

A publication of the International Society for Horticultural Science

# Chronica Horticulturae



## Horticultural highlights

IHC2022: "Demandez le programme!" (Ask for the program!)

## Symposia and workshops

Protea Research • Reproductive Biology of Fruit Tree Species • Plant Bioregulators in Fruit Production • Pomegranate and Minor Mediterranean Fruits • Processing Tomato • *Vaccinium* • Grapevine Physiology and Biotechnology • UrbanFarm2022 – International Student Challenge

Volume 62

Number 2  
2022



IHC 2022  
ANGERS – FRANCE

# Chronica Horticulturae



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.



**Chronica Horticulturae**® Volume 62 – Number 2; June 2022;  
ISSN: 0578-039X (print), 2506-9772 (electronic).

Published quarterly by the International Society for Horticultural Science, Leuven, Belgium. Lay-out and printing by Drukkerij Graphius, Gent, Belgium. ISHS© 2022. All rights reserved. No part of this magazine may be reproduced and/or published in any form, photocopy, microfilm or any other means without written permission from the publisher. All previous issues are also available online at [www.ishs.org](http://www.ishs.org). Contact the ISHS Secretariat for details on full colour advertisements (1/1, 1/2, 1/4 page) and/or mailing list options.

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*Scripta Horticulturae* is a series from ISHS devoted to specific horticultural issues such as position papers, crop or technology monographs and special workshops or conferences.

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PubHort is a service of ISHS as part of its mission to promote and to encourage research in all branches of horticulture, and to efficiently transfer knowledge on a global scale. The PubHort platform aims to provide opportunities not only to ISHS publications but also to other important series of related societies and organizations. The ISHS and its partners welcome their members to use this valuable tool and invite others to share their commitment to our profession. The PubHort eLibrary portal contains over 78,000 downloadable full text scientific articles in pdf format, and includes The Horticulture Journal, Journal of the American Pomological Society, Journal of the International Society for Mushroom Science, Proceedings of the International Plant Propagators' Society, Journal of the Interamerican Society for Tropical Horticulture, etc.

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Cover photograph: City gardens at the base of the castle of Angers. Photo credit: Dorothee Mouraud/Destination Angers. See article p.17.



## > Effects of COVID-19

Yüksel Tüzel, President of ISHS



> Yüksel Tüzel

For the past three years, this pandemic has not only impacted our health, but also the environment, economy, education, and human psychology (Miyah et al., 2022). It also affected us as scientists in our personal and professional lives.

### What are the effects of the pandemic on scientists?

The COVID-19 pandemic has affected scientists and research globally to a great extent. This pandemic unquestionably shifted the focus of science towards areas such as epidemiology, public health, virology, immunology, pharmacology, and human behavioral research, which are directly related to COVID-19 (López-Vergès et al., 2021). The scientific community reacted immediately by releasing over 125,000 scientific articles related to COVID-19 within 10 months after the first confirmed case (Fraser et al., 2021). However, this high rate in publications was partially due to the weakened screening on publications because of attempts to get as much information published as possible on a previously unseen situation. On the other hand, scientific areas that are not directly associated with the pandemic have also been affected due to unavoidable physical and social restrictions and shutdowns. Shutdowns and travel bans caused the cancellation or postponement of scientific events, some of which were later realized virtually.

Myers et al. (2020) conducted a survey with scientists one month after the official declaration of COVID-19 and the data showed that time devoted to research had declined compared with different types of activities such as teaching, fundraising, and administration. This rate of decline in research activities was greatest in fields that relied on physical laboratories and time-sensitive experiments, e.g.,

biochemistry, cellular and molecular science, chemical engineering, education, agriculture and natural resources, with a reduction of 30-40%. Moreover, female scientists conducting experiments in the labs or fields and especially scientists with young children experienced a substantial decline in time devoted to research. A later survey conducted in January 2021 reported some recovery in the working hours (Gao et al., 2021). However, the pandemic did not only affect the working hours and access to labs, fields or experimental sites, but also the workforce and funding of research, especially of those not related to COVID-19 (López-Vergès et al., 2021). The reduced rates in new publications and new submissions were found to be relatively modest compared with the large negative change in new projects (Gao et al., 2021). No doubt, the impact of the pandemic on ongoing project timelines cannot be ignored. While all scientists have been impacted in many ways by the new conditions, scientists at their early career stage were more susceptible due to delays of their publications, insufficient funding, and limited opportunities, e.g., research awards, in-person networking interactions, exchange programs, travel grants, scientific events, post-doc positions (Termini and Traver, 2020). Furthermore, the COVID-19 pandemic also adversely affected the academic environment through limitations imposed on theoretical and practical courses, i.e., colleges and universities, resulting in the fulfillment of specified learning outcome targets for the graduates (Subramanya et al., 2020).

During these unprecedented times, digital platforms, i.e., video conferencing systems, gained importance for communication, cooperation and education. Most scientists, no matter where or at which career stage, are

now better acquainted with those platforms for different purposes such as communication with their supervisors/managers and research colleagues, e-learning (e-courses), webinars, and virtual symposia (Korbel and Stegle, 2020). It also brought the opportunity to be more efficient and inclusive regarding outreach and continuity.

### Importance of horticultural crops

The pandemic highlighted the importance of food security, but also the link between nutrition and health. Focus shifted towards fruit and vegetable consumption to boost the immune system, access to greenspaces, gardening, and horticultural therapy (Nicola, 2022).

The pandemic initiated additional discussions on food security at global level in terms of availability, accessibility, utilization and stability (Laborde et al., 2020). Food insecurity created significant problems in some regions or specifically on some disadvantaged groups, impacting their vulnerability, which was associated with diet quality where fruit and vegetable intake was at inadequate levels. The WHO/FAO recommended having at least 400 g of edible fruits and vegetables per day to prevent chronic diseases and to avoid and mitigate micronutrient deficiency. A healthy diet with adequate and appropriate nutrition supports the immune system, which could limit severe and long-term complications of COVID-19 (Moreb et al., 2021). Surveys conducted in Italy, Spain, Chile, Colombia, and Brazil during COVID-19 confinement showed the influence on the eating habits and modifications in fruit and vegetable consumption in adolescents aged 10 to 19 years (Ruiz-Roso et al., 2020).

In addition to the nutritional content and phytochemicals with therapeutic effects of horticultural crops, greenspaces such as parks and gardens gained importance as a lifeline during the pandemic (Egerer et al., 2022). They decreased the impacts of social isolation (Simard and Volicer, 2020). Lin et al. (2021) studied the relationship between the date of first-wave infection peaks and the date when online interest for gardening peaked in each of 39 countries, and they found that the pattern in gardening inter-

■ Table 1. Number of cancellations/postponements in scientific events of ISHS.

	Planned	Cancelled	Rescheduled	Organized as			Total
				Virtual	Hybrid	In person	
2019	29	4	0	0	0	25	25
2020	41	3	36	0	2	0	2
2021	47	1	18	23	5	0	28

est was strongly synchronized with the first-wave infection peaks of the COVID-19 pandemic. People also tried to provide and diversify their own food production, in backyards, balconies, indoor or rooftop gardens, in response to the disruption of the food supply chain during the pandemic. A survey conducted in Canada showed that more than half of the respondents grew at least one type of fruit or vegetable in a home garden (Mullins et al., 2021). Home gardening and urban horticulture can contribute to food security and will have a key role in the coming decades.

COVID 19 has revealed the fragilities of the current food production systems. The relationship between nature, pandemics, and climate has become more evident. Horticultural science may have a significant role during the recovery stage and in socio-economic transformations. The COVID-19 pandemic triggered a rethink regarding logistics, redesign of food systems, i.e., production, distribution, and the need to access safe and healthy food, and sustainable food supply chains. The discussion on the need to change the policy direction towards sustainability resulted in new policies and strategies on redesigning agri-food systems. For instance, the European Union launched (in December 2019) the European Green Deal to make food systems fair, healthy, and environmentally friendly, and with a target to make Europe “climate-neutral” (an economy with net-zero greenhouse gas emissions) by 2050. No doubt this will affect the policies and strategies of other countries. Also, in 2021, the UN Climate Change Conference (COP 26) brought countries together to accelerate action to respond to climate change. These international summits showed the importance of cooperation for developing local solutions, which requires input from scientists.

### The effects of the pandemic on ISHS

As a prominent scientific network, ISHS was impacted by the COVID-19 pandemic. ISHS symposia are the leading activities of our Society. The pandemic had a major effect on our meetings due to its physical and social restrictions, shutdowns and travel bans, which forced most of our pre-scheduled meetings to be rescheduled. In 2019, 25 symposia were held in person, and 4 symposia were cancelled, whereas the numbers of rescheduled symposia were 36 and 18 in 2020 and 2021, respectively (Table 1). The number of scientific paper submissions to the symposia were affected by the decline in working hours, shutdowns, and difficulties in research. ISHS used video conferencing/webinars as a communication tool. Mostly, the symposia/congresses were organized

■ Table 2. Manuscripts published in ISHS publications during the pandemic.

	<i>eJHS</i>	<i>Fruits</i>	<i>Chronica Horticulturae</i>
2019	42	30	16
2020	52	28	15
2021	70	33	13

■ Table 3. ISHS memberships during the last 3 years.

	Individual membership	Student membership	Total
2019	5522	330	5852
2020	4689	241	4930
2021	5494	562	6056

virtually. Board and Executive Committee meetings were also held virtually.

In total, 23 webinars/videos were produced in 2021 (<https://www.ishs.org/hortdialogues>) as an additional instrument for communication because in-person symposia were not an option. Subsequently, the total count of the combined views was more than 5,000 over the same period of time. This was an opportunity to widen our network, and further knowledge-transfer.

Regarding publications, the number of *Acta Horticulturae* was 37, 35 and 30 published in 2019, 2020 and 2021, respectively. The decreasing number of symposia held in 2020 influenced the number of issues. The change in the number of manuscript submissions to *eJHS* was similar to the pre-pandemic period. Even the number of submissions and published manuscripts was higher for *eJHS* in 2021 than in previous years, while the submissions to *Fruits* declined in 2020 and 2021, although without affecting the number of manuscripts published (Table 2). There was little difference in terms of the number of articles submitted to *Chronica Horticulturae*. However, all ISHS publications were published on time, with no delays due to the impact of COVID-19.

As expected, COVID-19 affected our membership, particularly because a proportion of membership is driven by attendance at symposia. The total number of members declined 15.8% in 2020 compared with 2019, while the decrease was 27.3% in student memberships (Table 3). However, the increasing number of members in 2021, particularly by students, is encouraging.

Despite the negative impacts of the COVID-19 pandemic, ISHS contributed actively to the action plan of the International Year of Fruits & Vegetables in 2021. This topic will not be limited with activities in a year, but it will continue to keep its importance and be a tool towards reaching the UN Sustainable Development Goals.

When we experience difficulties in our lives, we think that time passes slowly. However, time flies despite this mental construct. As a matter of fact, four years have passed since the XXX International Horticultural Congress in Istanbul in 2018, when we started working as the new elected Board Members. During this period, everyone had difficult times; all of us felt our freedom was lost and did not see our loved ones for long periods of time. Many people lost relatives, friends, and colleagues. We also commemorate the losses in the ISHS community. Their contributions to the field of horticulture will always be remembered.

### The future

The World Health Organization expects that the pandemic will switch into an endemic phase in 2022, due to medical advancement, e.g., vaccines, medication, and the milder effects of the omicron variant on health (Kharas, 2022). However, the after-effects of the pandemic will last longer and shape science, technology, innovations, and networking. We should be aware that many things will permanently change when returning to routine after the restrictions.

Science, technology, innovations, and networking will continue to play critical roles in constructing more sustainable, inclusive, and resilient futures. Science should be an effective and fundamental part of decision-making, not just a tool that provides a solution when there is a challenge like COVID-19.

We should not forget that we reach our resilient future targets by supporting and sharing sustainable solutions at local, regional, and global levels in a participatory approach. With its global network, ISHS will continue to be effective in encompassing science and channeling different experiences to the end-users at a world-wide level.

Despite the odds, our scientific activities, such as symposia, workshops, congresses,

trainings, and publications, will continue to be significant platforms to disseminate our research findings, for knowledge transfer, networking and further collaborations. Our scientific events are crucial for young minds

to introduce themselves and to present their research findings to a broader group. We look forward to the IHC2022 to provide a platform for us to meet in person again. Current registration numbers show that this will happen.

ISHS, including the Board, the headquarters, and the entire membership network, will take the changes triggered by COVID-19 as an opportunity to promote even more horticulture and horticultural science. ●

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## > Invitation to the membership

Join the ISHS General Assembly

**IHC2022, Angers, France**

**Thursday, 18 August 2022, 1 pm-3 pm**



Spotlight  
on Honoured  
ISHS Members

# > Yves Desjardins

## Position or previous position

Full professor, two terms ISHS Board Member responsible for publications

## ISHS honour

ISHS Honorary Member

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

I was born in Montreal but grew up in Quebec City and lived there for most of my life. This is where I completed the most part of my university studies, namely a BSc in Agriculture (plant science), and a Ph.D. in plant biology. I have always been involved in sports like ice hockey, baseball, softball, golf, but prefer badminton, and sailing. I learned to sail on a Flying Dutchmen dinghy (an old Olympic class) and I have owned many boats since then from a small Laser dinghy to an F18 Capricorn catamaran.

Having four boys, that I got at a relatively young age (starting at 23), I have been involved with them in community sports like soccer, speed skating, tennis, and many others, sometimes as a daddy coach, but most of the time as a taxi driver following them all over the province.

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

Some may say that I was destined to become a horticulturist. I do not believe in serendipity and always found some aptonyms funny, but in hindsight, my name Desjardins meaning "gardens" in French, may after all mean something. My maternal grandfather and uncle were both professional agronomists. I vividly recall my uncle Jacques Rioux, who was a Québec Ministry of Agriculture's extension horticulturist speaking with passion of his profession. My interest in horticulture certainly stems from the discussions I had with him.

I had two interests when I came to enroll at university, philosophy and biology. I was accepted at both the University of Montreal in philosophy and at Laval University in agriculture. I married early (at 20) and knew I would have to earn a living for a family sooner or later. I thus chose Agriculture as a career. I enrolled at Laval University for its reputation and also its history, being one of the oldest agriculture schools in North Amer-

ica. Laval University agriculture program was and is still recognized for its strong science curriculum, but I soon learned that the department of plant science only had three horticulture professors. Moreover, the aggies cohorts were very large at the end of the 70s (the tail of the babyboom), with more than 250 students in the freshman classes. While the prospects of having a job at the end of my university training were good, I felt that I needed to broaden my horizons and try something that would distinguish myself from the rest of my student colleagues. Because my interests were focused on fruit and vegetable production, I decided to leave Laval University after two years of basic training and enrolled at Guelph University in Ontario. For me, this move was a game changer and opened many opportunities. The Department of Horticulture at Guelph was much bigger than that at Laval (this is not the case anymore...), with about 15 professors in the different specializations of horticulture. Most interestingly, the students enrolled in the program were coming from different parts of Canada, North America, and the world.

Apart from learning English, a positive outcome of my studies in Guelph is that I developed my portfolio of contacts, many of which I have kept and cultivated since then. I gained much experience while working on the "Cambridge" university farm, where I got acquainted to many different crops, but most

importantly where my interest in research bloomed. I was then working for the late Dr. Herm Tiessen, who accepted me in his asparagus breeding program. I became specialized in the crop and I took part in the different tasks revolving around the breeding program. We identified parents with a very good general combining ability and had to prepare seedbeds to provide seeds for Canadian growers. Tissue culture was becoming an important biotechnology (it is not considered a biotech anymore) and asparagus tissue culture was one of the high-tech alternatives to propagate the crop rapidly, especially to establish seedbeds. I thus accepted to undertake a master's degree to tackle a recurrent problem with asparagus tissue culture, the very poor rooting on the in vitro plantlets. Interestingly, being part of the asparagus breeding program enabled me to personally get to know the different breeders from all over the world, from California to New Jersey, from Italy to France, and from Taiwan to New Zealand. I recall being invited to act as a translator for Dr. Tiessen while he was discussing licensing with French nursery growers and breeders (Darbone) and having a good time drinking good wines. I was further invited to visit the Darbone asparagus nursery in Blois and the French INRA breeding program at Versailles. This was an eye-opener, and I knew then that the career I had chosen would be exciting and would allow me to travel around the world.



> Newspaper title of the 2<sup>nd</sup> prize won in the Moët-Hennessy contest in 1987. On the picture, André Gosselin (left) and Yves (right) when he still had hair...



> Yves on the soccer pitch with the kids (2009). He was a great coach!!

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

One of the great advantages of being a university professor is the academic liberty you have and the possibility to modify your research program with the evolution of your career. I cherish this liberty and certainly took advantage of it, changing my area of research a few times. My original training in tissue culture and the topic of my Ph.D. thesis, dealing with the physiology of acclimatization of tissue culture plantlets and the transition from heterotrophy to photoautotrophy, oriented my early years in research. I worked as a research professional at the newly established Greenhouse Specialization Center at Laval University, while pursuing my Ph.D. The success of a professional career obviously depends on the intensity of your work, but it also depends on the serendipitous encounters you make with guiding people and mentors. My mentor at Laval University was Dr. André Gosselin. For those who knew André, he was a very dynamic researcher who launched the greenhouse industry in the province of Québec and in Canada. André had great leadership qualities and surrounded himself with many young scientists like me. We worked hard together founding the Horticulture Research Center (HRC) and making it one of the most successful centres in the field in Canada. On my side, I continued working on strawberry plant tissue culture and characterizing the early development of photosynthetic capacity of young plantlets during the acclimatization phase. We particularly showed that the medium sucrose was inhibiting the activity of RuBisCo and in conjunction with nitrogen was stimulating an anaplerotic route of CO<sub>2</sub> fixation, involved in stress protection. This area of work enabled me to undertake a number of fruitful collaborations in many countries like Belgium (Drs. P. Debergh and P. Boxus), Japan (Dr. T. Kozai) and Mexico (Dr. J. Santamaria).

At the turn of the millennium, I was nominated director of the HRC collaborating with 20 professors and about 100 graduate students. At the same time, I got involved in the creation of the Institute of Nutrition and Functional Food (INAF) at Laval University. This was another turn in my career. Through a collaboration with Dr. Sharokh Khanisazeh, strawberry breeder at Agriculture Canada, we characterized a newly introduced strawberry cultivar with exceptional postharvest qualities and white mold resistance. This cultivar, further named 'Authentique Orleans' was accumulating 30% more procyanidins and ellagic acid, two components recognized for their antimicrobial activity, but also for their health properties. At the time, the research community was interested in the antioxidant activity of these compounds, which was correlated to many health benefits like anti-inflammatory, anti-obesity, type-2 diabetes protection, and many others. This innovative finding was my introduction to the fascinating topic of health effects of polyphenols. Using my biochemistry and chemistry background, I started a phytochemical analysis laboratory at INAF. Through the years, I got associated with many research projects as a PI dealing with health properties of polyphenols. For example, as co-PI of the Neurophenol research consortium, funded by three Canadian and two French companies, we developed a proprietary blueberry and grape seed polyphenolic extract to prevent cognitive decline of elderly people. This project included in vitro assays, animal preclinical trials and a human clinical trial to assess the effect of the extract on memory in cognitively impaired elderly people. Using innovative targeted metabolomic methods (PMID 24628392), we developed a well-characterized extract to be produced by the companies. We studied the bioavailability of the extract in mice and demonstrat-

ed the synergistic effect of the blueberry and grape seed polyphenols on absorption (PMID 27443888). Through animal studies, we were able to demonstrate that the extract improved cognitive and neuronal function of aging mice (PMID 29854398; 27662290). These results were corroborated in a large human clinical trial with 200 subjects in both France and Quebec, which showed a remarkable improvement in cognitive age and episodic memory of the elderly (PMID 30032176). These astonishing results led to the development of three supplement formulations marketed under the names Neurophenol, Memophenol and Cerebelle. The consortium was awarded an innovation prize in France, as a notable example of industry-university collaboration (Laval University and University of Bordeaux) with important spin-offs.

Another interesting project I was involved in was the Glucophenol project studying the effect of berry extracts to improve insulin resistance in metabolic syndrome subjects. We carried a large-scale parallel, double-blind, controlled, and randomized clinical trial with this strawberry and cranberry polyphenolic extract to show that it improved the insulin sensitivity in insulin-resistant, non-diabetic adults (PMID 28290272). This paper had a good scientific impact with Altmetric High Attention Score in the 98<sup>th</sup> higher percentile. Glucophenol™ is now a commercial supplement sold worldwide to control hyperglycemia for people suffering from metabolic syndrome. Recently, I became involved, as PI, in a new project called Gastrophenol to study how polyphenols affect the gut microbiota and its impact on metabolic health. Feeding mice an obesogenic diet supplemented with a cranberry extract, we showed that it prevented weight gain. Strikingly, the microbiota of the extract-supplemented mice were enriched with the bacteria *Akkermansia muciniphila*, a bacterium shown to prevent low-grade inflammation and obesity. The paper stemming from this research (PMID 25080446) has become seminal, cited more than 800 times in the last six years, with a Field Citation Ratio of 181; it is in the 5% most cited papers in Altmetrics. These results on mice were transposed to humans in a large clinical trial at INAF. This research thematic largely contributed to the growth and reputation of our research multidisciplinary group. Since then, we have shown that the cranberry polyphenols extract not only prevents metabolic disorders, but also cures hepatic steatosis in obese mice (PMID 29107524). We were able to identify bacterial consortia associated to this remarkable effect; this enabled us to propose a work model of the effect of polyphenols on the gut-host interaction in a review paper published in Gut Microbes (PMID 26900906). In two recent papers published in high-im-



> Yves speaking at the VII International Strawberry Symposium in Beijing in 2012. He made a successful bid to host the 8<sup>th</sup> symposium in Quebec City.

pact journals, we were able to show that a high molecular weight polyphenol polymeric fraction was responsible for the important modulatory effect on the gut microbiota and stimulated the production of mucin, the ecological niche of *A. muciniphila* (PMID 32041991) in the gut, and that the beneficial effect of the polyphenols was gut microbiota dependent, as fecal transplants reproduced the metabolic outcome (PMID 32228321). Over the last six years, I have published over 42 research papers (h-index: 45). I have led many important interdisciplinary projects with colleagues from INAF and abroad. These contributions led to many invitations (40+) to present results at international conferences. Many of the research projects I have led have had important spin-offs and many derived products have been marketed by the partnering companies. Through this success, I recently obtained an important NSERC industrial chair (Diana Food) (PhenoBio<sup>®</sup>) to study the prebiotic effect of fruit and vegetables polyphenols on the gut microbiota.

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

I am quite proud of the first research paper I published on improvement of in vitro rooting of asparagus plantlets, published in *HortScience* in 1986. This research altogether has enabled the efficient and rapid propagation of seed fields and has allowed for the introduction of a new cultivar for Canada called 'Guelph Millenium'. This was the first introduced cultivar from the breeding program and it provided the industry with a new high-yielding cultivar that changed the profitability of the Canadian asparagus industry. I have a feeling of accomplishment when I think that this small piece of research was instrumental in improving the livelihood of many asparagus growers.

However, I consider my latest research on the role of polyphenols on the gut microbiota and the ensuing health effects one of my greatest scientific achievements. It is very stimulating knowing that your research is at the forefront of knowledge and that you are advancing in a very competitive environment and making significant advancements to the field. Through this work, we were able to secure important equipment grants to establish a well-equipped metabolomics laboratory (e.g., one UPLC-IMS-QToF MS and one UPLC-Fusion Orbitrap MS) as well as a full in vitro artificial gut model to study the interaction between dietary ingredients like polyphenols and the microbiota.

I am also very proud of my participation in ISHS activities. As I will explain below, I felt a great accomplishment organizing IHC2002 in Toronto. Moreover, I also felt great satisfaction organizing the first International Symposium on Human Health Effects of Fruits and Vegetables (FAVHEALTH) in 2005 in Quebec City, which has become an ISHS symposium series still taking place nowadays. It felt great to see the ISHS Board and Council recognize the importance of this topic with the creation of the Fruits and Vegetables and Health Commission. I am also very proud of my two terms as ISHS Board member in charge of publications. I was somewhat reluctant to replace Dr. Jules Janick in this position, but I think we have built on his legacy and improved the quality of each of the Society's publications. Among other things, I think I contributed to improving the quality of *Acta Horticulturae* both in terms of editorial style, but also in terms of submission facility and tracking of the papers using ROSA (Responsive Online System for *Acta Horticulturae* submission and review). This was a huge task for the Society, but I received strong support from then ISHS President António Monteiro and the staff at the Secretariat.

On a personal basis, I am very proud of having maintained a healthy and balanced lifestyle throughout my career, thanks to my wife, having four wonderful sons, and now seven grandchildren. When I see them all, it gives me a real and true sense of achievement.

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

University politics can sometimes (often) be a burden, especially when you want to change inherent ways of doing. I am grateful to the former director of the Guelph Department of Horticulture, Dr. Ib Nonnecke, who instructed us to read the *Micrographia academica; Being a Guide for the Young University Politician*, written in 1908 (<https://www.cs.kent.ac.uk/people/staff/iau/cornford/cornford.html>). This has been an inspiration to understand humankind and university management. One thing I learned since is to avoid working with toxic people and to only associate with those you have pleasure being with. This is the way to have a happy and long career. I must say that I have tackled a lot of large projects with many people I enjoyed working with. This is the case of my colleagues at HRC and INAF, and the many collaborations I have entertained over the last 35 years. I particularly cherish the work I did with my ISHS colleagues, and in particular with the ISHS staff on the many challenges we undertook.

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

I guess you must recognize an opportunity when one passes by and take it. That's what I did in 1986, when I saw one day, by chance, a contest organized by Moët-Hennessy, the company, famously known for its champagne. I was then in the second year of my Ph.D. and had a few results on my project on CO<sub>2</sub> enrichment and photosynthesis of tissue culture. So, one afternoon while having lunch, I took 15 minutes to fill in the application form and sent it. Then, about eight months after submitting my project (I had completely forgotten that I had participated), I received a phone call from my vice-rectorate informing me that they had received a Belinograph, the ancestor of FAX machines, at their offices. The secretary started reading, somewhat nervously, over the phone the content: "Mr. Desjardins, Moët-Hennessy is proud to announce that your abstract has been selected by the review committee and that you are winning one of the 5 second prizes to the contest, "Plant Culture Innovation". You are invited to come and claim your prize of 20,000 French francs (then about



5000 CANS), which will be handed to you in Monaco from the hands of Prince Albert in the grand hall of l'Hôtel de Paris. All expenses for travel will be covered by the Company". You can understand that I was flabbergasted by this news. Well, I still have vivid memories of this one-of-a-kind, extravagant event attended by almost 1000 delegates where champagne was generously flowing. This prize enabled me to make a down payment on my first house...

**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 vividly recall my first participation to a scientific meeting, the joint ASHS/CSHS meeting in Vancouver in 1984. I then joined ASHS for some time and participated in the joint ASHS/IHC meeting in Davis, California, in 1986. This was my first encounter with ISHS, and it was a revelation to me. I became a solid member of our Society from that point on and participated in all IHC events ever since.

As I said earlier, your success in a professional career often depends on some key people that serendipitously stand on your path. In my case, through a series of circumstances, one very influential person was on my path and changed my whole life; Dr. Norm Looney. Norm was a visionary and a great human being. I recall when he phoned my former Ph.D. supervisor and then director of the Plant Science Department, André Gosselin, inquiring about his willingness to join the organization committee of IHC2002 in Toronto. At the time, André was not able to get involved and he kindly suggested my name to volunteer for the task (he twisted my arm for my participation). After some discussions



> Yves with his family 5 years ago.

with Norm, it became clear that we shared many interests, one of which was the passion for horticulture and the uniqueness of the International Horticultural Congress. It was a great honor to be responsible for the scientific program task force of the Congress. Right from the start, we made some important changes to the IHC scientific structure, asking the different ISHS Section and Commission chairs to become an integral part in the organization of the event, instead of having only a local organization waiting for submissions to organize the program. I think this approach contributed to the success of the Toronto Congress with its highly focused 22 symposia. The congress structure became a model for the other congresses to follow.

I then continued my involvement with the Society, creating the Fruits and Vegetables and Health Commission and was eventually elected by the Council to a position on the Board of the Society.

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

One suggestion that I constantly give my students is to be curious. There is always something you can read and apply to your research or your own personal development. Horticulture science is an applied science but an applied science does not mean it is second-level science. Making a significant contribution to your field requires dedication, hard work and understanding of basic principles. It also necessitates having an open mind ready to dig deeper to comprehensively understand all aspects of a topic. Do not follow recipes, rather question yourself about all the steps of a procedure. And, as Steve Jobs once said, it is important to be conscious that the journey is the reward...

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

Horticulture is an integrative science and we now have powerful tools to tackle the complexity of living entities, using big data, artificial intelligence, and "omics." It is essential to use these new techniques and knowledge to cope with the many challenges posed to humankind. The first one is feeding the population in a sustainable way. Understanding the complexity of ecosystems and the services they provide is a new science that must be applied by horticulturists. 🌱



> Participants to the ISHS Council meeting organized by Yves Desjardins in Quebec City in 2016, under the auspices of the General Charles de Gaulle.

# > 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](http://www.ishs.org/young-minds-award).

## Fruit transpirational water loss in blueberry is affected by stem scar size and cuticular waxes



> Yifan Yan

Yifan Yan is a PhD student in Wine Research Centre at the University of British Columbia, Canada, and is supervised by Dr. Simone Castellarin. Her research project focuses on blueberry quality, and particularly on aspects related to berry water loss during postharvest and berry pigmentation. North America is the largest producer of blueberries. British Columbia (BC) produces more than 95% of the highbush blueberries in Canada. In the past two decades, the main breeding targets for blueberries have shifted from increas-

ing yield only to both increasing yield and improving quality. Yan's research is conducted in collaboration with the BC Blueberry Council and has the final goal to support the selection of new genotypes of enhanced fruit quality for the fresh market.

The three major objectives of Yan's research are i) to determine the role of cuticular waxes and the stem scar on blueberry dehydration during postharvest; ii) to assess the role of cuticular waxes in determining blueberry fruit surface color in addition to the presence of anthocyanins; iii) to understand the hormonal regulation of blueberry wax deposition and identify the major genes controlling the wax profiles. Three independent experiments were conducted to achieve these objectives. This report presents the first experiment which was published as a full manuscript entitled "Blueberry water loss is related to both cuticular wax composition and stem scar size".

Postharvest fruit dehydration is a major concern for blueberry breeders and growers. It accelerates fruit softening and results in a great loss of marketability. Fruit dehydration occurs through at least two pathways in mature blueberries – the cuticle and the stem scar. Yan's study determined that the

cuticle contributes more than the stem scar to the overall blueberry dehydration. The chemical composition of the cuticular waxes is critical in influencing fruit dehydration. A higher level of the triterpene acid oleanolic acid is associated with a lower dehydration rate, while a higher level of wax esters is associated with a higher dehydration rate. Within the same variety, fruits with a smaller stem scar size have a lower dehydration rate, but this relationship is not found when comparing across varieties, suggesting a potential role of other physiological aspects (e.g., the permeability of the stem scar to water) in fruit dehydration.

Yifan Yan won the ISHS Young Minds Award for the best oral presentation at the XII International *Vaccinium* Symposium, which was held virtually in Canada in August 2021.

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## Confirming identity of blueberry cultivars with a microsatellite fingerprinting set



> Ozgecan Yalcin

Ozgecan Yalcin is a Master's student in the Department of Horticulture at Oregon State University in Corvallis, Oregon, USA, under the supervision of her academic advisors, Dr. Nahla Bassil, and Dr. Claire Luby. She is conducting her studies in the United States Department of Agriculture (USDA)-Agricultural Research Service (ARS)-National Clonal Germplasm Repository (NCGR) in Corvallis, Oregon, USA. One of the projects she has been working on for her master's thesis is "Confirming identity of blueberry cultivars with a microsatellite fingerprinting set."

The USDA-ARS-NCGR in Corvallis Oregon preserves genetic resources of fruit and nut crops. The NCGR is a part of the U.S. National Plant Germplasm System (NPGS), which is

a collaborative effort by public and private organizations to protect the genetic diversity of plants, and aims to acquire, conserve, evaluate, document, and distribute crop germplasm. The NCGR maintains more than 1,800 *Vaccinium* L. accessions represented by 83 *Vaccinium* taxa from 34 countries. The ability to confirm the genotypic identity of the blueberry cultivars in the NCGR is crucial to genebank management. Previously, a 10-SSR fingerprinting set of tri-nucleotide-containing-SSRs in blueberry was developed and utilized together with parentage analysis to confirm identity in 297 plants representing 143 unique accessions from the collection. Four categories of plants were observed: true-to-type (TTT), where morphology, SSR

markers, and parentage analysis agreed; identity ok (IDOK), where a unique genotype was produced in multiple plants from different sources but parentage analysis was incomplete; identity question (IDQ), where allele composition did not match parentage and more testing is needed to confirm identity; and identity wrong (IDX), where incorrect identity is confirmed by parentage analysis and replacement with TTT is required. The objectives of this study were to confirm the identity of accessions in the IDOK (7) and IDQ (13) categories, replace accessions in the IDX

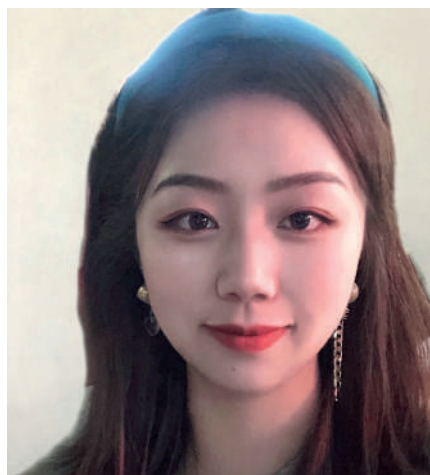
(2) category with TTT genotypes, and create baseline fingerprints for the remaining cultivated blueberries (53) in the collection. Leaf samples from each of the cultivars in the IDOK, IDQ and IDX categories were obtained from multiple sources such as breeders and nurseries and were genotyped with this fingerprinting set. Parentage analysis using TTT parents or offspring was able to confirm the identities of some of these cultivars. This study enables a protocol that can ensure clonal identity of the blueberry cultivars in the NCGR collection.

Ozgecan Yalcin won the ISHS Young Minds Award for the best poster presentation at the XII International *Vaccinium* Symposium, which was held virtually in Canada in August 2021.

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## Construction of yeast cDNA library and screening of TTM3 interaction protein in jujube fruit



> Zhao Zixuan

Zhao Zixuan is a graduate student in fruit tree science at the school of horticulture, Hebei Agricultural University, China. Her research provides an effective material

database and basis for studying the molecular mechanism of jujube fruit development regulation. She constructed a cDNA library of jujube fruit yeast. Jujube fruit is rich in nutrients and contains a variety of bioactive substances such as cyclic adenosine monophosphate (cAMP), polysaccharide and vitamin C. The construction of a jujube fruit yeast cDNA library is important. The jujube genome data show that the expression of the TTM3 gene may be related to the efficient synthesis of cAMP in jujube fruit. The yeast cDNA library using pGADT7 as a vector was constructed by gateway technology. The proteins interacting with TTM3 were screened by a yeast two-hybrid. The library quality test results showed that the library capacity was about  $1.44 \times 10^7$  CFU, the recombination rate was 96%, and the average length of the inserted cDNA fragment was more than 1 kb. The library was of high quality and met the requirements of yeast hybridization test. The

pGBKT7-PHYL1 decoy plasmid was constructed and transferred into Y2HGold yeast cells after no self-activation activity was detected. Seven proteins interacting with TTM3 were screened by yeast two-hybrid verification. The construction of the library has important scientific significance for the study of jujube fruit development, and the regulation mechanism of fruit nutrients.

Zhao Zixuan won the ISHS Young Minds Award for the best poster presentation at the V International Jujube Symposium in China in September 2021.

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## Esca complex grapevine trunk disease leads to cell wall changes in asymptomatic berries



> Helena Santos

My PhD research work focuses on changes in grape (*Vitis vinifera*) berries upon fungal infection. Many fungi, such as *Botrytis cinerea*, *Erysiphe necator*, and Esca complex trunk disease, cause major economic damage for the viticulture economy and wine production industries. Different species of pathogens utilize diverse approaches for infection, leading to specific alterations in the affected host. In addition, diverse cultivars have different levels of susceptibility to these pathogens. During my research, I explored changes

regarding the metabolisms of volatiles and the cell wall. Using metabolic profiling techniques, such as gas-chromatography or comprehensive microarray polymer profiling, I sought to establish a putative model of the role of the cell wall during infection. I will correlate my model with the susceptibility/tolerance level of different cultivars. The metabolic data will be supported by transcriptomic data, using techniques such as RNA sequencing and real time PCR. Together, this data will provide a model of host-pathogen interactions under different scenarios. To study *B. cinerea* infection, two Portuguese cultivars were selected: 'Trincadeira' (highly susceptible) and 'Syrah' (tolerant). The infection was followed from green to ripe grapes, with 'Trincadeira' exhibiting heavy symptoms of infections already at the green stage. For *E. necator*, the susceptible cultivar 'Carignan' was selected at the green and the veraison developmental stages, when the pathogen had a preference for chlorophyll rich tissues. For the Esca analysis, the grapes were collected from vines with symptomatic and asymptomatic "tiger-stripe" leaves. An overall analysis of cell wall polymers in the three circumstances showed different cell wall alterations, with *B. cinerea* leading

to pectin degradation and extensin accumulation. *E. necator* caused callose deposition, and Esca reduced rhamnogalacturonan I arabinan branches, as well as increased glucose monomers. This development needs further study to understand the complex interactions.

The wine sector has a growing need to understand these diseases and cultivar resilience to implement environmentally sustainable strategies and reduce the use of dangerous pesticides.

Helena Santos won the ISHS Young Minds Award for the best poster presentation at the XI International Symposium on Grapevine Physiology and Biotechnology, which was held virtually in South Africa in October-November 2021.

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## First report of Amazon lily mosaic virus infecting amaryllis in Taiwan



> Chian-Chi Lin

Chian-Chi Lin is an undergraduate student of the Department of Medical Laboratory Science and Biotechnology, Asia University, Wufeng, Taichung, Taiwan. Her research is addressed to identify a new virus affecting amaryllis (*Hippeastrum hybridum* Hort.), which is a perennial bulbous plant belonging to the *Amaryllidaceae* family very popular as garden flower in Taiwan. The ornamental value of amaryllis plants can be greatly

affected by several viruses. In Taiwan, *Capsicum chlorosis virus* (CaCV), *Cucumber mosaic virus* (CMV), *Hippeastrum mosaic virus* (HiMV) and *Nerine latent virus* (NeLV) have been already shown to infect amaryllis. In April 2011, we observed amaryllis showing chlorotic ringspots at a private garden in Changhua County, central Taiwan. The virus was obtained by single lesion isolation on *Chenopodium quinoa* leaves. Filamentous virus particles of about 1000 nm long were examined in the crude sap of symptomatic plant tissue by transmission electron microscopy. Total RNA was extracted from the virus-infected *C. quinoa* leaves as a template to build a cDNA library using random primers. The Illumina MiSeq sequencing system was used to obtain the genomic sequences of the virus. Sequence reads were *de novo* assembled to generate contigs and then were subjected to BLAST searches against the non-redundant protein database of NCBI for annotation. A 9377 nt contig consisting of a putative open reading frame of a potyviral polyprotein was obtained. It shares 95.5% nt identity and 96.5% aa identity with the partial genome sequence of *Amazon lily mosaic*

*virus* (ALiMV) (NC\_043137.1). The complete genome sequence of the virus was clarified by rapid amplification of cDNA ends. Genome sequence analysis indicated that the amaryllis virus is a distinct potyvirus ALiMV. To our knowledge, this is the first report on ALiMV infecting amaryllis in Taiwan.

Chian-Chi Lin won the ISHS Young Minds Award for the best poster presentation at the XV International Symposium on Virus Diseases of Ornamental Plants, which was held virtually in USA and Singapore in December 2021.

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## Plants & polyester: suitable plants for a textile based living wall system



> Maren Stollberg

Increasingly, people want to enjoy the advantages of living in a city with the many cultural offerings and recreational opportunities. In addition, work tends to be close to home, and stores and other activities also remain within a short distance. To enjoy these benefits, people have up until now accepted living in a tiny area. Their houses have been small flats, without a garden, park, or forest nearby for relaxation or exercise. In addition, city dwellers exist in a highly populated

environment and need infrastructure, including reasonable living space and transport. Dense and numerous buildings, and packed streets without green areas can make a city unattractive.

The consequences of dense cities and climate change result in many problems including the urban heat island effect. These issues could be mitigated by including more natural areas within city boundaries (the urban green infrastructure). At the same time, that these green areas could provide cooling, the city could become more attractive again, with more comfortable living areas near nature. One approach is to use living walls to integrate vegetation into our cities. Living walls are a system for growing vegetation vertically and, therefore, use previously unused space of facades and walls. The plants on these walls do not need a specific connection to the ground, because the plants grow directly into the wall.

These green walls include sources of growing media or substrate for the plants they contain. The objective of this study was to test a new kind of living wall system built from polyester. The research focused on the suitability of plants to survive using the poly-

ester living wall system. We analysed the development of 30 different perennials and seedlings over the course of three years. We built field experiments with walls exposed to the north, south, east, and west. The data showed which plants were well suited for living walls in a temperate oceanic climate, and plotted differences as their visual appearance developed throughout the seasons. With these findings, we will plan a more pleasant liveable, green city for the future! Maren Stollberg won the ISHS Young Minds Award for the best oral presentation at the VIII International Conference on Landscape and Urban Horticulture, which was held virtually in Italy in December 2021.

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## Effects of indoor LED light on secondary metabolites biosynthesis in medicinal and aromatic plants, edible flowers, and microgreens



> Elisa Appolloni

Elisa Appolloni is a PhD student at the University of Bologna, at the Department of Agro-Food Sciences and Technologies (DISTAL), Italy. Her research interests cover numerous topics in the field of urban agriculture, including soilless cultivation systems, application of artificial LED light for plants cultivation, vertical and indoor farming, building-in-

tegrated agriculture, and rooftop agriculture. Under the supervision of Prof. Francesco Orsini, she is focusing her PhD research topic on the effects of supplementary LED light on greenhouse-grown truss-tomato, cultivated with soilless systems. The objectives of her research were to evaluate several aspects related not only to the physiological and vegetative response of the plant, but also to the yield, nutritional value and commercial quality of the product. It also investigated post-harvest characteristics and shelf-life. Beside her PhD topic, she is conducting complementary research focused on the application of artificial LED light for indoor cultivation of high valuable plants. In collaboration with her research group, she developed a database compiling the most recent literature on the effects of LED light on the biosynthesis of secondary metabolites in medicinal plants, aromatics, edible flowers and microgreens. The database included the characteristics of each applied light treatment (e.g., intensity, spectrum, photoperiod), dividing them by each plant category and secondary metab-

olite typology. Based on the results, each light treatment was assigned a 1 to 3 score, to identify the best combination to enhance secondary metabolites according to plant species. The on-line database represents a useful tool for producers to identify the best light combination to increase the secondary metabolites for economically valuable crops. Elisa Appolloni won the ISHS Young Minds Award for the best poster presentation at the VIII International Conference on Landscape and Urban Horticulture, which was held virtually in Italy in December 2021.

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## Effect of leguminous green manure crops on white cabbage in organic vegetable production in southwestern Germany



› Sophie Stein

Vegetables require high amounts of nitrogen (N) and rather low amounts of phosphorus (P). Therefore, fertilization with farmyard manure often results in nutrient imbalances, commonly seen in P oversupply. Leguminous green manures increase the nutrient supply of the successive vegetable crop by the mineralization of the residues and the exclusive N input into the soil by biological N<sub>2</sub> fixation. This may reduce the need for organic fertilizers in vegetable production and contribute

to more balanced nutrient flows. In field trials in 2019 and 2020, different green manures were tested in southwestern Germany. In the preceding October, the winter-hardy cover crops rye (*Secale cereale*), a mixture of rye with Hungarian vetch (*Vicia pannonica*), winter pea (*Pisum sativum*) and winter field bean (*Vicia faba*) were sown. Bare soil served as the control treatment. After incorporation of the green manures in late May, white cabbage was planted and harvested in October. The green manures influenced cabbage yield due to differences in mineralization rates of crop biomass as indicated by N flows as measured by green manure biomass, chlorophyll status of cabbage leaves, and soil mineral N content (N<sub>min</sub>). The N content of incorporated biomass was higher in peas and field beans (156 and 195 kg N ha<sup>-1</sup>, respectively) than in rye (97 kg) and the mixture of rye with vetch (131 kg). The carbon:nitrogen ratio in the pure legume stands was significantly lower. The chlorophyll status during cabbage head formation as well as the soil N<sub>min</sub> levels at the time of cabbage planting and onset of head formation was significantly lower in the rye and rye with vetch treatments compared to pea and field bean treatments. This resulted in higher

cabbage yields for the pure legume treatments compared to bare soil and the cereal treatments of rye and rye with vetch. Therefore, cultivating legumes as green manure crops during winter is an effective approach to increase yields of subsequent vegetable crops, increase internal N cycling and reduce surplus P. Leguminous green manures can compensate for fertilizers such as farmyard manure or compost in organic farming. Sophie Stein won the ISHS Young Minds Award for the best oral presentation at the III International Organic Fruit Symposium and I International Organic Vegetable Symposium, which was held virtually in Italy in December 2021.

### › Contact

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## Impact of sulphur, a plant protection agent in organic apple production, on nutrient and heavy metal mobility in the soil



› Birgit Lepp

Sulphur (S) is a widely used plant protection agent (mainly against apple scab) in organic apple production in temperate regions. Current attempts of reducing the use of copper (Cu) to avoid heavy metal accumulation in the soil lead to an increased application of S. In Germany, the amounts of S range from 30 to 90 kg ha<sup>-1</sup> year<sup>-1</sup> in intensive, organic apple production systems. S is washed into the soil

through rainfall events and is transformed to sulphate by bacteria (*Thiobacillus*), which promotes soil acidification and thus increases the availability and mobility of nutrients and heavy metals.

The aim of the project was to analyse the effect of S on soil-chemical changes and the leaching of nutrients and pollutants. A pot trial was conducted from November 2019 until May 2020, simulating long term S-input and leaching. Five top soils from two German fruit growing regions (Lake Constance and Altes Land near Hamburg) with differing cultivation history and differing history of S, Cu and nutrient application were chosen. Every five weeks, S was applied (as H<sub>2</sub>SO<sub>4</sub>) in three levels in order to simulate annual S input of 0, 40 and 80 kg ha<sup>-1</sup>, followed by a leaching event after two weeks. This was repeated six times during the 7 months of the trial. Nutrient and heavy metal content (N, P, K, Ca, Mg, S, Cu, Zn) were analysed in soil and eluate. S input decreased soil pH and leached K, Ca, Mg and S. Its severity varied depending on the soil type, being highest in the soil with low pH and lowest Ca content, in combi-

nation with lowest clay and highest sand content, indicating a low cation exchange capacity. S input showed no clear effect on Cu and Zn leaching.

Depending on the soil, high S input poses a risk for nutrient supply of the apple trees if not compensated by liming and fertilization in the long-term.

Birgit Lepp won the ISHS Young Minds Award for the best poster presentation at the III International Organic Fruit Symposium and I International Organic Vegetable Symposium, which was held virtually in Italy in December 2021.

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## Reducing losses due to rotting on fresh tomatoes using SO<sub>2</sub>



> Chanel K. Daniel-Swartland

Tomatoes are a popular horticultural commodity prone to quick postharvest deterioration. In the absence of cold storage and postharvest fungicides to prevent spoilage, other means to preserve the shelf life of fresh tomatoes is sought. Reducing decay and extending the shelf life of such a popular and easily accessible food crop will decrease food waste. For this reason, Chanel Daniel-Swartland, a PhD candidate at Stellenbosch University Plant Pathology Department and Lead Research Scientist on the tomato project at Tessara (Pty) Ltd, is looking at methods to reduce postharvest rot on tomatoes using sulphur dioxide. Thus far, research conducted on 'Round' and 'Roma' tomatoes has shown promise in reducing rotting for up to 21 days in cold storage and subsequent shelf life. The use of SO<sub>2</sub> reduced postharvest rots on 'Roma' tomatoes by more than 50%. Rot on 'Round' tomatoes was reduced less than 50% compared to the control group. This provided valuable insight that varietal differences may require a varietal-dependent solution. The application of SO<sub>2</sub> did not negatively affect the firmness or taste profile of either variety of tomato used in the trial. Some drawbacks in the form of SO<sub>2</sub> damage was noted, but a varietal response was apparent. In trials thus far, 'Round' tomatoes were observed to be more susceptible to SO<sub>2</sub> damage than were 'Roma' tomatoes. The damage was primarily centered around the stem scar, which is known to be an entry wound for opportunistic pathogens. One action of the SO<sub>2</sub> was to seal off that area from infection, but the

SO<sub>2</sub> damage caused thinning of the skin, or pitting, and in severe cases made the tomato unmarketable. Research is ongoing and will continue to examine aspects of reducing SO<sub>2</sub> damage, varietal responses, and suitable applications within the industry. Chanel Daniel-Swartland won the ISHS Young Minds Award for the best oral presentation at the V International Symposium on Pomegranate and Minor Mediterranean Fruits in South Africa in February 2022.

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Chanel Daniel-Swartland won the ISHS Young Minds Award for the best oral presentation at the V International Symposium on Pomegranate and Minor Mediterranean Fruits in South Africa in February 2022.

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## Jasmonate signaling and regulation of anthocyanin biosynthesis in fruits: searching for key targets of MYC2 in strawberry



> Paz E. Zúñiga

Paz E. Zúñiga is a candidate for Dr.Sc. in Plant Biology and Biotechnology in the Laboratory of Plant Molecular Physiology (LFMV) of the Institute of Biological Sciences at the University of Talca, Chile, under the supervision of Prof. Dr. Carlos R. Figueroa. They are currently interested in studying the transcriptional regulation of anthocyanin biosynthesis on strawberry (*Fragaria × ananassa*) fruit. Strawberries are a great source of flavonoids, such as anthocyanins, which can protect plants against stress due to their antioxidant properties. However, little is known about upstream regulatory genes controlling anthocyanin biosynthesis. Paz's research focused on the role of MYC2, a core transcription factor (TF) of most aspects of the jasmonate (JA) signaling pathway in plants, in the biosynthesis regulation of anthocyanins in strawberries. In this study, the strawberry MYC2 gene was cloned and overexpressed on degreening strawberry fruit through *Agrobacterium*-mediated transformation. This experiment aimed to evaluate the effect of MYC2 overexpression on anthocyanin content and its impact on the transcription of essential genes for anthocyanin biosynthesis in strawberries. She found that transformed fruit showed a higher anthocyanin content and an increase in redness after eight days. Also, genes related to JA signaling and biosynthesis of abscisic acid (ABA) and anthocyanins were upregulated. Among these genes, some new targets of MYC2 related to ABA biosynthesis were found. The new findings of this study suggest that MYC2 could be a relevant upstream positive regulator for anthocyanin biosynthesis in strawberry fruit. This work was possible thanks to the invaluable support of my laboratory colleagues. It is an honor to be awarded for this work.

Paz E. Zúñiga won the ISHS Young Minds Award for the best poster presentation at the XIV International Symposium on Plant Bioregulators in Fruit Production, which was held virtually in Italy in February 2022. Her work is financed through the National Research and Development Agency (ANID, Chile) – Doctoral Scholarship/2020-1201520, FONDECYT/Regular 1210941, and Millennium Science Initiative Program - NCN2021\_010.

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## Phenological studies of *Protea cynaroides* (L.) 'Arctic Ice' following a synchronising winter pruning regime



> Naomi Hattingh

Over the past decade, South Africa has seen an increase in the plantings of *Protea cynaroides* as an export cut flower. Producers rely on superior cultivars, such as *P. cynaroides* (L.) 'Arctic Ice', to secure the desired returns. The production volumes of 'Arctic Ice' have more than tripled over the past three years. Current cropping distribution for 'Arctic Ice' is restricted to two peak periods in the southern hemisphere; April-May and October-November, with low productivity outside these main harvesting seasons. Our research

aimed to evaluate synchronising pruning techniques within a biennial bearing system of 'Arctic Ice' to create a consistent year-round supply of flowers. We observed the vegetative and reproductive phenological events following pruning of 'Arctic Ice' in the Western Cape region of South Africa and compared results from 2017-2019. Unpruned control plants were managed according to current commercial practices within an annual bearing system. We reported the data generated from bi-weekly tracking of shoot flushing patterns, increases in shoot diameter and number of flushes, as well as documented the flowering times obtained from harvest data. Our results showed that defined periods of active growth, similar to the control, persisted in shoots from pruned plants. Inflorescences were produced 21-27 months after winter pruning, but only on shoots that achieved a minimum number of flushes and attained a sufficient stem diameter. Synchronised plants resulted in increased production volumes per season, yet most flowering remained clustered within the two commercial harvest peaks similar to that observed for control plants. The flowering outcomes, as well as the estimated time (days) from prune to harvest (DPH), was

established using vegetative shoot characteristics as predictor variables. We determined that thorough characterisation of shoot regrowth from prune to harvest, locality specific inferences, and shoot phenology can aid in the understanding and management of commercial 'Arctic Ice' production systems to extend product availability. Naomi Hattingh completed her MSc research project at Stellenbosch University, South Africa, under the supervision of Dr. Lynn Hoffman, Dr. Eugenie-Lien Louw and Mrs. Caroline O'Brien. This project investigated regrowth and flowering behaviour in Ayoba® 'Arctic Ice' and the manipulation of flowering time through various horticultural techniques. Naomi Hattingh won the ISHS Young Minds Award for the best oral presentation at the XIV International Protea Research Symposium in the Canary Islands (Spain) in March 2022.

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# > IHC2022: “Demandez le programme!” (Ask for the program!)



François Laurens, Emmanuel Geoffriau, Rémi Kahane,  
Emmanuelle Rousseau, Valérie Mathieu-Fichot and Mickaël Delaire

## A congress at the source of the Anjou ecosystem dedicated to plants

Plant life is an inherent and vital part of Angers' identity. In a region accounting for more than 25,000 related jobs, the city of Angers is undoubtedly the horticultural capital of France (Figure 1). No other city in France has the same historic, cultural and economic identity! Angers is remarkable due to its abundance of plants and great diversity: from the traditional to the innovative, from the urban to the natural.

First, the optimal temperate oceanic climate for plant growth and the presence of good quality water and soil have provided the ideal range for a broad diversity of plant life. Emblematic characters mark the history of Anjou and have favoured it as a horticultural centre.

In the 13<sup>th</sup> century, the gardeners of the castles were already breeding plants. In the 15<sup>th</sup> century, King René introduced improved plants such as the 'Rose de Provins' or the apricot tree in Anjou. In the 19<sup>th</sup> century, peddler-florists of Oisans (in the French Alps) resettled as horticulturists in Anjou. Gaston Allard created the arboretum. André Leroy opened the biggest nursery in Europe. In the early 1960s, Edgard Pisani, a great reforming Minister of Agriculture, launched the development of the Authion valley (to the east of Angers) into a French "Little Holland."

Angers is the first green city in France, with 14% of its surface as green space, so that every inhabitant has a green space within 500 m of their home. There is a great diversity in the urban landscapes of the region. Cultivated plant landscapes are dedicated to the production of crops and the living environment. Natural plant landscapes include exceptional natural areas such as: Basses Vallées Angevines, Basses Brosses, Ardoisières, as well as gardens and landscapes along the Loire River.

When you arrive for the IHC2022, make sure to visit some of the parks and castles that are present throughout the city. Take advantage

of the technical tours to meet the historical and internationally known horticultural companies of the region.

## Internationalisation of institutions and organisations to become an academic leader in Europe

A dedicated ecosystem has been organized beginning in the 1970s. This system includes the development of higher education and research, collaborations between research centres and companies, business events, networks, and business tourism.

Angers is home to a number of internationally-reputed institutions and organisations, such as Vegepolys Valley, the international plant cluster that federates 500 members, research centres such as the National Research Institute for Agriculture, Food and Environment (INRAE), the Centre for International Cooperation in Agricultural Research

for Development (CIRAD), various plant institutes and education centres such as L'Institut Agro, the University of Angers, the College of Agriculture of Angers (ESA), the Graduate School of International Agro-Development (ISTOM), and up to 350 companies, including the Community Plant Variety Office (CPVO), which manages the European Union system of plant variety rights covering the 27 Member States. Key international events such as Sival (one of the main trade shows in France to present a comprehensive and impressive offering of equipment and services for all horticulture productions), the "Salon du Végétal" (professional plant trade exhibition) or the Loire Valley Wine Trade Fair, make Angers a pivotal meetup for anybody working in the plant sector. With 25 courses and 2,500 students, Angers offers one of the widest choice of plant science training in France, and leads the way in Europe for academic opportunities in this field.

## Must-see address booklet

- Heritage visits: to explore the cultural influence of Anjou at the Château d'Angers, the Palais du Tau, the Musée des Beaux-Arts, the Collégiale Saint-Martin, the Cathedral Saint-Martin, the Galerie David d'Angers, and to discover its green walks, there is only one reliable address: the tourist office and its official guides, 7 place Kennedy, 49000 Angers. [www.tourisme.destination-angers.com](http://www.tourisme.destination-angers.com)
- The House of Adam, also known as the House of Adam and Eve or of the Tree of Life (Figure 2), is a half-timbered house located in the heart of the city of Angers, at the crossroads of Rue Montault and Place Sainte-Croix, just behind the cathedral. It is one of the architectural testimonies of the medieval heritage still existing today, since it was built around 1491. Today it houses the "Maison des artisans d'Angers," where more than 80 craftsmen and designers offer their creations, with thousands of gift ideas to choose from. [www.maison-artisans.com](http://www.maison-artisans.com)
- "Escapades Ligériennes:" immediate boarding on traditional flat-bottomed boats that ply the largest river in France! Guided tours from 1 to 3 hours, with breakfast, aperitif or unusual night service. <https://escapadesligeriennes.fr/>
- La Réserve: on the rooftop of the theater Le Quai, the slates review trendy recipes, facing Angers castle. [www.lareserveangers.fr](http://www.lareserveangers.fr)
- "Aux Jeunes Pousses:" with Clément Paillard in the kitchen, a chef who trained with the greats, the new gourmet sensation in Angers is raising the bar for regional gastronomy. [www.auxjeunespousses.fr](http://www.auxjeunespousses.fr)

■ Table 1. Synthetic scientific programme of IHC2022.

Schedule		Monday 15 August		Tuesday 16 August		Wednesday 17 August		Thursday 18 August		Friday 19 August	
		10:30-12:30	15:30-17:30	10:30-12:30	15:30-17:30	8:30-10:00	10:30-12:30	10:30-12:30	15:30-17:30	10:30-12:30	15:30-17:30
<b>SYMPOSIA</b>											
S1	Breeding and Effective Use of Biotechnology and Molecular Tools in Horticultural Crops										
S2	Conservation and Sustainable Use of Horticultural Genetic Resources										
S3	Quality Seeds and Transplants for Horticultural Crops and Restorative Species										
S4	In Vitro Technology and Micro-propagated Plants										
S5	Innovations in Ornamentals: from Breeding to Market										
S6	Innovative Technologies and Production Strategies for Sustainable Controlled Environment Horticulture										
S7	II International Symposium on Greener Cities: Improving Ecosystem Services in a Climate-Changing World (GreenCities2022)										
S8	Advances in Vertical Farming										
S9	Urban Horticulture for Sustainable Food Security (UrbanFood2022)										
S10	Value Adding and Innovation Management in the Horticultural Sector										
S11	Adaptation of Horticultural Plants to Abiotic Stresses										
S12	Water: a Worldwide Challenge for Horticulture!										
S13	Plant Nutrition, Fertilization, Soil Management										
S14	Sustainable Control of Pests and Diseases										
S15	Agroecology and System Approach for Sustainable and Resilient Horticultural Production										
S16	Innovative Perennial Crops Management										
S17	Integrative Approaches to Product Quality in Fruits and Vegetables										
S18	III International Symposium on Mechanization, Precision Horticulture, and Robotics: Precision and Digital Horticulture in Field Environments										
S19	Advances in Berry Crops										
S20	The Vitivinicultural Sector: Which Tools to Face Current Challenges?										
S21	XII International Symposium on Banana: Celebrating Banana Organic Production										
S22	Natural Colorants from Plants										
S23	Postharvest Technologies to Reduce Food Losses										
S24	IX International Symposium on Human Health Effects of Fruits and Vegetables - FAVHEALTH2022										
S25	Medicinal and Aromatic Plants: Domestication, Breeding, Cultivation and New Perspectives										



■ Figure 1. Angers, French capital of horticulture. Garden of the castle. ©Destination Angers

During IHC2022, the technical tours on Wednesday afternoon will allow participants to get acquainted with this large intertwined agro-ecosystem, as examples:

- The “Campus du végétal” in Angers (presentation of research and innovative work ranging from genes to sustainable cropping systems and environment);
- Technical Institutes of fruit and vegetables (CTIFL), flowers and plants (ASTREDHOR), medicinal plants (ITEIPMAI);
- Seed companies such as Vilmorin-Mikado, tree variety breeding and development companies such as International Fruit Obtention (IFO-Fruit), horticultural nurseries such as Hortival or Dalival, organic crop companies, etc.;
- Horticultural training centres on the theme of agroecology.

The intention of this scientific congress is to be open to experimental research and to the business sector to promote knowledge transfer and exchanges based on the principle of competitiveness clusters such as Vegepolys Valley. As Mrs. Séverine Darsonville, President of Vegepolys Valley, points out, “This event is a unique opportunity for companies to exchange and debate on innovation with the global scientific community.”

Specialized plants are more than ever at the heart of food and well-being issues. The ways of producing, selling and consuming are changing. This congress will enable everyone to orient their strategies.

To make the congress more accessible to professionals, i) some sessions will be highlighted with translation into French on demand, ii) a preparation tool to challenge the scientists that allows the sharing of individual or

collective problems will share recommendations for sessions and personalized appointments, and iii) an app will be available to attendees, with agenda preparation and appointment bookings.

Three price offers have been created and adapted to professional attendees’ situations, including learning expeditions, one of which is on the theme of “agriculture and plants in the city.” For more information: [www.ihc2022.org/you-are-a-professional/](http://www.ihc2022.org/you-are-a-professional/)

### What is special in the IHC2022?

The scientific programme of the congress is composed of 25 symposia (Table 1). Each integrates oral communications and e-posters

in alternation, giving a higher exposure for the poster authors. The e-posters will also be accessible online so that delegates can get in touch with their authors. In addition to the rich scientific interactions during symposia and workshops, IHC2022 is a great opportunity to bring scientists and non-research professionals, as well as teachers and trainers from different disciplines of vocational or higher education, from various organizations and from different countries and cultures together. For instance, a “Pedagogical Innovations” workshop is organized to highlight and share pedagogical innovations in training and academic courses with a specific call for contributions ([www.ihc2022.org/w10-what-pedagogical-innovations-in-horticulture-and-landscape-training/](http://www.ihc2022.org/w10-what-pedagogical-innovations-in-horticulture-and-landscape-training/)). Including the civil society in the agrifood sustainability equation is another challenge of the 14 workshops of the congress. For example, the following question will be moderated by the French Agency for research and information on fruit and vegetables (Aprifel) on disseminating the scientific knowledge to the society: what balance should be struck when deciding between accuracy and simplification of research results? ([www.ihc2022.org/scientific-program/workshops/w13-dissemination-of-scientific-knowledge-to-the-society-balance-between-accuracy-and-simplification/](http://www.ihc2022.org/scientific-program/workshops/w13-dissemination-of-scientific-knowledge-to-the-society-balance-between-accuracy-and-simplification/)).

While the scientific programme of IHC2022 is dense and diverse, encouraging interactions between disciplines, delegate origins and generations, the social programme is equally rich and exciting. Besides the quintessential wine tastings and botanical discoveries (city botanic garden, castle botanic garden, Terra



■ Figure 2. The House of Adam or of the Tree of Life, in the heart of Angers (<http://aigle44.a.i.pic.centerblog.net/5b4b6120.JPG>).

## Terra Botanica

Located on the edge of Angers, it is the first theme park in Europe dedicated to plant life. With 11 hectares of gardens, water features and greenhouses, 275,000 plants, some 40 new attractions and entertainment features added in 2021 (4D films, interactive games, crossing a bamboo forest, ascending into the tree tops). Terra Botanica offers a whole new approach to the world of plants, taking the visitors on an amazing journey of fun and learning. Surrounded by flowers and rare and exotic species of trees, you will experience the amazing times of the explorers that brought back new plants and shrubs from all around the world. Terra Botanica is a trailblazing park, designed in a spirit of respect for the environment, of preservation and of transmission to future generations of our exceptional natural heritage. [www.terraborotanica.fr](http://www.terraborotanica.fr)



■ Figure 3. Terra Botanica, plant thematic parks and gardens of Angers. ©Terra Botanica

Botanica tremendous park (Figure 3)), the opening ceremony and cocktail party will open a week of outdoor evenings with entertainment and a gala dinner with a music concert in an exceptional setting.

The city of Angers decided to set up its town centre at IHC clock time since it is hosting the congress in two sites 200-m distant, the Congress Centre and the University of Angers. Most of the accommodation and catering places are at walking distance, through streets and squares specially greened and flowered by the landscaping services of Angers, technical schools, and professionals associated with local urbanists (Figure 4).



■ Figure 4. Container gardening project in the city of Angers.

## National opening and international outreach

Although the congress is taking place in Angers, the indisputable French capital of horticulture, all French regions including French territories overseas, are rich in horticultural production. The south of France has a strong touristic reputation, made of history, culture, climate and landscape, and horticulture is involved in almost all of them. This is why two post-congress tours have been set up and proposed to the participants, one centered in Avignon, and the other in Montpellier. Included in Mediterranean horticulture, grapes and wines will be a major emphasis in the field and in cellar visits. The role that innovation is now playing in France to keep high quality in the fruit, vegetable, and aromatic plant industries will be emphasized.

This focus on regional horticulture is without question linked to the international outreach of French horticultural teams, whether based in Angers, Montpellier, French West Indies or La Réunion. Horticulture is worldwide, diverse and sensitive to any changes of the environment; the reason why the scientific and professional horticultural community has to be connected and aware of all experiences and progress made here or there, in various disciplines, and in different places. The opening ceremony as well as the plenary sessions will present international visionaries as keynote speakers, not necessarily experts in horticulture, but with a strong vision and interesting message to share together on one of the global challenges and key topics of the congress: agroecological transition, climate change, sustainable value chains and health and nutrition.

President Ameenah Gurib-Fakim (Mauritius), Prof. Rachel Bezner Kerr (USA), Dr. Yvonne Pinto (UK), and Prof. Jennie Macdiarmid (UK) are among the prominent female characters from Africa, America, and Europe. French keynote speakers are also called to the stage such as Mrs. Christiane Lambert (Committee of Professional Agricultural Organisations - General Confederation of Agricultural Cooperatives, COPA-COGECA), Prof. Jean Jouzel (Intergovernmental Panel on Climate Change, GIEC/IPCC) and Mr. Jérôme Leroy (My Digital Farm).

Shortly after them, recently promoted PhD, in a competition, will give a new inspiration on the same topics during a 3-minute presentation of the results and impacts of their thesis work. Following a national selection according to scientific excellency, an international jury constituted of 12 renowned field professionals from all continents will decide on those to compete in Angers. In addition to the international panel, the plenary audience will have the chance to vote for each candidate, and three prizes will be awarded during the closing ceremony, hand delivered by Agropolis Foundation, the French Society of Horticulture (SNHF) and the French Alliance of education and research for agriculture, food, environment and global health (Agreenium).

More on the international outreach of IHC2022, the participation of FAO is scheduled in several activities, as co-convenor, moderator of a workshop, present on a stand in the exhibition hall and guest speaker during the opening ceremony.

**Welcome to the Congress!**

## > About the authors



> François Laurens

François Laurens, Agronomist (PhD), INRAE, Research Institute on Horticulture and Seeds (IRHS, Angers, France), chairs the IHC2022 Executive Committee. As a geneticist, he has bred disease resistant apple varieties. He has led many international research projects (FP7 Fruit Breedomics, Climate-Kic Friendly fruit, H2020 Invite) and he co-leads the French Fruits Scientific Interest Group ([www.gis-fruits.org](http://www.gis-fruits.org)). E-mail: [francois.laurens@inrae.fr](mailto:francois.laurens@inrae.fr)



> Emmanuel Geoffriau

Emmanuel Geoffriau is Professor in genetic diversity and agronomy of vegetable crops at L'Institut Agro and researcher at the Research Institute of Horticulture and Seeds, Angers, France. His research deals with genetic diversity, management of genetic resources and genetic determinism combined with environment adaptation of quality traits. He is a French representative to the ISHS Council and Chair of ISHS Working Group Carrot and other *Apiaceae*. He is Vice-President of IHC2022, Chair of the Scientific Committee. E-mail: [Emmanuel.Geoffriau@agrocampus-ouest.fr](mailto:Emmanuel.Geoffriau@agrocampus-ouest.fr)



> Rémi Kahane

Rémi Kahane has been in charge of horticultural research for development at CIRAD in Montpellier, France, since 2002. He was an onion breeder for a farmers' cooperative in France for 15 years, and the Executive Secretary of the Global Horticulture Initiative from 2006 to 2013. He is Vice-President of IHC2022, Chair of the International Committee, and co-organizer of the international 3MHT competition of the congress. E-mail: [remi.kahane@cirad.fr](mailto:remi.kahane@cirad.fr)



> Emmanuelle Rousseau

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# › XIV International Protea Research Symposium and XIX International Protea Association Conference

Division Ornamental Plants

Division Plant Genetic Resources and Biotechnology

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The XIV International Protea Research Symposium and the XIX International Protea Association Conference were held from 13 to 18 March 2022 in La Palma and Tenerife, Canary Islands, Spain. The event was organized by the ASOCAN (Association of Producers and Exporters of Flowers and Plants of the Canaries) and subsidized by the Councils of La Palma and Tenerife Islands and the Canary Islands government, through PROEX-CA (Canarian Society for Economic Development, S.A.). About 50 participants, including students from nine countries, took part in the symposium and conference. The first part of the event, the IPA Conference, took place in La Palma, from 13 to 16 March, with visits to the protea farms in the north, east, and west of the island and to the flower packaging of the Proteas de La Palma cooperative. Two technical workshops were also held, the first entitled “Crop Management in the Production Areas,” and the second entitled “New Cultivars and Marketing.” During this time, there was a very important exchange of technical knowledge about cultivation, between growers, technicians, and researchers.

On the afternoon of 16 March, the participants traveled to Tenerife, where the next morning they visited a protea farm in the north of the island. In the afternoon, the XIV International Protea Research Symposium began, which was structured in six sessions dedicated to: Propagation, Breeding, Crop management: nutrition and irrigation, Crop management: pruning, flowering and production, Postharvest, and Plant protection. Therefore, the main objective of this symposium was to update the scientific knowledge for scientists working in protea cultivation. Sixteen oral communications and nine posters were presented.

The opening keynote lecture was presented by Prof. Juan F. Pérez-Francés from the Department of Botany, Ecology and Plant Physiology, University of La Laguna, Tenerife, Canary Islands, Spain, who made a journey through the history of the micropropagation of proteas, and the problems that researchers have encountered during the process, highlighting the research done in his laboratory on using forced solutions as a pre-treatment of mother plants, as well as

the work that has been done on axillary or terminal buds proliferation methods. Likewise, he presented the preliminary results concerning the addition of macronutrients that the leaves contain in the period of maximum growth to the culture medium, and the ultrastructural changes of plantlets during transfer from in vitro to ex vitro environment. Prof. Kenneth W. Leonhardt from the Department of Tropical Plant and Soil Sciences, University of Hawaii at Manoa, Hawaii, USA, discussed the protea breeding program at the University of Hawaii, which includes the development of *Leucospermum* hybrids with improved horticultural characteristics such as desirable floral, foliar, and plant structural characteristics; earliness to flower; an extended flowering season; long, slender, straight stems; slender leaves; reduced leaf and stem pubescence. Tolerance of root and foliar fungal diseases is an important objective, as well as the selection of hybrids for coastal areas. The third session dedicated to Nutrition and Irrigation had as keynote speaker Dr. Avner Silber from the Institute of Soil, Water and Environmental Sciences,



› Dr. Margherita Beruto (right) presenting the ISHS medal award to the symposium convener, Dr. Juan A. Rodríguez Pérez (left).



› Naomi Hattingh (right) receiving the ISHS Young Minds Award for her oral presentation from Dr. Margherita Beruto (left).

Israel, who discussed the role of P in plant development and the role of proteoid roots, typical of proteas, to mobilize organic P so that it can be used by protea plants. Dr. D.G. Malan from Fynflor, South Africa, was the keynote speaker for the fourth session. He spoke online for health reasons and discussed pruning cut-flower protea. The objective of pruning is to distribute the growth of the plant to the correct number of shoots, to optimize saleable length flower stem production. A sound knowledge of the plant's natural requirements and ability at a given age, in a given climate, with predictable agricultural practice and market requirements, is thus essential before pruning can be done to target the required yield. E.W. Hoffman from the University of Queensland, Australia, discussed in the fifth session the proteas postharvest, describing the different factors that affect the life of the cut flowers, as well as the physiological postharvest disorders (chilling injury, leaf blackening, the maturity of the flowers, the time and day of harvesting, the cold chain management, the presence of ethylene, and pulsing with glucose). She sent her recorded presentation, as she was not allowed to attend in person. M.J. Leandro from Flora United Farm, Portugal, was the keynote speaker for the sixth session. An overview of the main pests and diseases affecting *Proteaceae* was presented with a reference to the main problems identified in the different production areas around the world, with a more detailed analysis of the Portuguese situation. Some of the prelim-



› Participants in the symposium room in La Laguna, Tenerife.

inary experiments using some new products, recently introduced in the Portuguese market specially directed to the berry industry, were presented, and discussed.

The ISHS Young Minds Award was given to Naomi Hattingh from the Department of Horticultural Science, University of Stellenbosch, South Africa, who presented an oral communication entitled "Phenological studies of *Protea cynaroides* (L.) 'Arctic Ice' following a synchronising winter pruning regime".

At the ISHS Business Meeting, Dr. Eugénie-Lien Louw was elected Chair of ISHS Working Group Protea. The next International Protea Research Symposium will be held in

San Diego, California, in 2025, and the Convener will be Prof. Kenneth W. Leonhardt, from the University of Hawaii. ●

*Juan A. Rodríguez Pérez*

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# › First International Symposium on Reproductive Biology of Fruit Tree Species

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

#ishs\_dphy

The First International Symposium on Reproductive Biology of Fruit Tree Species was organized on 8-10 November 2021, by two co-conveners, Dr. Evelyne Costes (UMR AGAP Montpellier Institute, France) and Prof. Henryk Flachowsky (Julius Kühn Institut (JKI), Institute for Breeding Research on Fruit Crops, Dresden, Germany). This symposium was hosted on a virtual platform where all oral presentations and posters were accessi-

ble. The co-conveners welcomed the attendees and presented their respective research structures before opening the symposium. The symposium was organized in eight thematic sessions, each of which was introduced by an invited keynote speaker. In total, during the eight sessions, 38 orals and 30 posters were presented. After each session, round table discussions were organized jointly by the guest speaker and the session moderator.

This permitted questions to be debated and deepened the scientific exchange. In total, 117 scientists participated from 32 countries ranging from Japan to Chile. There was a strong European participation (France, Spain, Italy, Germany, Belgium, Hungary, Serbia and the Czech Republic). In addition to various themes, the presentations discussed a large range of species from temperate to Mediterranean and tropical fruit.

Fruit production depends on flowering, and fruit set and development interacting with the environment. However, flowers and growing fruit face many ongoing changes, which are affected by both the environment and agronomic practices. Climate change leads to increased production irregularities as well as flowering and pollination disorders. In this context, many teams are studying the genetic, molecular, agronomic, and environmental conditions leading to fruit production and ensuring its regularity. The objective of this International Symposium was to enable meetings and exchange among researchers working on themes related to the biology of reproduction in fruit species. The scientific sessions, as well as the round tables, were organized to cover the different dimensions of these themes:

- Genetic and molecular control of floral induction and flowering regularity;
- Horticultural management of the regularity of fruit production;
- Environmental factors and pheno-climatic models;
- Genetic and molecular control of dormancy and flowering;
- Genetic and molecular control of pollination incompatibility;
- Development and sexuality of flowers;
- Pollination, fertilization and fruit development;
- Environmental factors and fruit set.

Prof. Henryk Flachowsky introduced the first session and proposed an overview of the last advances on the genetic and molecular control of floral induction in fruit trees. He stated that “the genetic mechanisms of flower induction are still an enigma.” New state-of-the-art technologies, especially “omics” technologies, have contributed to a better understanding, but unfortunately, many of the published studies allow only limited insight into genetic mechanisms due to inadequate design. The different assumptions related to floral induction control were presented in the next oral presentations. Possible control by phytohormones was proposed by Dr. Avi Sadka (Israel), Mr. Anton Milayev (Germany) and Dr. Fares Belhassine (France), while the epigenetic mechanisms were exemplified on *Citrus* by Assoc. Prof. Carlos Mesejo (Spain). The discussion was moderated by Dr. Fernando Andres and led to underline the need for concerted research efforts to decipher these complex mechanisms. Contacts were made in this direction.

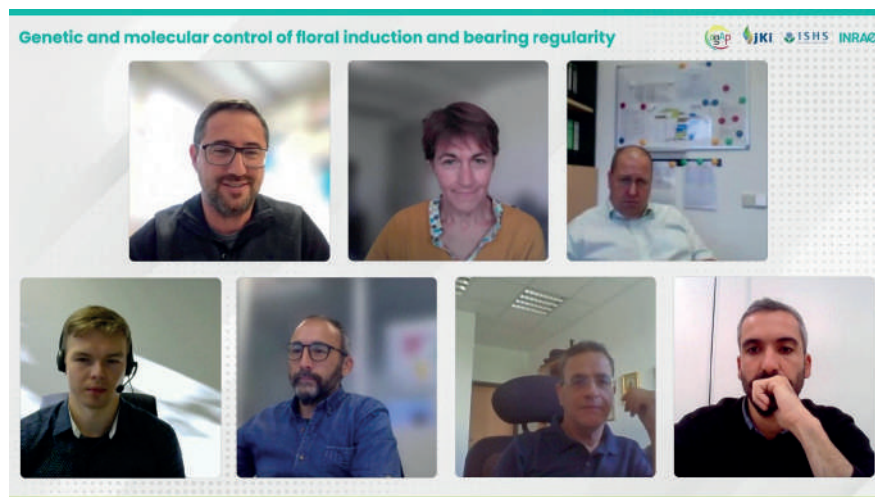
The second session was introduced by Prof. Eliezer E. Goldschmidt (Hebrew University of Jerusalem, Israel) who proposed a large review on alternate bearing and a new conceptual model of this phenomenon. This model mixes tree age, physiology, and the balance between vegetative and reproductive growth as key

factors for alternate bearing. The oral presentations of this session emphasized the role of pollination and fertilization on fruit set success, avoidance of fruit drop and return bloom. The discussion round table was moderated by Dr. Pavlina Drogoudi (Greece).

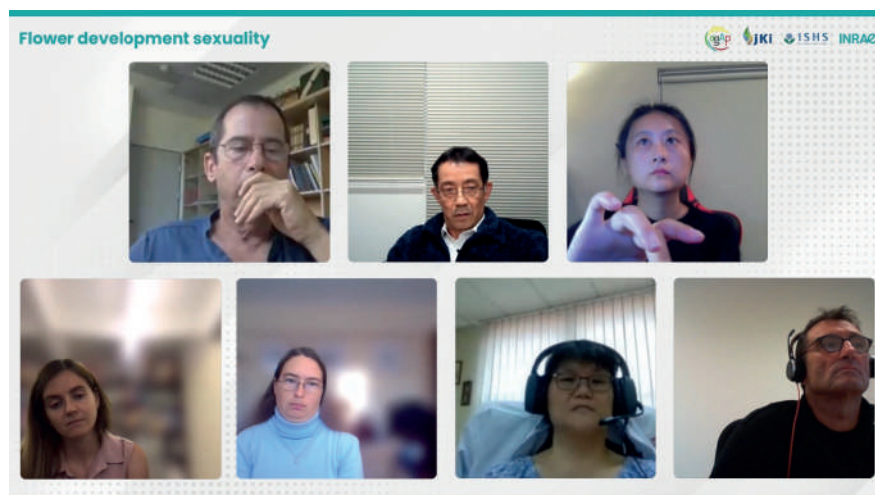
Prof. Alan N. Lakso (Cornell University, NY, USA), who introduced the session on environmental factors and fruit set, drew a comprehensive description of fruit development under the influence of genetic, physiological, environmental and management factors. He based his presentation on the apple growth, from initial cell division to cell expansion, as a typical example for many fruits, and argued for an integrated approach with simulation modelling to help improve crop management. Other examples of the interplay between climatic conditions, crop management and fruit development were provided in the oral presentations by Dr. Terence Robinson (USA) and Mr. Franz Niederholzer (USA)

and during the round table discussion moderated by Dr. Susan Schröpfer (Germany).

In the session on genetic and molecular control of dormancy and flowering time, Dr. Fernando Andres (INRAE, France) emphasized the role of MADS transcription factors (TFs), referred to as DORMANCY-ASSOCIATED MADS-BOX (DAM) in *Rosaceae* species. He showed that, in the apple tree, DAM, FLC- and SVP-like TFs form protein complexes and that those genes operate in a regulatory network that integrates environmental and hormonal signaling pathways to regulate dormancy cycle progression. The key role of those genes was also emphasized by Dr. Rongmei Wu (New Zealand) and by Dr. Alejandro Calle (Spain) in the sweet cherry. The involvement of miRNA and global methylation was suggested by recent results obtained in apple (Dr. Julio Garighan, France) and sweet cherry (Prof. Andrea Miayasaki, Chile), respectively. Other approaches, based



› Screen capture of panel discussion during “Genetic and molecular control of floral induction and bearing regularity” session. From top left: Dr. F. Andres, Dr. E. Costes, Prof. H. Flachowsky, Mr. A. Milyaev, Dr. C. Mesjo, Dr. A. Sadka, Dr. F. Belhassine.



› Screen capture of panel discussion during “Flower development sexuality” session. From top left: Dr. A. Samach, Prof. R. Tao, Dr. L. Zhang, Ms. M. Stanton, Dr. M. Quinet, Dr. P. Ding, Dr. F. Luro.



on GWAS or QTL detection aimed at selecting apple cultivars with appropriate blooming periods, were proposed by Dr. Janne Lempe (Germany). The discussion was moderated by Dr. Carlos Mesejos (Spain).

Pheno-climatic models were introduced by Dr. Bénédicte Wenden (INRAE, France), who proposed an integrative vision of bud dormancy progression through a model based on ABA metabolism that she has developed for sweet cherry. This model represents an interesting alternative to a more classical statistical model used to predict the dates of bud break. Statistical analysis of long time-series agro-climatic datasets and physiological characterization, as well as a new model for rate of flowering in the olive tree were proposed by Dr. Cécile Laurent (France) and Dr. Alon Samach (Israel). The round table, moderated by Dr. Frédéric Normand (CIRAD, France), discussed those different approaches based on either physiology or statistics and the interest of mixing the two.

Dr. Encarnación Ortega Pastor (CEBAS-CSIC Spanish National Research Council, Murcia, Spain) proposed a comprehensive introduction of the mechanisms involved in self-incompatible and cross pollination. Three examples were then provided on Japanese plum by Engracia Guerra (Spain) and apple cider orchards by Dr. Carlos Miranda (Spain). The discussion session moderated by Dr. Terence Robinson made it possible to bring out points on which the community present needs more contacts and structuring. Notably, colleagues working on incompatibility systems have launched a project to set up a shared database to standardize the nomenclature of S alleles in fruit species, particularly between species of the genus *Prunus*.

Prof. Ryutarō Tao (Kyoto University, Japan) explained in a very comprehensive way the selfing-prevention mechanisms that are present in many fruit tree species and detailed those mechanisms in persimmon (*Diospyros* spp.) and kiwifruit (*Actinidia* spp.). Sex determinant genes were identified in these two fruit trees that, although sharing the same XY sexuality system, display distinct molecular mechanisms underlying sex determination. The oral presentations in



> ISHS Young Minds Award certificates received: A) Mrs. Michelle Stanton (South Africa) for the best oral presentation; B) Mr. Han Palmers for the best poster presentation.

this session browsed different aspects and consequences of floral development, such as pollen abnormalities (Dr. Michelle Stanton, South Africa), parthenocarpy (Assoc. Prof. Muriel Quinet, Belgium), monoecy in jackfruit and its consequences for pollination success (Dr. Phebe Ding, Malaysia), and heterozygosity and its consequences for interspecific crosses in *Citrus* sp. to obtain seedless varieties (Dr. François Luro, France). The discussion was moderated by Dr. Alon Samach (Israel).

The last session on the genetic and molecular control of self-incompatibility was introduced by Dr. Attila Hegedüs (Hungarian University of Agriculture and Life Sciences, Budapest, Hungary). He drew an overview of S-alleles detected in different fruit tree families that display gametophytic self-incompatibility (GSI) and highlighted their consequences for potential applications in breeding and cultivation systems. Several examples were then presented in *Prunus* species (Assoc. Prof. Kentaro Ono, Japan; Afif Hedhly, Sara Herrero and Brenda Guerrero from Spain), apple (Dr. Andreas Peil, Germany), and pear (Hanne Claessen, Belgium). The discussion was moderated by Dr. Ana Wünsch (Spain).

ISHS promotes young PhD studies. ISHS Young Minds Awards were presented to Mrs. Michelle Stanton from University of Pretoria, South Africa, for the best oral presentation entitled “The combination of a novel pollen

counting methodology and light microscopy reveal pollen abnormalities,” and to Mr. Han Palmers from KU Leuven, Belgium, for the best poster entitled “Occurrence and mechanistic basis of diplogamete formation in apple (*Malus × domestica* Borkh.).”

This symposium brought scientists from different disciplines together and allowed the members of two ISHS Working Groups “Flowering, Fruit Set and Alternate Bearing,” chaired by Prof. Francesco Marra (University of Palermo, Italy), and “Floral Biology in Fruit Trees,” chaired by Dr. Encarnación Ortega Pastor (CEBAS-CSIC, Murcia, Spain) to meet and interact. The two working groups decided to merge into a single Working Group “Reproductive Biology of Fruit Tree Species,” chaired by Dr. Encarnación Ortega Pastor, and an appointment was made for the II International Symposium on Reproductive Biology of Fruit Tree Species in 2024, which will be organized by the Volcani Institute group (Agricultural Research Organization, Israel). ●

Evelyne Costes

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# > XIV International Symposium on Plant Bioregulators in Fruit Production

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

#ishs\_dphy



> Live discussion with Prof. George Manganaris (top left), Prof. Fabrizio Costa (top right), Prof. Chris Watkins (bottom left) and Prof. Jim Giovannoni (bottom right) during the last day of the symposium.

In February 2022, the XIV International Symposium on Plant Bioregulators in Fruit Production was organized by Prof. Fabrizio Costa of the University of Trento, in collaboration with the Fondazione Edmund Mach (Italy) under the aegis of the International Society for Horticultural Science (ISHS). As for many other symposia, also this meeting was affected by the unfortunate COVID-19 pandemic situation. The meeting was originally planned to be held in Riva del Garda, in September 2021, but due to the persisting restrictions and limitations it was postponed and converted into a virtual symposium, with pre-recorded presentations made available to the attendees on a virtual platform for two months (from 16 February to 16 April, 2022) and four live appointments dedicated to interactive discussions (21-24 February 2022). This has allowed the participation of about 60 people from 16 countries, confirming the internationality of this community. The symposium was focused on four main scientific topics: 1) plant hormone mechanism and fruit ripening; 2) crop load and fruit production; 3) application of bioregulators;

4) fruit quality and postharvest. The several works submitted highlighted that this community is extremely active in disclosing the effect and understanding the function of the

different classes of molecules playing a pivotal role in the control of several aspects of fruit tree physiology and oriented to improve the quality of fruits. It is worth noting that a novel aspect presented in several contributions and highly discussed during the live sessions was related to the established hormonal crosstalk and interplay existing among the different types of hormones in regulating specific ripening processes in different fruits. This aspect, beside shedding light on the action of the distinct categories of plant hormones, also stimulated an active discussion about their synergic control of the fruit ripening physiology. To this end, an important contribution was provided by an increasing number of works based on a multidisciplinary approach, integrating field trials, hormonal application, and biotechnology, investigating the molecular network regulating the plant/fruit physiology. The two keynote talks presented by Prof. Jim Giovannoni and Prof. Mondher Bouzayen, on tomato, a model plant for fruit ripening and quality, clearly illustrated that these approaches can pave the way for a better and more accurate understanding of the mechanism of action of these bioregulators



> Pre-harvest fruit drop in Huanglongbing-affected 'Valencia' trees.



> ISHS Young Minds Award winners: A) Paula Muñoz (best oral presentation), B) Paz Zuñiga (best poster presentation).

in governing the plant and fruit physiology in diverse fruit crops. The results presented during the symposium have certainly underlined the importance of these regulators in the commercial horticultural management oriented to improve the crop production, from the stimulation of the plant growth to a promoted flowering, but also understanding how specific molecules can support the achievement of a better quality and a superior postharvest performance, especially in a scenario characterized by important environmental modification due to climate change. The application of plant bioregulators might therefore play a primary

role in mediating the negative effects of the long-term increase of temperatures, while promoting plant growth and fruit quality. This symposium was also distinguished by an active participation of young scientists presenting high quality works as both oral and poster communications. During the last day, the evaluating committee presented the ISHS Young Minds Awards to Dr. Paula Muñoz from the University of Barcelona, Spain, for the best oral presentation entitled “Abscisic acid promotes vitamin E accumulation in sweet cherries by activation of phyto kinases”, and to Dr. Paz

Zuñiga from the University of Talca, Chile, for the best poster presentation entitled “Jasmonate signaling and regulation of anthocyanin biosynthesis in fruit: searching for key targets of MYC2 in strawberry”.

The symposium was supported by leading companies in the field of plant bioregulators and fruit ripening control, such as Biolchim, AgroFresh, Fine Agrochemicals, and Sumitomo chemicals, validating the tight interaction existing in this field among academia, research institutes and companies involved in the production and application of these types of molecules.

The scientific community present at the symposium were actively seeking new solutions for the horticulture of tomorrow that will have to increase production and quality to face the challenges of a global increasing population in a context of climate change. In the last action taken during the symposium, the participants voted for the next venue. They decided to meet again, hopefully in person, in Chicago, USA, in 2025. ●

*Fabrizio Costa*

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## > V International Symposium on Pomegranate and Minor Mediterranean Fruits

Division Temperate Tree Fruits

#ishs\_dfriu

The V International Symposium on Pomegranate and Minor Mediterranean Fruits (V ISPMMF) was hosted virtually by the Africa Institute for Postharvest Technology, Stellenbosch University, South Africa, from 15 to 17 February 2022. It was organised under the aegis of the International Society for Horticultural Science (ISHS), Division Temperate Tree Fruits, Working Group Pomegranate and Minor Mediterranean Fruits. This is the first time the ISPMMF was hosted 1) virtually and 2) by an African institution. It was changed from a hybrid to a fully virtual event when it became evident that our dates would coincide with the fourth COVID-19 wave, driven

by the Omicron variant. The theme of the symposium was “Towards a resilient and prosperous future,” with sub-themes including Breeding and plant improvement, Fruit maturity and pre-harvest management, Pest and disease management, Agro-processing and value addition, and Postharvest management (packaging and cold chain logistics, non-destructive quality measurement, edible coatings, quality management). A total of 114 registrants from 19 countries, including 39 students, participated in this event, which was arranged into plenary and two parallel sessions to accommodate 65 oral presentations. The 30 poster presentations were avail-

able as 3-minute poster pitches and e-posters on the virtual platform throughout the symposium. Presenters were asked to pre-record all presentations to safeguard against connection issues and had the option to present live on the day. The majority opted to use the pre-recording.

The symposium included six renowned keynote speakers and twelve celebrated guest speakers. The keynote speakers included: Professor Francisco Tomás-Barberán from the Applied Biology Centre of Segura-CSIC in Spain, with his keynote presentation on “Pomegranate and human health. Where are we after twenty years of research?”;

Dr Doron Holland from the Neve Ya'ar Research Centre, ARO, in Israel with his keynote presentation on "The pomegranate breeding project in Israel: facing challenges of climate and fruit quality and incorporating genomic approaches to accelerate breeding;" Professor María Serrano and Professor Daniel Valero from Miguel Hernández University in Spain with their keynote presentation on "Role of tree elicitor treatment on crop yield and pomegranate fruit quality parameters and bioactive compounds;" Distinguished Professor Umezuruike Linus Opara from Stellenbosch University in South Africa with his keynote presentation on "Postharvest technology of pomegranates: a decade of research and innovation;" and Professor Olaniyi Fawole from the University of Johannesburg in South Africa with his keynote presentation on "Recent developments in value-addition of pomegranate fruit in South Africa: from edible to non-edible fruit parts." Guest speakers included: Professor Ahsen İşik Özgüven from Cyprus International University in Northern Cyprus, Dr. Julián Bartual from Agricultural Experiment Station of Elche in Spain, Dr. Rajiv Arvind Marathe from ICAR – National Research Centre on Pomegranate in India, Professor George Manganaris from Cyprus University of Technology in Cyprus, Professor Sunil Pareek from the National Institute of Food Technology Entrepreneurship and Management in India, Professor Tilahun Seyoum Workneh from the University of KwaZulu-Natal in South Africa, Dr. Cheryl Lennox from Stellenbosch University in South Africa, Mrs. Elrita Venter from AgriEdge in South Africa, Professor Lembe Magwaza from the University of KwaZulu-Natal in South Africa, Dr. Alemayehu Ambaw Tsige from Stellenbosch University in South Africa, Professor Dharini Sivakumar from Tshwane University of Technology in South Africa, and



> Professor Olaniyi Fawole (Convener) and Lizanne de Kock (Symposium Coordinator) at the post-symposium lunch.

Dr. Oluwafemi Caleb from the Agricultural Research Council in South Africa. During the ISHS Business Meeting, Prof. Olaniyi Fawole was unanimously elected as Chairman of ISHS Working Group Pomegranate and Minor Mediterranean Fruits. Professor Giuseppe Ferrara (Italy) won the bid between himself and Professor Ibrahim Kahramanoglu (Turkey) after presenting their proposals to host the VI ISPMMF in 2025. During the closing ceremony, Student Awards were announced along with the voting result for the VI ISPMMF to be held in Italy in 2025. For the ISHS Young Minds Award for best oral presentation, the jury selected Chanel Daniel-Swartland, a PhD student at Stellenbosch University, South Africa, working as a Research Scientist at Tessara, for her work on "Postharvest management of decay on tomatoes using sulphur dioxide sheets." Two additional student awards were imple-

mented, the Africa Institute for Postharvest Technology Innovation Oral Award and the Convener's Innovation Poster Award, which were presented to Sbulelo Mwelase for his work on "Chitosan-based melatonin composite coating extended storage life of fresh-cut pomegranate aril sacs" and Faith Mokapane for her work on "Effect of pretreatments on the preservation of quality attributes of dried pomegranate arils during simulated retail condition," respectively.

According to the feedback we received, the event was a great success and 58% preferred a hybrid over an on-site event. The symposium was also praised for the high level of student involvement and the excellent standard of their presentations.

We acknowledge the support of our partners and sponsors for making this event possible: the National Research Foundation, Stellenbosch University, the University of Johannesburg, the Pomegranate Association of South Africa (POMASA), Yukon (Unlimited Group) and Tessara. A special thanks to GoVirtual, Prestige Conferences, CECO and our organising committee, who contributed to the success of this event. ●

*Lizanne de Kock and Olaniyi Fawole*

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> Student Award winners: A) the ISHS Young Minds Award for best oral presentation, presented by Professor Umezuruike Linus Opara on behalf of the ISHS representative (left) and Professor Olaniyi Fawole, Convener (right), to Chanel Daniel-Swartland; B) Sbulelo Mwelase receiving the Africa Institute for Postharvest Technology Innovation Oral Award; C) Faith Mokapane receiving the Convener's Innovation Poster Award.

# > XVI International Symposium on Processing Tomato

Division Vegetables, Roots and Tubers

#ishs\_dveg

The XVI International Symposium on Processing Tomato was held in conjunction with the XIV World Processing Tomato Congress from 21 March to 1 April 2022. Initially scheduled to take place in San Juan (Argentina) in March 2020, the event was postponed twice due to the COVID-19 pandemic and was finally rescheduled as an online event due to the uncertainties of international travel.

As in previous editions, the symposium was jointly organized by ISHS in collaboration with the World Processing Tomato Council (WPTC), and the government of San Juan acting as the local organizer. Since the creation of WPTC in 1998, at Pamplona, Spain, congresses have taken place regularly every two years in a different WPTC member country. The “multidisciplinary and participative” spirit of the first meeting is still alive and is fully in the spirit of the ISHS mission statement: To nurture and deploy scientific growing knowledge for creating a better world.

For this edition, two scientists worked together as Co-Conveners: Luca Sandei (Experimental Station for the Food Preserving Industry, SSICA, Italy; the current Chair of ISHS Working Group Production of Vegetables for Processing) and Cosme Argerich (National Agricultural Technology Institute, INTA La Consulta, Argentina), with Sophie Colvine (WPTC, France) acting once again as Symposium Secretary.



> Cosme Argerich, symposium co-convenor, in a tomato field near San Juan (photo credit: WPTC).

The call for papers was focused on three main topics: “Adaptability and resilience in crop production,” “The smart tomato factory: new trends and added value products,” and “Healthy and tasty products for demanding consumers.” It was initially opened in 2019, reopened in 2021, and attracted 74 abstract submissions from 18 different countries. Some abstracts were not presented due to the very long timeframe between submission and the symposium.

Invited speakers, Marco Dalla Rossa from the University of Bologna in Italy and Jean-François Landrier from the French National Institute of Health and Medical Research (INSERM) in France, as well as a few selected researchers, both spoke during the first week in congress sessions entitled “Innovations in the factory and traceability” and “Consumption revival by health promotion,” respectively.

During the second week, the symposium program itself was arranged into four sessions on the following major topics: “Crop management: controlling weeds and pests,” opened by invited speaker Darren Robinson from the University of Guelph in Canada, “Crop management: irrigation and fertilisation,” “Crop management and breeding,” and “Processing, technology and health,” as well as a roundtable on “Research and industry working together.” Short presentations on specific research needs in major tomato processing countries were given. These were addressed

by researchers and followed by a discussion on how best to collaborate through international projects.

Altogether, 32 oral presentations and 22 posters were discussed. The online format significantly increased the attendance to the symposium by avoiding parallel congress and symposium sessions, by scheduling the event over two weeks, and by reducing participation costs of everyone. Moreover, sponsorship by two private companies funded the participation of six scientists who may not have participated otherwise.

Although this format reduced the level of interaction both during the sessions and in more informal settings during recesses and meals, for all of us, the symposium remained an excellent opportunity for exchange between leading scientists as well as tomato industry representatives from around the world. We know that the scientific papers published in *Acta Horticulturae* will be of great value for everybody involved in tomato research.

During the symposium, the Scientific Committee selected two ISHS Young Minds Awards for junior scientists. The award for the best oral presentation was given to José María Vadillo Hurtado, a PhD candidate at the Centre for Scientific and Technological Research of Extremadura (CICYTEX) in Spain, for his oral presentation on “Development of a methodology to characterize the nitrogen nutritional status of open field processing



> José María Vadillo, winner of the ISHS Young Minds Award for the best oral presentation.

tomato by means of fast indicators,” and the award for the best poster was given to Patrick Smith from INTA La Consulta in Argentina for the work entitled “Evaluation of soil amendments to replace the use of raw poultry manure in processing tomatoes.” The fifth “Bernard Bièche Memorial Award” was presented to Lajos Helyes for his long involvement in tomato research and the excellence of his contributions during previous ISHS tomato symposia. He will be co-convenor and organiser for the next symposium, which will take place in Budapest, Hungary, in June 2024. ●

*Luca Sandei, Cosme Argerich and Sophie Colvine*



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 Cosme Argerich, INTA La Consulta, Argentina, e-mail: argerichcosme@yahoo.com.ar  
 Sophie Colvine, WPTC, France, e-mail: colvine@tomate.org

> Patrick Smith, winner of the ISHS Young Minds Award for the best poster, in the test plots at INTA La Consulta (photo credit: WPTC).

## > XII International Vaccinium Symposium

Division Vine and Berry Fruits  
 Division Horticulture for Human Health  
 Division Protected Cultivation and Soilless Culture  
 Commission Agroecology and Organic Farming Systems

#ishs\_dvin  
 #ishs\_dhea  
 #ishs\_dpro  
 #ishs\_cmor

The XII International *Vaccinium* Symposium was held virtually from 30 August to 1 September 2021. Hosted by Dalhousie University under the auspices of the International Society for Horticultural Science (ISHS), it occurred 54 years after the first symposium in Venlo, The Netherlands. The ISHS groups involved in the symposium included the Divisions Vine and Berry Fruits, Protected Cultivation and Soilless Culture, Horticulture for Human Health, the Commission Agroecology and Organic Farming Systems, and the Working Group *Vaccinium* Species and Management. The symposium attracted 240 participants including presenters, staff, researchers, industry representatives, and government agents from over 35 countries. The symposium provided the opportunity to share their knowledge and experiences on a wide range of topics involving *Vaccinium* species. Despite the virtual format, participants had the opportunity to listen to and see 71 oral and 56 poster presentations and participate in a virtual trade show. Given the various challenges and travel restrictions associated with the COVID-19 pandemic, the decision was made to proceed with a virtual symposium in August 2021, and return to having an in-person symposium in 2024. To try and reduce technical difficulties

and audio-visual problems, all presentations were pre-recorded and uploaded onto the virtual symposium service provider’s website prior to the start of the symposium. This provided authors with the ability for real time answering of questions and interchanging ideas in the chat room, and provided attendees with the opportunity to revisit the presentations both during and after the symposium.

Two excellent keynote presentations were made at the symposium with David Brazelton (Executive Chairman of Fall Creek Farm and Nursery Inc., Eugene, Oregon, USA) making the initial presentation entitled “Blueberries – Where have we been and where are we going?” The presentation focused on the past, present, and future production trends; the viability of the sector; and future oppor-



> Keynote speakers: A) David Brazelton, founder and developer of Fall Creek Nursery, international supplier of blueberry and other fruit plants, with home offices in Lowell, Oregon, and additional offices in Tala, Jalisco, Mexico, Cañete, Peru, Aznalcázar, Spain, and Paarl, Western Cape, South Africa. B) Dr. Laura Jaakola, Research Leader and Professor of the Arctic University of Norway, Department of Arctic and Marine Biology, Tromsø, Norway.



> Tributes were paid to Dr. Chad Finn (A), Research Geneticist at the United States Department of Agriculture, Agricultural Research Service, Horticultural Crop Research Unit, Corvallis, Oregon, and Dr. Rolf Nestby (B), Senior Scientist, Division Food Production and Society, Norwegian Institute of Bioeconomy Research Bioforsk, Trondheim, Norway. Both of these scientists participated in the ISHS Division Vine and Berry Fruits and the series of ISHS *Vaccinium* symposia over their career lifetimes. They have special places in our hearts and will be remembered for their excellent science and contributions to the research community.

tunities. Dr. Laura Jaakola’s presentation was entitled “Phenolic compounds in *Vaccinium* spp.: diversity, biosynthesis, and molecular regulation.” This presentation examined the diversity of phenolic compounds found in *Vaccinium* species, the biosynthesis and molecular and environmental regulation of these compounds and resulting implications on new cultivar development. The two presentations provided the framework for dynamic and global exchange of information and ideas.

Over the course of the three days, oral and poster presentations were made in disciplines including breeding, genetics, genomics, and phenomics; berry composition, quality, and postharvest physiology; pest management; production systems and sustainability; germplasm and propagation; soil fertility, plant physiology and plant nutrition; and precision agriculture; with session moderators including: Peter Jeranyama (University of Massachusetts, USA), Lara Giongo (Fondazione Edmund Mach, Italy), Katherine Gbantous (University of Massachusetts, USA), Bill Cline (North Carolina State University, USA), Massimo Iorizzo (North Carolina State University, USA), Alejandro Pannunzio (Universidad de Buenos Aires, Argentina), Inger Martinussen (Norwegian Institute of Bioeconomy Research, Norway), Dorrie Main (Washington State University, USA), James Polashock (United States Department of Agriculture, USA), Sebastian Rivera (Massey University, New Zealand), Margit Laimer (Boku University, Austria), Bernadine Strik (Oregon State University, USA), Philip Fanning (University of Maine, USA), Pedros Bras Oliveira (Instituto Nacional de Investigacao Agraria e Veterinaria, Portugal), Charles Forney (Agriculture and Agri-Food Canada, Canada), and David Bryla (United States Department of Agriculture, USA). The Organizing Committee would like to thank the moderators for their efforts in introducing the oral presentations, facilitating discussions, and their patience and perseverance in addressing audio-visual challenges.

Numerous oral and poster presentations were made by participants as part of the ISHS Young Minds Awards competition, and the symposium appreciates the efforts James Polashock (Chair, ISHS Working Group *Vaccinium* Species and Management) and members of the competition committee in assessing the oral and poster presentations. The caliber of the presentations was excellent, and the Organizing Committee would like to extend our gratitude to those who participated. The ISHS Young Minds Award for best oral presentation was awarded to Yifan Yan from the Vancouver Campus of

the University of British Columbia (Canada) for the presentation entitled “Fruit transpiration water loss in blueberry is affected by stem scar size and cuticular waxes.” The ISHS Young Minds Award for best poster presentation was awarded to Ozgecan Yalcin from the Department of Horticulture, Oregon State University (USA) for the presentation entitled “Confirming identity of blueberry cultivars with a microsatellite fingerprinting set.”

New virtual symposium technologies were also used at the symposium, which included the ability to access the recorded sessions on demand across a variety of devices, attend and participate in a virtual trade show, and participate in a virtual field tour. A six-part series of the various *Vaccinium* industries present in Atlantic Canada was organized and produced by Hugh Lyu (Wild Blueberry Specialist) from Perennia Food and Agriculture Inc. The components included providing an overview of horticultural crop production in Nova Scotia, a virtual tour of highbush blueberry, wild (lowbush) blueberry and cranberry production systems, and insight into research and development activities underway. Although not the equivalent of an in-person field tour, the series provided some awareness of the various *Vaccinium* sectors present in Atlantic Canada, insight into some of the research and development activities underway, and interviews with extension and industry personnel.

Sadly, the *Vaccinium* community lost two productive and influential members prior to the symposium. The symposium paused, reflected upon, and celebrated the lives and careers of Drs. Chad Finn and Rolf Nestby. Chad was a well-regarded research geneticist and berry breeder that worked for the United States Department of Agriculture-Agricultural Research Services (USDA-ARS) in Corvallis, Oregon, USA. His expertise was berry breeding, germplasm, and cultivar performance, but he also had expertise in berry production and processing. Rolf worked at the Division



> ISHS Young Minds Award winners: A) Yifan Yan (best oral presentation), B) Ozgecan Yalcin (best poster presentation).



> Wild lowbush blueberry field, including native *Vaccinium angustifolium* and *Vaccinium myrtilloides*, overlooking the Bay of Fundy, Nova Scotia, Canada.

Food Production and Society, Norwegian Institute of Bioeconomy Research, in Stjordal, Norway. His research activities focused on berry crop plant physiology, stress physiology, cultivation and nutrition. The Organizing Committee would like to thank Robert Martin and Arnfinn Nes for their efforts in preparing the superb and thoughtful tribute presentations.

The symposium concluded with the Business Meeting in which the patience, hard work, and perseverance of numerous people contributing to the symposium was acknowledged. Special thanks go to the Organizing Committee members (Jorge Retamales, James Polashock, Inger Martinussen, Justine Cox, Samir Debnath and David Percival) who diligently continued with planning and

preparing activities despite the plethora of challenges. With the symposium operating as a not-for-profit function, the fiscal status of the symposium was also discussed during the business meeting. Significant reductions in registration occurred when the symposium was transitioned over to a virtual format, and sufficient revenues were present to cover remaining expenses. Ongoing efforts have been made during the autumn and winter months on reviewing and editing the manuscripts with the goal of having the *Acta Horticulturae* volume completed before the summer of 2022. Preparations for the next International *Vaccinium* Symposium in 2024 are also underway with a blended in-person and virtual symposium scheduled to occur in August 2024. ●

David Percival

### > Contact

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# > XI International Symposium on Grapevine Physiology and Biotechnology

Division Vine and Berry Fruits

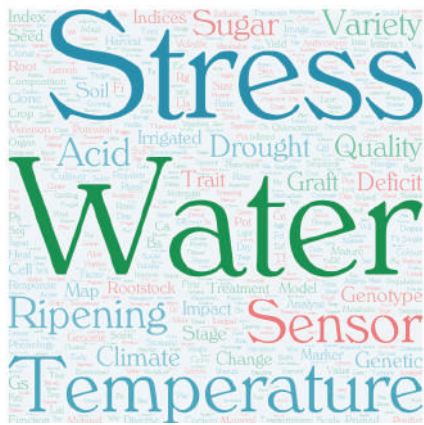
#ishs\_dvin

This 11<sup>th</sup> installment of the International Symposium on Grapevine Physiology and Biotechnology (ISGPB) symposium series followed the highly successful event that was held in Verona, Italy, during 2016. The global COVID-19 pandemic first caused a one-year postponement to the original date (October 2020) of the event, and eventually the decision to host the event virtually, leading to the “historic” convening of the first fully online ISGPB symposium. The local and scientific committees are grateful that the international grapevine community showed their interest and support to the symposium

by registering, submitting abstracts and making their time available to participate in the symposium. The theme of the symposium was “Grapevines in interaction with their environments” and included five main topics: a) Environmental interactions; b) Grapevine development; c) Fruit composition; d) Computational resources and data integration; and e) Technological advances. Over the five days of the symposium, the programme included 10 plenary/keynote presentations, 46 oral and 99 poster presentations (of which 18 were also presented as flash poster presentations), as well as a

European cooperation of science and technology, COST ACTION (CA17111) workshop dedicated to the advances for data sharing in the grapevine research community. Based on the abstracts submitted, a strong focus emerged on the disruptive potential of climate change, specifically in terms of water constraints. It was also obvious that the previously emerging theme of precision viticulture is growing rapidly with a significant number of abstracts submitted on the testing and optimising of sensor-based technologies to monitor grapevines and their environments.





> A WordArt representation of all abstracts submitted to the symposium, confirming the most prominent keywords that emerged at the symposium.

## Highlights from some of the topics

### Environmental interactions

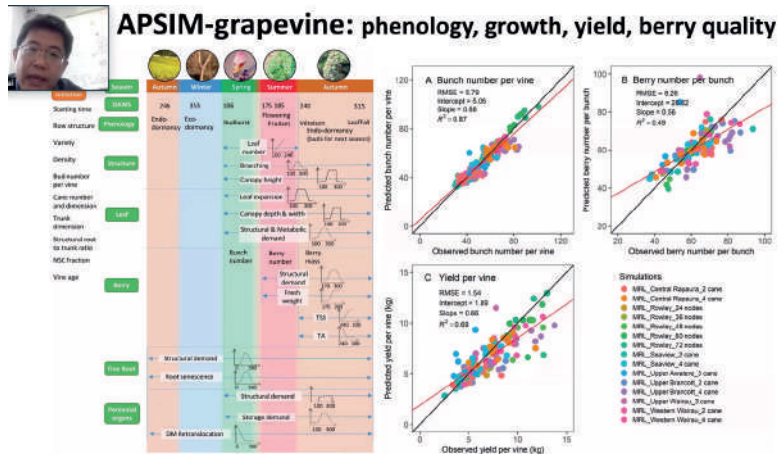
From the opening plenary lecture on the infection process of *Botrytis* by Prof. Jan van Kan (Wageningen University, The Netherlands), the “environmental interactions” topic had a strong focus on biotic stress physiological interactions. Topics ranged from the molecular physiology of powdery mildew grapevine interactions to the current topical microbiome grapevine ecology. The continued interest in volatile signalling in mediating grapevine-environment interactions was also notable. From the abiotic stress perspective there was a strong representation of topics relevant to climate change impacts on viticulture globally, and reports on water and heat stress studies.

### Grapevine development

Specific attention was given to the importance of the below ground aspects of the plant. Indeed, the impact of rootstocks on general plant growth as well as in relation to the plant’s ability to manage climate change linked water stress were considered important themes for the symposium, and received more attention than the more traditional focus of berry development and ripening.

### Gene editing in grapevine

A session was also dedicated to the advances in gene editing in grapevine – a topic that was not reflected yet in the previous symposia in this series. The session consisted of two live oral presentations and four pre-recorded flash presentations. The presentations were followed by an open panel discussion during which applications of the technology in grapevine, as well as the regulatory aspects in different parts of the world were discussed. Despite the technology being relatively new



Zhu et al., 2021a *in silico* Plants

> A screenshot of data by Prof. Zhanwu Dai, China, during his keynote presentation entitled “Modeling berry growth and quality formation at multiple levels”.

and presenting obvious difficulties in working in a system like grapevine, interesting and promising applications were described to address issues like fungal diseases and drought. From the discussion, a clear interest emerged from the grapevine community in developing and optimising this technology to develop a reliable and non-GMO system to improve grapevine production.

### INTEGRAPE Workshop (COST ACTION CA17111): Data integration, the power of omics and grape improvement

The goals of the COST action are to develop tools for harnessing, standardisation and exploitation of datasets collected by grapevine scientists from all fields of research. The action has established an open, international, and representative network to integrate data in a cost-effective manner

and make it available to public and private research communities. During the workshop, the following recent achievements were highlighted: a) Finalisation of Guideline ‘cookbooks’ and Dictionary of unified grape-sample ontologies; b) Establishment of a platform for the curation and release of the PN40024 fourth grape genome reference assembly; c) The Gene Reference Catalogue; and d) Establishment of a website listing all repositories and tools for the community (<https://integrape.eu/>).

### Winners of the ISHS Young Minds Awards

The award for the best oral presentation went to Bernadette Rubio from the University of Bordeaux, France, for her presentation entitled “Small RNA populations reflect the complex dialogue established between heterograft partners in grapevine”. The award



> ISHS Young Minds Award winners: A) Bernadette Rubio (best oral presentation), B) Helena Santos (best poster).

for the best poster went to Helena Santos from the University of Lisbon, Portugal, with her poster entitled “Esca complex grapevine trunk disease leads to cell wall changes in asymptomatic grape berries”.

### Organisational aspects of the meeting

The ISGPB2021 virtual symposium was hosted through a combination of a Zoom webinars and a specially developed microsite. The format of the programme alternating live and pre-recorded events and using a microsite enabled delegates in different time

zones to access sessions and resources when it suited them. Presenters had the opportunity to rehearse the onboarding process and successfully participated in the symposium. We want to express our sincere gratitude to the local committee, as well as the excellent support of the scientific committee that participated in the organisation of the symposium. We also want to thank the sponsors of the symposium for their generous support. It was a great pity that we were not able to arrange the in-person symposium in Stellenbosch, but the local organisers still enjoyed the challenge of ‘creating’ a successful virtu-

al symposium and wish the organisers of the XII International Symposium on Grapevine Physiology and Biotechnology in Spain all possible success. ●

Melane Vivier

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# > UrbanFarm2022 – International Student Challenge



Division Landscape and Urban Horticulture

#ishs\_durb

The Fourth Annual International Student Challenge UrbanFarm, organized by the Department of Agricultural and Food Sciences (DISTAL) of the University of Bologna, Italy, was launched on 11 October 2021. This competition witnessed the participation of 16 interdisciplinary student groups from university degrees on agriculture, architecture, design, economics, engineering, environmental, and social sciences. The teams took over the challenge of rethinking food production in cities, designing innovative urban agriculture systems, combining the best architectural and newly introduced technology, aiming to promote the sustainability of City/Region Food Systems (CRFS).

The two spaces identified in this competition were Le Serre of Giardini Margherita located in Bologna (Italy) and the Solberga District in Stockholm municipality (Sweden), thanks to the collaboration with the local administrations of Bologna and Stockholm. In the first stage, the teams studied and redesigned the location, focusing on agricultural, environmental, and architectural sustainability. Their proposal also had a solid social and business connotation, promoting new forms of employment for disadvantaged users. The final stage of the competition was held online on 17 February 2022, because the ongoing pandemic restrictions did not allow for the event to be held in person. The whole

finale was streamed on the Facebook social media pages of Rescue AB, FoodE and UrbanFarm international student challenge. The eight teams that reached the finale presented their project through a presentation in front of an interdisciplinary jury of experts represented by Mohsen Aboulnaga (Cairo University, Egypt), Runrid Fox-Kamper (ILS - Research Institute for Regional and Urban Development, Germany), Michael Alan Martin (IVL - Swedish Environmental Research Institute), Anna María Pálsdóttir (Swedish University of Agricultural Sciences) and Matteo Vittuari (University of Bologna, Italy). After the presentations and questions session, the jury completed the overall evaluation of the



> A) Greenius team, winner of first prize for Stockholm location. From left to right: Monica Perez Bocardo, Felix Schachenmayr, Lukas Madl, Emma Girot, and Gonçalo Martins. B) Title of Greenius team’s first prize winning project for Solberga district in Stockholm location, presented during the final event. Photos: Greenius team.



### A PLACE FOR EVERYONE



## GREEN SPOT

SERRE OF GIARDINI MARGHERITA - BOLOGNA, ITALY.

THURSDAY, 17TH FEB. 2022

- B**
- > A) Green Spot team, winner of first prize for Bologna location. From left to right: Giuseppe Muliere, Abdelrahman Mohamed Abdalla, Lamyaa Gamal Helmy Rayhan, Rana Samir, Pietro Durantini, Chiara Cappucci and Simone Prospero. B) Title of Green Spot team's first prize winning project for Le Serre of Giardini Margherita in Bologna location, presented during the final event. Photos: Green Spot team.

projects integrating scores achieved during the previous stages with those provided to the final presentations.

The winners for the Serre of Giardini Margherita site were the Green Spot team, composed of Abdelrahman Mohamed Abdalla, Lamyaa Gamal Helmy Rayhan and Rana Samir (University of Cairo, Egypt), Chiara Cappucci, Pietro Durantini and Simone Prospero (University of Bologna, Italy), and Giuseppe Muliere (Catholic University of Milan, Italy). In the Solberga location, the winning team was Greenius, composed of Monica Perez Bocardo, Emma Girot, Lukas Madl, Gonçalo Martins and Felix Schachenmayr (University of Unilasalle, Rouen, France).

Both teams that won this competition received a €4000 prize, together with the ISHS Young Minds Award certificate and a complimentary subscription to the ISHS for 2022.

The organizational committee of Urban-Farm2022 would like to express appreciation to the sponsor, Flytech company, the municipal administration of Bologna and Stockholm as well as all the participants and members of the international jury and scientific committee who helped and contributed to creating this wonderful and engaging experience. ●

*Giuseppina Pennisi, Ilaria Zauli and Giuseppe Picca*

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 Giuseppe Picca, Instituto de Ciencias Agrarias ICA-CSIC, Serrano 115 bis, 28006 Madrid, Spain, e-mail: giuseppe.picca@csic.es

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From the  
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## > New ISHS members

ISHS is pleased to welcome the following new members:

### New Individual Members

**Australia:** Ms. Miriam Villen; **Azerbaijan:** Mr. Ayaz Alakbarov; **Belgium:** Dr. Ammar Alhmedi, Dr. Juan Carlos Cabrera, Dr. Nelson Laurent, Ms. Clara Spruyt, Dr. Marjolein Visser; **Canada:** Mr. Tyler Blauel, Dr. Guillaume Grégoire, Michael Kooy, Ms. Emily McFaul; **Chile:** Diego Gonzalez, Mr. Francisco Maldonado, Assoc. Prof. Ernesto Moya-Eli-zondo, Juan David Villavicencio, Ms. Paz Zúñiga; **China:** Assist. Prof. Jie Gao, Assoc. Prof. Qinghua Ma, Shunjin Mo, Hantai Yin; **Colombia:** Assist. Prof. Francisco Muñoz, Prof. Ginna Alejandra Ordoñez Narvaez; **Croatia:** Mr. Tvrtko Karlo Kovacevic, Dr. Nikola Major; **Cyprus:** Ms. Maria-Dolores Christofi, Assoc. Prof. Vasileios Fotopoulos, Ms. Efremia Hajisolomou, Mr. Constantinos Stefanou, Mr. Georgios Toumazou; **Czech Republic:** Mr. Martin Suchanek, Ms. Terezie Vojtová; **Ecuador:** Gabriel Sanchez; **Egypt:** Assoc. Prof. Diaa El-Ansary, Mohamed Salama; **France:** Mr. Ludovic Andres, Mr. Thomas Baron, Ms. Eriselda Canaj, Mr. Alexis Comar, Mr. Antoine De Troij, Mr. Cedric Dresch, Ms. Florentine Dupont, Mr. Salah Fgaier, Dr. Rachid Hamidi, Mr. Vincent Joly, Dr. Leonardo Miele, Dr. Olivier Naud, Dr. Manon Rapetti, Mr. Olivier Vimont; **Germany:** Ms. Narjes Jamal Aldine, Dr. Van Thi Hong Nguyen, Mr. Oliver Salzburg; **Ghana:** Dr. Stella Agyemang Duah, Abigail T. Asare; **Greece:** Mr. Dimitrios Gkouderis, Prof. George Karaoglanidis, Kristina Ilektr Maknea, Dr. Michail Michailidis, Mr. Ioannis Moutsinas, Vasilis G. Rodovitis, Dr. Stefanos Testempasis; **Hungary:** Mr. Gábor Palotás; **India:** Prof. Dr. Harvinder Singh Dhaliwal, Mr. Rajat Gupta, Mr. Justin Joseph, Dr. Santhy Mathews, Dr. Vijayakumari N, Mr. Abhilash Padhan, Mr. Jay Narendrabha Patel, Mr. Dinesh Singh, Prof. Sureshkumar Sorokhaibam; **Indonesia:** Mr. Vitho Alveno, Mr. Ida Bagus Made Artadana, Kusuma Darma, Prof. Dr. Sri Hidayat, Dr. Awang Maharijaya,

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## Year 2022

- August 14-20, 2022, Angers (France): **XXXI International Horticultural Congress: IHC2022**. Info: Dr. François Laurens, INRAE, Centre d'Angers, 49071 Beaucouzé, France. Phone: (33)2 41 22 57 63, Fax: (33)2 41 22 57 55, E-mail: francois.laurens@inrae.fr E-mail symposium: info@ihc2022.org Web: <https://www.ihc2022.org/>

## Symposia at IHC2022:

- August 14-20, 2022, Angers (France): **International Symposium on Breeding and Effective Use of Biotechnology and Molecular Tools in Horticultural Crops**. Info: Dr. Vincent Gerardus Maria Bus, Plant and Food Research, Private Bag 1401, Havelock North 4157, New Zealand. Phone: (64)69758946, Fax: (64)69758881, E-mail: vincent.bus@plantandfood.co.nz or Dr. Mathilde Causse, INRA-GAFL, BP 94, 84143 Montfavet Cedex, France. E-mail: mathilde.causse@inrae.fr E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s1-breeding-and-effective-use-of-biotechnology-and-molecular-tools-in-horticultural-crops/>
- August 14-20, 2022, Angers (France): **International Symposium on Conservation and Sustainable Use of Horticultural Genetic Resources**. Info: Dr. Tiziana Ulian, Royal Botanic Gardens, Kew, Wellcome Trust Millennium Building, Wakehurst, RH17 6TN West Sussex Ardingly, United Kingdom. E-mail: t.ulian@kew.org or Dr. Raphael Morillon, Station CIRAD de Roujol, Petit Bourg, 97170 Guadeloupe, Guadeloupe. Phone: (33)590386162, E-mail: raphael.morillon@cirad.fr E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s2-conservation-and-sustainable-use-of-horticultural-genetic-resources/>
- August 14-20, 2022, Angers (France): **International Symposium on Quality Seeds and Transplants for Horticultural Crops and Restorative Species**. Info: Prof. Dr. Daniel Leskovar, 1619 Garner Field Rd., Texas A&M AgriLife Research, Texas A&M University, Uvalde Texas 78801, United States of America. Phone: (1)830-278-9151, Fax: (1)830-278-1570, E-mail: daniel.leskovar@agnet.tamu.edu or Prof. Dr. Olivier Leprince, 42 rue Georges Morel, 49070 Beaucouzé, France. E-mail: olivier.leprince@agrocampus-ouest.fr E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s3-quality-seeds-and-transplants-for-horticultural-crops/>
- August 14-20, 2022, Angers (France): **International Symposium on In Vitro Technology and Micropropagated Plants**. Info: Dr. Sandra Correia, Department of Life Sciences, University of Coimbra, Calçada Martim de Freitas, 3000-456 Coimbra, Portugal. Phone: (351)239240700, Fax: (351)239240701, E-mail: sandraimc@uc.pt or Prof. Dr. Stefaan Werbrouck, University Gent, Department Applied Biosciences, Valentin Vaerwyckweg 1, 9000 Gent, Belgium. Phone: (32)9 244 88 59, Fax: (32)9 242 42 79, E-mail: stefaan.werbrouck@ugent.be E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s4-in-vitro-techniques-and-micropropagated-plants/>
- August 14-20, 2022, Angers (France): **International Symposium on Innovations in Ornamentals: from Breeding to Market**. Info: Dr. Johan Van Huylbroeck, ILVO- Plant Sciences Unit, Applied genetics & breeding, Caritasstraat 39, 9090 Melle, Belgium. Phone: (32) 9-2722862, Fax: (32) 9-2722901, E-mail: johan.vanhuylenbroeck@ilvo.vlaanderen.be or Dr. Fabrice Foucher, UMR IRHS, Centre INRA, BP 60057, 49071 Beaucouze, France. E-mail: fabrice.foucher@inrae.fr E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s5-innovations-in-ornamentals-from-breeding-to-market/>
- August 14-20, 2022, Angers (France): **International Symposium on Innovative Technologies and Production Strategies for Sustainable Controlled Environment Horticulture**. Info: Assoc. Prof. Youssef Roupheal, University of Naples, Via Università 100, 80055 Portici(Napoli), Italy. E-mail: youssef.roupheal@unina.it or Dr. Jean-Charles Michel, L2Institut Agro - Agrocampus Ouest, 2 rue Le Notre, 49045 Angers, France. Phone: (33)241225422, Fax: (33)241225553, E-mail: jean-charles.michel@agrocampus-ouest.fr E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s6-innovative-technologies-and-production-strategies-for-sustainable-controlled-environment/>
- August 14-20, 2022, Angers (France): **II International Symposium on Greener Cities: Improving Ecosystem Services in a Climate-Changing World (GreenCities2022)**. Info: Dr. Vivian Loges, Univ.Federal Rural de Pernambuco, Rua José Bezerra de Albuquerque 38a, Recife, 54315-580, Brazil. Phone: (51)8134624552, Fax: (51)8133206250, E-mail: vloges@yahoo.com or Mr. Philippe Faucon, 22 rue de l'Arse-nal, 17300 ROCHEFORT, France. Phone: (33)546991701, E-mail: p.faucon@critt-horticole.com E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s7-greencities2022/>
- August 14-20, 2022, Angers (France): **International Symposium on Advances in Vertical Farming**. Info: Dr. Eri Hayashi, 6-2-1 Kashiwanoha, Kashiwa 277-088, Japan. E-mail: ehayashi@npoplantfactory.org or Prof. Dr. Leo F. M. Marcelis, Wageningen University, Horticulture & Product Physiology, Droevendaalsesteeg 1, 6708 PB Wageningen, Netherlands. Phone: (31)317485675, E-mail: leo.marcelis@wur.nl E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s8-advances-in-vertical-farming/>
- August 14-20, 2022, Angers (France): **International Symposium on Urban Horticulture for Sustainable Food Security (UrbanFood2022)**. Info: Dr. Kathrin Specht, Arndtstrasse 15, 10965 Berlin, Germany. E-mail: kathrin.specht@ils-forschung.de or Dr. Kevin Morel, 16, rue Claude Bernard, 75231 Paris, France. E-mail: kevin.morel@inrae.fr E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s9-urban-horticulture-for-sustainable-food-security/>
- August 14-20, 2022, Angers (France): **International Symposium on Value Adding and Innovation Management in the Horticultural Sector**. Info: Dr. David Neven, FAOB605, Viale delle Terme di Caracalla, 00153 Rome, Italy. E-mail: david.neven@fao.org or Dr. Synhia Mathé, CIRAD-UMR Innovation / CSIR-STEPRI, P.O Box CT 519, Cantonments, Accra, Ghana. E-mail: synhia.mathe@cirad.fr E-mail symposium: sciences@ihc2022.org

- Web: <https://www.ihc2022.org/symposia/s10-value-adding-and-innovation-management-in-the-horticultural-sector/>
- August 14-20, 2022, Angers (France): **International Symposium on Adaptation of Horticultural Plants to Abiotic Stresses.** Info: Dr. Fulai Liu, Department of Plant & Environmental Science, University of Copenhagen, Højbakkegaard Alle 13, 2630 Taastrup, Denmark. Phone: (45)3533 3392, Fax: (45)35333478, E-mail: fl@plen.ku.dk or Dr. Bénédicte Wenden, INRA - UMR BFP - 71 avenue Edouard Bourlaux, 33882 Villenave d'Ornon Cedex, France. Phone: (33)557122549, E-mail: benedicte.wenden@inrae.fr E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s11-adaptation-of-horticultural-plants-to-abiotic-stresses/>
  - August 14-20, 2022, Angers (France): **International Symposium on Water: a Worldwide Challenge for Horticulture!** Info: Brunella Morandi, Università di Bologna, Viale Fanin 44, 40127 Bologna, Italy. E-mail: brunella.morandi@unibo.it or Dr. Marcel Kuper, 361 rue Jean-François Breton, 34196 Montpellier, France. E-mail: kuper@cirad.fr E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s12-water-a-worldwide-challenge-for-horticulture/>
  - August 14-20, 2022, Angers (France): **International Symposium on Plant Nutrition, Fertilization, Soil Management.** Info: Assoc. Prof. Lee Kalcsits, Washington State University, WSU-TFREC, Wenatchee, WA 98801, United States of America. Phone: (1)5096638181, E-mail: lee.kalcsits@wsu.edu or Prof. Patrice Cannavo, Agrocampus Ouest, Unité de Recherche EPHor, 2 rue André Le Notre, 49045 Angers, France. E-mail: patrice.cannavo@agrocampus-ouest.fr E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s13-plant-nutrition-fertilization-soil-management/>
  - August 14-20, 2022, Angers (France): **International Symposium on Sustainable Control of Pests and Diseases.** Info: Prof. Lucia Zappala, viale tirreno, 31, 95123 Catania, Italy. E-mail: lzappala@unict.it or Dr. Michel Peterschmitt, Campus International de Baillarguet, CIRAD, TA A-120K, 34398 Montpellier Cedex 5, France. E-mail: michel.peterschmitt@cirad.fr E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s14-sustainable-control-of-pests-and-diseases/>
  - August 14-20, 2022, Angers (France): **International Symposium on Agroecology and System Approach for Sustainable and Resilient Horticultural Production.** Info: Prof. Dr. Maria Claudia Dussi, Universidad Nacional del Comahue, Facultad de Ciencias Agrarias, CC 85 (8303) Cinco Saltos, Rio Negro-Patagonia, Argentina. Phone: (54) 299 9 5719365, E-mail: mcdussi@yahoo.com or Dr. Sylvaine Simon, INRAE Gotheron, 460 Chemin de Gotheron, 26320 Saint-Marcel-lès-Valence, France. Phone: (33)432722206, Fax: (33)475588626, E-mail: sylvaine.simon@inrae.fr E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s15-agroecology-and-system-approach-for-sustainable-and-resilient-horticultural-production/>
  - August 14-20, 2022, Angers (France): **International Symposium on Innovative Perennial Crops Management.** Info: Dr. Sara Serra, Washington State University, Department of Horticulture, Pullman, WA 99164, United States of America. E-mail: sara.serra@wsu.edu or Dr. Pierre-Eric Lauri, UMR SYSTEM, INRA, Place Pierre Viala, 34060 Montpellier, France. Phone: (33)499613054, E-mail: pierre-eric.lauri@inrae.fr E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s16-innovative-perennial-crops-management/>
  - August 14-20, 2022, Angers (France): **International Symposium on Integrative Approaches to Product Quality in Fruits and Vegetables.** Info: Alyson Mitchell, Department of Food Science Technology, UC Davis, 1 Shields Ave, Davis CA 95616, United States of America. Phone: (1)5303046618, E-mail: aemitchell@ucdavis.edu or Dr. Nadia Bertin, UR 1115 PSH, INRA, Domaine St Paul, 228 route de l'aérodrome, Site Agroparc, 84914 Avignon, France. Phone: (33)0432722324, E-mail: nadia.bertin@inrae.fr E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s17-integrative-approaches-to-product-quality-in-fruits-and-vegetables/>
  - August 14-20, 2022, Angers (France): **III International Symposium on Mechanization, Precision Horticulture, and Robotics: Precision and Digital Horticulture in Field Environments.** Info: Dr. Sindhuja Sankaran, Washington State University, P.O. Box 641020, Pullman Washington 99164, United States of America. Phone: (1)5093358828, E-mail: sindhuja.sankaran@wsu.edu or Prof. David Rousseau, Université d'Angers, 62 Avenue Notre Dame du Lac, 49000 Angers, France. Phone: (33)638291612, E-mail: david.rousseau@univ-angers.fr E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s18-precision-and-digital-horticulture-in-field-environments/>
  - August 14-20, 2022, Angers (France): **International Symposium on Advances in Berry Crops.** Info: Dr. Susan McCallum, The James Hutton Institute, Errol Road, Invergowrie, DD2 5DA Dundee, Scotland, United Kingdom. E-mail: susan.mccallum@hutton.ac.uk or Dr. Béatrice Denoyes, 71 avenue Edouard Bourlaux, 33882 Villenave d'Ornon, France. E-mail: beatrice.denoyes@inrae.fr E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s19-advances-in-berry-crops/>
  - August 14-20, 2022, Angers (France): **International Symposium on the Vitivinicultural Sector: Which Tools to Face Current Challenges?.** Info: Prof. Dr. Ahmet Altindisli, Ege University Faculty of Agriculture, Department of Horticulture, 35100 Bornova Izmir, Turkey. Phone: (90)2323882622, Fax: (90)2323881865, E-mail: ahmet.altindisli@gmail.com or Assoc. Prof. Benjamin Bois, Biogéosciences UMR 6282 CNRS uB, 6 Boulevard Gabriel, 21000 DIJON, France. Phone: (33)662605225, E-mail: benjamin.bois@u-bourgogne.fr E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s20-the-vitivinicultural-sector-which-tools-to-face-current-challenges/>
  - August 14-20, 2022, Angers (France): **XII International Symposium on Banana: Celebrating Banana Organic Production.** Info: Mr. Walter Ocimati, Bioversity International, Plot 106, Katalima Road, P. O. Box 24384, 256 Kampala, Uganda. Phone: (256)414286213, Fax: (256)414286949, E-mail: w.ocimati@cgiar.org or Dr. Thierry Lescot, CIRAD, RU GECO, Persyst Department, Boulevard de la Lironde, TA B26/PS4, 34398 Montpellier, France. Phone: (33)467615666, Fax: (33)467615821, E-mail: thierry.lescot@cirad.fr E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s21-international-symposium-on-banana-celebrating-banana-organic-production/>
  - August 14-20, 2022, Angers (France): **International Symposium on Natural Colorants from Plants.** Info: Assoc. Prof. Riikka Räsänen, Craft Studies P.O. Box 8, 00014 University of Helsinki, Finland. E-mail: riikka.raisanen@helsinki.fi or Ms. Anne de la Sayette, 22 rue de l'Arsenal, 17300 Rochefort, France. Phone: (33)54699170, E-mail: arrdhor@wanadoo.fr E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s22-natural-colorants-from-plants/>
  - August 14-20, 2022, Angers (France): **International Symposium on Postharvest Technologies to Reduce Food Losses.** Info: Gustavo Teixeira, Av. José Adriano Arrobas Martins, 210, 14.883-298 Jaboaticabal São Paulo, Brazil. E-mail:

teixeiragha@yahoo.com.br or Dr. Florence Charles, Université d'Avignon, 301 rue Baruch de Spinoza, BP 21239, cedex 9, 84916 Avignon, France. Phone: (33)4.90.84.22.08, E-mail: florence.charles@univ-avignon.fr E-mailsymposium:sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s23-post-harvest-technologies-to-reduce-food-losses/>

■ August 14-20, 2022, Angers (France): **IX International Symposium on Human Health Effects of Fruits and Vegetables** **NEW**

- **FAVHEALTH2022**. Info: Assoc. Prof. Kaleab Baye, Bole Sub-city, Addis Ababa, Ethiopia. E-mail: kaleab.baye@aau.edu.et or Dr. Marie-Josèphe Amiot Carlin, INRAE, 2 place Pierre Viala, Campus La Gaillarde, 34060 Montpellier, France. E-mail: marie-josephe.amiot-carlin@inrae.fr E-mail symposium: sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s24-horticulture-for-nutrition-and-food-security-health-and-well-being/>

■ August 14-20, 2022, Angers (France): **International Symposium on Medicinal and Aromatic Plants: Domestication, Breeding, Cultivation and New Perspectives**.

Info: Dr. Christoph Carlen, Agroscope, Route des Eterpys 18, 1964 Conthey, Switzerland. Phone: (41) 58 481 35 13, E-mail: christoph.carlen@agroscope.admin.ch or Mr. Philippe Gallois, ITEIPMAI, Domaine de la Vesc, 26760 Romthoucher - Jabour, France. Phone: (33)475918146, E-mail: philippe.gallois@iteipmai.fr E-mailsymposium:sciences@ihc2022.org Web: <https://www.ihc2022.org/symposia/s25-medicinal-and-aromatic-plants-domestication-breeding-cultivation-and-new-perspectives/>

■ September 5-9, 2022, Corvallis, OR (United States of America):

**X International Congress on Hazelnut**. Info: Prof. Shawn A. Mehlenbacher, Department of Horticulture, 4017 ALS Bldg., Oregon State University, Corvallis, OR 97331-7304, United States of America. Phone: (1)5417375467, Fax: (1)5417373479, E-mail: mehlenbs@hort.oregonstate.edu Web: <https://hazelnut2022.org/>

■ September 26-29, 2022, João Pessoa, Paraíba (Brazil):

**X International Congress on Cactus Pear and Cochineal**. Info: Mr. Mário Borba, 1571 Rio Grande do Sul Avenue, 58030021 João Pessoa-Paraíba, Brazil. E-mail: presidente@faepapb.com.br E-mail symposium: cactuscongress2022@faepapb.com.br Web: <http://www.cactuscongress2022.com>

NEW

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/>

NEW

NEW

■ November 15-18, 2022, 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, 71100, Foggia, Italy. Phone: (39)0881589237, E-mail: antonio.elia@unifg.it E-mail symposium: info@artichoke2022.org Web: <https://artichoke2022.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/>

■ 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: stephaniem@elsenburg.com 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: nicollette.taylor@up.ac.za Web: <https://ishsirrigationsa2023.com>

■ 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: cgviguer@cebas.csic.es Web: <https://www.bevcrops21.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/>

■ 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/](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>

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