



PLANT SCIENCE BULLETIN

SUMMER 2021 VOLUME 67 NUMBER 2

A PUBLICATION OF THE BOTANICAL SOCIETY OF AMERICA



Meet the Newest Members of the BSA Board!



Vivian Negrón-Ortiz



J. Chris Pires



Rachel Jabaily



Ioana Anghel

IN THIS ISSUE...



Kate Parsley on new ways to combat "plant awareness disparity".....p. 94



Cole Imperi explores the emerging field of thanabotany... p. 101



Wanda Lovan, BSA Director of Finance & Administration, Retires... Inside Back Cover

From the Editor

Greetings,

Summer 2021 is upon us and many of us are still experiencing personal and professional difficulties due to the global pandemic. Operating conditions in many places in the United States are slowly returning to normal as vaccination rates have risen; however, there is still great uncertainty as U.S. vaccinations level off and Covid cases continue to fluctuate globally. The second virtual Botany conference will allow us to once again gather in this new environment, albeit not in person. In preparation for this meeting, we are excited to feature many of our annual award winners and introduce the new student representative to the Executive Board, Ioana Anghel.

In this issue, we also present two articles that consider the connections of people to plants. In Dr. Kate Parsley's article, she discusses new strategies for describing and combatting plant awareness disparity. I am particularly pleased to feature this article as it furthers the discussion on this issue that has been carried on in the pages of *Plant Science Bulletin* for several decades. Cole Imperi's article introduces the concept of Thanabotany and the relationships people have with plants in situations involving death. Recognizing these types of relationships can only increase people's awareness of the importance of plants in human culture and, hopefully, in the environment. I hope you find these article informative and inspiring. Sincerely,



A handwritten signature in cursive script that reads "Mackenzie".

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SOCIETY NEWS

Meet the New BSA Board Members!



Vivian Negron-Ortiz

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Rachel Jabaily

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University of California, Los Angeles

BOTANICAL SOCIETY OF AMERICA'S AWARD WINNERS (PART 1)

Distinguished Fellow of the Botanical Society of America

The Distinguished Fellow of the Botanical Society of America is the highest honor our Society bestows. Each year, the award committee solicits nominations, evaluates candidates, and selects those to receive an award. Awardees are chosen based on their outstanding contributions to the mission of our scientific Society. The committee identifies recipients who have demonstrated excellence in basic research, education, public policy, or who have provided exceptional service to the professional botanical community, or who may have made contributions to a combination of these categories.



DR. QIUYUN (JENNY) XIANG

North Carolina State University

Dr. Xiang is well known globally for her diverse contributions to plant systematics and evolution. She is best known for her extensive work on Cornaceae, for which she is the world's expert, as well as her numerous important contributions to our understanding of the well-known Eastern Asia–Eastern North America floristic disjunction. Few groups of plants are now as well-studied as dogwoods, thanks to Jenny's dedication. Her expertise is diverse and spans classical taxonomy, molecular

systematics/phylogenetics, genomics, and developmental genetics. Much of her recent work focuses on population-level and phylogeographic problems. She has an extremely rich publication record and has also maintained continuous NSF support throughout her long career.

One of Dr. Xiang's most important contributions has been fostering close interactions and research connectivity between botanists in China and the United States. Since 2008, she and colleagues in China have taught the "East Asia–North America Field Botany and Ecology Course" at Zhejiang University and North Carolina State University, making a great impact on the training of Chinese and American students in this field. This has been a remarkable opportunity for students from both countries and has helped to foster new international research, as well as many friendships. These student exchanges have had significant impact on the number and quality of collaborations between U.S. and Chinese labs in the botanical sciences.

Jenny has been a life-long member of the Botanical Society of America. She is an outstanding mentor to students, post-docs, and young faculty, often bringing them along to annual scientific conferences including

Botany conferences. Her courses have inspired both plant biology majors and non-majors to think more deeply about plant evolution and diversity. She is well respected and well loved by her mentees, whether they are from the United States or China or elsewhere in the world. In addition, Jenny has been an active reviewer for the *American Journal of Botany*, served on several BSA committees, is a frequent organizer of workshops, symposia, special journal issues, and more—all in service to her profession.

BSA Emerging Leader Award



DR. BRIAN ATKINSON

University of Kansas

Dr. Atkinson is currently Assistant Professor in the Department of Ecology and Evolutionary Biology at the University of Kansas and curator of the paleobotany collection at the KU Biodiversity Institute. Brian completed his doctoral dissertation at Oregon State University in 2017, after earning among other awards, a NSF Doctoral Fellowship and the BSA Paleobotanical Section Isabel Cookson Award. Dr. Atkinson is one of the leading

scientists of his generation in paleobotany and plant evolution. He is making impressive contributions as a field-based scientist who combines morphological and molecular data, extant and extinct plants, as well as biological and geological data. In addition, Dr. Atkinson has become an accomplished teacher, inspiring mentor, and an exceptional role model.

Donald R. Kaplan Memorial Lecture

This award was created to promote research in plant comparative morphology, the Kaplan family has established an endowed fund, administered through the Botanical Society of America, to support the Ph.D. research of graduate students in this area.



M. ALEJANDRA GANDOLFO-NIXON

Cornell University

BOTANY ADVOCACY LEADERSHIP GRANT

This award organized by the Environmental and Public Policy Committees of BSA and ASPT aims to support local efforts that contribute to shaping public policy on issues relevant to plant sciences.

Rocio Deanna, University of Colorado-Boulder, for the Proposal: *ARG Plant Women Network*

Karolina Heyduk, University of Hawaii, for the Proposal: *Hawaiian Culture and the Herbarium*

Carolyn Mills, California Botanic Garden/Claremont Graduate University, for the Proposal *Promoting Indigenous Co-management of Federal Lands in the Nopah Range*

DONALD R. KAPLAN AWARD IN COMPARATIVE MORPHOLOGY

Donald R. Kaplan was a leading researcher in the area of plant form, where he sought to deduce fundamental principles from comparative developmental morphology. Through his own work and the work of the many graduate students he mentored, he had a profound effect on the fields of plant development and structure. Kaplan always encouraged his students to work independently, often on projects unrelated to his own research. He believed that students should publish their work independently, and rarely coauthored his students' papers.

To promote research in plant comparative morphology, the Kaplan family has established an endowed fund, administered through the Botanical Society of America, to support the Ph.D. research of graduate students in this area. The annual award of up to \$10,000 may be used to support equipment and supplies, travel for research and to attend meetings, and for summer support. This award was created to promote research in plant comparative morphology, the Kaplan family has established an endowed fund, administered through the Botanical Society of America, to support the Ph.D. research of graduate students in this area.

Erin Patterson, University of Massachusetts, Amherst, for the Proposal: *The development and evolution of awns in the grass subfamily Pooideae*

Honorable Mention:

Jacob Suissa, Harvard University, for the Proposal: *Bumps in the node: the effects of vascular architecture on hydraulic integration in fern rhizomes*

THE BSA GRADUATE STUDENT RESEARCH AWARD INCLUDING THE J. S. KARLING AWARD

The BSA Graduate Student Research Awards support graduate student research and are made on the basis of research proposals and letters of recommendations. Withing the award group is the Karling Graduate Student Research Award. This award was instituted by the Society in 1997 with funds derived through a generous gift from the estate of the eminent mycologist, John Sidney Karling (1897-1994), and supports and promotes graduate student research in the botanical sciences. The 2021 award recipients are:

THE J. S. KARLING GRADUATE STUDENT RESEARCH AWARD

Isabela Lima Borges, Michigan State University, for the Proposal: *The effects of plant inbreeding on the legume-rhizobia mutualism*

THE BSA GRADUATE STUDENT RESEARCH AWARDS

Laymon Ball, Louisiana State University, for the Proposal: *Mutualisms, mountains, and machine learning: Disentangling drivers of evolution in a florally diverse Neotropical plant clade, Hillieae (Rubiaceae)*

Philip Bentz, University of Georgia, for the Proposal: *Origins and evolution of genetic sex-determination and sex chromosomes in the genus Asparagus*

Haley Branch, University of British Columbia, for the Proposal: *Remembering the hard times: how stress memory evolves in response to environmental pressure*

Stephanie Calloway, California Polytechnic State University, San Luis Obispo, for the Proposal: *Saving a rare plant species from extinction on Anacapa Island*

Anri Chomentowska, Yale University, for the Proposal: *Investigating the evolution of syndromes: life history, mating system, and environmental niche of a desert-alpine lineage in the plant family Montiaceae*

Eva Colberg, University of Missouri - St. Louis, for the Proposal: *The effects of prescribed fire on ant-mediated seed dispersal of *Sanguinaria canadensis**

Mari Cookson, Cal State Fullerton, for the Proposal: *Investigating systematics and host-parasite coevolutionary dynamics in dwarf mistletoes (*Arceuthobium* spp.) using population genomics*

Brandon Corder, University of Wisconsin-Madison, for the Proposal: *Partial mycoheterotrophy in North American orchids: incorporating evolutionary ecological and molecular evolutionary approaches*

Sontosh Deb, University of Alabama, For the Proposal: *Evolution of flooding tolerance in maize relatives*

Caroline Dowling, University College Dublin, For the Proposal: *The genetic architecture of flowering time in Cannabis sativa*

Samar El-Abdallah, Humboldt State University, For the Proposal: *Constructing whole plant concepts for two Early Devonian fossil plants in the assemblages of the Beartooth Butte Formation (Wyoming)*

Paige Fabre, The Ohio State University, For the Proposal: *Patterns of staminode evolution in Penstemon (Plantaginaceae)*

Laura Fehling, Miami University, For the Proposal: *Context-dependency of reward complementarity in a multispecies mutualism*

Emma Frawley, Washington University in St. Louis, For the Proposal: *Little barley: variation, domestication, and adaptation in a North American lost crop*

Elsa Godtfredsen, Northwestern University, for the Proposal: *Early snowmelt, changing phenology and increased drought exposure: consequences for plant survival and reproduction of four subalpine plant species*

Nikolai Hay, Duke University, for the Proposal: *Locating a “missing link” using microsatellite data from herbarium specimens*

Zhe He, Harvard University, for the Proposal: *Pit membranes and plant resistance to cavitation*

Samuel Lockhart, Ohio University, for the Proposal: *Population genetic structure and breeding system characterization of four mixed-breeding violets and one exclusively chasmogamous violet*

Diana Macias, University of New Mexico, for the Proposal: *Adaptability of piñon pine (Pinus edulis) populations to future hot droughts*

Janet Mansaray, Louisiana State University, for the Proposal: *Plants, ants, and curvy bills: the evolution of mutualisms in neotropical bellflowers*

Skylar McDaniel, Utah State University, for the Proposal: *Floral microbiome assembly and function in the face of phenological change*

Michael McKibben, University of Arizona, for the Proposal: *The Contribution of paleopolyploidy to adaptation in diploid descendants*

Elise Miller, University of Minnesota Duluth, for the Proposal: *How do sources, sinks, and physical constraints impact phloem hydraulic conductivity?*

Carina Motta, Universidade Estadual Paulista – Rio Claro, for the Proposal: *Contribution of a naturalized tropical tree to bird diet in secondary forest fragments*

Taryn Mueller, University of Minnesota, for the Proposal: *Ecological genetic drivers of foliar fungal endophyte community assembly in Clarkia xantiana*

Olivia Murrell, Northwestern University, for the Proposal: *Influence of metapopulation dynamics on genetic structure: Case study of the endangered and exceptional species Amorphophallus titanum*

Deannah Neupert, Miami University, for the Proposal: *The evolution and development of the aerial bulbil: a study of novelty in Mimulus*

Megan Nibbelink, Humboldt State University, for the Proposal: *Anatomically-preserved zosterophylls of the Battery Point Formation (Québec, Canada) and a new analysis of zosterophyll relationships*

Kasey Pham, University of Florida, for the Proposal: *What got swapped? Investigating the genomic consequences of hybridization in two species of Eucalyptus*

Alyssa Phillips, UC Davis, for the Proposal: *Origins of polyploidy and their impact on adaptation in Andropogon gerardi*

Neill Prohaska, University of Arizona, for the Proposal: *How does leaf microclimate affect population density and diversity of microbes living on leaves in tropical forest canopies?*

Austin Rosen, Colorado State University, for the Proposal: *Uncovering taxonomic boundaries in a group of seep-loving desert thistles (Asteraceae: Cirsium)*

Malia Santos, University of Idaho, for the Proposal: *Investigating species relationships and evolutionary patterns of defense strategies in Tricalysia (Rubiaceae)*

Amber Stanley, University of Pittsburgh, for the Proposal: *Have floral traits of Impatiens capensis responded to pollinator mismatches caused by climate change and urbanization? A retrospective study using herbarium specimens*

Christina Steinecke, Queen's University, for the Proposal: *Investigating correlated evolution of sexual and asexual reproduction in Mimulus guttatus*

Andrea Turcu, The University of Louisiana at Lafayette, for the Proposal: *The evolution of divergent mating systems across temporally and spatially heterogeneous environments*

Emma Vtipilthorpe, North Carolina State University, for the Proposal: *Relationships between niche breadth and geographic range size in Liatris*

Sophie Young, Lancaster University, for the Proposal: *Phloem loading in the context of C4 photosynthesis in tree-form Hawaiian Euphorbia*

Joseph Zailaa, Yale University, for the Proposal: *Investigating drought impacts on native-California shrubland vegetation from cells to communities*

THE BSA UNDERGRADUATE STUDENT RESEARCH AWARD

The BSA Undergraduate Student Research Awards support undergraduate student research and are made on the basis of research proposals and letters of recommendation.

Anais Barnes, Bucknell University, for the Proposal: *Assessing the geographic distribution and conservation status of Heuchera alba and Heuchera pubescens using field surveys, morphology and genomics methods*

Jeffrey Heim, Bucknell University, for the Proposal: *A population genomics approach to understanding the role of Indigenous foragers in the distribution and genetic diversity of an Australian wild bush tomato (Solanum diversiflorum)*

Matthew Hilz, Saint Louis University, for the Proposal: *Testing the effect of plant age on phenotypic traits in the field*

Hsin Kuo, National Taiwan University, for the Proposal: *Evolution of the AUXIN RESPONSE FACTOR gene family in land plants*

Claire Marino, Bucknell University, for the Proposal: *Solanum sp. 'Deaf Adder,' a new bush tomato species from the Australian monsoon tropics*

Theodore Matel, Cornell University, for the Proposal: *Cunoniaceae fossil from the early Eocene (~58 m. y.) Laguna del Hunco, Huitrera Formation, Patagonia, Argentina*

Ryan McGinnis, Drake University, for the Proposal: *Battle of the sexes: Intra- and Interindividual floral variation in a native fruit tree, American persimmon (Diospyros virginiana, Ebenaceae)*

Nola Rettenmaier, Cornell University, for the Proposal: *Assessing NAM/CUC3 Expression in Costus spicatus*

Nicholas Rocha, Cornell University, for the Proposal: *The role of pollinators in the phenotypic diversity of Calochortus venustus*

Aryaman Saksena, Cornell University, for the Proposal: *Evolution of floral fusion in the banana families*

Emily Smith, Drake University, for the Proposal: *The function of staminodes in the reproductive success and pollination ecology of American Persimmon, Diospyros virginiana (Ebenaceae)*

Ethan Stolen, University of Florida, for the Proposal: *The impact of genome doubling on gene expression noise in Arabidopsis thaliana*

THE BSA YOUNG BOTANIST AWARDS

The purpose of these awards is to offer individual recognition to outstanding graduating seniors in the plant sciences and to encourage their participation in the Botanical Society of America.

Andrea Appleton, Georgia Southern University, Advisor: Dr. John Schenk

Olyvia Foster, University of Guelph, Advisor: Dr. Christina Caruso

Renée Geyer, Oberlin College, Advisor: Dr. Michael J. Moore

Jonathan Hayes, Bucknell University, Advisor: Dr. Christopher T. Martine

Jeff Heim, Bucknell University, Advisor: Dr. Christopher T. Martine

Emily Humphreys, Oberlin College, Advisor: Dr. Michael J. Moore

Kiana Lee, University of Guelph, Advisor: Dr. Christina Caruso

Michelle Liu, Oberlin College, Advisor: Dr. Michael J. Moore

Tallia Maglione, Connecticut College, Advisor: Dr. Rachel Spicer

Jordan Manchego, University of Alabama-Huntsville, Advisor: Dr. Alex Harkess

Livia Martinez, Barnard College - Columbia University, Advisor: Dr. Hilary Callahan

Colleen Mills, Weber State University, Advisor: Dr. Sue Harley

Abigail Moore, Ohio University, Advisor: Dr. John Schenk

Claire Pellegrini, Connecticut College, Advisor: Dr. Rachel Spicer

Eva Popp, Rutgers, The State University of New Jersey, Advisor: Dr. Steven Handel

Riki Ross, University of Akron, Advisor: Dr. Randall Mitchell

Megan Soehnlen, Walsh University, Advisor: Dr. Jennifer Clevinger

Heather Wetreich, Bucknell University, Advisor: Dr. Christopher T. Martine

Shefka Williams, Connecticut College, Advisor: Dr. Rachel Spicer

THE BSA PLANTS GRANT RECIPIENTS

The PLANTS (Preparing Leaders and Nurturing Tomorrow's Scientists: Increasing the diversity of plant scientists) program recognizes outstanding undergraduates from diverse backgrounds and provides travel grant.

Anais Barnes, Bucknell University, Advisor: Chris Martine

Serena Blais, California State University, Sacramento, Advisor: Clayton Visger

Jonathan Carcache, Florida International University, Advisor: Daniela Hernandez

Josh Felton, Colorado College, Advisor: Rachel Jabaily

Aaliyah Holliday, Cornell University, Advisor: Chelsea D. Specht

Caitlyn Hughes, University of Georgia, Advisor: Jim Leebens-Mack

Emily Hughes, Rutgers University, Advisor: Suzanne Sukhdeo

Al Lichamer, University of Wisconsin-Madison, Advisor: Ingrid Jordon-Thaden

Annie Nelson, University of Nebraska- Lincoln, Advisor: Katarzyna Glowacka

Matthew Norman, Atlanta Botanical Garden, Advisor: Lauren Eserman

Deirdre O'Malley, Hobart and William Smith Colleges, Advisor: Shannon Straub

Ryan Schmidt, Rutgers University, Advisor: Lena Struwe

Madilyn Vetter, University of Wisconsin Eau Claire, Advisor: Nora Mitchel

Jayla Wade, Howard University, Advisor: Dr. Janelle Burke

Audrey Widmier, Mercer University, Advisor: Dr. John Stanga

THE BSA DEVELOPING NATIONS TRAVEL GRANTS

Yetunde Bulu, Adekunle Ajasin University, Akungba-Akoko, Nigeria

Paula Burchardt, Londrina State University (UEL), Brazil

Laura Calvillo Canadell, Instituto de Biología, UNAM., Mexico

Ítalo Coutinho, Universidade Federal do Ceará, Brazil

Kelsey Glennon, University of the Witwatersrand, South Africa

Thliza Ijai Ayuba, Federal University, Gashua, Yobe State, Nigeria

Yesenia Madrigal, Universidad de Antioquia, Colombia

Oluwasanmi Odeyemi, Federal College of Animal Health and Production Technology, Nigeria

Oluwatobi OSO, University of Ibadan, Nigeria

Vashist N. Pandey, DDU Gorakhpur University, Gorakhpur, India

Nantenaina Herizo Rakotomalala, Kew Madagascar Conservation Centre, Madagascar

THE BSA STUDENT AND POSTDOC TRAVEL AWARDS

Winners were selected by lottery

Diana Castillo Diaz

Funmilola Mabel Ojo

Paige Ellestad

Namrata Pradhan

Chuangwei Fang

Laura Super

Matias Köhler

Yingtong Wu

Jessica LaBella

Mei Yang

Francesco Martini

SOUTHEASTERN SECTION STUDENT PRESENTATION AWARDS

The following winners were selected from the Association of Southeastern Biologists meeting that took place at the end of March, 2021.

Southeastern Section Paper Presentation Award

Emily Oppmann, Middle Tennessee State University

Southeastern Section Poster Presentation Award

Regina Javier, Appalachian State University

ECOLOGICAL SECTION STUDENT TRAVEL AWARDS

Mimi Serrano, San Francisco State University, Advisor: Dr. Kevin Simonin, for the Presentation: *Tracking Leaf Trait Differentiation of Newly Diverging Subspecies of Chenopodium oahuense on the Hawaiian Islands*

Laura Super, University of British Columbia, Advisor: Dr. Robert Guy, for the Presentation: *The impact of simulated climate change and nitrogen deposition on conifer phytobiomes and associated vegetation* Co-author: Dr. Robert Guy

Yingtong Wu, University of Missouri - St. Louis, Advisor: Dr. Robert E. Ricklefs, for the Presentation: *What Limits Species Ranges? Investigating the Effects of Biotic and Abiotic Factors on Oaks (Quercus spp.) through Experiments and Field Survey* Co-author: Dr. Robert E. Ricklefs

PTERIDOLOGICAL SECTION & AMERICAN FERN SOCIETY STUDENT TRAVEL AWARDS

Ana Gabriela Martinez Becerril, National Autonomous University of Mexico, UNAM. Faculty of Higher Studies Zaragoza, Advisor: Alejandra Vasco, for the Proposal: *Disentangling the systematics of the Elaphoglossum petiolatum complex (Dryopteridaceae)* Co-author: Alejandra Vasco

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Botany 2021 Featured Speakers



Beronda Montgomery
Plenary Address



Chris Muir
BSA Emerging Leader



Anita Sil
MSA Karling Address



Mario Vallejo-Marin
Annals of Botany
Address



Carolyn Ferguson
Incoming ASPT President



David Asai
Belonging in Botany



Michael Donohue
Incoming BSA President



Marc Cubeta
MSA Presidential Address

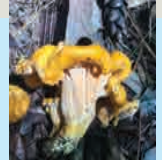
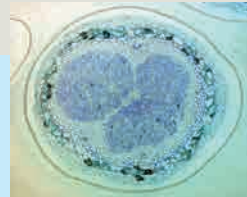


M. Alejandra Gandolfo-Nixon
Kaplan Lecture

B & PB21 PLANT BIOLOGY
Worldwide Summit
July 19–23

**Botany 2021 and Plant Biology 2021
Present a Special Joint Symposium
Wednesday July 21, 11:00 am (ET)**

**An Exploration of
Inter-kingdom Interactions
Featuring:**



Bacterial endosymbionts of Mucoromycota fungi; lessons from evolutionary, functional, and computational genomics

Jessie Uehling
Oregon State University



Bidirectional communication along the microbiome-root-shoot axis.

Corné Pieterse
Utrecht University



Perception of lipo-chitooligosaccharides by the bioenergy crop *Populus*

Jean-Michel Ané
University of Wisconsin



A set of conserved receptors is essential for root system architectural changes induced by arbuscular mycorrhizal fungi

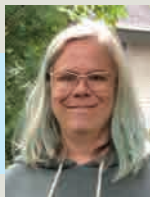
Uta Paszkowski
Cambridge University



Symbiotic forms and the lichenized phenotype

Klara Scharnagl
University of California, Berkeley

Organized by:



Heather Hallen-Adams
University of Nebraska-Lincoln
Mycological Society of America



Gary Stacey
University of Missouri
American Society of
Plant Biologists



Elizabeth Kellogg
The Danforth Center
Botanical Society of America



SPECIAL FEATURES

Plant Awareness Disparity: Looking to the Past to Inform the Future

A SHORT HISTORY OF PLANT BLINDNESS

Many readers of the the *Plant Science Bulletin* are likely familiar with a problem that has plagued botanists and science educators for at least a century: most students are not interested in learning about plants. This simple fact has been written about extensively, both within this very publication and throughout the field of botany education research (e.g., Balas and Momsen, 2014; Hershey, 2002; Strgar, 2007; Wandersee, 1986; Wandersee et al., 2006; Wandersee and Schussler, 1999; Wandersee and Schussler, 2001).

What many people do not often recognize is that the history of this problem is more extensive than it seems on the surface. The original idea behind plant blindness first surfaced in the journal *Science* in 1919, when George Nichols discussed the teaching of botany and zoology in American universities and how the development of general biology courses would affect these topics. In the article, Nichols laments that these new general biology courses “are responsible for the popular delusion that biology is the study of animals: that the words biology and zoology are synonymous,” (Nichols, 1919). Before this phenomenon even had a name, plant blindness was recognized as a major problem for biology education.

Several years later, in 1994, the term “zoochauvinism” appeared on the scene. Zoochauvinism is known as a bias against plants in favor of animals, and while this term appeared first in the literature, it is now largely recognized as a consequence of plant blindness (Bozniak, 1994; Hershey, 1993; Wandersee and Schussler, 2001). Shortly after, the term “plant blindness” was coined by James Wandersee and Elisabeth Schussler (Wandersee and Schussler, 1999, 2001).



By Kathryn M. Parsley
*Education Project
Manager
Education Research and
Outreach Laboratory
Donald Danforth Plant
Science Center*

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Website: www.kathrynpmarsley.com
Blog: <https://plantawarenessdisparity.wordpress.com/>

Plant blindness is defined as “the inability to see or notice the plants in one’s own environment—leading to: (a) the inability to recognize the importance of plants in the biosphere, and in human affairs; (b) the inability to appreciate the aesthetic and unique biological features of the life forms belonging to the Plant Kingdom; and (c) the misguided, anthropocentric ranking of plants as inferior to animals, leading to the erroneous conclusion that they are unworthy of human consideration,” (Wandersee and Schussler, 2001). This definition can be extrapolated into four components of plant blindness: attention, attitude, knowledge, and relative interest (Parsley, 2020). The attention component refers to the visual phenomenon of not noticing plants in an environment, which is supported by research in visual cognition (Balas and Momsen, 2014; Norretranders, 1998; Parsley, 2020). The attitude component is denoted by a lack of positive affect toward plants and/or being apathetic toward them (Parsley, 2020; Parsley et al., in review). The knowledge component refers to the inability to recognize the importance of plants in the biosphere and human affairs (Parsley, 2020; Uno, 2009; Wandersee and Schussler, 2001). The relative interest component is characterized by a lack of interest in plants when compared to animals (Lindemann-Matthies, 2005; Parsley, 2020; Wandersee, 1986; Wandersee and Schussler, 2001).

These four components and the detailed definition of plant blindness indicate that this phenomenon goes much further than simply not noticing plants. These attentional deficits cascade into impacts on student attitude, interest, and knowledge, and each is an important component to student learning. This makes plant blindness a multifaceted, complex problem that has significant implications for biology and botany education.

As such, what we call the phenomenon and the language we use to describe it matters. In the past few years, botanists and educators have spoken out about the problems with the term *plant blindness* and how it is inherently exclusive toward disabled scientists. For example, McDonough MacKenzie et al. (2019) posited that instead of focusing on “curing plant blindness,” we should instead seek to “grow plant love.” While the ideas behind the term are not in question (no one is proposing to change the definition cited above), the term itself has been identified as a potential barrier to diversity and inclusion within the plant sciences.

MOVING AWAY FROM THE TERM “PLANT BLINDNESS”— WELCOMING DIVERSITY, ACCESSIBILITY, AND INCLUSION

Although the term *plant blindness* is unique in that it captures an incredibly complex phenomenon in a simple and easily digestible phrase, it is still highly problematic in other ways. The authors who developed this term used a disability metaphor, and while ableism was not the authors’ intention, disability metaphors are inherently ableist (McDonough MacKenzie et al., 2019; Sanders, 2019). Disability metaphors equate disabilities with negative or undesirable traits that require “fixing” (Schalk, 2013; Smith, 2015). As someone who is visually impaired and has learning disabilities, I must admit that I do find it problematic to equate blindness with not noticing plants in my environment. If we are to

promote a diverse and equitable environment in which everyone feels comfortable learning about plants, it is important that we choose language to reflect these goals.

As such, I have proposed that we change the term *plant blindness* to a new one: *plant awareness disparity (PAD)* (Parsley, 2020). Plant awareness disparity is accurate, inclusive, and maintains the conceptual intentions behind the original term. PAD highlights the fact that the root of the problem with this phenomenon is a disparity in visual attention between plants and animals. The problem is not just that we do not see plants, it is that our visual systems have evolved to place plants in the background of our visual field in service of noticing animals (Parsley, 2020). At the same time, it recognizes that this visual cognition reality creates the other three components of PAD. This attention disparity between plants and animals is responsible for the development of negative attitudes toward plants, a lack of interest in plants, and a lack of knowledge of why plants are important (Parsley, 2020). As such, PAD emphasizes the visual roots of the phenomenon while still encompassing the rest of the original definition of plant blindness. Because PAD is both more inclusive and continues to preserve the integrity of the definition behind plant blindness, I have begun using PAD to refer to this phenomenon instead of plant blindness. I encourage others to do the same for the reasons outlined above.

PAD IN EDUCATIONAL SYSTEMS AND TOOLS

PAD is present at all levels of education and can even be transmitted from teachers to students. For example, Nyberg et al. (2019)

noted that elementary school student teachers notice plants in environments where plants are in the foreground (such as botanical gardens), much more than in environments where animals are the focus (such as a science center). These findings regarding student teachers are significant, because if student teachers do not have experiences with plants in the foreground, their PAD levels may continue uninhibited until they begin teaching students. Once they do, these new teachers may favor animals in biology examples, leading to PAD in their students as well. There is even evidence that high school students do not perceive plants as being alive, partly due to plants' lack of observable motion (Yorek et al., 2009). PAD does not automatically decline over time without an intentional intervention. Examples of intentional interventions include: educational curriculum, the introduction of a plant mentor (someone who mentors others and teaches them about the importance of plants), or the special interest and enthusiasm of a teacher.

PAD is even a problem within the very instructional tools that we use to teach biology. Schussler et al. (2010) discovered that even in two nationally syndicated textbook series in the United States, animals and plants are represented unequally. There were more than twice as many animal examples as plant examples in the textbooks. Even in highly regarded and frequently used general biology textbooks at the university level, this trend continues. Brownlee et al. (2021) noted a similar tendency for textbooks to represent animals in images more often than plants (and focus on animals in images containing both plants and animals). PAD is infused into instructional materials at all educational levels in the United States. As one might imagine, this has disastrous consequences for botanical

literacy and botany education. If students are not exposed to both plant and animal examples of biological concepts, they can come away with misconceptions such as that plants do not evolve.

HOW TO COMBAT PAD IN AND OUTSIDE OF THE CLASSROOM

Given how ubiquitous PAD is at all levels of education (particularly in the United States), many authors have explored strategies to reduce PAD in a multitude of contexts. Wandersee et al. (2006) probed community college students' botanical sense of place to help them see and understand how plants are important to not only the students, but also humans in general. Frisch et al. (2010) used this approach to help educate science teachers about why teaching plants in elementary school is important as well.

A proposed way to alleviate PAD in K-12 students is through an outdoor education program, where students (ages 10 and 11) have hands-on opportunities to interact with the plants (Fančovičová and Prokop, 2011). Wyner and Doherty (2019) demonstrated that local street trees can be used to decrease urban middle school students' levels of PAD, despite a lack of large outdoor spaces present in these urban environments. Patrick and Tunnicliffe (2011) demonstrated that children of the ages 4, 6, 8, and 10 are in touch with their environment to varying extents, and that children who have rich experiences outdoors tend to have more knowledge about both plants and animals.

Outside of formal learning environments, Hoekstra (2000) noted that in order to help combat PAD, botanists should partner with the media and get better at presenting information in a relatable and entertaining way. Hershey (2002) had several ideas for combating PAD: a college course for preservice teachers, an online botanical glossary, a botanical seal of approval on biology textbooks from botanists, and even a bibliography of accurate botanical and biological teaching materials. Wandersee and Schussler (2001) noted that having a knowledgeable and friendly plant mentor has also been shown to result in lowered PAD in students. Having experiences with a plant mentor also results in increased attention to, interest in, and scientific understanding of plants at a later point in life for many people. Wandersee and Schussler took an activist approach in their 1999 paper, in which they announced that they were launching a campaign to “prevent plant blindness,” as it was then called, which was followed up with special posters to hang in classrooms and even a children's book about a plant. To follow up with this idea, they even created an award called the Giverny Award for children's books that accurately teach at least one scientific principle, and preference is given to books that teach about botany and plant biology.

NEW STRATEGIES AND SUGGESTIONS FOR APPROACHING PAD

In the Classroom

Parsley et al. (in review) note that when designing ways to reduce PAD in students, it is important to consider that simply teaching students may not be enough. We found that even after an active learning botanical

curriculum, only student attention and knowledge of plants improved significantly—their attitudes and interest in plants did not (Parsley et al., in review). This is important because if we are to reduce PAD, we have to be sure to address the problem from a more holistic perspective. Botanists and instructors cannot rely on increased knowledge alone to change students' minds about plants.

Introductory biology textbooks need to improve their representation of plants in images at both the elementary and university levels (Schussler et al., 2010; Brownlee et al., 2021). Instructors who are using textbooks with high levels of PAD should incorporate outside resources such as herbarium specimens, online repositories such as botanydepot.com, and even botanical social media accounts to better represent plants in their classes (Brownlee et al., 2021).

In Personal Experiences

Making plants personal seems to be a major strategy to help combat PAD. Krosnick et al. (2018) noted that personal experience growing plants and treating them as pets can also have an effect on PAD. When students get personally invested in these activities, it can help them develop those feelings of empathy that also develop when they have a plant mentor or have significant memories of being around plants in their childhood.

Notably, my research (both in exploring the literature and in conducting my own research studies) indicates that interpersonal relationships are an important part of reducing PAD. Often the relationship with a plant mentor, family member, or friend is what gets students interested in plants. It typically takes students being taught by another person how to empathize with plants, while this seems to happen automatically with animals.

As instructors, botanists, and outreach activists, we can take on this role for our students. We can go the extra mile to demonstrate our enthusiasm for plants, and to encourage the same in our students. And, if we are ever going to be rid of PAD, we *must* do these things. To advance in the fight against PAD and botanical illiteracy, I am proposing a social media campaign specific to PAD.

Online

On Twitter or Instagram, use #PADisBad to tell the world how you are fighting PAD with educational curricula, field trips, active learning activities, or even science communication methods. If you have funny memes related to PAD, ideas for interventions to reduce PAD, or if you just want to show others how PAD affects their lives, #PADisBad can help get the word out. The more people involved in this discussion, the more likely we are to make a difference in PAD and botanical literacy, not only for our students, but also for the public at large.

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FROM THE *PSB* ARCHIVES

60 years ago

A condensation of papers given at the Teaching Section Symposium "The Botanical Garden as an Outdoor Teaching Laboratory" are published, including articles by Walter Hodge, William Campbell Steere, and William S. Stewart.

--*PSB* 7(2): 4-6.

50 years ago

"Owing to increasing costs and decreasing revenues, Dr. Lawrence J. Crockett, Business Manager, *American Journal of Botany*, regrets to announce that the very liberal rule that everybody who publishes in the journal receives the first 100 reprints free must be changed. Beginning with the August issue, only those who are paying the voluntary page charge will get the reprints free.

"Hopefully, members of the Society will understand why this change is necessary. Our membership dues are very low in comparison to other similar scientific societies. It has been possible for a member who published two articles in one year to get back as much as \$30.00 on his \$10.00 membership fee. While finances were rosy, this could be tolerated. but with science and economics being what they are today, the Society can no longer grant this gift."

--*American Journal of Botany* Reprint Policy. *PSB* 17(2): 18

40 years ago

"The rapid decrease in the natural vegetation of the world is of great concern to all botanists. The wasteful and flagrant violation of man's stewardship over forests, plains, marshes and estuaries has appalled generations of botanists, but the complexity of solutions to these problems (which necessarily includes political, legal and social components) has eluded us and has discouraged too many of us from actively working toward solutions.

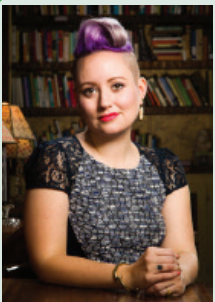
"The International Union for Conservation of Nature and World Wildlife Natural Resources has prepared a detailed strategy of global dimensions for the United Nations Environmental program. This strategy provides for active participation of botanists in the making of decisions regarding future use of plant and other resources. Thirty countries (including the United States) have already pledged their support to this proposal, as have also the international monetary organizations."

--Salute to World Conservation Strategy. *PSB* 27(3): 17-18.

Thanabotany: the Emerging Field Where Plants, People and Death Intersect

Imagine this: it's 2018 and an independent thanatologist from Cincinnati, Ohio embarks on a research fellowship exploring the intersection of plants, people, and death. What results is a new field of study called *thanabotany*. Three years later, this emerging field now has students and researchers from 20 different countries around the world.

I am that independent thanatologist who made her way into the world of botany through that fellowship. If *thanatology* is a new word for you, you're not alone. Put most simply, thanatology is the study of death and dying. The word *thanatology* was coined in 1905, yet, things have been dying long before 1905! Take this as proof of how death-avoidant humanity truly is. I am a dual-certified thanatologist and will be triple-certified later in 2021. I'm interested in changing the way we approach death and loss in my lifetime, and that's my life's mission. Thanabotany is a part of that. *Thanabotany* is the word I coined to describe this emerging field, and I'm excited to share with all of you what's happened in the last three years. Hopefully, I'll lure some of you over!



By Cole Imperi
*Thanatologist,
Chaplain, Deathworker
Founder, School of
American Thanatology*
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While under a fellowship, funded by the Lloyd Library & Museum, I was shocked to discover that there weren't really any texts solely dedicated to discussing how plants have been used for death, dying, grief, loss, and bereavement, despite the fact that every human being experiences death and loss. Every living thing dies, so how were there no books focused on this specific area? So many religions, cultures, and communities have plant-based rituals across time and into modern day that prescribe how specific plants are to be used before death, at death, and after death. How was there no guidebook?! How was there no central text?

WHAT IS THANABOTANY?

Thanabotany is where ethnobotany—the study of the plant–person relationship—intersects with thanatology—the study of death and dying. In thanabotany, we want to understand how humans have used plants to deal with death, dying, grief, loss, and bereavement. From funerary rituals to body preservation to social behaviors, thanabotanical practices appear across different times, cultures, religions, and countries.

Under my fellowship, it was a challenge to find information about these practices offered as a primary focus. I have a huge research database at this point, and all of the information about these practices have been pulled out of books

and texts piecemeal. I'd find a paragraph here, or maybe half a page on one death-related plant practice there. As my research deepened, I found much of the written information about plants and death buried under clouded or avoidant language. Instead of a text saying, "For grief, make a tea of violets," it would substitute words like *hysteria* or *lunacy* in place of *grief*. How many of you, in the aftermath of a significant loss, have had the experience of feeling out of your mind or completely not in normal reality? That's grief, not lunacy—and it's normal. Truth be told, we still are lagging in our understanding and acceptance of grief in modern day, so it is no surprise that what humanity has recorded isn't clear and direct about it. This has proven to be an exciting challenge for those of us in this emerging field attempting to save this recorded information.

In thanabotany, we seek to understand not only *what* plants were used for death, dying, grief, loss, and bereavement, but also *why*, *how*, and by *who*. We are interested in understanding how thanabotanical practices from the past are still alive today and how they can be restarted in a modern context.

THANABOTANY TODAY

I now have students and researchers studying thanabotany with me from 20 countries, across 10 time zones and spanning ages from 18 to 83 years old. Our courses have lessons broken into videos, slide presentations, reading assignments, class discussions, live lectures, tests, and an active community, which allow for real-time communication and collaboration between students during and after courses. It's all spread by word of mouth and via social media. Within 9 months of publishing a single podcast episode about thanabotany in 2019, it had been played in 42 countries more than

1000 times. I've been invited to speak about thanabotany to a wide variety of audiences, from associations for funeral directors to universities to international organizations. The outside interest is real, and it has been a challenge to keep up with—but it shouldn't have come as a surprise, since interest and experience with both plants and death spans cultures around the globe.

In a recent issue of the *Plant Science Bulletin* (Vol. 66, No. 3), I learned that there has been a decrease in the number of botany departments in higher education across the United States. I'm happy to share that, a new independent botany department has emerged! Housed under the School of American Thanatology (which I founded in 2020), we are the only place offering programs in thanabotany today. Additionally, we now officially have an herbarium! The Margaret H. Fulford Herbarium at the University of Cincinnati is the home herbarium for the Thanabotany Department at the School of American Thanatology. They will house a thanabotanical collection comprised of specimens submitted by our students worldwide (Fig. 1). We want to capture modern-day thanabotanical plants, and details about their usage. The Margaret H. Fulford Herbarium is a dream herbarium for us. It houses 127,000 specimens of vascular plants, bryophytes, fungi, lichens and wood samples. The herbarium also houses the research of Margaret H. Fulford, a pioneering liverwort researcher, and the collection of E. Lucy Braun, a plant ecologist. For an emerging field, we are very proud of what has been accomplished in such a short time.



Figure 1. Specimen of *Ocimum basilicum* L. housed at the Margaret H. Fulford Herbarium at the University of Cincinnati; <https://midwestherbaria.org/portal/collections/individual/index.php?occid=15326114&clid=0>. Margaret H. Fulford Herbarium. CINC-V-0000103Lloyd, Curtis Gates 2791904-10-00. Samoa, Upolu, Upolu, -13.924665 -171.739014.

An Increased Interest in Plants

The COVID-19 pandemic has no doubt fueled a lot of change. Many people have been forced into time at home they didn't have before. This time has revealed to a lot of people what *actually* makes them happy, how they *really* want to live their lives, and what they *truly* care about. As a result, many Americans have discovered a newfound interest in plants. During the pandemic, houseplants became an accessible and necessary link between people and nature. Growers across the United States have reported a surge in sales through 2020 and the need to eat into 2021's plant stock sooner than anticipated (<https://www.greenhousemag.com/article/2021-the-year-of-flexibility/>).

One of the most common things self-reported by students on my intake survey is the number of houseplants currently in their homes, or how large their garden is. It's not uncommon for me to have a student with 80+ houseplants at home.

Changing Views on Education

In the United States, the way higher education is perceived and valued is changing, and I would argue—has changed. Many of my students come to the School of American Thanatology to learn about something they care about as directly as possible. In a way, there seems to be a prestige—I'm using actual verbiage from my students here—in studying with an independent institution like

WHERE IS THE INTEREST COMING FROM?

How has this gone from an independent research fellowship to an emerging field with students and researchers from 20 countries in 3 years? I think there are a few important factors:

mine. Students want to cut out the middle man, so to speak, and the middleman is the “institution.” They want the professor. They want the person. They don’t want the school.

When I started the school, my big concern was our lack of accreditation by a larger body. I didn’t know how I would make time to figure out which accreditations mattered, let alone finding the time or resources to devote to those lengthy processes. I came to find, however, my students don’t care about accreditation. They view it as a fee the school likely has to pay that inflates the cost of education, but as a professional in the field, I do still care about it. While leading a young institution, pursuing accreditation helps me express my care and value for our work. I value my peers, and I want my colleagues to trust my commitment.

For those of you reading this with perhaps a niche knowledge in something plant related, let this be encouragement to you to try teaching what you want to teach independently and directly to the people who want to learn from you. People want to learn from people with passion, no matter their home.

WANTING TO TAKE MORE ACTION

Last year was no joke, and 2021 certainly isn’t either. Between the political upheaval, social change, racial injustice, lockdowns and distancing, 2020 left people asking *WHAT*. What can I do, with what I have, where I am? How can I contribute? How can I have an impact?

Plants are humanity’s original best friends. There is an opportunity to take care of ourselves through the plant–person relationship and our

communities through the plant–community connection. Many of my students want to learn how to be in a relationship with plants again, or maybe for the first time ever.

Thanabotany focuses on not only historical research, but also what can be done now, where you already are. We need people recording their modern-day traditions and rituals with plants and death *now*. And we need to collect specimens alongside our written records. Thanabotany is a chance to honor, record, and preserve this relationship and take real, positive action. People can participate in the field from wherever they are in the world. They just need an internet connection.

WHO IS INTERESTED IN THANABOTANY?

There are two answers here: people who want to *study* thanabotany and people who want to *use* it.

Based on surveys my students take when they enroll, my students come from a wide variety of professional backgrounds. The following is a selected list of job titles reported by my students:

- Arborists
- Arboretum professionals
- Artists
- Attorneys
- Board-certified physicians
- Currently enrolled college students
- Educators (K-12 and college)
- Field botanists
- Funeral directors
- Genealogists
- Government workers
- Human resource professionals
- Insurance salespeople

- Librarians
- Non-profit executives
- Parks and recreations staff
- Psychiatrists, psychotherapists, and counselors
- Registered nurses
- Retail managers
- Software company executives
- Veterinarians and veterinary staff
- Zoologists
- Teachers
- Writers
- Veterinarians
- Zoos

THANABOTANY IN REAL LIFE: FUNERAL SERVICE

Since 2019, I have kept a list of the inquiries that come into my website and comments I get after my talks from people who are seeking thanabotanical information. Here's a selected list of groups/professions who have expressed a desire to have access to information from the field of thanabotany for use within their own contexts:

- Arboreta
- Cannabis and CBD companies/products
- Cemeteries
- Chefs/cooks
- City planners
- Clergy
- Embalmers
- Florists
- Funeral directors
- Gardeners
- Genealogists
- Grievers
- Grocery stores
- Hospices
- Historians
- Horticultural therapists
- Indigenous leaders looking to reconnect their modern communities to their forgotten death practices
- Journalists
- Landscapers
- Nurseries
- Parks and recreation staff
- Sommeliers

Louis Linnemann, President of Linnemann Family Funeral Homes and Cremation Center in Northern Kentucky said, "When Cole presented her talk about Thanabotany at the Annual Meeting of the Northern District of Funeral Directors and Embalmers, we knew immediately that the use of flowers and plants would have an application to funeral service."

One of their Funeral Directors, Bart Pindela, was able to immediately take what he learned about thanabotany at that talk and run with it. "Thanabotany can provide a meaningful and memorable connection for families to their deceased. Plants not only serve as an expression of sympathy but can be used as a catalyst for connecting families to the memory of their deceased," said Pindela. "Through the recommendation of the local Thanatologist, Cole Imperi, I have used rosemary in place of filler greens in a casket spray. This was very appropriate because the deceased was a native of England, where rosemary has a symbolic and historical connection to funeral ritual and grief. A few of the rosemary plants were planted at the graveside and the rest were taken home by the family to be planted in their gardens. After the funeral services were over, a family member thanked me for recommending the use of rosemary. She said that rosemary, an herb she overlooked before, now holds a lasting connection to her mother. Her comment made me appreciate the potential of plants to serve families on their

path through grief. Plants used during funeral services are not just expressions of sympathy but can offer survivors a connection to their loved ones that continues past the day of the funeral service.”

This is, in my view, one of the best possible applications of thanabotany. It provides additional tools to those in professional roles (in this case, to funeral directors), and it helps people move through the grieving process and find meaning. Research consistently shows that when we can identify something with meaning—whether that’s a rosemary plant or something else—we are likely to live longer and be healthier. Thanabotany provides opportunities for plant professionals, as well as lay people, to find a meaningful role in the field.

THANABOTANY IN REAL LIFE: CEMETERY ARBORETUMS

Did you know that many historic cemeteries have worked to become arboretums? Once they “fill up,” they have the time and resources available to put back into the landscape. Gertrude Lorenz—an Ecological Designer, Rewilding Specialist, Certified Permaculturalist and Board Member at Historic Linden Grove Cemetery & Arboretum in Covington, Kentucky—said, “There are infinite possibilities for Thanabotany at Linden Grove—from green burials and scattering gardens to traditional burials and existing grave sites. Each space is an opportunity for the use of plants to speak for and about our loved ones. In addition to the benefit to each family during the grieving process, it opens up the wider conversation in the community about how our natural world has a language

of its own and how it is constantly speaking to us. It provides a beautifully meaningful pathway into developing closer relationships with the individual plants around us which will ultimately move beyond the cemetery and flow out into our everyday lives. Nature is one of our core values at Linden Grove and many of our current efforts are moving towards alignment with this value and so Thanabotany couldn’t be more on point with the type of practices we need. Ultimately, it creates a higher quality experience for our community and a more refined conversation around grieving and nature. Thanabotany is a perfect fit for Linden Grove, but I think it would be for any cemetery.”

Linden Grove is currently in the process of installing a thanabotanical garden with specimens connected to the loss of children and healing from grief. This includes trees, shrubs, and flowers with recorded usage practices related to this specific type of loss and/or to remedies for grief recovery.

THANABOTANY ISN’T NEW

Academic and research applications of thanabotany can provide new ways of looking at an entire collection, or even a single specimen. Dr. Eric Tepe, Assistant Professor and Herbarium Curator at the University of Cincinnati’s Margaret H. Fulford Herbarium, pulled a magnificent specimen from their collection with a special note that would be of particular interest to a thanabotanist:

“The specimen of basil collected by C.G. Lloyd in Samoa is interesting for a number of reasons,” said Tepe. “First, it is native to Africa and Asia, so probably arrived

in Samoa relatively recently. Its culinary use is obvious, but the fact that it was adopted for more ritualistic purposes—"rubbing dead bodies"—in that short time is interesting. Lloyd collected ethnobotanical data for only a few of his Samoan collections, and the extra data that accompanies this specimen makes it especially valuable. According to Art Whistler's *Plants in Samoan Culture*, coconut oil is used traditionally to absorb plant aromas, which is then used as a perfume, for massages, and 'in the past, for embalming the dead.' He doesn't comment on when this practice was abandoned, but the Lloyd specimen could be on the tail end."

FINALLY

In the last three years, the growth of thanatology worldwide, without much effort on my part to market or advertise it, is what has shocked me the most. It *doesn't* surprise me, however, that people are interested. Plants and death are universal experiences. Both are natural. I look forward to seeing where things are in another three years, and if you read this and find yourself interested in being a part of an emerging field, please reach out! You can find me at AmericanThanatologist.com, and you can find the school at AmericanThanatology.com.

NEW FROM PRINCETON



Nature's Palette
A Color Reference System from
the Natural World

Patrick Ruby
Cloth \$28.95



Florapedia
A Brief Compendium
of Floral Lore

Carol Grecke
Cloth \$18.95



Treepedia
A Brief Compendium
of Arboreal Lore

Joe S. Malcof
Cloth \$18.95



Trees of Life

Max Adams
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Poetry Corner

There are a few things that I particularly enjoy when being a teaching fellow for the class OEB 52 - Biology of Plants at Harvard University: the process of how students gradually became very familiar with the concept of alternation of generations, the moments when they were surprised or impressed by random facts of plants, the times when they tell me how they started to pay more attention to plants around them—and my favorite is when their final creative arts projects were finally revealed. In this class, we require all students to complete a final creative project to illustrate the “rise of sporophyte,” and students have their full artistic freedom to create a project in any form and format. This is definitely the highlight of the class every year, and we were blown away by their creativity every single time.

We got submissions in songwriting, song adaptations, interpretive dances, yoga lessons, drawings (watercolor, pencil, vector art, pixel art, sand art—just to name a few), clay art, stop motion videos, time-lapse videos, song playlists, children’s books, games (e.g., board games, online video games), recipe books and menus, magazines, embroidery, puzzles, essays, poems, and more. A video trailer about the creative projects of the class was made in 2017 and can be found here: https://drive.google.com/file/d/1EKsgJ_8PEZIVX8-A5dyj1YLaI23BEm4V/view?usp=sharing.

This year, one of my students, Jude Okonkwo, composed a beautiful poem for his final project, and I was particularly touched by it. I encouraged him to publish it in the *Plant Science Bulletin* because I felt this poem can touch many botanists’ hearts and inspire more people to express the love and thoughts for botany with arts and literature.

Enjoy! --Min Ya, Harvard University

In Lasting

By Jude T. Okonkwo

Project Goal: In nature, there is a selective pressure for sporophytes to grow larger in order to disperse spores by air and a selective pressure for gametophytes to grow smaller to take advantage of films of water for sperm dispersal. Additionally, heterospory and endospory are traits that evolved to allow sporophytes to become the dominant generation and these traits have evolved many times independently. My hope is to explore the question of “lasting” through poetry and incorporate these physical realities into that poetic endeavor.

Part 1:

when your bare feet taps against the clovers in the pavement cracks doesn't it tear you from the webs of photography and the allure of lights and guide you to a more primal home

in the city, do you ever press beyond the concrete dominion and gaze again at the phantoms of great oak and bristling vine that once defined our heaven

what does it mean for man to yearn for what cannot be seen what does it mean for woman to seek what cannot be understood

I knew a man who sailed a boat to the center of the Caspian and threw himself into the sea he said there was pleasure to be found in abandonment in the roar of the water flush against the ears and the burn of salt scraping up against the skin

was this his atonement for the way we live a way out of the urges that bind and prod us to build larger gadgets, larger toys, larger lives as a means of escape

a botanist taught me that men aren't the only ones that seek escape from the body that sporophytes too push against the structure that God gave pushing against the body wall, hoarding sunlight and oxygen

growing further and faster in order to shed parts of themselves into the wind with hopes of finding refuge somewhere beyond

Part 2:

Like a sailor who sees in the boundless ocean image a home and the weary sojourner who digs through the desert sands for water I have sought the shimmers of love's delightful mirage

Do u grasp too at stones in hopes of finding a drop of human feeling in this cold world

Have we not seen what men can do? how a boy can lie against pavement for nineteen hours and be left unattended

I often wonder how people mill about knowing that at any hour their souls can be seized from them that the oxygen that courses through their blood will dissipate leaving behind a temple of tissues, scars and bones

And just like that!
(What is that evolution that pushes this haunting from us?)
But here we are!
(Where in my bones is this escape from fear?)

But I have known the aroma of love just as well that which dwells like an oracle in the depths of the living like a shivering fern who hides her child in a vegetable womb her lifeblood food for her offspring to eat like the moss that shrinks the body in a flush of humility nearing the molecule water that will carry on his fertile seed and isn't that all I desire that in ages after my body has folded back into soil that another will arise to roam with a speck of my heart that another will love with a hint of my soul



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New Releases:

Mary Strong Clemens (Ships Oct. 2021)

A Systematic Vademecum To The Vascular Plants of Saba (Ships Oct. 2021)

Flora of Oregon. Volume 2: Dicots A-F

Guide to the Vascular Flora of Buxton Woods, Dare County, North Carolina, U.S.A.

Drosera of the New Jersey Pinelands, U.S.A.

Stay in touch!

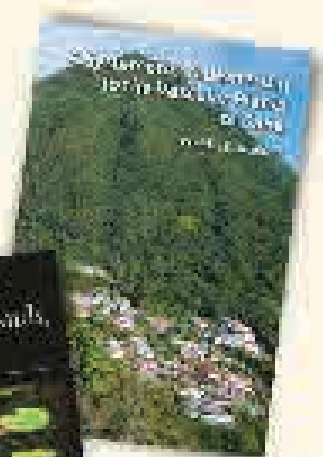
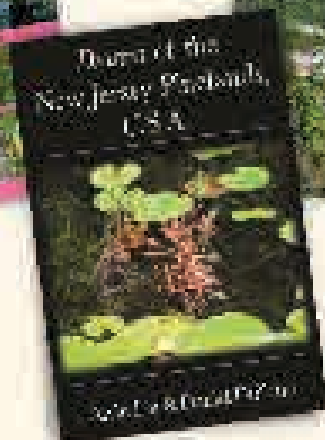
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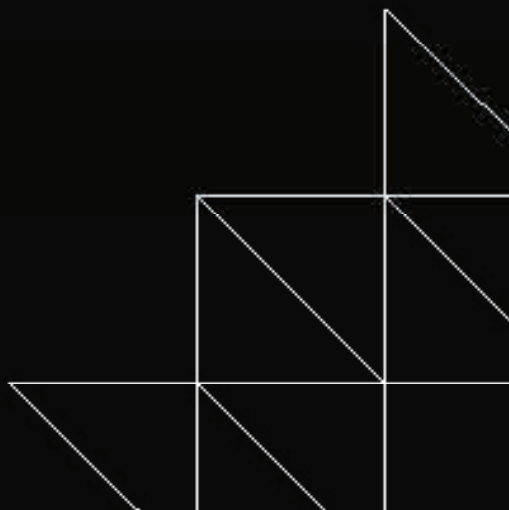
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SCIENCE EDUCATION

PlantingScience Has Large Session, Successful Student/Scientist Mentoring Conversations Despite Pandemic Disruptions

Despite facing disruptions and a dynamic range of teaching situations, from fully in-person learning to hybrid, to fully remote learning, we had a larger-than-usual spring PlantingScience session. Nearly 1000 students from 26 classrooms participated this fall, working closely with scientist mentors and our Master Plant Science Team liaisons. Some student teams worked remotely from each other, and commented to their scientists about challenges and lessons learned when collaborating remotely. “Next time we could try to check comments and responses of our group members more often. Most of us used centimeters, but one or two group members used inch[e]s.”

Throughout the session, students and scientists shared a general feeling of optimism and “light at the end of the tunnel” regarding the COVID-19 pandemic disruptions, and there was a lot of appreciation for the motivation boost of interacting with scientist mentors virtually, as well as the opportunity to do science projects again for those participating virtually.

Explore the PlantingScience Star Project Gallery at <https://plantingscience.org/psprojects/starprojectgallery> to see examples of the work of PlantingScience student teams this spring and the conversations they had with their scientist mentors over the course of their project.



By Dr. Catrina Adams, *Education Director*



Dr. Jodi Creasap Gee, *Education Technology Manager*

BE MORE THAN A MENTOR

SEEKING 20 GRADUATE STUDENTS & POST-DOCTORAL RESEARCHERS FOR PLANTINGSCIENCE MASTER PLANT SCIENCE TEAM

“Being part of the Master Plant Science Team was a great entry point for me to start mentoring an age group I don’t normally interact with. Their curiosity and engagement with their experiments was fantastic to see, and it was also a good chance for me to practice communicating my research in a broadly accessible way.” – Greta Rockstad, PlantingScience Liaison

Are You Ready to Be More Than a PlantingScience Mentor?

Graduate students and post-doctoral researchers: does mentoring with PlantingScience sound exciting to you? Do you have good communication skills already and some experience with or a strong interest in helping secondary students and teachers? If so, consider serving as a teacher/scientist liaison as part of our Master Plant Science Team. We provide training in what it takes to excel as an online mentor and reveal behind-the-scenes aspects of how the program works. First, you’ll get to mentor several teams to learn the ropes and practice mentoring with diverse groups of students.

Then you are paired with one of our participating teachers to help the teacher get the most from the program, make sure the teacher’s mentors get the classroom and scheduling context they need to be good mentors, and help to keep the student/scientist conversations going strong. It is an excellent opportunity to see how a variety of mentoring styles play out with students and a powerful way develop your own mentoring and communication style. Liaisons make the program possible!

In exchange for your extra help, we sponsor your BSA membership for the year and provide a 50% discount off of meeting registration. Learn more and apply by August 16, 2021 at <https://plantingscience.org/joinmpst>.

LIFE DISCOVERY: DOING SCIENCE CONFERENCE

To Be Held In-Person at
Estes Park, CO,
Sept. 30–Oct. 2, 2021

The 7th Life Discovery – Doing Science Conference (esa.org/lcdc) will be held in person in September, and we are still accepting Education Share Fair Roundtables. Check the website for details on the COVID-19 policy for the conference.

This stand-alone education conference—co-sponsored by the Botanical Society of America along with the Ecological Society of America and the Society for the Study of Evolution—is for high-school teachers, informal science educators, program coordinators and directors, lecturers, and faculty who teach organismal or environmental biology.

2021 Conference Theme



The ecological sciences are well positioned to serve as bridges between research, life experiences, and societal needs. Join us to share and learn practical strategies in

Pushing Past
Barriers: Ecological
Science for All.

Pushing Past Barriers: Ecological Science for All.

In recent years, we have seen a significant change in public attitudes in support of climate science and sustainability. At the same time, whether it is about food safety, endangered species or protection of waterways, we continue to see the latest science being pushed aside in public discourse. As we embark into a new decade, ensuring that ecology is relevant to all students is vital so that we can prepare all students to be ecologically literate.

- How do we transform ecological teaching in order to maintain a connection with a vast student population that is not interested in science and retain those who aim to become science researchers and professionals?
- How do we encourage nonscience majors to take away important messages that will inform their personal and professional decisions?
- What does a science-based, culturally relevant and inclusive curriculum that connects student learning to current events look like?
- How can educators activate the appropriate levers of change to overcome systemic barriers to organismal biology education?

This year's theme is "Pushing Past Barriers: Ecological Science for All." Taking advantage of the YMCA of the Rockies location, the conference will offer three pre-conference field trip options, including a hands-on workshop (EREN-NEON Flexible Learning Projects – Building skills in field ecology and data science) and two trips (National Ecological Observatory Network's (NEON) Rocky Mountain National Park terrestrial field site and the Boulder Apple Tree Project – Exploring techniques and practices of community-engaged undergraduate research).

The Life Discovery Conference is a great place to meet other educators. The discussion-heavy conference format, high ratio of presenters to attendees, and small (~100) size allows for great networking and deep conversations about the best ways forward in organismal biology science education. It draws a diverse group of educators, which adds to the richness of discussion by bridging perspectives across the worlds of university, high school, and informal education. We hope you can join us!

EDUCATION FEATURES AT BOTANY 2021 VIRTUAL!

Consider attending some of the many education, outreach, and training opportunities:

Tuesday June 15

1:00 PM EDT: Pre-conference workshop: Ace it! Practice, Get Feedback, Give a Better Talk

(This session was recorded and will be available on the conference platform for registered attendees.)

Sunday, July 18

1:00 PM EDT: Workshop: Challenges and successes of research at primarily undergraduate institutions: Jumpstarting your 2021-2022 research program

1:00 PM EDT: Workshop: Tips for Success: Applying to Graduate School

3:00 PM EDT: Primarily Undergraduate Institution Section Business Meeting

Monday, July 19

12:00 PM EDT: Careers in Botany Luncheon

3:00 PM EDT: Plenary Address: From Seeds of Change to a Harvest of Discovery, Beronda Montgomery

4:00 PM EDT: SciComm Celebration Day Mixer

6:00 PM EDT: Student Social and Networking Event

Tuesday, July 20

12:30 PM EDT: Contributed Paper Session Education and Outreach I: Botany for Diverse Audiences and Under-Resourced Communities

3:00 PM EDT: Belonging in Botany Special Lecture: Perspectives on DEI, David Asai

4:00 PM EDT: Belonging in Botany Discussion

5:00 PM EDT: Education and Outreach Poster Session

Wednesday, July 21

10:00 AM EDT: Contributed Paper Session Education and Outreach II: Engagement, Communication, and Teaching Tools

12:00 PM EDT: BSA Teaching Section Business Meeting

1:00 PM EDT: Contributed Paper Session Education and Outreach III: Teaching Tools, Laboratories and Research Experiences

Looking forward to seeing
many of you
at these conference
sessions!

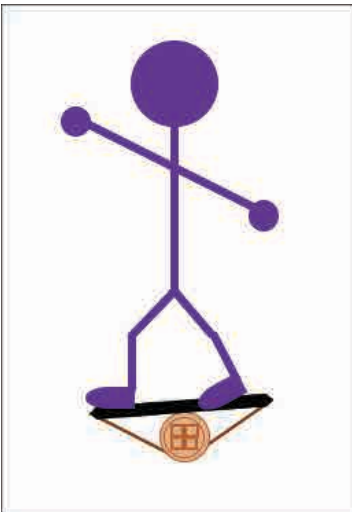


STUDENT SECTION

Graduate School Advice

Since the summer is a time of transition and many of you may be starting graduate programs soon, we decided to collect some general advice on succeeding in graduate school. Often graduate school-related advice focuses on how to get into programs, rather than how to succeed in them. Here we focus on how to flourish in graduate school. The advice shared below, by BSA members (in quotes), focuses on balance, support systems, planning ahead, and taking care of yourself.

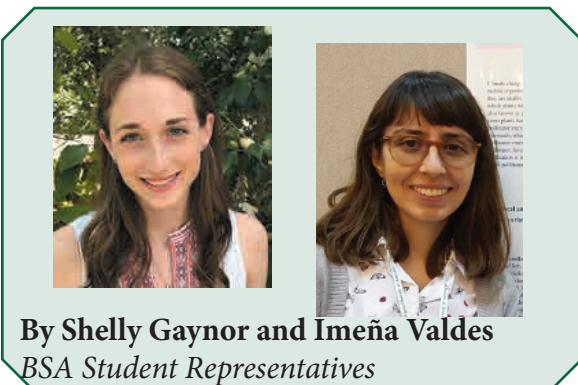
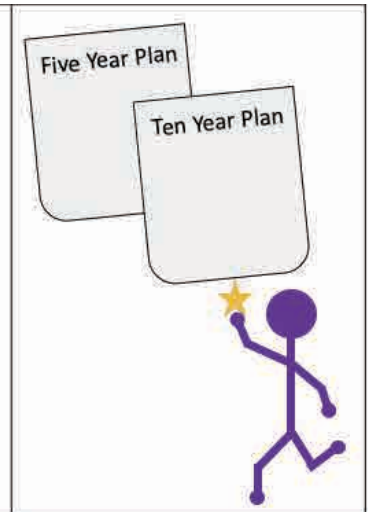
BALANCE



SUPPORT



PLANNING AHEAD



By Shelly Gaynor and Imeña Valdes
BSA Student Representatives

FIND BALANCE

Graduate school can often feel like a never-ending marathon. It's important to learn how to set boundaries, find work-life balance, and recharge. This may look different for everyone: some people may work great during typical work hours, while others may work great from noon to 1 a.m. Find what works for you!

Dr. Chris Martine*Bucknell University*

“Treat it like a job. Come in every day and work your hours like it’s a real job. You will be more efficient and more productive ... and you will also be able to set boundaries on your time that will allow for the sort of work–life balance that promotes good mental health. If you don’t develop that habit in grad school, there’s a decent chance you might never do so.”

Dr. Karolina Heyduk*University of Hawai‘i at Mānoa*

“Make time for you. Hobbies, family, friends. It’s so easy to get wrapped up into the “I have to work all the time!” aesthetic of academia, but no good will come of that. Prioritize things that make you happy (hopefully your research is one of those things!).”

Anonymous

“Figure out what is most essential to recharge your batteries—sleep, exercise, a special hobby—and protect it fiercely. Set boundaries, because grad school does not respect your time.”

Prioritize your tasks and break them down into smaller, more achievable goals (Lewis Jr. et al., 2019). Check out the Summer 2020 *PSB* issue for time management strategies.

Learn how to say “no”! This is a really important skill to gain during graduate school. It is recommended to think carefully before saying “yes” by consulting mentors or peers and weighing your current commitments

(Summerville et al., 2021). It is also important to learn when to say “yes”—specifically, what drives you and what you enjoy. Graduate school is a great time to explore and define your interests.

GET A SUPPORT SYSTEM

Reach out to find supportive friends and be nice!

Dr. Karolina Heyduk*University of Hawai‘i at Mānoa*

“Get a squad of peers, people who you feel comfortable with and enjoy spending time with. It’ll be so important to have that support system through grad school, and helps you reframe the grad school dynamic into mutual support, rather than competition.”

Anonymous

“(1) Invest in relationships with people, in and out of your program. Have a support network that you can be honest and vulnerable with. (2) Corollary: don’t **** where you eat. You may be entering lifelong professional relationships with your colleagues. Try not to be out of control or mean or toxic around them. Exercise judgment about how open you are and with whom. Treat the people around you well. Everyone is smart, so distinguish yourself by being kind.”

HOW TO MAKE FRIENDS IN GRADUATE SCHOOL

- Join clubs, sports teams, or other organizations in your new city to meet people outside of your program.

- Check if your university has a BSA student chapter; if not, think about starting one!
- Join the BSA Slack and interact with BSA members on Twitter!
- Attend the Botany Student Socials!

PLAN AHEAD

Dr. Karolina Heyduk

University of Hawai‘i at Mānoa

“Start thinking about the future (and your next career step) earlier than you think you should. That final defense will come fast, and it’s good to be prepared.”

Anonymous

“Two things I have learned are important, (1) have a 5-year and 10-year plan. These can change and be flexible, but planning for the future and thinking about it often is a helpful tool when choosing what project/side projects will help you accomplish those goals. (2) Learn to market yourself and your research. It takes practice and skill to talk to journalists in helpful ways that enable them to share your research.”

TAKE CARE OF YOURSELF

COVID-19 has worsened the mental health crisis that already existed in academia. It is important to understand your limitations and take breaks when necessary. Seeking help from a professional or online resources can provide support during your time in graduate school (find a list of resources in the Fall 2020 *PSB*).

Anonymous

“Posturing behavior is common and it’s easy to feel like an imposter in this environment. Understanding this might’ve helped me feel ‘sufficient’ during grad school.”

Being open to being wrong and not taking criticism personally will help you succeed in an academic environment (Cunningham et al., 2021). In academia, you are always learning; the more you know, the more you feel like you know nothing. Receiving a document back covered in corrections may sting a little at first, but your advisor and other mentors are there to help you grow and provide new insights through those corrections. Take everything in stride and learn from your mistakes.

EXPLORE DIFFERENT CAREER PATHS

- Attend the Careers in Botany Luncheon at annual Botany meetings.
- Check the BSA Virtual Networking Board for different opportunities.
- Check out the Spring 2021 *PSB* issue for internship and job-related resources.

LITERATURE CITED

Cunningham, W. A., J. J. Van Bavel, N. A. Lewis, and J. Gruber. 2021. Science relies on constructive criticism. Here’s how to keep it useful and respectful. *Letters to Young Sci-*

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Lewis Jr., N.A., L. H. Sommerville, J. J. Van Bavel, J. Gruber, and W. A. Cunningham. 2019. Step back to move forward: Setting new priorities in the new year. *Letters to Young Scientists*. doi: 10.1126/science.caredit.aaw5301.

Sommerville, L. H., J. J. Van Bavel, N. A. Lewis, J. Gruber, and W. A. Cunningham. 2021. Learn when—and how—to say no in your professional life. *Letters to Young Scientists*. doi:10.1126/science.caredit.abg4310.

PAPERS TO READ FOR FUTURE LEADERS

As we continue in our careers, we hope to see the academic culture shift to be healthier and more inclusive. Below are a few papers we think you should read if you hope to lead. We hope to continue to recommend “Papers to Read for Future Leaders” to BSA Student members; if you have papers you would like us to include, please share it with us via this Google form: <https://tinyurl.com/y5dp8r4m>.

- Cooper, K. M., A. J. J. Auerbach, J. D. Bader, A. S. Beadles-Bohling, J. A. Brasshears, E. Cline, S. L. Eddy, et al. 2020. Fourteen recommendations to create a more inclusive environment for LGBTQ+ individuals in academic biology. *CBE - Life Science Education* 19:es6: 1-18.
- Chaudhury, A., and S. Colla. 2021. Next steps on dismantling discrimination: Lessons from ecology and conservation science. *Conservation Letters* 14: e12774.
- Claire Demery, A. J., and M. A. Pipkin. 2021. Safe fieldwork strategies for at-risk individuals, their supervisors and institutions. *Nature Ecology & Evolution* 5: 5-9.
- Nocco, M. A., B. M. McGill, C. M. MacKenzie, R. K. Tonietto, J. Dudney, M. C. Bletz, T. Young, and S. E. Kuebbing. 2021. Mentorship, equity, and research productivity: lessons from a pandemic. *Biological Conservation* 255: 108966.

GETTING TO KNOW YOUR NEW STUDENT REPRESENTATIVE



IOANA ANGHEL

University of California,
Los Angeles

When did you join BSA and what motivated you to do so? Will you encourage other students to become members and participate in the Society as well?

I joined BSA as a first-year graduate student in 2018 when my advisor, Dr. Felipe Zapata, sponsored my membership. I was excited to join to get to know a broader community of botanists outside of my home and local institutions. I am looking forward to learning what motivates students to join a Society, and to encourage students to be active in the Society by reflecting their motivations through BSA activities and programming.

What motivated you to run for the position of Student Representative to the Board of Directors, and what do you plan to do as the student representative of BSA?

I was so impressed by the student reps I met at the Botany Conference in 2019. Minya and Chelsea Pretz were an inspiration—they helped students feel connected by being present and checking in. They created a sense of community and made me feel included and welcome. The student-centered events they planned and managed were intentional and meaningful, like the Student Luncheon where professionals shared how they leveraged their botany education into successful careers. I wanted to help continue these traditions, as well as try to enhance student participation through additional activities and projects.

As the BSA student representative, I would love to develop a program to help students find potential collaborators through activities that encourage open idea generation and low-stakes discussions. This would look like a space, either virtual or at the Botany Conference, where students can openly discuss ideas and interests and find other people who are excited about similar topics. Formalizing such a space would hopefully energize and motivate students to become involved with other BSA initiatives and connect with both plants and plant people. I believe students thrive when they trust that their short experience is still valued and nurtured by the other members of the community. To support this, I would like to formalize a way for students to connect with other botanists with common interests and with people who can expand their sense of possibility in botany.

What have you gained from being a student member of BSA, and why would you encourage other students to become members and participate in the Society?

Finding mentors and friends working with plants is so important in encouraging early botanists to identify their interests and strengths. BSA is an organization that helps me foster my interests through creating a sense of community and helping connect members with opportunities to develop their skills, network, and sense of possibility for their work.

What's your research about, and how did you discover your research interest?

I study the evolution of species in *Linanthus*, a group of diverse annual ephemeral plants with a center of diversity in the Southern California. I am reconstructing the phylogeny of the group, including both genomic and morphological data, and looking at the role of floral scent in differentiating co-occurring species in sympatry. I think annual desert plants are a fascinating and underappreciated group of organisms, and I am hoping that my research can help reveal a little more of their magic.

What sorts of hobbies do you have?

I love anything outdoors, cultural or crafty. I'm Romanian and I enjoy learning traditional skills, like painting eggs in the batik style for Easter or sewing and embroidering traditional clothing. I also have many indoor plants and love to spend long periods of time watering them and observing changes, and I answer questions about plant care from my friends.



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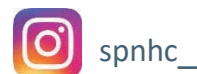
[spnhc.org](https://www.spnhc.org)

SPNHC 2022: hosted by Royal Botanic Garden Edinburgh and National Museums Scotland, UK

SPNHC 2023: hosted by California Academy of Sciences, San Francisco, USA, May 28-June 2, 2023



"It's pronounced "SPINACH!"





MEMBERSHIP NEWS

REFER A PROFESSIONAL

Do you know a Professional in the plant sciences that would benefit from being in the BSA community? Our summer “Refer a Professional” member program introduces professional plant scientists to the benefits of BSA and offers them a one-time discount of 20% off an annual membership. To refer a professional, email me at aneely@botany.org with their information and I will send them the information. Referrals must come from current BSA members, and the professionals **must be new to BSA.**

BSA LEGACY SOCIETY

The intent of the **Botanical Society of America’s Legacy Society** is to ensure a vibrant BSA for tomorrow’s botanists and to assist all members in providing wisely planned giving options. All that is asked is that you remember the Botanical Society of America as a component in your legacy gifts. It’s that simple—no minimum amount, just a simple promise to remember the Society. We hope this allows *all BSA members* to play a meaningful part in the Society’s future. To learn more about the BSA Legacy Society and how to join, please visit: <https://botany.org/home/membership/the-bsa-legacy-society.html>.



By Amelia Neely

*BSA Membership &
Communications
Manager*

*E-mail: [ANeely@
botany.org](mailto:ANeely@botany.org)*

THANK YOU, JARED!



Jared Meeks was one of two original BSA Student Social Media Liaisons, and has been working with us since October 2019. His two-year term will be up this September and we are thankful for the lasting impact that he has had on BSA and our social media presence. Jared was in charge of the BSA Twitter account, and created interesting content such as Morphology Monday. He also helped to create the BSA Liaison Handbook that houses important information for future BSA liaisons. In his role, Jared worked with BSA staff, student representatives, and the Early Career Advisory Board (ECAB) to coordinate daily posts, Twitter Takeovers, and the popular SciComm Celebration at the Botany Conferences.

When he started, Jared was a Master's student studying the *Pedicularis* genus in the mountains of southwest China. While working for BSA, he received his Master's degree, had a daughter, and started his PhD program at Columbia University, where he has expanded his research to compare processes of flowering plant speciation in multiple temperate mountain systems across Asia and North America. He plans to continue teaching, researching angiosperm evolution, and fostering greater care and concern for mountain biodiversity throughout his life.

Are you an early career scientist, or do you know an early career scientist that we should highlight in our Spotlight Series? Fill out the simple form at <https://bit.ly/3dkfWtj>. This opportunity is open to current early career BSA members.

SPOTLIGHT SERIES

The **BSA Spotlight Series**, created and run by the BSA Student Social Media Liaisons, highlights **early career scientists** in the BSA community. Scientists' profiles are shared on all BSA social media platforms, the BSA eNewsletter, and housed on the BSA website. The Spotlight Series shares both scientific goals and achievements, as well as personal interests of the scientists, so you can get to know your BSA community better.



STUDENT CHAPTERS

BSA currently has 23 active Student Chapters! Student Chapters are a great way for students to network with their peers at their institution of learning through engaging activities as well as to take advantage of special BSA discounts, including a \$10 Student Membership and greatly discounted registration to Botany Conferences each year. To learn more about current student chapters, or how to start your own student chapter, visit: <https://botany.org/home/membership/student-chapters.html>.





ANNOUNCEMENTS

In Memoriam



WALTER LEWIS (1930–2020)

With the passing of Dr. Walter H. Lewis on 17 November 2020, the world has lost a great biologist, and each of us who knew and treasured him has lost a dear friend and valued colleague. Walter Hepworth Lewis was born in Carleton Place, Ontario, Canada on 26 June 1930, and grew up in Victoria, British Columbia. He showed an early interest in plants and the natural world. He told his father that he wanted a greenhouse for his 12th birthday, and his father gave him one. His uncle taught him how to grow roses from cuttings, and that was the beginning of a lifelong fascination with and dedication to the genus *Rosa*. Over his lifetime he amassed a huge living collection of wild rose species, mostly from North America, which he maintained partly

at his home and partly in various scientific and horticultural institutions, including the Missouri Botanical Garden. His decades-long taxonomic and cytological study of North American *Rosa* culminated in the treatment of *Rosa* in the *Flora of North America* (Lewis et al., 2015), co-authored with Barbara Ertter and Anne Bruneau, with the entire volume dedicated to him. Subsequent publications dealt with natural North American rose hybrids and described the new species *Rosa memoryae* in honor of his wife and lifelong research partner Dr. Memory P. Elvin-Lewis (Lewis, 2016), and detailed chromosome variation within the worldwide *Rosa acicularis* complex (Lewis and Elvin-Lewis, 2017). His contribution to the scientific understanding of wild roses cannot be overestimated, yet it is only one aspect of his exceptionally long and productive career.

Walter completed his PhD in Biology at the University of Virginia in 1957 under the guidance of Walter S. Flory, Jr., with a monograph of *Rosa* in North America east of the Rocky Mountains. He then taught biology for four years at Stephen F. Austin State College (now University) in Nacogdoches, Texas. He took a leave of absence after being awarded a grant from the National Science Foundation for study in Europe and Africa, and then a Guggenheim Fellowship to study palynology. For two years he worked in the Herbarium of the Royal Botanic Gardens, Kew, at the University of Leeds, and at the Swedish Academy of Sciences in Stockholm with Professor Gunnar Erdtman. During this time, he also made a six-month field expedition by Land Rover in Africa to collect

cytological materials for studies of Rubiaceae, traveling through Kenya, Tanzania, Zambia, and South Africa under difficult logistical conditions and in unstable political times. This work focused on Rubiaceae, and he remained a leading specialist in the family throughout his career. Returning to North America, he accepted a joint position with the Missouri Botanical Garden and Washington University in St. Louis. He was Curator and Director of the Missouri Botanical Garden Herbarium (MO) from 1964 to 1972.

Walter arrived at the Garden during a period of transition following the death in 1963 of Robert Woodson, the previous Herbarium Director. The following year Dr. David M. Gates arrived as the Garden's new Director. Walter immediately began to institute changes that revitalized the Garden's programs and set them on new courses that continue until this day. He revitalized publication of the *Annals of the Missouri Botanical Garden* in 1964. He restarted and invigorated the *Flora of Panama* project, which had lapsed with Woodson's death, instituted a permanent field station in Panama, and founded the herbarium at the Smithsonian Tropical Research Institute (SCZ) in Balboa, Panama. He obtained funds from the Smithsonian Tropical Research Institute and Washington University to create a new position to write the *Flora of Barro Colorado Island*, and in 1967 hired Thomas B. Croat, still on the Garden's staff, to do the job. He reached an agreement with other major herbaria in North America and Europe that the Missouri Botanical Garden would act as the primary North American repository for African plant collections (Lewis, 1970), which quickly led to a large inflow of African specimens that provided the groundwork for the Garden's present-day Africa and Madagascar Department and related programs.

At Walter's initiative, the Garden established a consortium with Washington University, Saint Louis University, the University of Missouri at St. Louis, and Southern Illinois University at Edwardsville to identify core areas of specialization of each institution and allocate them so that students could obtain the best possible botanical education, with the Garden as the focal institution. One feature of that training was the initiation of a weekly plant taxonomy seminar for staff and students, which continues today—more than 50 years later!—as the Floristic Taxonomy Seminar on Fridays. Based on an October 1990 celebratory event at the Garden occasioned by Walter's 60th birthday, D'Arcy et al. (1992) published a detailed and moving tribute to him.

Walter's career in the Department of Biology at Washington University began in 1964 at the same time as his work at the Missouri Botanical Garden, and never really ended during his lifetime; on a website dated 14 May 2020, his status is still listed as "semi-retired". He was a gifted and very popular teacher of undergraduate students, with his Medical Plants course having the highest enrollment of all the upper-level undergraduate courses offered by the University. His extremely effective lectures about the ethnobotany of the Achuar Jívaro people of Amazonian Ecuador and Peru drew upon his collaborative work with Memory Elvin-Lewis, which generated massive plant collections and ethnomedical data from areas with little or no previous botanical exploration. Their rigorously scientific book *Medical Botany: Plants Affecting Man's Health* (Lewis and Elvin-Lewis, 1977, 2003) is still a definitive work on traditional pharmacopeias and their relevance to modern life. They developed a set of practices for ethical use of traditional knowledge as part of their field work, which became the standard for other projects and an element of today's intellectual property bioethics.

Photo Courtesy of Missouri Botanical Garden



Walter's accomplishments and contributions are far too many to detail exhaustively here. His outstanding work in cytology and its relevance to plant function is well exemplified in the pioneering congress on polyploidy held in 1979 at Washington University. This brought together systematic and agricultural scientists for the first time, and resulted in a book summarizing the results of the congress (Lewis, 1980), as well as an ongoing series of international conferences on this area. His expertise in palynology led him to research and publication on aeroallergens (e.g., Lewis et al., 1983). Walter also found time to work with the taxonomy of wild ginseng (*Panax quinquefolius*) and design of a conservation program for it in Missouri (e.g., Wilson and Lewis, 1980). His many graduate students include outstanding leaders in botany and various related fields, and he has an impressive set of career awards and honorary degrees.

Walter contributed much to science, and also to humanity. Above all, we remember Walter as a kind and thoughtful friend and colleague who always thought of others' needs in the midst of his own dynamic and brilliant life.

Sally Bommarito, a plant mounter at the Missouri Botanical Garden, remembers one Valentine's Day when he brought the Garden's plant mounters chocolate truffles and folders of rose specimens (of course they were roses!) to mount. He will not be forgotten by those who knew him, and his legacy of scientific contributions will continue to influence and inform us.

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-Roy E. Gereau, Charlotte M. Taylor, Thomas B. Croat, Peter C. Hoch & James S. Miller
 Missouri Botanical Garden, 4344 Shaw Blvd., Saint Louis, Missouri 63110



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BOOK REVIEWS

Achieving Sustainable Cultivation of Vegetables
Evolutionary Dynamics of Plant-Pathogen Interactions
Foraging for Survival. Edible Wild Plants of North America.
A History of Orchids in South America: Volume I – Colonial Times from Discovery to Independence.
Lessons from Plants
Orchid Species from Himalaya and South East Asia Vol. 1 (A-E)
Plant Genetic Resources: A Review of Current Research and Future Needs
The Pomegranate: Botany, Production and Uses
Wild Orchids of the Southwestern United States. A Field and Study Guide.

Achieving Sustainable Cultivation of Vegetables

George Hochmuth (ed.)
2019. ISBN: 9781786762368
£180 (hard cover); 644 pp.
Burleigh Dodds Science Publishing



“Sustainability involves meeting current needs without compromising the ability to meet future requirements” (Hochmuth, p. xviii). This opening remark of the Introduction to *Achieving Sustainable Cultivation of Vegetables* edited by Professor George Hochmuth, University of Florida, USA, is not a flippant observation as Hochmuth asserts that proper (and successful) sustainable agricultural practices make all the difference between substantial crop yield versus utter loss in impacting the environment, marketing, and/or food justice in a locale. As a reviewer of Hochmuth’s compilation, with consideration of the time, effort, and work that went into his book, I must caution the reader that I will not do adequate justice to the research and insight contained in this admirable book. I summarily dissected the four main parts of the book to provide an overview for each chapter.

The three chapters of Part 1: Physiology and Breeding are divided to discuss root physiology, abiotic stressors, and breeding quality of plants. For Chapter 1: Advances in Understanding Vegetable Physiology, is a discussion of complex root frameworks reaching for the water sources carrying needed nutrients, the importance of xylem vessel diameter, and the hydraulics for transport of said water and nutrients. Chapter 2: Abiotic Stressor Influences includes any external condition inflicted on the plant through the air, soil, or water. These external influences may dominate, alter, or destroy functional cellular properties of a plant. Thoroughly discussed in this chapter are environmental conditions which hold sway over successful plant metabolism affecting crop production, economic fundamentals, and foodstuff essentials. The 3rd chapter, Developments in Breeding Vegetables, reminds the reader (and researcher) that the vegetable products from the veg fields of our forefathers, with dimples and blemishes from insect and pathogen damage, are considered substandard by today’s consumers. There are sections denoted to phenotype and genotype strategies of genetic mapping, marker-assisted

and genome- selection/editing/engineering. A case study focus with tomatoes, and another with Brassica oleracea vegetables, continues the comprehensive and erudite discussion of genetics.

Cultivation is represented in Chapters 4 through 8 of *Part 2* of this academic tome and discusses the mediums for plant growth including health and irrigation of soil, greenhouse and hydroponic techniques, and concludes with a chapter on advancements in organic cultivation. Chapter 4: *Advances in Irrigation Techniques in Vegetable Cultivation*, discusses varied irrigation systems such as sprinkler, drip, surface flood/furrow, and subirrigation. The mathematics for determining soil moisture capacity are explained in the latter half of this chapter. Chapter 5: *Advances in Understanding Soil Health for Vegetable Cultivation*, lends to scientific discussions of soil quality, soil properties, soil-borne diseases, and the essential life-giving nature of what is soil, and not dirt. Hochmuth echoes Aldo Leopold's extracted sentiment from *A Sand County Almanac* (1949) that soil health is the land's capacity for self-renewal. It is the swapping of an academic cap for one of philosophy that I most admired in this fifth chapter.

The 6th chapter, *Advances in Greenhouses and Other Protected Structures Used for Cultivation of Vegetables*, begins with a historical introduction of the origins of sheltered gardens. The research presented in Chapter 6 includes a comprehensive table of the worldwide distribution of principle production countries in greenhouse cultivation. Hochmuth subsets include detailed bio-management stratagems including (in part) types of structures, location considerations, climate management, soil and

soilless growing systems. The chapter is a topic unto itself and is the longest in Hochmuth's book.

Hydroponic systems are expounded upon in the 7th chapter, *Developments in Soilless/Hydroponic Cultivation of Vegetables*. Defined by the editor as "...any method of growing plants without the use of soil as a rooting medium, which involves supply of all inorganic nutrients exclusively via the irrigation water," (Hochmuth, p. 211) this chapter nicely supplements the previous with greater detail into the developments, advantages and disadvantages of hydroponic gardening. Chapter 8, *Advances in Organic Cultivation of Vegetables, rounds off this second section, Cultivation*, of Hochmuth's volume. Use of manure and compost, cover crop, and biostimulant substances are part of this section on integrated nutrient management. To his credit, Hochmuth provides references and websites, even for the omission discussions, to provide the reader-researcher a complete intellection of progress with organic cultivation of vegetables.

Part 3: Pests and Pathogens, include Chapters 9 to 12, as related to vegetable produce and production, pathogen identification technology, integrated pest management (IPM) techniques, and finally with microbiological sources including safety and impact. Before the discussions of pathogenicity in the serial chapters of the third section, the apportionment that is chapter 9, *Understanding and Monitoring diseases of Vegetables*, is a quick-read for those familiar with microscopic and submicroscopic testing processes, and a quick-reference for those who are not. One may get a rudimentary understanding of what exactly constitutes polymerase chain reaction (PCR), microarray, DNA sequencing, enzyme-linked

immunosorbent assay (ELISA) and others. Chapter 10: Advances in Understanding Insect Pests of Vegetables: a Case-study of the Sweetpotato Weevil is a unique chapter in which Hochmuth, "...focusses on one pest of one vegetable that advances greater understanding of the sweetpotato and [sweetpotato weevil] SPW..." which also has parallel applications to other pests and their veg of choice (Hochmuth, p. 293). The crops' importance, and the SPW's significance, are detailed separately as the sweetpotato has far-reaching roots around the world, particularly in 3rd-World countries, with over forty species of insect pests worldwide noshing and destroying the plants from top to root. Chapter 11: Integrated Pest Management (IPM) in Vegetables: Examples of Successful Deployment, and Chapter 12: Microbiological Safety of Vegetable Produce: the Impact of Pre- and Post-Harvest Practices, are interesting precursors to the forthcoming Part 4: Case Studies. Both chapters are paired here as they both shed light on the significance of using multiple gardening strategies whether the invader be macro- or microscopic. In the aforementioned chapter, an IPM approach is discussed through two case studies, selective and individualized to the farm field, to stave off pests. In the latter chapter, various production methods and amendments, which may be modes of deployment for curbing microbial pathogens, are discussed. Organic composts, irrigation water management, seed contamination, cover crops, mulches, and more are all conveyed with corresponding references to current research and literature.

Part 4: Case Studies is a large section with a representative crop for each chapter. The final eight chapters (13 through 20) present an inclusive discussion of breeding, production practices, nutrient management, or pathogens

as warranted by the presented research. Trends, challenges, conservation and nutrition control are all included for improving said breeding quality and production of each case study chapter. The crops selected, in chapter order, are carrot cultivars, lettuce varieties, cucumber (*Cucumis sativus*) and watermelon (*Citrullus lanatus*), and pea breeding (dry/field pea, vegetable/green pea, and silage/grazing pea). There are approximately 200 pages of research information, article references, and resources compiled here in *Part 4 which support the research and discussions of Parts 1, 2, and 3.*

From the beginning of his book to its end, it has been Hochmuth's intent to address and educate with a comprehensive synopsis of what he calls "...the wealth of research addressing these challenges..." (Hochmuth, p. xviii) in sustainable growth of vegetables with crop protection and cultivation, and minimal destructive impactions from various determinants. I believe he has succeeded.

-Karen Penders St. Clair, Ph. D.

Evolutionary Dynamics of Plant-Pathogen Interactions

Jeremy J. Burdon and

Anna-Liisa Laine

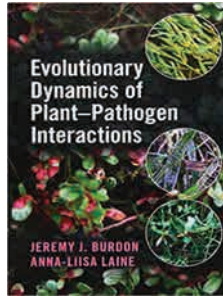
2019.

ISBN13: 978-1-108-62551-7

Paperback, US\$49.99;

392 pp.

Cambridge University Press, Cambridge,
United Kingdom



Plant pathogens are ubiquitous and vastly diverse. All parts of plants are vulnerable to pathogens that may directly affect the vigor, fecundity, and mortality of the host plant. In *Evolutionary Dynamics of Plant-Pathogen Interactions*, Dr. Jeremy Burdon and Dr. Anna-Liisa Laine take readers through the history and science surrounding plant-pathogen interactions in hopes of enhancing interest in and highlighting the importance of space and time on the complex development and ever evolving dynamics of pathogen relationships with their host plants. The book is organized into nine chapters, including an introductory chapter, seven core chapters, and final chapter with tips for future research.

In the first chapter, Burdon and Laine ease the reader into the book with an introduction on the basics of plant pathology. They take the time to highlight some of the cases that stimulated interest in the role of pathogens as driving forces in evolution (e.g., role of barberry eradication in controlling wheat stem rust), and the importance of invasive pathogen impacts on naïve hosts (e.g., destruction of American chestnut by *Cryphonectria parasitica*) to provide some context on why plant pathogens are important. Chapter Two discusses how the environment determines pathogen incidence, abundance, and evolution. For example, the chapter

addresses how temperature and precipitation influence the abundance and incidence of plant pathogens. The authors use variations of the disease triangle to explain how seasonality and other factors (e.g., microbiome) interact with the plant genotype, pathogen genotype, and environment to drive or limit disease signs and symptoms.

The third chapter addresses the genetics of pathogenicity and host plant resistance. There are many means by which plants can resist, escape/avoid, tolerate, or reduce the aggressiveness of pathogens. The chapter discusses the importance of the gene-for-gene hypothesis and provides a very helpful table with wild plant-pathogen associations that involve putative gene-for-gene systems. Major resistance genes, multiple minor resistance genes, and adult plant resistance are also discussed in depth with lots of information and figures derived from peer-reviewed literature. Chapter Four focuses on sources of variation in plant pathogens, especially as it pertains to aggressiveness and infectivity. The authors aptly quote E.C. Stakman in saying that “plant diseases are shifty enemies” before detailing how different forms of recombination (e.g., sexual, asexual, intraspecific, interspecific, viral), mutation, genetic drift, and gene flow contribute to pathogen variation in aggressiveness. Speciation is also addressed in an interesting and thoughtful discussion on cryptic species complexes.

The fifth chapter discusses the demographic and genetic processes in pathogen and plant host populations. Much of the book highlights the extreme complexities surrounding plant-pathogen complexes. However, this chapter along with the sixth and seventh chapters (which focus on the co-evolutionary dynamics from the context of metapopulations and plant-pathogen life histories, respectively) really demonstrate the diversity of responses

possible with plants and their associated pathogens. Specifically, Chapter Six provides three examples of plant-pathogen metapopulation studies—meadowsweet (*Filipendula ulmaria*)-*Triphragmium ulmariae* rust interactions in the Skeppsvik archipelago, narrowleaf plantain (*Plantago lanceolata*)-powdery mildew (*Podosphaera plantaginis*) interactions in southwestern Finland, and Australian flax (*Linum marginale*)-*Melampsora lini* rust interactions in New South Wales, Australia—that demonstrate the spatial and temporal unpredictability of interactions. The complexities of host and pathogen life history traits (e.g., dispersal, infection, lifestyle, mating system) are discussed in the context of modeling in Chapter Seven.

The eighth chapter focuses on the effect of pathogens on plant community dynamics, and contains tables and a lot of fascinating discussion around the effects of non-native, invasive, and native plant diseases. Some readers might find the section on the future impact of diseases considering anthropogenic change to be rather bleak, but thought provoking at the same time. The final chapter of the book focuses on knowledge gaps and suggests ideas for future study, including studies on the evolutionary dynamics of plant resistance genes, impact of climate change on epidemiological patterns, and effects of invasive pathogens on plant community structure. Burdon and Laine also provide a few pages of glossary to help define some of the scientific terms that are used throughout the book. At the end, the extensive knowledge summarized in the book is documented in a 70+-page reference list for those wanting to learn more about the research contained in each chapter.

There were only a few shortcomings of the book. Of these, some were partially remedied

by other parts of the book. For example, several chapters have grayscale images and figures to illustrate some of the pathogen signs and symptoms on plant hosts. Many of the grayscale images do not have enough contrast to see differences, but, fortunately, the pictures are reproduced on color plates as an insert in the center of the book. Additionally, the content within the book can get quite dense, understandably due to the extensive scientific jargon associated with the overall topic. This is partially remedied by the glossary at the end, but not enough to make this book suitable for a more general audience without prior knowledge about plant pathology and genetics. A final limitation of this book is that, although the authors indicate that they address “plant-pathogen interactions,” they base most of their discussion around fungal pathogens and oomycetes, not bacteria, viruses, and nematodes. This limitation certainly does not diminish the quality of the book; it just makes the title seem somewhat misleading.

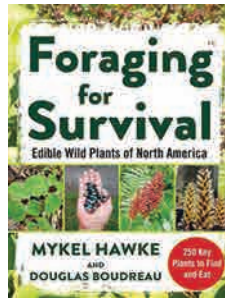
Overall, there are many positive things to say about this book. In the back cover description, Burdon and Laine express that a key goal was to unite different disciplines that “have largely kept themselves separate,” including agriculture and forestry, conservation biology, and genomics. They have certainly accomplished this and, in the process, provided a timely synthesis for any person that regularly works with plant pathogens (in agricultural or natural settings) and wants to learn more about the ecological and evolutionary aspects of plant-pathogen (fungi) interactions.

--A.N. Schulz, *Department of Agricultural Biology, Colorado State University, Ft. Collins, Colorado, USA*

Foraging for Survival: Edible Wild Plants of North America

Mykel Hawke and Douglas
Boudreau

2020. ISBN: 978-1-5107-3833-1
Paperback. \$17.00; 195 + VII pp.
Skyhorse Publishing, New York,
New York



The title of this important contribution to foraging wild edible plants is both accurate and misleading—accurate because it provides detailed information on survival plants; on the other hand, misleading because the region covered is not North America (despite the statement that plants included occur “all over the United States”). Rather, the coverage is of the Southeastern United States with a definite subtropical and tropical Florida bias. The book is apparently largely co-authored but with some chapters under the name of either Hawke or Boudreau.

Like the title, the arrangement of topics is confusing. For example, Chapter One (“Special Rules”) is a discussion of how to learn the plants. There is a warning about poisonous plants, a rational treatment of herbal remedies, universal edibility testing, mushrooms, seasonal considerations (something that most guides do not include), and other good information. Inexplicably, the final entry in this chapter is a “tip from your uncle Myke” describing the use of bleach for “poison sumac” that inflicted him in California. To my knowledge, poison sumac (*Toxicodendron vernix*) does not occur in California although *T. diversilobum* is common there and can be a large shrub. (Despite the experience of Uncle Myke, I would not recommend bleach to clear up urticaria from any species of *Toxicodendron*.)

Chapter Three is an excursus by Boudreau on

the warnings in Chapter One. It is wordy but contains information any forager should know. Accuracy of determination and warnings of toxic plants continues the cautionary theme based on the author’s personal experience. Another example of the book’s quirky nature is Chapter Five, which promotes entomophagy!

The bulk of the book is a treatment of more than 200 plants, each with images of varying quality and therefore limited utility. Harvesting and preparing food from these plants is given in detail. Reading these accounts, one feels the authenticity of the information despite the quiriness. Most of the entries would be in any treatment of edible plants of the Southeastern United States though, as noted, many species are not found outside Florida. Examples include *Coccinia grandis*, *Chrysobalamus* [sic] *icaco*, *Paederia foetida*, and *Eugenia axillaris*. There are more. Oddly, there is an entry for American cancer root (*Conopholis americana*) but nothing about its use or why it is included.

The final chapters deal with poisonous plants, medicinal plants, and “nibbles.”

Who should buy the book? It is a must for survivalists, and anyone interested in foraging in Florida. The attention to detail for species common in the eastern United States gives the work currency beyond the borders of the Sunshine State. I regret I did not have this volume before completing the manuscript of our book on edible wild plants (Musselman and Schafran, in press). *Foraging for Survival* is a good deal at less than \$20.

This is a book for serious foragers. It includes warnings about poisoning, foraging ethics, nutrition, methods of preparation, and much more. Despite apparently limited editing, inadequate images for many entries, unnecessary repetition, botanical lassitude, and digressions, I recommend this work as a

source for foragers and echo what is said in the foreword: “Consider this book a resource of good country knowledge. Learn, study, build on and pass on this knowledge, as it is sure to be useful.”

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--Lytton John Musselman, *Blackwater Ecologic Preserve, Old Dominion University, Norfolk, VA 23529-0266*

A History of Orchids in South America: Volume I Colonial Times from Discovery to Independence

Carlos Offenbach
2020. ISBN: 9783946583240
£195.00 (hardcover); 626 pp.
Oberreifenberg (Germany);
Koeltz Botanical Books



This magnificently illustrated volume presents a history of European botanical exploration and collection that contributed to the discovery of South American orchid species from the 17th to early 19th centuries. It does not consider orchid phylogeny or the history of our understanding of their classification or biology. The book consists of mini-biographies of nearly 100 personages, each typically followed by a list of orchid species described from their collections and/or named in their honor. Any orchid collections they made outside South America, or any plants other than orchids they collected on the continent, are outside the scope of the book, as the author repeatedly reminds us. Several introductory pages on the colonial history

of the continent provide a backdrop for the biographical sketches. It is interesting to note how many of these early botanical explorers were physicians by training, or ordained priests, or men of title and leisure. And how often their lifetime efforts ended in disastrous loss of their collections, penury in old age, death by tropical disease, or failure to ever publish results! Nearly all the biographical subjects are Europeans, and the perspective throughout is understandably Eurocentric. The reader feels the awe and excitement of their encounters with unfamiliar landscapes and biodiversity, and when the narrator tells us who was “first” to navigate the full length of a principal river, climb an Andean peak, or resolve the question of whether the Orinoco and Rio Negro tributaries interconnect, we easily forget that such things were almost certainly done and known previously by indigenous Americans, who, of course, had inhabited the continent for many thousands of years prior to these recorded events. Indeed, one cannot help wondering just how much the native South Americans themselves understood about their local biodiversity. Did they recognize orchids—or epiphytes—as a group, and to what extent did they have names for different orchids? What might they have known about orchid flowering and interactions with insects and animals of the community? Did anyone bother to ask them?

The biographies are treated in roughly chronological order, but as lifetimes overlap, the narrative skips back and forth in time, leaving the attentive reader with chronological whiplash. While there are many little details that make a lasting impression, it is difficult to keep track of the large number of individuals covered in so many separate portraits, which frequently share similarities. At times, the reader gets the impression that individually written biographies were assembled into the present order without a reworking or

rereading of the narrative as a whole; some details are repeated in a way that suggests the narrator has forgotten what was said previously, while elsewhere, persons who will be portrayed only later on are referred to as though the reader were already familiar with them. One may regret the absence of a unified narrative that might integrate the stories of the more significant protagonists involved and give a more critical perspective on the events in which they participated.

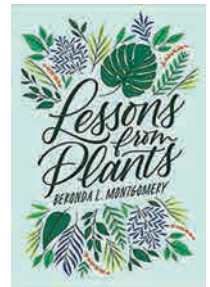
Errors of typography and spelling are unfortunately numerous. Most could have been caught with conventional word-processing software. Even a few orchid terms are affected (*sic*: *gymnostemium*, *Bolbophyllum*), and the continent's largest city, São Paulo, is everywhere misspelled, as is another Brazilian toponym, Santa Catarina. "Swainson" is alternatively spelled "Swanson" so many times that one begins to wonder if in fact they are two different people. A number of dates are obviously erroneous: Juan Pizarro founds the city of Lima in 1535 but also that of San Miguel de Piura in 1832, and meets his death at the hands of Almagro's son in 1841; the period covered in the present book is given in the first paragraph of the introduction as 1848–1823, that of the 17th-century Dutch colonization of Brazil as 1830–1854, and a Franz Post landscape painting of that period is dated 1838. Nor is it believable that Jorge Juan's measurement of the distance corresponding to one degree of longitude along the equator produced a figure of around 112,000,000 meters; this is three orders of magnitude too large, and obviously many times the circumference of the earth. It's a pity to see editing and proofreading neglected when the author has done such prodigious historical research, and the publisher has assembled the work with otherwise superb production standards.

Regardless of any shortcomings, many readers will be persuaded to acquire this book if they are given the opportunity to leaf through it. Nearly every page has excellent quality color figures that include period portraits of the collectors, explorers, and relevant historical figures; contemporaneous maps; landscapes painted by the European artists documenting the New World; and, of course, a considerable number of the original botanical illustrations that accompanied the orchid species discovered. This visual treasure is highly effective in pulling the reader into another time and place and makes a lasting impression.

--William B. Sanders, Florida Gulf Coast University

Lessons from Plants

Beronda L. Montgomery
2021. ISBN-10: 0674241282;
ISBN-13: 978-0674241282
\$22.95 (hardcover); 240 pages
Harvard University Press



The first thing that strikes you is the beautiful cover of the book and the overall attractive presentation produced by Harvard University Press. Once you start reading, you will find some wisdom and life lessons for humans based on the study of plant biology, physiology, and ecology.

As someone who studies plant tropisms, I frequently start seminars with the comment that plants cannot run away from adverse conditions, but they can adjust to their environment. So, we have the directed growth in response to gravity (gravitropism) and light (phototropism). Plants also can change their physiology or morphology to deal with the environment. The author uses broad themes in plant physiology and biochemistry to provide lessons for human behavior with a little bit of anthropomorphism thrown in.

Dr. Beronda Montgomery is a Professor in the Departments of Biochemistry & Molecular Biology and in Microbiology & Molecular Genetics at Michigan State University. Full disclosure: I know her since we both share a common interest in the role of phytochromes in plant development (Hopkins and Kiss, 2012; Oh and Montgomery, 2017).

This short, easy-to-read book has six chapters and a very extensive notes/bibliographic section. The second chapter (“Friend or Foe”) considers topics such as the effects of light quality/quantity on plant development and the important topic of mycorrhizal relationships in plants. She calls these fungi “friendly” microorganisms and, indeed, 90% of vascular plant species have mycorrhizal associations (Moora, 2014). The human lesson here is that it is important for us to form wide-ranging collaborative networks to be successful in life.

The chapter titled “Transformation” considers ecological succession after a natural disaster. Montgomery uses the recovery of the landscape after the volcanic eruption at Mount St. Helens as an example. Human leaders are like pioneering plant species—they can help forge new directions and innovations. Just like in plant ecology, the transformational pioneers may require a period of disruption to make their mark.

In “Plan for Success”, the author shows how plants care for themselves and engage with other plants by budgeting energy and altering their life cycle to meet the present conditions. She asks if house plants do not thrive, do humans consider it the fault of the plant? The answer is no and that we will try to alter the conditions for the plants so that they do well. However, why do we place the blame on a student if they are not doing well? Perhaps we should consider that the support provided

does not meet the needs of the individual we are trying to support. An interesting thought!

In some ways this book is in the genre of books that provide insights into plant biology to a broader audience. Two books that come to mind are “What a Plant Knows” by Daniel Chamovitz (2012) and “Plantwatching: How Plants Remember, Tell Time, Form Partnerships and More” by Malcolm Wilkins (1998). Chamovitz gives insights into major themes in plant sensory physiology in a very accessible way, yet he provides abundant scientific citations. Wilkins, who has written specialist books, uses spectacular photography to make important points about plant physiology and development.

“Lessons from Plants” tries to take some of these same themes and apply them more broadly as models for human behavior. Dr. Montgomery clearly provides insights into her love of plants and is a very enthusiastic author. The book, which is for both botanists and a general audience, makes for a great gift, and I noticed that many lab directors bought these for their students this past year.

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--John Z. Kiss, PhD, University of North Carolina Greensboro, Greensboro, NC

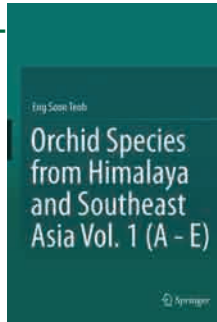
Orchid Species from Himalaya and South East Asia Vol. 1 (A-E)

Eng Soon Teoh

2021. ISBN: 978-3-030-58871-7 (hardcover); ISBN: 978-3-030-58872-4 (ebook)

\$219.99 (hardcover); 504 pp.

Springer Nature Switzerland AG, Gewerbestrasse 11, 6330 Cham, Switzerland



A staggeringly large number of species are native to the area covered by the first volume (of three) of this work. If the numbers found in every country or geographic area were added, the total may well be in the many thousands. In reality this is not the case, because many species are widespread and can be found in more than one country and/or area. Numbers are changing constantly as new species are discovered and/or as taxonomists split and/or lump taxa. Regardless, the task Dr. Teoh (a Singapore gynecologist by profession, an accomplished orchid grower and scholar by avocation, a talented photographer, a prolific author of books about orchids in his spare time, and a friend of nearly 50 years, who provided me with a copy of the book) has assigned to himself is brobdingnagian, even if one considers only library searches and writing the text. But this is not all Dr. Teoh has done. An excellent photographer, he photographed the orchids, which are described in the book, in private collections, commercial establishments, botanical gardens, and native habitats. Living in Singapore, as he does, helps

because orchids abound there, but he also traveled extensively.

Photographs are from one to several per page. They vary in size from full (p. 76) to quarter page (p. 453), or less (p. 259) with many gradations (p. 403) in between. The photographs display the orchids from different perspectives, which present them at their best. Included are images of plant rows in a commercial orchid farm (e.g., *Aranda* Mak Chin On in Maryland Orchids Company, Singapore, where I visited often and resided for a while; p. 65), plants in full bloom with many flowers or inflorescences (*Bulbophyllum lepidum* on p. 129), entire racemes (*Bulbophyllum coniferum*, p. 132), individual flowers (*Aranda hookeriana*, p. 56), close-ups (*Bulbophyllum grandiflorum* on p. 138 and *Eulophia nuda* on p. 489), and plants in their natural habitats (a Vietnamese *Acriopsis* on p. 16 and *Dendrobium signatum* on p. 354). For orchids that have beautiful leaves, the photographs show both foliage and flowers (*Anoectochilus brevilabris*, p. 45). Also included are drawings and paintings from rare old books (*Calanthe Dominyi*, p. 172). To put it simply, the book is profusely, beautifully, and instructively illustrated. Only one photograph does not meet the high standards of the others. It is of *Anthogonium gracile* on p. 48. Most of it is black background, and details of the orchid are lacking—and the hand that holds the plant should have been removed. It would have been easy to do with Photoshop.

A total of 491 species plus 13 botanical varieties and 3 natural hybrids in 51 genera are described in the book. The approach is encyclopedic. Arrangement is alphabetical by genus and within genera. Every genus has its own numbered chapter and list of references. Chapter lengths vary depending on the size of each genus. For example, *Calostylis* and

Cephalanthera occupy two pages each (pp. 183-184 and pp. 185-186, respectively), whereas *Dendrobium* is spread over 154 pages (pp. 293-447). Descriptions are short, to the point, easy to read, clear, informative, and never unnecessarily verbose. They include information regarding geographical distribution of a species, habitat, growth habit, stems, leaves, inflorescences, and flowers. Dimensions and size are included. Herbal medicine uses, flowering seasons, life span of flowers, and cultivation methods are described for some species.

Every genus (i.e., chapter) has its own list of references. Generally, I believe that books should have a single Literature Cited or References section for all chapters. This saves space and avoids repetitions. In this case separate references are necessary because volumes will be published separately with varying intervals between them.

The book also mentions and/or describes 61 cultivated hybrids. Some are old and well known, such as *Arachnis* Maggie Oei (*Arachnis hookeriana* × *Arachnis flos-aeris*), produced in 1950 by (Christopher) John Laycock (1887, UK; 1960, Singapore)—a lawyer, an early orchid grower in Singapore, and one of the founders of the Malayan Orchid Society in 1928. He named the hybrid for his friend and companion, Maggie Oei (when the hybrid that bears her name became famous, an unsuccessful effort was made to locate her). It received consideration when a national flower was being selected for Singapore, but *Vanda* Miss Joaquim, which also has an interesting history (Hew et al., 2002; Arditti and Hew, 2007) was chosen. Hybrids I never heard of until now, and that have less exotic histories, like *Cymbidium* Peter Pan (p. 283), are also described or mentioned.

Another hybrid mentioned in the book is *Calanthe dominyi* (originally *Calanthe dominii*), the very first horticultural orchid hybrid. Its history dates back to 1852 when a gregarious surgeon, who tended to civic affairs (he was elected as sheriff), and both humans and circus animals, John Harris (1782-1855, <https://artuk.org/discover/artworks/john-harris-17821855-surgeon-95524>), suggested to John Dominy (1826–1891, https://en.wikipedia.org/wiki/John_Dominy), orchid grower for the famous Veitch nursery, that orchids can be cross-pollinated. Dominy made a cross (*Calanthe masuca* × *Calanthe triplicata*) and sowed the seeds “. . . on blocks of wood, pieces of tree-fern stems, strips of cork [and] upon . . . moss . . .” (horticultural orchid seed germination was just being developed then). At least some of the seeds germinated and a number of seedlings grew to maturity. The hybrid flowered in 1856. John Lindley (1799-1865), the so-called “Father of Orchidology,” named it for Dominy “. . . in order to put upon permanent record the name of the first man who succeeded in this operation . . .” Lindley also published a colored plate (number 5042) in the *Botanical Magazine*, vol. 84, 1858 (there is more to this story; for details see Arditti, 1984).

Paper quality is important for a book like this one because text and illustrations must not “bleed” from one side of the page to the other. Fortunately, the publisher did decide to use good glossy paper, which, even if not thick and heavy, prevents “bleeding.” The book is still heavy.

There are two indexes in the book, one for species and a second for hybrids. This is well and good, but such a monumental work also requires a detailed general index (what if someone wants to search for white flowered species, orchids that flower in May, or taxa

found only in Papua New Guinea?). My hope is that there will be a general index for all three volumes when the last volume is published. I also hope that page and chapter numbers will be sequential (i.e., the first chapter in volumes two will be numbered 53 and text page numbers will start with 505). And, I would like to see a colored, well-annotated map of the world with the relevant areas and countries outlined.

When completed, this will not be a mere three-volume book about orchids. It will be an excellent three-volume excellently illustrated and very informative encyclopedia for an orchid-rich part of the world. It should prove to be very useful for, and of interest to, orchid growers (amateur and commercial), botanists in general, and individuals who simply enjoy good photography of beautiful and interesting flowers. The only real problem is the usual Springer Verlag overpricing.

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--Joseph Arditti, Professor of Biology Emeritus, Department of Developmental and Cell Biology, University of California, Irvine, CA.

Plant Genetic Resources: A Review of Current Research and Future Needs

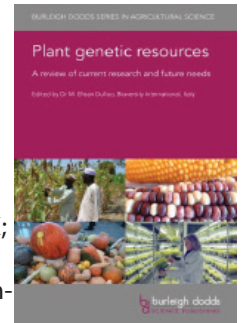
M. Ehsan Dulloo, Ed.

2021; ISBN-13: 9781786764515

£160.00, €190.00, \$210.00

(hardcover) ebook 178924076X; 352 pp.

Burleigh Dodds Science Publishing, Cambridge, UK



A revolution in the planning, design, financing, and delivery infrastructure for plant germplasm is urgently needed to meet the acute needs of our warming world. As we grapple with the challenge of sustainably feeding an increasing population in the face of harsh and unpredictable growing conditions, the newly released book: *Plant Genetic Resources*, presents results of a major global assessment to prepare agricultural crops for climate change.

Editor M. Ehsan Dulloo is eminently qualified, having published widely on biodiversity and the conservation of genetic resources, as Principal Scientist at Biodiversity International and CIAT, and co-Leader of the Genetic Diversity Cluster in the CGIAR research program on Roots, Tubers and Bananas. He previously served as Senior Policy Officer, Plant Genetic Resources, FAO. The authors of each chapter are notable within the constellation of plant germplasm conservation. One can find an imprint of the pioneering role of Jack R. Harlan within many chapters.

Organized into three sections—importance and value of conservation and use of plant genetic diversity, protecting plant genetic diversity: in-situ and on-farm strategies, and enhancing conservation and use of plant genetic diversity—together the chapters articulate the value and challenge of saving seeds of crops and their wild relatives, since the aim of gene banks is primarily to secure

germplasm for crop improvement, particularly critical now, confronted with global heating.

The FAO established a Commission in 1983, emphasizing the interdependence of nations in both the responsibility of safeguarding plant genetic resources (PGR) and the mutual benefits of using them. Their objective was “to ensure that PGR of economic and/or social interest, particularly for agriculture, will be explored, preserved, evaluated and made available for plant breeding and scientific purposes” (p. 7).

Admittedly, protection efforts are often shaped by politics as well as science. Regulations and practices that govern exchange of germplasm to address broader global challenges such as advancement of science and innovation are not as successful as they could be, because they fail to integrate the complexity of the exchange environment. It is important to go beyond a legalistic approach to exchange, to look at the broader social context. Addressing the “hot potato issue” of Access and Benefit Sharing: “the more the development of internationally agreed enabling environment lags behind the pace of technological and scientific advancements, the more polarizing arguments fester, contrasting viewpoints calcify, and the dimmer hopes grow for leveraging these tools to attain sustainable food systems” (p. 25).

This reader views the chapter titled “Improving the global exchange of germplasm for crop breeding,” by Selim Louafi (UMRAGAP Institut, CIRAD, University of Montpellier, INRAE, Institut Agro, Montpellier) and Eric Welch (Arizona State University), as foundational. International and national rules, regulations and laws have established increasing levels of control over access, exchange, and use of PGR, but the proliferation of procedures and obligations for monitoring transfers to

third parties with memoranda of agreement, prior informed consent and material transfer agreements have added complexities to the exchange process with the consequence that breeders and researchers can no longer act according to their own set of preferred rules and norms; these have increased transaction costs (p. 84). There is a concise assessment of the complexities of collaborations involving PGR (pp. 87-92), including definitions (e.g., “sustained relationship,” which would be valuable required reading for anyone preparing to conduct international fieldwork). Having arrived at a destination, one may encounter efforts to “add additional terms” or conditions to collect or use germplasm in an opportunistic environment. The chapter offers “a renewed perspective on the issue of germplasm exchange, describing the reasons why facilitation of exchange cannot be confined to a simple set of legal access rules” by recognizing that difficulties arise from the reconciliation of various institutional logics (p. 96).

Another example of this sourcebook’s usefulness is “Key steps in conservation and use of PGR” by Nigel Maxted and Joana Brehm (University of Birmingham), which reviews the multitude of techniques for collation and analysis of ecogeographic data, which can be handy in preparation for fieldwork and subsequent data analysis.

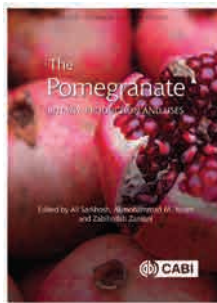
Printed in the United States on sturdy paper stock, the hardcover copy will withstand long-term handling well. There are a few minor grammatical issues: spelling, agreement of noun and verb tenses, to be more useful; the book needs a more complete index. The key phrase “Nagoya Protocols” is listed only once, but in the chapters, it appears at least five times.

It is likely that *Plant Genetic Resources* will become the essential methods manual to facilitate their international exchange and local dissemination, with its commendable component of advocacy. It may well become the standard reference for researchers at universities, institutes, government departments, and plant nursery facilities for many years. It provides an indispensable contribution as a handbook for plant collectors, with proposals about conservation and use, from data management to strategies.

–Dorothea Bedigian, Research Associate, Missouri Botanical Garden, St. Louis, Missouri, USA

The Pomegranate: Botany, Production and Uses

Ali Sarkhosh, Alimohammad M. Yavari, Zabihollah Zamani, Eds. 2020. ISBN: 9781789240764 Hardcover, £160.00, €185.00, \$215.00; ebook 178924076X. 584 pp. Commonwealth Agriculture Bureau International Books, London



Pomegranate is an outstanding encyclopedic handbook, the first comprehensive monograph offering perspectives on issues related to its botany, production, processing, health, and industrial use. Its 100 contributors represent 12 countries: Afghanistan, Azerbaijan, China, Egypt, France, Germany, India, Iran, Italy, Spain, Turkey, and the United States.

Included is information about cultivation and how to increase yields and profits; practices to mitigate pests, diseases, abiotic stresses; plant nutrition management; approaches addressing earliness, yield, improved taste, soft seeds, disease resistance, splitting and sunscald rates; taxonomy and physiology; increasing genetic diversity to improve crop security; and nutritional composition and medicinal uses.

Punica granatum L. is among the earliest known edible fruits. Appealing most to this reader's ethnobotanical interests is "Archaeology, History and Symbolism", including a photo montage combining a Persepolis wall relief showing a hand holding a pomegranate flower, with a true-to-life example. To these they could add the photograph of an unearthed pomegranate flower from the excavations of fortress Karmir-Blur (VII BC) near Yerevan, Armenia (Stepanyan, 2007). Striking photographs of magnificent gold charms show impeccably rendered pomegranates festooning gold necklaces and earrings, from excavations in Iran. To the authors' derivations of the linguistic origins of the term *pomegranate* from Sumerian *nu-urma* and Akkadian *nurmu* to Persian *nar*, one could include Armenian Նուր, *nurr*.

Reading "Production and Growing Regions", it was surprising that the authors cited outdated production data (Holland et al., 2009), until discovering that FAOSTAT offers no coverage about pomegranate production!

Broadening "Biodiversity, Germplasm Resources and Breeding Methods", Baer's (2007) letter to *The New Yorker*, in connection with seeds and crops lost during Afghanistan's wars, offers another connection between Afghanistan's lost heritage and the importance of gene bank seed repositories. Beginning in the 1930s, Harold Olmo, a California horticulturalist / plant explorer, traveled to Afghanistan to collect regional cultivars for a station at Davis, CA. His seeds and cuttings were saved, propagated, and bred into varieties of fruits and nuts consumed today. In 2003, a delegation of Afghan horticulturalists arrived at the USDA/ARS facility on the UC Davis campus, where they rediscovered fruit- and nut-bearing trees that have since been lost in their country. Horticulturalists are now

attempting to replant the denuded hillsides of Afghanistan with offspring bred from crops Olmo saved 70 years ago.

Although “World Pomegranate Cultivars” omits Armenia, Chandra et al. (2010) indicate that it was grown in 7 districts besides the Ararat plain, in 52 of its 60 regions. Hovhannissyan et al. (2014) refer to the Armenian cultivar Gyullosha, and F.M. Harutyunyan, Head Winemaker, Maran Winery (pers. comm. via S. Tashjian, March 1, 2021) names strictly Armenian cultivars, Gyullosha, Gyullosha pink and Shahnar / Meghri golden.

“Pomegranate Bioactive Compounds and Health” examines constituents effective in fighting disease and slowing aging. Pomegranates may help combat cancer and hardening of the arteries. Antioxidant flavonoids with beneficial effects are found at high concentrations in pomegranate peel.

This subject appeals for several reasons: its delicious and nutritious fruit; and how pomegranate awakens memories, appearing in art, folklore, and cuisine throughout historic Armenia. Consequently, pomegranate was adopted as a national emblem often used at Armenian celebrations.

Unfortunately, the fruit with which Armenians identify so strongly is conspicuously absent from these pages. Within Armenian culture, the pomegranate has long represented fertility, abundance, and good fortune; paintings and ceramic, metal, wood, and textile pomegranates are ever-present. At weddings in Western Armenia, it was customary for a bride to throw a pomegranate against a wall, to shatter it; its scattered seeds ensured the bride future children. In Van, Armenian women wishing to bear a son, ate bread baked with pomegranate seeds. At the culmination of weddings in Yerevan, a

small, dried pomegranate called *taratosik* is given by the bride to unmarried guests as a blessing (Petrosian and Underwood, 2006). Pomegranate is viewed as an amulet, protecting people from the evil eye (Petrosian and Underwood 2006) against bad spirits or ill intentions.

Pomegranate has been used as an archetypal ornament found on numerous historical Armenian manuscripts; in religious art, pomegranate appears on sculptured relief friezes adorning the Cathedral of the Holy Cross, Aghtamar Island in Lake Van, Western Armenia, erected 915-921 AD. A film about poet, musician, and bard Sayat Nova, born Harutyun Sayatyan (1712-1795), repeats those images on a coat worn by the actor representing the father of the bride.

Among the most iconic Armenian art films is Sergei Paradjanov’s “The Color of Pomegranates”, a biography of Sayat-Nova (King of Song) that attempts to reveal the poet’s life metaphorically. A symbolic scene shows a red pomegranate on a table, its skin wrinkled, standing out against fresh pulp, as an embodiment of the strength of the Armenian spirit, its invincible soul. After the horrific Armenian Genocide, many Armenian artists have used pomegranates in their lyrics and poems to describe a range of emotions, from suffering to hope, rebirth and national survival. The search term *pomegranate* in ProQuest® Newspapers found an article in the *New York Times* titled “Pomegranate as Fruit of a Vintner’s Labor” about pomegranate wine from Armenia, linked to numerous news articles about the Ottoman-era Armenian Genocide, beginning in 1894.

Colleague S. Martiros (pers. comm., May 25, 2021) describes a celebration that he heard about from director, screenwriter, writer, and

friend of Parajanov, Rustam Ibragimbekov, during Parajanov's 60th birthday at his birthplace, Tbilisi. The courtyard was covered with planks on which guests stepped as they entered. Under the boards were pomegranate fruits. As the guests stepped on the boards, the fruits' juice was expressed; that liquid was collected in a vat through special grooves. Later, guests were treated to this juice. Subsequently, Ibragimbekov was subjected to persecution in Azerbaijan and was expelled by deputies when they discovered his bond with Armenia.

In William Saroyan's short story "The Pomegranate Trees" (1937), the narrator's Armenian uncle bought large tracts of infertile land in central California hoping to plant an orchard of *pomegranate trees*. Unfortunately, he could not sell the few fruits produced on that desert soil; the buyer in Chicago did not even know what *pomegranates* were, but these cherished fruits, deeply entrenched in memory, served as a transitional bridge for the immigrant.

Pomegranate is so inextricably woven with Armenia that a children's book, "Hagop and the Hairy Giant" (White, 2011), the Armenian version of Jack and the Beanstalk, is set in Masis, Armenia, where the hero Hagop scales a magic pomegranate tree to rescue the lovely Maryam, a prisoner of Medz Mazod, the hairy giant. Hagop goes head-to-head with Medz Mazod, battling him with a kebab shish, leading to other adventures with the giant's magic oud and golden hen.

The importance of pomegranate is also found in a traditional ending for Armenian fairy tales (Petrosian and Underwood, 2006): "Three pomegranates fell down from heaven: One for the storyteller, one for the listener, and one for the whole world".

Particularly in this age of climate change, pomegranate is a drought-resistant, salinity-tolerant pivotal fruit that deserves more scholarly attention, especially for regions where agriculture is threatened by those factors. *Pomegranate* should be the standard textbook for horticultural research institutes, libraries, government agriculture departments, and plant nurseries. It provides a dense consolidation of relevant topics that can provide the field with valuable guidance as a manual for growers, displacing a previously reviewed attempt (Seeram et al., 2006). It is well-illustrated, showing stages of flower and fruit development, plant habit, various approaches to pruning. The bibliographies are substantial; the editors did their subject justice. Ignoring occasional typographical errors, and duplicate citations inserted out of order (pp. 501-503), the well-bound volume should enjoy long use as a reference work.

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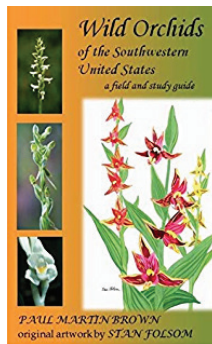
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–*Dorothea Bedigian, Research Associate, Missouri Botanical Garden, St. Louis, Missouri, USA*

Wild Orchids of the Southwestern United States: a Field and Study Guide

P. M. Brown, with original artwork by S. Folsom
2019. ISBN 978-3-946583-21-9
\$70.00 (hard cover); 312 pp.
Koeltz Botanical Books,
Heftricher Str. 1, 61479
Germany



Approximately 250 orchid species are native to the United States (9,834,185 km²), and about half of them are in Florida (168 km²). This book covers species found in Arizona (29 species and varieties in 293 km²), California (39; 423,963 km²), Colorado (30; 269 km²), Nevada (16; 285 km²), New Mexico (32; 313 km²), and Utah (25; 220 km²). Of these, 6 species occur in all of these states and 29 are found in one state only.

The number of species per area in the United States is remarkably small when compared to Colombia (4270 species in 1,141,748 km²) or Malaysia (4000 species in 329,613 km²), for example. Colombia with an area 8.6 times smaller than the United States has 17 times as many orchid species. For Malaysia these numbers are 30 and 16, respectively. Many of the orchids in Colombia and Malaysia are

spectacular, whereas only very few American species attract attention by others than those interested in orchids.

This paucity of native species and the small proportion of those bearing attractive flowers are two reasons for the relatively small number of books on American native orchids. Other reasons are difficulties in (1) germinating their seeds (we tried in my laboratories years ago with limited success; recent efforts have been more successful), and (2) cultivating many of them despite a few successes. The authors of this book and a few others (referenced in this book) are among the small number of botanists and growers who have paid and/or are paying attention to at least some North American orchid species (not referenced in this book; for one list of horticultural sources for some species please see <http://botanyboy.org/where-to-buy-lady-slipper-orchids-online-north-american-sources/>, although a Google search should find more).

Despite its modest subtitle and relatively few pages, this book is much more than just a guide. It is more of a tightly and carefully written and well-organized, concise, reference work.

In Part One, two introductory sections set the tone of the book: one is about orchids in the southwest and the second deals with orchids in general. They are useful, but I think that their order should have been reversed; first introduce orchids, and then discuss them geographically. What seems to be a workable and useful key (I did not try to use it) to genera (keys to species are included in the descriptions of genera) follows. The key is followed by discussion of plant names. This discussion should have preceded the key, but this comment, like my previous remark about the order of sections is a matter of opinion.

The second part (pp. 17-196) consists of descriptions of all native orchids (in alphabetical order) in the southwest. The first genus in the descriptions section is the circumpolar *Calypso*, which is found in America, Europe; and Asia; despite its small flowers (2-4 cm) it is “one of the most sought-after and most delightful of all native orchids . . .” True, and a good start! Descriptions are detailed and include clear narrative, dimensions and line drawings, color photographs and sometimes paintings, distribution maps, and flowering period. All descriptions follow the same format, are well written, easy to read, and very informative. They are a good example of what such descriptions should be.

Part Three is what makes this book a good and concise reference work rather than only a guide. It contains checklists of orchids for the southwestern United States and the six states in it; regional statistics; a list of rare, threatened, and endangered species; recent literature references; synonyms and misapplied names; and much additional and very useful information.

The fourth part is all about orchid hunting. It tells readers when, where, and how to find orchids in the southwest. The information in this part should make it easy to find and enjoy native orchid in the southwestern United States. Those who will hunt orchids should do it with their eyes and cameras only. Native orchids must not be touched and never collected.

Several appendices are included in the fifth part: distribution of species in the six southwestern states, a table of flowering times, an extensive bibliography, a list of new hybrids and nomenclatural combinations, photo credits, and a good, detailed index.

The illustrations in the book are its major problem. Some of the line drawings, color photographs, and paintings are somewhat useful, maybe passable, and perhaps even good. Many convey only a general impression at best. A few are confusing and of not much use. At least one line drawing (p. 6), one painting (p. 70), and one photograph (upper left on p. 81) are not useful at all. I mention one bad example for every type of illustration in the book, but there are more. Good digital cameras, excellent macro lenses, and very good illuminators for close-ups (flash or LED) are inexpensive and easy to use even under field conditions. Programs like Photoshop make possible production of good, attractive, and instructive illustrations and layouts. Photographic tools such as these leave no excuse for what is presented as illustrations in this book.

This book is valuable not only because books on native American orchids are not common, but also due to its excellent content. This is exactly the kind of guide needed by those who want to see and/or photograph southwestern U.S. native orchids in their natural habitats. If not as a guide for orchid hunting, this book is an excellent source of valuable information for botanists in general and those interested in orchids in particular, and it will make readers realize that there are many interesting, even if not always gorgeous, orchids in the United States.

*-Joseph Arditti, Professor of Biology Emeritus,
Department of Developmental and Cell Biology,
University of California, Irvine.*

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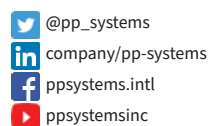
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Plant Science Bulletin



Wanda Lovan
is Retiring:
An
Appreciation
of her 18 Years
with the BSA

It is with heartfelt gratitude that we acknowledge the contribution of Wanda Lovan to the BSA on the occasion of her retirement on July 16, 2021. Wanda began as an Administrative Coordinator at the BSA in 2003, when the BSA's first Executive Director, Bill Dahl, established the headquarters of the BSA at the Missouri Botanical Garden in St. Louis. (This was at the invitation of then-Garden President, and former BSA President, Peter Raven.)

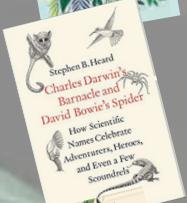
Wanda came to the BSA after a 12-year stint with the Missouri Field Office of The Nature Conservancy, where she went from part-time secretary to Director of Operations. At the BSA, Wanda initially managed membership and subscription services for the BSA and the *American Journal of Botany*. Over the years, her responsibilities grew, and the Society members and staff have grown and thrived under her care and attention. She kept the 3000-plus members happy and the books in order—and ultimately coordinated 10 staff members in 4 different locations, from California to New York.

Wanda's current title is Director of Finance & Administration. She has expertly handled accounting responsibilities for grant funding from NSF and management services provided to the Society for Economic Botany, the Society for the Study of Evolution, and the American Fern Society.

In addition to her many achievements for the Society, Wanda is an enthusiastic supporter of the Missouri Botanical Garden and an avid gardener in her own right. She is known for her unique way with words (in poetry and conversation!), her enjoyment of being active, her pleasure in wine tasting, and her overall positive outlook. We wish her all the best in her retirement!



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