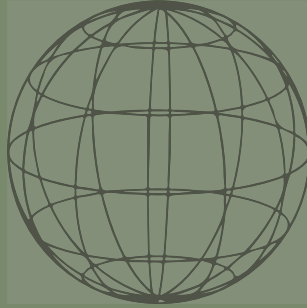




THE SECOND INTERNATIONAL ELDERBERRY SYMPOSIUM

June 18-20, 2025

Columbia, Missouri, USA



Welcome to the Second International Symposium on Elderberry (*Sambucus*), being held in Columbia, Missouri, USA, June 18-20, 2025. The FIRST such Symposium was held in the exact same place exactly 12 years ago, June 9-14, 2013. So much has transpired with elderberry in the past 12 years, that it is truly difficult to grasp. While our scientific understanding of elderberry both as a crop and as a consumable has advanced considerably over this time, it is the ingenuity of farmers, processors, marketers, and even discerning consumers that has propelled elderberry into the forefront as one of the most important and rapidly growing specialty crops in the world. We here in Missouri feel incredibly privileged and humbled to serve as a focal point, once again, for all things elderberry, and are so pleased that all of you have made the effort to attend this extraordinary gathering. Welcome again!!



Andrew Thomas, Convener

University of Missouri

Division of Plant Science and Technology

Southwest Research Extension and Education Center

Mt. Vernon, Missouri, USA



Cultivating Connections:
A Global Convergence of
Elderberry Minds

The Second International Symposium on Elderberry

June 18-20, 2025| Stoney Creek Inn, Columbia, Missouri, USA

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EDITORS



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Organizing Committee



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Lloyd Sumner
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Matthew Huchteman
University of Missouri



Kelly McGown,
University of Missouri



C. Michael Greenlief
University of Missouri



David Handley
University of Maine

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Alice Jones is an Agri-Food Scientist working as Senior Food Innovation Advisor at the Food Innovation Centre, University of Nottingham, UK, where she provides practical food science and technology consultancy and business-led research to the food and drink industry. Previous to that, she spent 12 years in technical roles in manufacturing sites, mostly in the small-medium sectors, often working with premium products and specialising in the application of sensory science to various products, especially, drinks, botanicals and fruit. Her passion for ingredient-led NPD and pursuing good quality and flavour in products invariably

leads her back to the field. She has had a keen interest in elderflower production & processing dating back to her Master thesis in 2009. In 2019 she was awarded a Nuffield Farming Scholarship to study 'Cultivating elders for the UK processing industries' in response to the need to secure the UK elderflower supply chain for the future. Since then, she has initiated research at the University aimed at developing and improving elder tree cultivation knowledge and practices in the UK."

Andrew Thomas is Research Associate Professor in the Division of Plant Science and Technology, based at the University of Missouri's Southwest Research, Extension, and Education Center at Mt. Vernon. He received his B.S. in Horticulture from the University of Missouri, and his M.S. in Agronomy from Iowa State University. Before coming to the Southwest Center in 1996, Andy worked for two agricultural biotech companies in California and Wisconsin, the Center for Plant Conservation at Missouri Botanical Garden in St. Louis, and the Rwandan Agricultural Research Institute as a Peace Corps Volunteer.



Andy conducts research on a wide variety of horticultural, agronomic, and agroforestry crops. His main interests include the development of overlooked native fruit and nut crops with commercial potential, but he also studies aspects of mainstream horticultural crop production. His research projects at the Southwest Center have included black walnuts, pecans, elderberries, grapes, asparagus, soybeans, pawpaws, persimmons, blackberries, medicinal plants, and wildflowers. He has consulted internationally on numerous horticultural and agroforestry projects, and currently serves as a Director of Ozark Regional Land Trust. Andy and his wife Diann live in southwest Missouri near the town of Monett, where they farm 70 acres tending a variety of fruit, nut, and hay crops.



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Patrick Byers, recently retired from the position of Horticulture Field Specialist with the Webster County office of University of Missouri Extension, was born in Nebraska and raised in the Midwest. His educational background includes horticulture degrees from the Universities of Nebraska, Missouri, and Arkansas. Patrick's 33-year career touched all aspects of horticulture, and his most recent job focused on advisement to fruit and vegetable farmers with the goal of supporting sustainability and profitability. His passions include berries (especially elderberry), garlic, native fruits and nuts, hops and orchids. In retirement he is developing his own homestead on 24 rocky Ozark acres in south Missouri.



Dr. David Beversdorf is a practicing neurologist who specializes in neurology and psychiatry. In his memory disorders clinic, he treats patients with disorders such as Alzheimer's disease. Dr. Beversdorf aims to understand approaches that will decrease the risk of developing the disease. He performs neuropsychological testing, which is an in-depth assessment of skills and abilities linked to brain function. Dr. Beversdorf also sees children and adult patients at the Thompson Center for Autism and Neurodevelopmental Disorders.

Dr. Jiankun (Janice) Cui currently serves as an Assistant Research Professor at Pathology and Anatomical Sciences, University of Missouri, School of Medicine and is the Associate director of TBI Open Field Blast Center (OFBC), where she oversees Neurobehavioral assessment facility, and Research Health Scientist at Turman VA Hospital of Veterans Affairs. Previously, she was the manager of MU Center of Translational Neuroscience and the manager of the Center for Neuroscience & Aging at Sanford Burnham Prebys Medical Discovery Institute. Her research spans from various animal



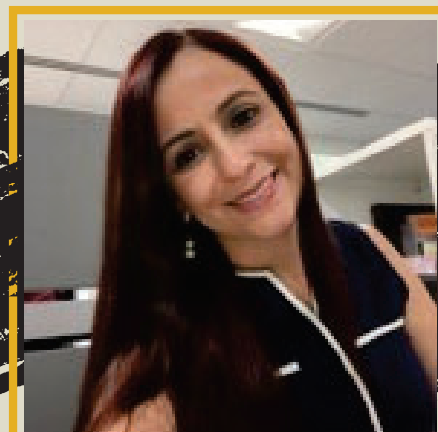
models in rodents and behavioral studies to biochemistry and pathology. Her projects have supported by the NIH, the Department of Defense, the Department of Veterans Affairs, the American Heart Association, The Dana Foundation, and the NFL Charities Foundation, and other funding organizations.

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Madison Musich, MA. Madison is a doctoral student in the Department of Psychological Sciences in the area of Cognition and Neuroscience. She is under the supervision of Dr. Beversdorf where they examine various factors (e.g., psychosocial, biobotanical, and neuro-pathophysiological) that may contribute to healthy cognitive aging, along with identifying potential factors that may mitigate the progression of cognitive decline.

Dr. Maria Monagas is a Principal Scientist at the Department of Dietary Supplements and Herbal Medicines of the United States Pharmacopeia (USP). She has a Ph.D in Food Science and Technology from the Autonomous University of Madrid (Spain) and a MSc in Industrial Fermentation Technology from Heriot-Watt University (Scotland, United Kingdom). Before joining USP, she was a tenured track Research Scientist at the Spanish Scientific Research Council (CSIC) in Madrid, Spain.



During her 12-year career at USP, Dr. Monagas has been responsible for the development and review of USP monographs and General Chapters related to botanical articles to be admitted into USP-NF and the Dietary Supplements Compendium (DSC) publications. She is also responsible for the new USP Expert Panel on Botanical Dietary Supplements and Herbal Medicines for the Pan-American region. Dr. Monagas has more than 20 years of experience in the analysis and characterization of botanical ingredients used in the production of dietary supplements; particularly in ingredients derived from plants rich in polyphenols. She has contributed to more than 70 scientific publications, including original articles, book chapters, and industrial patents.



Jesse Smith is the Director of Land Stewardship at White Buffalo Land Trust, a non-profit dedicated to advancing regenerative agriculture. Raised on California's Central Coast, he focuses on fostering diverse partnerships for multi-stakeholder projects. Jesse is particularly interested in multi-strata agroforestry, hydrological restoration, and specialized agroforestry crops such as agave, elderberry, and mushroom farming. He actively works to restore ecological balance in food, fiber, and medicine production, emphasizing soil health, water cycles, and biodiversity.

In his role, Jesse manages the Center of Regenerative Agriculture at Jalama Canyon Ranch, a 1,000-acre site that integrates farming, ranching, and conservation. He oversees vineyard operations, livestock care, and restoration activities. Jesse Smith's leadership and dedication to regenerative agriculture are driving transformative changes. Through collaboration and commitment, he inspires others and advances the principles of regenerative land stewardship.

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Dr. Mariana Cecilia Grohar is a researcher at the Department of Agronomy, Biotechnical Faculty, University of Ljubljana, Slovenia. Her research focuses on the biochemistry and physiology of horticultural crops, with a particular interest in volatile organic compounds (VOCs) and fatty acids, which she analyzes using gas chromatography-mass spectrometry (GC-MS). She investigates how environmental factors, cultivation practices, and postharvest conditions influence the aromatic profile, nutritional quality, and metabolic composition of horticultural crops. Her interdisciplinary work contributes to improving crop quality and understanding plant responses to abiotic stress.



Dr. Robert Veberič is a Full Professor at the Biotechnical Faculty of the University of Ljubljana, Slovenia, where he works in the Department of Agronomy, specifically within the Chair of Fruit Growing, Viticulture, and Vegetable Growing. His research focuses on plant physiology, horticulture, and the biochemistry of plant metabolites, with particular emphasis on phenolic compounds in fruits and other horticultural species. His work contributes to a deeper understanding of how cultivation practices, environmental factors, and developmental stages influence the nutritional and phytochemical composition of crops. He has co-authored more than 300 scientific publications.

Pierce Hollingsworth is an accomplished writer and President of Hollingsworth Media, a consulting firm focused on integrated marketing and media strategy. He advises Hammons Products Co., the nation's top producer of wild American Black Walnuts, enhancing their brand and market reach. As Chief Content Officer at Sifter Solutions, he supports development of tools like the "Scan by Diet" app, helping consumers make informed food choices and advancing Food as Medicine initiatives. His prior senior executive roles at EnsembleIQ and BNP Media, both major food industry media companies, drove multimillion-dollar growth through innovation. A former journalism professor Northwestern University's Medill School of Journalism, Pierce blends academic insight with real-world expertise to shape impactful marketing and health-tech strategies.



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Dr Sílvia M. Rocha is Associated Professor with Habilitation in Biochemistry, at the Chemistry Department of the University of Aveiro (Portugal). She is leader of the x-Chroma Lab ([Research | x-Chroma Lab](#) - University of Aveiro), a laboratory specialized on the design of workflows, based on advanced chromatographic methodologies, for unveiling complex biological systems, namely plants, plant-based foods, and microorganisms (with biotechnological interest or pathogenic). For the last 30 years, her research is mainly focused on the characterization of plant raw materials, agro-food by-products and foodstuffs, for the prospec-

-tion of bioactive compounds, and understanding them from the analytical, technological, sensorial and metabolomics point of view, toward the development of innovative and sustainable formulations. Valorisation and characterization of native Portuguese cultivars are the focus of her research, namely grape varieties and wines, and elderberries.

Sílvia M. Rocha is vice-director of the Chemistry Department of the Aveiro University for the area for internationalization, dissemination and cooperation, and she is member of the Board of Directors of the Food Science and Technology and Nutrition Doctoral Program. Sílvia M. Rocha is author or co-author of over 170 SCI papers, 2 books, 18 book chapters, and 8 patent applications and possesses a h-index 47 (<http://www.scopus.com/authid/detail.url?authorId=7006653213>).

Dr. Lloyd Sumner acquired his B.Sc. degree in chemistry with a minor in mathematics in 1989 from Cameron University in Lawton, OK, USA and a Ph.D. in analytical chemistry focused on mass spectrometry in 1993 from Oklahoma State University in Stillwater, OK, USA. He then joined Texas A&M University, College Station TX, where he was the Director of the Mass Spectrometry Applications Laboratory and where he later served as the cofounder and Associate Director of the TAMU Laboratory for Biological Mass Spectrometry with Prof. David H Russell. He joined



the Noble Foundation in 1999 and rose to the rank of Professor within the Plant Biology Division. Dr. Sumner relocated to the University of Missouri, Columbia in January 2016 as a Professor in the Biochemistry Department and Director of the new University of Missouri Metabolomics Center. His laboratory is housed in the Bond Life Sciences Center and he is currently an Executive Board member of the MU Interdisciplinary Plant Group. Dr. Sumner's research focuses on the development, integration and application of large-scale biochemical profiling of plant metabolites, proteins, and transcripts (metabolomics, proteomics and transcriptomics) for the discovery and characterization of the molecular and biochemical components related to the biosynthesis of plant natural products/specialized metabolites. He also actively applies these integrated omics technologies in a collaborative manner for greater insight into health and disease in a large number of species including humans. A current focal area is cancer.

The Second International Symposium on Elderberry

06.18.2025 | 08.00 AM - 08.00 PM | Stoney Creek Inn

7:00 AM – 8:30 AM: Registration and Welcome (Reg. will start 5 PM to 7 PM on 06.17.2025)

8:30 AM – 9:00 AM: Plenary. Jesse Smith, Director of Land Stewardship, White Buffalo Land Trust, Santa Barbara County, CA

Elderberry's Role in Land Conservation and Regenerative Agriculture

9:00 AM – 9:30 AM: Plenary. Pierce Hollingsworth, Hollingsworth Media, Chicago, IL

Elderberry Rising: Global Trends Shaping the Future of a Superfruit

9:30 AM – 10:00 AM: Plenary. Madison Musich and David Beversdorf, University of Missouri

Elderberry and Mild Cognitive Impairment: Results of a Human Clinical Trial

10:00 AM – 10:30 AM: Break: Posters, Vendors, and Demonstrations :

Elderberry Mechanical Harvesting Technology Demonstrations (Location: Outside/Parking lot)

10:30 AM – 12:00 PM: Concurrent Sessions (Session 1): Lewis & Clark Room

What's Bugging Elderberry? Pests, Natural Enemies, and Pollinators

Moderator: Avery Russell, Missouri State University

Jenny Burrow, Missouri State University

Fruit for Thought: How Cultivar Affects Pollination Ecology of American Elderberry

Katelin Meek, Missouri State University

Berry Important Bugs: Arthropod Visitors to American Elderberry Flowers

Waana Kaluwasha, et al., Lincoln University

Tech Meets Agriculture: Smart Monitoring for Spotted Wing Drosophila

Clement Akotsen-Mensah, Auburn University

The Potential of *Leptopilina japonica*, a Larval Parasitic Wasp for Control of Spotted Wing Drosophila in Berry Crops: Lessons from Alabama

10:30 AM – 12:00 PM: Concurrent Sessions (Session 2): Salon A

Blue Elderberry Propagation and Western Growing Contexts: What We Know, What We're Learning, and the Questions that Remain

Moderator: Gwenaël Engelskirchen, Sustainable Food & Farming Coordinator with University of California Sustainable Agriculture Research & Education Program (SAREP)

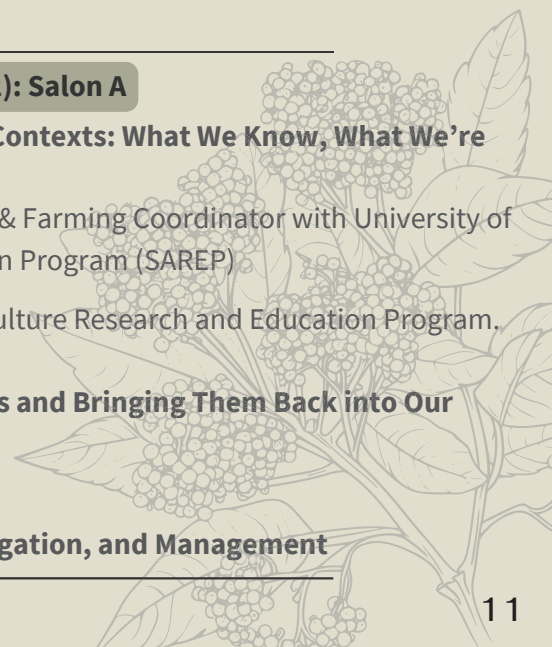
Sonja Brodt, University of California, Sustainable Agriculture Research and Education Program, Davis, CA

Introduction & Framing: Importance of Native Plants and Bringing Them Back into Our Agricultural Systems across North America

Brent Black, Utah State University, Logan, UT

Blue Elderberry Research in Utah: Selections, Propagation, and Management

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06.18.2025 | 08.00 AM - 08.00 PM | Stoney Creek Inn

10:30 AM – 12:00 PM: Concurrent Sessions (Session 2-Continued): Salon A

Rose High Bear (Deg Hit'an Dine, Inupiaq), Founding Director, Elderberry Wisdom Farm, Salem, OR

Elderberry Wisdom Farm's Commitment to *Sambucus nigra* ssp. *cerulea* from a Traditional Ecological Knowledge and Habitat Restoration Perspective (Willamette Valley, Oregon)

Jesse Smith, Director of Land Stewardship, White Buffalo Land Trust, Santa Barbara, CA

Growing Producer Networks and New Markets for Blue Elderberry in the West

10:30 AM – 12:00 PM: Concurrent Sessions (Session 3): Columbia Room (upstairs)

Economics / Human Dimensions of Elderberry

Moderator: Pierce Hollingsworth, Hollingsworth Media, Chicago, IL

Hernan Camacho Borrero, University of Missouri

1. Unpacking Elderberry Demand: How Consumer Segments and Socioeconomic Factors Shape Purchasing Behavior in the United States.

2. A Cost-Benefit Analysis of Elderberry Production across Five Experimental Fields in the United States.

3. Economic Evaluation and Comparative Analysis of Six Weed Management Methods in Elderberry Production

4. Seeing is Believing? Preliminary Insights into Objective vs. Subjective Drivers of Pest Control Adoption

Kelsi Stubblefield, University of Missouri

From Niche to Mainstream: US Consumer Trends and Preferences for Elderberry Products

Andrew Leach, University of Minnesota

Developing Elderberry Markets in Minnesota

12:00 PM – 1:30 PM: Lunch, Posters, Vendors, and Demonstration

Elderberry Mechanical Harvesting Technology Demonstrations (Location: Outside/Parking lot)

1:30 PM – 2:00 PM: Plenary. Patrick Solverson, Washinton State University, Spokane, WA

A One-Week Elderberry Juice Intervention Augments the Fecal Microbiota and Suggests Improvement in Glucose Tolerance and Fat Oxidation in a Randomized Controlled Trial

2:00 PM – 2:30 PM: Plenary. Maria Monagas, U.S. Pharmacopeia (USP), Washington, D.C.

USP Standards for European Elderberry Dietary Ingredients: Solutions to Address Quality and Adulteration Issues

2:30 PM – 3:00 PM: Plenary. Alice Jones, Senior Food Innovation Advisor, The Food Innovation Centre, University of Nottingham, Loughborough, UK

Reimagining the UK Elderflower Supply Chain

3:00 PM – 3:30 PM: Break, Posters, Vendors, and Demonstration

Elderberry Mechanical Harvesting Technology Demonstrations (Location: Outside/Parking lot)

FOUNDATIONS

The Second International Symposium on Elderberry

06.18.2025 | 08.00 AM - 08.00 PM | Stoney Creek Inn

3:30 PM – 5:00 PM: Concurrent Sessions (Session 4): Lewis & Clark Room

Elderberries: Food Innovations and Value-added Products

Moderator: Kiruba Krishnaswamy, University of Missouri

Alice Jones, Senior Food Innovation Advisor, The Food Innovation Centre, University of Nottingham, Loughborough, UK

Overview of Elderflower Product Development in the UK

Penny Perkins-Veazie, North Carolina State University, and Kiruba Krishnaswamy, University of Missouri

Overview of USDA-Specialty Crop Research Initiative Project Results

Panel Discussion on Food Science Innovations: Successes and Needs for Growers and Processors

3:30 PM – 5:00 PM: Concurrent Sessions (Session 5): Salon A

Farmers Forum: Experiences, Challenges, and Successes Growing Elderberries Around the World!

Moderator: Terry Durham, River Hills Harvest

- Dave Buehler, Elder Farms, Mt. Vernon, MO
- Jed Wiebe, Elder Grove, Salmon Arm, BC, Canada
- Karen Van Huizen Elderglen, Victoria, Australia
- Sherrie Hagenhoff, Sac River Valley Elderflower and Elderberry Farm, Springfield, MO
- Andy Baugh, Flint Ridge Farm, Mt. Vernon, MO
- Katie Reneker, Carmel Berry Co., Carmel, CA

3:30 PM – 5:00 PM: Concurrent Sessions (Session 6): Columbia Room (upstairs)

Elderberry Breeding

Moderator: Liz Prenger, University of Missouri

Lily Hislop, Savanna Institute, Madison, WI

Observations from the Savanna Institute Breeding Program

Liz Prenger, University of Missouri

Floral Phenology and Compatibility Characterization of American Elderberry Cultivars Supports Breeding Efforts and Orchard Design

Ron Revord, University of Missouri

Building an American Elderberry Breeding Program in the Lower Midwest

6:00 PM – 8:00 PM: Evening Social at ElderBlossom View Farm and Winery, New Bloomfield, MO <https://www.elderblossomview.com/>

We will have a 55-passenger bus available – please sign up for this at the registration table. Guests are otherwise encouraged to arrange their own transportation or carpool, as parking is limited. Wine tastings are available. Directions will be provided. Food and drinks (including vegan options) will be available for purchase on-site from two Food Trucks.

ELDERBLOSSOM



Genomics Reveals

ch Tells Us So Far

Health in Aging Mice

FOUND

The Process Flow of Berry Clean (Virus-free) Plant Generation

The Second International Symposium on Elderberry

06.19.2025 | 07.00 AM - 08.00 PM | Stoney Creek Inn

10:30 AM – 12:00 PM: Concurrent Sessions (Session 9): Columbia Room (upstairs)

Successful Wholesale Market Participation and Building Consumer Awareness

Moderator: PJ Connolly, Savanna Institute, Madison, WI

Chris Patton, Midwest Elderberry Cooperative

Elderberry Quality Standards and Grading Metrics for a Consistent Value Proposition

Ariel Pressman, Principal, Whole Farm Strategies

Food Safety and Supply Chain Solutions to Meet Wholesale Needs

Ryan Rosenthal, Savanna Institute

Billion Berry Project: Growing Awareness and Demand with a Grassroots Movement

Jenny Blair, MD

The Power of Story to Connect People with the Benefits of Elderberry

12:00 PM – 1:30 PM: Lunch, Posters, and Vendors

1:30 PM – 2:00 PM: Plenary. Patrick Byers, University of Missouri

Progress with American Elderberry - Missouri's Contribution

2:00 PM – 2:30 PM: Plenary. Lloyd Sumner, University of Missouri, Center for Metabolomics

High-resolution Biochemical Phenotyping of American Elderberries

2:30 PM – 3:00 PM: Plenary. Andrew Thomas, University of Missouri

Elderberry Producer Brainstorming Session for Needed Research and Future Grant Proposals

3:00 PM – 3:30 PM: Break, Posters and Vendors

3:30 PM – 5:00 PM: Concurrent Sessions (Session 10): Salon A

Elderberry and Health #2

Moderator: Ronnie Myers, University of Missouri

Mariana Grohar, University of Ljubljana, Ljubljana, Slovenia

Daily Variability in the Metabolism of Elderberry Inflorescences

Dr Silvia M. Rocha, University of Aveiro, Aveiro, Portugal

Ronnie Myers

Amanda Dwikarina, University of Missouri

Chung-Ho Lin, University of Missouri

RUN DOWN



The Second International Symposium on Elderberry

06.19.2025 | 07.00 AM - 08.00 PM | Stoney Creek Inn

3:30 PM – 5:00 PM: Concurrent Sessions (Session 10): Columbia Room (upstairs)

Elderberry Wine and Vinegar

Facilitator: Azlin Mustapha, University of Missouri

Tom Ruggieri, Fair Share Farm, Kearney, Missouri

Feasibility of American Elderberry Vinegar Production for Small Farms

John Brewer and Tracie Trotter, Wyldewood Cellars, Wichita, KS and St. Joseph, IL

1. 'Marge' Elderberry Cultivation and Post Harvest Processing for Wine Production
2. Elderberry Wine Production
3. Tastings of Different Elderberry Wine Styles

3:30 PM – 5:00 PM: Concurrent Sessions (Session 12): Lewis & Clark Room

Elderberry Horticulture

Moderator: Matthew Huchteman, University of Missouri

Beth Taylor, Natural England, York, United Kingdom

How Pruning Affects the Flower Yield and Quality of Elder (*Sambucus nigra*) in the UK

David Handley, University of Maine, Monmouth, ME

Elderberry Production from a Northern Perspective

Caleb O'Neal, University of Missouri, Mt. Vernon, MO

Direct Field Propagation of American Elderberry

Sydney Moore, University of Missouri

Elderberry Genotype × Environment Study Results

Matthew Huchteman, University of Missouri, Carthage, MO

American Elderberry Performance, Yield and Potential Profitability are Influenced by Weed Management Method

6:00 PM – 8:00 PM: Celebration Banquet (Ticketed Event)

Welcome Remarks: Shibu Jose, University of Missouri, Associate Dean, College of Agriculture, Food, and Natural Resources and Director, Agriculture Experiment Station

ROUND
OWN



The Second International Symposium on Elderberry

06.20.2025 | 07.40 AM - 04.00 PM

7:45 AM – 9:15 AM: University of Missouri Laboratory Tours

Limited availability – sign-ups required (Vans leave hotel at 7:45 and return to hotel at 9:15)

8:00 AM – 9:00 AM: TOUR 1 (Walking tour among three labs)

Center for Metabolomics, Dr. Lloyd Sumner

Center for Proteomics, Dr. Michael Greenlief

Natural Products Chemistry Lab, Dr. Chung-Ho Lin

8:00 AM – 9:00 AM: TOUR 2: Food Engineering and Sustainable Technologies (FEAST Lab)

Dr. Kiruba Krishnaswamy

8:00 AM – 9:00 AM: TOUR 3: Neuroscience Preclinic Laboratory

Drs. Zezong Gu and Janice Cui

10:00 AM – 12:00 PM: Horticulture and Agroforestry Research Farm, New Franklin, MO

Sydney Moore, University of Missouri

Regional Elderberry Genotype × Environment Trial Results

Liz Prenger and Ron Revord

1. **Elderberry Breeding Program**

2. **Elderberry Germplasm Repository**

12:30 PM – 2:00 PM: LUNCH: Missouri River Center (The Nature Conservancy), Huntsdale, MO

Zack Miller, The Nature Conservancy

Agroforestry at The Nature Conservancy's Missouri River Center

2:00 PM – 4:00 PM: Elderberry Producer / Processor Tours

1. Crown Gordon Orchards and Vineyard, Frank Gordon, Huntsdale, MO

2. Blue Fox Farm, Alan Helland, Ashland, MO

3. River Hills Harvest, Terry Durham, Hartsburg, MO

Guests are encouraged to arrange their own transportation or carpool, as limited transportation options are available for those in need. Directions will be provided. Boxed lunches will be available for those who RSVP'd during conference registration.

TOUR ITINERARY

The Second International Symposium on Elderberry

June 18-20, 2025 | Stoney Creek Inn, Columbia, Missouri, USA

American Elderberry Performance, Yield, and Potential Profitability are Influenced by Weed Management Method

Matthew Huchteman, Sydney Moore, Caleb O'Neal, Andrew L. Thomas
University of Missouri

Environment Affects Performance, Fruit Yields, and Fruit Chemistry of Diverse American Elderberry Genotypes

Sydney Moore, et al.
University of Missouri

Field Propagation of American Elderberry: Planting Early and Large is Key for Success

Caleb S. O'Neal, Patrick L. Byers, Christine M. Spinka, and Andrew L. Thomas
University of Missouri

Kick-starting UK Elder Cultivation: Elderflower Yield in Named *nigra* Selections

Alice Jones
University of Nottingham, UK

Overcoming Drought: Stress Priming in Elderflower Cuttings and Seed

Alison Tidy
University of Nottingham, UK

Quantification of Cyanogenic Glycosides in American Elderberry

Ronald J. Myers Jr.¹, Sydney D. Moore², Caleb O'Neal², Andrew L. Thomas², and Lloyd Sumner^{1,3}
¹Department of Biochemistry, University of Missouri, Columbia, MO
²Division of Plant Sciences and Technology, University of Missouri, Columbia, MO;
³Metabolomics Center, University of Missouri, Columbia, MO

A Survey of Viruses of Missouri Elderberry

Peng Tian, et al.
Division of Plant Science and Technology, University of Missouri

Traditional Wisdom in Skincare: American Elderberry Targeting Inflammatory Skin Maladies

Isa Kupke, Amanda Dwikarina, Lloyd Sumner, Zhentian Lei, Andrew Thomas, Chung-Ho Lin
University of Missouri

Beneath the Berry: Exploring the Enigmatic Powers of American Elderberry for Healthy Skin

Isa Kupke, Chung-Ho Lin
University of Missouri



POSTERS

The Second International Symposium on Elderberry

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Floral Phenology and Compatibility Characterization of American Elderberry Cultivars Supports Breeding Efforts and Orchard Design

Liz Prenger, Sydney Moore, Aubrey Teckam, Caleb O'Neal, Nick Meier, Andrew Thomas,
Ron Revord
University of Missouri

Arthropod Visitors of American Elderberry Across Cultivar

Katelin Meek, James Bynum, Caleb O'Neal, Andrew Thomas, Avery Russell, Jenny Burrow
Missouri State University and the University of Missouri

Overcoming a Market Barrier: Elderberry Research in Plain Language

Jenny Blair, MD

Feasibility of American Elderberry Vinegar Production for Small Farms

Tom Ruggieri
Fair Share Farm, Kearney, Missouri, USA

AHP and USP Elder Berry Monographs: HPTLC Analysis of Different Species, Dietary Supplement Ingredients, and Products

Maria Monagas¹, Wilmer Perera², Débora Frommenwiler³, Mona Hänni³, Roy Upton⁴, Eike Rich³

¹ United States Pharmacopeia Convention (USP), Dietary Supplements and Herbal Medicines,
Rockville, MD, USA

² CAMAG Scientific Inc. Wilmington, NC, USA

³ CAMAG. Muttens, Switzerland

⁴ American Herbal Pharmacopeia (AHP), Soquel, CA, USA

USP Admission Evaluation for European Elder Berry Ingredients: A New Cautionary Labeling Statement

Nadeem Akhtar¹, Maria Monagas¹, Johan Lundqvist², Scott Jordan², Amy L. Roe²

¹ United States Pharmacopeia Convention (USP), Dietary Supplements and Herbal Medicines,
Rockville, MD, USA

² USP Dietary Supplement Admission Evaluation and Labeling Expert Committee 2020-2025,
United States Pharmacopeia, Rockville, Maryland, USA.

Elderberry and Brain Health in Aging Mice: Behavioral Endpoints

Jiankun Cui, Tamanna Jahan Mony, Wenyan Yu, Amitai Zuckerman, Runting Li, C. Michael
Greenlief, Grace Y. Sun, and Zelong Gu
University of Missouri

POSTERS

The Second International Symposium on Elderberry

June 18-20, 2025 | Stoney Creek Inn, Columbia, Missouri, USA

Identification and Characterization of American Elderberry Bioactive Compounds Using High-Throughput Screening Assays in Combination of Untargeted Global Metabolomics Approach

Amanda Dwikarina, et al.
University of Missouri

Elucidating Antiviral Mode of Action of the Bioactive Compounds in American Elderberry (*Sambucus nigra* subsp. *canadensis*)

Amanda Dwikarina, et al.
University of Missouri

Characterizing U.S. Elderberry Grower Enterprises and Challenges Using Latent Class Analysis

Andria Caruthers
University of Missouri

Determining Inhibitory Effects of American Elderberry Compounds on Influenza Neuraminidase

Katherine Spitzmiller, et al.
University of Missouri

Quantifying Harvest Efficiency of Manual Pickers for American Elderberry using an Automated GPS-Enabled Fruit Weight Logger

Sazzad Mahmud Rifat, Jianfeng Zhou, and Andrew Thomas
University of Missouri

Mechanical Elderberry Harvesting System: Fruit Removal Efficiency at Different Vibration Frequency and Amplitude

Sazzad Mahmud Rifat, Jianfeng Zhou, and Andrew Thomas
University of Missouri

Influence of various maturity stages of American elderberries on its quality attributes

Karishma Sri Ravichandran, Sazzad Mahmud Rifat, Jianfeng Zhou, Andrew Thomas, and Kiruba Krishnaswamy
University of Missouri

POSTERS



The Second International Symposium on Elderberry

June 18-20, 2025 | Stoney Creek Inn, Columbia, Missouri, USA

SCIENTIFIC RESEARCH SUMMARIES



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Environment Affects Performance, Fruit Yields, and Fruit Chemistry of Diverse American Elderberry Genotypes

Sydney D. Moore¹, Matthew W. Huchteman¹, Elizabeth Prenger², Ronald Revord², David Redhage³, Simon Billy³, Eric Wolske⁴, Malachi Persche⁴, Caleb S. O'Neal⁵, Andrew L. Thomas⁵

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The production and consumption of American elderberry (*Sambucus nigra* subsp. *canadensis*) is increasing rapidly due to its health benefits and diverse array of value-added products. While production continues to increase, American Elderberry as a crop remains in the early stages of development. Identification of genotypes suitable for a range of hardiness zones is called for. A genotype by environment study that included 12 American elderberry genotypes originating from eight states was established in the Spring of 2022. The study spans five sites located in Poteau, Oklahoma; Mt. Vernon, Missouri; New Franklin, Missouri; Champaign, Illinois; and Spring Green, Wisconsin. Variables targeted in our data collection included plant growth, disease and pest incidence, phenology, fruit yield, and fruit quality. We found significant differences in multiple traits among genotypes, environments, and interactions between the two. These differences include yield, plant height, lodging, sawfly damage, eriophyid mite damage, Japanese beetle damage, leaf spot diseases, lodging, bud break date, flowering date, total monomeric anthocyanins, total polyphenol content, soluble solids, pH, titratable acidity, and leaf nutrients. Suitability analyses were completed to identify the most suitable genotypes for the differing climates. The analysis for fruit production defined the optimum as no disease and pest damage, high yield, and higher levels of anthocyanins. The most suitable genotypes for fruit production at each location are 'Pocahontas' at KERR, 'Cherokee' at SWC, 'Pocahontas' at HARF, 'Ranch' at UIFF, and 'Hamilton' at SGC. The information gained from this study will help inform growers' planting decisions depending on their environment. Identified edaphoclimatic differences between environments can help distinguish if characteristics are genetically or environmentally controlled, which will aid in furthering breeding efforts. Nutrient testing was performed on leaf tissue collected from each genotype at all research locations. These nutrient values were used to generate nutrient status designation levels for use in foliar testing. These designation levels will aid producers in interpreting American elderberry foliar analysis results and to determine subsequent fertilization needs.



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American Elderberry Performance, Yield and Potential Profitability are Influenced by Weed Management Method

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American elderberry (*Sambucus nigra* subsp. *canadensis*) is a rapidly developing specialty crop, native to eastern and midwestern North America. Crop development over the last three decades has been driven by a renewed interest in the crop's purported health benefits, including antiviral, antioxidant, anti-inflammatory, and immunoregulatory properties. Weed management in American elderberry is a major challenge, but little information or guidance is currently available to producers. The aim of this study was to conduct a comprehensive evaluation of six weed management strategies, with the goal of elucidating cost effective and practical methods for weed management in American elderberry production. Study objectives included evaluating elderberry plant performance and yields, assessing weed suppression outcomes, and conducting an economic comparison among the six weed management methods. Research plantings, incorporating three cultivars, were established in 2022 at two sites in Missouri, USA, and data were collected over the 2023 and 2024 growing seasons. Treatments included woven landscape fabric, woodchip mulch, cover crop, herbicide, managed (hand-weeded) control, and unmanaged control. Weed management treatment had a limited effect on elderberry plant phenology and fruit quality but influenced plant growth and cumulative fruit yield. Woodchip mulch and woven fabric treatments resulted in plant heights similar to that of the managed control. Herbicide, mulch, and woven fabric treatments offered the greatest fruit yields, which were not significantly different from the managed control. Compared to the unmanaged control, the woven fabric treatment reduced weed biomass by 44%, while the cover crop, woodchip mulch, and herbicide treatments reduced weed biomass by 71%, 86%, and 91%, respectively. Results indicate that both woodchip mulch and herbicide treatments were effective in reducing weed biomass and improving both plant growth and fruit yield, while also proving to be the most economically efficient across year, site, and cultivar.



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Field Propagation of American Elderberry: Planting Early and Large is Key for Success

Caleb S. O'Neal¹, Patrick L. Byers¹, Christine M. Spinka¹, and Andrew L. Thomas¹

¹University of Missouri

American Elderberry (*Sambucus nigra* subsp. *canadensis*) is a specialty crop that is quickly gaining traction with growers in the United States due to the high medicinal value of the fruit and flower. Many elderberry orchards are established using rooted plants, but some elderberry growers attempt to root hardwood cuttings in the field to reduce establishment costs. Little to no data exist to guide growers into successful orchard establishment by means of direct field propagation.

In the years 2022 and 2023, we conducted an experiment designed to elucidate the most effective methods for establishing an elderberry planting through direct field propagation of dormant hardwood cuttings. We replicated the study at two sites in southwest Missouri, USA, and incorporated a total of 6,480 elderberry cuttings comprised of an equal sum of 2-node and 4-node hardwood cuttings from three cultivars. At four-week intervals beginning in early February, we pushed untreated cuttings directly into the soil and measured the diameter of each propagule between the two lower nodes. In late July, all cuttings were scored as alive / dead.

In both years of our study, we found the number of nodes (two vs. four) had no effect on survival, while propagule diameter was a highly significant variable; the largest cuttings had the highest rates of survival, with survival decreasing as diameter size decreased. In 2023, across both sites and all three cultivars, 76% of cuttings in the largest diameter class survived while the smallest cuttings only had a 29% survival rate. We also observed the earliest planting dates had a significantly greater chance of propagule survival in both years; e.g., in 2022, propagules (across sites and cultivars) planted at the earliest date had a survival rate of 61%, but a 22% survival rate in the latest planting date.

Our results suggest that direct field propagation of American elderberry is an economically viable method for establishing an elderberry orchard, with a winter planting of the largest diameter cuttings providing the best opportunity for success.

A Cost-Benefit Analysis of elderberry production across five experimental fields in the United States

Hernan Borrero

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This benefit-cost analysis evaluates the economic performance of elderberry production across five experimental fields in the U.S. over a three-year period (2022–2024). Using standardized methods to calculate and annualize Net Present Values (NPVs), the study compares revenues and costs—including establishment, management, and harvesting—across sites. Results show profitability at Mount Vernon, Champaign, and New Franklin, with Mount Vernon generating the highest annualized NPV. In contrast, Spring Green and Poteau reported losses due to high production costs. These findings highlight site-specific variability and can inform future decisions on elderberry cultivation and resource allocation.

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A Common-garden Comparison of Geographically Diverse American Elderberry Genotypes with Varying Polyphenol Profiles

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American elderberry (*Sambucus nigra* subsp. *canadensis*) is an increasingly popular specialty crop, primarily grown in North America for its flowers and fruits for use in wine, juice, and dietary supplement products. Elderberry is a versatile shrubby species with excellent utility in a variety of agroforestry systems, and provides important ecosystem services. Little is known about the genetic diversity of indigenous American elderberry, especially in terms of its horticultural attributes and health-benefitting metabolites. A previous project sampled wild germplasm (n=107) from across much of eastern and midwestern North America. Fruit from these samples was analyzed for polyphenol profiles, after which propagules of accessions of interest were collected for further study. Eighteen geographically diverse accessions, along with three standard cultivars (used as control), were brought into replicated, randomized, Common Garden plantings in southwest Missouri, USA in 2015. The objective was to assess genetic diversity, breeding potential, and to determine if polyphenol profile differences are genetic or environmental in nature – or both. The study incorporated 21 genotypes planted at two locations, with three replications (plots) per genotype. Horticultural data (phenology, plant growth, pests, fruit yields, fruit quality) were quantified across four years (2016-2019), and fruit samples were analyzed for polyphenol fingerprint (2017-2018). The majority of horticultural parameters varied significantly across factors of site, year, and genotype (Table 1). Across the study factors of year and site, budbreak varied 33 days (22 Feb - 27 Mar) among genotypes. In fact, one genotype (“1898” – collected from Connecticut) consistently broke bud 20 days later than the next latest genotype. Peak flowering date ranged 31 days (25 May - 25 June). Differences in maximum plant height among genotypes were also considerable, ranging from 0.95 - 1.83 m. Pest and disease incidence varied significantly across all factors of year, site, and genotype. Keeping in mind that the accessions were selected for genetic diversity rather than horticultural potential, fruit yields ranged from 0.67 - 4.75 kg/plot (plot = 2.23 m²). This snapshot of the genetic diversity among phenological and horticultural factors within wild American elderberry underscores the potential for breeders to select various traits of interest as it continues to develop as a viable specialty crop.



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Processing and Analyzing the Bioactive Compounds from American Elderberries (*Sambucus nigra* subsp. *canadensis*) to develop Value Added Products

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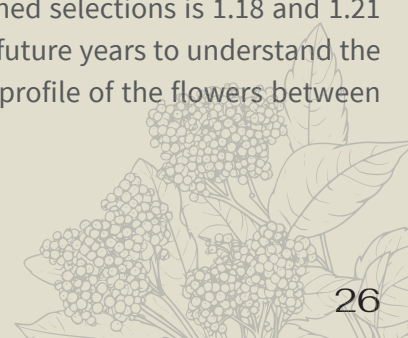
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The American elderberry (*Sambucus nigra* subsp. *canadensis*) is a native North American fruit gaining attention for its nutritional and economic potential. Its berries and flowers are rich in anthocyanins and polyphenols—natural compounds known for their antioxidant activity. The primary goals of this study are the extraction, characterization, and quantification of these bioactive compounds. By assessing their bioavailability and stability, the study tries to find the best processing techniques that preserve their functional advantages while improving their suitability for use in value-added products. Examples of possible uses include food & beverage products, pharmaceutical formulations, and nutraceuticals. The U.S. elderberry industry is valued at approximately \$320 million annually, with a projected growth of over 30% by the end of the decade. The results contribute to advancing elderberry-based value-added products, supporting food security and sustainable agriculture while reinforcing its role as a culturally significant crop.

How Pruning Affects the Flower Yield and Quality of Elder (*Sambucus nigra*) in the UK

Beth Taylor, Alice Jones, Debbie Sparkes, Murray Lark, John Alcock, Stacia Stetkiewicz

Elder (*Sambucus nigra*) produces crops of flowers and berries which are used in the food and drinks industry in the UK. Despite elder being a common tree, the majority of UK demand for flowers (60-70%) is met through imports from Europe, with the remaining demand heavily reliant on publicly picked flowers. With the aim of meeting growing demand for elder products in the UK, it is important to quantify best methods for growth, and the potential yields. Pruning has previously been identified as a beneficial method for increasing longevity and quality in fruit trees. Evidence of these same results are seen in commercial elder production outside of the UK. This paper investigates the effect of pruning on the flower yield and quality of 11 selections of elder in the UK. Trials demonstrate that pruned trees show a reduced yield (measured by flower count and total tree weight) in the first year after pruning, but flower quality (measured by individual flower weight) increases. The difference in yield is expected to reduce and ultimately reverse as the trees mature. The selections which showed most potential for growth in the UK were Donau (of unknown origin) and Haschburg (the most commonly grown selection in Europe). The potential yield calculated in this study for these pruned selections is 1.18 and 1.21 tonnes/ha, respectively. Further research should focus on yield in future years to understand the long term cost-benefits of pruning, and the differences in flavour profile of the flowers between selections.



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Overcoming Drought: Stress Priming in Elderflower Cuttings and Seed

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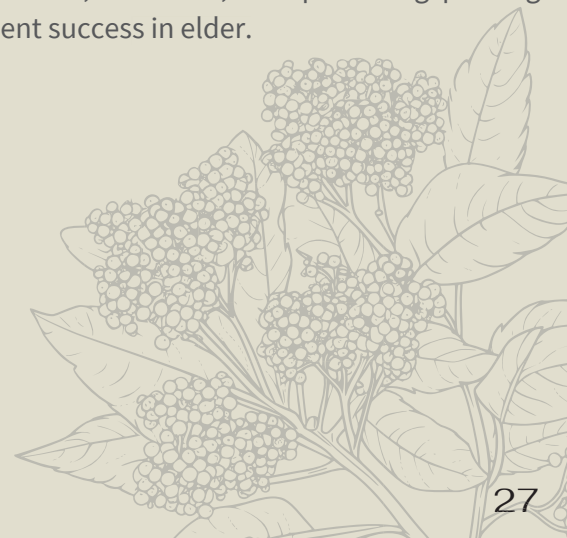
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Climate change is resulting in increased global temperature and changes in precipitation. This year (Spring 2025) was the warmest and driest on record for the UK in over 100 years. These conditions can negatively affect tree health especially in the first two establishment years. In the UK approximately 30% of young saplings are lost within this period, often due to drought or heat stress. We therefore tested stress priming as a method to increase stress resilience during establishment. Stress priming has attracted intensive research over the last decade, especially in crop species showing better adaptability and improved stress tolerance. While this is well studied in crops and the mechanisms behind stress memory are being to be elucidated, there is very limited studies in trees, and no testing on tree cuttings. An initial stress or molecule is used to trigger the stress response in plants, this sets up a stress memory, with changes at the molecular, metabolic and epigenetic level, priming the plants ready for a future stress. Through this stress memory the plants can respond more rapidly or strongly to a new stress leading to an increased stress resilience.

Elder is an excellent model tree species since it can be propagated from cuttings easily and grows quickly. Here we tested 9 *Sambucus nigra* accessions based on their growth habits within the field, including both weak and strong phenotypes in growth and yield. We then tested three different priming treatments, a short drought, BABA and CaCl as a method to induce stress memory into seeds and cuttings. After recovery from the priming event, these cuttings and seedlings were put into a severe drought and growth rates, photosynthesis, stomatal conductance, and plant health were monitored during the stress and in recovery; finally dry weight was recorded. From our work, while all priming treatments provided increased growth and photosynthesis rates under stress conditions, BABA was the best performer, with healthier plants in recovery and gave a 40% improvement in survival in the first 6 months of field establishment in comparison to un-primed control. BABA, therefore, is a promising priming agent for drought resilience and increased establishment success in elder.



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Quantification of Cyanogenic Glycosides in American Elderberry

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American Elderberry (*Sambucus nigra* subsp. *canadensis*) is a deciduous fruit-bearing shrub native to North America. Found throughout the United States in moist, edge habitats, this species is emerging as an increasingly popular crop plant that is cultivated for the use of its fruit within wines, jellies, juice, and supplements. American elderberry products are thought to provide positive health benefits due to antioxidant and anti-inflammatory effects arising from the action of multiple classes of beneficial metabolites produced within the fruit. Leaf tissues from these species have been shown to contain a class of compounds known as cyanogenic glycosides (CNGs). These CNGs are thought to potentially provide American Elderberry protective effects against predators and pathogens, but this effect is not currently well described. We have recently published a novel multiple reaction monitoring (MRM)-based ultra-high-performance liquid chromatography-tandem mass spectrometry (UHPLC-MS/MS) method to simultaneously separate and quantify five CNGs, including amygdalin, dhurrin, linamarin, (R)-Prunasin, and (S)-Prunasin (Kasote et al, 2024). Utilization of ammonium formate and optimization of chromatographic parameters allowed for chromatographic separation of the CNG isomers (R)- and (S)-Prunasin, which had previously been a substantial challenge. We are using this newly developed method to quantify leaf CNGs within twelve unique genotypes/cultivars of American Elderberry grown at 5 different geographic locations. We will correlate the levels of CNGs with field performance data to better understand the role of CNGs on Japanese beetle damage, Eriophyid mite damage, and leaf spot damage.

Unpacking Elderberry Demand: How Consumer Segments and Socioeconomic Factors Shape Purchasing Behavior in the United States

Hernan Borrero Camacho

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This study analyzes U.S. consumer behavior toward elderberry products, using data from a 2022 national survey of over 1,000 respondents. We examine both the decision to purchase and consumption frequency, focusing on attitudes toward product attributes like price, taste, nutrition, and environmental impact. Factor and cluster analyses identify four consumer segments: taste and value seekers, health-conscious, basic value, and socially conscious consumers. A double-hurdle model shows that only socially conscious consumers are significantly more likely to buy and consume elderberry products. Socioeconomic factors such as age, income, education, race, and family structure also influence behavior. The findings offer guidance for targeting key consumer groups.

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Floral Phenology and Compatibility Characterization of American Elderberry Cultivars Supports Breeding Efforts and Orchard Design

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American elderberry (*Sambucus nigra* subsp. *canadensis*) is growing in popularity due to its reported health benefits. As a native species, it is adapted to growing environments in eastern North America, providing opportunities for local produce to meet consumer demand. Growers require both improved cultivars and evidence-based production recommendations as more elderberry acreage is established. An understanding of the floral phenology and pollination biology of popular cultivars is needed to support effective orchard design and inform breeding strategies. Twelve cultivars sourced from environments across the eastern United States were included in a genotype by environment study at two Missouri locations. Stages of flowering and fruit development are being characterized, including inflorescence bud break, anthesis, percentages of flowering, end of flowering, and beginning of fruit ripening. Assessment of self-fertility will identify cultivars that may be less dependent on other cultivars for fruit set. There were significant differences among the twelve cultivars for all individual flowering stages across two years and two locations. The flowering window of most cultivars overlapped with at least one other, and most shared a similar peak bloom time with at least one other cultivar. However, the earliest flowers on Ranch and the latest flowers on Hamilton may not have received external pollen. Self-fertility will be studied in 2025. Cultivars such as Ranch may require a companion cultivar with earlier flowering for improved pollination, and Hamilton may require a later-season external pollen source. Detailed floral phenology data identify cultivars that should work well together in orchard settings and provide flowering information that can be utilized in breeding programs to select for desired flowering windows.

Blue Elderberry Research in Utah: Selections, Propagation and Management.

Brent L. Black

Plants, Soils and Climate Department, Utah State University

Utah's fruit industry is heavily focused on crops used for value-added processing, and growers are looking for diversification opportunities. Early trials with American Elderberry found that many cultivars were not tolerant of Utah's alkaline soils or ripened too late for the short growing seasons of the high-elevation valleys. Blue elderberry (*Sambucus nigra* subsp. *cerulea*) is native to these areas, but the local ecotypes have proven difficult to vegetatively propagate. We previously found that hardwood cuttings subjected to cold callusing for 14 to 18 weeks had relatively high rooting success, but scaling up to commercial propagation has still been slow. Current research efforts are focusing on both seed and tissue culture propagation. Several cerulea selections have now been established in tissue culture (stage 2) using previously published media formulations, and we are now optimizing stage 3 and 4 protocols. Seed germination is optimum after 18 weeks of cold stratification. Evaluations are underway to determine seedling variability across open-pollinated half-sib populations.

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A Survey of Viruses of Missouri Elderberry with Identification of A New Variant of Tobacco Ringspot Virus (TRSV)

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The American elderberry industry in the U.S. continues to experience rapid growth, with Missouri leading this nationwide interest. Within the last 15 years, elderberry has transitioned from a wild fruit used occasionally for homemade jellies and wines to a significant specialty crop used primarily in a variety of high-end dietary supplements. Elderberry is a native species and relatively easy to grow. However, as concentrated plantings are established, we are finding increased pest and disease pressure including viral diseases. Information on viruses that infect elderberry is lacking. We collected 400 elderberry samples (both cultivated and wild) from different regions of Missouri and screened for 10 distinct viruses using RT-PCR. Of the 400 samples, 224 and 285 samples tested positive for elderberry virus C (EVC) and D (EVD), respectively. No EVA, EVB and EVE were detected among the samples. Tomato ringspot virus (ToRSV) and Tobacco ringspot virus (TRSV) were confirmed in 36 and 52 samples, respectively, while Blueberry scorch, Arabis mosaic, and Tomato bushy stunt viruses were not detected. High-throughput sequencing using total RNA extracted from eight common elderberry cultivars revealed the presence of a potentially novel variant of TRSV that shows 85% homology to the reference genome sequence in GenBank. This project will allow us to better understand Missouri elderberry's virus situations and further assist nursery leaders in generating virus-free cuttings for the market.

Methods for the Measurement of Elderberry, Docosaheptaenoic Acid, Peroxidation Products and Proteomics

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To understand the role of Elderberry and docosaheptaenoic acid (DHA) in brain health, we have developed mass spectrometry-based methods to quantitatively follow the chemical changes involved. Our initial studies began in microglial cells to test the effects of DHA and its lipid aldehyde, 4-hydroxyhexenal (4-HHE), on the oxidative/inflammatory responses through regulation of the Nrf2 and NF- κ B pathways. Results showed that DHA as well as 4-HHE and 4-HNE (peroxidation of arachidonic acid) can inhibit lipopolysaccharide (LPS)-induced NO and ROS production. Global proteomics was also used to examine effects of DHA on microglial cells stimulated with LPS. Deep proteome coverage was achieved using the parallel accumulation serial fragmentation (PASEF) method in a hybrid trapped ion mobility spectrometry (TIMS) – quadrupole time-of-flight mass spectrometer (TIMS-ToF). Using label-free quantitative proteomics, a total of 2858 protein groups (with more than one unique peptide) were confidently identified and quantified in microglial cells. We then examined the effect of quercetin, a major anthocyanin in elderberry, combined with DHA in microglial cells. In addition to cell-based studies, we have developed methods to extend these quantitative measurements to mammals. The presentation will focus on the methods developed for these studies.

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Sustainable Valorization of *Sambucus nigra* L. Berries from Portuguese Cultivars: From Crop Biodiversity to Nutritional Value

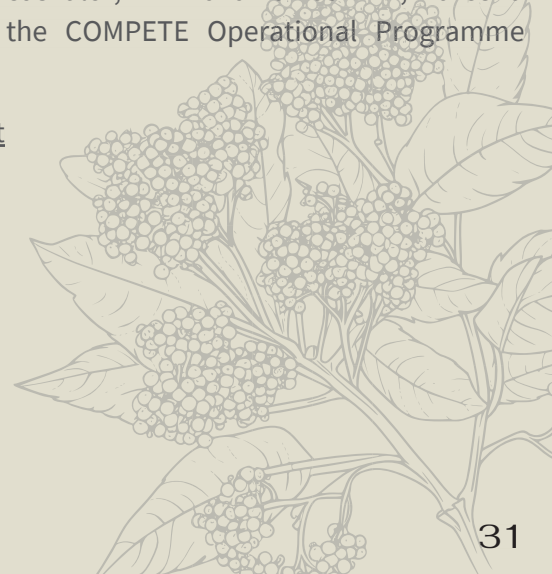
Sílvia M. Rocha

LAQV-REQUIMTE & Department of Chemistry, Campus Universitário Santiago, University of Aveiro, 3810-193 Aveiro, Portugal

Improvement of dietary and ecological biodiversity, namely by exploring autochthonous varieties, is a key point to the construction of a more sustainable food system and planetary health. However, the environmental sustainability continues to face huge challenges, reflecting the importance of achieving a better understanding about the functional role of biodiversity in ecosystems. Current market studies show that consumers increasingly value local products, their history of connection to local communities and their convenience, which must be in line with the current lifestyle. In this context, elderberry (*Sambucus nigra* L.) was identified as an attractive crop that has been used for centuries as a source of food additives and nutraceuticals. However, elderberry growing areas are not considerable and food products containing these berries are not exceptionally common on the market. Thus, this talk will be focused on the elderberries (*Sambucus nigra* L.) produced on the Tavora-Varosa valley (Portugal), and it will be discussed their potential as “smart product” based on nutritional characteristics and potential for developing sustainable and convenient food products. Also, emphasis will be placed on a comprehensive evaluation the effects of elderberry’s cultivar, harvest, and plantation field on the berry composition. The harvest, followed by field and the interaction of harvest×field, accounted for the highest impact on the berry’s characteristics. It is also important to point out the relevant effect of the soil water status. Elderberries and related extracts are a good source of carbohydrates, minerals, vitamins, with low amounts of fat, which making them low-energy foods and potential alternative source of vegetal protein.

Acknowledgments: This work was supported by National Funds by FCT - Portuguese Foundation for Science and Technology, through the UID/50006 -Laboratório Associado para a Química Verde - Tecnologias e Processos Limpos (Associated Laboratory for Green Chemistry - Clean Technologies and Processes) and the project SambucusValor, PDR2020-101-031117, Parceria Number 146/Iniciativa Number 341, supported by the COMPETE Operational Programme (COMPETE 2020) under the PORTUGAL 2020.

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Metabolomics And Natural Products: A Step Forward To A More Sustainable And Efficient Production

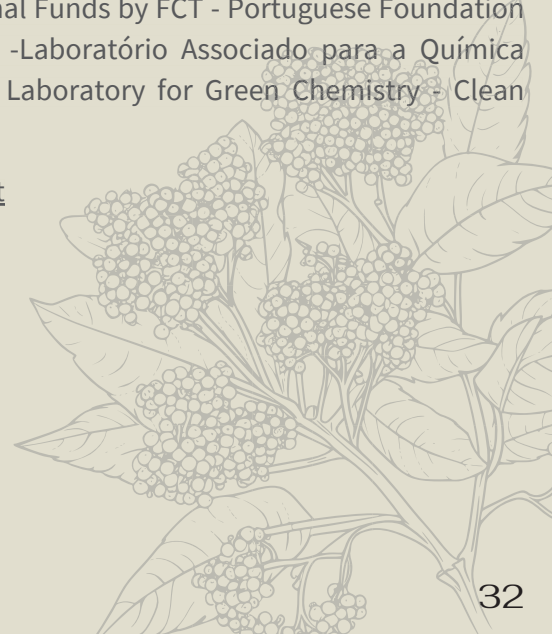
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Plant-derived natural products have been considered a valuable source of bioactive compounds and are usually composed of hundreds to thousands of metabolites. These metabolites may exhibit several functionalities, i.e., they may contribute to sensory characteristics, nutritional value, or may have specific beneficial health effects. The primary and secondary metabolism of the plants are modulated by several parameters, such as, cultivar, harvest year, soil and climate conditions, agricultural practices, among others. Understanding and ranking the impact of factors that influence plant metabolism are fundamental for more sustainable and efficient production. Metabolomics, a comprehensive study of the endogenous and exogenous low-molecular-weight small metabolites in a biological system using high-throughput technologies, has been used in the characterization of natural products. These techniques may represent key platforms driving the efficiency of metabolic profiling. Advancements in analytical instrumentation and bioinformatics fields have to fasten the processes of extraction and characterization of those metabolites along with their qualitative and quantitative analyses. Thus, this talk will be focused on the potential of the metabolomic-based strategy for mapping plant metabolites based on the application of advanced chromatographic techniques combined with chemometric tools. Several practical examples will be discussed, such as the integration of metabolomics to support i) ripening fruit development studies that can support producers on harvesting management, ii) spatial and temporal diversity of fruits across several consecutive harvests, iii) construction of omics pipeline, among others. These studies can provide important insights into the biochemical mechanisms involved, and may be combined with several domains of information, to lately support decision-making.

Acknowledgments. This work was supported by National Funds by FCT - Portuguese Foundation for Science and Technology, through the UID/50006 -Laboratório Associado para a Química Verde - Tecnologias e Processos Limpos (Associated Laboratory for Green Chemistry - Clean Technologies and Processes).

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Elderberry Supplementation Enhances Cognitive Resilience and Brain Health in Aging Mice

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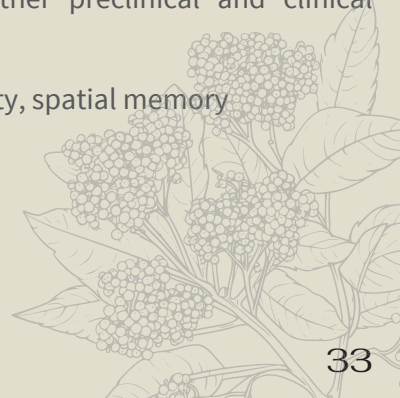
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Elderberry (*Sambucus*) is a specialty crop valued for its health-enhancing properties, largely attributed to its rich flavonoid content. Flavonoids possess antioxidant, anti-inflammatory, and free radical-scavenging activities that contribute to the neuroprotective effects. Cell membranes in the central nervous system (CNS) are enriched in docosahexaenoic acid (DHA). This fatty acid, commonly present in fish oil, is a well-known nutraceutical that supports brain development and offers protection against age-related neurodegenerative disorders, including Alzheimer's disease. This study investigated the impact of elderberry extract, DHA, and their combined supplementation on cognitive performance and brain health in aged mice. C57BL/6 mice (The Jackson Laboratory, Bar Harbor, ME) at 44 weeks of age were divided into four dietary groups (Control, DHA, Elderberry, DHA+Elderberry) feeding for 12 weeks. Mice were acclimated to the reversed light/dark cycles for seven days. A battery of neurobehavioral tests was performed at 56 weeks of age to assess age-related impairments, including motor dysfunction, anxiety/neophobia, hyperlocomotion, as well as deficits in memory, cognition, and learning.

Significant group differences were observed in anxiety-like behavior (Elevated Plus Maze and Emergence Test) and spatial learning/memory (Barnes Maze). Both elderberry and DHA-treated groups exhibited reduced time spent in the closed arms of the Elevated Plus Maze and shorter immobility periods in the Emergence Test, suggesting decreased anxiety and enhanced exploratory behavior. In the Barnes Maze probe trial (Day 9, no escape box), both elderberry and DHA groups demonstrated reduced latency to the first head entry in the former target hole and increased time spent in the target zone, suggesting improved spatial memory retention. In general, the group given Elderberry+DHA did not show an additive effect.

Although some outcomes did not reach statistical significance due to variability, limited sample size, and/or relative short duration of feeding. Nevertheless, overall findings indicate a positive trend toward cognitive enhancement with both Elderberry and DHA supplementation. These results support the potential of elderberry extract as a nutraceutical for promoting cognitive resilience and attenuating age-related behavioral decline. Further preclinical and clinical investigations are warranted to substantiate these findings.

Keywords: Elderberry extract, DHA, cognitive function, aging, anxiety, spatial memory



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A One-Week Elderberry Juice Intervention Augments the Fecal Microbiota and Suggests Improvement in Glucose Tolerance and Fat Oxidation in a Randomized Controlled Trial

Patrick Solverson

Washington State University

Obesity is a costly and ongoing health complication in the United States and globally. Berry-derived anthocyanins and their metabolites are of particular interest for their bioactive effects, including weight maintenance and protection from metabolic aberrations. Clinical trials suggest meaningful improvements in macronutrient metabolism via berry anthocyanins, but mixed results suggest achievable anthocyanin doses poses a major challenge. The objective of this randomized, placebo-controlled study was to determine if anthocyanin-dense elderberry juice (EBJ) reproduces glucoregulatory and substrate oxidation effects observed with other berries and if this is mediated by the gut microbiota. Overweight or obese adults (BMI > 25 kg/m²) without chronic illnesses were randomized to a 5-week crossover study protocol with two 1-week periods of twice-daily EBJ or placebo separated by a washout period. Each treatment period included 4 days of controlled feeding with a 40% fat diet to allow for comparison of measurements in fecal microbiota, meal tolerance testing (MTT), and indirect calorimetry between test beverages. Eighteen study volunteers completed the study. The EBJ caused changes to the fecal microbiota at both the phylum and genus levels in communities associated with both gut health and anthocyanin metabolism. The EBJ treatment also significantly improved clinical measures of a meal tolerance test, which was supported by increased fat oxidation both during the MTT and during moderate physical activity. Our findings confirm the bioactivity of EBJ-sourced anthocyanins on outcomes related to gut health and obesity. Follow-up investigation is needed to confirm our findings and to test for longer durations.

Missouri Experiences with Elderberry

Patrick Byers

The American elderberry (*Sambucus nigra* subsp. *canadensis*) is a widespread native North American shrub. Elderberry was widely used medicinally and as a food source by Indigenous peoples, including groups living on lands that later became Missouri. European settlers in Missouri likewise utilized this versatile plant. However, until the latter years of the twentieth century, most of the berries, flowers and other plant parts used were foraged from wild plants. Coordinated efforts to develop American elderberry as a commercially cultivated crop began in Missouri in 1997, with these efforts eventually led by a team including University of Missouri, Missouri State University, Lincoln University, Missouri Department of Agriculture, and innovative farmers. These ongoing efforts focus on production practices, pest management, marketing and economics, medicinal benefits, breeding, and outreach education. As a result of these efforts, Missouri now has a growing commercial elderberry industry, and the future looks bright for this Missouri specialty crop.

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A History of Elderberry and DHA on Brain Health

Grace Sun, Professor Emerita

Departments of Biochemistry and Pathology, University of Missouri

Elderberry (*Sambucus*) is a medicinal plant with many health benefits especially in support of the immune system to fight against allergies, cold and flu symptoms. However, studies to explore its benefits on the nervous system to fight against neurodegenerative diseases have not been well developed. Interest to investigate elderberry and brain health in University of Missouri was initiated around 2010 as a part of the MU Botanical Center under the leadership of Professor Dennis Lubahn. Our project showed that feeding elderberry pomace to mice (for 2 months) could minimize stroke-mediated brain damage as compared with controls without elderberry supplement. Most berries, including elderberry, contain flavonoids with antioxidant properties. The mammalian brain is a complex organ comprising of neurons, astrocytes, microglia, and endothelial cells which orchestrate different commands including thoughts, movements, and behavioral patterns. Studies with BV2 microglial cells showed that quercetin, a flavonoid high in elderberry, could suppress bacterial endotoxin (LPS) – mediated stimulation. Brain cell membranes are uniquely high in docosahexaenoic acid (DHA), a n-3 polyunsaturated fatty acid also present in fish oil. DHA has been widely used as a nutraceutical to support brain growth as well as fighting against different disorders. While DHA is known to mediate a protective pathway, brain cells also contain arachidonic acid (ARA), a n-6 polyunsaturated fatty acid known to mediate inflammatory pathways. Nevertheless, both DHA and ARA are susceptible to peroxidation, resulting in production of 4-hydroxyhexenal (4-HHE) and 4-hydroxynonenal (4-HNE), respectively. Previously, difficulty in analysis had prevented a clear understanding of the physiological properties of these peroxidation products. Bo Yang in M. Greenlief's lab developed an LC-MS/MS protocol to simultaneous determination of 4-HHE and 4-HNE. Together with Dr. David Beversdorf, a study was carried out to test whether DHA supplementation to pregnant dams and offsprings could minimize autistic traits. Over these years, substantial effort was made in marketing new elderberry products such as gummies and drinks. There is also increased interest to engage elderberry products with other nutraceuticals. With the advancement in technology on proteomics and lipidomic, and more sensitive methods to assess behavioral outcomes in Drs. Z. Gu, J. Cui and M. Greenlief's laboratories, and with support from the Elderberry grant (P.I. Andrew Thomas), we have launched a study to investigate effects of elderberry products on neuroprotective effects of DHA in the mouse model.

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Overcoming a Market Barrier: Elderberry Research in Plain Language

Jenny Blair, MD

American elderberry (*Sambucus nigra* subsp. *canadensis*) is a native perennial shrub that shows promise in agroforestry systems. Consumer interest in specialty crops is growing, and growers able to vertically integrate and create value-added products from elderberries often find ready markets. Yet lack of knowledge about many aspects of elderberry may still be a market barrier, potentially resulting in banks that are reluctant to loan, would-be customers who are unaware of elderberry properties, and industry-funded research in other crops garnering more attention.

Biomedical research into both American and European elderberry has resulted in findings of potential interest to farmers, lenders, consumers, and others. Elderberry has been explored for its potential or known antiviral, antibacterial, antidiabetic, anti-inflammatory, anti-cancer, antioxidant, and neuroprotective properties, among others.

However, scientific research in peer-reviewed publications is typically reported in complex language that can be inaccessible to laypeople. In addition, many US residents have low literacy skills, with over half reading below a sixth-grade level. Such factors complicate broad dissemination of elderberry research results.

In consultation with elderberry growers, the feasibility and utility of translating selected research results into plain language to communicate elderberry science are explored. Best practices for fostering trust in science are considered, such as avoiding jargon, using analogies, and paying attention to audience values. Legal pitfalls surrounding health claims are also considered. This approach may also be applied to other specialty crops that can be incorporated into agroforestry systems.

Economic Evaluation and Comparative Analysis of Six weeding Methods in Elderberry Production: Evidence from Two Experimental Fields in Missouri

Hernan Borrero Camacho

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This study presents a comprehensive benefit-cost analysis (BCA) of six weeding suppression methods in American elderberry production, based on data collected from 144 plots over a three-year period (2022–2024). Based on annualized Net Present Value (NPV) calculations for each plot, the analysis compares both average outcomes and distributional differences across treatments. A one-way ANOVA revealed significant differences in mean NPVs between treatments, with herbicide, weed-free control, woodchip mulch, and woven fabric significantly outperforming cover crops and unmanaged controls. Complementary Kolmogorov-Smirnov (K-S) tests confirmed these findings, showing that the outperforming treatments not only had higher means but also dominated the less effective methods across their entire distributions. The strong agreement between parametric and non-parametric tests enhances the reliability of the results, providing robust guidance for optimizing weed management strategies in elderberry cultivation.

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High-resolution Biochemical Phenotyping of American Elderberries

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American Elderberry is a deciduous shrub native to North America that flourishes in diverse soils and produces fragrant white flowers in late spring and eventual dark purple berries in late summer. This plant species holds substantial commercial value and is rapidly emerging as a specialty crop. Due to its potential medicinal and nutritional benefits, American elderberry is widely cultivated for its fruits and flowers, which are utilized for a variety of products including food, teas, jellies, syrups, and wines. The medicinal and nutraceutical benefits of Elderberry have been mostly attributed to specialized metabolites. Plants produce these specialized metabolites to make themselves more competitive in complex environments and in the absence of mobility. Thus, we are biochemically phenotyping a large number of cultivars using non-targeted metabolomics to better understand the nutraceutical content and the impact of specialized metabolites on field performance. The presentation will start with an introduction to our nontargeted approach and provide data that documents increased identifications obtained using complex technology known as PASEF UHPLC-TIMS-QTOF-MS/MS relative to the more traditional UHPLC-QTOF-MS/MS. This presentation will then describe results obtained for Elderberry fruits/berries and flowers. Elderberry flowers appear more biochemically complex than fruits and may be a better nutraceutical based on the results. We will also describe how we are using nontargeted metabolomics to further understand environmental effects on Elderberry specialized metabolism in a large Genotype x Environment study. We will also briefly note other targeted analyses of cyanogenic glucosides for the same reason. We will present data that illustrates the chemical diversity found in Elderberry and we are attempting to correlate this diversity with field performance.



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Characterizing U.S. Elderberry Grower Enterprises and Challenges Using Latent Class Analysis

Andria Caruthers

University of Missouri

American elderberry (*Sambucus nigra* subsp. *canadensis*) is a native perennial gaining popularity among small and mid-sized growers for its ecological value and market potential. However, growers encounter varied experiences when navigating markets, scaling operations, and building sustainable enterprises. This study used latent class analysis (LCA) to identify distinct subgroups of U.S. elderberry growers based on shared perceptions of market barriers and enterprise outlook. Survey responses from 64 commercial growers revealed two classes. The first, labeled Motivated-positives, experienced fewer market barriers and expressed strong optimism about enterprise growth. In contrast, Motivated-neutrals reported greater difficulty with securing consistent buyers, navigating insurance and regulatory issues, and obtaining reliable processing services, leading to a more cautious or uncertain outlook. Regression analysis revealed that class membership was associated with differences in marketing activities and demographic characteristics, including years of experience and scale of production. These findings indicate that elderberry producers are not a homogenous group but represent distinct pathways and constraints within the emerging value chain. Segmenting growers in this way enables more targeted technical assistance, cooperative development, and policy support to help overcome barriers and expand elderberry as a viable, resilient livelihood strategy. This research contributes to broader efforts to support specialty perennial crops within sustainable agriculture frameworks.

Determining Inhibitory Effects of American Elderberry Compounds on Influenza Neuraminidase

Katherine Spitzmiller, Amanda Dwikarina, Hsin-Yeh Hsieh, Chung-Ho Lin

University of Missouri

Elderberry supplements have become increasingly popular in recent years. Specifically, American elderberry extract is taken for relief from Influenza symptoms, and to aid in faster recovery from the illness. Influenza is a prominent global health issue due to its ability to spread and replicate rapidly. Neuraminidase is an enzyme on the surface of influenza virions that cleaves sialic acid from the surface of epithelial nasal and throat cells in humans and is responsible for the spread of virions. Medications like Zanamivir (Relenza) and Oseltamivir (Tamiflu) can block the active sites of neuraminidase and stop the spread of virions. This project is to investigate if the compounds extracted from American elderberry can act as Tamiflu and Relenza to inhibit influenza neuraminidase activity. To prove this, inhibitory assays were preformed- testing 22 compounds extracted from American elderberry and using Tamiflu as a positive control for inhibition. It is shown that Tamiflu demonstrated >95% inhibition of influenza neuraminidase in testing, and 21 compounds extracted from American elderberry has shown various levels of inhibition but one with no effect. Given the demonstrated inhibitory effects by American elderberry compounds, these results may drive the public's interest in elderberry supplement uptake, leading to it becoming a more popular immune support choice during the Flu seasons.

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USP Standards for European Elder Berry Dietary Ingredients: Solutions to Address Quality and Adulteration Issues

Maria Monagas

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The demand for dietary ingredients derived from European Elder berry (*Sambucus nigra* L.), traditionally used to alleviate cold or flu symptoms remedy, has drastically increased due to the COVID-19 pandemic which has led to increased reports of adulteration. In 2021, in response to stakeholder inquiries, USP hosted the Elderberry Standard Development Open Forum to address the adulteration crisis and the need for new quality standards. Since then, USP has been actively working in the modernization of the currently official monograph for European Elder berry Dry Extract, published in PF 49(3) (May/June 2023), and in the creation of new standards for other ingredients, including: aqueous dry extracts, liquid extracts, juice concentrates and dry juices. The use of confounding materials rich in anthocyanins such as black rice extract and purple carrot juice, undeclared synthetic dyes and species misbranding, are among the most common types of adulteration in elder berry products. In addition to adulteration related to identity and purity, manufacturing-related issues resulting in anthocyanin thermal degradation during the processing of juice concentrates, as well as excessive use of carriers during the juice spray drying process, can also lead to quality issues in these types of ingredients, affecting both identity and composition.

This presentation summarizes the work conducted by USP and Expert Committee collaborators for the development of new and modernized monographs, including Identity tests based on the polyphenol profile by both HPLC-DAD and HPTLC, as well as an HPLC-DAD quantification test for anthocyanins, which has been validated for each type of ingredient. Examples of the application of these tests using data collected in our labs to address issues related to ingredient specifications, species differentiation, detection of adulteration, and other quality matters in European Elder berry ingredients will be presented.



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USP Admission Evaluation for European Elder berry ingredients: A New Cautionary Labeling Statement

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European Elder berry, *Sambucus nigra* L. fruit has a long history of traditional use as a cold and flu remedy. The United States Pharmacopeia (USP) has recently published a family of quality monographs including specifications for identity, composition, purity and limits of contaminants for different ingredients derived from the elder berry fruit (i.e., juice concentrate, dry juice, liquid and dry extracts and fruit powder). The USP Dietary Supplements Admission Evaluation and Labeling Expert Committee (DSAEL EC) reviewed reports indicating that type I allergy to elder berry is caused by an allergen with significant homology to ribosomal inactivating proteins. Assessment report on *S. nigra*, fructus by European Medicines Agency (EMA) cited an article mentioning lectins are able to promote the release of histamine from basophils and mast cells. *S. nigra* agglutinin can cause allergic reactions because it is able to release interleukins IL-4 and IL-13 from human basophils and mast cells. Further, the EMA report identified several adverse events reported to the World Health Organization Uppsala Monitoring Centre (WHO-UMC). Additionally, the Health Canada monograph for *S. nigra* recommends including a cautionary label to warn users to discontinue use if hypersensitivity or allergic reactions occur. Considering this evidence, the DSAEL EC decided to introduce a cautionary statement regarding allergic reactions that reads: "Elder berry may cause allergic reactions. Individuals at high risk of allergic reactions due to preexisting food allergies or other health conditions should consult their healthcare providers before using elder berry products. Discontinue use immediately if hypersensitivity or an allergic reaction occurs." This presentation will include a summary of this evaluation and the rationale for the proposal of a new cautionary labeling statement for dosage forms derived from elder berry ingredients.



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AHP and USP Elderberry monographs: HPTLC analysis of different species, Dietary Supplement ingredients and products

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European Elderberry, *Sambucus nigra* L. has a long history of traditional use as a cold and flu remedy. However, increased demand due to COVID-19 and limited supply of traditional Elderberry ingredients has created a situation that increases adulteration risk. Major concerns related to adulteration are substitution of Elderberry with black rice extract, addition of synthetic dyes and species mislabeling. This poster summarizes the progress made towards developing new American Herbal Pharmacopeia (AHP) and United States Pharmacopeia (USP) monographs for Elderberry, and the different categories of derived ingredients. A summary of HPTLC analysis of a total of 167 samples from different types of ingredients marketed as containing *S. nigra*, including whole fruits, juice concentrates, dry juices, fruit powders, liquid extracts, aqueous extracts and Dietary Supplements (DS) products (capsules and syrups) is presented. Related species (*S. cerulea*, *S. canadensis*, *S. ebulus* and *S. rubra*) and confounding anthocyanin sources were also analyzed, including black rice extract as the main adulterant of Elderberry ingredients. The HPTLC method published in USP European Elder berry Dry Extract monograph was optimized and applied following USP <203> HPTLC for Article of Botanical Origin. HPTLC images, peak profiles from images, and peak profiles from scanning densitometry (at 210, 254, 280, and 540 nm) were used to compare the fingerprinting of the different types of samples. According to the profile of flavonols and phenolic acids, samples corresponding to *S. nigra* berries could be classified into 4 different groups or chemotypes. In comparison to related species, the anthocyanins profile of *S. nigra* revealed an additional zone due to cyanidin-3-glucoside. Among the different types of ingredients, 55 ingredients met the characteristic zones for *S. nigra* for anthocyanins, flavonols, and phenolic acids. Adulteration by substitution with black rice extract was clearly detected in 5 samples. In some ingredients, particularly liquid extracts, dry juices, and fruit powders, the anthocyanin detection was very poor, but flavonols and phenolic acids were detectable. The same was observed for the syrups category and some capsule products. Other capsules products did not show characteristic zones in any detection mode, which might indicate either the absence of Elderberry ingredients or the large dilutions with excipients. In conclusion, the HPTLC method proposed in this work is selective enough to allow species differentiation, distinction from cofounding anthocyanin sources, and the detection of adulteration in both ingredients and DS products.

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Fruit for Thought: How Plant Cultivar Affects Pollination Ecology of American Elderberry

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Inter-individual variation is ubiquitous in nature, but consequences for mutualisms are often poorly understood. Floral traits often differ among plant cultivars, which could affect interactions with pollinators and thus impact pollination success. In this study we investigated how pollination ecology varied among cultivars of the American elderberry (*Sambucus nigra* subsp. *canadensis*). We characterized the abundance and diversity of arthropod flower visitors, as well as the relative contribution of visitors to fruit set and developmental patterns across six co-flowering cultivars. To assess how visitors contributed to pollination, we performed an exclusion experiment by bagging a subset of unopened inflorescences with fine mesh organza bags. Unripe fruit set did not differ among cultivars or exclusion treatments; however, ongoing ripened fruit analyses could reveal effects on plant fitness. To determine identities and abundance of visitors to elderberry flowers, we sampled elderberry plants over their flowering period using both timed floral observations and collections. While identification and diversity analyses are ongoing, arthropod abundance and diversity does not appear to differ significantly among plant cultivars. Altogether, our results suggest that although plant cultivar can impact ecology in other systems, the potential differences among cultivars of American elderberry have limited influence on associated arthropod communities in terms of overall abundance, diversity, and their contribution to pollination.



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Berry Important Pollinators: Arthropod Visitors of American Elderberry Across Cultivar

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Conservation of native plants often depends on an understanding of their pollination ecology. Historically, American Elderberry (*Sambucus nigra* subsp. *canadensis*) has served as a food source and health aid for many indigenous groups in North America and has increasingly been developed as a specialty crop for the dietary supplement market. Although American Elderberry has been hypothesized to be animal pollinated, the identity and relative abundance of arthropod visitors to its flowers remain uncharacterized. In this study, we sought to identify arthropod visitors to elderberry flowers and how patterns of visitation differed among cultivars. A comprehensive assessment of arthropod visitors to elderberry flowers was conducted in southwest Missouri from May 28th - June 26th, 2024. Although arthropod identification is ongoing, we find that arthropod visitors are spread among 11 orders and >40 families, with the greatest family level diversity occurring in the Coleoptera (>15 families), Diptera (>11 families, and Hemiptera (>8 families). There were no significant differences among cultivars in terms of abundance or Shannon Diversity. Most arthropod visitors to flowers were likely incidental pollinators: 32.4% were predators and 25.8% were phytophagous. Our results indicate that arthropod visitation of elderberry is common, yet most visitors likely play little role in pollination.

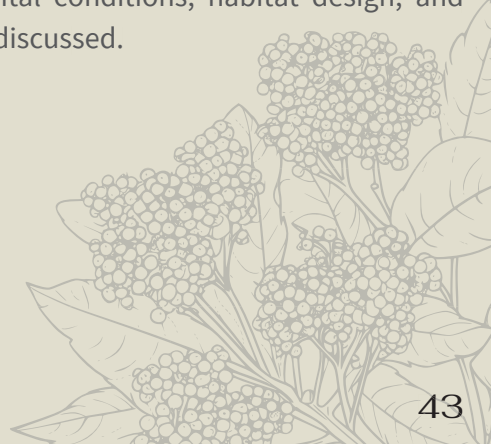
The Potential of *Leptopilina japonica*, A larval Parasitic Wasp for Control of Spotted Wing *Drosophila* in Berry Crops: Lessons from Alabama

Clement Akotsen-Mensah

Alabama Cooperative Extension System, Alabama A&M University, Huntsville, AL

As the drawbacks of chemical pesticides become increasingly evident, biological control of insects has emerged as a vital component of sustainable pest management. This poster presents the potential of *Leptopilina japonica*, a larval parasitoid for control of the spotted wing drosophila in berry crops.

Factors affecting their success, such as host, environmental conditions, habitat design, and compatibility with other pest management techniques, are discussed.



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Elderberry Wisdom Farm's Commitment to *Sambucus nigra* ssp. *cerulea* from a Traditional Ecological Knowledge and Habitat Restoration Perspective (Willamette Valley, Oregon)

Rose High Bear (Deg Hit'an Dine, Inupiaq)

Elderberry Wisdom Farm, Salem, OR

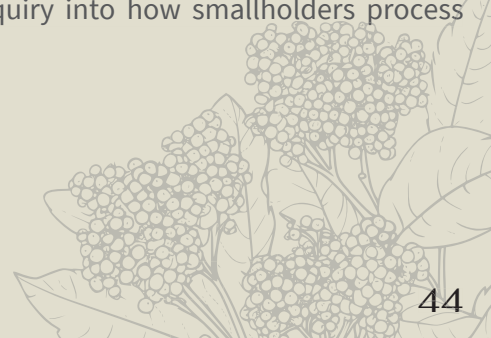
The Native American nonprofit corporation, Elderberry Wisdom Farm, located in the Willamette Valley of Oregon, has been cultivating *Sambucus nigra* subsp. *Cerulea* (Blue Elderberry) since formation in 2019. Founding Director Rose High Bear (Deg Hit'an Dine, Inupiaq) is committed to work with this native plant species, and will discuss its importance from a cultural, ecological and business perspective. It is a powerful ethnobotanical that provides medicine sought after by today's increasingly health-conscious consumer. The plant enriches the environment, its root strengthening the earth and the biodiversity of the soil, while it nourishes the black tail deer who love to nibble on its leaves. Its flowers blossom over four months in the spring and summer with berries produced for several months throughout the summer. Blue Elderberry Farm was formed in 2021 to serve as EWF's social and economic development initiative. Rose is developing it as an example of a hybrid business model to other Native Americans interested in forming their own microenterprise business. She completed the feasibility study and business plan in 2022 and is scheduling the launch of the production on a small scale in 2026 at the local farmer's market. It is a challenging plant to grow so production was delayed due to crop losses in 2022 and 2024. However, the orchard is still growing and exhibiting healthy crops, with transition to organic certification planned between 2025-2027. The marketing plan has been developed with a soft launch scheduled for September 2025 and 2026 when the first pilot projects will be held at the local farmer's market in Salem, Oregon's state capitol.

Seeing is Believing? Preliminary Insights into Objective vs. Subjective Drivers of Pest Control Adoption

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This exploratory study investigates whether farmers' pest management decisions are more responsive to subjective perceptions of pest pressure or to objective indicators of pest presence. Using survey data from 97 producers collected in 2022, we estimate logistic and count models of pest control adoption. Preliminary findings suggest that objective measures—namely, the number of pest types observed—are significantly associated with adoption, whereas perceived pest challenges show no consistent effect. These results are tentative and raise concerns about potential endogeneity between pest presence, perception, and management behavior. This working paper serves as the foundation for a broader inquiry into how smallholders process information when deciding to manage agricultural pests.



Contributors



ELDERFARMS



CARMEL BERRY



The Kerr Center
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WHITE BUFFALO
LAND TRUST



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Conservancy



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