
2024

ANNUAL REPORT



NATIONAL
HORTICULTURE
FOUNDATION.





ABOUT US

Dedicated to Enhancing the Lives Within the Horticulture Industry Since 1987

For over 37 years, National Horticulture Foundation has been an innovator in enhancing the horticulture industry. The National Horticulture Foundation (NHF) continues to deliver research and education to a broad base of industry members. Comprised of an esteemed team of contributors, the Foundation is dedicated to seeing the industry grow and thrive well into the future. NHF understands the meaning of paying it forward and needs your help to continue its mission.





OUR VISION

Guided by a vibrant network of industry professionals, the Foundation is committed to fostering the growth and sustainability of the horticulture sector for future generations. Through research initiatives, strategic partnerships, marketing strategies, and educational support, the Foundation empowers students and emerging leaders to thrive in horticulture-related fields. We are proud to play a key role in developing the next generation of industry leaders, ensuring that the industry not only survives but flourishes in the years to come.

OUR MISSION

The National Horticulture Foundation is a 501 (c)(3), non-profit organization providing funding for research and education. Its mission is to embrace the opportunity to seek out and provide support to projects relevant to the nursery and landscape industry along with addressing issues related to a diverse and changing horticulture industry.

01. Solving Industry Challenges
02. Building Future Leaders
03. Focusing on A Sustainable Future
04. Securing Industry Legacy



2024 NHF BOARD OF DIRECTORS

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Marshall Tree Farm



NHF PRESIDENT
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Tropical Computers, Inc.



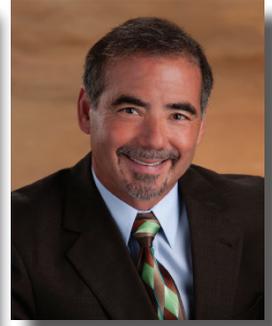
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Hackney Nursery Inc.



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No Worries Landscape



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Foliage Design Systems, retired



John Mendozza
Amerivest Business Brokers



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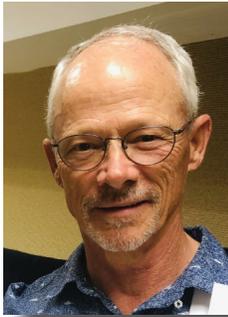
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National Horticulture Foundation,
1533 Park Center Drive,
Orlando, FL 32835.

If you have additional questions,
contact Linda Reindl, lreindl@fn gla.org
or call 407/295-7994 or
800/375-3642.

Ex-officio Board Members



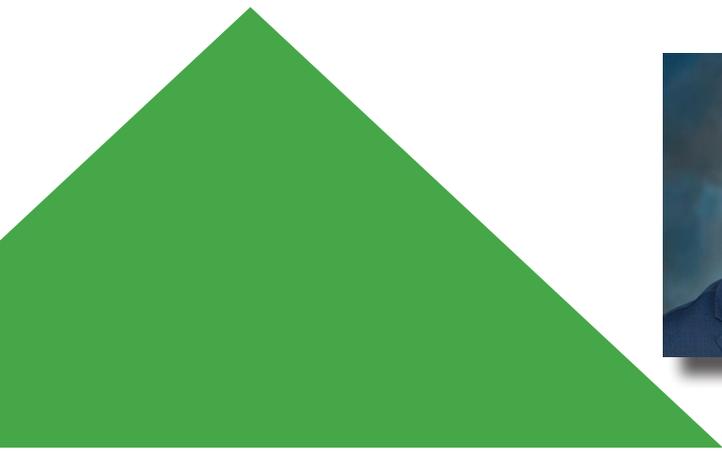
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Liz Felter
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LETTER FROM OUR PRESIDENT



2024 has been a whirlwind [pun intended] for the National Horticulture Foundation (NHF) and its dedicated team of volunteers, board members, directors, and staff. Despite facing significant challenges — from a contentious presidential election to the devastation of sixteen named storms and three powerful hurricanes — NHF has remained steadfast in its mission. These storms have reshaped communities, disrupted industries, and caused widespread damage. But the full impact is still unfolding, with potential long-term effects on horticultural crops and landscapes yet to be fully realized.

As NHF's past president Mike Marshall often says, "NHF takes its role of investing in the future of horticulture very seriously through research, scholarships, and education." And this year, we have remained true to that commitment. Our mission is more vital than ever as we work to solve industry challenges through research, provide scholarships to the next generation of horticultural leaders, and ensure a sustainable future for our industry.

Despite the obstacles, the NHF and our Board of Directors have achieved some exciting milestones this year. We launched a dynamic marketing campaign, featuring a 5-minute commercial produced by Pioneer Productions. This video, part of the "Viewpoint" series, will be broadcast nationwide on PBS throughout 2025. We also created shorter vignettes that will be used to promote NHF at industry events. Our marketing committee is also busy updating our website and kicking off a new E-campaign to encourage wider participation in NHF's mission.

In 2024, our Scholarship Committee reviewed 40 outstanding applications and awarded \$33,836.58 in scholarships. We're also thrilled to announce the creation of the "Taking Root Scholarship," with a generous contribution of \$50,000 provided by Arborjet/Ecogel, to support students pursuing studies in Arboriculture. The interior Industry Growth Fund [IIGF] also grew in principal with over \$150,000 in additional contributions. In two years, this fund has grown to over \$500,000, thanks to a very forward thinking sector of the industry.

On January 23rd, we will honor Mr. Joe Cialone at the International Plantscape Awards Gala at TPIE in Ft. Lauderdale. Joe has been an invaluable mentor and a driving force behind the growth of NHF and the new IIGF. His selfless service to the horticulture industry, FNGLA, and NHF will have a lasting impact for generations to come. Joe, we extend our deepest gratitude for your unwavering dedication.

Finally, NHF's endowment continues to grow, thanks to the generosity of our supporters and the careful stewardship of our volunteer board and advisors. Our board reviews financial reports quarterly, ensuring that our investments are managed responsibly to sustain the future of horticulture.

It is my great honor to serve as NHF President for the 2024-2025 term. I could not do this without the wisdom, experience, and dedication of the incredible individuals who serve on our board and committees. Their contributions are the driving force behind NHF's success.

Respectfully,
Ed Bravo, NHF President
Big Trees Nursery



FINANCIAL REVIEW

National Horticulture Foundation COMBINED Portfolio Performance

NHF Funds are overseen by NHF's investment subcommittee and managed by Edward Jones

NHF has been tasked with supporting projects in the areas of production, marketing, utilization, and distribution with an emphasis on research needs of Florida's horticulture industry. NHF was named a "national" foundation because it not only supports the horticulture industry in the state of Florida but seeks to protect the plants grown and exported to states across the country.

- In 2024, NHF supported two research project with total funding of \$69,264.00
- In 2024, NHF provided 30 scholarships totalling \$33,836.58
- In 2024, NHF provided \$10,000 to Green Plants For Green Buildings for AIA project

TOTAL CONTRIBUTIONS SINCE 1987	\$3,094,453.02
TOTAL NEW CONTRIBUTIONS IN 2024	\$229,873.47
2024 SUPPORT FOR RESEARCH AND SCHOLARSHIPS	\$103,100.58

ASSETS HELD AT EDWARD JONES	2022	2023	2024	2025 as of Jan. 15	Since 2009
Year Ending	\$3,201,911.78	\$3,546,818.01	\$3,943,008.70	\$3,960,796.01	\$3,943,008.70
Rate of Return	-14.36%	12.24%	10.97%	-0.32%	7.12%

National Horticulture Foundation Graduate Assistantship

Graduate Assistantship Funds are managed by the University of Florida's Foundation.

CONTRIBUTION	\$525,000.00
ENDOWMENT PRINCIPAL VALUE	\$669,632.05

Graduate Assistantship Funds are managed by the University of Florida's Foundation. The National Horticulture Foundation's complete financial reports are available upon request from the NHF office.

2024/25 SCHOLARSHIP RECIPIENTS

On an annual basis, NHF's scholarship program continues to establish pathways for qualified students in need of financial support. It allows students to gain experience and expertise, earn post high school degrees and become active members and leaders in the horticulture industry.

Scholarships are available through the

- James H. Davis Memorial Scholarship
- NHF General Scholarship
- Hoskin/McDougald Scholarship
- NE FNGLA Chapter's Billy Barwald Scholarship
- Arborjet | Ecologel's Taking Root Scholarship



Luke Anderson
West Texas A&M
University



Chauncey Barber II
North Carolina
State University



Megan Bichotte
Florida Atlantic
University



Whitner Bobo
Abraham Baldwin
Agriculture College



Cash Cilento
Palm Beach
State College



Sarah da Silva
Benevute
University of Florida



Cristi Demnowicz
Colorado State
University



Yvonne Elmore
Indian River
State College



Landon Erbrick
Auburn
University



Jessica Ervien
Florida Gateway
College



Tori Guarino
University of Florida



Dana Harris
North Carolina
State University



Nathan Hawks
Michigan State
University



Annabelle Horton
Clemson University



Addison Kust
Fox Valley
Technical College



Olivia Laws
University of Kentucky



Sophie LeBard
Washington State
University



Katelyn Medlin
North Carolina State
University



Mase Olivia Merkel
University of Florida



Ellie Miller
California
Polytechnic State
University



Stanley Oleckna
University of Florida



Caleb Olmstead
Tarleton State
University



Amanda Profera
Farmingdale State
College



Andrew Raffenberg
University of Florida



Philip Shaske
University of Florida



Bella Smith
Colorado State
University



Carissa Sohm
Kansas State
University



Cassie Valenti
University of
Washington



Celia Wilson
Michigan State
University



Reece Wineinger
Purdue
University

The following students received scholarships but photos were not provided:

DeAree Harris, Southern University and A & M College, Hailey Martin, The University of Mount Olive; Sonya Williams Cankdeska Cikana Community College; AveryWolf, University of Alabama.

Annual Deadline for all scholarships is January 15th. Scholarships are announced in April for the following Fall/Spring Semesters



ARBORJET | ECOLOGEL
TAKING ROOT
 Scholarship Program



Supporting the Future of Plant Health Care

Our scholarship, in partnership with the **National Horticulture Foundation**, helps students pursue their dreams in plant health care.

ARBORJET | Ecologel
 PARTNERS IN PLANT CARE

NATIONAL HORTICULTURE FOUNDATION

Taking Root Scholarship Program
 BY THE NUMBERS

\$2,500
 SCHOLARSHIP

10
 YEARS

54
 SCHOLARS

\$100,000
 AWARDED



Arborjet.com

A Brand New Scholarship Opportunity for the 2025/2026 school year

One student will be awarded \$2,500.

With a generous contribution of \$50,000, Arborjet | Ecologel has joined forces with NHF to support the mission of providing vital funds for students pursuing careers in horticulture. NHF is excited to administer this new scholarship opportunity, which will help foster the next generation of industry leaders.

While this is a new partnership for NHF, Arborjet | Ecologel is no stranger to giving back, having already provided 54 scholarships and over \$100,000 in funding to students. By teaming up with Arborjet | Ecologel, NHF aims to raise awareness for this and other scholarships available through the foundation, creating even greater opportunities for aspiring professionals.

Ideal applicants should have a passion for arboriculture or plant health care, and a desire to study science and technology that will advance the industry. We're seeking candidates with a demonstrated commitment to community engagement and a curiosity about exploring plant health care, including fields such as plant pathology, entomology, chemistry for invasive insect and disease management, arboriculture, urban forestry, horticulture, and landscape architecture. This scholarship is an exciting chance to make a real difference in the future of plant science and sustainability.



RESEARCH

Minimizing the Incidence of Edema in Ornamental Foliage Plants

Funded in 2024, two-year project conducted by Dr. Jianjun Chen, at the University of Florida's Mid-Florida Research and Education Center, in Apopka, FL, aims to further understand and mitigate edema in ornamental foliage plants.

Edema or intumescence injury is a physiological disorder occurring primarily in plant leaves. Its symptoms include abnormal, translucent, warty growth bulging out of the leaves or a water-soaked appearance with swollen areas. Edema has been reported in a wide range of horticultural crops produced in protected culture, including important ornamental foliage plants, such as Aphelandra, Begonia, Bromeliads, Dianthus, Ficus, Hibiscus, Impatiens, Pelargonium, Peperomia, Philodendron, Ruellia, Sansevieria, and Tibouchina. Since ornamental plants are priced by their aesthetic appearance (Chen et al., 2005), any growth abnormality could substantially reduce their value. Thus, minimizing the incidence of edema in foliage plants will sustain their marketability.

This project aims to evaluate how different environmental factors and cultural practices affect edema and develop methods for minimizing the incidence of edema in ornamental foliage plants.



Dr. Jianjun Chen is a professor of plant physiology in the Department of Environmental Horticulture. He is a researcher and educator who focuses on how plants function. He is specifically interested in how genetic, environmental, and cultural factors influence the growth and development of specialty crops. By better understanding how plants interact with their surroundings, horticulturalists will be able to improve current plant breeding and production practices to minimize environmental impact.



Chemical Control of the Invasive Pest Thrips *parvispinus*

Florida continues to be threatened by the invasive thrips species, *Thrips parvispinus*. Given the regulatory implications, its rapid expansion and injury, chemical control should be explored. The goal is to identify efficacious conventional and biorational insecticides against *T. parvispinus*. Results will be shared with ornamental growers in a workshop.

The goal is to identify efficacious conventional and biorational insecticides against *T. parvispinus*.

- Objective 1: Evaluate conventional insecticides under laboratory conditions
- Objective 2: Evaluate biorational insecticides under laboratory conditions
- Objective 3: Evaluate the most efficacious conventional and biorational insecticides under greenhouse conditions
- Objective 4: Inform ornamental producers about the findings of this study



Principal Researcher

Dr. Alexandra Revynthi, Tropical Research and Education Center

Dr. Revynthi is an Assistant Professor at Tropical Research and Education Center, in Homestead. She holds a PhD in acarology from University of Amsterdam with specialization in behavioral ecology of predatory mites. Dr. Revynthi has a keen interest in arthropod behavior, population dynamics, chemical ecology, biological control and IPM in ornamental crops. Current research and extension efforts focus on developing an IPM program to control the Hibiscus bud weevil (*Anthonomus testaceosquamosus*), a new invasive species affecting the hibiscus industry in south Florida. Moreover, Dr. Revynthi explores the potential of a predatory mite as a biocontrol agent of the Ficus whitefly (*Singhiella simplex*). Additionally, she studies acarine pests of agricultural importance and aim to develop IPM programs to control them. Acarine pests of interest include new invasive species such as the Lychee erinose mite (*Aceria litchii*) and the Hemp russet mite (*Aculops cannabicola*), as well as established pests.

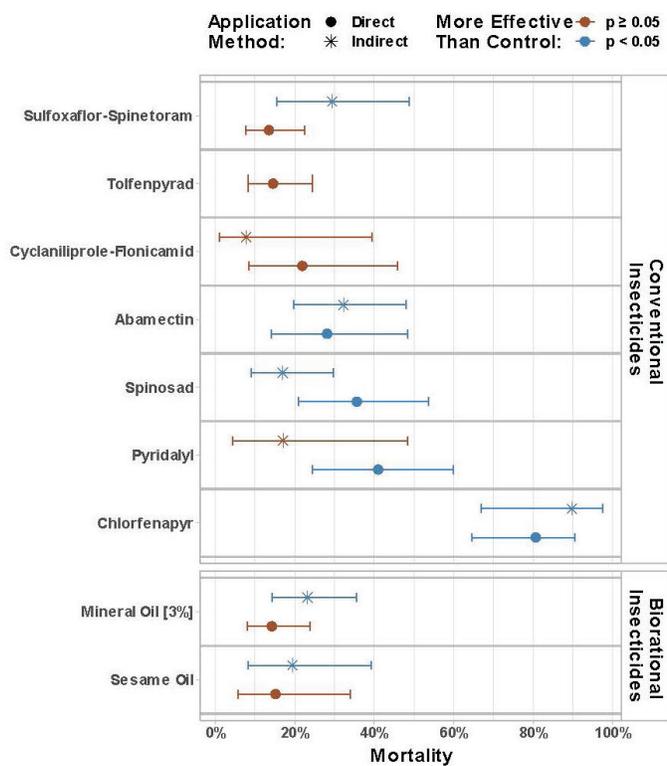
Annual Report (12/2024): Greenhouse Evaluation of Conventional and Biorational Insecticides for Managing the Invasive *Thrips parvispinus* (Thysanoptera: Thripidae)

Last year, we evaluated 32 conventional and biorational insecticides for their efficacy in reducing the survival and feeding activity of *T. parvispinus* in larval and adult stages under laboratory conditions. Twenty-one chemical insecticides, ten horticultural oils, and one insecticidal soap were tested. The nine most effective products were spinosad, chlorfenapyr, sulfoxaflor-spinetoram, pyridalyl, tolfenpyrad, abamectin, cyclaniliprole-flonicamid, mineral oil [3%], and sesame oil (Table 1). In this follow-up study, we tested these products in greenhouse conditions on two primary *T. parvispinus* ornamental hosts: gardenia (*Gardenia jasminoides*) and mandevilla (*Mandevilla splendens*). We conducted contact toxicity experiments using two exposure methods: (i) direct application (curative approach) of these products on plants infested with larvae and adult thrips and (ii) indirect exposure (prophylactic approach) by evaluating residue toxicity through the application of these products on plants before infesting them with larvae and adults. In both cases, the insecticides were applied until run-off using a manual sprayer, but the infestation time was different for each exposure method. In direct application assays, ten larvae and ten adults were released two weeks before the treatment application. After treatment, we assessed the efficacy of each product by scoring the number of dead thrips obtained from three leaves harvested from the bottom, middle, and top canopy at 24 h, 7 days, and 14 days post-treatment. For residue assays, plants were first sprayed with insecticides, and ten larvae and ten adults were introduced 24 hours later. Three leaves from the bottom, middle, and top canopy were harvested 24 h, 7 days, and 14 days post-infestation. We assessed the number of live and dead thrips for each leaf and used these values to calculate the proportion of dead thrips. Fig. 1 presents the cumulative proportion of dead thrips observed on mandevilla plants across all time points (24h, 7 days, and 14 days), while Fig. 2 for gardenia plants. The experiments were carried out twice for each host plant, i.e., two blocks, each block consisting of six replicates per treatment, totaling 12 replicates ($N = 12$), including the water control. Please note that statistical analyses were performed differently for each plant species dataset. The greenhouse evaluations for gardenia (shown in Fig. 2) were just finished and therefore, a preliminary statistical analysis is presented. A similar statistical analysis to the generalized linear mixed models (GLMM) performed for mandevilla (shown in Fig. 1) is underway.

Mortality data in mandevilla plants (Fig. 1) showed that the pesticides chlorfenapyr (direct: $P \leq 0.001$; indirect: $P \leq 0.001$), abamectin (direct: $P = 0.006$; indirect: $P \leq 0.001$), and spinosad (direct: $P \leq 0.001$; indirect: $P = 0.004$) caused the highest thrips mortality in both exposure methods. However, while chlorfenapyr caused 80 to 100% mortality, spinosad caused 10 to 50% mortality, and abamectin caused 20 to 50% mortality, indicating in this case that the first was more lethal than the other two. Among horticultural oils, mineral oil [3%] (direct: $P = 0.015$; indirect: $P \leq 0.001$) and sesame oil (direct: $P = 0.33$; indirect: $P = 0.007$) promoted increased mortality in residue toxicity assays only, and mortality was below 40%. Preliminary statistical analysis using the non-parametric model Kruskal-Wallis with the thrips mortality dataset of gardenia plants showed that the pesticides chlorfenapyr ($P \leq 0.001$), pyridalyl ($P \leq 0.001$) and sulfoxaflor-spinetoram ($P = 0.05$) caused the highest mortality in direct assays when compared to other products and the control (Fig. 2a). In the residue toxicity assays, none of the treatments were significantly different from the control ($P = 0.08$, Fig. 2b). Overall, a low quantity of thrips and mortality rates were obtained in the toxicity residue assays. Additionally, for both host plants tested, the majority of live and dead thrips were found in the top part of the canopy (Fig. 3). In mandevilla (Fig. 3a), the average number of thrips was significantly higher at the top compared to the middle ($P \leq 0.001$) and bottom ($P \leq 0.001$) canopy with a significant difference also observed between the middle and bottom ($P \leq 0.001$). Similarly, in gardenia (Fig. 3b), the average number of thrips was higher at the top than at the middle ($P \leq 0.001$) and bottom ($P \leq 0.001$), but no difference was observed between the middle and bottom ($P = 0.18$) canopy. Altogether, these results confirm the highest potential of chlorfenapyr, abamectin, sulfoxaflor-spinetoram, pyridalyl, and spinosad for efficacy against *T. parvispinus*. Still, they also show that each product performs differently depending on the host plant. Thus, a rotation program with these promising products is suggested, exploiting their diverse modes of action and minimizing the risks of resistance development.

Table 1. The nine products tested against *Thrips parvispinus* under greenhouse conditions. Water was used as control.

Product Name	Active Ingredient	IRAC Group	Rate
Piston	Chlorfenapyr	13	10 fl oz/ 100 gal
Xxpire	Sulfoxaflor-Spinetoram	4C-5	2.75 oz/ 100 gal
Conserve SC	Spinosad	5	0.1 fl oz/ 1 gal
Overture	Pyridalyl	Unclassified	8 oz/ 100 gal
Hachi-Hachi	Tolfenpyrad	21A	27 fl oz/ 100 gal
Timectin 0.15 EC	Abamectin	6	8 fl oz/100 gal
Pradia	Cyclaniliprole-Flonicamid	28-29	17.5 fl oz/ 100 gal
Ultrafine	Mineral oil	Unclassified	3%
Bee Safe 3-in-1	Sesame oil	Unclassified	3 fl oz/ 1 gal



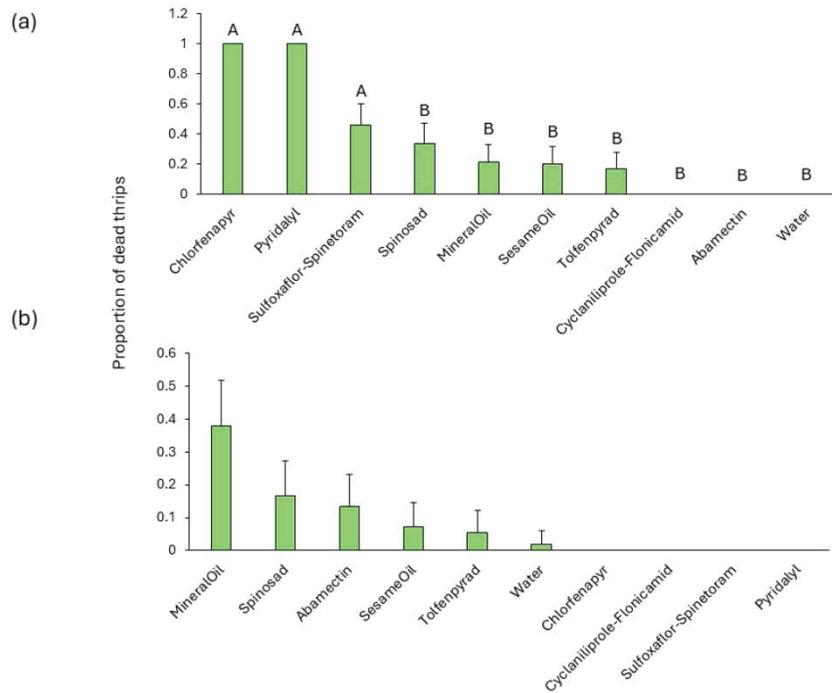


Fig. 2 Cumulative proportion of dead *Thrips parvispinus* caused by conventional and biorational insecticides on gardenia plants across all time points (24h, 7 days and 14 days). Panels illustrate the mortality larvae and adult thrips in both direct (a) and residue toxicity assays (b). Different letters denote significant differences among treatments ($p \leq 0.05$; Kruskal-Wallis).

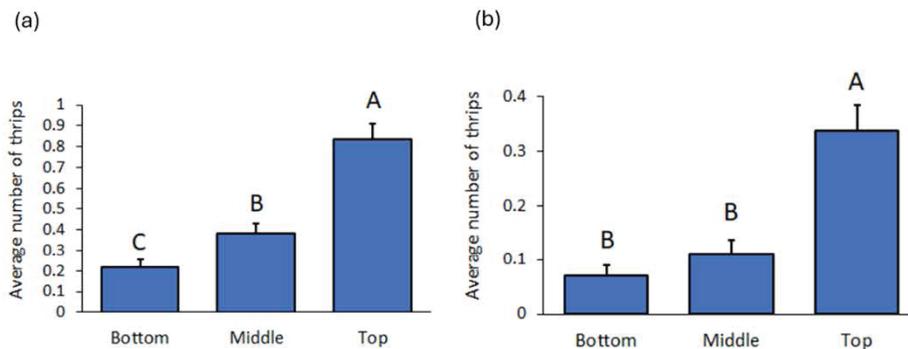


Fig. 3 Mean number of thrips sampled from bottom, middle and top part of mandevilla (a) and gardenia (b) plants. Panels show the cumulative numbers of dead and live *Thrips parvispinus* across all timepoints (24h, 7 days and 14 days) and exposure methods (direct and residue toxicity assays). Different letters denote significant differences among treatments ($P \leq 0.05$; GLMM).



GRADUATE ASSISTANTSHIP

As a commitment to the strong partnership that already existed with the University of Florida's Environmental Horticulture Department, a portion of the National Horticulture Foundation's portfolio moved to the University of Florida Foundation where it received a 50% match in state funds to develop NHF's graduate assistantship program. With just over \$500,000 in principal, its first graduate-student project was started in 2010.

NHF Board of Directors continues to serve as an advisory committee and provides guidance to each selected NHF graduate student and faculty member involved at the University of Florida. This assistantship provides a two or three-year funding source to students working on their masters or PhD.

Meet NHF's Current Graduate Student



Fangchen Liu,
Ph.D. Student
Environmental Horticulture
University of Florida

Ms. Liu's plan at the University of Florida has been designed to build upon her strong foundation in biological sciences from the University of California, Davis, where she graduated with the highest honors and a GPA of 3.98. Now at the University of Florida, her education, through several specialized courses, will support her research into the genetic engineering of horticultural crops. She maintains a 4.0 GPA and has actively apply the concepts learned to her research on modifying flower coloration in petunias using advanced technologies.

She began her PhD studies in horticultural genetics at the University of Florida in August 2023, with an anticipated graduation date in the fall of 2028. Over the next few years, her research will focus on advancing plant biotechnology to enhance color variations in petunias without integration of trans-gene. This endeavor aims to explore the aesthetic and commercial potential of this popular ornamental plant. The timeline set is designed to efficiently manage her research goals alongside her academic requirements.

Enhancing Petunia Varieties through Advanced Genetic Techniques: Modifying Flower Colors via Gene Editing and Gene Overexpression

Graduate Student: Fangchen Liu, Major Advisor: Dr. Alfred Huo

Enrolled Semester: Fall, 2023

B.S. in Biological Sciences, University of California, Davis, 2023.

Abstract

This report presents two innovative genetic modification strategies aimed at expanding and enhancing the color palette of petunia. Utilizing CRISPR-Cas9 technology, we target specific pigment-related genes for precise, transgene-free editing, while parallel efforts involve traditional gene overexpression to intensify and diversify floral colors. These methods support the development of enhanced petunia varieties that meet both aesthetic and commercial cultivation standards without relying on traditional approaches.

Introduction

Petunia is one of the most economically important ornamental plants worldwide, prized for its diverse flower colors and extended blooming period in gardens, containers and urban landscapes. Petunia contributes substantially to the horticultural sector's economic performance in the United States, representing a significant portion of the annual wholesale market for ornamental plants. According to the USDA's 2020 Floriculture Crops Summary, petunias sold in pots generated a wholesale value of over \$55 million, with more than 26 million pots sold in 2020. Among petunia cultivars, elite commercial varieties are particularly notable for their vigorous growth habit and exceptional flowering performance. However, introducing additional traits of interest such as flower color into these elite commercial varieties through conventional hybridization and selection is challenging due to their highly heterozygous nature. Traditional breeding approaches risk disrupting existing desirable traits, necessitating innovative genetic strategies to enhance these varieties while preserving their superior characteristics.

Petunia flower coloration is primarily dictated by the biosynthesis of anthocyanins, a complex process involving several key enzymes and regulatory genes. This pathway includes crucial structural genes as well as various transcription factors that regulate their expression (Fig.1). Our transgene-free gene editing project aims to manipulate this pathway by targeting genes involved in regulating anthocyanin biosynthesis. For example, editing repressor-type transcription factors can enhance anthocyanin accumulation and deepen flower color. Modifying genes involved in metabolic flux can redirect precursor availability toward anthocyanin biosynthesis. Disrupting key structural genes may result in white flowers by blocking critical enzymatic steps in the pathway. Furthermore, editing genes that influence anthocyanin hydroxylation patterns can broaden the range of achievable pigment hues.

To expand the color palette of petunia flowers, we are implementing strategic gene overexpression approaches. By heterologously overexpressing anthocyanin-activating genes from snapdragon, we aim to enhance anthocyanin biosynthesis to develop purple and dark purple flower phenotypes. In parallel, overexpressing a betalain biosynthesis gene from sugar beet will produce novel bright red and dark red coloration. Additionally, enhanced expression of hydroxylation-related genes will increase delphinidin accumulation, leading to more pronounced blue flower colors. These complementary genetic engineering strategies are designed to create a diverse spectrum of flower colors, significantly enhancing both the commercial and aesthetic appeal of petunia varieties.

Recent advancements in genetic engineering, particularly the development of CRISPR/Cas9 gene-editing technology, have provided promising new methods for enhancing petunia varieties. One advantage of CRISPR genome editing over traditional genetic engineering is that transgene-free modifications can be achieved.

Several transgene-free gene editing methods have been developed. For example, Ribonucleoprotein (RNP) delivery introduces pre-assembled CRISPR/Cas complexes directly into plant cells, particle bombardment uses high-velocity particles to deliver editing components into plant tissue, and virus-based vectors employ viral particles for efficient delivery of gene-editing tools. Despite these advancements, each method has drawbacks: RNP delivery often struggles with low editing efficiency, particle bombardment can cause cell damage and inconsistent delivery, and virus-based vectors face limitations in virus-host specificity and can

trigger immune responses. Unlike other transgene-free methods, our proposal offers a novel approach with broad applicability across diverse plant species through targeted manipulation of DNA repair pathways. The pivotal component of our methodology is the strategic suppression of a specific DNA repair-related polymerase involved in alternative repair mechanisms. This enzyme plays a dual role in plant genome modification: it mediates microhomology-mediated end joining (MMEJ) during DNA repair and facilitates T-DNA integration into host genomes. By transiently suppressing this polymerase during CRISPR/Cas9-mediated genome editing, we can decrease the frequency of T-DNA insertion while maintaining efficient gene editing via the classical non-homologous end joining (NHEJ) pathway. This is particularly valuable for developing non-GMO edited crops, as it minimizes the risk of foreign DNA persistence in the plant genome.

The significance of this method is exemplified in our current work with an elite commercial petunia variety with a complex genetic background derived from multiple interspecific hybridizations. Due to its highly heterozygous nature and exclusive vegetative propagation, traditional breeding approaches are ineffective for trait improvement while maintaining its unique horticultural characteristics. Our DNA repair suppression strategy enables precise genetic modifications without transgene integration, preserving the plant's non-GMO status. This not only satisfies regulatory requirements but also addresses market demands for non-GMO ornamental varieties while allowing for targeted trait enhancement. Furthermore, this methodology can be adapted for other vegetatively propagated crops where maintaining genetic fidelity while introducing beneficial traits is crucial.

Objectives

The goal of this project is to modify the flower color through genetic engineering approaches. Three objectives are proposed to achieve this goal.

- To Modify Flower Color by Editing Structural Genes in Anthocyanin Pathway without Transgene Integration

- To Intensify Flower Pigmentation by Knocking Out Transcription Factors That Act as Repressors in the Anthocyanin Biosynthesis Pathway
- To Diversify Flower Coloration by Overexpressing Key Genes Involved in Pigment Production

Research Progress

For the first objective, we have constructed vectors for editing key structural genes and have successfully transformed model petunia cultivars. We are currently monitoring for phenotypic changes. Vectors targeting additional structural genes are under construction.

For the second objective, vectors targeting anthocyanin repressor genes have been constructed and transformed into model cultivars. Observations are ongoing.

For the third objective, we have transformed overexpression vectors carrying pigment-activating genes into model cultivars. Enhanced pigmentation has been observed, demonstrating success in color diversification.

Educational Achievements and Coursework

I obtained my bachelor's degree from the University of California, Davis, graduating with the highest honors and a GPA of 3.98 in Biological Sciences. This strong foundation has been vital in preparing me for advanced scientific inquiries and research.

At the University of Florida, I have furthered my education by completing several specialized courses that directly support my research in genetic engineering of horticultural crops. These courses include:

- PLS5222C (30398) - Propagation of Horticultural Crops
- AGR5307 (24456) - Molecular Genetics of Crop Improvement
- PCB5530 (16626) - Plant Molecular Biology and Genomics
- STA6093 (16790) - Introduction to Applied Statistics

I am currently enrolled in PLS5222C and maintain a 4.0 GPA, continuously applying learned concepts to my ongoing research on modifying flower coloration in petunia using advanced gene-editing technologies.

Timeline and Future Directions

I began my PhD studies in horticultural genetics at the University of Florida in August 2023, with an anticipated graduation date in the summer of 2028. My qualifying exam is expected to schedule in the summer of 2025. Over the next few years, my research will concentrate on advancing plant biotechnology to enhance color variations in petunia. This timeline is designed to efficiently manage my research goals and academic requirements, leading up to the preparation and defense of my dissertation in 2028.

Figures

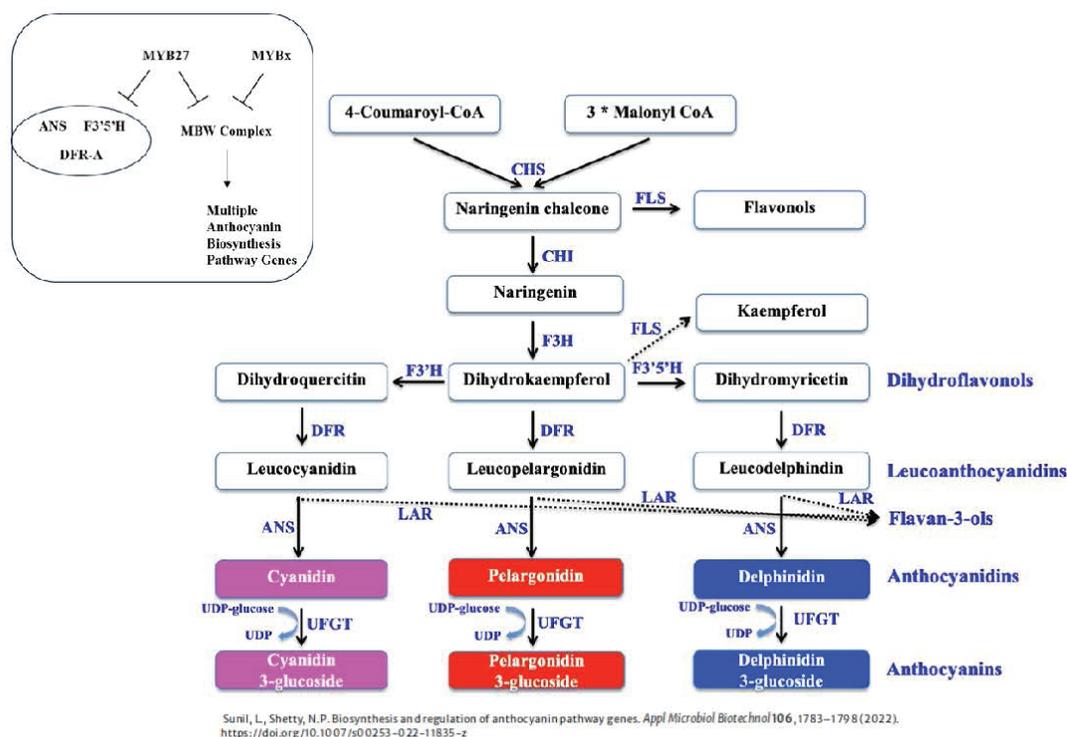


Fig. 1, Biosynthetic pathways of anthocyanins. CHS, chalcone synthase; FLS, flavonol synthase; CHI, chalcone isomerase; F3H, flavanone 3-hydroxylase; F3'H, flavonoid 3'-hydroxylase; F3'5'H, flavonoid 3',5'-hydroxylase; DFR, dihydroflavonol 4-reductase; ANS, anthocyanidin synthase; LAR, leucoanthocyanidin reductase; UFGT, flavonoid 3-O-glucosyltransferase; UDP-glucose, uridine diphosphate glucose; asterisk indicates multiplication (Sunil et al., 2022). MYB repressors may directly limit the expression of structural genes and disrupt the formation of the MBW complex, thereby repressing anthocyanin biosynthesis.



Fig. 2, Comparative display of Petunia flowers showing the wild type (left) with a standard pink hue and a genetically modified variant (right) with a deeper pink color due to the overexpression of a key structural gene.

References

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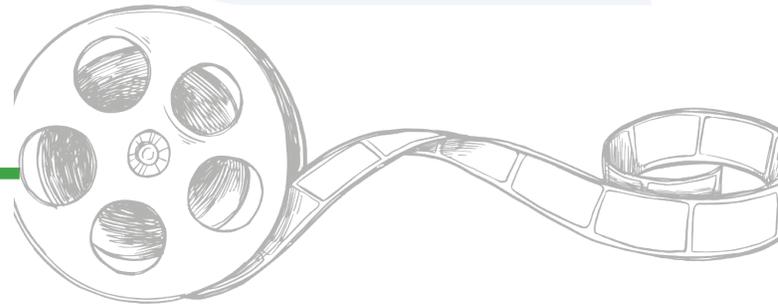
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SPECIAL PROJECT



NHF At Work Developing Our Story & Highlighting the Industry We Serve



At the National Horticultural Foundation (NHF), we recognize that storytelling is more than just a way to share information—it's a powerful tool to educate, inspire, and connect. Our journey to enhance how we communicate our mission began almost a year ago when we received an exciting call from a South Florida production company. They asked if we would be interested in creating a documentary. Without hesitation, we saw it as the perfect opportunity to further our mission of supporting industry professionals and nurturing the next generation of leaders in horticulture.

The two-day film shoot not only set the stage for the documentary but NHF's team produced a 5-minute video, 30-second commercial and 6 video vignettes for NHF to use to promote the foundation's efforts and move its mission forward. The documentary, which aired on public television this past October, provides us with a unique platform to reach a wider audience. It showcases the vital role that horticulture plays in our communities and the environment. By shining a light on the stories of passionate professionals and the tangible impact of their work, we aim to inspire viewers to engage with and appreciate the world of horticulture.

More than just a promotional tool, this documentary is a testament to the vibrant community we proudly support within the horticulture sector. Each station that airs the documentary has the right to broadcast it for a full year, providing invaluable exposure and amplifying our message. The awareness generated is not only vital for NHF's mission, but also for generating the financial support that will allow us to continue advocating for the industry.

As we move forward, we invite you to join us in this exciting chapter. Your support is integral to advancing our efforts in research, education, and advocacy for the nursery and landscape industry. Together, we can cultivate a thriving horticultural community that benefits everyone. We encourage you to get involved in our upcoming initiatives and contribute to the continued growth of this essential sector.







In addition to our engaging video production and vignettes, we launched an email campaign that reached up to 1 million opt-in subscribers, effectively delivering an inspiring overview of our mission. This powerful outreach not only gave us the opportunity to highlight our commitment to sustainable communities but allowed us to potentially capture the attention of a new audience who share our vision for a brighter, more sustainable future. With this initiative, we've expanded our reach and connected with passionate individuals who are ready to be part of the change.

CAMPAIGN REPORT

Campaign Summary

Name: The National Horticulture Foundation

From/Brand:	The National Horticulture Foundation		
Headline:	The Future of Horticulture Starts Here – Join NHF's Mission		
Broadcast Date:	11/14/2024		
Audience:	1,000,000	ID:	2189674
Views:	60,121	Clicks:	2,818
View %:	6.01%	Click %:	0.28%

Campaign Creative

CAMPAIGN STATS

Views | 6.01% Total Views 60,121

Clicks | 0.28% Total Clicks 2,818

CTVR | 4.69%

Clicks by Device

	Desktop	38.68%	1,090
	Mobile	61.32%	1,728

CLICKS BY WEB BROWSER

1,367 Chrome	137 Edge	161 Firefox	748 Safari	405 Other
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INVESTING IN THE HORTICULTURE INDUSTRY

Through Research, Scholarships,
Education and Marketing

Our Mission:

- ✓ **Solving Industry Challenges**
NHF supports horticulture research focused on addressing the needs of all industry segments.
- ✓ **Building Future Leaders**
NHF offers scholarships to support students pursuing careers in horticulture.
- ✓ **Securing Industry Legacy**
NHF provides a pathway for industry members to leave a legacy for future generations.
- ✓ **Focusing on A Sustainable Future**
NHF promotes awareness of practices that protect the environment and support biodiversity.



WATCH NHF's
Informational
Video

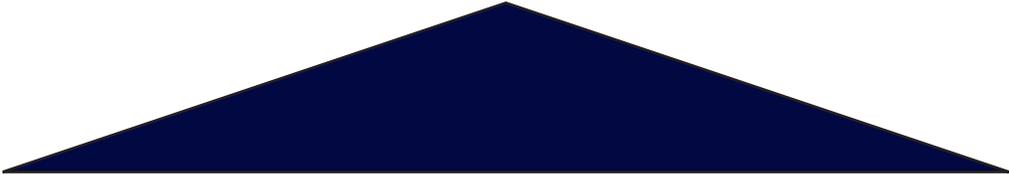


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Visit Our Website
www.nationalhorticulturefoundation.org





INTERIOR INDUSTRY GROWTH FUND CONTRIBUTORS

The Interior Industry Growth Fund (IIGF) is comprised of numerous company and individual endowments. The Fund's earnings will be dedicated to advancing research, supporting professional education, and executing strategic marketing efforts aimed at influencing key decision-makers and industry leaders. A robust and well-supported IIGF ensures that interior landscape services are recognized as essential by the leaders of high performing organizations. By thoughtfully investing in the IIGF, you help secure the future of the interior landscape industry and contribute to its continued growth and relevance.

Silver Builder Level **\$35,000-\$49,999**

- Cityscapes Endowment
- Senneff Family Endowment

Builder Level **\$25,000-\$34,999**

- Architectural Supplements and Feinman Family Endowment
- Blondie's Treehouse Endowment
- FIHRE Endowment
- Mangum Family Endowment
- New Pro Containers Endowment
- Planterra Endowment

Benefactor Level **\$20,000-\$24,999**

- Dick Ott Endowment
- Gsky Plant Systems Endowment
- Joel and Teri Pesapane Family Endowment
- McRae Anderson Endowment
- National Interiorscape Network Endowment

Patron Level **\$15,000-\$19,999**

- Ambius Endowment
- Botanical Designs Legacy Endowment
- Les and Catherine Love Endowment
- Oasis Plantscapes/DeHaven & Whitting Endowment

Founder Level **\$10,000-\$14,999**

- Amlings Interior Landscape Endowment
- Green Plants for Green Buildings Endowment
- Grundy's Plantscaping Endowment
- John Mini - Distinctive Landscape LTD Endowment
- Leafscape Connell Family Endowment
- Plant Solutions, Inc. Endowment
- Plantscaping Endowment
- Scott & Diane Barron Family Endowment

Donations

- Foster Plants
- Foliage Design Systems

Endowment Level **\$5,000-\$9,999**

- Air Strength Canada/I Plants Magazine Endowment
- Good Earth Plantscapes Endowment
- Green Oak Endowment
- Greenery NYC Endowment
- Olive Hill Endowment
- Parker Interior Plantscapes Endowment
- Plants in Design Endowment
- Raimondi Horticulture Group and Family Endowment

Giver Level **\$1,000-\$2,499**

- Anything Groes
- Batch-O Blooms
- Buckingham Greenery
- Greenery Office Interiors
- Interior Plantscapes
- Plantscapes, Inc.
- Seattle Plant Company
- Steve Stanford
- Texas Tropicals



Interior Industry Growth Fund At Work

Guided by a vibrant network of business professionals, Green Plants for Green Buildings (GPGB) and NHF are dedicated to positioning the Interior Landscape industry through the Interior Industry Growth Fund, to thrive well into the future. It is positioned to help support research initiatives, professional education, and targeted marketing to influencers and decision-makers.

In June, NHF provided \$10,000 to support GPGB efforts at the American Institute of Architecture 2024 conference, in Washington, D.C.

Their booth showcased the integration of green plants into building designs, highlighting their environmental and aesthetic benefits. The financial assistance played a pivotal role in covering a range of essential expenses, ensuring that industry presence at the conference was both impactful and memorable. Their efforts at the AIA Conference have set a high standard for what can be achieved when partnering together to prioritize the natural world in our architectural endeavors.



Positioned As A Sponsor

As a gold sponsor, GPGB showcased its commitment to promoting biophilic design and the integration of natural elements into built environments. GPGB's presence at the conference highlighted its mission and demonstrated the growing importance of sustainable practices in architecture and urban planning.



Engaging Speaker Lineup

The GPGB booth hosted a series of talks by renowned experts in the field of biophilic design. Bill Browning, Dr. Tuwanda Green, and Janice Goodman delivered compelling presentations on topics such as the psychological and physiological benefits of biophilia and the science behind plants and brain function. Their insights captivated the audience, sparking meaningful discussions and a deeper interest in integrating natural elements into architectural design.

Looking Ahead

GPGB's website saw an enormous increase in website traffic during the AIA Conference with approximately 83,000 year-to-date event counts on the site as of July 3, 2024. This was a significant increase from the 47,000 event counts from January 2024-May 2024. In June, GPGB's Instagram saw a 38.6% increased reach, Facebook had a 38.6% increase in reach, and LinkedIn had an increase of 533% impressions. Thousands from the Architecture, Engineering, and Construction sector were reached through the marketing efforts and on-site efforts of GPGB at AIA24.

The positive reception of GPGB's initiatives at the AIA Conference is a promising sign for the future of biophilic design and sustainable building practices. As awareness of the benefits of green buildings continues to grow, GPGB's work will likely inspire more architects, designers, and developers to incorporate natural elements into their projects.

Credits: This article was inspired by the Planter Trends Monthly Newsletter, published June 8, 2024, by Jean-Pierre Sijmons, Architectural Supplements



An Interior Industry-specific endowment is the best approach to provide a permanent source of funding to grow the size and profitability of the Interior Landscape Industry and future-proof it for new generations.

The Interior Industry Growth Fund will provide research initiatives, professional education, and targeted marketing to influencers and decision-makers. A well-endowed Fund will assure interior landscape services are deemed essential by informed leaders of top-performing companies. Thoughtful investment in the IIGF will help to future-proof the interior landscape industry.



NATIONAL HORTICULTURE FOUNDATION.

An endowment is much more than just a fund—it's a lasting investment in the future, a powerful resource that continues to give long after it's made. NHF holds strong in its mission to never spend the principal of the foundation's funds, only its earnings. By contributing to an endowment, you're not just supporting immediate projects, you're helping to shape the growth and sustainability of horticulture for generations to come.

Thanks to the generosity of donors, NHF has been able to build a legacy of success, one that empowers the next wave of horticulturists, researchers, and educators to push boundaries and cultivate new possibilities.

No contribution is too small, and it's never too early to begin your own legacy. Every gift, no matter the size, helps strengthen the foundation that supports the future of horticulture.

NHF is incredibly proud and grateful for the unwavering support of industry members who share the vision of a thriving, innovative future. Together, we are cultivating the seeds of success that will continue to flourish for years to come.

Names highlighted in green have made contributions to their endowment in 2024

Platinum Level

\$100,000 +

- Hoskin/McDougald Scholarship Endowment
- Hughes Memorial Fund Endowment
- Interior Industry Growth Fund
- James H. Davis Memorial Scholarship Fund
- June and Richard Rosacker Endowment
- **Richard Fuhr Endowment**

Gold Builder Level

\$50,000 +

- **Arborjet | Ecologel Endowment**
- FNGLA Action Chapter Endowment
- FNGLA Northeast Chapter Endowment
- **Olive Hill Greenhouses Endowment**
- Phillip Matalon/Fancy Flora Endowment
- Raymond P. Oglesby Endowment
- TPIE Golf Classic/Allied Division

Silver Builder Level

\$35,000-\$49,999

- Agri-Starts Inc. Endowment
- **Bolusky Family Endowment**
- **Cityscapes Endowment**
- Dorothy and Richard Entorf Endowment
- Florikan Endowment
- Jason R. Zala Memorial Scholarship Fund
- **Marshall Tree Farm Endowment**
- **Senneff Family Endowment**

Builder Level

\$25,000-\$34,999

- **Architectural Supplements & Feinman Family Endowment**
- **Howard Freilich - Blondies Treehouse Endowment**
- FNGLA Broward Chapter Endowment
- FIHRE Endowment
- **Theo & Christina Bryant Endowment**
- Jose Costa Memorial Endowment
- Mangum Family Endowment
- Palm Beach Growers Classic Endowment
- **Planterra Endowment**

Benefactor Level

\$20,000-\$24,999

Cialone Family Endowment

Hackney Nursery Endowment

Dick Ott Endowment

Gsky Plant Systems, LLC Endowment

Joel and Teri Pesapane Family Endowment

National Interior Network Endowment

New Pro Containers Endowment

McRae Anderson Endowment

Tropical Plant Industry Exhibition

Patron Level

\$15,000-\$19,999

Albert & Mildred Kraft Endowment

Ambius Endowment

Florida Nurserymen And Growers Association

Florida Potting Soils Endowment

Les & Catherine Love Endowment

Mike and Cecilia Rimland Endowment

Past Presidents' Endowment

Peckett Family Endowment

Shannon Rinck Memorial Endowment

Verlite Co. Endowment

Founder Level

\$10,000-\$14,999

Amilings Endowment

Anthony Frumento Endowment

Batson's Greenhouse Endowment

Botanical Designs, LLC

Central FL Marketing Research Endowment

Foliage Design Systems Endowment

FNGLA - Treasure Coast Chapter Endowment

FNGLA - Palm Beach Chapter

Frank H. Abrahamson Endowment

Green Plants for Green Buildings Endowment

John Mini - Distinctive Landscape LTD

Leafscape Connell Family Endowment

Ned & Kim Bradford Endowment

Oasis Landscapes/Dehaven & Whitting Endowment

Parrish Family Endowment

Prolific Plants Endowment

R.A. Chris Christiansen Endowment

Kevin & Theresa Riley (Rockledge Gardens) Endowment

Scott & Diane Barron Family Endowment

The Scotts Company

Wekiwa Gardens Endowment

Van Donnan Endowment

Endowment Level

\$5,000-\$9,999

Agri-Starts II, Inc. Endowment

Air Strength Canada/I Plants Magazine

Bernecker Nursery Inc. Endowment

Bryan Mitchell Endowment

Charles A. Conover Endowment

Charles MacLean Memorial Endowment

Costa Farms Endowment

Farm Life Tropical Foliage Of Homestead Endowment

FNGLA Lake Region Endowment

Good Earth Plantscape Endowment

Grandview Botanicals Endowment

Green Oak Endowment

Green Star Foliage, Inc. Endowment

Grundy's Landscaping/Sean Campbell Endowment

Helen and Harold Martin Endowment

Hermann Engelmann Endowment

Hughes Memorial (Budwood Contributions)

John E. Brown Endowment

Kerry's Bromeliad Nursery Endowment

Lerio Corporation Endowment

Liners Unlimited

M. Leider Endowment

Mercer Botanicals Endowment

Michele Melnyk Endowment

Moore's Greenhouse's

New and Emerging Pests Endowment

Parker Interior Plantscape

Plant Solutions, Inc.

Raimondi Horticultural Group Inc.

Robert M. McColley Endowment

Robert T. Mellen Endowment

Robert R. and Sue Roberson Endowment

Southeast Growers Endowment

Spathiphyllum Growers' Endowment

Suncoast Nursery Inc. Endowment

Sunshine Foliage World Endowment

Tran Trex Foliage Endowment

Twyford Laboratories Endowment

Whistling Pines Inc. Endowment

Sponsor Level

\$2,500-\$4,999

A & L Southern Agricultural Labs

Botanics Wholesale

Jack Christmas

Donaldson Greenhouses

Eiichi Yoshida

Excelsa Gardens Inc.
Florida Plant Growers
FNGLA Highlands Heartland Chapter
FNGLA Pinellas Chapter
FNGLA Manasota Chapter
Frye Farms
Dr. Alfred B. Graf
Lake Placid View Foliage
Living Colors Nursery
Mike and Jo Raimondi
Morning Dew Tropical Plants, Inc.
N.G.M. Productions, Inc.
Silver Krome Gardens
Stepping Stone Nursery, Inc.
Sunshine Tropical Foliage
Universal Enterprise Supply

Giver Level

\$1,000-\$2,499

Anything Groes
Arvida Nurseries Corp of Kendall
Batch of Blooms
Benchmark Foliage, Inc.
Big Trees Plantation
Blalock Foliage Inc.
Buckingham Greenery
Combustion Service Co., Inc.
Cultivate Wealth Management
Deroose Plants, Inc.
Driftwood Gardens, Inc.
Everett L.Conklin
FNGLA Coastal Spring Chapter
Frederick C. Brummer
Frederick Gloeckner
Greenery Office Interiors
James Vosters, Sr.
Jerry Soowal/Broward Chapter
Joseph Hill
Happy Plants
Harry Ustler
Harry M. Smith Endowment
Hawaiian Sunshine Nursery
Raymond C. Hogshead
I G I Marketing
Illinois Landscape Contractors Assoc.
Imperial Builders & Supply, Inc.
Interior Plantscapes
Landmark Plastic Corporation
Landscape Services Professionals
Larry Cobia

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Milestone Agriculture
Nancy Carlisle Interior Plantings
New Christie Ventures
O.F. Nelson
Roger Kjelgren
Pixley Greenhouses
Plantique, Inc.
Plants In Design. Inc.
Plantscapes, Inc.
Plantscaping, Inc.
Professor Alex Laurie
Steve Stanford
Strickland Regis
The Jungle Nursery
Traymax Inc.
David and Karen Wheeler

(CONTRIBUTIONS LISTED WERE MADE PRIOR
TO 1/31/2024)



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