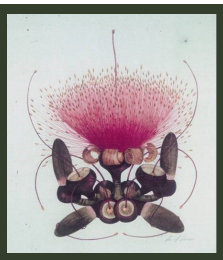
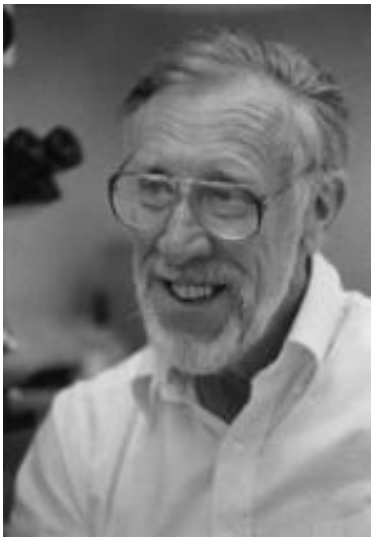
Gifford Arboretum Newsletter

Spring 2014 Volume 9, Issue 2



Dr. P. Barry Tomlinson 26th Annual Gifford Lecturer



The Gifford Arboretum is pleased to welcome P. Barry Tomlinson, Ph.D. as our 2014 Gifford Lecturer. Dr. Tomlinson is a world-renowned expert on plants, and on palms in particular. After 33 years as a Professor of Botany at Harvard University, he retired in 2003 and is now Professor of Botany *Emeritus* at Harvard. He is not a stranger to Miami, and he continues to serve as the Crum Professor of Tropical Botany and Scientist in Residence of the National Tropical Botanical Garden at the Kampong. He is also a Research Associate at both Fairchild Tropical Botanic Garden and Montgomery Botanical Center.

Dr. Tomlinson's professional background includes earning a B.Sc. in Botany in 1953 and a Ph.D. in Botany in 1956 from University of Leeds, U.K., and an A.M. (Hon.) degree from Harvard University in 1971. After earning his Ph.D., Dr. Tomlinson served as a member of the faculty at the University of Malaya in Singapore and at the University of Ghana in Achimota, Ghana. He then returned home in 1959 to serve as a Lecturer in Botany at the University of Leeds, U.K.. His association with the U.S. and Miami began in 1960 when he became Research Scientist at Fairchild Tropical Garden. He continued to serve as a Research Associate at Fairchild after he joined the faculty of Harvard University in 1971.

Dr. Tomlinson has worked extensively on the structure of palms, and his work includes several books and chapters on the Arecaceae. He has also published several books that combine original research results with literature surveys, mainly in tropical biology, for students working in the fields of ecology and systematics. He has also written authoritative works on tree architecture, mangroves, sea grasses, and the regional flora of southern Florida. In addition, he has published three monographs in the series *Anatomy of Monocotyledons* that was published by the Oxford University Press.

Throughout his career as a researcher and science educator, Dr. Tomlinson has always maintained "ask the plant" as the motto for his methodology. He believes that the most reliable source for seeking solutions to problems in botany is the direct study of plants. This has been the principle behind his research and he believes that inquiry-based observation is very important for students. Dr. Tomlinson's graduate classes in South Florida, offered during the summers through Harvard University, is very popular among students from North America as well as overseas. He has also been involved in the Kenan Fellowship program of the National Tropical Botanic Garden, which emphasizes inquiry-based instruction helpful to college biology professors. It has been estimated that more than 5,000 students have been impacted by and benefitted from this program.

Dr. Tomlinson's contributions to botanical science have been recognized by many prestigious organizations during his distinguished career. In the early stages, he was awarded the Montgomery Medal by Fairchild Tropical Garden in 1976. He was later awarded the Merit Award by the Botanical Society of America in 1990, the highest honor bestowed by the Society. It is awarded in recognition of someone who has demonstrated excellence in basic research, education or public policy, or who has provided exceptional service to the professional botanical community. He was also awarded the Gold Medal for Botany by the Linnaean Society of London in 1999, and the Smithsonian Institution honored him in 2002 by awarding the Cuatrecasas Medal for Excellence in Tropical Botany. Dr. Tomlinson was also awarded an honoree D.Sc. degree from the University of Guelph, Canada in 1997. Some of his more recent distinctions include a Symposium in his honor that was held by the Botanical Society of

America in Providence, RI, in 2010. He also presented a banquet address on "The Origin of the Monocot Vasculature: A Typological Approach", at the 5th International Conference on Comparative Biology of Monocotyledons in July 2013.

It is an honor and a privilege for us to welcome this distinguished scientist as the 26th Gifford Arboretum Lecturer. We are looking forward to **"Longevity in Plant Cells: Are Palms the Longest-Lived Trees?"**, a presentation in which Dr. Tomlinson will explore the fundamental nature of cell longevity in palms based on research that he initiated at Fairchild Tropical Garden and continued at Harvard. The question is whether palms have the secret of eternal youth – something sought in Florida by Ponce de Leon, who was bent on locating the mythical "Fountain of Youth."

Dr. Tomlinson teaching a class

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Beneficial Uses of Microbes for Improved Food Supplies

By: Philippe Douillet, Ph.D.
University of Miami Adjunct Professor and President of Ecomicrobials LLC

Recent reports from the Human Biome Project have caused great impact by showing the magnitude of the relationship we have with microbes. We host ten times more microbes in our bodies than human cells (100 trillion microbes, but only 10 trillion human cells per individual)! More importantly, this Project has brought into perspective the massive number of interactions we have with those microbes. These range from easily conceived protection of our skin from pathogens, to the impacts of gut microflora in obesity, diabetes, and even neurological conditions such as autism.

Just as microbes developed close relationships with humans, they also did this with plants and animals, many of which have been on our planet much longer than us. Not a single living plant or animal has been found without bacteria associations, and when grown without bacteria (under axenic conditions) both plants and animals develop poorly and incompletely. Even for more complex and less obvious interactions, such as those developed by arbuscular mycorrhizae fungi with plants, it has been found that over 95% of plants form symbiosis with these fungi.

I have now been working for over 30 years with beneficial microbes as they relate to plants and animals. I studied marine biology during college and also earned advanced degrees in this area. I have a passion for aquaculture, and I received my Ph.D. from Oregon State University in Fisheries and Aquaculture. However, early on, I noticed that microbes were blamed for culture problems such as disease and mortality, poor growth, high costs, and inefficiencies in water quality maintenance, etc., and, in all cases, microbes were treated as some black box for which there was only limited control.

I then started working with whole microbial communities, which were able to regulate stability in crustacean cultures and provide nutrients to supplement nitrogen poor diets, such as grass clippings. These regimes yielded better growth than those obtained with expensive, protein-rich diets. I found that these microbial communities could be stabilized and their beneficial effects transferred to bacteria-free crustacean cultures. However, the species composition of these beneficial communities could change, and it was impossible to control them long term.

I continued working with defined, single strains of beneficial microbes. Even though consistent beneficial effects under laboratory conditions could be obtained with these single strains, their applications in the field were not always consistent. This was an observation that I had also made with commercial probiotic products based on single strains.

Bacillus bacteria used as probiotics in agriculture and aquaculture applications

My next step was to work with defined blends of synergistic microbes. These communities of known composition do provide consistent beneficial effects in different crops as well as environmental conditions. They are more stable as a community than single strains, in part because they can utilize diverse mechanisms to accomplish a specific goal. For example, in order to control a fungal pathogen, a blend of bacteria can produce and secrete needed enzymes that break down the cell wall of the pathogen;

produce a whole array of antibiotics; and absorb and sequester essential nutrients for the pathogen by means of siderophores.

As a result of this research, I developed a blend of Bacillus that resulted in consistent control of the pathogen *Phytophthora* during two years of research on peppers and tomatoes, with no failures even in different geographical areas and crop varieties. This blend was patented in the U.S., and it has been found to control an array of fungal pathogens in plants. Part of the success was also due to the development of a balanced nutrient for the microbes, as they require building blocks to produce an array of complex beneficial molecules such as enzymes, vitamins, phytohormones and antibiotics.

This same approach has been used to control mortality in a fish farm in Florida where mortality rates had been very high for over a decade while utilizing conventional treatments with antibiotics and vaccines. Isolation studies revealed that there were 5 different pathogens associated with the diseased fish. A blend of Bacillus was formulated using in vitro antagonism studies against the pathogens isolated from the fish. With this approach complete bio-control of the disease was achieved (Douillet & Robinson, Global Aquaculture Advocate, May-June 2008), and the fish mortality rates plummeted.

There is no single magic bullet to efficiently control pathogens and reduce the stresses that organisms are exposed to. Microbial management is required to provide the conditions for the microbes to develop and perform their diverse mechanisms of biocenosis, and this is where beneficial interaction with other scientists came into play. Several years ago, I started working with Dr. Daniel Benetti from RSMAS on a project to improve larval survival of the marine fish Cobia (*Rachycentron canadum*). The fish reproduced well in captivity; however, the survival of larvae to fingerlings was low (around 5%). An integrated management that included the use of Bacillus probiotics developed by the team lead by Dr. Benetti has resulted in survival rates of 30 to 35%. We continue to work to further improve these percentages.

Similarly, integrated management of systems with probiotic bacteria have been developed in Ecuador with German, Russian and Ecuadoran scientists. We have been able to consistently increase yields in banana crops by 30% for more than a decade while also controlling the deadly Sigatoka fungus disease without the use of pesticides. In other crops such as rice and shrimp, the increases in yield have been in some cases over 100% with similar integrated management approaches.

Microbes in the soil have many functions, and they are well known for recycling nutrients such as nitrogen and phosphorus. This recycling allows a whole array of microbes to proliferate in the soil. Bacteria are the organisms with the highest proportion of nitrogen in their tissues; their C/N ratio is 3. The immediate bacterial grazers such as protozoa or nematodes have a C/N of 30 to 50, so they need to excrete nitrogen after grazing on bacteria, and this nitrogen is in the form that plants assimilate best. The reason plants excrete through the roots up to 25% of the carbon they fix is to attract and feed bacteria and to create a food web close to their roots in order to get valuable nitrogen. This is the natural way of nitrogen fertilization in the soils. But the use of fertilizers and pesticides reduces the diversity and density of microbes in the soil, making them less productive. Under those conditions, plants become more dependent on fertilizers to get their nutrients. However, fertilizers are very simple in composition (mostly NPK formulations) and do not satisfy all plant nutritional requirements. Therefore plants become weak and release biochemical compounds into the environment that signal predators and pathogens that they are debilitated and easy targets. This can in turn be the beginning of an outbreak of disease, and the response by growers usually is to use more fertilizers and pesticides, thus compounding the cycle of soil degradation.

Banana bunches produced in a commercial farm in Ecuador under conventional methods using pesticides on the left, and under a 100% organic integrated management that includes the use of probiotic bacteria on the right

Lead by Dr. Elaine Ingham, a group of scientists at Oregon State University has worked extensively on the organisms that live in the soil. They were so successful in explaining poor growth performance in crops that they formed a company called Soil Food Webs that performs soil analysis of the diverse groups of soil organisms. After decades of work, we have now been able to corroborate the findings of Soil Food Webs in many countries and in diverse ecosystems from desert to forest soils. The use of microbial management that includes some organic and inorganic additives has increased soil organic matter in desert soils from a content of 0.03% to 0.8% in only a couple of years. Furthermore, it was demonstrated that when microbes in the soil retain nutrients and water, erosion is also reduced. With microbial management in many agricultural ecosystems, we were able to increase yields by 30 to 40% while also using 30 to 50% less fertilizer and 40% less water than conventional methods. Increasing food yields while decreasing adverse environmental impacts should be a global goal in agriculture.

Ecomicrobials LLC's most recent achievement has been in integrating fish farms with hydroponics in Florida. Tilapia are first grown under intensive conditions in bioreactors where they are cultured with floc technology enriched with our Bacillus blend. The result was that there was little to no accumulation of sludge as the probiotics and biofloc converted the waste into natural feed for the fish. This microbial-based feed allows the production of fish with feed conversion rates of 0.9 instead of 1.4 kg of feed per kilogram of fish produced. The water from the fish tanks is then used to feed hydroponic crops such as passion fruit and Chinese sour melon grown in coconut fiber with yields significantly in excess of those reached with conventional fertilizers. Other fish farms in the Homestead area that also use probiotics have been able to reduce their water consumption by 80%, their feed consumption by 28%, and their energy bills by 25%.

For many years the main criticism to biological control has been the inconsistency of results. But with these integrated management strategies, we can now get results that are as consistent as chemical managements, but with higher yields at similar or lower production costs. The benefits to the environment of not damaging our soil and water are a very important bonus.

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Director's Message

By: Steve Pearson

I am pleased to report that our work on a new Arboretum catalog is proceeding nicely. We now have listings by Exhibit area of every plant in the Arboretum's collection, as well as initial plot maps for every Exhibit. Professor Don Olson's mapping class is now using GPS to refine our plot maps and, once that work is completed, our new catalog will be complete. We will then post these materials on our website and move on to completing needed new signage for the Arboretum.

Special thanks to TREEmendous Miami for co-sponsoring our annual picnic in December, 2013. TREEmendous Miami is a volunteer based tree-planting group that has done so much to improve the beauty and environmental health of our area. Its many projects include the plantings of flowering and native trees in the Metrorail corridor of the City of Miami's portion of South Dixie Highway, and extensive work on Virginia Key to restore that area's native plant community.

Special thanks also to the South Florida Cactus and Succulent Society for co-sponsoring our first Cactus and Succulent Symposium on April 26, 2014 from 9 AM to Noon. This will be a great opportunity to learn more about this fascinating group of plants, and I hope that you will plan to attend.

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Allspice Linked to Potential Cure for Prostate Cancer

University of Miami scientists have used Allspice (*Pimenta dioica*) to create an extract that was then mixed with distilled water to create a solution for application to human prostate-cancer cells. The solution significantly slowed the growth of cancer cells within 48 hours, and killed 50% of the cancer cells, compared with only 10% of noncancerous control cells. Continuous treatment was also shown to significantly interfere with the formation of cancer-cell colonies.

An antioxidant compound called ericifolin that is found in Allspice is attributed with being the active ingredient that produced these results. It works by suppressing a hormone that stimulates prostate-cancer growth. However, further testing is continuing as the safety of the strong doses of ericifolin used in this research had not yet been determined.

The Arboretum contains a specimen of *Pimenta dioica* in our Myrtales Exhibit. Please take a leaf and break it to enjoy the wonderful smell of this plant's aromatic oils.

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Science is a flickering light in our darkness, but it is the only one we have and woe to him who would put it out.

Morris Raphael Cohen

UNIVERSITY OF MIAMI
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The John C. Gifford Arboretum
University of Miami

2014 Plant of the Year – *Cordia bahamensis* (Boraginaceae)
(Bahama Manjack, Granny Bush)

Available for distribution in Spring 2014

Figure 1: The habit of *C. bahamensis*
Photo credit : Richard Lyon's Nursery Inc.

Figure 2: Flowers of *C. bahamensis*
Photo credit : Ethan Freid

Figure 3: Fruits of *C. bahamensis*
Photo credit : Roger L. Hammer

Importance

- Native to South Florida and the Bahamas

Source of the image : http://plants.usda.gov

- Presumed extirpated in South Florida
- Provides food for virtually all urban butterflies and many birds
- Has been introduced to the horticultural trade due to the presence of conspicuous red fruits and its importance to birds and butterflies, but it is still very rare in cultivation

Habit

- Shrub to small tree up to 12 feet high
- Bark - Black, with whitish lentils
- Leaves - Elliptic, may have a toothed margin, scabrous scales on the surface. About 10 cm long.
- Flowers – Small, white, arranged in heads
- Fruit – A berry that turns red on maturity

Growth Requirements

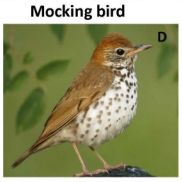
- Watering: Xeriscapic
- Light: Full Sun is best
- Salt Tolerance: None
- Growth: Slow to Moderate

Birds that feed on *C. Bahamensis*

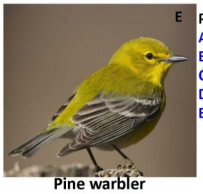
Gray catbird

Mocking bird

Blue headed vireo



Wood thrush



Pine warbler

Photo credit:
A: www.eclegeirn.wordpress.com
B. Ryan Hagerty
C. www.abel2know.org
D. www.birds.audubon.org
E. www.birds.audubon.org

Butterflies that feed on *C. bahamensis*

Zebra Butterfly

Julias Butterfly

Gulf Fritillary

White Peacock

Common Buckeye

Grey Hairstreak

Monarch butterfly

Swallowtail butterfly

Photo credit:
A: www.flheritage.com
B. Tim Knight
C. www.naba.org
D. www.caymanwildlife.org
E. Charles Montford
F. www.miamiblue.org
G. Anuradha Gunathilake
H.www.entnemdept.ufl.edu

SUMMARY OF EVENTS SINCE FALL 2013 NEWSLETTER

December 7th, 2013: The **Annual Picnic** began with a tour of the Arboretum by Steve Pearson, followed by a delicious lunch hosted by the Arboretum and TREEmendous Miami. After lunch, Gary Hunt (GA Advisory Committee and board member of TREEmendous Miami and Tropical Audubon) gave a presentation on landscaping to benefit native fauna, and Steve Woodmansee (GA Advisory Committee, President of the Florida Native Plant Society, and graduate of UM's Biology Dept.) then led a special tour of the South Florida Natives Exhibit.

Left: *Part of the attendees at the picnic enjoying lunch* ***Right:*** *Gary Hunt talking to the gathering on landscaping to benefit native fauna*

January 15th, 2014: Ben Pernick and his Jazz Trio kicked off **Music in the Arboretum** for the spring semester with an hour of lively jazz music, including original compositions.

February 5th, 2014: Dr. Suzanne Koptur, Professor of Biological Sciences at Florida International University presented "**Pollination Mechanisms and Plant/Animal Interactions in the Apocynaceae (Milkweed Family)**." Attendees learned about the floral architecture of the Apocynaceae and the various interactions that these flowers have with their pollinators.

Left: *Dr. Suzanne Koptur speaking to the Friends of the Arboretum* ***Right:*** *Stamps Woodwind Quintet performing in the Arboretum*

February 16th, 2014: Tour of the Arboretum - Steve Pearson, Director of the Gifford Arboretum, conducted a tour with a special focus on the Malvales Exhibit.

February 19th, 2014: Music in the Arboretum – A performance by the Stamps Woodwind Quintet from the Frost School of Music was enjoyed in the Arboretum.

March 5th, 2014: Dr. Osman Gutierrez, a Research Geneticist with the USDA's Agricultural Research Services in Miami presented "**Making a Better Chocolate: Breeding, Diseases, and Marker Assisted Selection in Cacao**." After indicating the growing demand and disease problems faced by the chocolate industry, his talk focused on the role modern science is playing in improving the production process with higher yields, quality, and disease resistance in *Theobroma cacao*.

March 19th, 2014: Music in the Arboretum performance by the Mélange Winds, a woodwind quintet, was enjoyed along with a variety of botanical sights and smells.

March 28th, 2014: Arboretum Director **Steve Pearson** presented **"The Strategic Role of Botanic Gardens in the 21st Century"** at the Friday Seminar Series of UM's Biology Department. After briefly describing the roles of gardens in history, literature and philosophy, Steve discussed the critical roles of gardens today. *(cont.)*

March 30th, 2014: Tour of the Arboretum and Special Music Performance -Steve Pearson led a tour of the Arboretum followed by "Musical Pictures for a Sunday Afternoon," a solo, atmospheric bass guitar performance by Randy Nutt, an accomplished and renowned visual artist who is also a very talented and original musician.

Girl Scouts earn "Bugs" and "Flowers" badges at the Arboretum

On March 1, 2014, Professors Barbara Whitlock and Alex Wilson worked with Biology graduate students Allie Graham, Sarah Cowles, Winter Beckles, Andrea Westerband, and Kelley Erickson to host a group of Girl Scouts in the Arboretum. The Brownies earned their "Bugs" badge, and the Juniors earned their "Flowers" badge. Activities included looking at and learning about different classes of insects, and learning about the major traits of several plant families. The girls picked flowers to then make corsages and perfume in the laboratory.

Students in Professor Leo Sternberg's Medicinal Botany class utilize the Arboretum

We have some great programs and activities lined up for the remainder of the Spring Semester. Please check them out and plan to join us!

April 16, 2014 – Music in the Arboretum at 6:00 PM. The Stamps Bass Quintet, another talented ensemble from UM's Frost School of Music, will be performing. Please bring a folding chair or blanket for your listening and viewing comfort. This is a very nice way to end your day.

April 26, 2014 – Cactus and Succulent Symposium from 9:00 AM to Noon. Co-sponsored by the South Florida Cactus and Succulent Society and the Gifford Arboretum, this will be the first of what is hoped to become an annual event. The morning will begin with a **Tour of the Arboretum's Cactus and Succulent Plants** led by Gifford Arboretum Advisory Committee member **Juan Espinosa-Almodovar** at 9 AM. The Symposium then moves inside to Cox Science Center Room 217 where **Corine Ferré** will present "**Cultivation of Cacti and Succulents - Have it Your Way!**" at 10.00 AM, followed by the keynote address by renown naturalist **Roger Hammer** on "**The Native Cacti and Succulents of Florida**" at 11 AM.

May 7, 2014 –Friends of the Gifford Arboretum Meeting and Presentation by Ms. Georgia Tasker – A well-known and respected author and plant expert, Ms. Tasker was garden writer for The Miami Herald for more than 30 years and now writes for Fairchild Tropical Botanic Garden. She will speak on "**Pathogens, Parasites and Pesticides put Honeybees in Peril**." This is a topic that should be of great interest and concern to all of us. 7:00 PM in Cox Science Center Room 166.

All Gifford Arboretum events are free and open to the public. For further information about upcoming events or for driving directions, please visit our website at www.bio.miami.edu/arboretum.

Please Donate to the Gifford Arboretum

Mailing Address: John C. Gifford Arboretum, Rm. 231 Cox Science Center
University of Miami, 1301 Memorial Drive, Coral Gables, FL 33124-0421
Website: http://www.bio.miami.edu/arboretum

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Your Name: _____
Address: _____
City: _____ State: _____ Zip: _____
Phone: _____ Email:_____

❒ **Please keep me informed of activities at the Gifford Arboretum.**

❒ **Please find enclosed my tax-deductible donation to the University of Miami-Gifford Arboretum. (Tax deduction excludes value of benefits)**

❒ **Please send me information about including the University of Miami in my estate plans.**

Membership levels (annual)		**Benefits**
❒ **Student friends**	**$5**	**newsletter and discounts**
❒ **Friends**	**$25**	**newsletter and discounts**
❒ **Supporters**	**$100**	**all above plus t-shirt**
❒ **Donors**	**$1,000**	**all above plus special luncheon**
❒ **Benefactors**	**$5,000**	**all above plus display on plaque**

T-shirt size (circle one): S, M, L, XL

Make your donation by check: Total amount enclosed $_____
(payable to *University of Miami– Gifford Arboretum*)
by credit card: Amount $_____
Type of Card (Master Card, Visa, AMEX, etc) _____