyone ever ate those of New World *Setaria*. I discovered that the seeds are edible for *S. parviflora* and for the species near my home. Moreover, they were formerly important in cultures from central Mexico to New England and the upper Great Plains. Eric O. Callen called *Setaria* grains the "first New World cereal," eaten in Mexico for perhaps 1,500 years.

Richard S. MacNeish and Lawrence Kaplan first reported *S. parviflora* as being food for the people in the Tehuacán valley of Mexico in 1960. The species was then discussed by Eric Callen in 1963. These grains appeared in the ^{14}C-dated 4000-3500 B.C. levels at the Ocampo Caves, and from the Sierra de Tamaulipas Caves dated at ca. 3000 B.C. These dates were before the domestication of maize (*Zea mays*) and fox-tail seeds were the best grasses available. Callen found that *S. parviflora* seeds were present in 71.5-77% of coprolites from the earlier levels in Tehuacán. Between A.D. 700-1500, *Setaria* had dropped to 20% in his samples, and continued to decline up to the Spanish arrival.

Setaria parviflora in the Mexican state of Tamaulipas, on the other hand, was a more important part of the human diet much later. Some have explained the difference by noting that maize did not appear in Tamaulipas until about 2200 B.C. Since maize arrived later than in the Tehuacán valley, *Setaria* remained an important cereal for longer in Tamaulipas.

Prehistoric use of the genus has now been extended from Tamaulipas and Tehuacán to people farther north and south in Mexico, the southwestern, central and eastern United States, and the Caribbean. We have records that seeds were eaten by pre-European people along the Río Grande river border between Coahuila, Mexico and Texas, the Pecos River of southern Texas, central Arizona east of Phoenix, the Big Sandy river of eastern Kentucky, the northwestern end of Lake Ontario, central Pennsylvania, and northwestern Iowa. There is even an archaeological site with *Setaria* in the Caribbean on San Salvador Island, Bahamas. These people represented the Arawakan islanders, Aztecs, the Salado culture, eastern Woodland cultures, Iroquoians, and Northeastern Plains groups. That is a diverse assemblage spanning a series of linguistic families.

There appear to be records of only two historic American tribes consuming seeds of *Setaria* – one by the Cocopa along the lower Colorado River, and the

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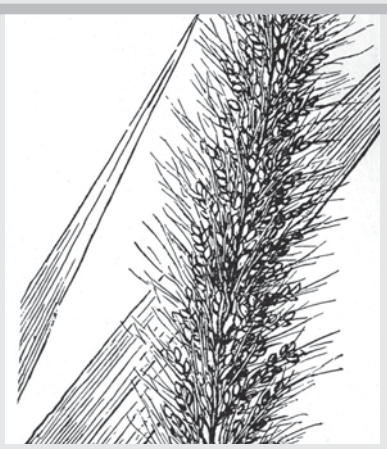
Fox-tail Millets ~ Bristly Foods

Setaria corrugata **(Elliot) J.A Schultes.** Artist: Edna May Whitehorn.



Setaria macrosperma **(Scribner and Merrill) Schumann.** Artist: Edna May Whitehorn.

Setaria magna **Grisebach.** Artist: Edna May Whitehorn.

Source: Hitchcock, A. S. and A. Chase. 1950. Manual of the Grasses of the United States. USDA Miscellaneous Publication No. 200, Washington, DC.

other by the Seri of coastal Sonora along the Gulf of Cortez. The Cocopa was experimenting with cultivating the Old World *S. italica*, and the Seri were gathering the native *S. macrostachya*. Seri call this grass *xica quiix* (globular things), and it was an important food to them into the 1980s.

What do millets taste like? Well, it depends on whom you talk with, and which one you eat. I have eaten millet raw (*Setaria*), in multigrain bread (*Panicum*), in porridge (*Panicum, Pennisetum*, *Setaria*), in Ethiopian *injera* (bread, *Eragrostis*), and made into *róka-farkú köles* (Hungarian crepes, *Panicum*). Raw, there is a somewhat nutty flavor so subtle that it almost cannot be detected. Of course, the species I tried from my front yard was not one of those recorded as being eaten by people. The bread mixture is excellent, but who could taste the millet? There are several other kinds of grains in the bread, but two kinds of wheat and oats dominate.

The porridge is certainly better than cream of wheat or oatmeal. I have never been fond of either of those, but many people think those are great. My wife Sandra took one taste of millet porridge and refused to touch it again. She is not like her Scotch-Irish great-grandfather who had a bowl of oatmeal porridge for breakfast every day of his long life. The last time I tried oatmeal was 1996 in Scotland. The dish was the Scottish specialty in the bed-and-breakfast where we stayed. The porridge was not sweetened, but revoltingly salty and served with a traditional cow-horn spoon. I tasted only a salty cow-horn and switched to eggs.

Our Hungarian neighbor Ildiko made the *köles* for an evening meal when we were visiting, and threatened to throw out the whole batch after sampling them. She made crepes of wheat flour for the meal, but kept the *köles*. I tried them, over her objections, and they were not nearly as bad as she portrayed them. They were a lot like the *injera* that our Ethiopian friend Nigist made a few years back in Florida. *Injera* is a pancake-like bread made of another millet, *Eragrostis tef*. Both were distinctive in texture and taste in a way that cannot be described – it has to be experienced. Actually, I liked the millet *köles* – but not well enough to completely substitute them for the wheat crepes.

So, why did people abandon *Setaria* as food such that New World records are mostly buried in archaeological literature? It is not a simple answer as there have been different reasons for diverse groups in distinct times and places. Some of the people in the Old World really did not like the way millet seeds taste any more than my wife or Hungarian friend. When different foods became available, people switched to those. Rice, our Japanese friend Kaoru contends, tastes better. Other people kept millets for making specialty foods like Japanese *awa okoshi* cakes and alcoholic beverages like Korean *dong dong ju* (a country sake). There are distinctive tastes that the grains impart to these products that have customary, ceremonial, and gustatory proponents. Some may even just like the cheap booze. I have not tried the rice cakes or sake, but they are recommended by my friends.

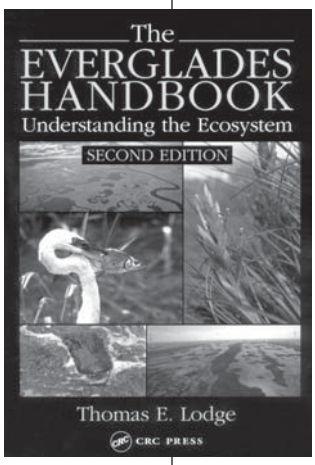
Regardless of whether you call the plants bristle-grasses, fox-tails, millets or fox-tail millets, remember that the seeds are edible when you see any of Florida's 4 native and 10 introduced *Setaria*. Still, you might want to let the wild birds and mammals eat their fruits. As of 1951 there were records of 67 birds and 10 mammals eating them; there are many more now. Wildlife has been eating *Setaria* far longer than humans, and they think the seeds are delicious!

For more information see: Austin, D. F. 2006. Fox-tail millets (*Setaria*: Poaceae) – abandoned food in two hemispheres. Economic Botany 60(2):143-158.

The Everglades Handbook – Understanding the Ecosystem

(2nd edition, 2005) by Thomas E. Lodge, CRC Press. **Reviewed by Suzanne Koptur**

When *The Everglades Handbook* first came out, I liked it, and used it as a supplemental text for the general Ecology course we teach at Florida International University. It was 'light-hearted, well-rounded, and highly readable' (quoting from a 1995 review I wrote), but a little light on the treatment of plants and the historical literature. Professors in Environmental Studies used it for the textbook for the Ecology of South Florida course, as it provided a concise introduction to all the habitats as well as a brief history of the geology and climate of the area. I am happy to report that in its second edition, it has gotten even better!



The author, an independent ecologist, agreed to teach one semester's offering of that course, and used his experience in teaching to guide the revision of his book. He has done a wonderful job. Though still highly readable, the book is now replete with references on every topic, so that interested readers can go to the sources he used, and learn more about every aspect of Everglades ecology. Each habitat has a plant list, and refers readers to relevant, up-to-date resources for plant distributions, conservation status, and illustrations. A new section on food webs helps the reader understand the importance of all the different habitats to the functioning of the ecosystem. The final section of the book reviews the influences of humans on the Everglades, including the impacts of specimen collecting and exotic introductions (plants and animals). Water and its movement determines what habitats exist and what organisms live there, and non-native humans transformed much of Florida over the last century with canals and draining flooded areas for agriculture and habitation. The author discusses Everglades restoration in a way everyone can understand, especially after his earlier explanations of geology and the aquifer system underlying the state.

Tom Lodge confides to his readers that he can understand the urge that many people have to collect things from nature, but says that once he learned to photograph things in nature, that urge subsided. The book has beautiful photos, mostly of animals and landscapes, but there are some distinctive plants, and the beautiful diagrams and maps convey the orderly complexity of habitat differentiation based on elevational differences of a few inches. After reading this book, who wouldn't want to visit this wonderful 'river of grass'? And for most visitors to the Everglades, eco-tourists, ecology students, and long-time residents of Florida, a better book for understanding the history and challenges to this ecosystem has probably not been written.

Suzanne Koptur is Professor of Biological Sciences at Florida International University, Miami, Florida.

A New Method of Propagation for *Ziziphus celata*

CONTINUED FROM PAGE 7

cuttings are generally taken only when the parent plant is in severe decline. For these reasons, micropropagation technology still holds promise for the restoration of the species and should be examined further to determine viable rooting and acclimatization procedures.

Literature Cited:

Burkhardt, S., T. Race., and C. Weekley. 1997. Breeding system of the rare Florida endemic, *Ziziphus celata*. Report to U.S. Fish and Wildlife Service; Vero Beach, FL.

Delaney, K.R., R.P. Wunderlin, and B.F. Hansen. 1989. Rediscovery of *Ziziphus celata* (Rhamnaceae). Sida 13:325-330.

Godt, M.W., T. Race, and J.L. Hamrick. 1997. A population genetic analysis of *Ziziphus celata*, an endangered Florida shrub. Journal of Heredity 88:531-533.

Judd, W.S. and D. W. Hall. 1984. A new species of *Ziziphus* (Rhamnaceae) from Florida. Rhodora 86:381-387.

Kane, M.E. 2000a. Culture indexing for bacterial and fungal contaminants. p.427-431. *In*: R. Trigiano and D. Gray (eds.) Plant Tissue Culture Concepts and Laboratory Exercises, 2nd Ed. CRC Press, Boca Raton, FL.

Kane, M.E. 2000b. Propagation from preexisting meristems. p.75-86. *In*: R. Trigiano and D. Gray (eds.) Plant Tissue Culture Concepts and Laboratory Exercises, 2nd Ed. CRC Press, Boca Raton, FL.

McCown, B. H. and G. Lloyd. 1981. Woody plant medium (WPM). A mineral nutrient formulation for microculture of woody plant species. HortScience 16:453.

Myers, R.L. 1990. Scrub and high pine. p.150-193. *In*: R.L. Myers and J.J.Ewel (eds.) Ecosystems of Florida. University Press, Orlando, FL.

United States Fish and Wildlife Service (USFWS). 1999. Recovery plan for *Ziziphus celata* (revised). U.S. Fish and Wildlife Service. Atlanta, Georgia.

Webb, S.D., 1990. Historical biogeography. p.70-100. *In*: R.L. Myers and J.J.Ewel (eds.) Ecosystems of Florida. University Press, Orlando, FL.

Weekley, C., T. Race, and D. Hardin. 1999. Saving Florida ziziphus (recovery of a rare Lake Wales Ridge endemic) The Palmetto 19:2.

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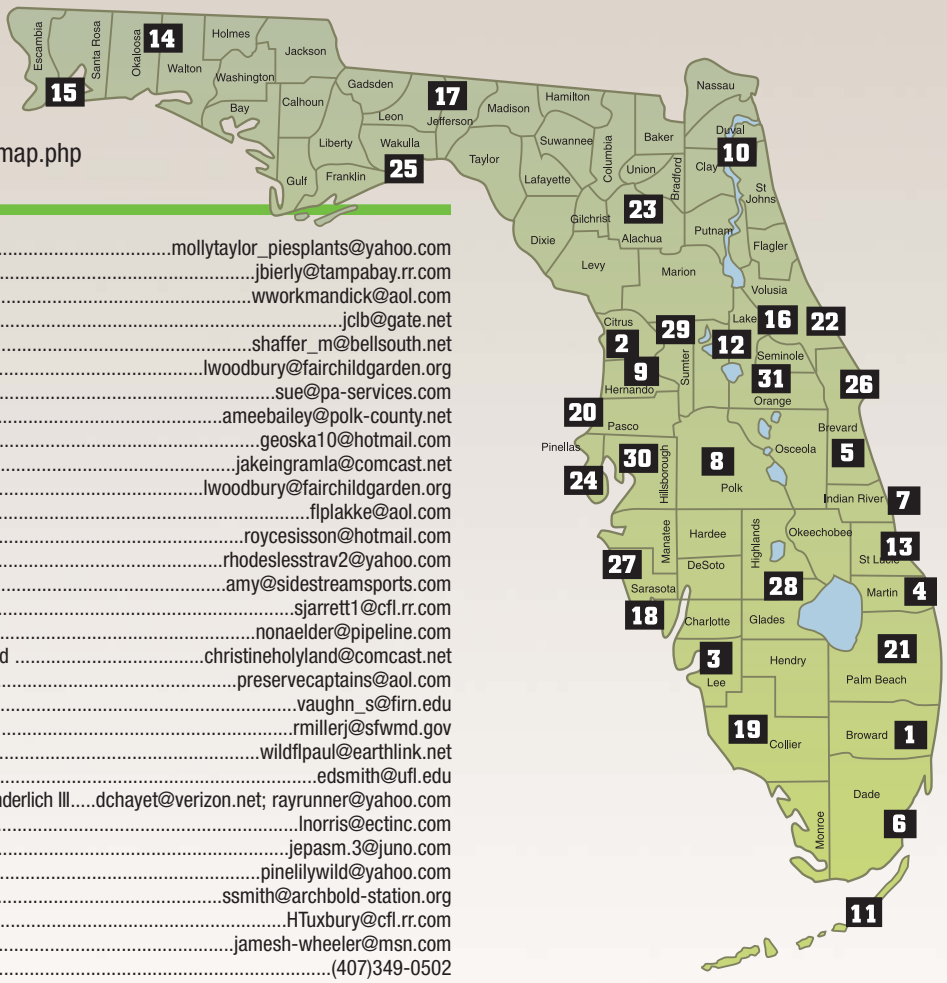

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