A publication of the International Society for Horticultural Science

# Chronica Horticulturae

## Horticultural highlights

ISHS Division Ornamental Plants: from challenges to new opportunities for the ornamental sector • Scientists use samba wasps to manage the invasive spotted-wing drosophila, a key pest of small and stone fruit worldwide • Rare fruits in Ukraine

## Symposia and workshops

Virus Diseases of Ornamental Plants • Postharvest Pathology • Peach • Date Palm

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# Chronica Horticulturae

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The *European Journal of Horticultural Science* (eJHS) accepts original research articles and reviews on significant plant science discoveries and new or modified methodologies and technologies with a broad international and cross-disciplinary interest in the scope of global horticulture. The Journal focuses on applied and fundamental aspects of the entire food value chain, ranging from breeding, production, processing, trading to retailing of horticultural crops and commodities in temperate and Mediterranean regions. ISHS members benefit from a discounted publishing charge. eJHS is available in print + online Open Access. Additional information can be viewed on **www.ishs.org/ejhs**.

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Additional information can be viewed on the PubHort website **www.pubhort.org**.

A publication of the International Society for Horticultural Science, a society of individuals, organizations, and government agencies devoted to horticultural research, education, industry, and human well-being.

## › Contents



**Cover photograph: Ukrainian fruits at the M. M. Hryshko National Botanical Garden of the National Academy of Science of Ukraine, in 2020. These fruits include many tasty cultivars of cornelian cherry *(Cornus mas)*, and plates of multiple pome fruit including Japanese quince *(Chaenomeles* spp.). This garden is one of the leading Ukrainian institutions that breed both the cornelian cherry and the Japanese quince for regional adaptation. See article p.40.**

# A new board with new ambitions for ISHS

› François Laurens

**François Laurens, President of ISHS**

It was both an honor and a privilege to be elected President of the International Society for Horticultural Science (ISHS) at the last Council meeting in Angers, France.

The endless sanitary, economic and security crisis our planet experienced in past years has been a major test case for how our civilization responds to adversity. And notwithstanding, from every crisis comes opportunity: business as usual is no longer possible. Reducing our carbon emissions, saving energy, preserving biodiversity, and a greater focus on safe and sustainable nutrition and the better use of natural resources are some of the key issues that need to be addressed to safeguard our future. It is our responsibility as scientists, educators and professionals to demonstrate that Horticulture can make a major contribution in addressing each of these challenges. Improving food quality (both from a nutritional and food safety perspective); reducing the use of chemical fertilizers and phytosanitary chemicals; developing resilience to climate change; and enhancing natural resistance to pests and diseases are all within our control, improving the sustainability of our food systems for health and wealth. Horticulture has the intrinsic capability to develop new ways of producing and consuming a multitude of crops, species and varieties. With all of us engaged in facilitating this transformation, our concerns need to focus not only on the technical aspects of our research and its application, but also on the issues of interest to the general public, consumers, farmers, policy and decision makers, and stakeholders in both the public and private arena.

ISHS provides a unique and perfect platform to do this. It gathers more than 6000 members from more than 120 countries, who bring their various skills, their own cultural perspectives, their expertise and backgrounds to the sector. My first general aim during the next four years will be to optimize and to draw benefits from this very rich and diverse network.

With the Board, I propose to work on a few key activities:

Science is our core business. I want us to stay on course, and to develop a clear and ambitious roadmap. I want ISHS to be recognized for the high quality and utility of the research outputs of its members from basic to applied science, but we must also remain cognizant of our responsibilities in the face of the main challenges that we face and therefore work towards a long-term vision that is sustainable, equitable and profitable.

ISHS must also increase its links with industry. The challenge is to bridge the gap between research and industry. Today's challenges require solutions from the research community for companies and industries to deploy and to scale up. I am convinced that the combination of research that creates solutions and industry that implements and extends them, will lead to success. We must encourage technology transfers at all levels of the sector, from basic research to commercial distribution, extending the concept of 'seed to plate' to 'lab to plate', thus recognizing the importance of research inputs in our food systems.

Another major challenge we face is gaining interest from the younger generations. Both the research community and the industry at-large are having difficulty recruiting the young people required for this sector to continue, to strengthen, to evolve and to meet the challenges at hand. We must develop specific actions targeted at these young minds. To reach this goal, we will need to adapt our communication tools and to be both more active and present in social networks.

Finally, looking at the latest statistics, the number of members from low income countries is one-tenth as high as regular income countries. We must seek to reach a more balanced ratio if ISHS is to have a positive impact on alleviating the challenges facing the planet and mankind.

At this point in time, I'd like to thank all the members of the previous ISHS Board and the Secretariat. I particularly want to thank the former President, Dr. Yüksel Tüzel, and the Executive Director, Mr. Peter Vanderborght, for their great work in these past difficult times. Thanks to their active work, and despite the complicated health and economic situation of recent years, the Society remains on a solid footing. However, we must also pursue the recommendations of our two internal auditors to rethink and perhaps review the business model for our Society, particularly in terms of publications.

We started to share these different views at our first two Board meetings held during the Congress. I have the great honor of working with a very talented, skilled and experienced Board, which will be able to tackle all the challenges cited above and to implement new strategies and directions for ISHS. It is my privilege to introduce you to the new ISHS Board members:

From the outset, we must acknowledge that we have only one woman in our team, Prof. Dr. Patricia Duarte de Oliveira Paiva, from Brazil, and as a Board, we were very concerned about this unbalanced gender ratio. For that reason, we have offered Patricia the position of first Vice-President of the Board in charge of young minds, highlighting the importance of both women and young minds.

Prof. Dr. Ted M. DeJong, from the USA, will be the Vice President in charge of Science and statutory Chair of the Executive Committee.

Mr. Moctar Fall, from Senegal, will take the role of Secretary. He will also be in charge of implementing our strategy in terms of partnership towards industry, institutions and NGOs.

Dr. Lukas Bertschinger, from Switzerland, accepted the mission of Treasurer and will also be in charge of strategy to strengthen membership and outreach.

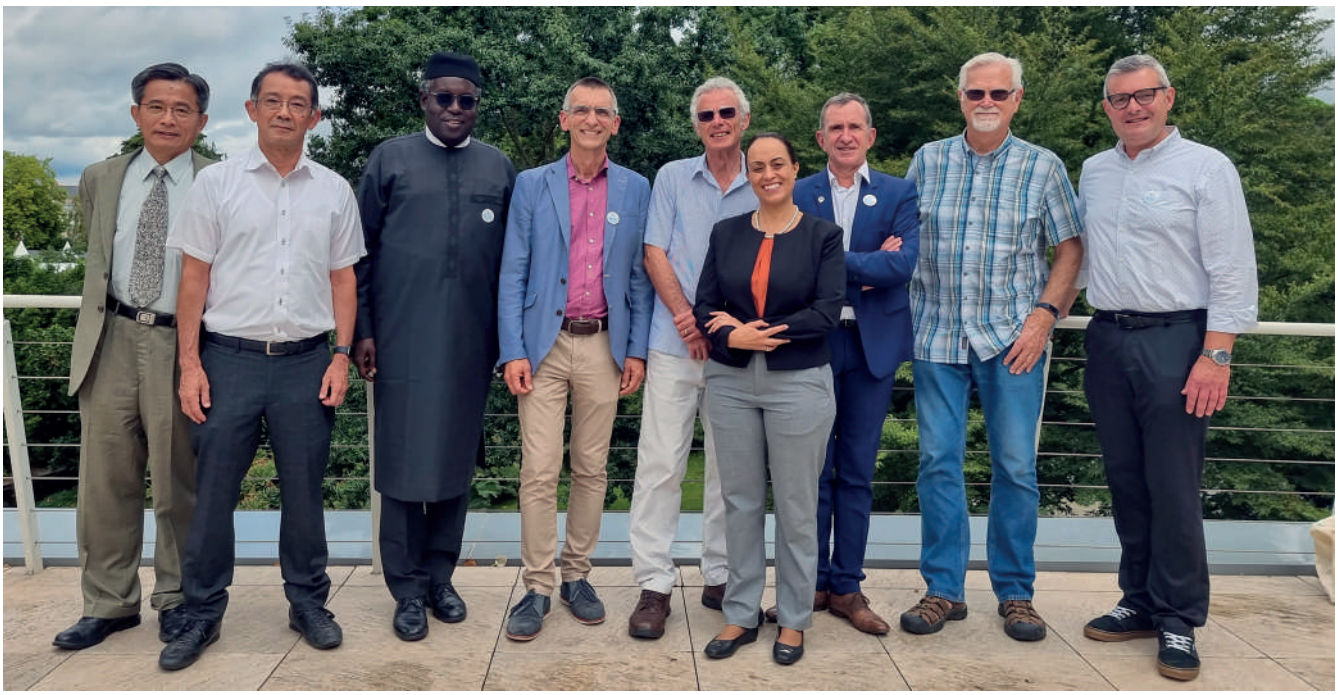
Prof. Dr. Yao-Chien Alex Chang, from Taiwan, will be in charge of our publication strategy.

Prof. Dr. Peter J. Batt, from Australia, will have the exciting task of improving our communication, not only within the scientific community, but also with the industry, with the general public and even within the Society itself, for our members want to know what we are doing, where we are going and to be more engaged in the process.

In addition, the Board will be joined, as *ex officio* members, by Prof. Dr. Ryutaro Tao, President of the upcoming International Horticultural Congress in Kyoto, Japan, IHC2026, and by Mr. Peter Vanderborght, the ISHS Executive Director.

You can be sure that your Board and I will do our very best to represent, promote and defend the interests of ISHS and of horticulture everywhere and on every occasion that we have the opportunity to do so. I am looking forward to working with and for you over the next four years.

# › The new Board of the ISHS



› The new Board members at IHC2022.

On 18 August 2022, at the meeting of the General Assembly, the ISHS members in attendance confirmed and inaugurated the new Board of the ISHS. As described in the Statutes and in the Rules of Procedure of the Society, the Board is composed of seven elected members and two *ex officio* members.

## Dr. François Laurens, President of ISHS and Chairperson of the Board

› François Laurens

Dr. François Laurens was born in France in 1961, graduated in Agronomy, Breeding and Genetics at the Universities of Tours and Angers, and then at the former Ecole Nationale Supérieure d'Agronomie in Rennes, now Institut-Agro AgroCampus Ouest, to obtain his "Ingénieur Agronome" diploma. He received his PhD at the University of Rennes in 1992, working on "the genetic determinism of resistance to clubroot in Brassicae." For the last 30 years, he has worked at INRAE Angers (France) as a geneticist and a breeder in charge of many and diverse missions: French fruit varietal testing network, apple and pear breeding programs, apple germplasm management, and fruit quality genetic studies. He is a member of the Excom of the Institute of Research on Horticulture and Seeds (IRHS), a large laboratory of 250 members developing research projects on quality and health of horticultural crops based in Angers and the leader of the Vadipom team which gathers 15 people working on the Valorization of the Diversity of Pip-fruits. His team has released more than 20 apple and pear cultivars so far with for instance the recent release of the apple cultivar 'Inored Story®'. This cultivar cumulates good behaviour against scab, very attractive and excellent fruits, and high and regular commercial production. With more than 4 million trees planted, 'Inored' is among the most planted new scab resistant cultivars in Europe.

Dr. Laurens is also the co-leader of GIS Fruits, a scientific interest group that draws together 22 French partners involved in research, training, and professional organizations in the fruit sector. He has been active in scientific committees of various institutes at national and international levels. He is currently the President of the scientific committee of CTIFL (French Technical Center for Fruit and Vegetables). He is the author and co-author of ca. 200 publications including scientific journals (H index 20), book chapters, and conference papers. He has been an invited speaker at more than 15 international symposia and associate editor of a few scientific journals. François Laurens has held leading positions and managed a lot of regional, national and European projects. Between 2011 and 2015, he coordinated the large collaborative European project FruitBreedomics, regrouping 28 partners, which aimed to improve the efficiency of apple and peach breeding programs by filling in the gap between basic research studies and applied breeding. He also led the EU-Climate-Kic project, Friendly Fruit (2018-2020), which aimed to develop and test new agricultural environment-friendly practices for apple and strawberry. He is an active member of the Eufrin (European Fruit Research Institutes Network) board. He is now the leader of the EU-H2020 INVITE project "INnovation in VarIety Testing in Europe", which consortium gathers more than 200 people representing 29 partners from various backgrounds and origins (scientists, examination offices, seed companies) working on nine different species, including agricultural crops but also a few horticultural crops (apple, tomato, potato). Its aim is to foster the introduction of new cultivars better adapted to varying biotic and abiotic conditions and to more sustainable crop management practices.

François Laurens has attended many ISHS symposia since 2000. He is co-editor of two volumes of *Acta Horticulturae* and has hosted two international symposia. He was the President of the XXXI International Horticultural Congress (IHC2022), which was held in Angers, France. He has been an active *ex officio* member of the previous ISHS Board and was elected President of ISHS in August 2022. François and his wife Catherine have three children, Marion, Quentin and Paul, a grandson Louison, and a new coming grandson in November 2022.

## Prof. Dr. Patricia Duarte de Oliveira Paiva, Vice-President of ISHS and Responsible for Young Minds

› Patricia Duarte de Oliveira Paiva

Professor Dr. Patricia Duarte de Oliveira Paiva is full Professor at the Federal University of Lavras in the Plant Science Department, where she started in 1997. She was born in Itanhandu, Minas Gerais, Brazil, in 1969, in a family with 3 sisters and 1 brother. She graduated with a BS in Agronomy in 1992, received an MS in Plant Science in 1994, and a PhD in Plant Science in 1998, from the Federal University of Lavras. Both her MS and PhD theses focused on ornamental plants. She teaches courses and performs research in floriculture and landscaping for undergraduate and graduate students. She has supervised 46 MS and 23 PhD students and 6 Post-Docs. She held the position of Vice-Head of the Plant Science Department from 2014 to 2015, and Head from 2015 to 2016. From 2016 through 2021, she was the Coordinator of the Graduate Program in Plant Science.

Professor Paiva is active in research with an interest in ornamental plant propagation (including in vitro propagation and conservation), production and postharvest conservation of cut flowers and foliage of tropical plants, and bulbous species. She has also been involved in landscaping studies, researching the origin and history of Brazilian gardens, and the uses and qualification of urban green areas. Her results have been published in more than 190 refereed scientific papers. She is author of 2 books on floriculture, 3 on landscaping, 16 brochures on historical Brazilian gardens, and many book chapters. She has been Associate Editor of the journal Ornamental Horticulture (since 2013) and a research topic of Frontiers in Plant Science (since 2019).

She became a member of the Brazilian Society of Floriculture and Ornamental Plants (SBFPO) in 1995. From 2013-2017, she was President of SBFPO and she remains a Board Member of this Society (2017-2025). Professor Paiva has been member of the ISHS since 2008 and has served as country representative for Brazil on the Council of ISHS since 2013. She has served as Convener and invited speaker of one ISHS international symposium and several non-ISHS congresses and symposia. In 2018, she was elected as Board member of ISHS, from South America, being responsible for Young Minds.

In 2022, she was elected for a second term on the ISHS Board. She is very proud to continue contributing to the future of ISHS, now as Vice-President focusing on Young Minds. She is proud of the opportunity to lead the initiative to reach out to young minds. She advocates the promotion of international educational programs that may give students and young scientists the opportunity to learn and practise Horticulture.

Professor Paiva is passionate about flowers and gardens. Besides teaching and research, she spends her time cultivating them at home, and helping family members and friends in their gardens. One thing that she loves is to visit different places where these species are cultivated, for commercial purposes or not, always learning about them, or their history and heritage. She shares this passion with her husband Renato and their three children, Alice, Elisa, and Gabriel.

## Prof. Dr. Ted M. DeJong, Vice-President of ISHS and Statutory Chair of the ISHS Executive Committee, Responsible for the Scientific Activities of the Society

› Ted M. DeJong

Professor DeJong is an emeritus professor who worked as a fruit tree crop physiologist in the Department of Plant Sciences at the University of California, Davis, from 1981 to 2016. He had a split appointment in teaching, fundamental and application-oriented research, and extension. He served as chair of the UC Davis Department of Pomology for eight years (1994-2002) and as vice-chair in the reorganized/consolidated Department of Plant Sciences for three years (2006-2009).

His research program mainly focused on understanding tree physiology and orchard management factors that control the carbon balance/budgets and productivity of fruit and nut trees. He has co-authored more than 250 scientific papers, taught fundamental pomology courses and mentored numerous graduate students, postdocs and visiting international scientists. He received the title of Distinguished Professor at UC Davis in recognition of his academic achievements and service. Dr. DeJong is a Fellow of the International Society for Horticultural Science and of the American Society of Horticultural Science and is a member of several ISHS Working Groups. He has chaired or co-chaired three ISHS symposia and served as Vice-Chair (2004-2010) and Chair (2014-2018) of ISHS Section Pome and Stone Fruits and Chair of ISHS Division Temperate Tree Fruits (2018-2022). Dr. DeJong's Board assignment will be Vice-President in charge of Science for the 2022-2026 term.

## Dr. Lukas Bertschinger, Treasurer and Responsible for Membership and Outreach

› Lukas Bertschinger

Dr. Lukas Bertschinger was born in Basel, Switzerland, in 1958, and graduated in Agronomy as an "agricultural engineer" in plant production at the Swiss Federal Institute of Technology (ETH Zürich). He received an awarded PhD at ETH in 1992, on potato virus epidemiology in different agroecological zones of Peru. Currently based in Wädenswil, Switzerland, he is the founder and acting manager of *klb innovation* (food system innovation and

expertise), co-founder and president of the Müller-Thurgau Foundation, co-founder and delegate for innovation and fund raising of the viticulture center Wädenswil and an international consultant for FAO.
Lukas is passionate as a teacher of master courses, researcher, consultant, and entrepreneur about engaging for sustainable innovation in horticulture. He advocates for the comparative advantages of horticulture to other agri-food sectors in providing solutions for global food systems related challenges, such as biodiversity loss, resource wasting, the need for strengthening value creation of farm based agri-food value chains, an eroding food security, and the continued climate change. Lukas has built his knowledge and extensive network on a career in international public research, first for the International Potato Center (CIP, Lima), and the International Wheat and Maize Improvement Center (CIMMYT, Mexico), followed by Agroscope (Swiss public agri-food sector research) in focusing on horticulture, as a scientist, department head, research director and programme leader. Increasingly, he engaged in creating private business-based innovation opportunities.
Aside from his experience as a fruit tree, vegetable and wine grape researcher, Lukas offers a broad experience in institution building, public private partnership contexts, as well as research strategy development and governance of research institutions. He served on the boards of several international platforms and as a Council member and Chair for the International Center for Insect Physiology and Ecology (*icipe*) at Nairobi. *icipe* honored his contributions to strengthening good governance, core donor ties, impact-orientation, and effective management procedures with an *icipe* achievement award. Lukas was part of the core group to develop a strategy for the European Fruit Research Institutes Network (EUFRIN) and contributed to several EU-projects in fruit research. Being an ISHS member since 1995, he served as Council member for Switzerland from 2002 to 2019, and co-convener and *Acta Horiculturae* editor of nine symposia, delivered invited talks at several International Horticultural Congresses (IHC), was a co-creator of the Horticulture in Europe symposia series (SHE) and authored articles in *Acta, Chronica,* and *Scripta Horticulturae*. Lukas is looking forward to team up with the new ISHS Board for strengthening the society with a special eye on finances, expanding memberships and strengthening outreach. Lukas and his wife Luzia have three adult children David, Mona and Rahel.

## Mr. Moctar Fall, Secretary and Responsible for Partnerships

› Moctar Fall

Mr. Moctar Fall is a post-graduate in Business Law, specializing in Regulation. He has a Master's degree in business administration (MBA) from the University of Quebec in Montreal (UQAM). Mr. Fall is the Founder and Chair of Agroseed and Hortisol agricultural fair-trade companies. These companies deliver goods and services to small scale growers as well as agri-business in Senegal and the West Africa sub-region. Mr. Fall is an international, independent expert, trainer, and consultant on environment and development issues. He is a founder and a former Board member of the World Fair Trade Organization (WFTO). Moctar contributed significantly to promoting and expanding fair trade in Africa and building up the Sustainable Fair-Trade Management System (SFTMS). For 16 years, Moctar was a trade negotiator for Senegal, the West African Economic and Monetary Union (WAEMU), and the Economic Community of West African States (ECOWAS). He worked on the World Trade Organization (WTO), United Nations Conference on Trade and Development (UNCTAD), and the African, Caribbean, and Pacific-European Union (ACP-EU) multilateral trade agreements. He's been a lecturer at Reims University (France) and Dakar University (Senegal). Moctar chairs the Board of the Senegalese Horticulture Cluster Association and was the Senegal Council representative for ISHS until 2022. He convened the IV All Africa Horticultural Congress (AAHC), which was held virtually in Dakar in 2021. With his excellent experience in the private sector, Moctar will be the Board member in charge of partnerships.

## Prof. Dr. Yao-Chien Alex Chang, Responsible for Publications

Dr. Yao-Chien Alex Chang is a professor of floriculture in the National Taiwan University. He was born in 1964 in Taichung, Taiwan. After a wonderful experience in gardening, at the age of 11 he decided that his career track would be in Horticulture. He did his B.S. and M.S degrees in horticulture in National Taiwan University and earned his Ph.D. in horticulture from Cornell University, Ithaca, New York, USA.

› Yao-Chien Alex Chang

Alex's research focus is on mineral nutrition, plant physiology, flowering regulation, postharvest, and tissue culture of ornamental crops, especially orchids. The major crops he studies include *Phalaenopsis*, *Oncidium*, *Cymbidium*, *Dendrobium*, and other commercially important orchid genera. His scientific research was recognized by the American Society for Horticultural Science, with its Kenneth Post Award (three times) as well as the ASHS Ornamental Publication Award. He also received the Award of Academic Contribution from the Taiwan Society for Horticultural Science (TSHS).
He is an enthusiastic educator for horticulture, who has spent a great deal of time on teaching and mentoring graduates and undergraduates. The major courses he teaches are Orchid Physiology, Introduction to Floriculture, Advanced Floriculture, Special Topics in Floriculture, and Horticultural Research Methods. He received the Award of Excellent Teaching (Top 10%) four times and the Award of Outstanding Teaching (Top 1%) from National Taiwan University.
Alex has devoted himself to orchid research and orchid industry for his whole career. He engaged in the development of the Taiwan orchid industry back in 1989, when he worked with Taiwan Sugar Cooperation. Taiwan Sugar Cooperation is the first company to use modern greenhouses to commercially mass produce orchids in Taiwan. Dr. Chang has been working as a Technical Consulter of Taiwan Orchid Growers Association and an Academic Consulter of Taiwan Orchid Breeders Society for decades and has helped numerous growers. He is in the Research Advisory Panel of Gardens by the Bay, Singapore. Alex also worked for the Council of Agriculture of Taiwan (comparable to Ministry of Agriculture in other countries) for 8 years to assist policy making and agricultural administration. Professor

Chang has been the chair of the International Affairs Committee of TSHS for about 10 years, which is a functional window to link the researchers in Taiwan and other countries for collaboration. He has also been serving on the TSHS Board.

Professor Chang has been an active ISHS member for more than two decades. He served on the ISHS Council (since 2014). He participated in various International Horticultural Congresses and ISHS symposia, serving in scientific committees, organizing committees, and editorial boards. Dr. Chang is also highly involved in the World Orchid Conferences and Asia Pacific Orchid Conferences. He was the Convener of the three-day 2021 Virtual World Orchid Conference (originally scheduled for March 2020 as the 23rd WOC) with nearly 500 participants. He will serve as the Convener again for the 23rd WOC in 2024. Over the years, he has delivered many keynote and invited speeches. He is keen to promote regional and international collaboration to make the world a better place.

## Prof. Dr. Peter J. Batt, Responsible for Communication

› Peter J. Batt

For almost 30 years, Peter J. Batt was Professor of Food and Agribusiness Marketing at Curtin University in Perth, Western Australia. For more than 20 years, Peter worked with various industry groups in Australia to facilitate the development of export markets for cut flowers, fresh fruit, vegetables, and seed potatoes. Peter is best known for his rural development work in linking smallholder farmers to institutional markets in Indonesia, the Philippines, and Viet Nam. Within ISHS, Peter has convened 12 international symposia. He has been both the Vice-Chair (two terms) and Chair (one term) of ISHS Commission Economics and Management before becoming the inaugural Chair of ISHS Division Horticulture for Development. For his long and meritorious service to the Society, Peter was made an ISHS Honorary Member in 2020. Today, Peter is the principal of Peter J. Batt and Associates, an international agribusiness marketing and rural development consulting company.

## Prof. Dr. Ryutaro Tao, President of IHC2026, *member ex officio*

› Ryutaro Tao

Professor Dr. Ryutaro Tao was born in Osaka, Japan, in 1961. He graduated from Kyoto University with a B.S. in Agriculture in 1984, and an M.S. in Agriculture in 1986. He received a Doctor of Agriculture degree from Kyoto University in 1992. He conducted his postdoctoral research on the transformation of persimmons with Professor Abhaya M. Dandekar at the Department of Pomology, University of California at Davis for two years from 1993 to 1995, as a Japan Society for the Promotion of Science (JSPS) Postdoctoral Fellow. Since 1988, Ryutaro Tao has been a professor at Kyoto University. His present professional activity includes teaching courses in horticulture and pomology at the Faculty of Agriculture and the Graduate School of Agriculture at Kyoto University.

Professor Tao's research interest is the reproduction biology of fruit trees, such as the S-RNase based self-incompatibility system in *Prunus*, the sexual system in *Diospyros* and *Actinidia*, and floral induction in *Diospyros* and *Rosaceae*. He has published more than 200 refereed journal articles, and more than 40 reviews and book chapters.

He received the American Society for Horticultural Science (ASHS) Cross-commodity Publication Award, the Japanese Society for Horticultural Science (JSHS) Publication Award, the JSHS Promising Researcher Award, the JSHS Outstanding Horticulturist Award, the Japan Prize of Agricultural Science from the Association of Japanese Agricultural Scientific Societies (AJASS), and the ISHS Fellow Award.

He is currently the President of JSHS and was ISHS Board member (Treasurer) from 2014 to 2018.

As IHC2026 President, Ryutaro Tao is keen to share his experience, vision, and enthusiasm to contribute to the fruitful future of ISHS by improving two-way information flow between Asia and the rest of the world.

## Mr. Peter Vanderborght, Executive Director of ISHS, *member ex officio*

› Peter Vanderborght

Mr. Peter Vanderborght was born in Belgium in 1967, graduated as a certified accountant and tax consultant and began his early career as auditor with Ernst & Young in Brussels, responsible for a wide range of international accounts. In 1993, he joined the ISHS and took on the challenge of restructuring and streamlining the ISHS office management, improving the accounting and financial administration processes and setting up an adequate IT environment to efficiently facilitate the anticipated growth in membership and publishing-related activities at the Society headquarters.

During the early 1990s, Peter Vanderborght was soon to identify the extreme importance of the rapid changes and developments that took place in the field of information technology and 'World Wide Web'. His vision materialized in the implementation of the ISHS publications scanning and digitizing project, converting the entire back catalogue of *Acta Horticulturae* from print to digital in a full-text searchable electronic format; in times where most publishers were still mainly focusing on print-only.

This new digital *Acta Horticulturae* catalogue he created, allowed *Acta Horticulturae* papers to become accessible to researchers all over the globe who now got instant access to a wealth of previously hidden or otherwise inaccessible papers right from their desktops!

During his career of almost 30 years with the ISHS, Peter Vanderborght served in various roles within the core-management of the Society. Peter Vanderborght was proposed by the ISHS Board and appointed by the ISHS

Council to become Executive Director (ED) beginning 1 January 2019.
It is an understatement that the past two years proved to be a tremendous management challenge. Peter Vanderborght, backed by the competent and dedicated team at the ISHS Secretariat and with the support of the ISHS Board, has ensured the continuity of the ISHS operations, navigating the ISHS headquarters through the difficult waters caused by the unprecedented worldwide pandemic. His hands-on and pragmatic approach as an administrator, in combination with his careful management decisions and pro-active measures to counter the negative impact of those extreme external factors on the Society, have proven effective.
After this extended time during which no in-person symposia could be held, when conveners had no alternative than to turn to hybrid or virtual solutions, it is encouraging to see that the management team 2018-2022 at the ISHS Council and General Assembly during IHC2022 reported strong meeting numbers and membership figures returning to pre-pandemic levels. The Society is coming out of those difficult years as a much stronger organisation and is now better prepared for the future.
After the successful IHC2022, Peter Vanderborght is eager to start working with the newly elected Board team 2022-2026 and he looks forward to implementing a series of important strategic proposals that could not be implemented before because of the ongoing pandemic. Peter will continue to work with the Board to realise these improvements in the near future.
Peter lives in Leuven, Belgium, he loves cooking, running, and always appreciates the pleasure of enjoying good food in company with friends and family. Peter and his wife, Véronique, are the proud parents of Sofie.

# Introduction to the Chairs of Divisions and Commissions for the term 2022-2026

| Divisions | |
|---|---|
| Division Horticulture for Development | Chair Dr. Melinda J. Knuth (USA) |
| | Vice-Chair Dr. Rémi Kahane (France) |
| Division Horticulture for Human Health | Chair Assoc. Prof. Tim J. O'Hare (Australia) |
| | Vice-Chair Prof. Dr. J.S. Bal (India) |
| Division Landscape and Urban Horticulture | Chair Dr. Francesco Orsini (Italy) |
| | Vice-Chair Dr. Vivian Loges (Brazil) |
| Division Ornamental Plants | Chair Dr. Margherita Beruto (Italy) |
| | Vice-Chair Prof. Dr. Kexuan Tang (China) |
| Division Physiology and Plant-Environment Interactions of Horticultural Crops in Field Systems | Chair Dr. Evelyne Costes (France) |
| | Vice-Chair Assoc. Prof. Ioannis Minas (USA) |
| Division Plant Genetic Resources and Biotechnology | Chair Prof. Dr. Jorge M. Canhoto (Portugal) |
| | Vice-Chair Dr. Sandhya Gupta (India) |
| Division Postharvest and Quality Assurance | Chair Prof. Giancarlo Colelli (Italy) |
| | Vice-Chair Dr. Sukhvinder Pal (SP) Singh (Australia) |
| Division Precision Horticulture and Engineering | Chair Prof. In-Bok Lee (Republic of Korea) |
| | Vice-Chair Prof. Dr. Pierre-Emmanuel Bournet (France) |
| Division Protected Cultivation and Soilless Culture | Chair Prof. Youssef Rouphael (Italy) |
| | Vice-Chair Mr. Graeme Smith (Australia) |
| Division Temperate Tree Fruits | Chair Prof. Luca Corelli Grappadelli (Italy) |
| | Vice-Chair Prof. George Manganaris (Cyprus) |
| Division Temperate Tree Nuts | Chair Dr. Giulia Marino (USA) |
| | Vice-Chair Prof. Santiago Pereira-Lorenzo (Spain) |
| Division Tropical and Subtropical Fruit and Nuts | Chair Dr. Karin Hannweg (South Africa) |
| | Vice-Chair Prof. Dr. Zora Singh (Australia) |
| Division Vegetables, Roots and Tubers | Chair Prof. Dr. Ferdinando Branca (Italy) |
| | Vice-Chair Prof. Dr. Nazim Gruda (Germany) |
| Division Vine and Berry Fruits | Chair Prof. Dr. Bruno Mezzetti (Italy) |
| | Vice-Chair Assoc. Prof. Arif Atak (Turkey) |
| **Commissions** | |
| Commission Agroecology and Organic Farming Systems | Chair Prof. Dr. Maria Claudia Dussi (Argentina) |
| | Vice-Chair Dr. Pierre-Eric Lauri (France) |
| Commission Banana | Chair Dr. Nicolas Roux (France) |
| | Vice-Chair Dr. Thierry Lescot (France) |

## Division Horticulture for Development

› Melinda J. Knuth

At the recent ISHS Council meeting in Angers, Dr. Melinda J. Knuth was confirmed as Chair of ISHS Division Horticulture for Development. She succeeds Professor Dr. Peter J. Batt in this position. Dr. Knuth will be supported by Vice-Chair Dr. Rémi Kahane (France).

Dr. Knuth is an Assistant Professor in Horticulture Marketing at North Carolina State University in Raleigh, North Carolina, USA. A graduate of the University of Nebraska-Lincoln, Melinda first worked for the Walt Disney Company for a year in hydroponic plant production and public education. She obtained her PhD in Horticultural Science with a certificate in Applied Statistics in 2020 from Texas A&M University. From there, she was a postdoctoral research associate at the University of Florida in the Food & Resource Economics Department before joining the faculty at North Carolina State University. Dr. Knuth's research area centers on consumer and market research experience by focusing on the interface between people and plants, helping the horticulture industry understand consumer preferences, perceptions, and motivations. Historically, Dr. Knuth has evaluated trade flows of horticulture products in the United States, assessed the supply chain in the cut flower industry, investigated profit margins in substituting species in floral arrangements, and estimated consumer acceptance of retail messaging.

Dr. Knuth teaches Greenhouse Management, Floriculture Production, Floral Design, and Horticulture Marketing. Melinda is a Certified Floral Designer with the American Institute of Floral Design. Dr. Knuth received the Greenhouse Product News Magazine's 40 under 40 award in 2021, is a member of the American Floral Endowment's Board of Directors, secretary of the American Society of Horticultural Science's Marketing and Economics Professional Interest Group, and a 2017 AmericanHort Scholar and lead of the GenNext AmericanHort Connector Community. Her research has been featured in the Washington Post and on Fox New's American Weather Weekend.

## Division Horticulture for Human Health

› Tim J. O'Hare

Associate Professor Tim J. O'Hare was elected Chair of ISHS Division Horticulture for Human Health, following Professor Dr. Bhimanagouda Patil in this position. He will be assisted by Vice-Chair Professor Dr. J.S. Bal (India).

Associate Professor O'Hare currently leads the Naturally Nutritious program within the Queensland Alliance for Agriculture and Food Innovation (QAAFI) at the University of Queensland, Australia. After completing his PhD in fruit tree physiology in 1989, he joined the Queensland Department of Primary Industries where he conducted postharvest horticultural research into tropical fruit and Asian vegetables. Working with the Department provided a chance to work in both sub-tropical and tropical locations within Australia, both in the field and in the laboratory. During this time, Tim conducted research into storage and postharvest quality of fruit and vegetables, including nutritional quality.

In parallel with an increasing community interest in healthy eating, he became involved in the phytonutrient assessment of functional foods, and subsequently instigated the development of biofortified horticultural crops through targeted breeding. Of specific interest to Associate Professor O'Hare was the dual application of the specific plant pigments, carotenoids, and anthocyanins, as phytonutrients for human health, but also as a means to visually differentiate biofortified products from standard product in the marketplace.

In 2010, Tim joined the newly formed Queensland Alliance for Agriculture and Food Innovation (QAAFI) at the University of Queensland. Tim's research has included the development and assessment of biofortified products including high-zeaxanthin sweetcorn and capsicums, high-lycopene tomatoes, purple-anthocyanin sweetcorn, omega-7 macadamias, high-folate strawberries, and enhanced beta-carotene mangoes. He was subsequently awarded the Australian Innovation Challenge Award in 2015 for the development of high-zeaxanthin sweetcorn for eye health.

Tim has been involved in the International Symposium on Human Health Effects of Fruits and Vegetables (FAVHEALTH), from the inaugural symposium in 2005 (Quebec) to the current symposium in Angers (2022). Tim was responsible for co-convening FAVHEALTH in 2014, at the IHC in Brisbane, Australia, with the symposium becoming a recurrent symposium theme at IHC, as well as being convened at an independent location every two years. Associate Professor O'Hare is also an elected council member of the International Carotenoid Society, which shares many common interests with the ISHS Division Horticulture for Human Health.

## Division Landscape and Urban Horticulture

› Francesco Orsini

Dr. Francesco Orsini was confirmed as Chair of ISHS Division Landscape and Urban Horticulture for a second term. He will serve in the office in close collaboration with Vice-Chair Dr. Vivian Loges (Brazil), who was also re-elected for a second term.

Dr. Orsini is Associate Professor on vegetable crop physiology and greenhouse and vertical farming systems at the Department of Agricultural Sciences and Technologies of the University of Bologna (Italy). He is adjunct professor at UniLaSalle (France) and was visiting scientist at Wageningen University (The Netherlands), Purdue University (USA), University of Cartagena (Spain), and IRTA (Spain). His research program has mainly focused on abiotic stress physiology, growing systems for urban horticulture (including simplified soilless systems, rooftop farms, and plant factories with artificial lighting), safety of urban food products and environmental assessment of urban agriculture systems. Dr. Orsini coordinates the EU H2020 project "Food Systems in European Cities (FoodE)" and the National project of the Italian Ministry for Research and Education "Sustainable Vertical Farming (VFarm)." He edited the book

"Rooftop Urban Agriculture" (Springer) and authored more than 100 scientific papers in international journals or books. He teaches "Vegetable crops," "Greenhouse and vertical farming systems," "Urban agriculture," and "Smart horticulture" at the University of Bologna. He was convener of the first International Symposium on Greener Cities for More Efficient Ecosystem Services in a Climate Changing World (Bologna, Italy, 2017), and the first International Workshop on Vertical Farming (VertiFarm2019, Wageningen, The Netherlands), and organized the webinar series "ISHS talks on Vertical Farming." He served as consultant of international bodies (e.g., FAO-UN, NGOs) in international cooperation projects on urban horticulture in Brazil, Peru, Ivory Coast, Cape Verde, Kenya, Mauritania, and Myanmar.

## Division Ornamental Plants

› Margherita Beruto

Dr. Margherita Beruto was re-elected Chair of ISHS Division Ornamental Plants. She will be assisted by Vice-Chair Professor Dr. Kexuan Tang (China), who was also re-appointed for a second term.

Dr. Beruto has been actively involved in ISHS as Chair of ISHS Division Ornamental Plants (2018-2022), Vice-Chair of ISHS Section Ornamental Plants (2014-2018), and Chair of ISHS Working Group Quality Management in Plant Propagation (2011-2017).

She obtained her PhD in agricultural sciences and applied biology: biotechnology cellular and genetics in 1997 from the University of Ghent (Belgium) and she has reached a global reputation for her research in bringing new ornamentals into the market and the use of plant tissue culture on commercial production. Her research focused on classical and advanced micropropagation systems. Studies were undertaken to outline nutritional models for in vitro plant tissues through a multidisciplinary approach that considered physical, chemical and biological aspects. The research was developed in close cooperation with the production world and the gained expertise enabled her to develop specialized services supporting breeders and nurseries in the floriculture sector. For more than 12 years (2009-2021), Margherita Beruto was the Director of the Regional Institute for Floriculture (IRF), Sanremo, Italy, a public research institute whose mission is to support growers and nurserymen involved in the floriculture sector, with particular attention to the achievement of novelties and with an eye towards sustainable management. In this rule, she had the leadership of different research units in Ornamentals (Plant pathology, Tissue culture, Breeding and Crop management). In 2013, Dr. Beruto was appointed part-time Professor at Henan University of Science and Technology, China. She is on the editorial board of international scientific journals, and she has been appointed to national panels of experts in floriculture. Dr. Beruto coordinated different international projects with public-private partnerships addressed to build innovation platforms in floriculture.

## Division Physiology and Plant-Environment Interactions of Horticultural Crops in Field Systems

› Evelyne Costes

In Angers, the ISHS Council confirmed the re-election of Dr. Evelyne Costes as Chair of ISHS Division Physiology and Plant-Environment Interactions of Horticultural Crops in Field Systems. She will serve in close collaboration with Vice-Chair Professor Ioannis Minas (USA) to support the activities of nine working groups that are related to this Division in the next four years.

Evelyne Costes is Director of Research at the National Research Institute for Agriculture and Environment (INRAe) in the AGAP Institute, Montpellier, France. Since her undergraduate degree in Botany, she has studied fruit tree development on many species from tropical (litchi, coffee) to temperate (apple, apricot, peach, almond) at CIRAD and INRAe (France). Her research aims at understanding fruit tree architecture and flowering, considering their genetic and environmental control. She has longstanding skills in tree physiology, quantitative genetics, statistics, and modelling. Her current research combines architectural descriptions, eco-physiology, and structural-functional modeling to address fundamental questions with applied practices.

Evelyne Costes has co-authored about 100 scientific papers in international peer-reviewed journals and a large number of publications in *Acta Horticulturae*. She actively hosts, trains, and collaborates with graduate and PhD students, post-docs, and scientists from around the world. Member of the ISHS since 1992, she has been involved in the former ISHS Section Pome and Stone Fruits, has been a member and Chair of ISHS Working Group Modelling in Fruit Research and Orchard Management, and has actively contributed as a member of scientific committees at several ISHS symposia. In 2021, she co-convened the I International Symposium on Reproductive Biology of Fruit Tree Species and she will be actively involved in IHC2022.

## Division Plant Genetic Resources and Biotechnology

› Jorge Canhoto

Professor Dr. Jorge M. Canhoto was appointed Chair of ISHS Division Plant Genetic Resources and Biotechnology for a second term. He will work closely with Vice-Chair Dr. Sandhya Gupta (India).

Professor Canhoto completed his PhD in biology (plant physiology) in 1995 at the University of Coimbra, Portugal. In 2004, he obtained a position as professor at the Department of Botany, University of Coimbra, where he is now associate professor. He currently leads the Plant Biotechnology Group of the Centre for Functional Ecology of the University of Coimbra and is President of the Portuguese Centre for Information in Biotechnology. He is responsible for the courses on plant biotechnology, plant development, forest biodiversity and biotechnology and experimental biology and director of the Master's degree program in Plant Biotechnology and Biodiversity.

Professor Canhoto was Convener of the VIII International Symposium on In Vitro Culture and Horticultural Breeding, held in Coimbra, in 2013. Together with Sandra Correia, he edited the symposium proceedings, which were published as *Acta Horticulturae* 1083. He has been a member of the Scientific Committee as well as invited speaker of several international symposia organized under the umbrella of the ISHS. Professor Canhoto has given oral and poster presentations at several ISHS symposia, has published several articles in *Acta Horticulturae* and has been referee of articles for this publication and other journals published by the ISHS. He was the Portuguese representative at the Joint ISHS Executive Committee and Council Meeting in 2014, held in Brisbane, Australia. From 2014 to 2017, he was a member of the board of the APH (Portuguese Association for Horticultural Science). Nowadays, he is Editor of the journals In Vitro Cellular & Developmental Biology – Plant, Plants, and Frontiers in Plant Science.

## Division Postharvest and Quality Assurance

› Giancarlo Colelli

Professor Giancarlo Colelli was elected Chair of ISHS Division Postharvest and Quality Assurance. He succeeds Professor Dr. Christopher B. Watkins in this position. Professor Colelli will be assisted by Vice-Chair Dr. Sukhvinder Pal (SP) Singh (Australia).

Giancarlo Colelli is Full Professor and Coordinator of the Doctorate Program on "Management of Innovation in Agricultural and Food Systems of the Mediterranean Region" at the University of Foggia, Italy. His research activities focus on relationships between physiology/quality of fresh fruit and vegetables and equipment for postharvest handling and storage. He has been active on topics related to low impact technologies to extend the shelf-life and the use of spectral information to non-destructively assess quality and discriminate fresh fruits and vegetables according to many factors. Professor Colelli has coordinated more than 20 national and international R&D projects including QUAFETY (EU 7FP) and on-going SUS&LOW (MIUR PRIN17) and CIRCUL-A-BILITY (co-chair, EU-COST). He was co-organizer of all editions of the European Short-course on Quality & Safety of Fresh-cut Produce (an industry-oriented training event in Italy, Spain, Germany, Turkey, UK, and Portugal) and of other international events including two ISHS symposia (VI International Symposium on Applications of Modelling as an Innovative Technology in the Horticultural Supply Chain - Model-IT 2019 and XI International Controlled and Modified Atmosphere Research Conference - CAMA2013). He was author of more than 200 papers, of which 134 are listed in Scopus. He was co-editor of two *Acta Horticulturae* volumes (1071, 1311) and served as Chair of ISHS Working Groups Controlled & Modified Atmosphere Storage of Horticultural Products, and Modelling of Postharvest Processes. Giancarlo Colelli has actively contributed, as a member of scientific committees and as invited speaker, to several ISHS symposia. He is presently co-convener of the XI ISHS International Symposium on Artichoke, Cardoon, and their Wild Relatives, to be held in Molfetta, Italy, on 18-21 April 2023 (https://www.ishs.org/symposium/467).

## Division Precision Horticulture and Engineering

› In-Bok Lee

Professor In-Bok Lee was elected as the new Chair of ISHS Division Precision Horticulture and Engineering from the recently concluded ISHS election, following Dr. Murat Kacira in this position. He will work closely with Vice-Chair Professor Dr. Pierre-Emmanuel Bournet (France), who was re-appointed for a second term.

Professor Lee acquired both his MSc and PhD at Ohio State University in USA. Later, he worked as post-doctoral researcher at the same institution and then transferred to the Laboratory of Controlled Environment Agriculture at the National Institute for Rural Engineering in Tsukuba, Japan, as a visiting scholar. He was also employed as a Junior Researcher for the Bioproduction Fundamental Engineering Division at the National Institute of Agricultural Engineering, South Korea. He is currently a full Professor at the Department of Rural Systems Engineering at Seoul National University where he founded the Aero-environment Energy Engineering Laboratory (A3EL). His career has been actively devoted to teaching and research focusing on agriculture industry, including the environmental control for different agricultural structures (e.g., greenhouse, livestock house, etc.), energy saving technologies, and computational fluid dynamics (CFD), among others. Presently, he was appointed as the President of the Society of Bio-Environmental Control in South Korea and the current Vice-President of the Korean Society of Livestock Environment. In addition, he has also held the Director position in the GreenBio Science and Technology Institute at Seoul National University and the National Center for Agro Meteorology, South Korea.

Professor Lee has authored, and co-authored hundreds of scientific papers published domestically and internationally paving his way to become one of the distinguished editorial members of different scientific journals, including the Biosystems Engineering Journal (SCI), AgriEngineering Journal (SCIE), Agricultural Mechanization in Asia, Africa, and Latin America (SCI), International Journal of Agricultural and Biological Engineering (SCI), IJABE International Journal (SCI) and so on. For the past years, he has been in constant collaboration with the former ISHS officials and has also served as Chair of ISHS Working Group Computational Fluid Dynamics for four years. As member of this Working Group, he has been involved in organizing events supported by the ISHS for almost 20 years. He has also taken the initiative to organize the International Symposium on New Technologies for Environment Control, Energy-Saving and Crop Production in Greenhouse and Plant Factory (Greensys2013), where he was appointed as the secretary of the organizing committee. Moreover, Professor Lee has been invited regularly as a keynote speaker and/or chair of different local and international conferences and meetings for smart crop and livestock production.

## Division Protected Cultivation and Soilless Culture

In Angers, the ISHS Council confirmed the election of Professor Youssef Rouphael as the Chair of ISHS Division Protected Cultivation and Soilless Culture. He succeeds Professor Dr. Stefania De Pascale in this prestigious position. Professor Rouphael will serve in the ISHS office in close collaboration with Vice-Chair Mr. Graeme Smith (Australia), who was re-appointed for a second term.

› Youssef Rouphael

Dr. Youssef Rouphael is a professor of horticulture in the Department of Agricultural Sciences (DIA) of the University of Naples Federico II, Italy. He received his BSc in Agricultural Sciences at USEK University, Lebanon, his Master Science degree in Irrigation at the Mediterranean Agricultural Institute, Bari, Italy, and his PhD in Horticulture from University of Tuscia, Italy. He teaches and performs research related to protected cultivation and soilless culture. He works collaboratively in Lebanon, Germany, and Italy. He has been with the University of Naples Federico II since 2014. His scientific interest focuses on greenhouse crops with emphasis on the importance of pre-harvest factors to improve vegetable quality, plant nutrition, water, and irrigation management. He studies the role of vegetable grafting, beneficial microorganisms and biostimulants in horticultural plants under optimal and sub-optimal stress conditions, and enhancing quality of fresh vegetables through salinity, nutritional eustress and biofortification applications facilitated by soilless cultivation. His expertise concerns the validation of innovative agricultural practices (plant biostimulants, eustress application, innovative and sustainable soilless cultivation, and vegetable grafting). Professor Rouphael has authored or co-authored many scientific and technical papers dealing with protected cultivation, in particular vegetables and floriculture production under protected cultivation. His Scopus bibliometric indices (August 2022) are: 431 documents; 13347 citations; H-index: 65; ID 8377881200. He is actively involved with ISHS, where he served as co-convener of the IHC2022 symposium "Innovative Technologies and Production Strategies for Sustainable Controlled Environment Horticulture." Professor Rouphael gives lectures on protected cultivation and soilless culture, and has given invited and keynote lectures to national and international scientific meetings and conferences. He is a member of the International Society for Horticultural Science (ISHS) and the Italian Society for Horticultural Science (SOI).

## Division Temperate Tree Fruits

› Luca Corelli Grappadelli

Professor Luca Corelli Grappadelli was appointed Chair of ISHS Division Temperate Tree Fruits, following Professor Dr. Ted M. DeJong in this position. Professor Corelli Grappadelli has previously served as Vice-Chair of the Division and will be assisted by Vice-Chair Professor George Manganaris (Cyprus).

Luca Corelli Grappadelli is Professor of Fruit Growing at the University of Bologna (Unibo), Italy. He has an extensive research career, spanning almost 40 years, in the field of fruit tree ecophysiology. He has been quite active at the international level, with a total of 3.5 years in the US (Clemson and Cornell Universities) and Australia (Tatura Center for Excellence). His work has covered tree/leaf gas exchanges, carbon partitioning, water relations and fruit growth. This has led to current research in precision fruit growing, including novel training systems, agrivoltaics, autonomous electric vehicles, precision irrigation in IoT, and fruit growth forecasting. He is/has been involved in many international research projects, including EU, but also outside Europe. He was Vice-Chair of ISHS Section Pome and Stone Fruits (2014-2018) and Vice-Chair of ISHS Division Temperate Tree Fruits (2018-2022). He is currently Chair of ISHS Working Group Environmental Physiology and Developmental Biology (since 2016), and has convened/co-convened three ISHS symposia, and edited the respective *Acta Horticulturae* proceedings. During his tenure at Unibo he has taught classes in Fruit Tree Physiology, Arboriculture, and Viticulture. He has supervised/co-supervised 18 PhD students, and many MSc students as well. For 11 years (2006-2017) he was part (as Secretary) of the 5-Member Evaluation Committee of the Italian Consiglio delle Ricerche in Agricoltura (CREA). He has participated in and presented papers to over 20 ISHS symposia and 7 IHCs.

## Division Temperate Tree Nuts

Dr. Giulia Marino was elected Chair of ISHS Division Temperate Tree Nuts. She succeeds Professor Dr. Tiziano Caruso in this position.

› Giulia Marino

Dr. Marino will work closely with Vice-Chair Professor Santiago Pereira-Lorenzo (Spain). Giulia Marino is an Assistant Professor of Cooperative Extension in Orchard Systems in the Department of Plant Science at the University of California (UC), Davis, USA. Her applied research program on pomology and tree physiology aims to improve orchard system profitability and abiotic-stress resilience. She explores the interactions between cultivar-rootstock traits, pedo-climatic conditions, and management practices. She received a PhD in Fruit Tree Systems at the University of Palermo in Italy focusing on pistachio alternate bearing and carbon budget dynamic. Over her career she has investigated multiple aspects of tree physiology and pomology including clonal propagation, tree water use and water relations in drought and saline soils, and nut phenology, ripening and quality. Dr. Marino collaboratively characterizes fruit varieties (namely olive and more recently almonds and pistachios) for their horticultural performance in high density of plantings and drought tolerance. She also worked for five years in the Agricultural and Forestry Department of Sicily developing the first Sicilian germplasm repository of autochthonous fruit varieties. She has recently been awarded the University of California Presidential Chair for Tree Nuts Genetics, a 5 years-long funding that will allow evaluating the horticultural and physiological performance of some promising new scion-rootstock options stemming from the UC pistachio breeding program.

She is a member of both the American and the International Society for Horticultural Science and of the editorial board of the Journal *Horticulturae*. She published multiple *Acta Horticulturae* papers, and she is currently the leading convener of the IX International Olive Symposium (https://www.ishs.org/symposium/637) and part of the scientific and organizing committee of the VIII International Symposium on Almonds and Pistachios (https://www.ishs.org/symposium/581), both to be held in 2023 in Davis, California.

As part of her extension appointment, she leads and participates in multiple extension

activities aimed to outreach science-based information to California growers and stakeholders.

## Division Tropical and Subtropical Fruit and Nuts

› Karin Hannweg

Dr. Karin Hannweg was confirmed as Chair of ISHS Division Tropical and Subtropical Fruit and Nuts for a second term. She will be assisted by Vice-Chair Professor Dr. Zora Singh (Australia), who was also re-appointed for a second term.

Dr. Karin Hannweg, a Senior Researcher at the Agricultural Research Council's Tropical and Subtropical Crops (ARC-TSC) campus, has over 25 years' experience in tropical and subtropical crops research in the Plant Improvement Division. She holds a BSc degree in chemistry and cell biology, a BSc (Hons) degree in cell biology, and an MSc degree in cell biology (specialising in plant tissue culture), all obtained from the University of Kwa-Zulu-Natal (Howard College campus). Her PhD (horticulture) was obtained from the same university (Pietermaritzburg campus) and focused on the evaluation of a variety of horticultural traits of induced polyploids of selected South African indigenous plant species.

Dr. Hannweg has been involved in a range of applied research projects, including the use of in vitro tools in plant improvement, propagation research of tropical and subtropical fruit and nut crops as well as indigenous medicinal plant species, cut flower cultivation and post-harvest research and quality aspects, graft incompatibility studies in various subtropical fruit and nut crops as well as horticultural trait evaluation across a wide range of crops and disciplines for which she also has a broad insight and understanding. She is linked to more than 12 societies and/or committees and has given over 100 oral and poster presentations at various scientific symposia/conferences. She has published several scientific manuscripts and popular articles in various fields. She serves as an editor for a variety of journals as well as being an external examiner for MSc and PhD theses. Dr. Hannweg has organised more than 10 events including the II All Africa Horticultural Congress in South Africa in 2012, during which time she was President of the Southern African Society for Horticultural Sciences (SASHS). She continues to serve on the SASHS Council and maintains strong ties with the International Society for Horticultural Science. Dr. Hannweg has organized and hosted various undergraduate student groups at the ARC-TSC, with the aim of inspiring young scientists to enter the broad but exciting field of horticulture. Several students who participated in the Education Outreach Programmes organised by Dr. Hannweg, are now active scientists and leaders. She is also involved in school career days where horticulture as an option for tertiary education and career development is promoted. Dr. Hannweg is also a qualified Training Assessor with the Agricultural Sector Education Training Authority in South Africa.

## Division Vegetables, Roots and Tubers

› Ferdinando Branca

Professor Dr. Ferdinando Branca was appointed Chair of ISHS Division Vegetables, Roots and Tubers, following Professor Dr. Daniel Leskovar in this position. Professor Branca will serve in the office in close collaboration with Vice-Chair Professor Dr. Nazim Gruda (Germany).

Professor Branca has worked on innovation of vegetable production by exploiting wild and cultivated morphotypes and establishing a working collection since 1988, starting with his PhD thesis, "Italian wild species of interest as vegetables," at the University of Catania (Italy). Professor Branca started his research activities led by his mentor Professor Giuseppe La Malfa, in 1995, as researcher of the Institute of Vegetable and Flower Crops of the University of Catania and, since 2010, he has been an associated professor participating/leading several regional, national, and international (China, South Korea, Tunisia) research projects on innovation of vegetables and medicinal/aromatic plants by implementing the related food supply chains. He has emphasized urban horticulture by exploiting growing and wild plant genetic resources. For several decades, he provided advanced breeding lines of broccoli, tomato, and snap bean for organic breeding and farming. Professor Branca teaches master's training in "Vegetable produce," "Food Technological Sciences," "Biotechnologies for vegetable and flower crops," and "Biotechnology" held by the University of Catania. He is member at the same university, teaching PhD courses in "Biotechnology." He was the convener of the VI International Symposium on Brassicas and XVIII Crucifer Genetics Workshop of ISHS held in Catania in 2012. From 2014, he was first Vice-Chair of ISHS Section Vegetables, Roots, Tubers, Edible Bulbs, Brassica, Asparagus, and from 2016, he was Chair of this Section. He was a co-convener of the III International Organic Fruit Symposium and I International Organic Vegetable Symposium in Catania, in December 2021. Since 1997, he has been the Chair of the Brassica Working Group of the European Cooperative Program on Genetic Research (ECPGR). Since 2018, he has been the Chair of ISHS Working Group Organic Vegetables. He was a member of the ECPGR Chair board for developing seventh to the tenth ECPGR work phases. Professor Branca is an advisory board member of the two Organic Breeding H2020 projects "Liveseed" and "Ecobreed," and he is currently coordinating the EU H2020 BRESOV project (www.bresov.eu) on organic breeding and farming of broccoli, snap bean, and tomato (GA 774244).

## Division Vine and Berry Fruits

› Bruno Mezzetti

Professor Dr. Bruno Mezzetti was elected Chair of ISHS Division Vine and Berry Fruits. He succeeds Professor Jorge B. Retamales in this position. Professor Mezzetti works closely with Vice-Chair Associate Professor Arif Atak (Turkey).

Professor Mezzetti has 30 years of academic and research career focused on different aspects of genetics, genetic improvement, biotechnology, and cultivation systems to improve the sustainability and quality of fruit production (mostly berries and grape). These activities included the integration between laboratory studies for the application of new biotechnological techniques (cisgenesis and RNAi) and field studies, in different

cultivation conditions, to study the genetic and environmental factors that determine the sustainability and quality of the productions. Particular attention was paid to the compositional analysis of new products to better determine the components of safety and nutritional benefit for the consumer. As an output of the research, he is author of 200 publications in referenced journals (H-Index SCOPUS: 42), mainly on studies concerning small fruits and vines; was nominated by Web of Science – CLARIVATE Highly Cited Researchers 2019, 2020, and 2021; and was coordinator and participant in 10 European projects and in various international networks.

Professor Mezzetti has been strictly involved in several ISHS activities, this by chairing one International Strawberry Symposium, two IHC berry symposia and two berry workshops. He also edited five *Acta Horticulturae*. In addition, he contributed to different symposia and *Acta* related to other groups, such as grape, in vitro culture and biotechnology. Professor Mezzetti has developed expertise specifically related to the Division, in particular the application of in vitro culture techniques for genetic improvement and propagation of different berries and vines; the development of biotechnological techniques (regeneration protocols and genetic engineering) applied for functional studies of genes and RNAi sequences to induce resistance and control plant habitus in strawberry, raspberry and vine; the study of the adaptability factors in different environments and cultivation systems of strawberry, raspberry and blueberry; the identification of factors that control the sensory and nutritional quality of strawberry, raspberry, and blueberry fruits.

All activities followed in these years for the Division allowed Professor Mezzetti to acquire extensive knowledge on the evolution of the various topics of interest to the research groups working on vines and berries. The solicitations received in recent years from the large number of known researchers give him the motivation to contribute to the development of new actions for the improvement, updating, strengthening and integration of the various Working Groups that represent the Division.

## Commission Agroecology and Organic Farming Systems

Professor Dr. Maria Claudia Dussi is the new Chair of ISHS Commission Agroecology and Organic Farming Systems, following Professor Martine Dorais in this position. She will be supported by Vice-Chair Dr. Pierre-Eric Lauri (France).

Professor Dussi previously served as a Vice-Chair of the same Commission, organized the first ISHS workshop on agroecology entitled "Agroecology and education: socio-ecological resilience to climate change" at IHC2018 (Turkey) and was a lecturer at the first ISHS webinar on Agroecology in 2021. She was involved in organizing the XI International Pear Symposium in Argentina in 2010, attended several ISHS symposia and was part of the scientific committee and speaker of the International Pear Symposium in 1993, 1997, 2000, 2007, 2010, 2014, 2018 as well as the International Symposium on Plant Bioregulators in Fruit Production in 2005 and 2009 and the VI International Symposium on Integrating Canopy, Rootstock and Environmental Physiology in Orchard Systems in 1996. She was involved in the scientific committee and other activities at the III International Organic Fruit Symposium and I International Organic Vegetable Symposium in 2021. She was convener of the International Symposium on Agroecology and System Approach for Sustainable and Resilient Horticultural Production at IHC2022 in Angers, France. She has been a member of the ISHS since 1991, Board Member of the Latin America Scientific Society of Agroecology (SOCLA) since 2017, and Board Member of the Argentinean Society of Agroecology (SAAE) since 2019.

› Maria Claudia Dussi

Claudia is a full professor of General ecology, Agroecology, and Temperate tree fruit physiology and culture level I and II since 1998, at the Department of Natural Resources, Comahue National University (UNCo), Rio Negro, Patagonia, Argentina. She leads the Study group in Sustainability of Agroecosystems (GESAF) in which she does research and extension. She trains graduate students in indicators of sustainability, energy flux and efficiency, carbon footprint in agroecosystems, plant bioregulators in fruit production, and organic fruit tree management and culture.

María Claudia was a Member of the Executive Committee of Graduate Studies at the Department of Agricultural Sciences, UNCo (2008-2011) and of the Academic Committee "Magister scientiae in Temperate climate fruit production" organized by Bologna University (Italy), UNCo and INTA (National Institute of Agricultural Technologies) (2007-2012) and professor of the Master Program in Agricultural Sciences and Biotechnology (AgroCampus Ouest, France; Universidad Católica del Maule (Chile); and UNCo, Argentina) (2012-2016).

Professor Dussi studied at UNCo and University of Buenos Aires (Argentina), Oregon State University (USA) and Ben-Gurion University of the Negev (Israel). She delivered invited presentations at national and international symposia, congresses, and seminars organized by professional societies. She is author/co-author of more than 70 scientific papers published in peer-reviewed journals, 4 book chapters, and more than 46 scientific and technology transfer papers in national and international journals. She has many awards and distinctions.

## Commission Banana

› Nicolas Roux

Dr. Nicolas Roux was appointed Chair of ISHS Commission Banana in 2020. He serves in the office in close collaboration with Dr. Thierry Lescot (France).

Nicolas is Principal Scientist and Banana Program Leader at the Alliance of Bioversity and CIAT in Montpellier, France. He is the Manager of the CGIAR International *Musa* Germplasm Transit Centre Genebank (ITC) based in Leuven, Belgium. Nicolas is also the Coordinator of MusaNet, the Global *Musa* Network that federates 100+ registered experts and national banana collections worldwide to identify strategic actions for conservation and use of *Musa* diversity. For many years, Nicolas led the genetic resources team of Bioversity International and managed the Global *Musa* Genomics Consortium that sequenced the banana genome, published in Nature in 2012. With the support of other Bioversity staff and partners, the banana program of the Alliance of Bioversity and CIAT is well recognized for their capacity to analyze sequence information and apply it to solve several issues such as deciphering important traits like tolerance to drought and Fusarium wilt Tropical race 4 (TR4) but also promoting quality fruit traits that have an enormous impact on farmers. Nicolas has been involved in multiple projects, for which he co-authored over 100 publications and was often invited as keynote speaker. Nicolas has been a member of ISHS since 2005 and participated in several ISHS symposia on banana.

# › ISHS awards bestowed

The ISHS takes great pride in presenting the ISHS award recipients for 2022. The ISHS Nominations and Awards Committee has met virtually and has been in consultation and received approval of the ISHS Council. This year the decision has been to bestow the ISHS Fellow Award on three distinguished scientists, and the Honorary Membership Award on one exceptional member of the Society.

According to the Society's Rules and Procedures, the ISHS Fellow Award is presented in recognition of a person's outstanding contributions to horticultural science worldwide. The Honorary Membership Award is presented to an ISHS member in recognition of exceptional service to the Society in many capacities throughout their career. The nominations for these awards were presented by individual ISHS members complete with supporting letters from five members of the Society from at least three different countries. Congratulations to the ISHS award winners for the Class of 2022.

## ISHS Fellow Award

### Dr. Joan Girona i Gomis


› Joan Girona i Gomis. Photo credit: François Lehmann

Dr. Joan Girona i Gomis began his career in horticulture as a technician in the Mas Bové Center in Tarragona, Catalonia, Spain, in 1981. During that time, he was attending university and attained an Agricultural Engineering degree in Plant Production in 1983. He later completed his MS degree in Horticulture at the University of California, Davis, in 1989, and received a PhD in Agricultural Engineering from the University of Lleida, Catalonia, Spain, in 1994. In 1988, he began working as a researcher at the Institute of Agri-food Research and Technology (IRTA) at the Mas Bové Center and transferred to the IRTA Center in Lleida in 1993, to become Head of the Fruit Tree Technology Department in one of the most important fruit production regions of Europe. He worked his way up through the researcher ranks from 1993 to 2006, when he became Director of Irrigation Technology and subsequently Program Director of Efficient Use of Water in 2010. In 2015, he was appointed to a Catalonian Government position as General Director, Food, AgroFood Quality and Agrofood Industry, but that appointment lasted less than a year because of a change in the Catalonian government. After returning to research in 2016, Dr. Girona was appointed as an Institutional Delegate of IRTA in Lleida and the Pyrenees of Spain and is the official representative for IRTA in all IRTA matters pertaining to that region.

Dr. Girona and his team are world leaders in research related to regulated deficit irrigation of tree fruit crops. He has conducted detailed studies and published refereed scientific papers on the water requirements and deficit irrigation responses of grape, apple, pear, peach, nectarine, sweet cherry, almond, hazelnut, and olive with the goal of identifying the most efficient use of irrigation water for these crops. A hallmark of his research team is the collection of extensive field data documenting tree physiological, growth and fruit quality responses to different irrigation strategies. He has co-authored 75 peer-reviewed scientific publications as well as numerous book chapters, conference papers and extension publications.

His research is singularly focused on directly supporting the regional needs for making efficient use of precious water resources in the Ebro Valley of Spain; a region distinguished for its production of high-quality fruit for the European market. He has been extensively involved in technology transfer and extending information to growers through short courses conferences and related educational activities. These educational activities are international in scope as indicated by his co-authorship of six chapters in Food and Agriculture Organization of the United Nations, Irrigation and Drainage Paper 66 – Crop Yield Response to Water. This publication is recognized as the most authoritative international reference for the irrigation requirements of numerous crops. Dr. Girona has been an active member of ISHS for nearly 30 years and has co-organized three ISHS symposia and co-edited three volumes of *Acta Horticulturae*. In addition, he has co-authored 33 *Acta Horticulturae* papers. His scholarship is of the highest quality and his contributions to horticultural research are extensive and noteworthy.

### Dr. Alan Lakso

Dr. Alan Lakso was educated at the University of California, Davis. He received his BS in Biological Sciences in 1970, his PhD in Plant Physiology on temperature effects on malic acid metabolism in grapes in 1973. He is one of the top 5 fruit crop physiologists of the past 50 years working primarily on apples and grapes. He is known and respected by all current fruit crop physiologists


› Alan Lakso

in the world. He has made numerous contributions to the science of horticulture. Three of his significant projects include his pioneering work on leaf and whole tree/vine photosynthesis, on water stress of apple, and on the modeling of apple tree and fruit growth.

His initial work on photosynthesis explained apple and grape photosynthesis of single leaves. He was a leader in explaining leaf photosynthetic changes with age and within the canopy. Through this work he brought understanding of the effect of pest stresses on plant response, which has helped put integrated control thresholds on a sound plant physiological foundation. He also explained the effects of plant growth regulators on whole tree photosynthesis. His photosynthesis chambers measure whole tree transpiration. He was a participant and leader in an international group of photosynthesis scientists loosely connected to ISHS that would meet after of before each congress in the 1970-2000s.

His pioneering work on tree physiological responses to water stress led to the understanding of water stress effects on shoot and fruit growth and helped design water management strategies using the Penman-Monteith transpiration formula and crop coefficients for humid climates like the eastern USA. This led him and his team to develop a modified equation specifically for apple using sap flow gauges and whole tree balloon chambers. He and an electrical engineer recently developed a micro-tensiometer that can be embedded in the trunk of a tree or vine to give continuous real-time measurements of stem water potential. This now forms the basis of irrigation scheduling based on tree water stress with thresholds based on maximizing fruit growth rate each day. His work has been the underlying basis of much of the water stress work on apples around the world.

Since the 1990s, he conducted experiments to construct an apple, and later, grape, whole tree/vine carbon balance model. The model served as a way of identifying gaps in knowledge about

carbon acquisition and uses in an apple tree over the course of a season. He was the world leader in first measuring and modeling tree and fruit growth using a carbon-based approach. The model has become an important method to predict the complex plant response to applications of chemical thinners and environmental factors in spring that resulted in fruit drop and thinning.

Dr. Lakso has served as the Vice-Chair of ISHS Working Group Computer Modeling in Fruit Research and Orchard Management and has led several working groups, including Plant Biology of the American Society for Horticultural Science. Dr. Lakso is recognized as one of the top 5 tree fruit physiologists in the world.

### Dr. John Palmer


› John Palmer

Dr. John Palmer received his BSc from Nottingham, UK, in 1966, his MSc from Ahmadu Bello, Nigeria, in 1968, and his PhD from Nottingham, UK, in 1976. For the past 38 years, Dr. Palmer provided outstanding contributions to the science of horticulture and to ISHS. He is one of the top fruit crop physiologists of his generation working primarily on apples and pears. He is known and respected by all current fruit crop physiologists in the world. He has made numerous contributions to the science of horticulture, including pioneering work on light interception, light distribution, orchard design, photosynthesis, and fruit quality.

His early work in the 1960s at East Malling Research Station in the UK, was on artificial shading trials, studies of within-tree variation in shade, and fruit quality. This led to computer modeling of light interception by solid hedgerow canopies. His data on light interception and its relationship to yield were the first of its kind in apple and were used by collaborators showing that light interception was related to total yield in many crops. Palmer's work on models was validated with his field systems trials and led to understanding the importance of light interception to dry matter production and fruit yield and light distribution to fruit quality. He was the first to measure light conversion efficiency, which explained differences in orchard system performance as partitioned between light interception and light conversion efficiency. His work on orchard design gave a physical basis for designing orchards to maximize light interception while still maintaining adequate light distribution in the canopy for optimum fruit quality.

He conducted research on carbon dioxide exchange of apple trees. He developed a leaf cup system for measuring gas exchange of individual leaves and a whole canopy gas exchange system. He developed large chambers to examine the gas exchange of whole trees to determine the interrelationships between the environment and fruit quality. His whole canopy gas exchange system provided significant information on the environmental effect of tree development and fruit quality. The whole tree gas exchange system was later used to heat groups of 'Royal Gala' apple fruit in the field and study the plant response and the genes involved in red skin coloration.

In the 2000s, Dr. Palmer began a holistic study of apple fruit quality and developed the concept of fruit dry matter concentration (DMC) as a quality metric for apples. Fruit DMC can be measured before or at harvest and is used to predict the sensory potential for the fruit after many months of storage. This concept was adopted by the New Zealand stone fruit industry and has led many fruit growers to focus on high dry matter content fruit to maximize market quality. Dr. Palmer has been a leader in the ISHS Working Group Orchard Systems and Technologies, contributing to symposia organized every four years since 1976. He was the convener of the VII International ISHS Symposium on Orchard and Plantation Systems, held in Nelson, New Zealand, in early 2000. He organized a symposium on "Enhancing Economic and Environmental Sustainability of Fruit Production in a Global Economy" at the ISHS 27th International Horticultural Congress in Seoul, 2006. He presented a seminar on the "Physiology, biochemistry and genetics of fruit growth in pome and stone fruit" at the 28th International Horticultural Congress in Lisbon, in 2010. He was editor for the *Acta Horticulturae* volumes from these meetings. He has been the long-term Chair of ISHS Working Group Environmental Physiology of Fruit Crops.

Throughout his career he straddled applied horticultural experimentation with mechanistic studies to understand how the fruit tree works. He was recognized by his peers at a symposium on applied physiology of fruit crops held in Geneva, NY, in 2014, with a lifetime achievement award from the ISHS Working Group Environmental Physiology of Fruit Crops.

## ISHS Honorary Membership Award

### Dr. Songpol Somsri


› Songpol Somsri

Dr. Songpol Somsri received his B.S. in Agriculture in 1977, and his M.S. in Agriculture in 1987, from Kasetsart University, Thailand. He received his Ph.D. in Plant Breeding and Biotechnology in 1998, from the University of Queensland, Australia. He is now the Senior Advisor in Plant Production for the Department of Agriculture, Chatuchak, Bangkok. His duties include research in plant breeding, plant germplasm conservation, molecular markers, and plant production. He specializes in tropical fruits such as durian, rambutan, mangosteen, *Lansium* sp., papaya, tangerine, pummelo, and mango. He has been an enthusiastic researcher at the Department of Agriculture, Ministry of Agriculture at his position in Thailand and has promoted both national and international horticultural projects and collaboration.

Dr. Somsri has been a strong supporter of ISHS in Thailand particularly during the past 16 years. He represents Thailand as an ISHS Council member. He has convened, organized, and promoted many ISHS meetings and horticultural related activities in Thailand. He was a convener or co-convener for seven ISHS symposia and one workshop.

He was on the organizing committee of four international ISHS symposia that occurred in Thailand between 2007 and 2020. In addition, Dr. Somsri served on the organizing committee for six of the symposia that occurred at the 29th International Horticultural Congress (IHC) in 2014, in Brisbane, Australia. He also was a member of the scientific committee for the III Asian Horticultural Congress in December 2020. Dr. Somsri was an invited speaker on tropical fruit at IHC2014 and five additional symposia. Dr. Songpol published 20 papers in 11 volumes of *Acta Horticulturae* between 1992 and 2017. He was also the author of "Durian, Southeast Asia's King of Fruits," published in *Chronica Horticulturae* in 2008.

Spotlight on Honoured ISHS Members

# › Bernadine C. Strik

## Position or previous position

Professor, Department of Horticulture, Oregon State University; Professor Emeritus after retirement Dec. 31, 2021
Member, ISHS Council
Chair, ISHS Section Vine and Berry Fruits, 2010-2018
Chair, ISHS Working Group *Vaccinium* Species and Management, 2001-2008
Member, ISHS Awards Committee
Co-convener, IX International *Vaccinium* Symposium, 2008

## ISHS honour

ISHS Fellow

**1. Tell us a bit about yourself (hometown, present location, family, hobbies, community involvement).**

I was born in The Hague, The Netherlands. My family moved to South Australia when I was young, because my parents saw a movie that inspired them to explore that beautiful country. Dad worked in the forest industry once there. We moved to British Columbia, Canada, in 1971 after my dad was offered a job to design and build a golf course on Vancouver Island. I moved to Oregon, USA, in 1987 after being offered a position as an Assistant Professor at Oregon State University (OSU). My husband, Neil Bell, and I live in the country near Monmouth. We have two daughters, Shannon and Nicole Bell. Shannon just graduated with a Masters in Environmental Science Public Policy from Yale University. Nicole is a Masters student in Horticulture at OSU. Neil retired from a Professor of Practice position in community horticulture at OSU in 2021 but continues in a parttime role and is active in ISHS. We love to garden and enjoy traveling and camping, particularly to enjoy scenic, old-growth forest and wildflower hikes.

**2. What got you started in a career in horticultural science?**

My parents exposed me to the wonders of horticulture at a young age. My dad and his family were vegetable growers in western Holland and my mom's family bought produce at the markets to sell in their specialty stores. I worked in my parents' retail ornamental nursery on Vancouver Island while in high school. They inspired me to get a higher education, and even though I did not go into the family business, they were proud of me for taking a different path in horticulture. Clearly, horticulture is in my blood. While my undergraduate degree was in ornamentals, my Ph.D. was in strawberry physiology – I wanted to work with a crop I could eat! I found out later that my paternal grandfather grew strawberries for off-season production in cold frames right after WWII. Having a historic photo of him with his large-fruited, specialty strawberries is very special to me.

**3. Give a brief overview of your career/achievements.**

I graduated with a Bachelors of Science in Botany, with honours, at the University of Victoria, B.C., Canada, in 1983. My thesis was on propagation of rhododendron. A professor and my first academic mentor, Dr. David Ballantyne, encouraged me to apply for a postgraduate Natural Sciences and Engineering Research Council of Canada (NSERC) Scholarship, which I was thrilled to be awarded. My NSERC provided a full stipend for graduate school. I was honoured to have Dr. John Proctor at the University of Guelph, Ontario, Canada, as an advisor and mentor. I was transferred from a Masters to a Ph.D. in Horticultural Science, studying strawberry physiology and graduated with distinction in 1987. Dr. Hugh Daubeny, berry breeder at Agriculture and Agrifoods, Vancouver, Canada, was an external examiner on my defense and became another key mentor and friend.


› Welcoming attendees to the IX International *Vaccinium* Symposium, Corvallis, Oregon, USA, in 2008, as co-convener (with Dr. Chad Finn).

I was thrilled to be offered my dream job in 1987 as an Assistant Professor in the Department of Horticulture at OSU. My job focused on Extension programs for commercial small fruit growers. I quickly asked to teach courses for undergraduate and graduate students and to support home horticulture educational programs. Working in Oregon appealed to me because OSU is what is termed in the US, a land grant institution. These universities address research, teaching, and extension. Another plus, from my point of view was that the Pacific Northwest region is a leader for berry crops and cool climate viticulture. In 1992, I was asked to be the research leader for berry crops at the North Willamette Research and Extension Center and the OSU lead horticulturist on the USDA/ARS – OSU Cooperative Breeding Program for berries. At that point I had a three-way appointment (extension, research, and teaching) and focused on physiology and production systems of berry crops. I was promoted to Professor in 1997. I have been an independent consultant for berry growers and companies throughout the world, in 17 countries to date.

Throughout my career, I strived to insure grower success through improved yield, quality, and net returns, as well as to increase the sustainability or resiliency of farms. I educated and advised students so that they could achieve their career goals. I developed educational programs to improve student and stakeholder success, and mentored junior faculty for professional advancement considering their work-life balance. I have always considered the importance of giving back through service to the university and professional organizations, such as ISHS and the American Society for Horticultural Science (ASHS).

During my 34-year career at OSU, I enjoyed teaching three undergraduate and two graduate courses, and advised 21 graduate students for a Masters or Ph.D. It was a true honour to receive the ASHS Outstanding Graduate Educator Award in 2015. Many of the students I mentored are working in horticulture in academia or in national or global companies. I co-authored 151 refereed scientific journal articles, 39 papers in *Acta Horticulturae*, 24 book chapters, and 71 OSU Extension Service publications. In addi-

› Highlighting research trial in 'Mini Blues' at Blueberry Field Day at the North Willamette Research and Extension Center, Oregon State University, 2019.

› Ready to teach in my strawberry costume, 2019.

tion, at OSU I was awarded the Agricultural Research Foundation Distinguished Professor, OSU Alumni Association Distinguished Professor, Extended Education Faculty Achievement, OSU Excellence in Extension Education, Alberta B. Johnston Excellence in Extension Education, and the Briskey for Faculty Excellence. I received four awards from ASHS for papers published in their journals, and achieved their highest honour, ASHS Fellow, in 2007. The American Pomological Society recognized me with the Chad Finn Ambassador Award recently for promoting horticulture throughout the USA. It was also a great honour to be become an ISHS Fellow in 2021.

I shared knowledge and key outcomes from research with berry industries in Oregon, nationally, and internationally through trade journal articles, presentations, workshops, field days, online courses, and webinars. I've been blessed to have my research, teaching, and extension outcomes recognized by regional and national industry organizations including the Duke Galletta Award for Excellence in Horticultural Research from the North American Blueberry Council, the Distinguished Service Award from the North American Raspberry and Blackberry Growers' Association, a Lifetime Achievement Award from the Oregon Blueberry Growers, the Chad Finn Distinguished Contributor Award from the Oregon Strawberry Commission, and the Bob Conroy Award for Service to the Oregon Berry Industry from the Oregon Raspberry and Blackberry Commission.

**4. What do you consider to be your greatest achievements?**

I'm fortunate to retire knowing that I've been able to make a difference in peoples' lives. This means a lot to me, as that has always been a key goal of my professional and personal life. Since I was raised on a farm, it was instilled in me to find ways to improve net returns while keeping farms sustainable and resilient. My research outcomes in modified planting densities, pruning methods, mulch types, optimization of fertilization programs, methods to improve fruit quality, and best organic production systems were estimated to increase the value of the berry industries by more than $10 million US per year in Oregon alone; many of the systems developed were adopted nationally and internationally. I'm particularly known for my research and training programs on blueberry pruning, my research and development of optimal organic production systems in blueberry and blackberry, and for a very successful online Blueberry Physiology and Production Systems 6-week Course, offered through OSU, that reached industry students in 34 countries.

› Bernadine with her husband, Neil Bell, at their retirement party hosted by OSU, March 4, 2022.

One of my greatest achievements is having a successful career while having a wonderful, enriched family life. Having both of my daughters at the doorstep of their careers in science makes me very proud, and spending time with them and my husband brings me great joy. Mentoring junior faculty during the promotion and tenure process and navigating the more challenging aspects of academic positions was very rewarding. I also shared with them the importance of work-life balance for a healthly, enjoyable career and am proud to have helped as I could.

One of the most fulfilling parts of my job was advising and mentoring graduate students. I helped them grow their passion for horticulture, their teaching, extension and research skills, and prepared them for positions in industry and academia.

**5. Did you encounter difficulties along your career path and how did you deal with them or how did you turn them into opportunities?**

When I started as an Assistant Professor there were few female faculty in my discipline and even fewer in farming or industry positions. I found it difficult to be heard by male counterparts amongst peers and in most of my initial interactions with industry. I was patient, and continued to share my thoughts and knowledge, confident that things would change. This strategy paid off. Over time I earned their respect, and was accepted. I have tried my best to help women in horticulture forge their way. Now, it's a joy to see so many women in various horticultural roles throughout the world.

**6. Tell us about one funny/exciting/interesting experience that happened to you during your career.**

My first pre-conference professional tour was for the International Strawberry Symposium in Italy in 1988. We had a very interesting and emotional visit to Pompei. Near the end of the organized visit, I went to the restroom. I then realized I was stuck in there when the door to the toilet did not open from the inside. I could not get out another way because the door went from the floor to the ceiling. I suddenly had this vision of me with a camera around my neck, looking like one of the horrible plaster casts of the Pompei residents afflicted by the pyroclastic flow from Mt. Vesuvius if I was stuck in there too long. Luckily, within 10 minutes, one of my colleagues came into the bathroom and let me out!

I'm known for wearing my homemade (by a friend) strawberry costume on special occasions when I teach (see picture). It's always a hit with students because I cannot reach the blackboard well (yes, I still use one to make points). Many ask for pictures beside me in the costume.

**7. What made you become a member of ISHS and why did you keep the membership? What contribution or role has ISHS played in your career?**

I became a member of ISHS in 1988, before I attended my first symposium on strawberry. Once I was a member I saw the many advantages, including learning more about horticulture throughout the world, meeting and networking with scientists who have similar areas of focus in other countries, reduced registration fees for symposia and congress meetings, and access to *Acta Horticulturae*. Symposia, focused on the crops and disciplines I work with, have always been my favorite conferences because so much useful information is packed into each day. I am confident that being a member of ISHS improved my research, teaching, and extension activities and outputs. I have contributed to ISHS through committee work, co-convening a symposium, being on scientific committees of symposia, and reviewing manuscripts for *Acta*. I served as a Working Group Chair, was on the Executive Committee as a Section Chair, and now serve on the Council. These are all such rewarding experiences.

› Bernadine with her daughters, Shannon (left) and Nicole (right) Bell at a local restaurant, May 26, 2021.

**8. What advice would you give to young people interested in a career in horticulture/horticultural science?**

Horticulture is a fantastic career choice, with most positions having a balance of indoor and outdoor work. The discipline is broad including production systems, physiology, breeding, genomics, environmental science, and weed, disease, and insect management. Do not feel like experience in one crop will limit you on getting a position focused on another crop. Also, training and experience in agronomic crops, such as breeding, for example, will not preclude you from a similar position focused on a horticultural crop. Do not be afraid to take exciting new opportunities during your studies if your interests change. Seek out internships and travel when you can, as a student at any stage. Become a member of your regional, national, and international (ISHS) horticultural societies as soon as you can – ask your advisor or department if they can cover the cost. Apply for travel grants and ask advisors for opportunities to attend national conferences and ISHS symposia. Enter student competitions for oral and poster presentations, for example, to broaden your experience. Approach and chat with scientists at meetings to get to know them and develop contacts. Ask them for advice on how to develop the qualifications needed for the type of position that appeals to you. Key industry leaders often attend ISHS symposia and many national meetings, and can provide advice and opportunities for industry positions. Your goal is to find a dream job that is a great fit and fulfills you.

**9. What are the most interesting new roles or opportunities you see emerging in the future within horticultural science?**

The pandemic has highlighted the importance of having a nice landscape and growing some of your own food at home, often in more limited spaces, and for places to decompress or help relieve stress (parks, gardens). More people are cooking at home and are making healthy food choices. Producing high-value horticultural crops will continue to be critical. Research on plant resiliency to climate change, growing more food in a limited space, including higher yield per unit area through vertical systems and a higher yield annually with off-season production, development of production systems that facilitate mechanization, and continued improvement in irrigation and fertilizer or nutrient uptake efficiency are some key areas. I've seen the production of berry crops change tremendously over the last four decades including growing crops in the desert using totally new production systems. The opportunities are endless.

Horticultural Science Focus

# ISHS Division Ornamental Plants: from challenges to new opportunities for the ornamental sector

Margherita Beruto, Scott Adkins, Rodrigo Barba-Gonzalez, Fisun G. Çelikel, Fabrice Foucher, Eugenie-Lien Louw, Ki-Byung Lim, So-Young Park, Kexuan Tang and Ernst J. Woltering

Ornamentals, e.g., cut flowers, ornamental plants, trees, and bulbs, is undoubtedly the most diversified and fast-changing agriculture sector. At the global level, the production turnover of flowers and ornamental plants accounts for about US$ 38 to 39 billion for a total cultivated surface of 745,000 ha (Hübner, 2020). Considering the trade of ornamental products, Van Horen (2022) highlights a twenty-year positive trend for the global export with a total value of US$ 19.5 billion in 2020. In addition, the world ornamental sector is characterized by a significant expansion for production and consumption of ornamental products.

The EU is traditionally a large producer, trader and consumer of flowers and ornamental plants (approximately 44% of the total world flower and pot plant production with the highest density per hectare) that is able to originate 335,000 full time equivalent (FTE) jobs in the production and 427,000 FTE in the trade-wholesale and retail (Hübner, 2020). The most important EU production countries are: the Netherlands, Italy, Germany, France, Spain, and UK. Moreover, new domestic producers are contributing to the EU production such as countries of the Baltic area, Malta, and Luxembourg. Retail turnover in the EU amounts up to US$ 52 billion, which is more than, for example, the total EU organic agricultural sector (Hübner, 2020).

A recent paper published by Gabellini and Scaramuzzi (2022) reported the classification elaborated by the International Association of Horticultural Producers (AIPH) to describe the global production and market of ornamentals. In summary, countries are divided in four groups according to geographical areas and considering the production and consumption of ornamental products.

- Mature domestic producer countries (Europe, Canada, US, China, and Japan) for which the ornamental products are part of the tradition; the increasing urbanization, the aging rate of population and a better economic performance are enhancing the attention towards the potential use and expansion of ornamental products. Ornamentals are considered critical for a better quality of life, a healthy lifestyle, for greening the cities, and offsetting the effects of climate change at various levels. For these countries a high-value demand of ornamental products is foreseen in a near future, which will be only partially counterbalanced by the domestic production.
- Mature exporting producer countries (Colombia, Kenya, and Ecuador) for which the optimal growing conditions, the low price of labor and energy, and foreigner investments determined the enhancement of their cut flowers and foliage production and the following export towards Europe and US. Market determinants for these countries involve unstable economic performance and high political instability.
- Emerging domestic producer countries (India, Mexico, and Brazil), where an increasing economic performance and a high urbanization rate, coupled with favorable climate conditions and the low cost of production inputs, are driving factors for increasing the production of ornamentals and the logistic strategies.

Figure 1. *Eustoma* interspecific hybrids produced at the Centro de Investigación y Asistencia en Tecnología y Diseño del Estado de Jalisco, Guadalajara, Mexico.

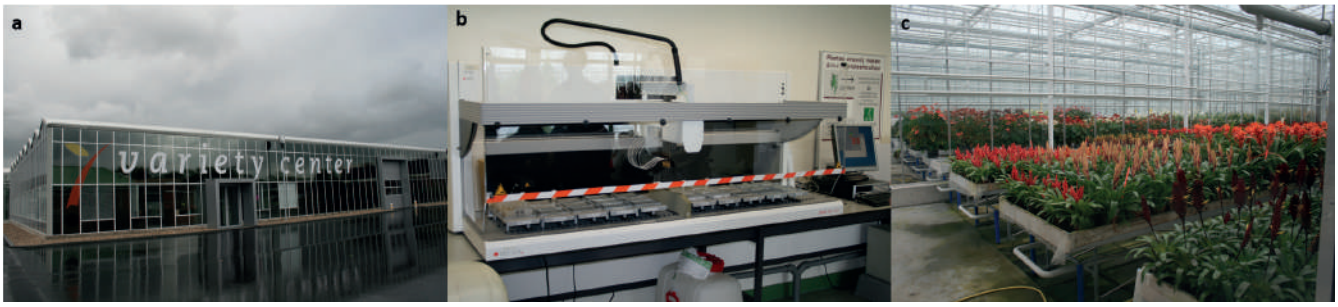



Figure 2. Naktuinbouw, the Netherlands Inspection Service for Horticulture facilities. a) Variety Center; b) ELISA virus test; c) Distinctness, uniformity and stability (DUS) testing.

- Emerging exporting producer countries (Ethiopia and Vietnam), which are presenting low rate of production and consumption of ornamentals, but are seen in the AIPH model as countries able to expand their impact in the ornamental sector thanks, among others, to the proximity of important consumer markets like Europe and Asia.

The consumption trend of ornamental products is expanding and changing due to economic development, the high level of available per capita income, and a more pronounced attention to the well-being and the ecological aspects that relate to the purchase of ornamentals. All-year consumption of flowers and ornamental plants is envisaged; the customer is becoming more demanding and requires sustainable and informative services and packaging for the purchased products. Consequently, the supply chain should take care of technological innovations, providing goods at high added value.

Therefore, the ornamental sector appears market-driven, extremely competitive, with a supply-chain very globalized, where dynamic flows on a worldwide scale are interdependent and integrated. At the global level, according to this production and market scenario, the ornamental industry is expected to change to react to the market globalization. Moreover, the ornamental sector must meet several other issues such as:

- modified consumption trends showing an increasing consciousness about biophilia and "neo-ecology" sentiments;
- evolution and spreading of information and communications technology (ICT) and internet;
- alterations arising from climate changes;
- necessity to reduce the energy-input and to reach a production flow sustainable under the environmental, social and economic point of view;
- pest management performed with alternative strategies and tools to reduce the agrochemicals;
- need to provide end-consumers with an increased product quality at an acceptable price.

Considering this, innovation is extremely important for seizing new opportunities from these challenges. The holistic approach and the involvement of different sectors (private, non-profit and public) are fundamental to take care of the different determinants playing a role in reaching an innovative and sustainable ornamental industry able to create socio-economic benefits and employment.

The ISHS Division Ornamental Plants (DORN) with its seven working groups, members and partnering industries, in accordance with the ISHS strategies, is aimed at considering aspects of research, technology transfer and education in the ornamental industry to contribute to the future of this sector having a great impact at global level. All the members are aware that it is mandatory to create a strong interaction with the other ISHS Divisions and Commissions, e.g., Divisions Protected Cultivation and Soilless Culture, Postharvest and Quality Assurance, Precision Horticulture and Engineering, Horticulture for Development, and Commission Cultivar Registration, to be able to develop an interdisciplinary approach that is essential to face the new challenges. In the present article, some important points related to the aforementioned context will be discussed.

## The role of innovations in ornamentals

No other agricultural sector demands as high a rate of innovation as the ornamental sector. This sector is driven by the consumer need to have new colors, shapes, textures, longer vase life, high quality products, new cultivars, and so on. Therefore, novelties are mandatory and, on the other hand, the possibilities to generate these innovations are endless. Innovation could be reached in several ways. The research conducted for centuries on the well-known and traditional ornamental species such as roses, lilies, and tulips, just to mention a few, allowed for the development and application of techniques and technologies that originated and continuously changed the whole production of ornamental plants and enhanced the field of knowledge. This research led the way to improve almost every plant species with ornamental potential. In other words, the research conducted on the traditional ornamental species paved the way to improve new species and to add these into an endless catalog of ornamental species.

Every year, thousands of new ornamental cultivars are registered. In the last decade, according to the Royal Horticultural Society (RHS), about 1,000 new varieties of lilies were registered. The Netherlands, the major producer of ornamental crops in the world, contributed to it with 633 varieties, China with 142, Russia with 95, and Canada with 48 (Royal Horticultural Society, 2017, 2019b, c). The International Union for the Protection of New Varieties of Plants (UPOV) database PLUTO contains information on plant varieties from UPOV members and the Organization for Economic Co-operation and Development (OECD). According to this database, for the major crop *Rosa* L., 4,944 records for plant breeder's rights in the European Union (1,451 records are in the Netherlands, 1,850 records in France, and 1,137 records in Germany) have been found. The US has 4,660 records of plant patents and Israel has 715 records for plant breeder's rights. If we make a comparison with an important horticulture crop like *Solanum tuberosum* L. (potato), 1,852 records in the European Union, 639 in the US, and 103 in China were found. The huge difference between the number of registers made for ornamental plants and the number of crop cultivars registered is evident. These numbers of registers can only be compared with crops like *Zea mays* L. where there are 5,472 plant breeder's rights registers in the EU, 2,737 in the US, and 696 in Mexico. *Solanum lycopersicum* L. (tomato) has 9,466 plant breeder's rights registers in the EU, but only 164 registers in the US, and 121 in China. Another comparable example is *Oryza sativa* L. (rice) where there are 179 plant breeder's rights registers in the US, 263 in the EU, and 4,077 in China (UPOV, 2022).

The demand for innovation in ornamental crops has always existed, however, in the last decade, the demand is not only for new varieties, but also for new ornamental crops. As described before, geographical areas play

an important role in the innovations of the ornamental sector. Mature domestic producer countries possess the knowledge and technology to produce on a large scale and to generate a huge number of new varieties. An important observation is that these countries (Europe, Canada, US, China, and Japan) are mainly characterized by a temperate climate. The mature exporting producer countries possess similar climatic characteristics in the producing regions and they aim to satisfy the demand mainly of the EU and the US. The emerging domestic producer countries as well as the emerging exporting producer countries are characterized by a tropical climate. Because of this, it is not surprising that the demand for ornamental plants in the last decade is mainly addressed to tropical species. In counterbalance, the knowledge and the technification in these emerging countries must be developed.

A few decisions must be taken to satisfy this constant demand for new ornamental crops. We can expect different scenarios. On one side, in temperate climate countries, both new variations are developed into well-known crops like *Lilium* and *Gerbera*, and new crops are introduced from the tropical climate countries and bred to adapt to temperate conditions. There are several examples where the adaptation of ornamental plants from tropical countries has been a success in temperate climates. For example, poinsettia (*Euphorbia pulcherrima* Wild. ex Klotzsch), which is indigenous to Mexico and Central America, is worldwide known for use in Christmas or winter floral displays. According to the PLUTO database, poinsettias have 608 registers in the US, 554 in the EU, and only 27 in Mexico, where it is native (UPOV, 2022). Another good example is the genus *Dahlia* Cav. also native to Mexico and Central America. This plant was introduced to Europe in the late 18$^{th}$ century and now about 19,200 cultivars are registered (Royal Horticultural Society, 2019a). A different case is lisianthus (*Eustoma grandiflorum* (Raf.) Shinners) (Figure 1). This plant is native to Mexico and the Greater Antilles and was introduced a few decades ago in Japan. This crop occupies the 11$^{th}$ place among cut flowers at Dutch auctions. As a consequence of indirect selection in breeding programs, most of the new cultivars have a tendency to rosette if the plantlets are exposed to high temperatures (Barba-Gonzalez et al., 2017). Paradoxically, this tropical crop presents cultivars that can be grown in temperate climates, but are not grown in tropical climates. Therefore, although this ornamental cut flower was more recently introduced compared to dahlia and poinsettia, its production in temperate climates has been successful.

On the other side, the emerging domestic producer and the emerging exporting producer countries will adopt a more important role in the ornamental market to fully develop this industry to a mature scenario. The emerging domestic producer countries (India, Brazil, and Mexico) are considered as megadiverse countries. These countries and others have at least 5,000 endemic species. The majority of these species could be considered potential new crops. In addition, the Cape Floristic Region in South Africa contains 9,086 species in an area of 90,000 km$^2$ with 68.8% endemic species having largely untapped commercial potential (Born et al., 2007).

One of the keys for success in the generation of new cultivars is a wide genetic base. An ample number of species in a genus, or broad phenotypic variation, plentiful variants can provide unusual plants with relative minor effort. This is the case of *Dahlia* accounting for 42 accepted species. It is a genus with an important genetic base, for which more than 19,200 cultivars have been registered (of course, mutagenesis and other techniques have been applied). The emerging domestic producer countries are an important source for new ornamental plants, but to take advantage of this biodiversity, the whole supply chain should be developed. In the mature domestic producer countries, a multi-echelon supply chain network from the wild species to the final consumer has been established. This network was constructed over centuries and each link in the chain is important to ensure a better supply to end markets. In this framework, logistics, industrial design, processes automation, and regulations must be considered. Disease control, variety certification, and validation, such as the Naktuinbouw in the Netherlands (Figure 2), are important. Research is needed regarding the production, trade, educational and promotional aspects of the product. In addition, cost evaluation must be pursued for innovative products. In this regard, we stress the importance of individual flower gardens. These are a valuable means for the conservation of plants, but also to educate the public concerning the world plant species diversity. Gardens also play a central role in meeting human needs and providing well-being. By way of example, we highlight the gardens Keukenhof in the Netherlands (Figure 3) and Nabana-no-Sato Flower Park in Japan, which play an important role in setting flower exhibitions where suppliers and consumers can validate the novelties

Figure 3. Lily exhibition at the Keukenhof, the Netherlands.

of the ornamental sector. These approaches should be taken into consideration by the emerging producer countries to reach the maturity of their markets.

The role of innovations in the ornamental sector has also been the subject of invaluable research in every aspect of the supply chain network. As an example, the generation of novel cultivars through a breeding program implies a step series including parental selection, chromosome analysis, and crossing. In some occasions prezygotic barriers hamper pollination, so different techniques to prevent these barriers have been developed. If the embryo is not able to grow or aborts, techniques such as embryo rescue can be applied. If fertility issues exist, polyploidization can be an option for further breeding. These steps are an exaggerated summary of the breeding process and might be needed or not, depending on the species. These steps result from centuries of research, thousands of research projects, manuscripts, theses, alliances with the productive sector, and numerous research budgets. This applies to every knowledge field in these complex supply chain networks. All this information is expected to be utilized to generate novel cultivars from new species, especially from megadiverse countries to introduce diversification in the supply chain and finally to get new ornamental crops.

The latest biotechnological advances, such as gene editing, broaden the possibilities to modify key characteristics on almost every crop, with certain restrictions. Gene editing (or genome editing) is a group of technologies that allow genetic material to be added, removed or altered at particular locations in the genome (MedlinePlus, 2022). Gene edition requires knowledge about the gene sequences to edit. Comprehensive whole transcriptome sequences have been obtained for most of the major ornamentals, which includes the genera: *Phalaenopsis*, *Oncidium*, *Dianthus*, *Rosa*, *Lilium*, *Tulipa*, *Chrysanthemum* and *Cymbidium* (Yagi, 2015). The whole genome sequences have been achieved for crops such as *Dianthus*, *Phalaenopsis*, *Dendrobium*, *Primula*, *Petunia*, *Ipomoea*, *Hibiscus*, *Helianthus* (Yagi, 2018) and *Rosa* (Hibrand Saint-Oyant et al., 2018; Raymond et al., 2018). For the main commercial traits in the world's ten best-selling cut flower species (*Alstroemeria*, *Chrysanthemum* × *morifolium*, *Dianthus* spp., *Eustoma exaltatum*, *Freesia* × *hybrida*, *Gerbera* × *hybrida*, *Hydrangea macrophylla*, *Lilium* spp., *Rosa* cultivars and *Tulipa* spp.) several gene sequences are available. These sequences include traits such as flowering induction, floral meristem initiation and organ development, flower color and flower scent (Giovannini et al., 2021).

The role of innovation in the ornamental sector has not only been the development of tens of thousands (or hundreds of thousands) of ornamental cultivars (floriculture, nursery plants, shrubs, trees, and foliage plants for outdoor and indoor use), but also the creation of this multi-echelon supply chain network, a worldwide network supporting millions of jobs, which for centuries has tried to satisfy an endless necessity for novelty. Things are changing worldwide and to be able to sustain the introduction of freshness in the market, cooperation among the mature and emerging producer countries is a must. Research is one of the echelons of this chain network. In our DORN, research is conducted worldwide contributing to enhance the knowledge with an interdisciplinary approach articulated in Working Groups related to the major ornamental crops (Orchids, Roses, Flower Bulbs and Herbaceous Perennials, and Protea) and Working Groups on New Ornamentals, Quality of Ornamentals, and Virus Diseases of Ornamentals.


Figure 4. Effect of 5 days dry storage at six different temperatures (0, 2.5, 5, 7.5, 10 and 12.5°C) on rose (*Rosa hybrida* L. 'First Red') flowers after 8 days in the vase (Çelikel and Reid, 2005).

## Sustainable postharvest solutions to enhance the quality of ornamentals

The most important postharvest factor in maintaining quality of ornamentals is temperature. The critical role of temperature in the life of cut flowers has been recognized in the literature and in texts on postharvest handling of these products (Mastalerz, 1953; Maxie et al., 1973; Nowak and Rudnicki, 1990; Jones and Moody, 1993; Sacalis, 1993). Recommended temperatures for a variety of products range from 2 to 4°C. Current commercial practice in the US and Europe for most cut flowers provides, at best, temperatures from 5 to 10°C during the transportation period, which often lasts 4-5 days (Çelikel et al., 2010). The experiments for a range of flowers (Cevallos and Reid, 2000; Çelikel and Reid, 2002a, b, 2005; Çelikel et al., 2010) clearly demonstrated the importance of proper temperature control in the postharvest handling of cut flowers. As the storage temperature increased, vase life of flowers after storage was dramatically reduced (Figure 4). The decrease in vase life of the flowers was matched by an exponential increase in the respiration of flowers at increasing storage temperatures. The studies at University of California at Davis (UCD) clearly showed that most of cut flowers that are not sensitive to chilling injury should be stored close to 0°C. At that temperature, ageing processes are suppressed and negative gravitropic bending is eliminated. In addition, fungal development is greatly suppressed. Storing the flowers in solution is not advantageous at that temperature. Shippers have been using 'wet' transportation systems like the proprietary 'Procona®' (which stands for "from PROducer to CONsumer in Aqua") system for transporting cut flowers. They claim a significant improvement in outcome of the flowers. This claim is substantiated by the research of the Department of Environmental Horticulture at UCD. Some flower species from tropical origin (e.g., anthurium, tropical orchids, ginger, and heliconia) will suffer from temperatures below 10-12°C and special attention should be taken in their storage and transport. Until now, no good solutions to alleviate the postharvest chilling injury have been developed and long-term storage and transportation of such flowers remains a challenge.

From a product-waste point of view maintaining low temperatures throughout the chain is recommended. This, however, needs more energy for cooling and thus needs the use and development of sustainable cooling principles. One obvious solution for storage facilities is the use of solar power. Various systems have been developed to store surplus energy during the daytime in the form

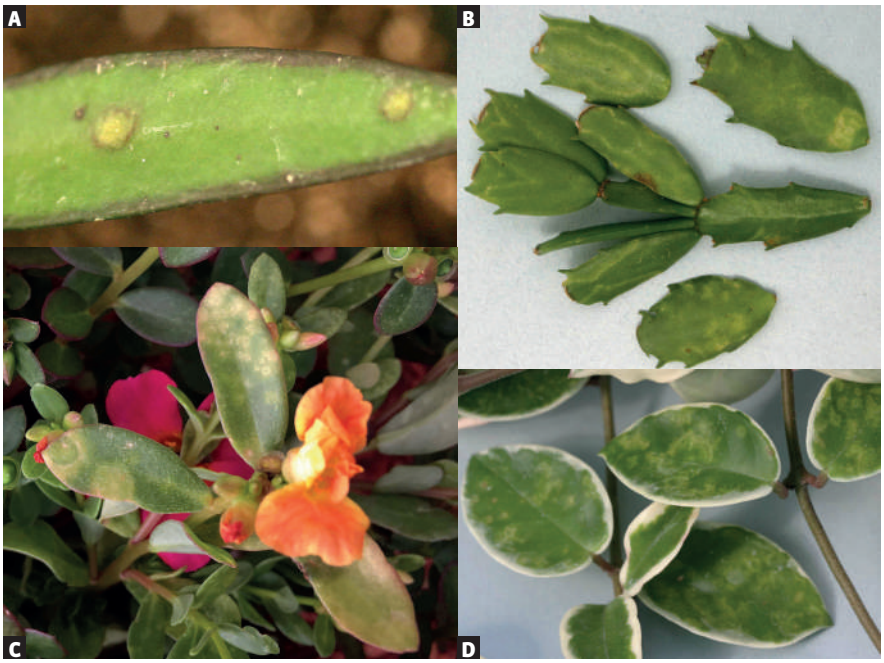



Figure 5. Typical symptoms of newly emerged viruses in ornamental crops. *Tomato chlorotic spot virus* infections of newly described ornamental plant hosts: a) waxflower (*Hoya wayetii*), b) false Christmas cactus (*Schlumbergera truncata*), and c) portulaca (*Portulaca oleracea*). d) Novel virus *Hoya chlorotic spot virus* infection of waxflower (*Hoya* spp.).

of an ice bank that can be used during the night to keep the product cool. Other smart cooling principles such as the Quest technology developed at Wageningen Food and Biobased Research, Wageningen University and Research, the Netherlands, runs on refrigerated containers. These aid in saving energy and lowering the carbon footprint during refrigerated transport (https://www.wur.nl/en/show/Quest-II-container-refrigeration-with-65-less-CO2-emission.htm).

Cut flowers should be transported at low temperatures, ideally close to 0°C, for non-chilling sensitive species to keep them fresh from grower to consumer. However, refrigerated trucks use about 25% more fuel than non-refrigerated ones. Shipping containers by sea is a more sustainable alternative to conventional, overland transport with significantly smaller $CO_2$ emissions per tonne per kilometre carried (16 g $CO_2$ $t^{-1}$ $km^{-1}$ vs. 22 g for rail and 62 g for truck) (https://www.unifeeder.com/plants-and-flowers-industry).

Shifting transport from road to rail can cut carbon emissions by up to 76%. 'GreenRail' is a collaborative project between more than 30 organizations. It aims to developing trade routes by rail for fresh flowers between the Netherlands and other European countries, which would cut emissions, costs, and time. Up to 50% cut in $CO_2$ emissions was achieved by the GreenRail project with a 20% cost reduction across the whole transport chain (WWF, 2016).

Most flowers are currently shipped by air for fast delivery. The benefits of transporting flowers by sea or rail under controlled temperature and atmosphere are not well understood. It is important to maintain product quality throughout the entire supply chain by efficient cold chain management immediately after harvest. Although transporting via sea often takes 3 to 4 weeks, transport in refrigerated containers assures ideal temperature control and thus provides the best possible way to transport flowers (https://home.kuehne-nagel.com/-/knowledge/success-stories/using-sea-to-ship-flowers).

Eco-friendly treatments such as spray, pulsing, and vase solutions are another important issue in sustainability of the flower industry. After harvest, cut flowers are commonly treated with a range of compounds with the aim to improve the storage performance and to prolong vase life. These compounds are either applied through the feeding solution or are used as sprays or dips. Some of the compounds affect biological processes (such as ethylene sensitivity or chlorophyll breakdown), and some, such as biocides, organic acids, and detergents, improve water relations. In addition, postharvest treatments with oxidative or fungicidal compounds are applied to suppress botrytis development. In rose cut flowers, a floral dip in a NaOCl solution prior to sea transportation greatly reduced botrytis development comparable to treatments with regular synthetic fungicides (Woltering et al., 2015).

Eco-friendly and sustainable pulsing and vase solutions such as natural extracts from medicinal plants should be preferred as a biocide in pulsing or vase solutions to maintain the postharvest quality of cut flowers and greens. Among others, ethylenediamine tetraacetic acid (EDTA), lysozyme and poly-aspartic acid showed good results as alternatives to chemical biocides in flower food (unpublished results). Other than bactericides, natural sources such as lemon juice could be used as acidifying agent. Ethylene is a problem for sensitive cut flowers like carnations. 1-Methylcyclopropene (1-MCP) is an ecofriendly alternative to the commonly used silver thiosulphate (STS) (Serek et al., 1995).

Plastics are being replaced by biodegradable packaging, ecofriendly renewable and recyclable materials, new heat-sealable, fiber-based materials from sustainably managed or certified forests, and other sustainable coatings. Forest certification is an important and powerful tool to ensure positive environmental, social, and economic benefits for forest management and wood supply. All materials used can be traced back to their origin. With Forest Stewardship Council (FSC) forest management certification all important environmental, ecological, social, and economic aspects are considered throughout the value chain, including respecting human (both worker and consumer) rights (https://paptic.com/applications/product-packaging/).

As to postharvest insect control, integrated pest management and eco-friendly quarantine treatments, such as hot air treatments under controlled atmospheres and controlled atmosphere temperature treatment (CATT), provide an alternative eco-friendly method to replace the previously used, methyl bromide, a potent ozone-depleting gas.

## The challenge of coping with emerging viral diseases affecting ornamental plants

As noted previously, the ornamental industry is driven by novelty – both new cultivars of existing and new crops. Each of these pathways to ornamental crop novelty provides a means for introducing new pathogens and diseases. Although all pathogen types (fungi, oomycetes, bacteria and viruses) may be introduced, viruses are especially prone to this type of introduction due to the continuous push for new germplasm for ornamental crop propagation and production systems. Thus, in the Division Ornamental Plants, an ISHS Working Group is devoted specifically to Virus Diseases of Ornamentals.

Viruses emerge from two principal pathways: new hosts for known viruses and new viruses previously unknown in any plant host. The scientific literature is replete with examples of both types, especially from subtropical and tropical regions of the world where growth is year-round (Adkins et al., 2018a).

However, temperate regions of the world are also impacted due to year-round greenhouse propagation and production, and the importation of plant material from subtropical and tropical regions. Examples from the orthotospovirus and tobamovirus groups exemplify both types of virus emergence pathways although emerging viruses are certainly not limited to these two virus groups.

The thrips-transmitted orthotospovirus *Tomato chlorotic spot virus* (TCSV) emerged in south Florida and the Caribbean basin in 2012 (Batuman et al., 2014; Londoño et al., 2012). It has since become the predominant tospovirus in vegetable crops, including tomato and pepper, in south Florida (Webster et al., 2015). Soon thereafter (2014), TCSV started to emerge in ornamentals in Florida, including waxflower (*Hoya wayetii*), false Christmas cactus (*Schlumbergera truncata*), annual vinca (*Catharanthus roseus*), Madagascar jasmine (*Marsdenia floribunda*) and portulaca (*Portulaca oleracea*) (Baker and Adkins, 2015; Dey et al., 2017; Raid et al., 2017; Warfield et al., 2015). Typical orthotospovirus symptoms of chlorotic or necrotic rings and/or spots were observed on all hosts (Figure 5). An orthotospovirus was initially identified in each of these new hosts using *Tomato spotted wilt virus* (TSWV) lateral flow immunoassays (Agdia, Inc., Elkhart, IN, US) previously demonstrated to detect TSWV, TCSV and other closely related tospoviruses (Adkins et al., 2015). Specific primers, polymerase chain reaction, and sequence analysis confirmed the identity of TCSV (Webster et al., 2015). These host/virus combinations represent new ornamental plant hosts for the known virus, TCSV.

During testing of waxflower samples for TCSV, some plants with similar symptoms (Figure 5) tested negative for TCSV and other orthtospoviruses. Instead, these plants tested positive with *Tobacco mosaic virus* (TMV) lateral flow immunoassays (Agdia, Inc.), which detect TMV and related tobamoviruses. Rigid rod-shaped particles of ~300 nm typical of tobamoviruses were observed by electron microscopy. Genome sequence analysis indicated the presence of a novel tobamovirus, for which the name *Hoya chlorotic spot virus* (HoCSV) was proposed (Adkins et al., 2018b). Systemic infections were observed in experimental host range studies with plants in the *Asclepiadaceae*, *Apocynaceae* and *Solanaceae*. At the time of its description HoCSV was the first tobamovirus reported from waxflower. However, at the December 2021 ISHS XV International Symposium on Virus Diseases of Ornamental Plants several additional reports of tobamoviruses in waxflower from other parts of the world were presented. This suggests that there may be an *Asclepiadaceae*-infecting group of tobamoviruses awaiting further description. Previous examples of novel tobamoviruses described in ornamental crop hosts include *Brugmansia mild mottle virus* and *Brugmansia latent virus* infecting Angel's trumpet (*Brugmansia* spp.), and *Hibiscus latent Fort Pierce virus* and *Hibiscus latent Singapore virus* infecting hibiscus (*Hibiscus rosa-sinensis*) (Adkins et al., 2003; Ilmberger et al., 2007; Scott-Brown et al., 2020; Srinivasan et al., 2005). These host/virus combinations all represent novel tobamoviruses infecting ornamental plant hosts.

Similar identification of new orthotospoviruses in ornamental crops has also occurred. The most recent set of ICTV-recognized orthotospoviruses includes *Alstroemeria necrotic streak virus* and *Alstroemeria yellow spot virus* infecting *Alstroemeria* spp., and *Hippeastrum chlorotic ringspot virus* infecting *Hippeastrum* spp. (Kuhn et al., 2021). These viruses are known to be important in these and other ornamental crops in various parts of the world. Like the above-described tobamoviruses, these host/virus combinations represent novel orthotospoviruses infecting ornamental plant hosts.

Collectively, these examples from the orthotospoviruses and tobamoviruses highlight the critical importance of indexing and testing ornamental crop stock plants for viruses prior to propagation and distribution. Overall, specific testing (to identify known viruses) and non-specific testing (to identify novel viruses) have roles to help maintain virus-free stock plants. Non-specific methods include increased use of high-throughput sequencing (HTS) although the importance of associated biological data including host range, transmission method and economic impact must not be forgotten.

## Conclusions

In closing, past research, which includes better understanding of crop physiology, genetics, and pest and disease control, has greatly improved the ornamental industry. Innovations have changed production systems, transport, and consumer enjoyment of ornamental products. Our current knowledge will increase the rate of development of novel ornamental products to satisfy demand and increase sales. However, many challenges remain in the ever-changing production environment and consumer preferences. When these challenges are approached in an inter-disciplinary way to enhance cross-learning between ISHS Divisions, the future is definitely bright for ornamentals.

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Horticultural Science News

# Scientists use samba wasps to manage the invasive spotted-wing drosophila, a key pest of small and stone fruit worldwide

Vaughn Walton

Recently, spotted-wing drosophila (*Drosophila suzukii*, SWD) has appeared in fruit production areas worldwide. This invasive pest that resembles a vinegar fly, is highly damaging to berries and stone fruits. This fly infests these fruits as they ripen, costing half a billion dollars of crop damage annually in the USA. Affected crops include strawberry, raspberry, blackberry, blueberry, cherry, and wine grape. Most vinegar flies attack overripe fruit laying eggs in the soft fruit. Spotted-wing drosophila has a saw-like ovipositor, and can lay its eggs into ripening, susceptible fruit. The saw-like ovipositor allows SWD to cut into the firm outside of fruit and push its eggs in. These eggs are laid directly under the fruit surface area and immediately, sometimes even within hours, start to hatch. Hatching larvae will start feeding on the pulp of the affected fruit. Within two or three days, feeding larvae soften the pulp and provide entry to microorganisms, resulting in unacceptably soft and spoiled fruit (Figure 1). Within a one-week period, under ideal conditions, larvae will emerge from fruit. Emerging SWD larvae can pupate either in fruit or outside, after which adults emerge to repeat the lifecycle. The lifecycle can be completed within as little as ten days, with up to ten generations per season, resulting in explosive pest populations.

Scientists are researching control measures for SWD. One possibility for control includes the release of insect predators. In Oregon, USA, during summer of 2022, scientists are releasing a parasitoid wasp, also called the samba wasp (*Ganaspis brasiliensis*) (Figure 2) as a predator, to combat the highly damaging and invasive pest, spotted-wing drosophila (*Drosophila suzukii*, SWD). Samba wasp releases in the Willamette Valley are part of a worldwide bid to help manage SWD.

Spotted-wing drosophila is native to Southeast Asia and was first detected in the USA, in California in 2008, and Oregon in 2009. It took scientists more than ten years to gain a parasitoid release permit from the U.S. Department of Agriculture for samba wasp as part of an overall control program against SWD. Spotted-wing drosophila is highly adaptable, ultimately resulting in rapid expansion through many areas worldwide. Each of these invasions has its own unique story. In Oregon during August 2009, the horticultural entomology laboratory received a sample from Oregon State University horticulturist, Dr. Bernadine Strik. The sample originated from a grower just outside of Corvallis. The grower observed that berries softened prematurely based on the grower's previous experience. This occurrence prompted searches and subsequent finds of SWD in western USA. Eventually SWD was observed in all key production regions in North America, Europe, and South America.

Figure 1. Spotted-wing drosophila can cause fruit spoilage on blueberry within a period of 3-7 days after egg laying.

Initially, scientists and extension agents worked with growers to find the best conventional pesticides to manage SWD. Effective use of conventional pesticides helped growers to protect their crops and markets very effectively. Currently, SWD control is managed mainly by using conventional insecticides. Generally, chemical control works well, but has limitations. The most worrying limitation is the development of insecticidal resistance and environmental degradation. The first signs of insecticidal resistance were recorded by scientists in California, just over ten years after the first finds of SWD.

Pesticide efficacy is negatively impacted by precipitation and environmental breakdown. As an example, most insecticides used against SWD wash-off during rainy conditions. Growers need to protect their crop during the ripening period, and in production regions where there is summer rain. Seasonal rain may render insecticides less effective within a day. Most conventional insecticides can affect the environment negatively and result in environmental degradation. Native and other pollinators are known to be negatively impacted by conventional insecticides. Natural enemies such as predators and parasitoids are affected more severely than the pest itself. Excessive pesticide use often results in other pests becoming problematic. This is mainly because less damaging pests' natural enemies are killed off by repeated pesticide use. This in turn results in more pesticide use, resulting in an economically and environmentally unsustainable production cycle.

Figure 2. Samba wasp, *Ganaspis brasiliensis*, is being used by scientists worldwide to target the damaging spotted-wing drosophila in susceptible small and stone fruit.

Figure 4. Kent Daane, University of California, Berkeley, working with foreign colleague Yoohan Song from Gyeongsang University, Jinju, South Korea.

There are multiple other technologies that are being developed to manage SWD. Scientists studied monitoring, modeling, timing, and mode of conventional insecticide sprays, cultural, and behavioral controls. Behavioral controls are exciting because often these do not necessitate full cover pesticide applications while being very targeted towards the pest insect only. At least one such control method is available to growers, while other technologies have not made it to market yet. One such technology includes sterile insect release under experimental conditions.

Pest insect populations are negatively affected by a variety of environmental and nutrient factors. Suboptimal environments such as excessive heat, cold and low humidity can result in most pest populations being wiped out. It has been shown that cold winters and excessively hot summer temperatures can result in significant relief from SWD pest pressure. Habitat surrounding the crop often has more mediated environmental conditions, serving as a source of pest infestation. Lack of nutritional resources and water also play an important role in pest population levels. Surrounding vegetation often provides both nutritive and moisture resources to SWD pest populations.

Natural enemies of pest insects can be used in integrated pest management programs. Biological control using natural enemies can include microbial control, which uses bacteria, fungi, and viruses. Pest insects can also be managed by nematodes and other natural enemy insects. These insect natural enemies are classified as predators and parasitoids. Predators feed on multiple life stages of the pest insect and need multiple hosts to complete its life cycle. Parasitoids attack certain life stages of the pest insect, such as eggs or larvae. Parasitoids also need only one pest insect to complete its lifecycle, and ultimately lead to the death of its host. Parasitoids are different from parasites. Parasites usually do not lead to killing their hosts. For this reason, we classify the samba wasp as a parasitoid, as opposed to a parasite. Finding the samba wasp has its foundations in taxonomy. Directly after taxonomic identification of SWD in the USA, we determined where it originated. This determination was based on earlier research based on taxonomic characters of the pest insect.

Typically, the original habitat of pest insects contains both host plants and natural enemies, and elements that represent the trophic levels related to SWD biology and ecology. These environments of native pest origin represent millions of years of coevolution containing all trophic levels, including host plants and natural enemies. For this reason, the first exploration expeditions for natural enemies were conducted in South Korea, China, and Japan starting in 2011. During these expeditions, scientists worked with horticulturists and entomologists in the native range to find naturally occurring wild stands of cherries, blueberries, blackberries, raspberries, and strawberries. During these initial collections, relatively high proportions of naturally occurring SWD populations were found to be parasitized by several species of parasitoids.

Figure 3. Betsey Miller and Helmuth Riedl, Oregon State University, collecting fruit from wild habitats in South Korea.

Scientists are most interested in parasitoids that specifically attack SWD. During the first seasons of foreign exploration a specialist parasitoid, *Ganaspis brasiliensis*, also known as samba wasp, was found to naturally occur in SWD larvae within fruit in non-crop habitats (Figures 3-5). It is believed that the samba wasp has evolved to specialize in attacking SWD. This biology and specialist status as it relates to SWD as host insect was confirmed by scientists in Dr. Kent Daane's laboratory at the University of California, Berkeley. Quarantine testing for host specificity is a very important step before a release permit can be approved. Such work can only be conducted under controlled quarantine laboratory conditions, to prevent releases of biocontrol agents that may result in unintended negative ecological impacts. Examples from introducing biological control species have backfired in the past. A classic example is from Australia where cane toads were brought to help control beetles. Currently, these toads are problematic. The quarantine process is therefore specifically geared to prevent unforeseen consequences where the solution can cause its own new problems.

The expensive lesson we learned from the cane toad, and other previous importation projects, resulted in a careful quarantine testing process. This is one of the reasons why it took about 10 years to obtain a release permit for this important biological control insect. Quarantine insectary testing has been rigorous. After the initial foreign exploration, three or four parasites were identified as candidate species to help control SWD. Some of these had a larger host range, while samba wasp has SWD as preferred host. Samba wasp survival is closely linked to populations of

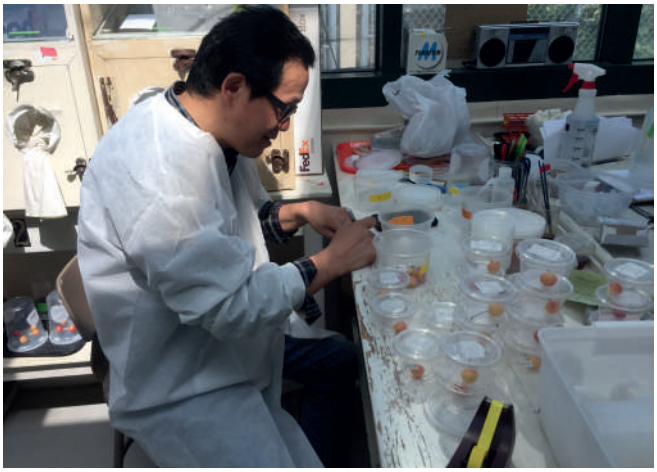

Figure 5. Xingeng Wang, USDA ARS, Delaware, conducting laboratory experiments on samba wasp.

Figure 6. Jana Lee, USDA ARS, releasing samba wasp in non-crop vegetation in the Willamette Valley, Oregon, in 2022.

SWD. When SWD populations increase, samba wasp populations will automatically start to reduce its pest populations. It is hoped that ultimately, the samba wasp will regulate SWD populations to become a non-issue or less impactful problem. With successful biological control, there are examples that pest insects disappear off the map. We believe that establishment of samba wasp parasitoids will likely help growers to spray pesticides less often.

Currently, growers and scientists are working towards determining the longer-term impacts of the establishment and success of samba wasp populations. Dr. Jana Lee (USDA ARS, Corvallis, Oregon) is leading an areawide grant to evaluate the impacts of samba wasps by monitoring for parasitism levels in sentinel traps (Figure 6). The samba wasp life cycle is very closely linked to the lifecycle of SWD. *G. brasiliensis,* or samba wasp, attacks the SWD larval life stage within the fruit. The parasitoid wasp lays its egg inside the SWD larva in the fruit. Samba wasp egg laying starts a very complex process where the developing parasitoid needs to overcome the immune defenses of the pest insect. Eventually, a successfully developing samba wasp inside SWD starts to grow. The developing samba wasp larva within the SWD larva will consume and fill the inside of SWD larvae. Eventually, the parasitized SWD larva will drop out of the fruit and die because of the effects of parasitism. The larva of the parasite will emerge from the parasitized host as an adult. This process happens more or less in the same timeline as the pest insect life cycle.

Releases of samba wasp parasitoids are focused on surrounding vegetation for several reasons. First, more than 90% of all SWD are outside of the crop. Scientific studies have shown that SWD has a very wide host range containing multiple natural hosts. These surrounding habitats provide an ideal habitat for SWD to persist and flourish. Second, environmental conditions in such surrounding habitats are also more favorable for SWD pest populations. And third, we believe that parasitoids released in non-crop vegetation will significantly reduce SWD pest populations, resulting in lower pest risk and pressure within the crop. Ultimately, lower SWD populations outside the crop should result in less pest pressure to the crop. This means that less fruit will be damaged in the commercial crop that we are eating. The releases of the samba wasps have started throughout the USA and certain regions in Europe. For example, in western production regions, releases are focused on key production regions such as the Willamette Valley and Columbia Gorge. Similar releases are focused on key western and eastern production regions of both California and Washington. Trial sites are set up within the areawide grant to demonstrate the evolving development and spread of samba wasps in the upcoming seasons. Eventually, parasitoid wasps will likely expand beyond these regions.

Ultimately the body of scientists working on this exciting project believe that samba wasps will establish in the wider environment and reduce fruit losses for all producers of susceptible crops. Typically, it is hoped that the newly established parasitoids will adapt to environments where susceptible crops are produced. It has been shown in the past that imported parasitoids such as samba wasps will establish, and they will naturally control SWD. Such work has successfully been conducted in the past resulting in significant successes, without any unintended consequences. For this reason, we believe that current progress and success in this field of control is reason to be enthusiastic. This strategy will allow growers to continue other effective management strategies. Ultimately growers would be able to be less dependent on pesticides to produce a high-quality crop. We as consumers also would benefit from a cleaner and safer fresh fruit product.

› Vaughn Walton

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# The laureates of the first 3MHT competition during the IHC2022 in Angers, France

Jean-Luc Regnard and Rémi Kahane

## Plenary exposure for the finalists of the 3MHT competition

The three-minute horticultural thesis (3MHT) competition was held during the plenary sessions of IHC2022. This constituted the culmination of a rigorous evaluation process conducted in accordance with the competition rules as published in *Chronica Horticulturae,* 2021, *61* (*3*). This competition was especially created for the IHC2022 congress to propel young scientists to the forefront of horticultural science visibility, sharing the stage with the most internationally recognized experts at the end of each of the prestigious plenary sessions. This first-of-a-kind competition kept its promise. It spectacularly highlighted the thesis work of seven young international scientists, with recently conferred Ph.D. degrees, who prominently displayed their capability to convince the audience of their scientific potential during their 3-minute presentations. Their clear speech, adapted gestures, and capacity to solicit the attention of the audience were key to the selection of the prize winners (Figure 1).

Of course, compared to the original and theoretical concept of the planned program, adjustments were needed to adapt to reality. For instance, the call for candidates was unequally disseminated among the ISHS country members. Overall, the organizers received only a limited number of applications. Nevertheless, the international jury played a critical role to check the eligibility and quality of each candidate. It was a challenging task for the president of the jury, Professor Dr. Yves Desjardins, to gather and analyze the independent reports (from 10 jury members, Table 1) on candidates from 12 countries leading to a shortlist of 10 finalists. Various external constraints such as travel restrictions due to sanitary rules in their country or professional unavailability, reduced the number of finalists to seven. These candidates were invited to attend IHC2022 and traveled to Angers at their own expense. The organizing committee felt successful in attracting such enthusiastic youth participants to this event, which was a first of its kind for any ISHS international horticultural congress.


Figure 1. Winner of the 3MHT competition, Marta Nunes da Silva, on stage for her 3-minute thesis presentation in front of the full auditorium.

## 3MHT contestants display an impressive composure in front of a 1000 audience

The final competition occurred in three sessions, with competitors grouped according to the theme of the plenary (Table 2).

Table 1. The international jury that selected the finalists.

| | | | |
|---|---|---|---|
| Prof. Yves Desjardins | University Laval, Quebec | Canada | Chair |
| Dr. Rajendran Ananthan | ICMR-National Institute of nutrition | India | Member |
| Dr. Seetha Anitha | ICRISAT | India & Malawi | Member |
| Prof. Maria-Isabel Ferreira | University of Lisbon | Portugal | Member |
| Dr. Hannah Jaenicke | University of Bonn | Germany | Member |
| Dr. Sophie Parks | NSW Department of Agriculture | Australia | Member |
| Dr. Mary Ann Sayoc | East-West Seed | Philippines | Member |
| Prof. Sergio Tombesi | Catholic University of the Sacred Heart, Piacenza | Italy | Member |
| Prof. Ian J. Warrington | Massey University | New Zealand | Member |
| Assoc. Prof. Hisayo Yamane | Kyoto University | Japan | Member |

Table 2. Distribution of the finalists during the plenary sessions of IHC2022.

| Date and theme of the plenary session | Name of the candidates | Origin of the candidates | Topic of the thesis of the candidates |
|---|---|---|---|
| 15/08/2022 Climate change | Chiara Amitrano | University of Naples Federico II, Italy | Characterization of plant water flows in controlled environment – plant smart sensors |
| | Gökçe Aydöner Çoban | Ege University, Izmir, Turkey | The effects of rhizobacteria against drought stress in tomato genotypes |
| 16/08/2022 Agroecology | Ana Moreno de la Fuente | Universidad Politécnica de Madrid, Spain | Global change and multitrophic interactions in agriculture: implications for biological control |
| | Marta Nunes da Silva | University of Porto, Portugal | Kiwifruit bacterial canker: exploring tolerance mechanisms and novel control strategies |
| | Cristiano Soares | University of Porto, Portugal | Mitigating glyphosate effects on crop plants and soil functions: strategies to minimize its potential toxicity |
| 18/08/2022 Competitiveness of the value chain | Elena Barcanu | Universtity of Agronomic Sciences & Veterinary Medicine, Bucharest, Romania | Assessment of sweet pepper (*Capsicum annuum* L.) germplasm collection in order to establish new genotypes suitable for greenhouse growing |
| | Céline Gentil-Sergent | L'Institut Agro Montpellier, France | Advancing the modeling of emissions and impacts of agricultural pesticides under tropical conditions, to improve the scientific foundation of environmental assessment of tropical agri-food systems |

Table 3. The laureates of the 3MHT competition.

| | | |
|---|---|---|
| 1st Prize – Agropolis Fondation | Marta Nunes da Silva | University of Porto, Portugal |
| 2nd Prize – SNHF | Cristiano Soares | University of Porto, Portugal |
| 3rd Prize – Agreenium | Chiara Amitrano | University of Naples Federico II, Italy |

The candidates had the option to rehearse their speech the day before their performance, to test their word flow, and to adjust their timing to respect the strict 3 minutes timeline, under the guidance of the organizers and the president of the jury. However, they all felt a shock and a strong adrenaline upsurge when they walked on the stage in front of the real, curious, and attentive 1000-person audience, who could electronically evaluate the presenters. The evaluation procedure used the application platform of the congress and allowed attendees to rate the competitors' performance after the morning presentations. Once the votes were tabulated, the average scores were calculated, and the statistics validated. The competition organizers, in agreement with the present members of the international jury, ranked the competitors leading to the choice of the three awardees. All finalists (Figure 2) received a certificate of participation signed by the President of IHC2022 and the President of the jury. Each of them was presented with a gift of local 'Anjou' specialties prepared by the Congress Organizing Committee. The laureates received a specific certificate with an award of 2,500, 2,000 or 1,500 Euros given to the 1st, 2nd and 3rd prize, respectively, cumulative endowment from three sponsors (Table 3).

There is no doubt that this competition has generated a great interest in this kind of event and allowed recent degree recipients to become known and make scientific contacts for their future careers. A more systematic communication of this competition should allow for subsequent events to consider an increased number of competitors to participate. As the president of the jury, Prof. Yves Desjardins, commented during the award ceremony: *"I sincerely hope this activity will become a tradition within IHC and will be reconducted at the Kyoto congress in 2026. This is my strong recommendation to the organizing committee."*

Figure 2. Award ceremony chaired by Prof. Yves Desjardins and facilitated by Prof. Jean-Luc Regnard (blue polo).

## Kiwifruit bacterial canker: exploring tolerance mechanisms and novel control strategies

› Marta Nunes da Silva

The kiwifruit bacterial canker (KBC), caused by *Pseudomonas syringae* pv. *actinidae* (Psa), is currently the most destructive disease of kiwifruit plants (*Actinidia* spp.), leading to significant economic impacts in several kiwifruit-producing countries, such as New Zealand, China, Italy, Portugal and France. Psa must be properly managed for optimal crop performance, but current disease management strategies are only preventive, relying on removing infected plant material and applying cupric formulations, which often have limited efficacy and environmental impacts. Considering this, the major aims of this PhD thesis were to: i) evaluate the susceptibility of different *Actinidia* species to Psa; ii) unravel plant tolerance mechanisms against Psa; and iii) explore novel and sustainable strategies to mitigate the disease. This PhD work demonstrated for the first time that *A. arguta* is more tolerant to Psa infection than *A. chinensis* var. *deliciosa*, due to faster recognition of the pathogen, a more complex antioxidant response at earlier stages of infection, tissue reinforcement with lignin, and downregulation of the ABA pathway. In the susceptible *A. chinensis*, Psa impaired the accumulation of glutamine and ornithine and the expression of genes involved in nitrogen (N) metabolism. In addition, infection of *A. chinensis* plants grown with nitrate ($NO_3^-$) resulted in lower bacterial colonization, improved plant photosynthetic capacity and mineral nutrition, as compared with ammonium ($NH_4^+$), demonstrating that plant fertilization favoring $NO_3^-$ as the N source could provide an adaptive advantage in cases of Psa infection by decreasing N concentration in plant tissues and improving plant mineral nutrition. Finally, six plant essential oils (PEOs) (from anise, basil, cardamom, cumin, fennel, and laurel) were successfully tested as antimicrobial agents against Psa (both in vitro and in planta), supporting the use of PEOs as tools for more sustainable disease management strategies, either by complementing or by substituting the currently used treatments. Overall, the findings of this thesis provide innovative knowledge on the regulatory pathways triggered by Psa infection in *Actinidia* spp., and demonstrate the relevance of N nutrition in plant susceptibility to Psa. Moreover, they also highlight the potential contribution of plant elicitors and PEOs to a more successful and sustainable Psa management.

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## Mitigating glyphosate effects on crop plants and soil functions – strategies to minimize its potential toxicity

› Cristiano Soares

Nowadays, glyphosate (GLY) is the most used herbicide worldwide. It is often considered to be rapidly inactivated in the soil, not threatening the surrounding environment. However, concerns about its environmental hazards have recently been raised. This work is thus aimed to assess GLY contamination risks to plants and soil quality, and to develop eco-friendly strategies to minimize its phytotoxicity. Although the effects behind GLY herbicidal activity are well described, not much is known concerning its impacts, as a soil contaminant, on non-target plants. In our results, GLY greatly hampered tomato plants' growth, inducing molecular and biochemical disturbances, mostly related to redox imbalances. Upon assessing its non-target phytotoxicity, the focus was on developing green strategies to reduce GLY-induced stress. First, the potential of silicon (Si), salicylic acid (SA) and nitric oxide (NO) to ameliorate GLY-mediated impacts was studied. Overall, all tested compounds alleviated, at least partially, GLY phytotoxicity. Additionally, the co-treatments boosted the antioxidant response, ensuring the maintenance of cellular redox homeostasis. The application of Si or NO, via foliar spraying, seemed to be the most promising strategy. In addition, the role of organic matter (OM) in limiting bioavailability of GLY in soils was also evaluated. GLY-mediated impacts in tomato plants were reduced in OM-enriched soils, either by promoting its adsorption and/or by preventing redox disorders. The ecotoxicological relevance of GLY-based herbicides was studied, focusing on soil habitat and retention functions. As farmers often apply mixtures of different herbicides, the impacts of a co-exposure to GLY

and flazasulfuron (FLA, a sulfonylurea herbicide) residues were also assessed. In general, increased concentrations of GLY used alone did not pose a major risk to non-target organisms, impeding earthworms' reproduction only at high levels. Regarding the co-exposure tests, plants and oligochaetes were majorly affected, with a prevalence of FLA particular impacts. Such findings confirm that risk assessment of individual compounds may be uninformative about expected effects in real-life situations. From a holistic perspective, besides unravelling the main mechanisms behind GLY toxicity, this work has provided important and practical knowledge on how to reduce its ecotoxicity.

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## Characterization of plant water flows in controlled environment – plant smart sensors

› Chiara Amitrano

This thesis was carried out at the Department of Agricultural Sciences of the University of Naples Federico II, in collaboration with the University of Arizona and the aerospace company Kayser Italia SRL, thus benefiting from a synergy between the world of scientific research and the industry. The introduction of new technologies is pivotal for production in a controlled environment on Earth, as well as for human permanence in Space in long-term missions, where plants will be used to regenerate resources and provide fresh food with high-nutritious value. The realization of these systems must be based on an accurate knowledge of plant behavior in closed growth systems, which are strongly influenced by many environmental factors including the vapor pressure deficit (VPD). In a protected environment, control of VPD is an important issue that has often been neglected. For instance, under poor aeration conditions, too much humidity can reduce plant transpiration, slowing or stopping the flow of water through the soil-plant-atmosphere continuum, ultimately blocking photosynthesis. Although there have been studies on the control of VPD, alone and/or in combination with other environmental factors, some points are still unclear or controversial. This is mainly due to the complex interactions between many microclimatic factors and the physiological behavior of plants at different phenological stages. To date, most of the research has focused either on specific physiological/structural aspects at the plant level, or on crop management or even on technological aspects, with only a few interlinks between the knowledge. The aim of this thesis was to develop knowledge to help fill this gap in order to improve the understanding of the effects of VPD on crop productivity, benefiting from the synergy between different expertise. To do so, it was fundamental to study the morpho-physiological responses of plants, since without a thorough knowledge of the mechanisms behind plant responses to the environment, it is difficult to determine how and to what extent plants can adapt to any changes in growing conditions. The application of a multidisciplinary approach in research will enable sustainable crop production even in harsh environments, where a "climate smart-agriculture" becomes necessary to improve crop yield and quality.

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# › ISHS Young Minds Award winner summaries

**Below is a selection of research summaries from winners of ISHS Young Minds Awards for best oral and poster presentations at ISHS symposia. To view other exciting research summaries by other winners, please visit www.ishs.org/young-minds-award.**

## Development of a methodology to characterize the nitrogen nutritional status of open field processing tomato by means of fast indicators

› José María Vadillo

José María Vadillo received his BS degree in Agricultural Engineering at the University of Extremadura, Spain, in 2017. After graduation, he began his master's studies in Agronomic Engineering and Agri-food Chain Management Engineering at the University of Cordoba, Spain, finishing in 2020. He is currently a student of the Food Science PhD programme at the Centro de Investigaciones Científicas y Tecnológicas de Extremadura (CICYTEX), Spain, under the supervision of Dr. Henar Prieto and Dr. Carmen Giménez.

His research focused on the evaluation of the response of horticultural crops (pepper, broccoli and processing tomato) to nitrogen fertilisation. Farmers need to be made aware of the major environmental problems that exist because of over fertilisation. Nitrate concentration in groundwater is increasing because of leaching from agriculture. This environmental problem is not an immediate danger but is getting worse. Food producers must be provided with information and tools on efficient use of fertilisers to solve this problem without reducing food production.

At the XVI International Symposium on Processing Tomato, José María presented some of his research on the relationships between rapid measurements of chlorophyll and nitrate content in sap versus the reference indicator nutritional nitrogen index (NNI). The main aim was to determine the threshold values of these rapid measurements to help technicians and producers in monitoring the nutritional status of their crops in an easier, quicker, and safer way. This will reduce production costs for farmers and reduce groundwater contamination by nitrate leaching. José María presented these threshold values for each phenological moment of the crop.

José María Vadillo won the ISHS Young Minds Award for the best oral presentation at the XVI International Symposium on Processing Tomato, which was held virtually in Argentina in March 2022.

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## The effect of natural elicitors and cold storage period on quality improvement of UAE date palm fruits


› Fatima Y.Y. Al Shaibani

Date palm (*Phoenix dactylifera* L.) is a widely cultivated agricultural crop in most Arab countries. 'Barhi' is very popular among the date palm cultivars grown in the United Arab Emirates and is often consumed at the Bisr stage (crunchy apple-like texture fruit). After harvest and during marketing, the major challenge of this fruit (Bisr stage) is to retain its long-term quality. Several studies have reported different spray treatments with elicitors or edible coating to improve the marketability of fresh fruit. The main objective of our study was to investigate the effect of preharvest spraying of natural elicitors such as chitosan (Ch), calcium chloride (Ca), and salicylic acid (SA) on the shelf life, quality, and phytochemicals content of 'Barhi' dates stored under cold storage for two months. These elicitor treatments were prepared as single treatment or in combination with other elicitors. The preharvest spray treatments were applied on the fruit 5, 15 and 18 weeks after pollination.

The results revealed that all treatments significantly delayed the rapid ripening and deterioration of date fruit. The least weight loss was observed in treatment Ch followed by Ch+SA and Ch+SA+Ca. When compared to control fruits, treatments Ch+Ca, Ch+SA+Ca and Ch+SA had significantly lower levels of total soluble solids. After 60 days of cold storage, the treatments Ch+Ca and Ch+Ca+SA did not show any decayed fruit. The treatment with Ca followed by Ch+Ca+SA had the highest levels of total phenols, flavonoids, and tannins at the end of the storage period. The antioxidant and antimicrobial activities were significantly higher in Ch+SA+Ca, Ch+SA and Ch treatments compared to the control. As a result, these three treatments are recommended for extending the shelf life of 'Barhi' date fruit. These are promising strategies to sustain the quality of fruit and decrease postharvest pathogen damage during cold storage.

Fatima Y.Y. Al Shaibani won the ISHS Young Minds Award for the best oral presentation at the VII International Date Palm Conference in the United Arab Emirates in March 2022.


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## Antioxidant, antibacterial capacity and antioxidant enzyme activities of date fruit (*Phoenix dactylifera* L. 'Khesab')

› Shamsa Alblooshi

Date palm (*Phoenix dactylifera* L.) is one of the most important fruit trees grown in arid and semi-arid regions. Despite the immense capabilities of date palm, maintaining the fruit's quality, marketability, and shelf life remains a challenge. Chemical treatments control some diseases but they can be harmful for the environment. Our goal was to find a safe, natural, effective, economical disease treatment. This study aimed to assess the synergistic effect of a preharvest spray application of natural elicitor chitosan (Ch) 1% alone and in combination with salicylic acid (SA) 2 mM and calcium chloride (Ca) 3% (Ch, SA, Ca, Ch+Ca, Ch+SA, Ch+SA+Ca) on the quality parameters, storage life, and bioactive compounds content of date fruit from 'Khasab' cultivar during cold storage for 60 days. The results revealed that all treatments significantly retarded senescence/decay of the fruit compared to the control. Ch+SA treated fruit followed by Ch and Ch+SA+Ca had the lowest weight loss, colour change, and the least decay after 60 days of storage. Ch+Ca, SA and Ca treated fruit had significantly lower levels of total soluble solids and higher total phenolic, tannins, and flavonoids content compared to the control fruit. Antioxidant activities were found in all treatments, with significantly higher effect in Ch+SA+Ca and Ch+SA compared to the control. Our results provide evidence for a synergistic effect of a combination of elicitors to extend the shelf life of date fruit during cold storage by preserving its quality and decreasing senescence/decay. We recommend it as a promising strategy.

Shamsa Alblooshi won the ISHS Young Minds Award for the best poster presentation at the VII International Date Palm Conference in the United Arab Emirates in March 2022.


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## Contribution of light wavelengths to melanin biosynthesis in *Monilinia* spp. causes brown rot in nectarine

› Lucía Verde

Lucía Verde is a Ph.D candidate in the Postharvest Programme at the Institute of Agrifood Research and Technology (IRTA), Lleida (Spain), under the supervision of Dr. Rosario Torres and Dr. Josep Usall. She completed her BSc in Biology in 2017, and her MSc in Agrobiotechnology in 2018. These degrees were obtained from A Coruña (Spain) and Salamanca University (Spain), respectively. Her research studies are focused on the disease caused by the fungus, *Monilinia* spp., known as brown rot, in stone fruit. The main species responsible for this disease are *Monilinia laxa*, *M. fructicola* and *M. fructigena*. Currently, brown rot is considered the most economically important fungal postharvest disease, especially in peaches and nectarines in Spain. The development of brown rot is variable and depends on both the host and environmental factors. Her thesis proposal included studies to evaluate how abiotic factors, in particular light, affect the development and virulence of the fungus in the host, the stone fruit. Light, especially wavelength, is one of the abiotic factors less evaluated in *Monilinia* spp. that could play an important role in the development of this disease. Among the different phenotypic changes produced by wavelengths, the pigmentation changes produced by melanin are affected. The objective of this work was to analyse and confirm the presence of melanogenesis genes in the three main *Monilinia* species based on the gene expression of the melanin biosynthesis pathway (DHN) genes, as well as the quantification of melanin in *Monilinia* spp. exposed under different wavelengths and darkness. Her results have shown that *Monilinia* spp. could adapt in unfavourable conditions and cause the disease. Overall, abiotic factors, such as light wavelength, play a significant role in the adaptive mechanisms of the fungus during the infection process in brown rot of stone fruit.

Lucía Verde won the ISHS Young Minds Award for the best poster presentation at the VI International Symposium on Postharvest Pathology: Innovation and Advanced Technologies for Managing Postharvest Pathogens in Cyprus in May-June 2022.

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The world of Horticulture

# › Rare fruits in Ukraine

Volodymyr Mezhenskyj

The climate of Ukraine is favorable for the culture of numerous fruit plants. Ukraine has a mostly temperate climate, except for the southern coast of Crimea, which is subtropical. More than 1000 species of fruit plants belonging to 124 genera and 49 families grow in Ukraine. These plant diversity estimates include more than 760 introduced species. About 110 species and interspecific hybrids from 50 genera and 22 families are economically important for Ukranian agriculture (Mezhenskyj, 2008). Genetic resource collections in Ukraine include 21,200 invaluable accessions of fruit crops, including 14,800 cultivars (Riabchun and Bohuslavskyi, 2007).

Horticulture in Ukraine began at the time of Greek colonization. Ancient Greeks started the culture of grapes and other fruit plants in the Black Sea Region and Crimea in the 5th century. Later, horticulture spread northward. The development of gardening in the Forest-Steppe zone was facilitated by the emergence of monasteries in the Kyivan Rus, which then became centers of plant material and purveyors of horticultural practices. Monastic and princely gardens were famous for their fruit cultivars. Both then, and to the present time, wild fruit and berries have been of great importance in feeding the Ukrainian people.

The Ukrainian names of the garden plants bespeak their history (Table 1). The Ukrainian names for checker tree (*Sorbus torminalis*), lingonberry (*Vaccinium vitis-idaea*), cherry (*Prunus cerasus*), hazelnut (*Corylus avellana*), rowan (*Sorbus aucuparia*), pear (*Pyrus communis*), cornelian cherry (*Cornus mas*), European cranberry bush (*Viburnum opulus*), raspberry (*Rubus idaeus*), blackberry (*Rubus caesius*), black currant (*Ribes nigrum*), blackthorn (*Prunus spinosa*), and bird cherry (*Prunus padus*) have proto-Slavic roots, for hawthorn (*Crataegus* L.), blue honeysuckle (*Lonicera caerulea*), prune (*Prunus domestica*), wild dog rose (*Rosa canina*), and apple (*Malus* × *domestica*) have even more ancient Indo-European ones.

The adoption of the Magdeburg Law[1] by Ukrainian cities and trade with western Europe strengthened international contacts. Immigrants from European countries

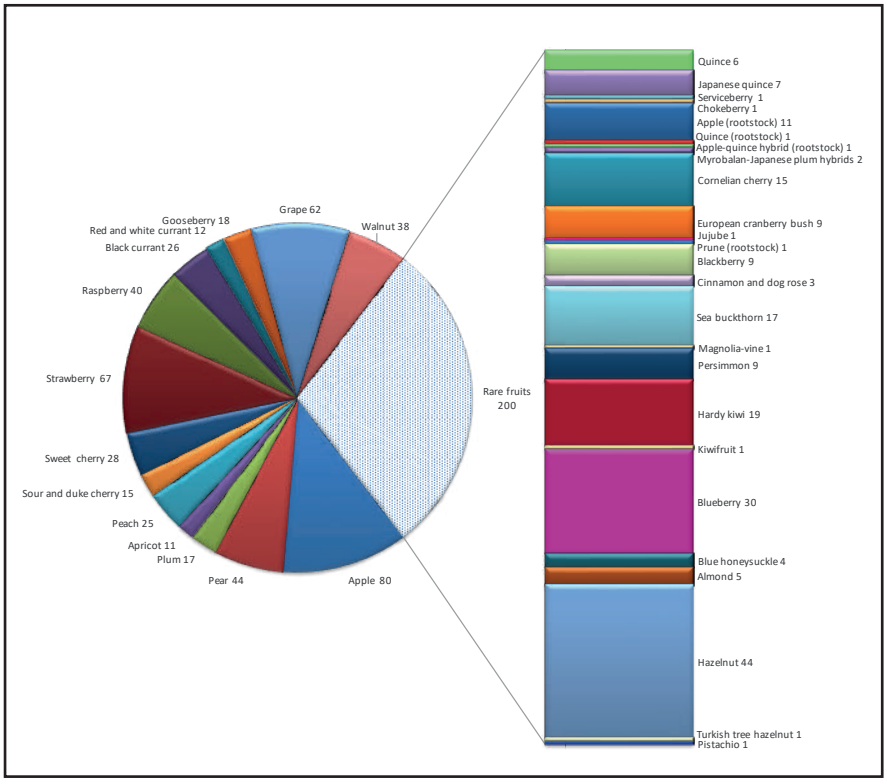


Figure 1. Fruit cultivars in the State Register of Plant Varieties of Ukraine.

carried with them the highest horticultural practices and introduced new fruit crops and varieties to Ukraine. In the middle of the 17th century, apple, pear, sour and sweet cherry, prune, apricot, walnut, grape, mulberry, gooseberry, and currants grew in the Forest-Steppe zone. The Ukrainian names for peach, sweet cherry, pomegranate, chestnut, gooseberry, and barberry, were borrowed from Latin through German, Polish, and Czech intermediaries. Polish influence is found in the Ukrainian names of aboriginal wild blueberries (*Vaccinium uliginosum*) and red currants (*Ribes rubrum*). The introduction of southern fruit plants with the borrowing of their names into the Ukrainian language came from the Ottoman Empire and the Crimean Khanate, on the territory of which quince, myrobalan, apricot, mahaleb cherry, cornelian cherry, medlar, fig, mulberry, and hazelnut were grown. In the foothills of the Crimea mountains grew apple, pear, quince, apricot, prune, sweet cherry, sour cherry, and grape in the 17th century. On the southern coast of the Crimea, fig, olive, pomegranate, peach, mulberry, service tree, medlar, and chestnut, including even lemon and orange, were cultivated (Mezhenskyj, 2011).

The development of horticulture depends on fruit varieties adapted to a microclimate or region. Fruit cultivar assortments for industrial production in certain regions of Ukraine were designated at the end of the 19th century. In Soviet times, further standardization and clarification of assortments, taking into account the greatest pairing of crops and varieties with the soil and climatic conditions of a particular administrative region, and economic plans for the development of fruit growing, took place. Crop and varietal zoning were revised and aligned with the established fruit zones after the Second World War. The fruit crops, including

[1] Magdeburg law is legal code adopted in medieval times by the city of Magdeburg and copied by many municipalities in Europe, including Ukraine. It introduced certain characteristics of western city life into Ukraine and played an important role in bringing Ukrainian culture and law closer to European developments.

■ Table 1. Orchards and vineyards in Ukraine[1] (State Statistics Service of Ukraine, 2022).

| Fruit crops | | Area of fruit plantations in bearing age (thousand ha) | | Production of fruits (thousand t) | |
|---|---|---|---|---|---|
| **English names** | **Ukrainian names** | **1990** | **2021** | **1990** | **2021** |
| ***All fruits, berries and nuts*** | | ***823.1*** | ***225.2*** | ***3737.4*** | ***2499.2*** |
| **Grape** | **Vynohrad** (Виноград) | **143.3** | **34.7** | **835.7** | **264.1** |
| **Pome crops** | | **248.1** | **97.3** | **812.9** | **1449.2** |
| Apple trees | Yablunia (Яблуня) | 227.6 | 84.4 | 648.2 | 1278.9 |
| Pear | Hrusha (Груша) | 19.0 | 12.0 | 155.7 | 163.3 |
| Quince | Aiva (Айва) | 0.9 | 0.8 | 7.8 | 7.0 |
| **Stone crops** | | **94.1** | **59.9** | **506.5** | **531.7** |
| Plum | Slyva (Слива) | 26.7 | 17.9 | 123.0 | 188.3 |
| Apricot | Abrykosa (Абрикоса) | 11.6 | 7.4 | 102.1 | 56.8 |
| Peach | Broskvyna/Persyk (Броскви́на/Персик) | 13.8 | 2.6 | 35.2 | 17.7 |
| Sour cherry | Vyshnia (Вишня) | 22.1 | 20.2 | 155.3 | 193.7 |
| Sweet cherry | Chereshnia (Черешня) | 16.9 | 10.3 | 76.2 | 61.9 |
| **Berry crops** | | **20.2** | **19.9** | **83.1** | **138.7** |
| Strawberry | Sunytsi (Суниці) | 7.5 | 8.0 | 32.1 | 62.3 |
| Raspberry and blackberry | Malyna ta ozhyna (Малина та ожина) | 5.1 | 5.4 | 19.7 | 36.3 |
| Currant | Smorodyna (Смородина) | 4.4 | 3.7 | 19.9 | 27.0 |
| Gooseberry | Agrus (Аґрус) | 1.0 | 0.9 | 8.9 | 8.9 |
| **Nut crops** | | **15.6** | **14.1** | **50.1** | **115.5** |
| Walnut | Voloskyi horikh (Волоський горіх) | 15.1 | 13.8 | 50.0 | 115.4 |

[1] Data given without taking into account the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol and part of the temporarily occupied territories in the Donetsk and Luhansk regions.

the State Assortment 1948, can be considered traditional for Ukrainian fruit growing throughout the country. One exception is for quince, which was recommended for cultivation on a limited scale only in the Southern Steppe. Walnut and peach, which were recommended in most, although not all, fruit zones, were correctly identified as traditional crops. So, the cultivars of apple, pear, plum, apricot, peach, sour and sweet cherry, grape, strawberry, black and red currant, gooseberry, and walnut were included in State Assortment 1948. Other fruit crops whose varieties were zoned since the second half of the 20th century, are called rare fruit crops. They are also frequently called alternative, exotic, less-known, new, niche, non-trivial, non-traditional, promising, or unusual crops. Each of the rare fruit crops occupies an area of plantations less than 1% of the total area of garden plantings in Ukraine, although some of them, such as blueberry and hazelnut, have recently been planted on an area of several thousand hectares.

Since the 1990s, the number of fruit crops and registered cultivars has increased. At the same time, with an increase in the number of rare fruit crops, the number of registered varieties has also increased. Over the last decade, varieties of almond, blackberry, blue honeysuckle, blueberry, cornelian cherry, cranberry bush, cinnamon and dog rose, hazelnut, fig, hardy kiwi, hawthorn, Japanese quince, jujube, kiwifruit, magnolia-vine, mulberry, nectarine, olive, paw paw, persimmon, pomegranate, quince, sea buckthorn, pistachio, Turkish tree hazelnut, chokeberry, and serviceberry have been registered in the State Register of Plant Varieties of Ukraine (hereinafter referred as State Register). State Register 2022 (Ministry of Agrarian Policy and Food of Ukraine, 2022) includes 483 cultivars of 14 traditional fruit crops and 200 cultivars of 25 rare fruit crops (Figure 1). Some decrease in the number of rare fruit crops and their registered cultivar in the State Register compared to previous ones is associated with certain economic and political phenomena in the country. Some of the scientific institutions where breeding work on rare fruits was carried out as well as many orchards and vineyards are in the temporarily occupied territory (Table 1). It is also worth noting that most of the fruit products in Ukraine are produced by individual homeowners.

The last garden census carried out in 1998 (State Statistics Service of Ukraine, 1999), recorded areas of chokeberry 1573 ha, sea buckthorn 260 ha, hazelnut 148 ha, and almond 486 ha. Unfortunately, the annual reports of the State Statistics Service of Ukraine do not provide data on rare fruit crops. Therefore, we will use expert assessments of the areas occupied by rare fruit crops today.

The decreased area under gardens is partly due to the replacement of old extensive orchards with new intensive ones, which led to an increase in yield and production of fruits. This is visible, for example, concerning the production of nuts. Ukraine occupies a leading position in the world in the production and export of walnuts. Despite a certain decrease in the area under this crop, the production of walnut doubled, thanks to the establishment of new industrial plantations with varietal material, which produces better nuts. Other nut crops in Ukraine belong to rare crops.

Although the first varieties of hazelnuts from Ukrainian breeding were registered in the 1980s, large commercial plantations have been established recently. The lack of planting material of native varieties led to the mass entry of varieties of foreign breeding in the State Register. Currently, the State Register includes 44 varieties of Ukrainian, Italian, British, German, American, and Croatian breeding programs.

State support for the development of horticulture in Ukraine, which provides for certain cost compensations, contributes to the expansion of plantations of nut crops. Thus, in recent years, 6224 ha of new hazelnut plantations have been established, which is almost as many as the already popular nut crop, walnut. Over the next ten years, hazelnut plantings are planned to increase to 15,000 ha. Particular attention is paid to the use of Turkish tree hazelnut (*Corylus colurna*) as a non-suckering rootstock for growing hazelnut without any irrigation. A variety of Turkish tree hazel with large nuts is also registered.

While earlier almond orchards were located in Crimea, now they are planted in the south of mainland Ukraine. The new almond cultivation is about 215 ha with plans to increase to 5000 ha in ten years.

The inclusion of the pistachio variety in the State Register should stimulate the establishment of plantations of this nut crop in Ukraine.

The successes of neighboring Poland in growing American blueberry and the high sales prices for its berries prompted Ukrainian farmers to introduce it. About 30 cultivars of American northern highbush blueberry (*Vaccinium corymbosum* hybrids) are being cultivated. These cultivars have a proven record in USA and Europe. 'Duke' is especially popular in Ukraine. The rate of planting has been very high over the past five years. The total area of blueberry plantings has reached 3500 ha, and is expanding. With their entry into the fruiting period, Ukrainian producers will significantly increase the supply of berries to the world market. According to forecasts, the export of fresh blueberries from Ukraine will increase by 1000 tons each year for the next five years.

Figure 2. Sea buckthorn 'Orange Revolution'.

Figure 3. Japanese quince 'Tamara'.

The Polish experience similarly influenced the decision of Ukrainian gardeners to grow modern varieties of blue honeysuckle (*Lonicera caerulea*), which is distinguished by the earliest ripening dates of any fruit. Plantings were established with varieties from the Canadian breeding program (University of Saskatchuan) that are not listed in the State Register. About 200 ha of honeysuckle has already been planted. The honeysuckle market in Ukraine is just established, but the potential high price of the fruit is considered a good guarantee for its promotion. Unfortunately, the general prospects of culture are still difficult to determine, because it has shortcomings that reduce its competitiveness.

Blackberries are more subject to winter injury than are raspberries. Thus, for a long time, blackberries were grown in limited quantities in Ukraine. The emergence of new thornless, more winter-hardy varieties with large tasty berries, is increasing the Ukrainian production area. The total area of blackberry production is estimated at 300 ha.

While blueberry, honeysuckle, and blackberry fruits can be harvested by hand for fresh consumption, large acreage sea buckthorn plantations require mechanical or semi-mechanical harvesting. Due to the lack of labor for harvesting sea buckthorn berries by hand, plantation owners innovated. They began harvesting by cutting and freezing the fruit-bearing branches. After freezing, the berries can easily be separated from the branches. Most of the registered varieties of sea buckthorn in Ukraine are intended for processing. Only 'Solodka Zhinka' has sour-sweet fruits suitable for fresh consumption as a dessert. In Ukraine, varietal sea buckthorn began to be grown in the 1980s, but during the economic transformation at the end of the last century, fruit nurseries stopped their reproduction due to the lack of

Figure 4. Chokeberry 'Vseslava'.

demand for nurslings and destroyed mother plantations. Therefore, now that interest in growing sea buckthorn has increased explosively, many varieties have been included in the State Register. In total, 17 cultivars of diverse origins are listed. The most promising is the Ukrainian cultivar 'Orange Revolution' (Figure 2), which can be distinguished by its large fruits, high productivity, and resistance to wilt. This cultivar is unlike many Russian bred varieties, which suffer from wilt under Ukrainian conditions. About 300 ha of sea buckthorn plantations are in Ukraine.

Kiwifruit is a commercial fruit crop of world importance, but has climatic restrictions in Ukraine. Only one variety is listed in the State Register. However, 19 varieties of hardy kiwi can be grown throughout the country. Hardy kiwi is popular in households, but there are few large hectare plantations. Noteably, a hardy kiwi plantation of 23.5 ha in the Odesa Region is the largest of this crop in Europe.

Cornelian cherry cultivars are a natural treasure to Ukraine. In the State Register there are 15 varieties that originated from Ukrainian breeding programs. They differ in size, weight, shape, color, taste, and timing of fruit ripening. Now, these varieties have spread throughout Europe and North America. Cornelian cherry trees are great shrubs, and are one of the longest-lived fruit plants. They can bear abundant fruit for more than one hundred years. The world's largest cornelian cherry plantation on an area of 14 ha is in the Zaporizhzhia Region.

Japanese plum varieties are very large-fruited (about 50-100 g) but are not usually hardy under the cold climatic conditions of Ukraine. Therefore, inter-specific hybrids between Japanese plum (*Prunus salicina*) and the local myrobalan plum (*Prunus cerasifera*) have become popular fruits in this country.

European cranberry bush is a symbol of Ukraine, the Ukrainian people, Cossacks, homeland, and national unity. It embodies the maiden purity and beauty, eternal love, fidelity, femininity, and motherhood. It is a favorite image of Ukrainian folk poetry and has a sacred meaning. Since ancient times, this *Viburnum opulus* has been planted near homes as an ornamental and fruit plant with medicinal properties. But only in the 1980s, did the selection of improved cultivars for commercial development of this plant begin. There are nine cultivars in the State Register 2022.

Oriental persimmon is a common fruit in many countries of the world. Hybrids between oriental persimmon and American persimmon that were developed in Ukraine, inherited the quality of the first species and the hardiness of the second. The hybrid cultivars 'Rossiianka', 'Nikitska Bordova', and other new strains have gained immense popularity among Ukrainian amateur gardeners and abroad.

Japanese quince has been under cultivation in Ukraine for over two centuries as ornamentals for their abundant flowers. In 1937, the first commercial fruit plantation was established near Kyiv. It was the first industrial plantation in the world located on an area of 2 ha. Japanese quinces are valuable for modern horticulture with their early fructification, annual and abundant fruiting, resistance to both biotic and abiotic environmental factors, and suitability for mechanized cultivation. The wide range of adaptability, ecological plasticity, easing in propagation, and high economic efficiency confirm advantages for this pome crop. Valuable biochemical fruit composition and high resistance to diseases and pests increase the biological value of fruit and make them an indispensable raw material for the processing and manufacture of baby food and dietary products. Now seven fruit cultivars of Japanese quince are included in the National Register. Especially it is worth noting the large-fruited cultivars 'Gold Calif', 'Maksym', and 'Tamara' (Figure 3). Establishment of up to 100 ha of industrial plantings is possible shortly.

The most successful result of breeding on sorboid plants is the development of garden chokeberry as a new fruit crop by Ivan Michurin. His large-fruited chokeberry (*Aronia ×mitschurinii*) was extended throughout the former USSR and later in other countries owing to the highest fruit content of anthocyanins and other phenolic compounds, possessing strong antioxidative potential. There are similar cultivars of Mitchurin's chokeberry developed in many countries in the world, but the first Ukrainian cultivar 'Vseslava' (Figure 4) surpasses other chokeberry cultivars in having more and larger fruit in the inflorescences.

Cultivars of magnolia-vine (*Schisandra*), jujube (*Ziziphus*), and serviceberry (*Amelanchier*) of Ukrainian breeding are also entered into the State Register. Modern industrial horticulture is based on the use of clonal rootstocks. In addition to apple, quince, and prune, which are used as a rootstock in other countries, an universal rootstock for pome crops, which is an apple-quince hybrid, is also included in the State Register.

Plant breeding does not stand still. Compared to the previous review (Mezhenskyj, 2018), varieties of three new fruit crops – chokeberry, serviceberry, and Turkish tree hazelnut – are included in the State Register. There are promising selections of rowan, checker tree, medlar, nashi, service tree, whitebeam, barberry, elder, Manchu cherry, golden current, and other fruits, which can expand the list of registered varieties in the future. Cultivation of new plant species provides stability to agricultural production, increases productivity, reduces material and energy consumption, and promotes a healthier environment. The new raw material base for various manufacturing industries is expanding and the diversity of products is increasing. Growing crops with a high content of bioactive substances improves the quality and nutritional value of consumed fresh fruit and processed products. This promotes a healthier nation. New fruit crops often fully meet the requirements of organic products that enable the development of organic horticulture. The success of orchard culture largely depends on the cultivars, so developing new rare fruit crop cultivars promotes progress in commercial and amateur horticulture.

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## › About the author


› Volodymyr Mezhenskyj

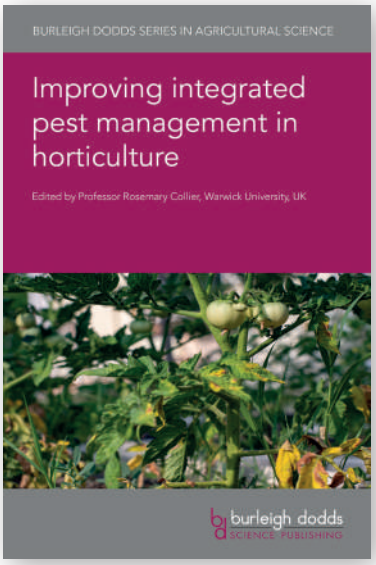

Prof. Dr. Volodymyr Mezhenskyj (Dr. Sci.) is a professor of Prof. V.L. Symyrenko Department of Horticulture of the National University of Life and Environmental Sciences of Ukraine in Kyiv. He curates and manages the rare fruit collections of the National Center for Genetic Resources of Ukraine. He developed 22 varieties of Japanese quince, hawthorn, walnut, sea buckthorn, cornelian cherry, cinnamon and doge rose, chokeberry, serviceberry, and Manchu cherry, now registered in Ukraine and Poland.

New Books
Websites

# › New books, websites

## Book reviews

**The books listed below are non-ISHS-publications. For ISHS publications covering these or other subjects, visit the ISHS website www.ishs.org or the *Acta Horticulturae* website www.actahort.org**




**Collier, R., ed. (2022). Improving Integrated Pest Management in Horticulture (Cambridge, UK: Burley Dodds Science Publishing), pp.486. ISBN 9781786767530 (hardback). £150 / $195 / €180.**

**A 25% discount will be received by entering the code "CHRON25" when ordering through https://shop.bdspublishing.com/store/bds/detail/workgroup/3-190-106510**

*Improving integrated pest management in horticulture* is a comprehensive work about integrated pest management (IPM) in horticulture. The work not only presents the state of the art for several aspects of IPM but goes a step further in analysing the actual issues of efficiency and obstacles for wider application by growers. It formulates challenges for future research. The word "improving" in the book title has been aptly chosen.

Coordinated by Professor Rosemary Collier (University of Warwick, UK), competent scientists from different European countries, Australia, and the USA contributed in respective chapters, grouped in four parts: 1) Biological agents in IPM, 2) Decision support systems in IPM, 3) IPM techniques and implementation, and 4) Case studies on the practical application of IPM. In each chapter, the authors discuss recent developments and meticulously add the sections of "Conclusion," "Challenges and future needs," and "Where to look for further information," thus giving the book a consistent structure.

Within the text bodies, the book provides a large vocabulary of words and terms associated with IPM: "bioprotectants," "E-nose,"

"conservation biological control," "companion plants," are only some examples. However, it is a pity that not all terms are used consistently throughout each chapter. This relates especially to the keyword "pest" in IPM. While Chapter 2 states that "pest" in IPM is increasingly understood to include weeds and causal agents of diseases as well as pest animals, the definition of this word is left unclear in many of the other chapters.

As a red line across all chapters, authors emphasize the poor adoption of IPM techniques, including decision support systems (DSSs), by growers. One key stumbling block for widening this adoption is the lack of reliable efficacy in the field. Tips are given to obtain more stabilisation of the field efficacy. Also, more experimental validation is needed of the efficiency of IPM techniques on a field scale. Another obstacle for adoption is the lack of quantification of the economic, environmental and consumer benefits of IPM techniques and DSSs. I quote: "*growers are understandably reluctant to replace practices they have developed over many years with alternative strategies that may incur large setup costs, and which may require long-term trade-offs between yield/quality and consistency/sustainability.*"

Wisely, the editor decided to include in Part 3 Chapter 10 about assessing the economics of IPM for horticultural crops, and Chapter 11 about encouraging IPM uptake. As for growers the most important thing is the return on investment, Chapter 10 pleads that, in the development of innovative agricultural systems, scientists should pay much more attention to the costs of application. Chapter 11 focuses on the role of extension in encouraging uptake of IPM. It provides an interesting diffusion theory, and a logic model for IPM programming, but fails to adapt the theory-examples to IPM. Extension approaches in the chapter seem to be rather targeting developing countries.

Part 4 offers useful reflections on IPM, thus being more than merely case studies. "Future trends" in Chapter 12 gives an interesting survey of ongoing technical developments in greenhouses that can constitute a threat to IPM and will require additional research. Chapter 13 uses tomato and *Brassica* as important model plants to illustrate differences in IPM application between protected and open-air cultivation. Chapter 14 treats the possibilities of cabbage root fly control in Flanders (Belgium). For a subsequent edition, I suggest choosing more appropriate chapter titles for this part to have a better coverage of the content.

In conclusion, this book is a must-have for horticultural students and scientists. It will certainly help to raise IPM application in horticulture onto a higher level.

***Reviewed by Peter Bleyaert, former research leader for glasshouse crops at Inagro, Rumbeke, Belgium***

## New title

Woudstra, J., and Allen, C., eds. (2022). The Politics of Street Trees, 1st edn (Routledge), pp. 432. ISBN 9780367516284 (paperback) / ISBN 9780367516291 (hardback) / ISBN 9781003054672 (eBook). £34.99 / $44.95 (paperback) / £120.00 / $160 (hardback) / £31.49 / $44.95 (eBook). www.routledge.com

## Documentary

Krumbiegel, G.H. The Maharadja's German gardener. https://www.youtube.com/watch?v=__ckCXs3N9Q

# › Courses and meetings

**The following are non-ISHS events. Be sure to check out the Calendar of ISHS Events for an extensive listing of all ISHS meetings. For updated information, log on to www.ishs.org/calendar**

Postharvest Technology Course, 18-21 October 2022, Wageningen, The Netherlands. Info: Monique Tulp MSc, Wageningen Academy, The Netherlands, phone: +31 317 48 22 98, e-mail: monique.tulp@wur.nl, web: https://www.wur.nl/en/Education-Programmes/Wageningen-Academy/What-we-offer-you/Courses/Plant/Course-Postharvest-Technology.htm

14th European Conference on Precision Agriculture - ECPA2023, 2-6 July 2023, Bologna, Italy. Info: Giuliano Vitali, e-mail: giuliano.vitali@unibo.it, web: https://events.unibo.it/ecpa2023

Symposia and Workshops

# XV International Symposium on Virus Diseases of Ornamental Plants

## Division Ornamental Plants #ishs_dorn
## Division Plant Genetic Resources and Biotechnology #ishs_dbio

The XV International Symposium on Virus Diseases of Ornamental Plants (ISVDOP) was hosted virtually by the National University of Singapore (NUS) from 13-15 December 2021. Convened by Sek-Man Wong (NUS), John Hammond (USDA-ARS) and Scott Adkins (USDA-ARS), XV ISVDOP was conducted in two time zones (one for Singapore/Asia time and a second for Europe/USA time) to accommodate 49 presenters and participants from 14 countries worldwide. A welcome was offered by Dr. Margherita Beruto, Chair of ISHS Division Ornamental Plants. During the symposium, invited plenary speaker, Professor Savithramma P. Dinesh-Kumar from University of California-Davis, USA, gave a lecture on virus-host interactions and gene editing using plant viruses. There were 16 oral and 17 poster presentations. Topics of discussion included new and emerging viruses, viroids and phytoplasmas, virus detection and characterization, diagnostic techniques, epidemiology and disease control, and application of high throughput sequencing to identify viruses causing diseases of unknown etiology.

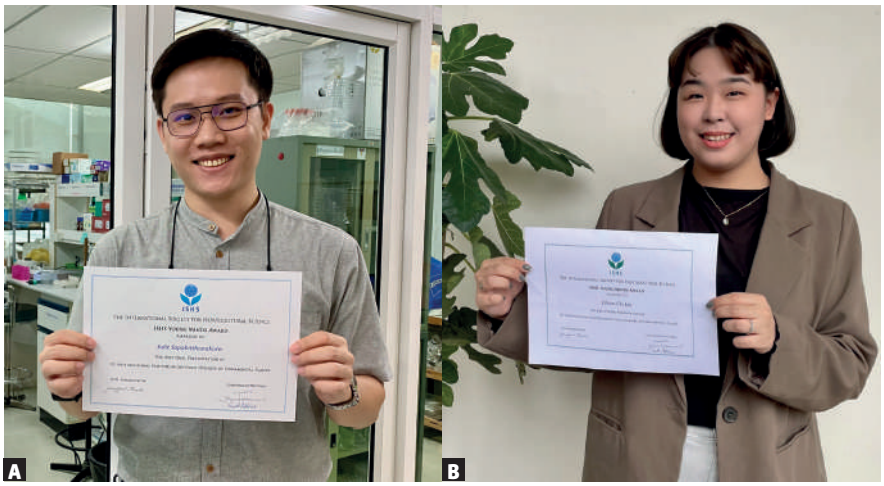
The ISHS Young Minds Awards were presented to Mr. Salit Supakitthanakorn from Chiang Mai University, Thailand, for the best student oral presentation entitled "Survey and detection of virus and viroid diseases from chrysanthemum in Thailand," and to Ms. Chian-Chi Lin from Asia University, Taiwan, for the best student poster presentation entitled "Amazon lily mosaic virus in amaryllis in Taiwan."

Attendees enjoyed multiple opportunities for open discussion following each oral presentation session in both time zones throughout the symposium. Although not the same as in-person gatherings, these discussions fostered several international cooperative research projects that otherwise would not have been possible.

During the ISHS business meeting, Scott Adkins from USDA-ARS, Fort Pierce, Florida, USA, was elected Chair of the ISHS Working Group Virus Diseases of Ornamentals. Attendees selected Florida, USA, as the location for XVI ISVDOP planned for the spring of 2024.

Program details can be found at the symposium website available at https://www.ishs.org/symposium/682.

*Sek-Man Wong, John Hammond and Scott Adkins*




› Winners of the ISHS Young Minds Awards: A) Salit Supakitthanakorn (best oral presentation), B) Chian-Chi Lin (best poster presentation).

### › Contact

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Dr. Scott Adkins, Symposium Convener, USDA-ARS, Fort Pierce, Florida, USA, e-mail: scott.adkins@usda.gov

# › VI International Symposium on Postharvest Pathology

## Division Postharvest and Quality Assurance #ishs_dphq

The VI International Symposium on Postharvest Pathology: Innovation and Advanced Technologies for Managing Postharvest Pathogens was held in person from 29 May to 2 June 2022, in Limassol, Cyprus. The symposium was initially scheduled to take place in 2021, in Limassol, Cyprus, but due to the COVID-19 pandemic restriction measures, the organizing committee, and the ISHS and ISPP decided to postpone the symposium for 1 year. The symposium was organized by the Cyprus University of Technology-CUT (Department of Agricultural Sciences, Biotechnology and Food Science) under the aegis of the International Society for Horticultural Science (ISHS) and the International Society for Plant Pathology (ISPP). The convener of the symposium, Dr. Nikolaos Tzortzakis, is an assistant professor at CUT. A total of 105 participants, representing 31 countries (Europe, South Africa, Cameroon, Chile, USA, Peru, New Zealand, United Arabic Emirates, etc.), attended the symposium. The symposium schedule consisted of 9 invited lectures, 39 oral presentations, 64 posters (18 of which were also presented as 3-minute flash poster presentations), 4 short presentations from the industrial sector, 2 roundtable discussion forums related to i) Industry perspective and consumer demand – quality vs. safety, ii) Research directions in postharvest pathology, 1 scientific session related to the StopMedWaste-PRIMA project, 1 workshop/training for the essential oil distillation and uses of the medicinal and aromatic plants extracts, and 1 ISHS/ISPP Working Group business meeting.

The symposium was focused on issues related to postharvest management of fruits, vegetables, herbs and flowers, with themes related to:

- new technologies for studying host-pathogen interactions
- elucidating pathogenicity and virulence mechanisms
- conventional and alternative technologies to manage postharvest diseases
- microbiome research and its relevance to postharvest pathology
- reducing waste throughout the supply chain
- industry perspective and consumer demands for high quality and safe fresh produce supply.

The symposium was supported by 11 sponsors: JANSSEN PMP®, a division of Janssen Pharmaceutica NV (Diamond sponsor), CITROSOL Advanced Postharvest Solutions (Platinum sponsor), Biopreparáty spol. s r.o. (Gold sponsor), Yialco Ltd. (Silver sponsor), Agrilaete, Zambartas Wineries, Anagyris Park, DECCO (Bronze sponsors), Amalthia Trading (Nicosia) Ltd., Development Agency of Lemesos Ltd, Masseria Fruttirossi Srl. (Supporting sponsors) and the European Research Project StopMedWaste-PRIMA. A plaque of appreciation and certification was awarded to the sponsors.

On top of the high level of the scientific talks and discussions, the main points and the take home message that achieved from this symposium were highlighted:

- The role of the industry and the involvement of the industry is of importance, to bridge the gap from the science to the consumers' needs.
- Policy makers need to be actively involved in the symposium, as policy makers need to be aware of the procedure to register a product, the delays, the safety issues, etc.
- Science is of importance, funding is of importance, companies' involvement in our projects submissions is important, collaboration among different parties is important.
- Giving space and encouraging young researchers to lead the next challenges in


› Participants of the symposium.


› Welcome message by the Convener, Dr. Nikolaos Tzortzakis.

› Convener Dr. Nikolaos Tzortzakis (center) and winners of ISHS Young Minds Awards, Annamaria Mincuzzi (left, best oral presentation) and Lucía Verde Yáñez (right, best poster) during the closing ceremony.

postharvest pathology is of importance. Peer researchers/academics can be supportive to that direction, to have a smooth continuation of the Postharvest Pathology community.

- There is a need to include several other specializations, i.e., economics, chemists, nutritionists, technologists, etc.

The symposium ended with the Working Group meeting and the closing ceremony. During the closing ceremony the ISHS certificate and medal were given to the convener by Professor Chris Watkins (former Chair of ISHS Division Postharvest and Quality Assurance) and the ISHS Young Minds Awards were announced by the convener and given by Prof. Samir Droby (Chair of the ISPP Postharvest Pathology Subject Matter Committee) to Mrs. Annamaria Mincuzzi (University of Bari Aldo Moro, Italy) for the best oral presentation entitled "Alternative means for controlling pomegranate postharvest decay" and given by Prof. Haissam Jijakli (former Chair of ISHS Working Group Postharvest Pathology) to Mrs. Lucía Verde Yáñez (IRTA-Institute of AgriFood Research and Technology, Spain) for the best poster presentation entitled "Contribution of light wavelengths to melanin biosynthesis in *Monilinia* spp. causes of brown rot in nectarine". The awards were accompanied with a prize of 250 euros per awardee, sponsored by the Organizing Committee. In addition, the convener gave a Special Recognition of Appreciation to Dr. Antonios Chrysargyris for his outstanding contribution in the organization of the present symposium in Cyprus.

The next, VII ISHS International Symposium on Postharvest Pathology will take place in Rotorua, New Zealand, in November 2024.

***Nikolaos Tzortzakis***

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› A) Poster session, B) coffee break.

# › X International Peach Symposium

## Division Temperate Tree Fruits #ishs_dfru


› Attending crowd of the X International Peach Symposium.

The X ISHS International Peach Symposium took place from 30 May to 3 June 2022, in the city of Naoussa, located in the Prefecture of Macedonia, Greece. Naoussa is a historical landmark because it is where the greatest philosopher, Aristotle, taught classical Greek thought and the ideals of Platonic philosophy to the son of the King of Macedonia Phillip II, Alexander, and the other nobles of the court. Notably, Naoussa is the place where peach production was first introduced in Greece, in 1938. In addition, Naoussa and the wider regions of Imathia and Pella are the epicenter of peach fruit production in Greece with leading cooperative units with international impact and a worldwide leading role in the canning industry. The symposium was the first held in an open-air environment with the employment of state-of-the-art audiovisual infrastructure. The venue was located within the Municipality Park of Naoussa, a unique example in the history of landscape architecture in Greece that is nowadays officially an integrate part of the European Route of Historic Gardens.

The organization of this event was an initiative of the Cyprus University of Technology (CUT), Department of Agricultural Sciences, Biotechnology & Food Science. It is worth noting that CUT is a newly established university in the Republic of Cyprus that welcomed its first students only in September 2007, and managed within a few years to develop into a modern, pioneering, and well recognized university, able to offer education and high-level research in leading fields of research.

The symposium was attended by more than 200 delegates and accompanying persons, mainly originating from Greece, Spain, Italy, and the United States. The symposium website (www.fruitsciences.eu/peach2021) exceeded the 12,000 unique visits from nearly 150 countries.

### Scientific part

The symposium brought together researchers from diverse fields of study who shared a common interest in peach fruit production covering the state of the art, spanning from breeding, development, and testing of new cultivars, to fruit physiology and advancements in training systems, to pest and disease management as well as to aspects related to fruit quality postharvest management and processing. All those disciplines were brought together in a coherent manner through a concrete scientific program, comprised of 16 plenary talks, 54 oral talks, and 67 poster contributions. The book of abstracts (https://www.fruitsciences.eu/peach2021/files/book-of-abstracts.pdf) has been disseminated to several thousands of recipients by


› Dr. George Manganaris, Convener (A), and Prof. Theodore DeJong, former Chair of ISHS Division Temperate Tree Fruits (B), during their welcome speeches.

› Technical visit of delegates at the premises of A.C. Naoussa and ASEPOP Naoussa.

electronic means through the symposium and ISHS dissemination and communication channels.

The symposium welcomed 16 excellent keynote speakers concerning peach research. Notably, a dedicated session with eight oral presentations on peach pest management was supported by the Fruit Flies-IPM (Horizon 2020 project), coordinated by Professor Nikos Papadopoulos, Head of Insect Biology Lab – University of Thessaly, Greece.

## Social part of the symposium

The social program of the symposium included a welcome reception party, an official dinner, a cocktail event, and a gala dinner. All details about the symposium, including a descriptive set of photos from the scientific and social program of the symposium, can be retrieved from the following Google drive link:
https://drive.google.com/drive/folders/1l7S-d6tFDnvNr6A9n12UsMDADby1Jjk3i


› Mrs. Najla Ksouri (A) and Mrs. Andrea Kohler (B) receiving their ISHS Young Minds Award.

Short videos regarding the scientific and social activities are available through the following links:
- Scientific part: https://www.youtube.com/watch?v=w0scqrtowSQ
- Social part: https://www.youtube.com/watch?v=TglPdGAbmlg

## Technical and cultural visit

Peaches coming from the Agricultural Protected Region of Naoussa have been recognized as products P.D.O., unique in Greece and one of the few in Europe. During the technical visit (June 2) delegates visited the premises of A.C. Naoussa and ASEPOP Naoussa who are marketing their premium peach fruits under the brand names Naougusta and Vermina, respectively. Such products are the epitome of the farm to fork concept with no phytosanitary applications upon harvest. Additionally, the tour encompassed guided tours at Aristotle's School Cultural Center, Mieza Theater and at the Tombs of King Philip II, the father of Alexander the Great, a UNESCO World Heritage.

## ISHS Young Minds Awards

Mrs. Najla Ksouri (CSIC, Spain) won the competition just one mark ahead of Mr. David Sterle (Colorado State University, USA) for the best oral presentation. Her presentation was entitled "Motif discovery within upstream regions of variable length reveals regulatory signatures in peach". The award of the best poster presentation was given to Mrs. Andrea Kohler for her work entitled "Fruit quality and yield in planar training systems for peach."

## Societal impact

The symposium resulted in a surplus that was allocated to scholarships of excellence at Cyprus University of Technology and to non-profit units linked with kids with special needs or low income in Greece and Cyprus.

Special thanks to the 33 financial supporters of the symposium: A.C. Naoussa, ASEPOP Naoussa, BASF, Syngenta, Yara International, Corteva Agriscience, Hellagrolip, Venus Growers, Neos Aliakmon, Vitro Hellas, Tsesmelis Fruit & Nut Nursery, Timac Agro | ΛΥΔΑ, Felix Instruments, Ecomatik, Papakonstantinou fruits, EuroChem, Bayer, Q-CERT Ltd., AgroFresh, Valent BioSciences, A.C. Episkopi, Agrology, Emphyton, Milis Nurseries, Vitaplant, Compo Expert, Agromillora Group, ASPIS, Agrohellas S.A., Fitotechniki, ASEPOP Velventos, Delcof, Anadiag.

*George Manganaris*

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## ISHS Peach Webinar on current trends and future challenges of peach fruit production

The initially scheduled date of the symposium (1-4 June 2021) was devoted to a series of webinars with 16 selective talks followed by Q&A sessions. The ISHS sponsored webinar was attended by nearly 800 attendees and all relevant information is available at https://www.ishs.org/news/peach-webinars-june-1-4-2021

# VII International Date Palm Conference

## Division Tropical and Subtropical Fruit and Nuts #ishs_dtro


› H.E. Sheikh Nahayan Mabarak Al Nahayan inaugurates the VII International Date Palm Conference.

Under the patronage of H.H. Sheikh Khalifa bin Zayed Al Nahyan, President of the United Arab Emirates, "May God protect him," H.E. Sheikh Nahayan Mabarak Al Nahayan, Minister of Tolerance and Coexistence, Chairman of Khalifa International Award for Date Palm and Agricultural Innovation Board of Trustees, inaugurated the VII International Date Palm Conference, which was organized from 14 to 16 March 2022, in Abu Dhabi, UAE, by the Award's General Secretariat, under the supervision of the Ministry of Presidential Affairs, in cooperation with the Ministry of Climate Change and Environment, and the United Arab Emirates University. In addition to 25 local institutions, regional and international organizations, 475 researchers and specialized academics, representing 42 countries from across the world, as well as a large number of interested participants in the field of date palm cultivation and agricultural innovation, participated in the conference.

H.E. Sheikh Nahayan Mabarak Al Nahayan praised the generous patronage of His Highness, President of the United Arab Emirates, "May God protect him," for this conference, which expresses the trust of His Highness, and encouragement for science and scientists, and their scientific role in the process of sustainable development in the country, as well as His Highness's interest in the field of date palm cultivation, which represents an important economic, social and heritage value that has its unique position in the country's development process. His Excellency also pointed out the interest that His Highness extends to the Khalifa International Award for Date Palm and Agricultural Innovation, which since its establishment in 2007, has been working to enhance the leading global role of the UAE in the development of scientific research in the field of date palm cultivation and agricultural innovation, by encouraging researchers, farmers, producers, exporters, institutions, and associations.

H.E. Sheikh Nahayan then added that we hope that this conference will achieve all the goals for which it was held, and will meet the expectations of H.H. Sheikh Khalifa bin Zayed Al Nahyan, President of the United Arab Emirates, "May God protect him," H.H. Sheikh Mohammad Bin Zayed Al Nahyan, Crown Prince of Abu Dhabi, Deputy Supreme Commander of the UAE Armed Forces, and H.H. Sheikh Mansour Bin Zayed Al Nahyan, Deputy Prime Minister, Minister of Presidential Affairs, for the benefit of all, by adding to our knowledge and experience in the field of date palm cultivation and agricultural innovation, following our path of comprehensive renaissance, which always aims to advance the country and achieve sustainable development.

From his side, Dr. Abdelouahhab Zaid, Khalifa International Award for Date Palm and Agricultural Innovation Secretary General, confirmed that the VII International Date Palm Conference is a model for the leading approach adopted by the Award in organizing scientific conferences, as it presents a topic of interest to everyone, not only in the


› Dr. Abdelouahhab Zaid opens the first session of the conference.

› Attendance at the opening ceremony.


› H.E. Sheikh Nahayan Mabarak Al Nahayan honors the Award winners. From left to right: Tarek Ben Abidine, Abdulla AlHumaydan, Dr. Abdulla AlJenaibi, Dr. Abdullah Saif Al-Sadi, Abdulkarim Aldoghmi, H.E. Sheikh Nahayan Mabarak Al Nahayan, Eng. Anwar Haddad, Dr. Abdul Hakim Eiwaer, Dr. Emmanuelle Joly, Dr. Ibtisam Al Harrasi, Dr. Tarifa Alzaabi, Dr. Abdelouahhab Zaid.

UAE and the Gulf region, but also regionally and internationally. It presents research and studies in various aspects of cultivation, industry, and date palm trade, as it is characterized by its comprehensiveness, as it involves the introduction of new and advanced experiences and expertise from across the world. The number of participants in the conference reached 475 researchers and scientists from 42 countries, while 141 scientific papers were presented in the form of lectures, in addition to 76 scientific posters.

The Award's Secretary General then added that the International Date Palm Conference, since its inception in 1998, and during seven consecutive sessions, has become one of the most prominent scientific research platforms in the field of development of date palm cultivation and agricultural innovation across the world. The conference has gained a high academic attendance and scientific participation of workers in this field. Given the professional sobriety and scientific credibility of the conference over a period of 24 years, the number of participants in the conference since its inception so far has reached 2,229 researchers and scientists from 42 countries, including 476 researchers from UAE, 1,235 researchers from Arab countries, and 518 researchers from across the world. Holding a global conference in Abu Dhabi periodically in this high-level manner is a milestone for the UAE on the map of supporting scientific research related to date palms worldwide, as it clearly reflects the keenness of the UAE's wise leadership to develop the date palm cultivation sector, as it is one of the main elements of food security to achieve sustainable development.


› Shamsa Alblooshi, ISHS Young Minds Award winner for the best poster presentation.

## Topics and objectives of the conference

The conference focused on updating the scientific knowledge on several topics, such as: the current state of date palm cultivation in the world, the commercial production of date palms, with focus on the 'Mejhoul' cultivar, planning the future of date palm cultivation, the date industry, genetic engineering, date palm genetic bank, and the rapid multiplication using tissue culture. In addition to agricultural services and practices, pests and diseases control, with a focus on red palm weevil, postharvest techniques, manufacturing, nutrition and marketing were discussed, and the UAE's recent experiences were presented and compared with those in other date producing countries, supporting international technical cooperation in various fields of the date palm production chain, and presenting modern scientific results in the field of date palm cultivation.

The UAE's wise leadership provided a positive academic climate and environment for this conference to continue succeeding over the past 24 years. The conference also provided a valuable opportunity for exchanging information, experiences and opinions between scientists specialized in date palm cultivation, as well as senior officials in the date industry from across the world. This indicates the increasing interest in the date palm tree by organizations, companies, and investors, which triggered the wide participation of various international researchers and scientists, where this increase is growing steadily each session.

## Scientific sessions of the conference

The International Date Palm Conference, in its seventh session, attracted a group of international scientists, specialists and researchers in the field of date palm cultivation. The scientific committee of the conference approved 141 scientific papers and 76 scientific posters, presented during seven sessions. The first main session was dedicated to Their Excellencies Ministers of Agriculture and Directors of International Organizations, in addition to six scientific sessions distributed as follows:

On the first day, the conference began with a main session opened by H.E. Mariam Al Mheiri, Minister of Climate Change and Environment in the UAE, Eng. Khaled Al Hneifat, Minister of Agriculture of the Hashemite Kingdom of Jordan, and directors of seven regional and international organizations.

On the second day, there were four scientific sessions that included 80 lectures distributed as follows: a session on the 'Mejhoul' cultivar (19 lectures), a session on the red palm weevil (26 lectures), a session on tissue

culture laboratories and biotechnologies (10 lectures), and a session on date palm diseases and pests (25 lectures).
On the third day, there were two scientific sessions that included 61 lectures distributed as follows: a session on date palm agricultural techniques and processes (13 lectures), and a general session on date palm cultivation (48 lectures).
The ISHS Young Minds Awards were presented to Fatima Y.Y. Al Shaibani from the United Arab Emirates University, UAE, for the best oral presentation entitled "The effect of natural elicitors and cold storage period on quality improvement of UAE date palm fruits" and to Shamsa Alblooshi from the United Arab Emirates University, UAE, for the best poster entitled "Antioxidant, antibacterial capacity and antioxidant enzyme activities of date fruit (*Phoenix dactylifera* L. 'Khesab')".

***Abdelouahhab Zaid***


## › Contact

Prof. Dr. Abdelouahhab Zaid, Agricultural Advisor, Ministry of Presidential Affairs, UAE; Secretary General of Khalifa International Award for Date Palm and Agricultural Innovation, PO Box 3614, Abu Dhabi, UAE, e-mail: abdelouahhabz@mopa.ae


From the Secretariat

# › New ISHS members

**ISHS is pleased to welcome the following new members:**

## New Individual Members

**Australia:** Rajendra Adhikari, Mr. Robin Dornauf, Mr. Steven Falivene, Mr. Scott Hill, Dr. Lexie McClymont; **Azerbaijan:** Rufat Badalov; **Barbados:** Mr. Justin Atkinson; **Belgium:** Louis De Jaeger, Prof. Dr. Nico De Storme, Mr. Guillaume Wegria; **Brazil:** Fernando Calisto, Dr. Deived Uilian de Carvalho; **Canada:** Dr. Ramin Bahmani, Michael Brennan, Dr. Maxime Delisle-Houde, Prof. Dr. Jacynthe Dessureault-Rompré, Claude Dubois, Ms. Nicole Mendolia, Lori Peplinskie, Mr. Daniel Plant, Dr. Matthew Stevens, James J. Willwerth; **Chile:** Mr. Julio Cornejo, Prof. Dr. Johanna Martiz, Ms. Sophia Tobar; **China:** Zheng Chuanyuan, Yao Feng, Mr. Steven Howl, Prof. Dr. Ruiyan Ma, Dr. Wanxia Shen, Jieqiu Wu, Xinghua Zhao; **Chinese Taipei:** Ms. Yu-Huei Wang; **Colombia:** Mr. Andres Martinez; **Croatia:** Assoc. Prof. Mara Maric, Assoc. Prof. Monika Zovko; **Denmark:** Aneta Stevenson; **Finland:** Prakriti Shah; **France:** Dr. Corinne Bitaud, Ms. Mona Gazon, Camille Luis, Fabien Robert, Mr. Frederic Villain, Dr. Maysam Zoor; **Georgia:** Ms. Nino Dekanoidze, Dr. Manana Kereselidze, Dr. Demetre Lipartia, Ms. Tamari Otkhmezuri, Mr. Allan Pineda; **Germany:** Dr. Katja Bogdan, Dr. Hardy Dembny, Mr. Luis Müller, Dr. Christos Stritsis, Dr. Rachael Wood; **Greece:** Mr. Panagiotis Tarantilis; **Indonesia:** Mr. lantip Kurniawan; **Iran:** Dr. Morteza Golmohammadi; **Ireland:** Ms. Eleanor Mathews; **Italy:** Paola Barzano, Dr. Stefania Bennici, Mr. Alessandro Bonora, Prof. Ippolito Camele, Dr. Pasquale Esposito, Dr. Federica Gaiotti, Dr. Sara Lombardo, Dr. Matteo Martina, Dr. Emanuele Medico, Gaetano Roberto Pesce, Dr. Valerio Pompili, Dr. Valentina Tolaini, Mr. Melvin Medina Navarro; **Jamaica:** Mr. Jervis Rowe; **Japan:** Assist. Prof. Josephine Galipon, Dr. Masahide Isozaki, Prof. Dr. Yoshiaki Kitaya, Mr. Dong Ruihao, Prof. Dr. Kyoko Watanabe; **Jordan:** Mr. Eyas Omar; **Kenya:** Ms. Lucrecia Bellido Perez; **Korea (Republic of):** Cheol Woo Choi, Dr. Sang Suk Kim, Dr. Si Hyun Kim, Cheoljun Yang; **Malaysia:** Mr. Tengku Mohd Suhaimi Raja Abdullah; **Moldova:** Mr. Railean Cristian; **Nepal:** Mr. Yadav Padhyoti; **Netherlands:** Mr. Asmerom Abreha, Mr. Henri Beekers, Bastiaan Brouwer, Ms. Jessica Snoek, Dr. Peter van Weel; **New Zealand:** Lee Boyd, Kirsten Hintze; **Nigeria:** Prof. Emmanuel C. Odiaka; **Portugal:** Prof. Dr. Nuno Alvarenga, Miguel Cutileiro, Ms. Beatriz Duarte, Mr. Tomás Magalhães, Mr. Pedro Matias, Dr. Maria do Carmo Serrano, Katia Teixeira, Assist. Prof. Olfa Zarrouk; **Romania:** Dr. Ionel Perju; **South Africa:** Mr. Thomas Chalmers, Ms. Karin Cluver, Mr. Prince Dangare, Tony Dean, Mr. Tristan Dorfling, Ms. Sally Duncan, Dr. Sebinasi Dzikiti, Mr. Wayne Kirkman, Ms. Boitumelo Lekgoathi, Mr. Edward Bongani Lulane, Mr. Wayne Mommsen, Mr. George Nel, Mr. Daniel Viljoen, Mr. John-Murray Visser, Dr. Ida Wilson; **Spain:** Dr. Gema Ancillo, Luz Karime Atencia Payares, Dr. Francisco Garcia Sanchez, David Gimeno, Ms. Amparo Martinez-Fuentes, Mr. Andrés Marzal Blay, Dr. Julia Morales, Ana Moreno-Delafuente, Dr. Josefa M Navarro, Dr. Juan Gabriel Pérez-Pérez, Dr. Juan Miguel Robles García, Marta Rodriguez Fernandez, Dr. Alejandra Salvador, Dr. Vicente Serna Escolano, Ms. Maria Tasa, Dr. Mar Vilanova, Mr. Fernando Vilariño; **Spain - Canary Islands:** Isidoro Rodríguez Hernández; **Sweden:** Casper Engström Ericsson; **Thailand:** Assist. Prof. Adisri Charoenpanich, Kullanart Obsuwan, Dr. Pathompong Penchaiya; **Turkey:** Assoc. Prof. Kibar Ak, Mr. Ridvan Arslan, Prof. Dr. Ahmet Aygün, Ms. Burcu Celikli, Mr. Arkin Enguney, Dr. Dogancan Kahya, Caglar Kalkan, Prof. Dr. Turan Karadeniz, Dr. Zafer Karasahin, Prof. Dr. Husrev Mennan, Dr. Islam Saruhan, Dr. Bengi Topkaya; **Uganda:** Ms. Elizabeth Nsimadala; **United Arab Emirates:** Ms. Noura Alnuaimi; **United Kingdom:** Jane Bradbeer, Ms. Georgia Jackson, Mr. David McLaren, Ms. Ciara O'Brien; **United States of America:** Fernando Alferez, Assist. Prof. Matthew Arrington, Dr. Nicolas Bambach, Nicholas Butun, Ann Colonna, Mr. Roger Cox, Octavia Crompton, Assoc. Prof. Julie Dawson, Ms. Noel Dickinson, Dr. Juan Enciso, Anthony Fortier, Dr. Sandipa Gautam, Mr. Benjamin Graebner, Gregory Hall, Jeffrey Alan Hoover, Israel Joukhadar, Dr. Ramdas Kanissery, Dr. Kyle Knipper, Dr. William Kustas, Tess Mairose, Dr. Andrew McElrone, Dr. Matthew O'Connor, Assoc. Prof. Jawwad Qureshi, Prof. Philippe Rolshausen, Michael Severeid, KC Shasteen, Joshua Sherman, Dr. Ed Stover, Mr. Samuel Talbot, Ms. Ashlyn Wedde, Dr. Qibin Yu, Dr. Xiaokang Zhuo; **Vietnam:** Ms. Binh Nguyen.

# › Calendar of ISHS events

**For updates and more information go to www.ishs.org › calendar of events. For a comprehensive list of meetings in each Division or Working Group use the "science" option from the website navigation menu. To claim reduced registration for ISHS members, your personal membership number is required when registering - ensure your ISHS membership is current before registering. When in doubt sign in to your membership account and check/renew your membership status first: www.actahort.org or www.ishs.org**

## Year 2022

NEW
- November 6-11, 2022, Mersin (Turkey): **XIV International Citrus Congress.** Info: Prof. Dr. Bilge Yilmaz, Cukurova University, Faculty of Agriculture, Department of Horticulture, 01330 Adana, Turkey. Phone: (+90)3223386388, Fax: (+90)3223386388, E-mail: bilgeyil@cu.edu.tr E-mail symposium: secretariat@citruscongressturkey.org Web: https://www.citruscongressturkey.org/
- December 15-18, 2022, Guangzhou (China): **IV International Orchid Symposium.** Info: Prof. Dr. Genfa Zhu, Enviromental Horticulture Research Inst., Guangdong Academy of Agricultural Sciences, No. 1 East Jinying Street 1, Wushan Road, Tianhe district, 510640 Guangzhou, China. E-mail: genfazhu@163.com Web: http://www.ios2022.cn/

## Year 2023

NEW
- January 22-26, 2023, Stellenbosch (South Africa): **XIV International Pear Symposium.** Info: Dr. Elke Crouch, University of Stellenbosch, Horticulture, Consumer Sciences Building, Private Bag X1, 7602 Matieland, South Africa. Phone: (27)218084763, Fax: (27)218082121, E-mail: elke@sun.ac.za or Prof. Karen I. Theron, Department of Horticulture, University of Stellenbosch, Private Bag X1, Matieland 7602, South Africa. Phone: (27)218084762, Fax: (27)218082121, E-mail: kit@sun.ac.za E-mail symposium: info@pearsymposium2023.co.za Web: https://pearsymposium2023.co.za/

NEW
- January 29 - February 2, 2023, Stellenbosch (South Africa): **X International Symposium on Irrigation of Horticultural Crops.** Info: Prof. Stephanie Midgley, Research and Technology Development Service, Western Cape Department of Agriculture, Private Bag X1, Elsenburg, 7607, South Africa. Phone: (27)218085080, E-mail: stephanie.midgley@westerncape.gov.za or Dr. Carlos Poblete-Echeverría, Stellenbosch University, Department of Viticulture and Oenology, Faculty of AgriSciences, SAGWRI, Matieland 7602, South Africa. Phone: (27)218082747, E-mail: cpe@sun.ac.za or Dr. Nicolette Taylor, Dept Plant Production and Soil Science, University of Pretoria, Private Bag X20, 0028 Gauteng Hatfield, South Africa. Phone: (27)124203666, Fax: (27)124204120, E-mail: nicolette.taylor@up.ac.za Web: https://ishsirrigationsa2023.com

NEW
- April 18-21, 2023, Molfetta (Italy): **XI International Symposium on Artichoke, Cardoon and their Wild Relatives.** Info: Prof. Giancarlo Colelli, Dip. DAFNE Università di Foggia, Via Napoli 25, 71100 Foggia, Italy. Phone: (39) 320 4394535, E-mail: giancarlo.colelli@unifg.it or Prof. Antonio Elia, Dip. DAFNE - University of Foggia, via Napoli, 25, 71122, Foggia, Italy. Phone: (39)0881589237, E-mail: antonio.elia@unifg.it E-mail symposium: info@artichoke2023.org Web: http://artichoke2023.org

NEW
- April 24-27, 2023, Murcia (Spain): **III International Symposium on Beverage Crops.** Info: Rocio Gil Muñoz, Avda Ntra Sra de la Asunción N24, 30520 Jumilla, Spain. E-mail: mariar.gil2@carm.es or Prof. Dr. Encarna Gómez-Plaza, Universidad de Murcia, Fac. Veterinaria, Dep. Tecnología Alimentos, Campus Espinardo, 30071 Murcia Murcia, Spain. Phone: (34) 868887323, E-mail: encarna.gomez@um.es or Prof. Dr. Cristina Garcia-Viguera, Phytochemistry and Healthy Foods Lab, Dept Food Science Technoloy CEBAS-CSIC, Campus Espinardo 25, Espinardo, 30100 Murcia, Spain. Phone: (34) 968396200, Fax: (32)9686213, E-mail: cgviguera@cebas.csic.es Web: https://www.bevcrops23.es/
- May 1-5, 2023, Uvero Alto, La Altagracia (Dominican Republic): **X International Pineapple Symposium.** Info: Mr. Joelin Santos, AsoproPimopla, C/ Altagracia 100, Monte Plata, Dominican Republic. Phone: (829)745-0318, E-mail: j.santos@asopropimopla.org E-mail symposium: xpineapple2020@gmail.com Web: http://www.cedaf.org.do/eventos/xpineapple2020/

NEW
- May 7-12, 2023, Davis, CA (United States of America): **VIII International Symposium on Almonds and Pistachios.** Info: Dr. Louise Ferguson, 2037 Wickson Hall, Plant Sciences Department Mail Stop II, UC Davis 1 Shields Ave. Davis CA 95616, United States of America. Phone: (1) 559 737 3061, Fax: (1) 530 752 8502, E-mail: lferguson@ucdavis.edu or Dr. Thomas M. Gradziel, Department of Pomology, University of California, 1 Shields Avenue, Davis, CA 95616-8683, United States of America. E-mail: tmgradziel@ucdavis.edu or Bruce Lampinen, Dept of Plant Sciences, University of California, 1 Shields Avenue, Davis, CA 95616, United States of America. E-mail: bdlampinen@ucdavis.edu Web: https://ucanr.edu/sites/Almond_Pistachio_2021/
- May 14-16, 2023, Wageningen (Netherlands): **XII International Symposium on Postharvest Quality of Ornamental Plants.** Info: Prof. Dr. Ernst J. Woltering, Wageningen UR, Food and Biobased research, PO Box 17, 6700 AA Wageningen, Netherlands. E-mail: ernst.woltering@wur.nl or Rob Schouten, Wageningen University, Horticulture and Product Physiology, Droevendaalsesteeg 1, 6708 PB Wageningen, Netherlands. E-mail: rob.schouten@wur.nl Web: https://www.wur.nl/en/show/Postharvest-Unlimited-Conference-Postharvest-Ornamentals-Symposium.htm
- May 14-18, 2023, Wageningen (Netherlands): **VII International Conference Postharvest Unlimited.** Info: Prof. Dr. Ernst J. Woltering, Wageningen UR, Food and Biobased research, PO Box 17, 6700 AA Wageningen, Netherlands. E-mail: ernst.woltering@wur.nl or Rob Schouten, Wageningen University, Horticulture and Product Physiology, Droevendaalsesteeg 1, 6708 PB Wageningen, Netherlands. E-mail: rob.schouten@wur.nl Web: https://www.wur.nl/en/show/Postharvest-Unlimited-Conference-Postharvest-Ornamentals-Symposium.htm

NEW
- May 21-25, 2023, Beijing (China): **IX International Cherry Symposium.** Info: Prof. Dr. Kaichun Zhang, Beijing Academy of Forestry & Pomology Sci., Jia 12, Ruiwangfen, Xiangshan Str, Haidian, Beijing, 100093, China. Phone: (86)1082596007, E-mail: kaichunzhang@126.com or Prof. Li Tianhong, No. 2 Old Summer Palace West Road, Haidian District, Beijing, China. E-mail: lith@cau.edu.cn or Assoc. Prof. Guohua Yan, Jia 12, Xiangshanruiwangfen, Beijing, China. E-mail: bigjohn6524@hotmail.com E-mail symposium: cherrysymposium9@126.com Web: http://2021.cherries.org.cn/

NEW
- June 6-8, 2023, Almeria (Spain): **X International Symposium on Soil and Substrate Disinfestation.** Info: Dr. Miguel de Cara, IFAPA-Centro La Mojonera, Camino San Nicolás, 1, 04745. La Mojonera, Almería, Spain. Phone: (34)671532026, Fax:

(34)950558055, E-mail: franciscom.cara@juntadeandalucia.es Web: http://sdalmeria2023.com

NEW ■ June 11-15, 2023, Quebec City (Canada): **I International Symposium on Growing Media, Compost Utilization and Substrate Analysis for Soilless Cultivation.** Info: Prof. Dr. Jean Caron, Dep Soil Sciences and Ag Engineering, Université Laval, Pavillon Envirotron, 2480 Boul Hochelaga, Quebec, QC G1V 0A6, Canada. Phone: (1)4186562131, Fax: (1)4186563723, E-mail: jean.caron@fsaa.ulaval.ca or Prof. Dr. Jacynthe Dessureault-Rompré, 2480 boul Hochelaga, Quebec, Canada. E-mail: jacynthe.dessureault-rompre@fsaa.ulaval.ca Web: http://www.re3-quebec.org/en

NEW ■ June 11-14, 2023, Potsdam (Germany): **VII International Symposium on Applications of Modelling as an Innovative Technology in the Horticultural Supply Chain - Model-IT 2023.** Info: Dr. Pramod Mahajan, Leibniz-Institut für Agrartechnik und Bioökonomie e.V. (ATB),, Max-Eyth-Allee 100, D-14469 Potsdam, Germany. E-mail: pmahajan@atb-potsdam.de or Dr. Martin Geyer, Inst. for Agricultural Eng. and Bioeconomy, Dept. Horticultural Engineering, Max-Eyth-Allee 100, D-14469 Potsdam, Germany. Phone: (49)3315699610, Fax: (49)3315699849, E-mail: mgeyer@atb-potsdam.de or Dr. Manuela Zude-Sasse, Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB), Max-Eyth-Allee 100, 14469 Potsdam-Bornim, Germany. Phone: (49)3315699612, Fax: (49)3315699849, E-mail: mzude@atb-potsdam.de E-mail symposium: model-it2023@atb-potsdam.deWeb:https://model-it2023.atb-potsdam.de

NEW ■ June 12-18, 2023, Zhengzhou, Henan (China): **VII International Symposium on Cucurbits.** Info: Liu Wenge, Zhengzhou Fruit Research Institute, Chinese Academy of Agricultural Science, South of No.63 Middle School, Hanghai East, 450009 Zhengzhou, Henan Province, China. E-mail: lwgwm@163.com

NEW ■ June 12-16, 2023, Grenoble (France): **IX International Symposium on Walnut and Pecan.** Info: Dr. Fabrice Lheureux, CTIFL, 28, route des nebouts, 24130 Prigonrieux, France. Phone: (33)553580005, E-mail: fabrice.lheureux@ctifl.fr or Benoit Benjamin Villard, RAISONOIX, 1 Le Verger, 26730 Hostun, France. E-mail: mpouchard@senura.com or Ms. Eloïse Tranchand, Perrical, 46600 Creysse, France. E-mail: e.tranchand.creysse@orange.fr

■ June 13-15, 2023, Oslo (Norway): **IV International Symposium on Plant Cryopreservation.** Info: Dr. Dag-Ragnar Blystad, NIBIO - Norwegian Institute of Bioeconomy R, Division of Biotechnology and Plant Health, Høgskoleveien 7, No-1431 Ås, Norway. Phone: (47)90872588, E-mail: dag-ragnar.blystad@nibio.no Web: https://nibio.pameldingssystem.no/cryo-2023

NEW ■ June 18-21, 2023, Zagreb (Croatia): **V Balkan Symposium on Fruit Growing.** Info: Prof. Dr. Boris Duralija, University of Zagreb Faculty of Agriculture, Department of Pomology, Svetosimunska 25, 10 000 Zagreb, Croatia. Phone: (385)12393726, Fax: (385)12393630, E-mail: bduralija@agr.hr or Prof. Dr. Martina Skendrovic Babojelic, Faculty of Agriculture University of Zagreb, Department of Pomology, Svetosimunska 25, 10000 Zagreb, Croatia. Phone: (385)1 23 94 070, Fax: (385)1 23 93 630, E-mail: mskendrovic@agr.hr E-mail symposium: info@5bsfg.com Web: https://www.5bsfg.com/

■ June 26-29, 2023, Lugo (Spain): **VII International Chestnut Symposium.** Info: Prof. Santiago Pereira-Lorenzo, Universidad de Santiago de Compostela, Escola Politécnica Superior de Ingeniería, Avda. Benigno Ledo sn, 27002 Lugo (Galicia), Spain. Phone: (34)982823128, E-mail: santiago.pereira.lorenzo@usc.es E-mail symposium: ChestnutLugo23@gmail.com Web: http://chestnutsymposium.com/

■ June 26-28, 2023, Almería (Spain): **International Symposium on Models for Plant Growth, Environments, Farm Management in Orchards and Protected Cultivation.** Info: Prof. Dr. Francisco Domingo Molina Aiz, Universidad de Almería, CITE II-A, Despacho 1.07, Carretera Sacramento s/n, 04120 Almería, Spain. Phone: (34)950015449, Fax: (34)950015491, E-mail: fmolina@ual.es or Dr. Lorenzo Leon, IFAPA Centro "Alameda del Obispo", Avda. Menendez Pidal s/n, E-14004, Córdoba, Spain. Phone: (34)671532697, Fax: (34)957016043, E-mail: lorenzo.leon@juntadeandalucia.es E-mail symposium: horchimodel2021@ual.esWeb:http://www2.ual.es/horchimodel2021/

NEW ■ June 27 - July 1, 2023, Guangzhou (China): **VII International Symposium on Lychee, Longan and Other Sapindaceae Fruits.** Info: Prof. Dr. Xuming Mr. Huang, College of Horticulture, South China Agricultural University, Guangzhou 510642, China. Phone: (86)2085283086, Fax: (86)85282107, E-mail: huangxm@scau.edu.cn Web: https://yy.scau.edu.cn/7thLLsym/

■ July 2-5, 2023, Genoa (Italy): **XXVII International Eucarpia Symposium Section Ornamentals - From Nature to Culture: Breeding Ornamentals for Sustainability.** Info: Mauro Mariotti, DISTAV, University of Genoa, Corso Europa 26, 16132 Genova, Italy. Phone: (39)3538139, E-mail: m.mariotti@unige.it

■ July 3-7, 2023, Bari (Italy): **I International Symposium on Plant Propagation, Nursery Organization and Management for the Production of Certified Fruit Trees.** Info: Prof. Salvatore Camposeo, Università di Bari, Dipt. di Scienze Agro-Ambientali e Territor, Via Amendola 165/a, 70126 Bari, Italy. Phone: (39)0805442982, Fax: (39)0805442982, E-mail: salvatore.camposeo@uniba.it or Prof. Dr. Tiziano Caruso, Department of Agricultural & Forest Science, University of Palermo, Viale delle Scienze, Edificio 4 ingresso H, 90128 Palermo, Italy. Phone: (39) 09123861207, E-mail: tiziano.caruso@unipa.it or Prof. Vito Nicola Savino, University of Bari - Microbiologia Applic., Dip. Protezione delle Piante, Via Amendola 165a, 70126 Bari, Italy. Phone: (39)0805443069, Fax: (39)0805443608, E-mail: viton.savino@gmail.com E-mail symposium: info@certfruit2020.org Web: http://www.certfruit2020.org

■ July 10-14, 2023, Hangzhou, Zhejiang Province (China): **III International Symposium on Fruit Culture along Silk Road Countries.** Info: Prof. Dr. Yuanwen Teng, Dept. Of Hort., College of Agric.& Biotech., Zhejiang University, Zijingang Campus, Hangzhou 310058, China. Phone: (86)571-88982803, Fax: (86)571-88982803, E-mail: ywteng@zju.edu.cn or Prof. Dr. Zhen-Hai Han, Institute for Horticultural Plants, China Agricultural University, No. 2 Yuanmingyuanxilu, 100193 Beijing, China. Phone: (86)1062732467, Fax: (86)1062734391, E-mail: rschan@cau.edu.cn or Prof. Dr. Xingjiang Qi, No. 298 Desheng Middle Road, Hangzhou, China. Web: http://www.silkroad2021.org/

NEW ■ July 15-21, 2023, Portland, OR (United States of America): **XIII International Rubus and Ribes Symposium.** Info: Assoc. Prof. Lisa DeVetter, WSU, 16650 Washington 536, Mount Vernon, WA 98273, United States of America. E-mail: lisa.devetter@wsu.edu or Dr. David Bryla, USDA ARS, Horticultural Crops Research Unit, 3420 NW Orchard Ave, Corvallis, OR 97330, United States of America. Phone: (1)541-738-4094, Fax: (1)541-738-4025, E-mail: david.bryla@usda.gov Web: https://cvent.me/71bzGL

NEW ■ August 14-20, 2023, Weiyuan, Neijiang City, Sichuan Province (China): **VII International Symposium on Fig.** Info: Prof. Dr. Huiqin Ma, China Agricultural University, Yuan Ming Yuan Xi Lu No. 2, Beijing, China. E-mail: hqma@cau.edu.cn or Lei Sun, 42 Wenhua East Road, Jinan, 250014, Shandong Academy of Forestry Sciences, 250014 Jinan, China. Phone: (86)053188557776, E-mail: sun7776@163.com E-mail symposium: figsymposium2023@cau.edu.cn Web: http://www.fig2023.org.cn

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| 1341 | EUFRIN Fruit Thinning Working Group Symposium | 39 |
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