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

Jean-Luc Regnard and Rémi Kahane

Plenary exposure for the finalists of the 3MHT competition

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

Of course, compared to the original and theoretical concept of the planned program, adjustments were needed to adapt to reality. For instance, the call for candidates was unequally disseminated among the ISHS country members. Overall, the organizers received only a limited number of applications. Nevertheless, the international jury played a critical role to check the eligibility



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

and quality of each candidate. It was a challenging task for the president of the jury, Professor Dr. Yves Desjardins, to gather and analyze the independent reports (from 10 jury members, Table 1) on candidates from 12 countries leading to a shortlist of 10 finalists. Various external constraints such as travel restrictions due to sanitary rules in their country or professional unavailability, reduced the number of finalists to seven. These candidates were invited to attend IHC2022 and traveled to Angers at their own expense. The organizing committee felt successful in attracting such enthusiastic youth participants to this event, which was a first of its kind for any ISHS international horticultural congress.

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

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

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

■ Table 1. The international jury that selected the finalists.



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

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

Table 3. The laureates of the 3MHT competition.

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

The candidates had the option to rehearse their speech the day before their performance, to test their word flow, and to adjust their timing to respect the strict 3 minutes timeline, under the guidance of the organizers and the president of the jury. However, they all felt a shock and a strong adrenaline upsurge when they walked on the stage in front of the real, curious, and attentive 1000-person audience, who could electronically evaluate the presenters. The evaluation procedure used the application platform of the congress and allowed attendees to rate the competitors' performance after



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

the morning presentations. Once the votes were tabulated, the average scores were calculated, and the statistics validated. The competition organizers, in agreement with the present members of the international jury, ranked the competitors leading to the choice of the three awardees. All finalists (Figure 2) received a certificate of participation signed by the President of IHC2022 and the President of the jury. Each of them was presented with a gift of local 'Anjou' specialties prepared by the Congress Organizing Committee. The laureates received a specific certificate with an award of 2,500, 2,000 or 1,500 Euros given to the 1st, 2nd and 3rd prize, respectively, cumulative endowment from three sponsors (Table 3).

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

Kiwifruit bacterial canker: exploring tolerance mechanisms and novel control strategies



> Marta Nunes da Silva

The kiwifruit bacterial canker (KBC), caused by *Pseudomonas syringae* pv. actinidae (Psa), is currently the most destructive disease of kiwifruit plants (*Actinidia* spp.), leading to significant economic impacts in several kiwifruit-producing countries, such as New Zealand, China, Italy, Portugal and France. Psa must be properly managed for optimal crop performance, but current disease management strategies are only preventive, relying on removing infected plant material and applying cupric formulations, which often have limited efficacy and environmental impacts. Considering this, the major aims of this PhD thesis were to: i) evaluate the susceptibility of different Actinidia species to Psa; ii) unravel plant tolerance mechanisms against Psa; and iii) explore novel and sustainable strategies to mitigate the disease. This PhD work demonstrated for the first time that A. arguta is more tolerant to Psa infection than A. chinensis var. deliciosa, due to faster recognition of the pathogen, a more complex antioxidant response at earlier stages of infection, tissue reinforcement with lignin, and downregulation of the ABA pathway. In the susceptible A. chinensis, Psa impaired the accumulation of glutamine and ornithine and the expression of genes involved in nitrogen (N) metabolism. In addition, infection of A. chinensis plants grown with nitrate (NO,) resulted in lower bacterial colonization, improved plant photosynthetic capacity and mineral nutrition, as compared with ammonium (NH,*), demonstrating that plant fertilization favoring NO, as the N source could provide an adaptive advantage in cases of Psa infection by decreasing N concentration in plant tissues and improving plant mineral nutrition. Finally, six plant essential oils (PEOs) (from anise, basil, cardamom, cumin, fennel, and laurel) were successfully tested as antimicrobial agents against Psa (both in vitro and in planta), supporting the use of PEOs as tools for more sustainable disease

management strategies, either by complementing or by substituting the currently used treatments. Overall, the findings of this thesis provide innovative knowledge on the regulatory pathways triggered by Psa infection in *Actinidia* spp., and demonstrate the relevance of N nutrition in plant susceptibility to Psa. Moreover, they also highlight the potential contribution of plant elicitors and PEOs to a more successful and sustainable Psa management.

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Nunes da Silva, M., et al. (2022). Defence-related pathways, phytohormones and primary metabolism are key players in kiwifruit plant tolerance to *Pseudomonas syringae* pv. *actinidiae*. Plant Cell Environ. *45*, 528–541. https://doi.org/10.1111/ pce.14224

> Contact

Marta Nunes da Silva, Researcher, Centre for Biotechnology and Fine Chemistry (CBFC), University of Porto, Portugal, e-mail: mansilva@ucp.pt, orcid.org/0000-0001-8228-0576

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



> Cristiano Soares

Nowadays, glyphosate (GLY) is the most used herbicide worldwide. It is often considered to be rapidly inactivated in the soil, not threatening the surrounding environment. However, concerns about its environmental hazards have recently been raised. This work is thus aimed to assess GLY contamination risks to plants and soil quality, and to develop eco-friendly strategies to minimize its phytotoxicity. Although the effects behind GLY herbicidal activity are well described, not much is known concerning its impacts, as a soil contaminant, on non-target plants. In our results, GLY greatly hampered tomato plants' growth, inducing molecular and biochemical disturbances, mostly related to redox imbalances. Upon assessing its non-target phytotoxicity, the focus was on developing green strategies to reduce GLY-induced stress. First, the potential of

silicon (Si), salicylic acid (SA) and nitric oxide (NO) to ameliorate GLY-mediated impacts was studied. Overall, all tested compounds alleviated, at least partially, GLY phytotoxicity. Additionally, the co-treatments boosted the antioxidant response, ensuring the maintenance of cellular redox homeostasis. The application of Si or NO, via foliar spraying, seemed to be the most promising strategy. In addition, the role of organic matter (OM) in limiting bioavailability of GLY in soils was also evaluated. GLY-mediated impacts in tomato plants were reduced in OM-enriched soils, either by promoting its adsorption and/or by preventing redox disorders. The ecotoxicological relevance of GLY-based herbicides was studied, focusing on soil habitat and retention functions. As farmers often apply mixtures of different herbicides, the impacts of a co-exposure to GLY



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

> Reference

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>Contact

Cristiano Soares, Post-doc researcher, GreenUPorto - Sustainable Agrifood Production Research Centre & INOV4Agro, Biology Department, Faculty of Sciences, University of Porto, Portugal, e-mail: cfsoares@fc.up.pt, orcid.org/0000-0003-3330-2024

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



> Chiara Amitrano

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

knowledge of the mechanisms behind plant responses to the environment, it is difficult to determine how and to what extent plants can adapt to any changes in growing conditions. The application of a multidisciplinary approach in research will enable sustainable crop production even in harsh environments, where a "climate smart-agriculture" becomes necessary to improve crop yield and quality.

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Amitrano, C., et al. (2021). Leaf morpho-anatomical traits in Vigna radiata L. affect plant photosynthetic acclimation to changing vapor pressure deficit. Environ. Exp. Bot. 186, 104453. https://doi.org/10.1016/j. envexpbot.2021.104453

> Contact

Chiara Amitrano, Post-doc researcher, Department of Agricultural Sciences, University of Naples Federico II, Portici, Italy, e-mail: chiara.amitrano@ unina.it, orcid.org/0000-0003-1864-5221





> About the authors

Jean-Luc Regnard is Professor Emeritus at Institut Agro Montpellier, Researcher at Agap Institute Research Unit, Montpellier University, France (https://umr-agap.cirad.fr/en), and member of the IHC2022 Education Committee. E-mail: jean-luc.regnard@supagro.fr Rémi Kahane is Agronomist and Vegetable Plant Breeder (PhD), Leader of the Cirad Horticulture value chain, and Vice-President of the International Committee of IHC2022. E-mail: remi.kahane@cirad.fr

> ISHS Young Minds Award winner summaries

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

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



> José María Vadillo

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

His research focused on the evaluation of the response of horticultural crops (pepper, broccoli and processing tomato) to nitrogen fertilisation. Farmers need to be made aware of the major environmental problems that exist because of over fertilisation. Nitrate concentration in groundwater is increasing because of leaching from agriculture. This environmental problem is not an immediate danger but is getting worse. Food producers must be provided with information and tools on efficient use of fertilisers to solve this problem without reducing food production. At the XVI International Symposium on Processing Tomato, José María presented some of his research on the relationships between rapid measurements of chlorophyll and nitrate content in sap versus the reference indicator nutritional nitrogen index (NNI). The main aim was to determine the threshold values of these rapid measurements to help technicians and producers in monitoring the nutritional status of their crops in an easier, quicker, and safer way. This will reduce production costs for farmers and reduce groundwater contamination by nitrate leaching. José María presented these threshold values for each phenological moment of the crop.

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

> Contact

José María Vadillo, Centro de Investigaciones Científicas y Tecnológicas de Extremadura (CICYTEX), 06187 Guadajira, Spain, e-mail: josemaria.vadilloh@juntaex.es

