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observed water-soaked symptoms that were seen on all leaves 2 days after inoculation with the blight pathogen – *Calonectria pseudonaviculata* (Cps) completely disappeared from three leaves 5 days later. She collected these three leaves and homogenized them using a blender after surface sterilization with 70% ethanol, then spread the resultant preparation in Petri dishes with potato dextrose agar and incubated at 25°C for 48 hours. She selected and subcultured eight emerging bacterial colonies by size and color then evaluated them against Cps. The isolate from Small Sage Green colony (SSG) consistently outperformed all other isolates. SSG was identified as a new species in the *Burkholderia cepacia* complex (Bcc) using Bcc selective agar and DNA sequencing.

DELIVERABLES

(Dec 2023 to Feb 2024)

Research

- 1 PhD dissertation
- 1 Conference proceedings

Extension & Outreach

- 14 Extension presentations
- 20 Samples diagnosed
- 40 Email/phone inquiries answered
- 4,095 People reached with articles/news

Education

- 3 Postdoctoral associates
- 1 Graduate student

FEATURED NEWS

BBIG Research Recognized at the 7th Biocontrol, Biostimulant & Microbiome Congress By Chuan Hong, Virginia Tech, Virginia Beach, VA

At the 7th Biocontrol, Biostimulant & Microbiome Congress held in Raleigh, NC, October 24 to 25, 2023, [Dr. Ping Kong](#)'s research identifying, evaluating and elucidating *Burkholderia* sp. SSG as a safe, powerful broad-spectrum biocontrol agent and biofertilizer was recognized as the winner of the poster competition. As part of the reward, she was invited to present her research on stage, in addition to the poster. Her presentations included five focal points.

How was SSG discovered and what is it? In a study with detached leaves under lab condition, Ping



At the poster competition ceremony, Ping receiving a copy of the Book entitled: Microbial Bioprotectants for Plant Disease Management

SSG is safe for agricultural

applications. Bcc is known to include clinical strains of an opportunistic human pathogen. To assess SSG's health risk, Dr. Kong used three methods that were developed specifically for differentiating non-clinical strains from all known clinical strains. These were: 1) DNA fingerprinting, 2) testing with the Bcc clinical strain marker, and 3) an onion maceration assay. Additionally, she sequenced the SSG genome. These studies all support that [SSG is NOT an epidemic strain and poses NO human and environmental health risk.](#)

SSG is a powerful biocontrol agent for boxwood blight and a variety of other diseases. For boxwood blight, [SSG has shown excellent protective and curative efficacy on a highly susceptible cultivar – Justin Brouwers – under containment conditions.](#) Similar protection was seen on

field-grown American (3-year old) and Vardar Valley boxwood (6 years) in western North Carolina – hotspots of the blight disease. Additionally, SSG was an effective ground sanitizer, reducing the potential of fallen blighted leaves as sources of inoculum for new infections of boxwood blight.

[SSG was effective against a variety of other pathogens and diseases.](#) These included three species of Phytophthora, three other fungi, one bacterium, and the diseases they caused on annual vinca, bell pepper, rhododendron, hydrangea, pansy, boxwood and geranium, plus a viral disease – tomato spotted wilt virus on impatiens.

SSG is a potent biofertilizer. In greenhouse studies with three boxwood cultivars, [SSG was most effective in promoting plant growth of slow growing ‘Justin Brouwers’, by 317% within 12 months.](#) This plant growth promoting trait is rooted in SSG producing indole-3-acetic acid and siderophore, fixing nitrogen and solubilizing phosphate as shown in the lab studies. These studies demonstrated that SSG is a potent biofertilizer as illustrated with boxwood.

What makes SSG a safe and potent biocontrol agent and biofertilizer? According to DNA sequencing, [SSG genome consists of over ten thousand genes and gene clusters coding plant growth promoting, antibiosis and other antagonistic traits against plant pathogens and insect pests, but none for the Bcc epidemic strain marker.](#) Microscopy showed that [SSG directly lyses conidia – the pathogen’s dispersal and infective spores.](#) Transcriptomic studies further demonstrated that [SSG primes plant defense mechanisms – making lasting plant protection.](#)

ADVISORY PANEL SPOTLIGHT



[Dr. Jill Calabro](#) is the chair of Boxwood Blight Insight Group (BBIG) Advisory Panel, acting as a liaison between the BBIG scientists and growers. Currently, she is serving the role of product development manager for fungicides at [Valent USA](#). She works with various teams at Valent across the United States, Canada, Latin America, and Mexico for the development of fungicides.

She grew up surrounded by a farm where she developed her admiration for agriculture and believes that agriculture is one of the most noble professions which is pure and critical to life. She takes great joy in supporting agriculture in whichever form possible. In her previous role as the Science and Research Program Director at AmericanHort, including the Horticultural Research Institute (HRI), she provided strategic leadership and advocated for research within the green industry to increase overall profitability and productivity by engaging with stakeholders, academia, government, and non-government entities. Her passion lies in applied research and translating its outcomes to assist growers. “I enjoy being the liaison between hardcore research and the growers. “I tell the growers, here is this information (results of the scientific research), what this means and how you could use it to improve your practices”, said Dr. Calabro.

She believes that among her most significant contributions to science was at HRI, where she helped leverage research dollars to benefit growers within the green industry. Boxwood blight research is a prime example. A lot of early boxwood blight research was supported by HRI, and the findings of those studies were some of the basis for the development of the current BBIG project.

Apart from her professional interests, she enjoys spending quality time with her 11-year-old son, walking her dog, gardening, and being active. She finds great joy in identifying and taking pictures of mushrooms. Her most fascinating mushroom finds so far are the “earthstars”. Her favorite host pathogen system is thatch collapse of turf caused by *Sphaerobolus stellatus* which she first attained insight into during her involvement in working with turfgrass diseases. She had an introduction to plant pathology and mycology as a child. Corn smut was visible in the field surrounding her house, and cedar apple rust plagued her grandmother’s prized crab apple tree, with a nearby juniper (red cedar tree) brilliantly displaying orange telial horns every spring. Hunting for morels with her grandmother fostered her curiosity about fungi.

Learning something new and ensuring that the work that she does helps agriculture in some way motivates her the most in this profession. She is most content when she realizes that she is providing solutions to the growers.

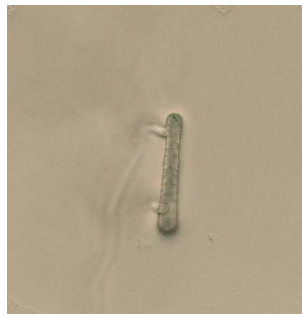
She advises early-career scientists that it is crucial to seize the opportunities presented to them to achieve success in their aspirations. It is good to try something new and keep exploring. Also, to be engaged in the plant pathologist society, be connected, and keep enjoying doing what they are doing.

([Dr. Bhawana Ghimire](#) of Tennessee State University contributed this interview article.)

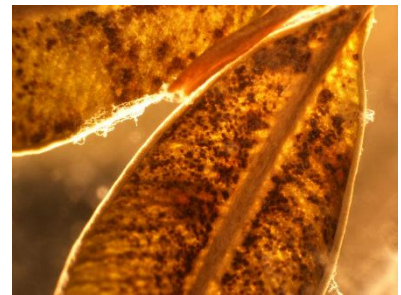
FEATURED RESEARCH

Eradication of Boxwood Blight Propagules by Nina Shishkoff, USDA ARS Foreign Disease-Weed Science Research Unit, Ft Detrick, MD

The boxwood blight pathogen produces conidia as dispersal and infective propagules and microsclerotia as survival structures. Rod-shaped conidia are sticky and they can be easily attached to tools, boots, shoes, and other personal belongings that come in contact with the infected plant materials. Microsclerotia can persist in soil and diseased leaf litter for long periods of time. Thus, stakeholders needed methods to disinfect tools, pots, and greenhouse surfaces. Growers also needed safe ways to dispose of infected plant material.



Rod-shaped 2-celled conidium each is germinating to form new thread-like mycelium



Microsclerotia are small dark lumps of mycelium that form inside boxwood tissue and persist for long periods of time

These different propagules require different methods of sterilization. For example, the conidia are killed quickly in 10% bleach, but the microsclerotia can tolerate bleach for almost an hour. I evaluated chemical sterilants, such as 10% bleach and 70% ethanol, as well as hot-water treatments, biological control, and the use of composting to deactivate the pathogen in leaf litter. Our research demonstrated 70% ethanol to be a quick method to sterilize tools, and described research at Penn State University shows properly-performed composting to be effective after 48 hours.

EXTENSION HIGHLIGHTS

Major Extension and Outreach Programs of the Quarter By Margery Daughtrey, Connell University, Riverhead, NY

The cornerstones of winter extension accomplishments for BBIG were a symposium on Boxwood Blight for the National Plant Diagnostic Network (NPDN) on January 17 and a webinar by Dr. Fred Gouker facilitated by HRI on January 31.

The NPDN Symposium brought updated information on Boxwood Blight and BBIG research to the national diagnostic communities—NPDN, the National Plant Board, and more, and it was very successful in this regard. Attendees numbered 147, including the 7 speakers. [Karen Snover-Clift](#) from Cornell University, who serves as the BBIG liaison to the NPDN, was the chief planner and moderator. [Drs. Xiao Yang](#) and [Mana Ohkura](#), both previously post-doctoral scientists within the BBIG team, both gave presentations in their new roles as Diagnosticians, in [South Carolina](#) and [Oregon](#), respectively. In addition, presentations were made by [Drs. Doug Luster](#), [Nina Shishkoff](#), [Chuan Hong](#) and [Margery Daughtrey](#) on aspects of research and extension related to boxwood blight. There were 62 in the audience who described themselves as diagnosticians or diagnostic lab staff, and 60 who were state Department of Agriculture staff, with extension educators, foresters, students, growers, USDA employees and a few miscellaneous interested parties making up the balance of the attendees. All regions of the country concerned with boxwood blight were represented: Great Plains, North Central, Northeast, Southern, and Western sections of the diagnostic network were present. The audience was very engaged and asked a lot of questions during and at the end of the symposium, so that it was

an excellent interactive session. If you are interested in viewing the symposium recordings, they are posted in the [Outreach to Different Stakeholders/First Responders](#) section under the [Boxwood Blight Knowledge Center](#) tab of the [BBIG](#) website.

[Dr. Gouker](#)'s seminar, for which 571 registered, was titled 'In the Lab and the Landscape at the National Arboretum: Boxwood Genomics and AI Solutions for Blight Detection and Protection'. As promised, it delivered a glimpse into the cutting-edge research at the U. S. National Arboretum (USNA) on the boxwood genome in support of plant breeding goals, as well as an introduction to how AI (Artificial Intelligence) might be brought to bear on studies to improve boxwood blight management. Fred began with a description of the tremendous genetic resources held by the National Arboretum, and reviewed the beginning of the boxwood breeding program in 2013 led by Dr. Richard Olsen. Current resources include 184 unique accessions—including 7 out of 12 of the hardy species of *Buxus*. Since 2011, the breeding program has expanded its focus to include many target pests as well as highly desirable horticultural traits—attention to boxwood blight resistance as well as to boxwood psyllid, boxwood mite, Volutella canker, and leaf miner. They have made 155 controlled crosses, resulted in >780 F₁ progeny, utilizing the Asiatic species as a potential source of disease resistance. They use traditional breeding methods (controlled greenhouse and field pollinations) for cultivar development as well as genetic mapping tools to locate genomic regions controlling desirable traits. They have selected, propagated and sent 15 F₁ hybrids with desirable horticultural traits and boxwood blight resistance to a collaborating grower to be tested and evaluated under commercial production settings. At the USNA they have been studying the use of detached leaves rather than whole plants to evaluate germplasm for its susceptibility to boxwood blight and have utilized software (Assess 2.0) to quantify disease. The AI approach to the research takes out the subjectivity and hugely expedites germplasm screening for disease resistance. Sorting out the genetics of boxwood in relation to disease resistance is not an easy task: by one analysis, they found a total of 32,326 genes in the iconic English boxwood cultivar 'Suffruticosa'. Over 238 people attended the live webinar, and of these 74% felt the information presented would financially benefit the industry. Dr. Gouker's seminar may be viewed at the [BBIG Boxwood Seminars](#) section under the [Boxwood Blight Knowledge Center](#) tab of the [BBIG](#) Website.

Chuan Hong worked closely with HRI partners, adding subheadings to the [Outreach to Different Stakeholders](#) section under the Knowledge Center tab to get rapidly increasing educational materials organized and help viewers navigate and locate the materials of their interest as quickly as possible. These new subheadings included: Horticulturists, Landscape Professionals, First Responders and Science Communities. In addition to the NPDN Symposium and Dr. Gouker's webinar, several other programs' recordings of interest to multiple stakeholder groups, as well as a lot of other useful information, are posted under [Research Updates](#) and [Knowledge Center](#) tabs.

PROJECT MEETING BRIEF

BBIG Leadership Team and [Advisory Panel](#) (AP) held their 13th quarterly project meeting on December 1, 2023. 'Boxwood in the Landscape: Successes and Shortcomings' presented by [Michael Gaines](#), President of CW Arborists and an AP member, was the featured talk, followed by research and extension updates and project management discussion. Mike's presentation highlighted some major difficulties in managing boxwood blight and more importantly his strategies that helped him successfully overcome those difficulties. The recording of his presentation is posted at the [BBIG outreach website](#) to share, in hopes of lifting everyone's spirits by showing that boxwood blight in the landscape is manageable.

Three monthly **Project Leadership Team** Meetings were held on December 13, January 12 and February 14, 2024, respectively. These meetings planned the NPDN Symposium – Boxwood blight Insight Group, the invited presentation at [Cultivate'24](#), and team input for upcoming Plantopia podcast, an educational program hosted by the [American Phytopathological Society](#). [Dr. Nina Shishkoff](#) is leading the Plantopia podcast on boxwood blight and she also accepted to speak at Cultivate'24 on behalf of the BBIG Team. These meetings discussed and finalized several initiatives: 1) meeting with individual team leaders to discuss project status and plans for remainder of the project period until August 31, 2025, 2) adding a new section – Advisory Panel Spotlight – to the BBIG Newsletter, and 3) featuring major accomplishments of this project in the Featured News section.

Project Directors and their associates held their 14th quarterly project meeting with [Dr. Nina Shishkoff](#) as the invited speaker. Her presentation title was ‘Eradication of boxwood blight propagules’. Team members also shared their latest research and extension accomplishments and discussed some project management matters. Also joining this quarterly meeting were two Advisory Panel members – [Jennifer Gray](#), HRI Program Administrator, and [Michael Gaines](#), President of CW Arborists.

ANNOUNCEMENTS



[Dr. Fred Gouker](#), BBIG Co-Project Director and Plant Geneticist/Breeder with USDA-ARS, U.S. National Arboretum (USNA), Floral and Nursery Plants Research Unit (FNPRU) in Beltsville, MD will be taking a new position within USDA-ARS. His research program at the U.S. National Arboretum was focused on development of improved woody ornamental landscape plants with superior ornamental value and that are tolerant to abiotic and biotic stress. For the BBIG project, Fred has been leading the boxwood blight resistance breeding, genetics research and extension. His research activities focused on development of new blight resistant cultivars using traditional breeding and advanced genetic and genomic technologies. This work is highly dependent on the Arboretum’s National Boxwood Collection as a primary source of genetic diversity for gene discovery and breeding.

As of February 2024, Fred has taken a new position as a Grape Geneticist/Breeder for the Grape Genetics Research Unit (GGRU) at the ARS station in Geneva, NY, co-located on Cornell University’s AgriTech campus where he will lead the trait integration research project for GGRU. In his new role, his research program will focus on pre-breeding and trait integration for development of novel grapevine germplasm to meet the U.S. grape industry needs, including rootstock, wine, table, juice, and raisin grapes. This work involves close collaboration with scientists in both public and private sectors to advance genetic and breeding knowledge of grapevines. His research will also be focused on the development of a rapid-cycling breeding system to be used for the introgression of numerous identified disease resistance genes and fruit quality traits into single lines useful for further breeding and genetic improvement. While this may result in a pause in some of the research he started at the USNA, please rest assured that the USNA team (Sue Bentz, Hui Duan, Henry Guo, Margaret Pooler, Piper Zettel, and Mitch Wingert) are committed to continuing the line of work that Fred started. Fred will still be advising and coordinating continuation of the breeding and research projects although in a much more limited capacity.



Congratulations to [Richard Schnall](#), a BBIG Advisory Panel member, on his recent retirement from [Rosedale Nurseries](#), a full-service landscape and retail nursery headquartered in Hawthorne, NY. Richard supported the BBIG Team since the very beginning of the project/proposal development and he will continue to serve on the Advisory Panel.

In addition to staying in close contact with Rosedale, Richard will be an active member of the Hortus Club of New York, the Metro Hort Group, the International Plant Propagators Society, the Professional Grounds Maintenance Society, the Perennial Plant Association and the American Rose Society. Specifically, he serves as Vice Chair for Kensico Cemetery, a 465-acre establishment that achieved Level 2 Arboretum status in 2023. Established in 1889, Kensico has an excellent collection of trees and shrubs including boxwood. Kensico is one of Rosedale’s leading clients and Richard has served on the Board of Directors as its horticultural advisor and landscape designer for 24 years. He is an Executive Committee member and chairs its Sales, Development and Environmental Committee.

RECENT PUBLICATIONS

Dissertation

1. Ghimire, B. 2023. Improving Woody Ornamental Crop Disease Mitigation through Innovation. PhD thesis. Tennessee State University.

RECENT PRESENTATIONS

At Professional Conferences, Seminars or Webinars

1. Ghimire, B., Parajuli, M., Simmons, T., Liyanapathirana, P., and Baysal-Gurel, F. 2023. Enhancing the boxwood blight control using fungicides, antitranspirant, and host plant defense inducer. The 2023 Tennessee Academy of Science Meeting, Memphis, TN. November 18.

At Extension and Outreach Programs

1. Daughtrey, M. 2024. Introduction: boxwood blight effects and how we are coping. NPDN Symposium – Boxwood Blight Insight Group, January 17.
2. Daughtrey, M. 2024. Certified Nursery and Landscape Professionals Training, New York State Nursery and Landscape Association, Inc., Riverhead, NY, February 7, 2024.
3. Daughtrey, M. 2024. Diseases of broadleaved trees and shrubs. Branching Out IPM Scouting Skills Workshop, Cornell University, February 8.
4. Daughtrey, M. 2024. Disease update 2024: boxwood, beech and more. Tree Conference, Long Island Arborists Association, February 13.
5. Hong, C. X. 2023. Boxwood Blight and other signature programs. The 2023 International Plant Propagator Society – Southern Region Annual Conference Attendee Tour of Hampton Roads Agricultural Research and Extension Center, Virginia Beach, VA, October 23.
6. Hong, C. X. 2023. Boxwood Blight and other signature programs. Old Dominion University/Biology Department Faculty Tour of Hampton Roads Agricultural Research and Extension Center, Virginia Beach, VA, November 6.
7. Hong, C. X. 2024. New IPM tools for boxwood blight. NPDN Symposium – Boxwood Blight Insight Group, January 17.
8. Luster, D., Yang, X., McMahon, M. B., Shishkoff, N., Stanley, O., and Carter, M. L. 2024. Diagnostic assays for the boxwood blight pathogens *Calonectria pseudonaviculata* and *C. henricotiae*. NPDN Symposium – Boxwood Blight Insight Group, January 17.
9. Ohkura, M. 2024. Sampling and detection methods for boxwood blight in nurseries. NPDN Symposium – Boxwood Blight Insight Group, January 17.
10. Pscheidt, J. 2024. Transition from an intelligent sprayer to drenching boxwood plants. Oregon Nursery Research Summit. February 1.
11. Santamaria, L. 2024. Integrating extension and research to serve the nursery industry. Oregon Nursery Research Summit. February 1.
12. Shishkoff, N. 2024. Boxwood, the plant and its blight symptom expression. NPDN Symposium – Boxwood Blight Insight Group, January 17.
13. Weiland, J. 2024. Nursery plant diseases: what have we learned? where do we go from here? Oregon Nursery Research Summit. February 1.
14. Yang, X. 2024. Boxwood blight pathogen morphology and how it differs from other pathogens. NPDN Symposium – Boxwood Blight Insight Group, January 17.

PROJECT DIRECTORS

Chuan Hong (Project Leader), Virginia Tech, Virginia Beach, VA

Margery Daughtrey (Extension Leader), Cornell University, Riverhead, NY

Douglas Luster (Research Leader), USDA, ARS, Foreign Disease & Weed Science Research, Ft. Detrick, MD

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Jerry Weiland, USDA, ARS, Horticultural Crops Disease and Pest Management Unit, Corvallis, OR
Fulya Baysal-Gurel, Tennessee State University, McMinnville, TN
Fred Gouker, USDA, ARS, Floral & Nursery Plants Research, Beltsville, MD
Ping Kong, Virginia Tech, Virginia Beach, VA
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Karen Snover-Clift, Cornell University, Ithaca, NY

ADVISORY PANEL & LIAISON TO AMERICANHORT

Jill Calabro (Chair), Sr Product Development Manager, Valent USA Corporation, Walnut Creek, CA
Lynn Batdorf, Boxwood Cultivar Registration Authority, International Society for Horticultural Science
Frank Collier, Owner, Pleasant Cove Nursery, Rock Island, TN
Michael Gaines, President, CW Arborists, Ltd., Sagaponack, NY
Laura Gladwin, Plant Health Manager, Everde Growers, Forest Grove, OR
John Keller, Planning & Research Vice President, Monrovia – Grow Beautifully in CA, CT, GA, OR
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Richard Schnall, Vice President, Rosedale Nurseries, Inc., Hawthorne, NY
Casey Sclar, H.O. Smith Endowed Director, The Arboretum at Penn State, State College, PA
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Jennifer Gray (Liaison to AmericanHort), Administrator, Horticultural Research Institute, Washington, DC

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