Editors' Note: This is the fifth in a six-part series of articles highlighting the research being performed at the University of Florida in Gainesville.

Breeding Brilliance

The University of Florida's breeding program involves a diverse array of projects spearheaded by a group of talented plant scientists.

By Rosanna Freyre, Dave Clark, Zhanao Deng, Brent Harbaugh and Jake Henny

The University of Florida has the largest university floriculture breeding program in the United States. Throughout its 60-year history, the program has become known for introductions of gladiolus, gypsophila, orchid, caladium and foliage varieties. The program has evolved to focus on foliage, lisianthus, gerbera, caladium, coleus, other bedding plants, and tropical flowering and foliage landscape plants.

Strengths of the program include the diversity of crops being addressed and the varied backgrounds of the scientists involved. Additionally, strong cooperation exists with commercial breeder companies and scientists within the university and at other schools. An important goal of the program is to develop young plant breeders needed by the commercial industries.

Unlocking Pollination

Jake Henny
Mid-Florida Research & Education Center
Apopka, Fla.

Foliage plants are the focus of Jake Henny's efforts at the Mid-Florida Research and Education Center in Apopka. Henny still uses traditional methods for most of his breeding work and states that "unlocking pollination has been the key to all breeding work with the aroids." His goal has been breeding new characteristics of foliar color, stem branching, cold hardiness, heat tolerance and disease resistance.

Thirty years ago, Henny participated in collecting a variety of germplasm from the jungles: beautiful species of dieffenbachia, aglaonema and anthurium. But the whole program mission of creating novel hybrids depended on pollen supply. The discovery that gibberellic acid induces blooming on demand cracked the field wide open. The other key was finding that high relative humidity was necessary for pollen germination and seed set.

To date, Henny has developed and released 28 foliage plant cultivars including new types of anthurium, dieffenbachia, aglaonema, heart-leaf philodendron (*Philodendron scandens oxycardium*) and pothos (*Epipremnum aureum*). Among the most successful has been the aglaonema Bay series, including 'Silver Bay', 'Golden Bay', 'Emerald Bay', 'Diamond Bay' and 'Moonlight Bay'. These plants are easy to grow and make outstanding interior plants. The most recent release from 2008, 'Mondo Bay', is derived from an interspecific hybridization, and was selected for its high level of basal shoot branching, smaller, narrower leaves, arching plant form and attractive foliar variegation.

In some foliage genera, sterility may prevent hybridization, as in heart-leaf philodendron. A mutation breeding program was initiated to develop unique forms of this important foliage plant. Heart-leaf philodendron proved to be quite responsive to irradiation, which led to the introduction of philodendron 'Frilly Philly' in 2008. This cultivar has grown well and remained true to type in growth tests. Also, in tests simulating interiorscape conditions, its quality was rated good to excellent even after six months indoors. 'Frilly Philly' can be grown as a hanging basket or totem. It should be grown with multiple cuttings per pot (at least five to 10 small tip cuttings per 4-inch pot) and will depend on container size and grower preference.

Currently, Henny is evaluating several other induced mutations of heart-leaf philodendron, pothos and gynura (velvet plant). ➧

Aglaonema 'Mondo Bay'

Heart-leaf philodendron 'Frilly Philly'

research

Improving Resistance and Tolerance

Zhanao Deng and Brent Harbaugh
Gulf Coast Research and Education Center
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Drs. Deng and Harbaugh are located at the Gulf Coast Research and Education Center (GCREC) in Balm, near Tampa Bay. This is the location of the world's leading caladium breeding program, which was under the leadership of Dr. Gary Wilfret for many years. Deng and Harbaugh now collaborate in its direction.

In recent years, Deng and Harbaugh's program's priority has been to improve disease and stress tolerance, and to control a crop's invasive traits. Disease resistance and stress tolerance have become increasingly important to commercial growers for cost-effective, sustainable production and to the end customers for dependable performance. Invasive behaviors of some ornamental plants, including prolific seed production and a tendency to spread to natural areas, negatively impact the environment and have become a major concern to the industry.

Specifically, focus has been on improving resistance to Fusarium tuber rot and Pythium root rot; resistance to powder mildew in gerbera; tolerance to sun burn and low temperatures in caladium; tolerance to high temperatures in lisianthus; and producing seedless, pollen-sterile lantana. Deng and Harbaugh have collaborated with plant pathologists to develop screening and selection techniques to find sources of resistance to pathogens. Similarly, they have screened germplasm to find sources of low temperature tolerance in caladium, and of high temperature tolerance in lisianthus. These traits are then patiently incorporated into new generations through hybridizing.

Over the years, a number of cultivars with improved disease resistance and/or stress tolerance have been released. Caladium cultivars 'Florida Moonlight', 'Florida Blizzard', 'Garden White', 'Florida Red Ruffles' and 'Florida Sweetheart' are commercially available. Another seven cultivars, 'Angel Wing Dwarf White', 'Angel Wing Dwarf Tricolor', 'Dr. Brent', 'Summer Rose', 'Firecracker Red', 'Cranberry Star' and 'Berry Patch', are currently being increased by the Florida caladium growers and should be available in the next one or two years for greenhouse growers.

Harbaugh has released two new series of lisianthus cultivars, 'UF Double Joy' and 'UF Savanna'. They have demonstrated excellent heat tolerance and year-round flowering capability, even in warm Southern states. The cultivars also were selected for basal branching and short stature; growth retardants are not required to produce pot plants, a big savings for greenhouse growers. Both

Lisianthus 'UF Double Joy Blue'

series come in a variety of colors. 'UF Double Joy' is the first series of double-flowered pot lisianthus.

'UF Multiflora Peach Bicolor' is the first gerbera cultivar specifically selected for powdery mildew resistance. More gerbera cultivars with improved powdery mildew resistance are in the works. Deng and Harbaugh also have investigated the genetic mechanisms responsible for lantana's variation in seed and pollen production and are now producing environmentally friendly lantana cultivars. This year, a selection of about a dozen lantana breeding lines will be evaluated at four research sites in Florida to evaluate for ornamental potential and sterility.

Success with Coleus

Dave Clark
University of Florida
Gainesville, Fla.

Dave Clark is located at the main campus in Gainesville and is probably most recognized for his floriculture biotechnology research program, which was highlighted in March *GPN*. He started a traditional coleus breeding program in 2002 following a few serendipitous events. In discussions with commercial flower breeders, Clark realized there was a shortage of new flower breeders graduating from universities. In the age of molecular biology, many academic breeders had retired and not been replaced, or were replaced with molecular biologists. Clark's lab was certainly a part of that process, but since his days breeding regal pelargonium as a Penn State graduate student, he had always maintained a passion for breeding. At the same time, a new graduate student, Penny Nguyen, did not want to be a molecular biologist but wanted to breed flowers. Timing is everything!

To begin Nguyen's research, she and Clark collected germplasm from several different plant species to assess the amount of genetic variability available for making new varieties. They eventually settled on coleus.

From the beginning, their primary goal has been to use tough selection criteria (Florida conditions) to develop vegetatively propagated coleus varieties for the mainstream U.S. bedding plant market. The main interests of their program have centered on several traits that are important for making an excellent summer annual bedding plant that anyone can grow well: late or no flowering; consistent garden performance in heat/sun; foliage color stability in full sun and shade; better branching and trailing habit; disease tolerance; and novel foliage color, shape and size.

Every year, they develop elite cultivars using recurrent mass selection techniques using a yearly cycle the for selection process. With this process, they have been able to maintain an excellent pool of coleus germplasm that continues to produce exciting new varieties that perform well in summer gardens across the United States. Current commercial coleus cultivars include 'Twist 'n' Twirl', 'Royal Glissade', 'Electric Lime', 'Frilly Milly', 'Splish Splash', 'Pineapple Splash', 'Lancelot Velvet Mocha', 'Lemon Sunsation', 'Big Red Judy' and 'Limon Blush'. May through June is a good time to see coleus plants at the University of Florida.

Clark also is helping to cultivate the next generation of ornamental plant breeders: Nguyen's research on the genetics of growth habit in coleus appeared in the December 2008 issue of the *Journal of Heredity*. ➧

'Pineapple Splash'

'Royal Glissade'

Breeding New Tropicals

Rosanna Freyre
University of Florida
Gainesville, Fla.

Rosanna Freyre is the "new kid on the block," having been at the University of Florida only since September 2006. Previously, she was at the University of New Hampshire breeding vegetatively propagated annuals. She had maintained a successful partnership since 2002 with Pleasant View Gardens and Proven Winners, which led to the release of four Wildcat anagallis, three Endless browallia and nolana 'Loma Blanca'. Now, Freyre is mainly devoted to research and breeding of ornamentals, has been involved in the management of the university's trial gardens and conducts private field and container performance evaluations for floriculture breeding companies.

Moving to the warmer climate of Florida meant that Freyre had to learn a new plant palette and change her breeding focus. She began by asking the advice of Florida growers and also looked at underutilized plants with exceptional trial performance at the university. Consequently, one of her new areas of research is breeding of tropical foliage plants for the landscape, such as sanchezia, strobilanthes, pseuderanthemums, alternanthera and iresine.

In addition to classical breeding using hybridization and selection cycles, Freyre has incorporated mutation breeding to her program using irradiation to create variants in foliage color, morphology and growth habit. Sports are propagated vegetatively to stabilize the desired trait, and the new plants are evaluated in the greenhouse, in the field under full sun and under 30 percent shade. An important selection is for plant compactness, which should result in less use of plant growth regulators. This summer, she also will be conducting a trial under different irrigation regimes to select plants with reduced water requirement, which is an important consideration under current water restrictions in Southern states. There has been considerable interest by growers around the United States on breeding lines developed by this new program, and many of them are already under commercial trial evaluation.

A second focus for Freyre's breeding research is on *Ruellia brittoniana* (Mexican petunia), a popular landscape plant in the South that is considered invasive because of its prolific seed production and high germination rates. Currently, the only sterile cultivar commercially available is purple-flowered 'Purple Showers'. Freyre is currently collaborating with University of Florida colleagues Sandy Wilson at Fort Pierce, Zhanao Deng at Balm and Gary Knox at Quincy, to develop other sterile

Ruellia brittoniana

ruellia cultivars as well as lantana, nandina and stachytarpheta. Their methods include irradiation of seeds and seedlings, and induction of polyploidy (plants with multiple chromosome sets) to create sterile triploids. Freyre also has compiled an extensive ruellia germplasm collection, aiming to create interspecific hybrids that are sterile and have good ornamental potential. This summer, she will be evaluating more than 1,000 ruellia hybrids and mutants in the field. She also will be evaluating a number of new genera for ornamental potential to start new breeding projects. GPN

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