

Project Title: Development of Begonias with Enhanced Heat Tolerance for Florida Nurseries

Annual Report Period: 08/2019-12/2019,

PI: Dr. Alfred Huo, Mid-Florida Research & Education Center, hhuo@ufl.edu

1) Copy of this cover sheet completed with original proposal

NHF Grant Request Application

Contact: Hegiang (Alfred) Huo
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Title of Proposal: Development of Begonias with Enhanced Heat Tolerance for Florida Nurseries

Does this proposal address an FNGLA Research Priority? ☒ Yes ☐ No

If yes, in which priority area: Environmental/Resource Mgmt ☒ Genetics and Breeding ☐ Pest Management

Enhance Quality of Life ☐ Production Systems

Significance to foliage industry (What impact will this research have on the industry?) 1) reduce cost for production management; 2) increase competition of local nurseries with new heat-tolerant cultivars; 3) expand market with newly developed cultivars

Objective and justification (What problem/opportunity will this research address?) Utilizing a unique heat-tolerant begonia germplasm, we will develop wax begonias and tuberous begonia with enhanced heat tolerance

Name of organization submitting request: Mid-Florida Research and Education Center (MREC), University of Florida

Name and title of individual(s) submitting request:

- a) Hegiang (Alfred) Huo, Assistant Professor, Ornamental Plant Breeder of MREC
b) Roger Kjellgren, Director and Professor of MREC
c) _____

Name and title of individual(s) conducting proposed project (if different):

- a) Matthew Creech, Biological Scientist II
b) Zhi Li, Ph.D Student
c) Linhchi Dinh Nguyen, OPS employee

Cost analysis:

- a) Total cost of project : \$21,523 for two years
b) Total request from foundation \$21,523 for two years
c) If project already initiated, funds expended to date _____
d) Funds anticipated from other sources (list sources and amounts) _____

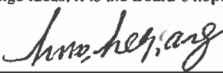
Timeline:

- a) If project has already commenced, provide date started _____
b) If project has not commenced, provide anticipated starting date 04/2018
c) Anticipated date on completion: 04/2020

Publication of Research Results

Acceptance of a grant award from the National Horticulture Foundation includes an agreement to provide the Foundation with a written report of the following: a) Title of paper, b) Author(s), c) Nature of work (introduction); brief but complete synopsis purpose, materials and method of research, d) Results and discussion (information should be thorough enough to be of value to reader), e) Significance to industry (brief statement of practical application), f) Literature cited.

The grant recipient(s) is also expected to participate in a conference currently in development that allows the recipients of NHF grants to focus on pertinent subjects essential to the survival of our industry. By holding the forum in locations where growers and allied tradesmen can attend, listen and exchange ideas, it is the Board's hope that more ideas of importance to the foliage industry will be generated for future research.


Signature of Proposal Applicant

12/24/2017

Date

2) Brief summary of research project

The research funds were not allocated to PI (Dr. Huo) until the end of August, 2019. We have performed the experiments as proposed in the proposal with slight modifications. We have started to collect different begonia varieties (Rex Foliage Begonia, Wax Bedding Begonia, Tuber Potting Begonia). Crossing of intra and inter-species have been made, however, ill-development of embryos has been observed among many crossing probably due to incompatibility. We have obtained around 70 hybrid progenies from crossing of our heat tolerant begonia with different Wax Begonias. These progenies will be further evaluated for their abiotic stress tolerance and horticultural performance. Experiments for testing different chemical compounds (Melatonin, Salicylic Acid or both) for alleviating heat stress have been performed. Various growth characteristics including plant height, overall plant health, chlorophyll and anthocyanin content, leaf area, plant biomass, and plant chlorophyll florescence have been measured to determine the effects of both chemical compounds. Surprisingly, the preliminary observation and results indicate that the combination of both salicylic acid and melatonin exhibited detrimental effects on plant growth under heat stress in August, 2019. However, the treatment with Melatonin can significantly promote leaf expansion, especially under low light conditions. This experiment will be repeated in 2020 summer. Results from both years of experiments will be expected to be published as an extension paper or a peer-reviewed research journal. To understand the mechanism underlying the mechanism of heat tolerance of FB08-59 begonia, we will also perform anatomical comparison between FB08-59 and Bada Boom through microscopic examination of different organs, the results may be used as morphological markers for breeding selection. In addition, future effort will be given to cytogenetic analysis through examining the chromosome numbers of different varieties, which may provide fundamental basis for selecting parental varieties.

3) A report of specific research that has been conducted and any results or benefits that it has to the industry.

Activity 1: We have collected over 40 begonia species and accessions over the course of 2019 (Figure1). In the process, we have identified previously unknown species and hybrid in our original collection and have been in contact with multiple begonia collectors and breeders across the state.



Figure 1 Begonia Germplasm

https://drive.google.com/file/d/18t6C_TxWDp_xlrRnMiHjAfJC_iN_ni-i/view?usp=sharing

Activity 2: We have conducted over 150 interspecies and intra-species crosses over the course of 2019 in order to determine the reproductive viability of our varieties (Table 1). Only a very small percentage of crosses germinated successfully indicating that there may be enough genetic difference between

species to inhibit proper germination. We plan on conducting a phylogenetic analysis to determine speciation in the genus *Begonia*.

Activity 3: Melatonin and Salicylic Acid experiment: Different concentrations of melatonin, Salicylic Acid or both were applied to heat tolerant FB08-59 or heat sensitive Bada Boom. All plants were initially grown in low-light greenhouse prior to exposure to direct sunlight. Each treatment will have 3 repetitions of 3 samples. Both SA and Melatonin were sprayed on surface and underside of plants starting 10 days prior to experiment. Plant Height (length of tallest shoots), Plant overall health (any fungi, disease, damage to plants, overall color of plants), Anthocyanin/chlorophyll content and Fluorescence/Gas exchange were measured once a week; plant biomass and leaf area were determined in the end of this experiment. The treatment portion of the project began at the start of August and lasted 10 days. We then collected data on the samples over the course of 5 weeks. Results from this project will be further analyzed for 2nd experimental design and implementation in 2020.

Table 1. Different crossing for heat tolerant begonia breeding	
Crossing	
Male	Female
FB08-59 (heat-tolerant)	Lady Francis
FB08-59 (heat-tolerant)	Spirt mix pink
Jason (Drought tolerant)	OPGC 3563
FB08-59 (heat-tolerant)	Spitfire
Jason (Drought tolerant)	FB08-59 (heat-tolerant)
FB08-59 (heat-tolerant)	OPGC 3563
Jason (Drought tolerant)	FB08-163(sterile, heat tolerant)
FB08-59 (heat-tolerant)	Dade
FB08-59 (heat-tolerant)	Benigo
FB08-59 (heat-tolerant)	Sinbad
FB08-59 (heat-tolerant)	OPGC 3563
Bada Boom Pink	Self
FB08-59 (heat-tolerant)	OPGC 3143
FB08-59 (heat-tolerant)	Lady Francis
FB08-59 (heat-tolerant)	Kaylen
Sinbad	Terri (Kane)
FB08-59 (heat-tolerant)	OPGC 3563
Jason (Drought tolerant)	OPGC 3563
FB08-59 (heat-tolerant)	Concord Trail

4) If any portion of the research has been published, provide location of any professional or published information

One EDIS paper (extension publication) is in press; PI has deliver information on begonia breeding program in the FNGLA organized “Plant Health” workshop.