IECPS 2024 Conference

The 3rd International Electronic Conference on Plant Sciences

15–17 January 2024 | Online

Program and Abstract Book

The 3rd International Electronic Conference on Plant Sciences

Online
15–17 January 2024

MDPI • Basel • Beijing • Wuhan • Barcelona • Belgrade

Organizing Committees

Conference Chairs

Prof. Dr. Adriano Sofo

Session Chair

Prof. Dr. Marko Sabovljevic
Prof. Dr. Adriana Basile
Prof. Dr. Maurizio Badiani
Prof. Dr. Oscar Vicente
Prof. Dr. Xinhua He
Prof. Dr. Leo Sabatino
Prof. Dr. Kermit Ritland
Prof. Dr. Luigi De Bellis
Dr. Baohong Zhang
Dr. Suresh Awale
Dr. Enrico Doria
Dr. Daiana Garcia
Prof. Dr. Giovanna VISIOLI

Scientific Committee

Dr. Jayanta Kumar Patra
Dr. Antonella Vitti
Dr. Francesca Degola
Dr. Jesús Palá-Paúl
Prof. Dr. Angelica Roman-Guerrero
Dr. Fernando Reboredo
Dr. Brigitta Tóth
Prof.Dr. Hazem S. Elshafie
Dr. Mauro Commisso
Prof. Dr. Eunice Areal Bacelar
Dr. Sergio de los Santos Villalobos
Prof. Dr. Xiaohan Yang
Dr. Naser Aziz Anjum
Dr. Matteo Marieschi
Prof. Dr. Pandiyan Muthuramalingam

Organised by

MDPI
Academic Open Access Publishing
since 1996

Conference Secretariat

Ms. Winnie Li
Mr. Andy Yi
Ms. Alethea Liu

Email:iecps2024@mdpi.com

Welcome from the Chairs

Dear Colleagues,

It is a great pleasure to welcome you to the 3rd Electronic Conference on Plant Sciences (IECPS 2024). The conference is organized by the MDPI open-access journal Plants (ISSN: 2223-7747, Impact Factor 4.5). It allows scientists from all over the world to present their latest research in Plant Sciences, receive direct feedback, and engage in discussions with the wider scientific community.

From an anthropocentric point of view, that leads to the so-called 'plant blindness', we forget that our life depends entirely on plants. Indeed, life on earth is carbon-based: around 82% of carbon in the biosphere is stored in the biomass of plants, the main contributors to the ecological stability of the planet. Even if they are sessile and solitary-like organisms, plants can be defined as 'holobionts' formed by the organism itself plus the enormity of microorganisms living on (epiphytic) and in (endophytic) it, that can establish diverse plant–microorganism interactions. Furthermore, plants are in chemical (e.g., volatile substances and root exudates), physical (e.g., shading, touch, electrical stimuli) and/or biological (e.g., by mycorrhizal network) connection with other plants of the same or different species. Thus, in a certain sense, they are never alone but strictly networked with each other and with a plethora of other organisms.
In this scenario, IECPS 2024 will deepen plant research at all levels, from the molecular through to the whole plant and community scale. This year, we have planned eight focused sessions:

Session A: Plant Physiology, Signaling and Communication
Session B: Plant Ecology, Biodiversity and Developmental Biology
Session C: Plant Response to Stresses and Changing Environment
Session D: Phytochemistry, Phytoremediation, and Plants in Urban Ecosystems
Session E: Plant Nutrition and Plant–Soil–Microorganism Interactions
Session F: Plant Molecular Biology and Plant Genetics, Genomics, and Biotechnology
Session G: Plant Modeling and Bioinformatics
Session H: Plant Ecosystem Services and Public Outreach

The IECPS 2024 will be an online-only proceeding, which allows participation from all over the world with no requirement for travel or related expenditures. An electronic conference provides a platform for rapid and direct exchanges about the latest research findings and novel ideas.

We are committed to equality and inclusion principles. Therefore, we ask authors to ensure that the papers and presentations are highly accessible to the wider and more diverse scientific community. We encourage submissions from scientists at all career stages and backgrounds and aim for an equal gender balance.

We look forward to receiving your contributions to this scientific event and would like to thank you in advance for your active support.

Prof. Dr. Adriano Sofo
Conference Chair

Table of Contents

General Information

Plants (ISSN 2223-7747) is an international and multidisciplinary scientific open access journal that covers all key areas of plant science. It publishes review articles, regular research articles, communications, and short notes in the fields of structural, functional and experimental botany. In addition to fundamental disciplines such as morphology, systematics, physiology and ecology of plants, the journal welcomes all types of articles in the field of applied plant science.

Journal Webpage: https://www.mdpi.com/journal/plants
Impact factor: 4.5 (2022)
5-Year Impact Factor: 4.8 (2022)

Program

Invited Speakers

Dr. Antonio Olmos
Instituto Valenciano de Investigaciones Agrarias (IVIA), Spain

Dr. Gianluigi Giannelli
University of Parma, Italy

Dr. Enrico Doria
Department of Biology and Biotechnology, University of Pavia, Italy

Prof. Dr. Enrico Vito Perrino
Mediterranean Agronomic Istitute of Bari, Italy

Prof. Dr. BELSEM MARZOUK REFIFA
Universty of Monastir, Tunisia

Prof. Dr. M. Teresa Boquete Seoane
ECOTOX group, Area of Ecology, Dpt. of Functional Biology, University of Santiago de Compostela, Spain

1**Dr. Kim Haeng-Hoon**
Department of Agricultural Life Science, Sunchon National University, Korea

Prof. Dr. Corina Tiulea Danciu
Department of Pharmacognosy, University of Medicine and Pharmacy "Victor Babeş", Romania

Program at a Glance

The 3rd International Electronic Conference on Plant Sciences 15–17 January 2024, Online			
	Monday 15 January 2024	**Tuesday 16 January 2024**	**Wednesday 17 January 2024**
Morning	*SESSION B. Plant Ecology, Biodiversity and Developmental Biology* *SESSION G. Plant Modeling and Bioinformatics* *SESSION H. Plant Ecosystem Services and Public Outreach*	*SESSION A. Plant Physiology Signaling and Communication* *SESSION E. Plant Nutrition and Plant–Soil–Microorganism Interactions*	*SESSION D. Phytochemistry, Phytoremediation, and Plants in Urban Ecosystems*
	Break	Break	Break
Afternoon	*SESSION C. Plant Response to Stresses and Changing Environment*	*SESSION F. Plant Molecular Biology and Plant Genetics, Genomics and Biotechnology*	*Poster session*

Conference Program

15 January 2024 (Monday)

SESSION B. Plant Ecology, Biodiversity and Developmental Biology

SESSION G. Plant Modeling and Bioinformatics

SESSION H. Plant Ecosystem Services and Public Outreach

CET	CST(Aisa)	EST	Speaker and Title
09:30-9:40	16:30-16:40	3:30-3:40	Welcome from the chair, Prof. Dr. Adriano Sofo, and session chair, Prof. Dr. Marko Sabovljevic
9:40-10:10	16:40-17:10	3:40-4:10	Invited Speaker: **Prof. Dr. M. Teresa Boquete Seoane** *Abiotic stress endurance in bryophytes: new insights from heavy metal tolerance studies*
10:10-10:40	17:10-17:40	4:10-4:40	Invited Speaker: **Prof. Dr. Enrico Vito Perrino** *SYNECOLOGY AND DISTRIBUTION OF SOME CROP WILD RELATIVES (CWR) OF CONSERVATION CONCERN IN ITALY*
10:40-10:55	17:40-17:55	4:40-4:55	**Jalal Kassout** *Aridity Gradients Shape Intraspecific Variability of leaf functionl Traits in Native Olea europaea L. of Morocco*
10:55-11:10	17:55-16:10	4:55-5:10	**ANSHUL DHYANI** *Influence of Various Biotic and Abiotic Factors on Moss Diversity and Community Composition in the Himalaya*

11:10-11:25	16:10-16:25	5:10-5:25	**Jannat E. Tajkia** *Characterization of Floral and Leaf Volatile Organic Compounds (VOCs) in Four Asian Annonaceae Species: Insights into Pollination and Stress Responses*
11:25-11:40	16:25-16:40	5:25-5:40	**Pablo Gonzalez-Suarez** *Hot and Cold: Mathematical Modeling of Temperature Sensing in Arabidopsis and Wheat*
11:40-11:55	16:40-16:55	5:40-5:55	**Chiara Suanno** *From big data to micro morphology: an experimental approach to ecosystem services calculation*

SESSION C. Plant Response to Stresses and Changing Environment

CET	CST(Aisa)	EST	Speaker and Title
14:00-14:10	21:00-21:10	8:00-8:10	Welcome from the session chair, Prof. Dr. Oscar Vicente, Prof. Dr. Giovanna VISIOLI and Prof. Dr. Maurizio Badiani
14:10-14:30	21:10-21:30	8:10-8:30	Invited Speaker: **Prof. Dr. Oscar Vicente** *Cakile maritima: A Halophyte Model to Study Salt Tolerance Mechanisms and Potential Useful Crop for Sustainable Saline Agriculture in the Context of Climate Change*

14:30-14:55	21:30-21:55	8:30-8:55	Invited Speaker: **Prof. Dr. BELSEM MARZOUK REFIFA** *Potential of Citrullus colonythis extracts as food preservative against a fungal mycotoxigenic contaminant*
14:55-15:20	21:55-22:20	8:55-9:20	Invited Speaker: **Dr. Gianluigi Giannelli** *The contribution of the Beijerinckia fluminensis strain PVr_9 in plants salt stress tolerance*
15:20-15:35	22:20-22:35	9:20-9:35	**Tamanna Bhardwaj** *Melatonin and microbial fortification improved photosynthetic efficiency and phenolic contents in Brassica juncea L. plants under Cd stress*
15:35-15:50	22:35-22:50	9:35-9:50	**Juan Sebastian León-Beltrán** *Induced Defense of Alstroemeria sp. against Frankliniella occidentalis (Pergande) via Elicitation with Inorganic Compounds*
15:50-16:05	22:50-23:05	9:50-10:05	**Silvia Potestio** *Bejierinkia fluminensis increases salt stress tolerance in tomato plants*
16:05-16:20	23:05-23:20	10:05 - 10:20	**Elisa Fasani** *Metal interactions in the Ni hyperaccumulating population Noccaea caerulescens Monte Prinzera*.

16:20-16:35	23:20-23:35	10:20 - 10:35	**Lou Lambert** *Type II metacaspase mediates light-dependent programmed cell death in Chlamydomonas reinhardtii*

16 January 2024 (Tuesday)

SESSION A. Plant Physiology Signaling and Communication

SESSION E. Plant Nutrition and Plant–Soil–Microorganism Interactions

CET	CST(Aisa)	EST	Speaker and Title
09:30-9:40	16:30-16:40	3:30-3:40	Welcome from the chair, Dr. Enrico Doria, Prof. Dr. Xinhua He and Prof. Leo Sabatino
9:40-10:05	16:40-17:05	3:40-4:05	Invited Speaker: **Prof. Dr. Ahmed M. Abdel-Azeem** *Endophytic Fungi: A hidden treasure towards pathogen management*
10:05-10:20	17:05-17:20	4:05-4:20	**Davide Farruggia** *Productive and Qualitative Response of Organic Lemon Balm Treated with Different Foliar Biostimulants*

10:20-10:35	17:20-17:35	4:20-4:35	**Michele Ciriello** *Investigation of the effects of different non-microbial biostimulants on primary and secondary metabolism of strawberry (Fragaria x ananassa) in organic farming*
10:35-10:50	17:35-17:50	4:35-4:50	**Giovanna Fusco** *Effects of microbial biostimulants on horticultural crops*
10:50-11:05	17:50-18:05	4:50-5:05	**Marzena Sujkowska-Rybkowska** *Rhizobia and arbuscular mycorrhizal fungi (AMF) as the microbiota potentially improving the growth of legumes in heavy metal polluted areas*
11:05-11:20	18:05-18:20	5:05-5:20	**Break**
11:20-11:35	18:20-18:35	5:20-5:35	**Francesca Degola** *The Characterization of the Glutamate Dehydrogenase Enzyme in Selected Marchantiophyta: A Study to Explore Nitrogen Management in Liverworts*
11:35-11:50	18:35-18:50	5:35-5:50	**Rosangela Addesso** *Soil microalgae and cyanobacteria characterization in a differentially managed olive orchard*
11:50-12:05	18:50-19:05	5:50-6:05	**Jorge Poveda** *A novel plant "wire communication" after infection by foliar necrotrophic pathogens: first description of Trichoderma as an interplant communicator*

12:05-12:20	19:05-19:20	6:05-6:20	**Xie Luo** *Community response of arbuscular mycorrhizal fungi between subsoil and topsoil layers to 15-year long-term fertilizer amendments in an intensively managed arable purple soil*

SESSION F. Plant Molecular Biology and Plant Genetics, Genomics and Biotechnology

CET	CST(Aisa)	EST	Speaker and Title
14:00-14:10	21:00-21:10	8:00-8:10	Welcome from the session committee, Dr. Pandiyan Muthuramalingam
14:10-14:40	21:10-21:40	8:10-8:40	Invited Speaker: **Dr. Kim Haeng-Hoon** A Systematic Approach to Optimize the Droplet-vitrification Procedure by Balancing the Cryoprotection and Cytotoxicity Based on the Donor Plant Vigor
14:40-15:10	21:40-22:10	8:40-9:10	Keynote Speaker: **Dr. Antonio Olmos** Advances on Plant Viruses and High Throughput Sequencing (HTS)
15:10-15:25	22:10-22:25	9:10-9:25	**Gianluca Gambacorta** *A metabolic engineering approach to study the biological role of the indolamines tryptamine and serotonin in the model species Solanum lycopersicum*

15:25-15:40	22:25 - 22:40	9:25-9:40	**Amy Klocko** *Efficient dual-gene targeting AGAMOUS-like genes in domestic apple*
15:40-15:55	22:40 - 22:55	9:40-9:55	**Sadhana Singh** *CRISPR/Cas-Mediated Genome Editing in Legumes*
15:55-16:10	22:55 - 23:10	9:55-10:10	**Catarina Estêvão** *Genome-wide analysis of Cation/Proton exchanger (CAX) gene family in Vitis vinifera L.*
16:10-16:25	23:10 - 23:25	10:10-10:25	**Rosa Paola Radice** *Effect of UV-C radiation on genomic variation on Chlamydomonas reinhardtii*

17 January 2024 (Wednesday)

SESSION D. Phytochemistry, Phytoremediation, and Plants in Urban Ecosystems

CET	CST(Aisa)	EST	Speaker and Title
09:30-9:40	16:30-16:40	3:30-3:40	Welcome from the chair, **Dr. Suresh Awale**
9:40-10:10	16:40-17:10	3:40-4:10	Invited Speaker: **Dr. Enrico Doria** *The polyphenol/saponin-rich Rhus tripartita extract has an apoptotic effect on THP-1 cells through the PI3K/AKT/mTOR signaling pathway*

10:10-10:40	17:10-17:40	4:10-4:40	Invited Speaker: **Prof. Dr. Corina Tiulea Danciu** *Olivae folium ethnolic extracts: phytochemical profile and biological activity assessment*
10:40-10:55	17:40-17:55	4:40-4:55	**Oumaima Chgari** *Orbea variegata (L.) Haw. (Apocynaceae) attenuates the progression of UV/sulfuric acid-induced skin carcinogenesis in Swiss albino mice*
10:55-11:10	17:55-19:10	4:55-5:10	**Stefano Negri** *Phylogenetic-guided bioprospection of the Italian flora: from the exploitation of bioactive phytochemicals to the study of chemo-evolutionary dynamics*
11:10-11:25	19:10-19:25	5:10-5:25	**Nutthawut Charoimek** *Aromatic Profile and Phytochemical Analysis of Comprehensive Fractions in the Aromatic Extraction of Damask Rose*
11:25-11:40	19:25-19:40	5:25-5:40	**Lina Raudone** *Phytoprofilling of Achillea millefolium morphotypes*
11:40-11:55	19:40-19:55	5:40-5:55	**Fabio Pietrolucci** *Bioprospection of the Artemisia genus: phytochemical profile and antioxidant activity of five Artemisia spp. from the Lessini mountains*
11:55-12:10	19:55-20:10	5:55-6:10	**Jesús Palá Paúl** *Essential oils of different populations of Baccharis halimifolia L. from USA*

Poster Session

17 January 2024

Anastasia Turba	Search for polymorphisms responsible for shifting fatty acid biosynthesis in sea buckthorn fruits
Lénia Rodrigues	Metabolomic approach in Vitis vinifera varieties with different stress tolerance in Alentejo region
Maria Doroteia Campos	Olive Endochitinase EP3-like gene mediates plant responses against Colletotrichum nymphae infection.
Lorena Asensio	Zucchini TINY4 gene regulates plant development through brassinosteroid signalling pathway

Yoel Aroca-Martínez	Response of specific leaf area to nutrient addition and competition release in Cistus ladanifer L.
Martin NDAYAMBAJE	Rwanda-native Tetradenia riparia (Hochst.) Codd: Phytochemical Profile, Antioxidant Toxicity, and Anti-Inflammatory and Immunomodulatory Effects
Hicham Wahnou	Artemisia herba-alba: A Promising Approach to Combating Arthritis Progression.
Giuseppe Molinari	Identification and investigation of terrestrial/freshwater algal species with adaptive mechanisms to Cr(VI) stress
Sergio Contreras-Liza	The use of bacterial consortia improves seed tuber production in potato varieties for frying
Elizabeth Kordyum	Photosynthetic apparatus of psammophytes Alyssum desertorum Stapf and Secale sylvestre Host under soil flooding
Ioannis-Dimosthenis Adamakis	Is MAP65-1 phosphorylation related to Cr(IV) effects on the microtubules of Arabidopsis thaliana?
Catarina Campos	Mycorrhizal inoculation affects oxidative stress response in wheat plants under manganese stress.
Giulia Salerno	Does an auxin-adjuvant urea derivative interfere with the vascular pattern formation? Preliminary results
Željana Fredotović	ANTI-PHYTOVIRAL AND CYTOTOXIC ACTIVITY OF HYDROSOL AND METHANOLIC EXTRACT OF THE SPECIES Seseli tomentosum Vis.
Leonardo Coviello	Exploring frass deriving from Hermetia illucens as a new sustainable tool for inducing biostimulant and antifungal activities in wheat and tomato against Fusarium spp.
ANIRBAN DEBNATH	Salinity stress-mediated phenotypic, biochemical and microscopic assessment of two flaxseed cultivars having contrasting lignan content
Urtė Griškevičienė	Biennial plant Cirsium vulgare savi Ten. comparison of chemical composition and antioxidant activity during two years grow
Juan Sebastian León-Beltrán	Elicitation by Organic Compounds for Inducing Defenses in Alstroemeria sp. against Frankliniella occidentalis (Pergande)
Diego Quiroga	Synthesis of acibenzolar-S-methyl analogs derived from salicylic acid and 4-hydroxybenzaldehyde: DFT B3LYP computational study and molecular docking against enzymatic targets of biological interest
Giorgio Chiari	The development of strategies for the use of rhizosphere microorganisms to reduce the use of fertilizers and to control biotic and abiotic adversities: experiences of the FERTLESS Project.
VIKASH KUMAR	The nano-priming of Eleusine coracana seeds and an evaluation of salinity stress tolerance
Majid Shouri	Conserved Motifs Identification of Polygalacturonase-inhibiting protein1 (PGIP1) in 19 Species of Plants
Maria Grossi Vanacore	Maize's Physiological Responses to the Foliar Pathogen Exserohilum turcicum and the Native Biocontroller Bacillus velezensis EM-A8 in Greenhouse Trials
Liudmyla Kozeko	Response of psammophyte Alyssum desertorum Stapf to soil flooding
Purificación Lison	Role of salicylic acid in the volatilome profile of tomato plants upon Citrus exocortis viroid infection

Maria Cavallero	In vivo experiments on the flow of mycotoxins in plants
Roxana Reyes Ríos	Antifungal activity of ethanol extract of thyme (Thymus vulgaris) and almond (Terminalia catappa) against ATCC strains of Candida albicans
Jorge López Pérez	Species richness distribution and endemism of butterworts (Pinguicula: Lentibulariaceae) in America
Bruno Casimiro	Optimization of enzymatic production in tamarillo (Solanum betaceum Cav.) cell suspension cultures using chemical elicitation
Elizabete Andersone-Trēziņa	An assessment of the chemical composition and physical parameters of Phaseolus vulgaris and Phaseolus lunatus beans
Narayan Singh	The modulatory effect of Nitric oxide molecules on the heavy metal stress in Triticum aestivum
Devindee Senanayake	The effect of BAP concentration and salt strength of MS medium on the in vitro shoot growth and multiplication of Passiflora edulis var. Horana Gold
Margit Olle	The effect of insect frass on tomato transplant growth and nutrient content
Sabrina Dookie	Mangrove tree growth, diversity, and distribution in tropical coastline ecosystems
Listya Karmawan	Feasibility of household-scale dual-culture bio-assay for the in vitro screening of banana resistance against fusarium wilt
Soufian Chakkour	Shifts in Arable Weeds Diversity and Community Structure in Response to Agricultural Intensification Practices: a Case Study from Northern Morocco
Borja Ferrández-Gómez	Enhancing salt stress tolerance in tomato (Solanum lycopersicum) through foliar silicon application
F.M. Junkeer	Climate resilience in crop rice: advancing the germplasm for submergence tolerance
Lorena Vultaggio	Synergistic effect between different plant growth-promoting bacteria and various nitrogen rates on production and quality of fennel grown in open field
Beppe Benedetto Consentino	Lettuce performances as influenced by different nitrogen dosages and A. brasilense strains
Szymon Bober	Proliferation of Rindera graeca hairy roots on polymeric scaffolds
Kamil Wierzchowski	Influence of he chitosan—xerogel ratio on rinderol production and biomass proliferation in transgenic root cultures of Rindera graeca
Vaide Sakalauskienė	Sustainable green synthesis of silver nanoparticles from Hippophae rhamnoides and Viburnum opulus plant by-product extracts and their antimicrobial activity and photochemical analysis
Roxana Călugăr	Breeding maize for heat and drought tolerance: a necessity, nowadays, in Romania
Dariusz Kulus	Enhancing the performance of chrysanthemum synthetic seeds through iron oxide nanoparticles supplementation
Orfeas Voutsinos-Frantzis	EXPLORING THE EFFECT OF “WHITE LIGHT” ON THE GROWTH, LEAF MORPHOLOGY AND PHYSIOLOGY OF SPINY CICHORY PLANTS (Cichorium spinosum L.) IN A VERTICAL FARM

Violetta Macioszek	Necrotrophic fungus Alternaria brassicicola infection influences the photosynthetic efficiency of Sinapis alba similarly as in other Brassicaceae
SAFIYE TUNALI	Investigation into Water–Yield Relationships in Some Drought-Resistant Cotton Varieties Cultivated in Aydın Province
Weronika Kursa	Evaluation of the biocidal effect of some plant extracts against Pseudomonas aeruginosa and selected microorganisms promoting plant growth (PGPM)
Ilaria Brugellis	Enhancing the Potential of Plant Microbial Fuel Cells: The Influence of Botanical Characteristics on Bioelectrical Performance
Mintu Meena	" Unraveling the Inter-specific hybrids of sugarcane for drought tolerant under the changing climates
Brigitta Tóth	A comparison of the effects of sewage sludge and compost on maize plant physiology
Zaynab OUADGHIRI	Zingiber Officinale antioxidant activity and immunomodulatory effects on human polymorphonuclear neutrophils.
Othman EL FAQER	In vitro and in silico evaluation of the immunomodulatory effects of Laurus nobilis L. essential oil and eucalyptol on polymorphonuclear neutrophils
Jelena Horvatinec	Enhancing fertility in acid Luvisol and sunflower (Helianthus annuus L.) yield with fly bioash application
Priyadarshini Bhorali	Dissecting the Sinapis alba L. defense transcriptome, a potential donor of resistance to Alternaria blight
Nishtha Paul	GC–MS profiling, assessment of antioxidant and anti-bacterial activity of the essential oil of Cestrum nocturnum, and Formulation and Evaluation of Herbal Toothpaste
Hanane EL Wazziki	Nitrogen fertilization for the management of powdery mildew of barley caused by Blumeria graminis f. sp. hordei
Elshafia Ali Hamid Mohammed	Review: Occurrence, Spread, and Management Possibilities of Citrus Bacterial Canker (Xanthomonas citri subsp. citri) in Sudan
Palakdeep Kaur	Evaluating the effect of different self-pollination methods on nut set and nutlet abscission in macadamia
magdoline Ahmed	Review: Arbuscular Mycorrhizal Fungi and Phosphorus Solubilizing Bacteria: Plausible Candidates or Striga hermonthica Management in Sorghum
Nicolò Iacuzzi	Effect of the Foliar Biostimulants on Yield and Quality of "Pizzutello" Tomato Sicilian Landrace Cultivated Without Irrigation
Dilek Killi	Heat and Drought Stress Associated with a Naturally Occurring Heat Wave Negatively Affected the Carbon and Water Balance of Olia Europea
Simrat Kaur	Algae and duckweed offer sustainable solutions to mitigate impacts of water and food insecurity
Leonardo Morini	Radial oxygen loss by Vallisneria spiralis affects microbial diversity and activity and pore-water chemistry in organic sediments.
Olena Bobrova	The Cryopreservation of Dormant Buds of Raspberry (Rubus idaeus L.)
Paola Malaspina	Pharmacognostic study of the rare Saponaria sicula Raf. in relation to different pedo-climatic conditions.

Iris Aloisi	Unveiling protein changes in the context of climate change: revelations from a historical wheat seed collection
Daniel Bozo	Effect of planting density on Pinus radiata growth and branch diameter before canopy closure
Julieta Almeida	The effect of sucrose and a gelling agent on the direct somatic embryogenesis capacity of decaffeinated genotypes of Coffea arabica L.
Neha Mathur	Evaluation of Inhibitory effect of Clitorea ternatia flower extract on the growth of Keratinophilic fungi isolated from Siliguri, West Bengal, India using Foldscope as a research tool
Brian Ssemugenze	Investigation of the effects of foliar fertilization on two maize hybrids’ physiological characteristics under irrigated conditions
Aboubakr Boutahar	Unveiling Vegetation Patterns, Modern Pollen Profiles, and Environmental Influences in Sougna Mountain, Northern Morocco
Naser Anjum	Cellular Redox Homeostasis in Plants: Violators, Protectors, and Their Modulation
Maris Klavins	Invasive plants as a source of biologically active lipids
Leonardo Bisson	Valorisation of the Italian biodiversity: specialised metabolism in the Rosid clade
Sinoy Johnson	Effect of Salicylic Acid priming on the expression of Susceptible genes in Zingiber–Pythium interactions
Francisco Vera-Sirera	Role of THT and Twi on the volatilome profile of tomato plants upon wounding
Giovanni Gugliuzza	A new soilless cultivation system for tomato production in southern Italy

What is Sciforum?

Sciforum is an event planning platform that supports open science by offering the opportunity to host and participate in academic conferences. It provides an environment for scholarly exchange, discussion of topics of current interest, building of networks and establishing collaborations.

The Benefits of Sciforum

Sciforum helps conference organizers to run online and physical conferences efficiently. The organizers reduce their administrative efforts thanks to an online tool that supports all aspects of conference organization, including setting up and maintaining the conference website, managing the peer-review process, publishing the conference proceedings, handling and coordinating the conference schedule, registration, billing, sponsors, etc.

We are here to help you to

- Set up your conference website
- Handle abstract & full paper submission and peer review
- Handle online registrations and billing
- Build your conference program & schedule, record the conference income & expenses
- Build customized mailing lists
- Have access to useful data from your conference (participants list, registration details, book of abstracts, etc.)
- Copy-edit, manage & publish your conference proceedings
- Manage Awards & post event surveys

For more information, please visit: **www.sciforum.net**

For any queries, please contact: **info@sciforum.net**

Abstracts

SESSION 1. Plant Physiology Signaling and Communication

sciforum-082737: Does an Auxin-Adjuvant Urea Derivative Interfere with the Vascular Pattern Formation? Preliminary Results

Giulia Giovanna Salerno [1], Eugenia Polverini [2], Stefano Bruno [3] and Ada Ricci [4]

[1] Dipartimento di Scienze Chimiche, della Vita e della Sostenibilità Ambientale, Università di Parma. Parma, Italy
[2] Dipartimento di Scienze Matematiche, Fisiche e Informatiche, Università di Parma, Parma, Italy
[3] Dipartimento di Scienze degli Alimenti e del Farmaco, Università di Parma, Parma, Italy
[4] Department of Chemistry, Life Sciences and Environmental Sustainability

The vascular system is essential for land plants by providing long-distance transportation for water, nutrients, and signaling molecules. Our knowledge about its structure comes from the study of the continuous conductive system of Arabidopsis leaves, composed of interconnected veins organized in a hierarchical network: single primary veins, loops of secondary veins, lateral veins, marginal veins, and tertiary-connected veins. Auxin is a key factor guiding the vascular network differentiation in all organs, and continuous polar auxin transportation reflects the continuity of conductive tissues. Indeed, auxin cell-to-cell movement involves at least influx and efflux carriers located at the plasma membrane (AUX1/LIKE AUX1 family and PIN-FORMED family, respectively) and receptor/receptors through which an auxin signaling mechanism operates. According to the canalization hypothesis, auxin induces the formation of self-organizing channels via a feedback regulation of its own transport.

Auxin-binding protein 1 (ABP1) is the first auxin-binding protein identified, predominantly located in the endoplasmic reticulum, while a small fraction remains in the apoplast. In this acidic region, it binds with auxin by acting as a receptor that mediates auxin canalization.

Here, we report preliminary results based on the interference between ABP1 and an auxin-adjuvant urea derivative, the N,N'-bis(2,3-methylenedioxyphenyl)urea (2,3-MDPU).

The simple and regular vein patterns of Arabidopsis cotyledons will be used to study the effects of this urea derivative on vascular development.

sciforum-082852: Effect of the Foliar Biostimulants on Yield and Quality of "Pizzutello" Tomato Sicilian Landrace Cultivated Without Irrigation

Nicolò Iacuzzi [1], Federica Alaimo [2], Davide Farruggia [2], Pietro Bellitto [2], Claudio Leto [2] and Salvatore La Bella [2]

[1] Department of Agricultural, Food and Forest Sciences, Università degli Studi di Palermo, Viale delle Scienze 6 13, Building 4, 90128 Palermo, Italy

[2] Department of Agricultural, Food and Forest Sciences, Università degli Studi di Palermo, Viale delle Scienze 13, Building 4, 90128 Palermo, Italy

Biostimulants represent a sustainable and efficient technology that can be used in the agriculture sector to improve nutrient use efficiency and secure the yield stability of crops. The application of microbial and non-microbial plant biostimulants has rapidly expanded because these substances may boost vegetative growth and enhance tolerance to biotic and abiotic stress. Tomato (*Solanum lycopersicum* L.) is a summer crop, affected by drought stress during the cultivation cycle, in particular in the most sensitive periods, such as fruit setting and fruit development. In Italy, especially in southern regions, long-storage tomato genotypes tomato (es. Pizzutello di Sciacca e Locale di Salina) were selected. These genotypes have drought resistance characteristics. In this study, the effect of the foliar application of different biostimulants (betanina, seaweed extracts, vegetable protein hydrolysate, and animal protein hydrolysate) on the productive and qualitative parameters of a local tomato ecotype (Pizzutello) cultivated in Sicily without irrigation was evaluated. In plants treated with betanina (F1), the highest dry matter (9.9%) and solid soluble content (6.9 °Brix) were observed. Foliar treatment with *A. nodosum* (F3) and animal protein hydrolysate (F4) allowed the highest potassium values to be obtained, vegetal protein hydrolysate (F5) allowed the highest calcium value to be obtained, and betaine (F1) allowed the highest nitrate value to be obtained. In tomatoes obtained from untreated plants, the highest firmness was observed. The highest marketable yield (13.8 t ha^{-1}) was obtained in plants treated with F5, with an increase of about 17% to control plants. The highest non-marketable yield was observed in control plants and in those treated with F1 (1.1 t ha^{-1}). The results obtained indicate that the application of biostimulants has proved effective in improving the growth and productivity of the tomato in conditions of limited water availability. Furthermore, qualitative performances were improved, despite the severe water stress conditions to which the crop was subjected in the test environment.

sciforum-084020: Effects of microbial biostimulants on horticultural crops

Giovanna Marta Fusco [1], Rosalinda Nicastro [1], Youssef Rouphael [2] and Petronia Carillo [1]

[1] Department of Environmental, Biological and Pharmaceutical Sciences and Technologies, University of Campania "Luigi Vanvitelli"

[2] Department of Agricultural Sciences, University of Naples "Federico II"

The use of microbial biostimulants, such as plant-growth-promoting bacteria (PGPB), arbuscular mycorrhizal fungi (AMF), alone or in combination with beneficial microorganisms such as fungi of the genus *Thichoderma* spp., has gained significant attention in recent years as an environmentally sustainable approach to increase the yield and quality of horticultural species. Our study focused on the qualitative and quantitative effects of treatments with microbial biostimulants approved by Regulation (EU) 2019/1009 on different vegetable crops. Through a meta-analysis based on the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) method, which until now has mostly been applied to studies of medical interest, it was possible to identify, select, and evaluate all relevant literature studies from 2010 to 2022, with the aim of providing a critical assessment of the most recent findings related to microbial biostimulants and their beneficial effects on horticultural crops. We performed studies on different tomato varieties treated with biostimulants of different microbial composition, on which we performed morphological and metabolic profile analyses. Treatments with biostimulants resulted in positive effects on the yield, fruit number, and content of essential amino acids, γ-aminobutyric acid (GABA), monoethanolamine (MEA), and secondary metabolites with antioxidant action (such as polyphenols and lycopene). These results demonstrate that microbial biostimulants could represent a valid eco-sustainable strategy due to their ability to influence the physiological mechanisms of plants by increasing their yield and/or quality. Indeed, it is essential to understand their mechanism of action in order to design more efficient biostimulants that can reduce the environmental impact caused by the excessive use of chemical fertilizers in agriculture.

sciforum-084163: Effects of Paclobutrazol on Reproductive and Vegetative Growth Traits in *Phalaenopsis* Join Grace 'TH288-4'

Yi-Chien Lu, Rong-Show Shen and Ting-Hsuan Huang

Department of Horticultural Science, National Chiayi University

Phalaenopsis is the most popular potted plant worldwide. However, its typically long spikes often lead to increased shipping costs and risks. This study investigates the effectiveness of varying the concentration, timing, and frequency of paclobutrazol (PP333) applications on shortening the spike of *Phalaenopsis* Join Grace 'TH288-4'. Concurrently, it also examines the potential for producing visually appealing, single-flower potted phalaenopsis products by truncation. Mature phalaenopsis plants were moved to a cool room at the seventh week to induce flowering. Three experimental groups were established based on different PP333 application schedules: the T2 group, a single application at the second week; the T2T3 group, applications at both the second and third weeks; and the T7T8 group, applications at the seventh and eighth weeks. The PP333 concentrations used were 0, 250, 500, 750, and 1000 mg·L^{-1}, applied as foliar sprays. The results showed that the shortest spikes, measured from base to first flower, were observed in the T2 group with 750 and 1000 mg·L^{-1}; the T2T3 group treated with 500, 750, and 1000 mg·L^{-1} PP333; and the T7T8 group treated with 1000 mg·L^{-1}. These treatments resulted in spike lengths of 16.7–22.2 cm, which are 54–69% shorter than the control ones. PP333 application had minimal effects on spike diameter, pedicel length, flower width, length, and length/width ratio. Nevertheless, root diameter was thicker in plants treated with PP333 compared with the control plants. For producing single-flower phalaenopsis, a foliar spray of 750 mg·L^{-1} PP333 is recommended approximately four weeks before moving *Phalaenopsis* Join Grace 'TH288-4' to cooler conditions, followed by truncation while retaining only the first flower. This study establishes a PP333 treatment protocol for phalaenopsis, offering a strategy to effectively shorten the spikes.

sciforum-080911: Exploring the Effect of "White Light" on the Growth, Leaf Morphology and Physiology of Spiny Cichory Plants (*Cichorium spinosum* L.) in a Vertical Farm

Orfeas Voutsinos-Frantzis [1], Dimitrios Savvas [1], Georgios Liakopoulos [2], Leo F. M. Marcelis [3] and Georgia Ntatsi [1]

[1] Agricultural University of Athens, Department of Crop Science, Laboratory of Vegetable Crops, Iera Odos 75, 11855 Athens, Greece
[2] Agricultural University of Athens, Department of Crop Science, Laboratory of Plant Physiology, Iera Odos 75, 11855 Athens, Greece
[3] Wageningen University and Research, Horticulture and Product Physiology Group, P.O. Box 16 6700AA, Wageningen, the Netherlands

Light-emitting diode (LED) technology has contributed significantly to the rapid development of the vertical farming sector. Even though applying "white lights" for human lighting has reduced the cost of initial investments compared to that of "specialized" horticultural lamps, most research has focused on blue (B) and red (R) spectra. In this study, three different kinds of "white light" were used, a "neutral" (N) light, a "full" (F) light, and a "SunLike" (S) light with B:G:R:FR ratios 14:32:43:10, 16:36:40:8 and 21:34:36:7, respectively. During the experiment, *Cichorium spinosum* L. plants were grown in a vertical farm for 36 days, with a light intensity of 300 umols m^{-2} s^{-1} and photoperiod of 12 h. A few days before the plants reached the commercially salable stage, gas exchange measurements were conducted to determine whether the type of light had any significant effect on the photosynthetic capacity of the plants. In addition, leaf morphological characteristics (such as leaf thickness, spongy and palisade parenchyma thickness, stomatal density, and stomata size (were measured. Moreover, the number of leaves, their surface area, and the fresh and dry weight of the edible leaves were measured during harvest. The results showed that the productivity, general morphology, and photosynthetic capacity of *Cichorium spinosum* L. were not significantly affected by the type of white light used in this work.

sciforum-082532: Induced Xylem Ontogenesis in Cotyledons of the *fra2* Katanin Mutant of the *Arabidopsis thaliana* Plant

Evangelos Charalampidis [1], Stavroula Statiri [1], Kosmas Haralampidis [1] and Ioannis-Dimosthenis Adamakis [2]

[1] Section of Botany, Department of Biology, National and Kapodistrian University of Athens, 157 84, Athens, Greece

[2] National Kapodistrian University of Athens

KATANIN is a heterodimeric microtubule-severing AAA ATPase protein, consisting of a catalytic p60 and a regulatory p80 unit, playing significant roles in various cellular processes, such as cell division, cell elongation, and morphogenesis. The mutant *fragile fiber 2 (fra2)* bares a deletion of the A2329 residue, which leads to a frameshift in the ORF and thus to a premature stop codon. The aberrant protein, which lacks 78 amino acids from the C-terminal region, affects the abovementioned processes in all organs of the plant and therefore *fra2* demonstrates a dwarf phenotype. It is known that cortical microtubules regulate cellulose microfibril deposition, and previous studies have also shown that root xylem differentiation in *fra2* is compromised. In this study, we examined xylem element differentiation in *fra2* and wild-type (Col-0) cotyledons, using the VISUAL culture system in which xylem ontogenesis is induced in vitro. Transverse and longitudinal sections of chemically-fixed and resin-embedded cotyledons of both *fra2* and Col-0, before and after induction, were stained with toluidine blue and observed under an optical microscope. Moreover, whole cotyledons were examined after chloral hydrate treatment. The results highlighted that the xylem-differentiated *fra2* cambial cells underwent an increased and irregular number of cell divisions. Also, as opposed to wild-type plants, *fra2* cotyledons exhibited an undifferentiated central nerve and incomplete vascular branching in their cotyledons, even after the induction of xylogenesis. Furthermore, while the induction of Col-0 plants often led to an increased number of ectopic xylem elements, in *fra2* mutants their appearance was sporadic. The above data underline the important role of KATANIN during xylem ontogenesis and differentiation in *Arabidopsis thaliana.*

sciforum-084213: Investigation of the Effects of Different Non-Microbial Biostimulants on Primary and Secondary Metabolism of Strawberry (Fragaria x Ananassa) in Organic Farming

Michele Ciriello, Christophe El-Nakhel, Stefania De Pascale and Youssef Rouphael

Department of Agricultural Sciences, University of Naples Federico II, Portici, Italy

The need to research innovative and sustainable agronomic practices able to improve the production and functional quality of products are pushing the entire agricultural sector towards the use of biostimulants. In this direction, our work compared the effects of three different non-microbial biostimulants (plant-derived protein hydrolysate, algae extract and tropical plant extract) and an untreated control on the yield and quality of organically grown strawberries (*Fragaria x ananassa*; cultivar Sabrina). Compared to the control condition, all biostimulants resulted in an improvement of photosynthetic performance, but only the plants treated with the plant-derived protein hydrolysate recorded a higher fresh marketable yield. A presumed mechanism involved in the increase in yield achieved could be attributed to the improved availability and uptake of essential macro- and micronutrients. The application of the seaweed extract resulted in a significant increase in total phenolics and ABTS antioxidant activity, measured by Q Extractive Orbitrap LC-MS/MS and UV-VIS spectrophotometer, respectively, thus contributing to the improved functional quality of the fruit. With regard to the total soluble solids content (°Brix), only the biostimulant based on tropical plant extracts resulted in significant differences. In summary, the results of our study show how the different nature of the biostimulants, due to a substantial difference in content and composition, determines different responses ranging from primary to secondary metabolism.

sciforum-082866: Productive and Qualitative Response of Organic Lemon Balm Treated with Different Foliar Biostimulants

Davide Farruggia, Noemi Tortorici, Mario Licata, Nicolò Iacuzzi, Francesco Salamone and Teresa Tuttolomondo

Department of Agricultural, Food and Forest Sciences, Università degli Studi di Palermo

Lemon balm (*Melissa officinalis* L.) is a medicinal and aromatic plant (MAP) belonging to the *Lamiaceae* family. Thanks to the high amount of secondary metabolites, such as phenolic compounds, flavonoids, and essential oils in the aerial parts, this species is a well-known herb used for different pharmaceutical, food/beverage, and cosmetic purposes. Like other MAPs, lemon balm shows significant variations in productive and qualitative parameters due to the effect of biotic and abiotic factors. The quantity of secondary metabolites represents a marker for MAP quality evaluation. The aim of this study was to assess the effects of foliar treatments with four different commercial biostimulants (B), namely *Eklonia maxima*, *Ascophillum nodosum*, fulvic acid, and protein hydrolysates, as well as two application frequencies (F) based on productive and qualitative parameters of lemon balm under organic agriculture conditions. The control treatment was provided by water only. After harvest, a number of parameters, such as plant height, total fresh yield, total dry yield, total phenolic, antioxidant activity, and rosmarinic acid levels, were measured. Morphological, productive, and qualitative traits were affected by both experimental factors and their interaction. The highest plant height was observed in plants exposed to protein hydrolysates. The highest fresh and dry yields were obtained in plants treated with fulvic acids applied every two weeks. The highest phenolic content was found in plants treated, weekly, with fulvic acids and protein hydrolysates. The highest antioxidant activity was recorded in plants treated every two weeks with *E. maxima*-based seaweed extract. Overall, this study represents an important step towards the organic cultivation of MAPs.

sciforum-074697: The Effects of mucilage Signaling Molecule Changes on the Induction or Inhibition of Hormogonia in the Endosymbiotic Cyanobacterium in the Cycas Plant

Rajesh Kanna Gopal

Assistant Professor, Department of Microbiology, Saveetha Dental College and Hospitals, SIMATS

This present investigation focuses on the function of mucilage signaling molecules released by the cycad plant in the control of hormogonia induction/suppression in a novel endosymbiotic cyanobacterium (*Cyanocohniella cycadae* sp. nov.), which was isolated from the coralloid root of *Cycas circinalis* (Gymnosperm). The primary purpose of the coralloid root, a unique variety of secondary apogeotrophic root, is to cultivate the endosymbiotic cyanobacterium for nitrogen. We conducted a series of experiments to identify and characterize the mucilage signaling molecules secreted by *Cycas circinalis* and their function in the regulation of hormogonia induction/suppression in *Cyanocohniella cycadae*. We used a combination of extraction, screening, acid hydrolysis, derivatization, and GC-MS approaches. Our findings showed that the same Cycas plant's pre-coralloid root (PCA) and coralloid root (CA) excreted different types of mucilage. Consequently, we determined the existence of particular monosaccharides, such as arabinose (14.93%), galactose (5.61%), xylose (6.46%), glucose (6.70%), and altrose (4.41%) in CA results in the suppression of hormogonia, whereas glucose (29.86%), fructose (18.86%), talose (6.73%), and lyxose (3.88%) in PCA induces hormogonia development. Overall, this study adds fresh knowledge on the function of changing mucilage signaling molecules. Hexose and pentose levels change in the pre-coralloid and coralloid roots, causing the cyanobacterium to either induce or repress hormogonia. To better understand how mucilage biosynthesis pathways regulate the induction/suppression of hormogonia in a variety of endosymbiotic cyanobacteria, more research is required.

sciforum-084170: The Modulatory Effect of Nitric Oxide Molecules on the Heavy Metal Stress in *Triticum aestivum*

Narayan Singh [1,2], Shalinder Kaur [2], Harminder Pal Singh [2] and Daizy Rani Batish [2]

[1] Department of Botany, Sai School of Biosciences, Sri Sai University, Palampur 17081, HP, India
[2] Department of Botany, Panjab University, Chandigarh 160014, India

This study investigates the impact of nitric oxide (NO) on heavy metal (HM) stress in *Triticum aestivum*. For this, heavy metals (Cr as $K_2Cr_2O_7$ and Ni as $NiSO_4$) at concentrations of 50 μM and 100 μM and NO as sodium nitroprusside (SNP; 50 μM) were given hydroponically (alone and in combination). Stress parameters in the roots of test plants were assessed after 72h of treatment. In response to HM treatment, the levels of ascorbic acid (a natural antioxidant) significantly declined (23.35 ± 0.67 to 13.24 ± 1.27 and 14.35 ± 0.4 μM/g fresh weight within 72 h for 100 μM Cr and Ni, respectively). However, in the HM + SNP combination, levels were observed at 22.65 ± 1.22 and 22.78 ± 1.25 μM/g fresh weight, respectively (SNP alone = 21.952 ± 0.403). HM exposure also led to increased levels of stress indicators such as H_2O_2 content, superoxide anions, and other stress markers (including total glutathione-S-transferase, peroxidases, polyphenol oxidases, lipoxygenases, monodehydroascorbate reductase, and malondialdehyde content). The NO demonstrated an alleviating effect when applied with HMs, lowering the levels of stress indicators. Antioxidative enzymes such as superoxide dismutase (~250%; SNP = 113%), ascorbate peroxidases (~160%; SNP = 2% decrease), and guaiacol peroxidase (~60%; SNP = 7% decrease) showed increased activity, whereas catalase had reduced enzymatic activity (~296% in the case of Cr and ~307% for Ni; SNP had a 113% increase) in response to the HM stress. When SNP was supplied with HMs, significant positive changes in the above parameters were observed, indicating the protection it offers against heavy metal toxicity. Also, both heavy metals exhibited similar toxic effects on the test plants. Overall, in our study, the NO molecule acts as a stress inducer when applied separately in some parameters. However, in combination with both Cr and Ni, it acts as a stress reliever, suggesting its possible use in agricultural systems located in areas abundant in these two heavy metals.

Abstracts

SESSION 2. Plant Ecology, Biodiversity and Developmental Biology

sciforum-082842: Aridity Gradients Shape the Intraspecific Variability of leaf functional Traits in Native *Olea europaea* L. of Morocco

Jalal Kassout [1] and Mohammed Ater [2]

[1] National Institute of Agricultural Research

[2] Laboratory of Applied Botany, Bio-Agrodiversity Team, Faculty of Sciences, University of Abdelmalek Essaâdi, Tétouan

Investigating the adaptive mechanisms of plants to drought is imperative for ecological studies, particularly in the current era of climate change and escalating aridity. This study specifically delves into the intraspecific variations of phenotypic traits in the wild olive (*Olea europaea* subsp. *europaea* var. *sylvestris*), a quintessential model species of the Mediterranean Basin, as influenced by diverse environmental factors. The primary objective of this functional analysis is to assess nine distinct leaf- and plant-size-related traits across a sample of 130 trees belonging to 13 populations. These populations are dispersed across varying environmental conditions. The results indicate discernible patterns of covariation in the nine scrutinized traits along the studied environmental gradients. These trends are intricately linked to distinct plant strategies, notably centered around resource acquisition, resource allocation, and water utilization. In this context, the wild olive trees exhibit substantial intraspecific diversity, both across different populations and within each population, in direct correlation to the environmental gradients. The comprehensive analysis reveals that a combination of climate factors, altitude variations, and the extent of vegetation cover collectively account for an impressive 93.8% of the observed trait covariations. Crucially, the study elucidates the underlying mechanisms employed by wild olive trees to counter the adversities of challenging environmental conditions. The findings underscore a pronounced shift in the species towards a conservative plant strategy, characterized by diminished resource allocation and heightened efficiency in water usage. This resilient strategy enables the wild olive trees to withstand and endure the pressures of extreme environmental stress. Significantly, the study accentuates the critical significance of accounting for intraspecific variations in plant responses when studying the impacts of environmental stressors.

sciforum-083916: Mangrove Tree Growth, Diversity, and Distribution in Tropical Coastline Ecosystems

Sabrina Dookie [1], Sirpaul Jaikishun [2] and Abdullah Adil Ansari [3]

[1] Department of Biology, Faculty of Natural Sciences, University of Guyana
[2] Senior Lecturer, Department of Biology, Faculty of Natural Sciences, University of Guyana
[3] Professor and Dean, Faculty of Natural Sciences, University of Guyana

Mangrove trees are subject to several environmental stresses that are often associated with the prevailing conditions of their ecosystems. These stresses are often known to challenge their survivability through their ecological resistance and resilience. We analysed the density, diversity, distribution, and biophysical measurements (height, diameter at breast height, and basal area) of more than 900 trees throughout nine natural, degraded, and restored tropical coastline ecosystems in Guyana. One year of systematic sampling was carried out using the point-centred quarter method (PCQM) throughout two clearly defined wet and dry seasons. Significant variations in the distribution, diversity, and spatial arrangement of trees were observed within both the restored and degraded mangrove habitats. Notable discrepancies in the biophysical measurements of trees were also observed [df = 8, p 2.2e-16], which were further found to have positive correlations [p 0.05, rs > 0.5] with their respective ecosystem types. Trees situated within restored and natural habitats, which experience few disturbances, display greater biophysical measures compared to trees in degraded ecosystems that are consistently subjected to multiple disturbances. These observations suggest that both natural and restored ecosystems showcase a heightened capacity for ecological resistance and resilience in the face of environmental stresses, in contrast to the degraded ecosystems that now exhibit states of vulnerability due to low ecological resistance and resilience, mainly attributed to prevailing anthropogenic disturbances. Our findings provide additional evidence to support the idea that periodically assessing mangrove vegetation, particularly trees, in different ecosystem types can serve as one indicator of their ecological state, as well as of their ability to withstand and recover from environmental stresses.

sciforum-080158: Cell Wall Polysaccharide Immunodetection in the Thallus of the Liverwort *Marchantia polymorpha* L.

Natalia Ntanou [1], Penelope Sotiriou [2] and Ioannis-Dimosthenis S. Adamakis [1]

[1] Section of Botany, Department of Biology, National and Kapodistrian University of Athens, 157 84 Athens, Greece

[2] Department of Botany, Faculty of Biology, National and Kapodistrian University of Athens, Greece

The plant cell wall is a complicated structure which surrounds the protoplast and contains pectin, hemicelluloses, cellulose polysaccharides and proteins. During the evolution and transition from the aquatic to the terrestrial environment, plant cell wall composition changed, so as to meet the new requirements driven by evolution. We therefore studied the cell wall polysaccharide composition of the thallus of *Marchantia polymorpha*, a model liverwort and a representative of the first plant genera that inhabited terrestrial environments. Using a collection of specific antibodies raised against different cell-wall polysaccharide epitopes, via immunofluresence, we detected in semithin sections of London Resin White emended thalli, low- and high-methylesterified homogalacturonans, arabinans, mannans, xyloglucans and arabinogalactan proteins. These epitopes showed a tissue-specific distribution, with the low- and high-methylesterified homogalacturonans unevenly distributed in the thallus, while the cell walls of smooth and pegged rhizoids exhibited a strong arabinogalactan protein signal. Xyloglucan and mannans were evenly present in the cell walls of every cell type of the thalli, except for the rhizoids. Moreover, the cell walls of idioblast cells also showed a differential cell wall composition. These results are discussed in the context of the transition from the aquatic environment towards terrestrial life. *M. polymorpha* cell walls depict the changes in cell wall composition that took place during the evolution of the green linage, from charophytes to embryophytes, and towards flowering plants.

sciforum-082727: Characterization of Floral and Leaf Volatile Organic Compounds (VOCs) in Four Asian Annonaceae Species: Insights into Pollination and Stress Responses

Jannat E Tajkia [1], Katherine R. Goodrich [2], Luiz Fonseca [3], A.K.M. Zakir Hossain [4] and Lars Chatrou [5]

[1] PhD student, Department of Biology, Faculty of Science, Ghent University
[2] Professor, Department of Biology, College of Arts & Sciences, Widener University
[3] Post-doctoral student, Department of Biology, Faculty of Science, Ghent University
[4] Professor, Department of Crop Botany, Faculty of Agriculture, Bangladesh Agricultural University, Mymensingh
[5] Professor, Department of Biology, Faculty of Science, Ghent University

Plant volatile organic compounds (VOCs) serve multifaceted roles in plant ecology, acting as attractants for pollinators and defence mechanisms against both biotic and abiotic stressors. Previous studies within the Annonaceae family have highlighted the dynamic and variable nature of floral scents. This study focuses on identifying and analysing VOCs in floral and leaf samples from four distinct Asian Annonaceae species. The primary objective is to isolate and characterize the specific VOCs responsible for the unique scents in these species, elucidating their established functions in pollination and protection mechanisms. Floral scent samples were collected using dynamic head-space sampling techniques in various landscapes of Bangladesh and analysed through Gas Chromatography–Mass Spectrometry (GC-MS) at Ghent University. A total of 69 distinct volatile compounds were identified, with fatty acid esters being the predominant class, followed by sesquiterpenes, monoterpenes, alkanes, phenyl propanoids, aldehydes, ketones, alkenes, and alcohols. Among these floral volatiles, *Cananga odorata* exhibited the highest diversity, with 33 compounds, followed by *Artabotrys hexapetalus* (21), *Uvaria hamiltonii* (21), and *Miliusa velutina* (18). *Cananga odorata* was primarily characterised by terpenoid compounds, dominated by germacrane D, alpha-farnesene, and beta-caryophyllene, while the other three species were predominantly composed of fatty acid esters, with hexanoic acid methyl ester, acetic acid butyl ester, and butanoic acid butyl ester as major constituents. Leaf volatiles in all species were dominated by fatty acid ester compounds. Fatty acid and phenyl propanoid compounds emit sweet, fruity scents, attracting diverse beetles for pollination. Terpenoids lure flies, beetles, and thrips, offering protection against stressors. Specific compounds such as alpha-pinene, beta-caryophyllene, and alpha-farnesene help combat drought, while monoterpenes and isoprene aid survival in high temperatures. This exploration lays the groundwork for future investigations aimed at unveiling the precise functions of these unique compounds in individual plants.

sciforum-084232: Histo-Anatomical Studies Regarding the Structure of *Thymus* sp. Seedlings Grown in Laboratory Conditions

Irina Boz and Gabriela Alina Stefan

"Ștefan cel Mare" University of Suceava, Faculty of Medicine and Biological Sciences, Suceava, Romania

Thyme is an aromatic plant used both for medicinal purposes and as a spice almost everywhere in the world. A common feature of these plants is the presence of secretory hairs of different shapes, containing volatile oils. The *purpose* of this study was to describe comparatively the vegetative organs of the six species (less-investigated species) of seedling belonging to the *Thymus* genus.

For histo-anatomical investigations, plants belonging to six species of *Thymus*, species that grow in Romania, were obtained in laboratory conditions: *Th. vulgaris, Th. serpyllum, Th. comptus, Th. praecox, Th. zygioides* and *Th. balcanus.* In order to investigate the histo-anatomy, the plant material was fixed and preserved in 70% alcohol, and was then sectioned with the hand microtome, using the botanical razor. Obtained sections were coloured with green iodine and red ruthenium, and were then analysed with a Novex microscope and photographed. To investigate the secretory structures, we used SEM (Scanning electron microscopy).

The root generally presents a diarch-type structure, with the transition from the primary to the secondary structure being early. In the seedling *Thymus balcanus,* the root is much thinner, compared to the other species, with the rhizodermis cells varying in size; the bark is also thinner, presenting three layers of cortical parenchyma and an endodermal layer (in which Caspary thickening is very rarely observed). *The hypocotyl* has an intermediate structure between the root and the stem. *The epicotyl* presents a cauline structure with three distinct anatomical areas: the epidermis, bark and the central cylinder. In *Thymus vulgaris* at the level of the epicotyl, the bark is thinner, and the cells from the marrow are disorganized. Regarding *the leaf*, in *Thymus praecox* the palisadic tissue is much thicker than the other species. In all analyzed species, the presence of secretory hairs with uni-, bi- and octocellular glands was observed.

sciforum-082262: Influence of Various Biotic and Abiotic Factors on Moss Diversity and Community Composition in the Himalaya

Anshul Dhyani [1], Kumar Shantanu [2] and Prem Lal Uniyal [1]

[1] Department of Botany, University of Delhi, Delhi 110007, India
[2] Deshbandhu College, University of Delhi, Delhi 110019, India

Mosses play various ecological roles in different ecosystems and thrive in diverse habitats. While previous studies in the Himalayas have explored moss diversity and community composition, they often overlooked the influence of factors like the type of substrate and other environmental conditions on moss species richness. This current study was conducted in different forest ecosystems of the North-Western Himalaya, encompassing four distinct forest types. Moss samples were collected using a standard quadrat method, and we examined both the overall species richness and the variation in moss species among these forest types. Additionally, we investigated how elevation gradients affected moss species richness. To understand the impact of environmental factors on moss diversity, we employed Canonical Corresponding Analysis (CCA). Our findings shed light on the significant role of various substrates and environmental factors in shaping moss richness. Notably, among all the forest types studied, mixed temperate deciduous forests exhibited the highest moss species richness, with a total of 87 species identified. Elevation emerged as a crucial factor influencing moss species richness, with statistically significant results (p 0.001). When assessing environmental variables, elevation had the most substantial impact, as indicated by CCA scores. The substrate analysis revealed that tree species and rocks were the two key substrates that contributed significantly to maintaining moss richness in the area. Therefore, the conservation of these tree species and crucial substrates is essential for preserving moss diversity and composition in the region. Consequently, forest management practices should prioritize the protection and maintenance of these substrates to ensure the continued well-being of moss habitats.

sciforum-084187: Response of Specific Leaf Area to Nutrient Addition and Competition Release in *Cistus ladanifer* L.

Yoel Aroca-Martínez [1], Juan A. Delgado [2] and María D. Jiménez [2]

[1] Department of Biodiversity, Ecology and Evolution; Faculty of Biological Sciences; Universidad Complutense de Madrid

[2] Department of Biodiversity, Ecology and Evolution, Faculty of Biological Sciences, Universidad Complutense de Madrid

Specific leaf area (SLA) is one of the most important plant traits. Variation in SLA reflects strategies of plants to obtain resources in response to diverse environmental conditions. Within a species, sun-exposed individuals usually present lower SLA values than shaded ones. In addition, SLA has been reported to increase with experimental nitrogen supplementation. The aim of this study is to understand SLA variation among individuals of the same population of *Cistus ladanifer* L., a typical Mediterranean shrub species. To assess this, we tested the short-term response (11 months) of 100 adult individuals in relation to increased nutrient availability and different levels of intra-specific competition. Specifically, we conducted a factorial field experiment with four treatments: (**1**) control (no nutrient addition and no neighbor removal); (**2**) nutrient addition (400 kg/ha of controlled release NPK fertilizer) and neighbor removal; (**3**) neighbor removal only; and (**4**) nutrient addition only. We collected a total of 50 leaves per individual and measured both leaf area and leaf dry weight to calculate the SLA. Our hypothesis indicated that individuals would decrease SLA in response to the competition release treatment, which would increase SLA in response to nutrient addition treatment. However, we found that the release from competition did not affect SLA values, although leaf area and leaf weight were slightly affected. No significant effect was detected for the nutrient addition treatment. Nevertheless, the interindividual variation in SLA responded to both treatments in a way that led to a significant decrease in variation among individuals in this functional trait compared to the control group.

sciforum-082791: Shifts in Arable Weeds Diversity and Community Structure in Response to Agricultural Intensification Practices: A Case Study from Northern Morocco

Soufian Chakkour [1] and Mohammed Ater [2]

[1] Laboratory of Applied Botany, Department of Biology, Faculty of Science of Tétouan, Abdelmalek Essaadi University

[2] Laboratory of Applied Botany, Department of Biology, Faculty of Sciences Tetouan, Abdelmalek Essaadi University

Arable weeds are plants that are associated with agricultural land, are pioneers of secondary succession, and possess adaptations that allow them to proliferate in disturbed environments. In North Morocco's Tingitane peninsula, we conducted a comparative survey of weed flora along an altitudinal gradient from the Atlantic coast to an elevation of 1000 m. This gradient corresponds to an inversely proportional intensification of agriculture, pitting traditional agroecosystems against modern and intensive counterparts. Our aim is to evaluate the impact of varying crop management practices on the diversity, structure, and composition of weed communities. We conducted a total of 133 floristic surveys across six agricultural sites. Our surveys identified 220 weed species, belonging to 36 botanical families, comprising 31 dicotyledons and 5 monocotyledons. Notably, the Asteraceae, Poaceae, and Fabaceae families collectively constituted 43% of the total species count. In terms of biological characteristics, therophytes predominated at 79.9%, followed by hemicryptophytes and geophytes at 10.2% and 6.8%, respectively. Mediterranean taxa constituted 57.4% of the overall species diversity. To qualitatively classify the nature of agroecosystems at the six sites, we employed five agrodiversity indices. Our findings revealed that the Tankoube site exhibited the highest agrodiversity, followed by Tafza, Bellota, Boujdiane, Khemis Sahel, and Laaoumra (in descending order). When examining biodiversity indices for weeds, the diversity gradient closely mirrored that of the agrodiversity indices. This alignment suggests that the specific diversity of weeds can be attributed to the nature of the agroecosystems and the agricultural techniques employed at each site. Our findings underscore the profound influence of agricultural practices on shaping arable plant communities within agroecosystems, and they emphasize the decline in weed diversity that accompanies agricultural intensification.

sciforum-084239: Species Richness Distribution and Endemism of Butterworts (*Pinguicula*: Lentibulariaceae) in America

Jorge David López Pérez and Guadalupe Munguía-Lino

University of Guadalajara

Within the genus *Pinguicula* (Lentibulariaceae), 127 types of carnivorous plants have been detected, and Mexico has recently been regarded as a centre of such diversification. The Mexican Transition Zone (MTZ) comprises the main mountain ranges of Mexico, Guatemala, Honduras, El Salvador, and Nicaragua. The MTZ represents the boundary between the Nearctic and Neotropical regions, and its geodiversity and climatic complexity promote floristic richness, as well as angiosperm endemism, in Central and North America. Based on this, we expected that the species richness distribution and endemism of *Pinguicula* would show the same pattern. To prove this, the species richness distribution and endemism of *Pinguicula* in America were evaluated by country, ecoregion, biogeographic province, elevation gradient, and grid cell. For this, a database was constructed based on a review of herbaria specimens housed in electronic databases. Only records that include geolocation information and that have a voucher were taken into account. For the criteria of country, ecoregion, and biogeographic province, a count of the species within each polygon was carried out. Intervals of 500 m were established for the elevation gradient criterion, whereas a cell size of 93 × 93 km was employed for the grid cell analyses. *Pinguicula* is distributed across 20 countries and Mexico harbours the highest number of species. The *Pinguicula* species grows in 104 ecoregions and is the richest in the Sierra Madre Oriental pine–oak forests. Meanwhile, 19 biogeographic provinces include almost one species, of which the Sierra Madre Oriental (SMO) province is the most diverse. On the other hand, richness based on the elevation gradient was concentrated between 0–499 and 1000–1499 m. The grid cell analyses supported this, as they identified cells with significant richness and endemism within the MTZ in Mexico. The results showed that the pattern of species richness and endemism of *Pinguicula* was concentrated along the MTZ, particularly in the SMO.

sciforum-082829: Unveiling Vegetation Patterns, Modern Pollen Profiles, and Environmental Influences in Sougna Mountain, Northern Morocco

Aboubakr Boutahar [1,2], Paloma Cariñanos Gonzalez [3], Zouhaire Lamrani [2] and Abderrahmane Merzouki [4]

[1] Laboratory of Applied Botany, Department of Biology, Abdelmalek Essaâdi University,
[2] Biology, Environment, and Sustainable Development Laboratory, ENS, Abdelmalek Essaadi University
[3] Department of Botany, Faculty of Pharmacy, University of Granada
[4] Laboratory of Applied Botany, Department of Biology, Faculty of Sciences of Tetouan, Abdelmalek Essaâdi

This study explores the distribution of vegetation within the Sougna mountain, analyzes its contemporary pollen composition, and examines its correlations with environmental factors and land use variables. In a range spanning from 138 to 1364 m asl, 31 moss polsters were gathered across diverse landscapes, including cork oak forest, pine reforestation, and matorrals, covering wooded and open areas. At each site, data on land use and environmental variables were gathered. Vegetation within the Sougna mountain is dispersed in a mosaic pattern across three distinct vegetation belts, each exhibiting unique pollen assemblages primarily composed of corresponding vegetation types (such as *Quercus suber* forest, matorrals of *Erica* spp. and *Cistus* spp., and *Pinus pinaster* reforestation). CCA analysis was employed to examine the variance between the variables and pollen data. Anthropogenic factors such as grazing and cultivation played a significant role in distinguishing degraded and grazed areas. Moreover, elevated precipitation levels and altitude showed a positive correlation with wooded communities, thereby establishing a strong relationship with tree cover. Our findings indicate that pollen types such as *Poaceae*, *Cannabis*, *Plantago*, *Nicotiana*,*Urtica*, and *Asteraceae* are primarily associated with human activities and serve as key indicators for distinguishing degraded communities. It is crucial to exercise caution when interpreting the presence of these taxa in the pollen diagram. Employing a high taxonomic resolution is advised in order to avoid overestimating the presence of certain taxa. These outcomes can significantly enhance palynological efforts aimed at reconstructing historical vegetation and land use patterns in the Sougna mountain and, more broadly, in the Rif landscape.

Abstracts

SESSION 3. Plant Response to Stresses and Changing Environment

sciforum-085005: Unraveling the Inter-Specific Hybrids of Sugarcane for Drought Tolerant under the Changing Climates

Mintu Ram Meena

ICAR-Sugarcane Breeding Institute

In order to evaluate the drought tolerance efficiency, 18 ISH clones with three standards (Co 0238, CoJ 88, and Co 98014) evaluated under drought stress during formative phase. The significant reductions in various parameters like tiller population at 120 days after planting (DAP) experienced a 37% reduction, while tillers at 150 DAP and 180 DAP reduced by 10% and 12%, respectively. We observed leaf rolling as a response to drought, with eleven clones exhibiting high intensity, six clones showing partial rolling, and four clones displaying no rolling. Four test entries (ISH-534, ISH-823, ISH-513, and ISH-536) performed better than Co 98014 in terms of leaf area reduction. The number of tillers at 150 DAP and 180 DAP, in both normal and drought conditions, were recorded as 1.07 and 0.96 lakhs/ha, and 1.10 and 0.94 lakhs/ha, respectively. At 150 DAP, nine clones outperformed the best standard, Co 98014 (0.68 lakhs/ha), while at 180 DAP, eight test clones (ISH-567, ISH-833, ISH-524, ISH-584, ISH-594, ISH-536, ISH-590, and ISH-502) were superior to the best standard, Co 0238 (0.78 lakhs/ha), in terms of tiller numbers. Eleven entries displayed the least reduction in NMC, surpassing the best standard. CoJ 88 was the best performing standard for sucrose (18.43%), while entries such as ISH-524, ISH-513, ISH-536, ISH-519, and ISH-512 also demonstrated favorable performance. The mean reduction in cane yield under drought stress, at 300 days after planting, was 32.28%. Co 98014 exhibited the least reduction in cane yield under drought stress (21%), and test entries ISH-548 (3.5%) and ISH-823 (12%) showed relatively less yield reduction under drought conditions. The mean fiber percentage under normal and drought conditions was recorded as 14.69% and 15.45%, respectively. Overall, this study provide the insight to drought-tolerant ISH clones in breeding programs, offering the potential to enhance climate resilience in sugarcane production and contribute to the sustainable agricultural development of drought-prone regions.

sciforum-082584: *Cakile maritima:* A Halophyte Model to Study Salt Tolerance Mechanisms and Potential Useful Crop for Sustainable Saline Agriculture in the Context of Climate Change

Ricardo Mir, Monica Boscaiu and Oscar Vicente

Universitat Politècnica de València

One of the most devastating effects of climate change on crop yields, together with drought, is due to the increasing salt accumulation in soils. Most plant species and all major crops can only tolerate low or, at best, moderate soil salinities. However, a small (1%) proportion of angiosperm wild species—halophytes—can survive and complete their life cycle in natural habitats with salinities equivalent to 200 mM NaCl or more. *Cakile maritima* is a glabrous, succulent annual halophyte belonging to the *Brassicaceae* family that naturally grows on East Asian, North African, and European foreshores; it is considered an invasive species in the east and west coasts of North America. *Cakile maritima* slightly reduces its germination potential and root length and increases its biomass and seed production under relatively low (i.e., 100 mM) NaCl concentrations. Higher salt concentrations, up to 500 mM NaCl, significantly impact its growth but do not compromise its survival. The salt resistance mechanisms of *C. maritima* are mainly based on the increase in its succulence and its capability to limit oxidative damage through several biochemical mechanisms. This species is potentially useful as a "minor" cash crop for the so-called saline agriculture due to its production of secondary metabolites of medical and nutritional interest and the high oil accumulation in its seeds. Moreover, its small diploid genome and fast life cycle make this species a suitable model for genetic research. This will facilitate the design and implementation of breeding programmes to develop new genetic variants with better agronomical performance. In this communication, we will highlight the relevance of this species as a model for studying the basic mechanisms of salt tolerance and for sustainable saline agriculture in the context of soil salination and climate change.

sciforum-080441: In Vivo Experiments on the Flow of Mycotoxins in Plants

Maria Cavallero [1], Enrico Rolli [2], Francesca Degola [2] and Chiara Dall'Asta [3]

[1] Department of Chemistry, Life Sciences and Environmental Sustainability, University of Parma, Italy
[2] Department of Chemistry, Life Sciences and Environmental Sustainability, University of Parma
[3] Department of Food and Drug, University of Parma

Mycotoxins, secondary metabolites produced by some fungal species that naturally contaminate the most important corps, are known for their negative effects on human and animal health. Hence, they deserve an increasingly careful and critical look, also because climate change is gradually expanding the geographical areas interested by the spread of producing species.

Despite these compounds have been extensively studied in terms of biosynthesis, detection, health threatening and mechanism of action, the fate of mycotoxins once released into the plant tissues after fungal infection has yet to be elucidated. As well, the uptake and translocation of xenobiotics in plants is an important process when considering the risk associated with mycotoxin contamination of food and feed commodities.

In this perspective, we used *Zea mays* L. as model system to study how mycotoxins such as Zearalenone (ZEN), T-2 and Aflatoxin B1 (AFB1) were distributed in the different organs/tissues when administrated to the plant either via root apparatus or at leaf level. Based on previously published results (Righetti et al., 2019) two types of experiments were set up: (i) a 'split root' experiment in which the toxins were added individually to the medium in contact with the root; (ii) a dipping experiment in which the leaf, once scarified, was dipped in a toxin containing solution.

Plants were incubated for 14 days under controlled conditions in a growth chamber, then an *UPLC–HRMS* analysis was performed on sampled plant material in order to detect both the toxins and their derivatives.

Preliminary results will be here presented and discussed.

sciforum-084276: Changes in Phenolic Composition during Natural Fermentation of Table Olives Produced under Regulated Deficit Irrigation

Anabela Afonso Fernandes-Silva [1], Maria Sousa [2], Rosa Carvalho [3] and António Francisco Inês [4]

[1] University of Trás-os-Montes and Alto Douro; CITAB—Centre for the Research and Technology of Agro-Environmental and Biological Sciences
[2] Department of Agronomy, School of Agrarian and Veterinary Sciences, University of Trás-os-Montes e Alto Douro, UTAD, Quinta de Prados, 5000-801 Vila Real, Portugal
[3] Department of Agronomy, School of Agrarian and Veterinary Sciences, University of Trás-os-Montes e Alto Douro, UTAD, Quinta de Prados, 5000-801 Vila Real, Portugal
[4] Department of Biology and Environment, School of Life and Environmental Sciences, University of Trás-os-Montes e Alto Douro, UTAD, Quinta de Prados, 5000-801 Vila Real, Portugal; Vila Real Chemistry Research Centre (CQ), University of Trás

Regulated deficit irrigation allows decreasing the amount of water applied without significant effects on yield and fruit quality. The influences of two irrigation treatments were evaluated in natural debittering olives ("Cobrançosa") from irrigation without water stress (FI) and regulated deficit irrigation (RDI) treatments. At the beginning of fermentation, the concentrations of hydroxytyrosol, verbascoside and isoverbascoside were more concentrated in samples from FI, while oleuropein, the main phenolic compound responsible for bitterness, the phenolic acid clorogenic, luteolin and luteolin-7-glucoside and quercetin rutinoside were higher in olives with RDI treatment. Despite these differences, they were not statistically important, nor was the sum fraction of phenolic compounds. During fermentation, and in both irrigation treatments, the concentration of all individual phenolic compounds, namely oleuropein, decreased, while the concentration of hydroxytyrosol increased due to the hydrolysis of oleuropein. Higher changes in oleuropein were observed in the first week after the beginning of fermentation, in which a decrease of less than one third of the initial content in olives from FI was observed, while in RDI it was about half. At the end of the fermentation, the oleuropein content in olives from FI was close to zero, while in RDI it was 25% of the initial content, whereas an increment in the content of hydroxytyrosol of 300 to 350% was observed in olives following FI and RDI treatments, respectively. Therefore, it can be concluded that it is possible to reduce the amount of water applied and improve the quality of table olives.

sciforum-082781: Enhancing Salt Stress Tolerance in Tomato (*Solanum lycopersicum*) through Foliar Silicon Application

Borja Ferrández-Gómez, Antonio Sánchez-Sánchez, Mar Cerdán and Juana D. Jordá

Department of Biochemistry, Molecular Biology, Edaphology and Agricultural Chemistry, University of Alicante, 03080 Alicante, Spain

Soil salinization poses a significant threat to agricultural productivity, necessitating innovative agronomic strategies to mitigate its impact. This study focuses on improving salt stress resistance in tomato plants through the foliar application of silicon (Si) in the form of Na_2SiO_3 solution. The greenhouse experiment was carried out with six treatment groups: three under normal conditions (control with distilled H_2O, 1- and 2- mM Si) and three under salinity stress (control with distilled H_2O, 1- and 2- mM Si), with 50 mM NaCl in the nutritional solution. These treatments were regularly applied via foliar pulverization. Various parameters, including fresh and dry weight, chlorophyll content, macro and micronutrient concentrations, catalase activity, total soluble sugars, malondialdehyde levels, and proline content, were analyzed in leaves and roots. Under normal conditions, tomato plants grown in non-saline conditions exhibited some toxicity when exposed to Na_2SiO_3. Specifically, an increase from 0.18 to 1.8% in Na uptake, an increase from 0.09 to 0.65 mg proline/g dry weight, and a 60% decrease in catalase activity were observed. In all cases, the lower dose produced better results under normal conditions than the 2 mM dose. As for the experiments under salt stress conditions, Si mitigated oxidative damage, preserving root cell membrane integrity. Na uptake was reduced by 42% with respect to the control, malondialdehyde concentration was reduced by 15%, and there was a 58% increase in catalase activity. Again, 1 mM Si showed improved results compared to 2 mM Si. In summary, this research offers a promising strategy for enhancing salt tolerance in tomato plants, primarily through foliar Si application. The results underscore the importance of optimizing Si dosage to achieve the desired effect. Furthermore, this study provides a potential application of Si in non-fertigated crop systems, emphasizing its importance in addressing the challenges posed by soil salinization in agriculture.

sciforum-083826: Feasibility of Household-Scale Dual-culture Bio-Assay for the In Vitro Screening of Banana Resistance against Fusarium Wilt

Listya Utami Karmawan, Imelda Judith Kurniawan and Graffy Intania

Atma Jaya Catholic University of Indonesia

Fusarium odoratissimum is the most common pathogenic fungus that causes Fusarium wilt disease in bananas. There is currently no established conventional method to prevent Fusarium wilt. Additionally, *F. odoratissimum*'s spores can persist in the soil for years. Breeding banana plants for resistant cultivars through mutation or somaclonal variation using plant tissue culture could serve as an alternative for controlling Fusarium wilt. The screening of resistant varieties of banana could be carried out via the dual-culture bioassay method. Due to the expensive and sophisticated instruments at the required to perform this method at the laboratory scale, we propose a dual-culture bioassay at a household scale, which can be adapted in remote areas to promote the development of Fusarium wilt control in many developing countries.

A pressure cooker and low-cost containers were used as adaptations of an autoclave and laminar airflow, respectively. The usage of a pressure cooker for MS0 preparation showed no significant difference compared to an autoclave (*p*-value: 0.287, Kruskal–Wallis test). Containers equipped with a UVC lamp increased the sterility of commercial PDA medium and the production of sterile non-commercial PDA medium, sterile Foc subculture in commercial PDA, and sterile banana subculture up to 100%, 86.67%, 93.33%, and 64.29%, respectively. Overall, under a controlled environment, the dual-culture bioassay of banana plants at a household scale yielded similar results compared to a laboratory scale.

sciforum-083966: Photosynthetic Apparatus of Psammophytes *Alyssum desertorum* Stapf and *Secale sylvestre* Host under Soil Flooding

Elizabeth Kordyum [1], Yuriy Akimov [1], Olexander Polischuk [1], Sergiy Stepanov [1], Liudmyla Kozeko [1], Tamara Vorob'ova [1], Olga Artemenko [1] and Boris Baranovskyi [2]

[1] Institute of Botany, National Academy of Sciences of Ukraine, Kyiv, Ukraine

[2] Oles Honchar Dnipro National University, Dnipro, Ukraine

Sand plants *Alyssum desertorum* (family Brassicaceae) and *Secale sylvestre* (family Poaceae) belonging to the ecological group "psammophytes" grow in Ukraine in the Forest-Steppe and Steppe zones, ephemeral. One of the significant abiotic factors that negatively affects plant growth, up to death, is soil flooding which quickly depletes oxygen. Since the photosynthesis is very sensitive to the effects of drought and flooding, we for the first time investigated the effect of 5- and 10-day soil flooding on the photosynthetic apparatus of these sand species using the methods of light and transmission electron microscopy, biochemistry and chlorophyll fluorescence induction (JIP test). Seeds for the experiments were collected from plants of dry sandy areas of the ravine forest in the Steppe zone of the Dnipropetrovsk region. The general organization of mesophyll cells on the 5th and 10th days of soil flooding was basically similar to that in the control. Changes in the ultrastructure and functional state of chloroplasts under soil flooding revealed in the transient starch grain volume, quantity and size of plastoglobules, swelling of granal and stromal thylakoids, pigment amount, the JIP test parameters, integral indicators of photosynthesis efficiency and coincided with those in mesophytes studied in this respect. Thus, photosynthesis occurred and contributed to the survival of seedlings during the first 10 days. The subsequent yellowing of leaves caused by decreased chlorophyll synthesis and ultimately plant death indicate that both species are capable only to short-term systemic metabolic adaptation to root hypoxia according to such indicators as the rate and level of synthesis of stress proteins HSP70 and alcohol dehydrogenase—a key enzyme of anaerobic energy metabolism.

sciforum-083993: A Comparison of the Effects of Sewage Sludge and Compost on Maize Plant Physiology

Dávid Kaczur [1], Makoena Joyce Moloi [2], Lóránt Szőke [3] and Brigitta Tóth [4]

[1] University of Debrecen, Faculty of Agricultural and Food Sciences and Environmental Management, Institute of Food Science
[2] University of the Free State, Faculty of Natural Science, Department of Plant Sciences, Bloemfontein, South Africa
[3] Department of Plant Nutrition, Faculty of Agriculture, University of Zagreb, Zagreb, Croatia
[4] University of Debrecen, Faculty of Agricultural and Food Sciences and Environmental Management, Institute of Food Science, Debrecen, Hungary

The search for alternative plant fertilizer materials is crucial because of continuously increasing food demand and the growing human population. This experiment hypothesized that the measured parameters of maize (*Zea mays* L. cv. Armagnac) linearly change with increasing concentrations of sewage sludge and compost (0% as control, 25%, 50%, and 75% as m/m%) treatments at the three-leaf stage. In addition, the goal of this study was to compare the effects of sewage sludge and compost on maize's characteristics in a greenhouse pot experiment.

The results showed that all three of the applied compost concentrations had positive effects on the initial growth of the plants, while sewage sludge increased the plant height at 25% and 50% treatments compared to the control. All the applied treatments increased chlorophyll-a, chlorophyll-b, and carotenoid contents related to the control. The proline content indicates that all treatments stressed the plants, though the nature and extent of the stress are not clear yet. In addition, the amount of malondialdehyde (MDA) and the activity of superoxide dismutase (SOD) did not change significantly compared to the control. This indicates that there is no correlation among MDA, proline content, and SOD activity in this experiment. Chlorophyll-b content was 2.8, 2.5, and 3.2 times higher at 25%, 50%, and 75% sewage sludge treatment relative to compost treatment. Concerning carotenoids, these values were also 33%, 25%, and 41% higher when plants were grown on sewage sludge. The concentration of proline and MDA content were not significantly different between the 25% sewage sludge and compost treatments. At 50% and 75% treatments, the MDA content was 25% and 33% higher while the proline concentration was 37% and 53% higher in the sewage-sludge-treated plants, respectively. The activity of SOD was significantly higher at 25% and 75% sewage sludge concentrations relative to the compost treatments.

sciforum-080185: Bejierinkia Fluminensis Increases Salt Stress Tolerance in Tomato Plants

Silvia Potestio, Gianluigi Giannelli, Francesca Degola and Giovanna Visioli

University of Parma

Salinity is considered one of the most limiting abiotic stresses affecting global agricultural production. Tomato plants are highly sensitive to salt stress. Hence, the use of halo-tolerant, plant-growth-promoting rhizobacteria (PGPR) as a soil amendment is considered a potential solution against salt stress adversities that could enhance tomato productivity in saline soils. We tested the capability of the PGPR bacterial strain Pvr_9, homologous to *Beijerinckia fluminensis,* to increase salt stress tolerance in *Solanum lycopersicum*. Morphological, physiological, and molecular markers were evaluated in plants cultivated in vitro, either inoculated or not with Pvr_9 and exposed for 56 and 72 h to 150 mM NaCl. Results showed that plants inoculated with Pvr_9 possessed a significant increase in primary root length and number of secondary roots and an increase in fresh weight when compared with uninoculated plants. The salt tolerance gene markers *SOS1* and *NHX1* were found to be over-expressed in Pvr_9-treated plants under salt stress while, in the same condition, the *SOD1* gene was under-expressed. In the roots, the *MYB1* gene transcription factor and *PIP1* gene, coding for an aquaporin, were also found to be over-expressed.

When analysed for proteome changes in response to 72 h exposure to 150 mM NaCl, plants inoculated with PVr_9 showed a total of 28 differentially expressed proteins in leaves with respect to uninoculated ones. Tomato plants grown in soil and inoculated or not with Pvr_9 were subjected to a 1-week salt stress treatment by watering them with 150 mM of NaCl. Pvr_9 inoculated plants showed a significant increase in biomass and in chlorophyll and proline content under salt stress treatment with respect to uninoculated ones. Overall, the results obtained in this study revealed the positive effects exerted by Pvr_9 in conferring salt stress tolerance in tomato plants both in vitro and in soil conditions.

sciforum-082572: Breeding Maize for Heat and Drought Tolerance: A Necessity, Nowadays, in Romania

Roxana Elena Călugăr [1], Andrei Varga [1], Carmen Daniela Vana [1], Loredana Ancuta Ceclan [1,2], Călin Popa [1,2], Felicia Chețan [1], Alina Șimon [1] and Nicolae Tritean [1]

[1] Agricultural Research and Development Station Turda

[2] University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca

Maize is one of the most important crops both in Romania and worldwide. Some of the main problems faced by this crop are drought and heat, phenomena encountered more frequently in recent years in some European countries. In the area of the city of Turda, in recent years an increase in average temperatures has been observed, sometimes associated with a lack of precipitation. In some years, although the precipitation had normal values or was above the multi-year average, the distribution was chaotic, often with unfavorable effects on the maize crop. Increased temperatures in June and July, which have been increasingly frequent in recent years, have determined the appearance of phenomena such as the drying of leaves and panicles, the worsening of protandry, the incomplete development of husks, and of course the significant decrease in yield. In order to observe the effects of climatic conditions on the maize hybrids created at ARDS Turda, 35 of our own creations were studied for 7 experimental years (2017–2023). The genotypes analyzed are both older creations and the newest registered hybrids, these being characterized by superior tolerance to unfavorable environmental conditions. The hybrids Turda332, Turda344, Turda335, Turda2020, Turda380, HST148 and SUR18/399 achieved superior yield in all experimental years, this being due to both their superior production capacity and adaptive heterosis. These genotypes are also characterized by a well-developed leaf system, erect or semi-erect leaves, good flowering consistency and a lack of sterile plants.

sciforum-082611: Cellular Redox Homeostasis in Plants: Violators, Protectors, and Their Modulation

Naser A. Anjum

Aligarh Muslim University, Aligarh, India

The generation and scavenging of varied reactive species, including reactive oxygen species (ROS), during metabolic reactions in varied cellular compartments are typical. At ROS-generation-scavenging equilibrium, ROS and its reaction products contribute to plant signaling. Notably, the impact of adverse growth conditions on plants is inevitable. These adverse growth conditions cause an imbalance between the generation and scavenging of ROS through either elevating ROS generation or diminishing their scavenging. In either case, ROS significantly violate cellular redox homeostasis and thereby impact overall plant health. Key soluble redox compounds ascorbate (AsA) and glutathione (GSH); enzymatic antioxidants such as ascorbate peroxidases (APX); monodehydroascorbate reductase; (MDHAR) and dehydroascorbate reductase (DHAR); catalase (CAT); glutathione reductase (GR); superoxide dismutase (SOD); and some proteinaceous thiol members including thioredoxin (Trx), glutaredoxin (Grx) and peroxiredoxin (Prx) proteins significantly maintain cellular redox homeostasis at its optimum, and protect the cells against potential damages caused by cellular redox violators. Notably, the outcome of the interaction between cellular redox homeostasis violators and protectors can be modulated by many exogenously supplied stimulants. This presentation aims to (i) briefly analyze the chemical behavior and production sites of ROS; (ii) highlight the dual behavior of ROS through overviewing ROS communication with other signaling molecules; ROS roles in stress signaling; and elevated ROS-accrued oxidative damage to biomolecules; (iii) discuss selected cellular redox homeostasis protectors; alternative oxidase; respiratory burst oxidase homologs; NADP-dependent malate dehydrogenase and the malate valve; plastid terminal oxidase; and proteinaceous thiol members; (iv) discuss selected exogenously supplied stimulant-induced modulation of cellular redox homeostasisprotectors; and also to (iv) highlight major aspects so far seldom explored about the subject.

sciforum-082755: Climate Resilience in Crop Rice: Advancing the Germplasm for Submergence Tolerance

F.M. Junkeer [1], G. D. A. Priyantha [2], W. D. P. Weerasinghe [2], D. M. R. G. Mayakaduwa [1], D. M. Withanawasam [2] and R. A. N. M. S. Senanayake [3]

[1] Department of Plant Sciences, University of Colombo, Colombo 03, Sri Lanka
[2] Regional Rice Research and Development Centre, Bombuwala, Sri Lanka
[3] Rice Research and Development Institute, Bathalagoda, Ibbagamuwa, Sri Lanka

Flash floods that occur during early seedling development lead to severe losses in rice crop cultivation. Therefore, the development of submergence-tolerant rice varieties is critically important to mitigate damage and ensure food security. The objective of this study was to assess the submergence tolerance of a new, improved collection of rice entries, using artificially induced complete submergence conditions during the vegetative phase. The artificial screening was carried out at the Regional Rice Research and Development Centre in Bombuwala, Sri Lanka. The study comprised two phases. In phase I, 138 rice entries were screened, including 104 international entries and 34 local entries. Twenty-one-day-old seedlings were subjected to submergence stress in concrete tanks filled with clean water (pH 7.1; EC 0.125 $mScm^{-1}$; T 26.5 °C) to a depth of 1 m for a period of 18 days. Survival percentages of de-submerged plants were recorded following 7 days of recovery. According to the scoring system of the International Rice Research Institute, the selected (138) entries were classified into different categories, highly tolerant (12), tolerant (9), moderately tolerant (55), moderately susceptible (31), and susceptible (31), based on their responses to submergence stress. In phase II, nine entries were selected from the previous phase, representing highly tolerant, tolerant, moderately tolerant, and susceptible categories to investigate respective morphological, physiological, biochemical, and anatomical responses upon submergence stress. The highly tolerant entries exhibited an accumulation of chlorophyll (0.17–0.73 mgg^{-1}) following submergence, while susceptible entries showed a degradation (0.23–1.03 mgg^{-1}). Non-structural carbohydrates were accumulated (1.79–6.55 $mgml^{-1}$) in both highly tolerant and tolerant entries, while degradation (2.25–4.46 $mgml^{-1}$) was observed in the susceptible entries following submergence. Standard susceptible check IR 42 exhibited significantly higher ($p \leq 0.05$) aerenchyma formation (34.6%) compared to highly tolerant (14.0–21.3%), tolerant (16.8–17.0%), and moderately tolerant (10.6–24.7%) groups. The evident physiological, biochemical, and anatomical responses provide crucial insights for further improving the rice crop for climate resilience.

sciforum-080163: Does the Accumulation of Lipid Droplets and Carotenoids Affect the Viability of *Dunaliella salina* Cells after Cryopreservation?

Nadiia Chernobai, Krystyna Vozovyk and Nadiia Shevchenko

Institute for Problems of Cryobiology and Cryomedicine of the National Academy of Sciences of Ukraine

Microalgae have garnered significant attention in recent years due to their diverse applications in various fields, including biotechnology, biofuels, nutraceuticals, and environmental monitoring. Among these microalgae, *Dunaliella salina* stands out as a species of immense biotechnological importance. Its unique characteristics and potential applications have prompted researchers to explore methods of preserving this microalga effectively, with cryopreservation being a particularly relevant approach.

In our previous studies, we demonstrated that *Dunaliella salina* cells are capable of accumulating significant amounts of carotenoids and lipids in response to salt and temperature stress, altering the pigment composition based on cooling regimes (Chernobai 2022, 2023). In this study, we attempted to address the question of whether the accumulation of lipid droplets and carotenoids affects the viability of cells after cryopreservation.

It has been shown that cooling to −40 °C followed by immersion in liquid nitrogen without the use of cryoprotectants significantly reduces the concentration and mobility of cells after thawing compared to intact culture.

To enhance cell viability after cooling—thawing, cold adaptation ("hardening") was applied for 24 h at a temperature of 4 °C, and 10% DMSO, glycerol, or ethylene glycol molecules were used as cryoprotectants.

The cryopreservation of pre-"hardened" *Dunaliella salina* cells, with the addition of cryoprotectant solutions, significantly improved viability (up to 80% compared to control) indicators after cooling—thawing. The best viability results at all stages of the experiment were achieved using cells cultivated under stress conditions (with nutrient deficiency and elevated sodium chloride content) and with the use of 10% DMSO and glycerol as cryoprotectants.

sciforum-079701: Effect of a Pre-Sowing Treatment on the Germination of Red Clover Seeds

Nadiya Shevchenko, Galyna Kovalenko and Tamara Strybul

Institute for Problems of Cryobiology and Cryomedicine of the National Academy of Sciences of Ukraine

Many different methods of pre-sowing seed treatment are used in modern agricultural production. Clover is a valuable source of protein and has a balanced amino acid composition and high digestibility, so it is indispensable in livestock production.

The purpose of our research was to establish the effect of a pre-sowing treatment of seeds with an ozone–air mixture, frozen to the temperature of the liquid nitrogen, and the combined effect of these factors on the sowing quality of clover seeds.

According to the parameters of the dynamics of seed germination, the shorter the germination time of half of the sown seeds (T50), the higher its germination index (GI), and therefore, the higher the rate of seed germination. These indicators describe the germination process, and the result of that process characterizes the seeds' germination.

A comparison of the effect of pre-sowing treatment by various physical factors on clover seeds of the "Chervona Lugova" variety showed that the pre-sowing freezing of clover seeds contributes to the greatest retardation of seed germination (the highest values of T50 and the lowest in GI) compared to the control. But at the same time, the highest values of germination were observed for the frozen seeds. The ozonation of clover seeds with an ozone–air mixture resulted in the slow germination of the seeds and the lowest germination values. The reaction to the combined effect of seed treatment factors before sowing (ozonation followed by freezing) was manifested in the highest germination rate, but the germination approached the control values, exceeding this parameter for ozonated seeds, but not reaching it for the frozen seeds.

sciforum-082799: Effect of Salicylic Acid Priming on the Expression of Susceptible Genes in *Zingiber–Pythium* Interactions

Sinoy Johnson and Sayuj Koyyappurath

Cochin University of Science and Technology, Kochi, Kerala, India

Ginger soft rot, caused by the soilborne oomycete pathogen *Pythium myriotylum*, is a devastating disease that poses a major threat to commercial ginger production in India. *P. myriotylum* infects all parts of the ginger, including the roots, rhizomes, pseudostems and sprouts, leading to huge economic loss. Previous research works have identified several candidate genes in host plants that are differentially expressed during such pathogen attacks, and which eventually exacerbate disease severity. At present, the management of such diseases caused by phytopathogens in commercial crops mainly relies on the use of chemical agents. These offer several drawbacks, including the hazardous nature of chemical agents, resulting in detrimental effects on nature and human health. These limitations shed light on the evaluation of prospects for novel eco-friendly approaches in combating this pathogen. However, to address these concerns, it is necessary to identify the exact molecular mechanisms that drive host plants prone to *P. myriotylum* ingression and subsequent infection. In this study, one-month-old healthy ginger plants were primed by the foliar application of Salicylic Acid (SA) at optimized concentrations. The Disease Severity Index was calculated to examine the impact of pathogen inoculation. Biochemical investigations evaluated carotenoid, lignin and total phenolic content in plants, which play a pivotal role in pathogen resistance. Furthermore, the temporal gene expression analysis was carried out to assess the effect of SA on susceptibility genes. Results revealed that the SA-primed plants were more susceptible to infection upon pathogen inoculation. This was accompanied by altered levels of carotenoids, total phenolics and lignin contents in treated plants. Moreover, a real-time analysis of the susceptibility genes depicted enhanced expression levels in treated plants compared to control plants. This study will help to identify the expression of susceptible genes during *P. myriotylum* attack, which can be silenced using gene silencing methods in future to induce resistance in cultivable ginger.

sciforum-080424: Elicitation by Organic Compounds for Inducing Defenses in *Alstroemeria sp.* against *Frankliniella occidentalis* (Pergande)

Juan Sebastian León-Beltrán, Andres Felipe Velasco-Cardenas, Diego Quiroga, Ericsson Coy-Barrera and Daniel Rodríguez

Basic and Applied Science Faculty, Universidad Militar Nueva Granada

Frankliniella occidentalis (Thysanoptera: Thripidae), better known as Western Flower Thrips (WFT), is a common pest affecting plant growth and reducing crop yields. They are particularly problematic in Alstroemeria sp. (Asparagales: Alstroemeriaceae) production in Colombia. The current management method relies heavily on the use of pesticides, which can have harmful effects on non-target organisms. Additionally, they may promote soil erosion and disrupt the functioning of the soil's biota. A novel alternative to mitigate the damage caused to plants is by carrying out an elicitation event for activating metabolic pathways related to defenses against phytophagous through diverse physiological and biochemical mechanisms. The alstroemeria–thrips case lacks substantial information regarding effective elicitation. Consequently, we assessed two organic elicitors, selected based on their well-established track record of successful elicitation against insects in other plant species. The plant response was evaluated by recording the phytochemical profiles. The first step in evaluating potential elicitors is to rule out their possible insecticidal activity. For this, we evaluated the direct effect of the compounds on the phytophagous by spraying a solution of each compound at 500 ppm with the respective adjuvants on individuals, placed on petri dishes with alstroemeria leaves as feed. After ruling out the insecticidal effect, alstroemeria plants were elicited by spraying with two concentrations of each elicitor (150 and 300 ppm). After 24 h, leaves were removed from the elicited plants to feed a cohort of second instar larvae of WFT, for which a survival curve was performed. We aimed to better understand the efficacy and selectivity of the test elicitors, thus ensuring a targeted and environmentally friendly approach to pest management in Alstroemeria cultivation. This study was funded by the Vice-Rector for Research at the Universidad Militar Nueva Granada through the IMP-CIAS-3739 research project, validity 2023–2025.

sciforum-081922: Enhancing the Performance of Chrysanthemum Synthetic Seeds through Iron Oxide Nanoparticles Supplementation

Dariusz Kulus [1], Alicja Tymoszuk [1], Magdalena Osiał [2] and Daria Groń [1]

[1] Bydgoszcz University of Science and Technology, Faculty of Agriculture and Biotechnology, Laboratory of Ornamental Plants and Vegetable Crops, Bernardyńska 6, 85-029 Bydgoszcz, Poland

[2] Polish Academy of Sciences, Institute of Fundamental Technological Research, Pawińskiego 5B Street, 02-106 Warsaw, Poland

Chrysanthemum holds significant economic importance as a popular ornamental plant globally, contributing to the horticultural and floricultural industries. To meet the growing demand for chrysanthemum plants, the development of synthetic seeds may become necessary, ensuring efficient propagation and genetic preservation of elite cultivars. Nanoparticles can be a valuable additive in the production of manufactured seeds as carriers of growth regulators. The aim of this study was to investigate the effect of iron oxide nanoparticles (Fe_3O_4NPs) in combination with auxin indole-3-acetic acid (IAA) on the growth and development of chrysanthemum synthetic seeds. Shoot tips of *Chrysanthemum* × *morifolium* (Ramat.) Hemsl. 'Richmond' were encapsulated in MS-based calcium alginate beads either with an addition of Fe_3O_4NPs alone or IAA or both the auxin and NPs. A control without Fe_2O_3NPs or IAA was included. Next, the synthetic seeds were inoculated on a water agar medium for six weeks and, then, sown in a greenhouse in a mixture of peat and perlite (2:1). It was found that the supplementation of alginate beads with Fe_3O_4NPs or IAA (alone or in combination) increased the germination efficiency (80–92%) compared with the control (60%). Even though the addition of nanoparticles did not enhance rhizogensis, synthetic seeds supplemented with Fe_3O_4NPs produced longer shoots that survived acclimatization better (75%) than the plant from the other treatments (11–33%). The reason for these results is that nanoparticles can ensure better nutrient and moisture retention. The utilization of nanoparticles in the production of synthetic seeds for chrysanthemum is a cutting-edge technique that can improve their viability and performance.

sciforum-082674: Exploring Frass Deriving from *Hermetia illucens* as a New Sustainable Tool for Inducing Biostimulant and Antifungal Activities in Wheat and Tomato against *Fusarium* spp.

Leonardo Coviello [1], Antonella Vitti [1], Antonio Franco [2], Giovanni Lomonaco [2], Antonio Dolce [2], Patrizia Falabella [2] and Maria Nuzzaci [1]

[1] School of Agricultural, Forestry, Food and Environmental Sciences, University of Basilicata, 85100 Potenza, Italy

[2] Department of Science, University of Basilicata, 85100 Potenza, Italy

Hermetia illucens (Diptera: Stratiomyidae) is commonly used as a bioconverter insect of organic wastes during its larval stage in order to obtain chitin (and its derivatives) and foster the circularity of the agri-food sector. The residual material of this bioconversion process using black soldier fly larvae, composed of larval excreta, exuviate and uneaten feedstock, is known as frass. It is rich in macro- and micro-nutrients and, for this reason, can be considered a secondary by-product usable as a sustainable alternative to chemical fertilizers. In addition, frass, similarly to compost and vermicompost, can exhibit suppressive effects against some phytopathogenic fungi. In this study, frass from *H. illucens* pupae reared on the Gainesville diet under standard conditions was investigated with in vitro and in vivo studies to assess its biostimulant and antifungal properties. The in vitro assay demonstrated that the frass aqueous extract (FAE) added in the media was able to stimulate the germination of seeds of the test plant cress (*Lepidium sativum* L.), never being phytotoxic. In addition, FAE inhibited the mycelial growth of soil-borne pathogens *Fusarium oxysporum* f.sp. *lycopersici* and *F. sporotrichioides* (by 30% and 49%, respectively). Moreover, when synergistically used with other antagonists, such as *Trichoderma harzianum*, FAE did not disturb their effectiveness in controlling phytopathogenic fungi. Germination tests on tomato (*Solanum lycopersicum* L. var *cerasiforme)* and durum wheat (*Triticum durum* Desf. var *Simeto)* seeds infected with the same above-mentioned fungi indicated that FAE was able to induce antifungal and biostimulant effects, especially with regard to lateral root branching and radicle length in tomato and wheat, respectively. In conclusion, our results open the door for further studies that use frass as a green, circular-economy-based, and sustainable tool in agriculture systems.

sciforum-082830: Heat and Drought Stress Associated with a Naturally Occurring Heat Wave Negatively Affected the Carbon and Water Balance of Olia Europea

Dilek Killi

Konya Food and Agriculture University, Plant Production and Technologies Department, 42080, Meram, Konya, Turkiye

Global warming will increase the number and severity of simultaneous droughts and heatwaves. This will have severe implications for agricultural sustainability in semi-arid regions. The absence of evapotranspirative cooling can contribute to the warming of temperatures in arid or drought-affected areas, particularly during hot and dry periods. Tree crops such as olive (*Olea europaea* L.) are particularly vulnerable to the long-term impacts of heat stress and water deficit. An understanding of the physiological responses of these stresses when combined is essential for mitigation and phenotyping efforts to climate-proof agriculture. We monitored biochemical and diffusive limitations to photosynthesis alongside the efficiency of mechanisms to enhance protection against photo-oxidative stress through the dissipation of excess energy in olive trees during a naturally occurring heatwave. Heat stress and water deficit impaired CO_2 assimilation through reduced ribulose-1,5-bisphosphate carboxylase/oxygenase (RubisCO) activity. Higher temperatures induced stomatal closure, exacerbating the impact of heat stress through reduced transpirative cooling. Heat stress also impaired photosystem II in olives, resulting in a lower capacity to utilize energy for photochemistry. The strong impact of heat stress when combined with water deficit negatively affected the carbon and water balance of the olive trees, illustrating the severe threat posed by climate change to the sustainability of olive production.

sciforum-084127: Identification and Investigation of Terrestrial/Freshwater Algal Species with Adaptive Mechanisms to Cr(VI) Stress

Giuseppe Molinari [1], Matteo Marieschi [2], Rossano Bolpagni [1] and Anna Torelli [1]

[1] Department of Chemistry, Life Sciences and Environmental Sustainability, University of Parma
[2] Department of Chemistry, Life Sciences and Environmental Sustainability, University of Parma

Sulfate metabolism plays a central role in enhancing cell defense to abiotic stresses and on the onset of tolerance mechanisms toward heavy metals, chromium included. Sulfur-containing molecules such cysteine (cys) and reduced glutathione (GSH) have an important role in scavenging during oxidative stress leading to a phenomenon, known as SED (Sulfur Enhanced Defense). These molecules are directly involved in chelating various metal ions, Cr(VI) included, and in reducing metal-induced oxidative stress. To verify if an enhanced cys production could represent a mechanism of environmental adaptation to Cr(VI), we isolated microalgae in habitats subject to abiotic stress for use in laboratory research. Algal samples were collected in a chromogen spring at Mount Prinzera, an ophyolitic mountain nearby Parma, Italy. In the water spring Cr(VI) levels are above legal limits (5 μg/L), with an average of 12 Cr(VI) μg/l depending on water flow, thus proving to be an optimal source for the isolation of organisms which could have evolved tolerance mechanisms to Cr(VI). Among the sampled organisms we isolated pure colonies of green algae, diatoms and cyanobacteria, identified through DNA barcoding. Among the isolated strains, three green algal species, *Neocystis* sp., *Bracteacoccus* sp. and *Chromochloris zofingensis* were tested with increasing Cr(VI) concentrations starting from a concentration 10-fold higher that of the spring in which they were isolated. This preliminary analysis allowed us to individuate species with different Cr(VI) tolerances, constituting good experimental material for future research on the role of sulfur uptake/assimilation pathway in Cr(VI) tolerance.

sciforum-080422: Induced Defense of *Alstroemeria* sp. against *Frankliniella occidentalis* (Pergande) via Elicitation with Inorganic Compounds

Juan Sebastian León-Beltrán, Andres Felipe Velasco-Cardenas, Diego Quiroga, Ericsson Coy-Barrera and Daniel Rodríguez

Basic and Applied Science Faculty, Universidad Militar Nueva Granada

Western flower thrips (WFT, *Frankliniella occidentalis*) represent a significant threat to *Alstroemeria* crop health and productivity due to their ability to cause extensive damage in leaves and flowers, and even in the transmission of plant diseases, which generates millions of dollars in losses per year to the floriculture industry. Traditional methods for thrips control often rely on chemical pesticides, which can have detrimental effects on the environment and human health. Plant defense induction using inorganic elicitors has gained increasing attention as a sustainable and eco-friendly alternative. This study aims to investigate the efficacy of inorganic elicitors in inducing plant defense responses against thrips infestation. The experiment involved the application of two different inorganic elicitors, i.e., potassium phosphite and calcium carbonate, at two concentrations (100 ppm and 300 ppm) to *Alstroemeria* plants. The elicitors were applied via foliar spray. Plant defense responses were then examined through recording phytochemical profiles. The life cycle of thrips was also assessed in the population fed with elicited plants compared to non-elicited control. In order to fully comprehend and complement our knowledge to ensure the best outcome interpretation, we reviewed previous studies that use these elicitors (and other chemically similar ones) against insects, particularly against thrips, to comprehend and predict how the interaction might be used in the *Alstroemeria*-Thrips model. This study was funded by the Vice-Rector for Research at the Universidad Militar Nueva Granada through the IMP-CIAS-3739 research project, 2023–2025.

sciforum-082602: Insights into Volatile Signaling and Defense Responses in Tomato Communication Triggered by Bacterial Infection

Eneritz Barbadilla, Ismael Rodrigo, José María Bellés, Francisco Vera-Sirera, María Pilar López-Gresa and Purificación Lison

Universitat Politècnica de València

Despite their apparent immobility, plants have developed chemical signaling systems to interact with their environment and other plants. In the plant kingdom, communication among plants through volatile organic compounds (VOCs), like terpenes, aldehydes, alcohols, or esters, enable each plant species to communicate uniquely in an intriguing phenomenon.

In tomatoes, infection caused by *P. syringae* pv. *tomato* activates defense mechanisms mediated by salicylic acid, including stomatal closure, the induction of defense genes, and metabolic changes that alter the volatile profile, alerting nearby plants. These compounds are differentially emitted when plants are resistant to infection. Thus, this study aims to compare the volatile emissions resulting from tomato emitters plants (e-plants) infected with virulent or avirulent bacterial strain, and their effects are not infected by nearby tomato receiver plants (r-plants).

Through this approach, it has been observed that healthy r-plants sharing an environment with bacterial-infected plants exhibit a higher tendency for stomatal closure and an induction in PR1 gene expression. Moreover, when these r-plants are then infected, they show increased resistance, displaying fewer symptoms and a decrease in bacterial population. Interestingly, r-plants co-cultivated with e- plants infected with the avirulent bacterial strain exhibit higher resistance rates when compared to r-plants co-cultivated with e-plants infected with virulent bacteria, suggesting that the emitted aroma from resistant e-plants may be more effective. Deciphering the aroma of resistance could be valuable for future phytosanitary treatments. The study of plant interactions provides an enriching perspective on the complexity and adaptability of nature, thereby opening the door to the development of more effective and sustainable agricultural strategies.

sciforum-080182: Investigation into Water–Yield Relationships in Some Drought-Resistant Cotton Varieties Cultivated in Aydın Province

Bayram Ali Ceylan, Oğuzhan Mantar, Yusuf Uğurlu and Safiye Pinar Tunali

Aydin Adnan Menderes University

This study evaluated drought-resistant cotton varieties grown in field conditions regarding water–yield relationships. It also aimed to investigate the effects of different irrigation water levels on the yield of cotton plants in the Aydın region. The research was conducted in field conditions at the Aydın Adnan Menderes University, Faculty of Agriculture, Research and Application Farm in 2022. Two drought-resistant seed varieties (Sahra, Özaltın) produced in the region were used as research material. The experiment was set up according to the randomized block design, with three replications and two factors. The first factor in the study is the cotton variety, and the second is the irrigation level. The gravimetric method approach, a soil-based monitoring technique, was used in irrigation programming. In the study, two different types of cotton with two different irrigation levels were applied with three replications. Thus, the experiment consisted of a total of 12 plots. In addition, the May 455 cotton variety, which is intensively grown in the region, was used as a control. In the study, irrigation water was applied to each plot by the drip irrigation method. When the harvest time came, the plants in the middle two rows were harvested by hand and weighed, and yields with plots were obtained. Thus, the relationship between irrigation water and plant yields in drought-resistant cultivars was determined.

sciforum-083860: Is MAP65-1 Phosphorylation Related to Cr(IV) Effects on the Microtubules of *Arabidopsis thaliana*?

Ioannis-Dimosthenis Adamakis

National Kapodistrian University of Athens

Chromium (Cr) is a heavy metal, occurring in both terrestrial and aquatic habitats. It is found in two oxidation states, the trivalent Cr(III) and the hexavalent Cr(VI). Cr (VI) is a toxic and non-essential element for plants. When encountered at high concentrations, almost all physiological, biochemical and cellular processes of plants are negatively affected. Microtubules (MTs), in particular, have been found to be prone to Cr(VI) in plant cells and constitute a universal target of Cr(VI) toxicity. MAP65-1 (the most abundant plant structural microtubule-associated protein) modulates microtubule stability since it binds and bundles them by forming stabilizing cross-bridges between neighboring MTs. This ability is affected by its phosphorylation status, and when MAP65-1 becomes phosphorylated it becomes unbound from MTs during the cell cycle phases. In the present study, the effects of Cr(VI) on MAP65-1 presence on the cortical MTs of *Arabidopsis thaliana* roots and hypocotyls were investigated. *A. thaliana* lines expressing GFP:TUA, CFP:AtMAP65-1 and the line expressing the non-phosphorylatable AtMAP65-1, AtMAP65-1^{9A} (CFP:AtMAP65-1^{9A}), were used. Four-day-old seedlings were transplanted to Petri dishes with ½ MS solid medium supplemented with 100 μM potassium dichromate ($K_2Cr_2O_7$, Cr(VI) for) and left to grow for 24 or 48 h. Confocal laser scanning microscopy (CLSM) revealed that, already after 24 h, Cr(VI) variably affected cortical MTs. Moreover, MAP65-1 presence was substantially reduced as revealed by the CFP:AtMAP65-1 signal intensity measurements. However, this was not the case for CFP:AtMAP65-1^{9A}, where its signal was retained when Cr(VI) was applied. When examining MTs of the CFP:AtMAP65-1^{9A} line, Cr(VI) did not affect them. The above observations show that the influence of Cr(VI) on MTs is related to MAP65-1 phosphorylation.

sciforum-084114: Maize's Physiological Responses to the Foliar Pathogen *Exserohilum turcicum* and the Native Biocontroller *Bacillus velezensis* EM-A8 in Greenhouse Trials

Maria Fiamma Grossi Vanacore [1], Melina Sartori [1], Francisco Giordanino [1] and Daiana Garcia [2]

[1] Facultad de Ciencias Exactas Físico Químicas y Naturales, Universidad Nacional de Río Cuarto
[2] FCEFQyN, Universidad Nacional de Río Cuarto

Maize is one of the most important cereals in the world. Northern corn leaf blight (NCLB) caused by the pathogen *Exserohilum turcicum* is among the diseases that threaten its yield. In the Laboratorio de Ecología Microbiana, UN de Río Cuarto, *Bacillus velezensis* EM-A8 was selected from the maize phyllosphere for its antagonistic activity in vitro and in vivo against *E. turcicum*. In order to find biological alternatives for NCLB management, two greenhouse trials were carried out between 2021 and 2022. Two formulations of the biocontroller were applied in pot-grown maize plants, both healthy and infected with *E. turcicum*. Treatments consisted of Control (C), biocontroller in formulation 1 (T1), biocontroller in formulation 2 (T2), formulation 1 + *E. turcicum* (T3), Formulation 2 + *E. turcicum* (T4) and *E. turcicum* (T5). Leaf hydrogen peroxide concentration (H_2O_2), salicylic acid concentration (SA), phenolic compound concentration (PC) and electrolyte leakage (EL) were measured to assess maize's physiological responses towards the pathogen and the biocontroller. Data obtained were analyzed using an analysis of variance test and principal component analysis. Parameters SA, H_2O_2 and PC were significantly lower in C and T1 compared to the rest of treatments (p 0.05). In addition, T3 showed the lowest level of SA in T3. EL was significantly higher in C, and T4 presented the highest membrane stability. Finally, principal component analysis explained 83% of the variation and determined an inverse association between SA and EL, and a positive correlation between PC and H_2O_2. T5 was associated with EL, while C aligned with H_2O_2 and SA. These results could indicate that the foliar application of *B. velezensis* EM-A8 enhances maize resistance and increases yield through both direct interferences with the pathogen and by influence over the plant sanitary status. Further studies are necessary to evaluate the bacterial biostimulant capacity over dry matter production.

sciforum-084310: Melatonin and Microbial Fortification Improved Photosynthetic Efficiency and Phenolic Content in *Brassica juncea* L. Plants under Cd Stress

Tamanna Bhardwaj [1], Renu Bhardwaj [1] and Sumit G. Gandhi [2]

[1] Department of Botanical and Environmental Sciences, Guru Nanak Dev University, Amritsar, India
[2] Indian Institute of Integrative Medicine (CSIR-IIIM), Council of Scientific and Industrial Research, Canal Road, Jammu 180001, India

The contamination of soil with cadmium (Cd) has become a serious environmental issue. Plants under cadmium stress have decreased biomass and photosynthetic rate. According to Voigt and Nagel (2002), cadmium can also impede the water-splitting complex of PS II's oxidizing site (Nirupama and Mohn 2003), stop photosynthetic electron transport, or competitively bind to PSII's critical Ca^{2+} site during photoactivation (Faller et al., 2005). Osmopriming with Mlt improves photosynthesis and modulates the expression of key photosynthetic genes. Plant Growth-Promoting Rhizobacteria (PGPR) are a helpful species of bacteria that are found among rhizobacteria. Plant roots can be colonized by PGPR, which can also greatly improve soil fertility, encourage plant growth and development, and raise crop output. The current study's goal was to evaluate the impact of Cd toxicity on *Brassica juncea* L. and to unriddle the ameliorative potential of phytohormone, Melatonin (Mlt)-mediated plant–microbe (*Pseudomonas putida* (Pp), *Pseudomonas fluorescence* (Pf)) interaction in *B. juncea* L. The largest significant increase in total chlorophyll, carotenoids, xanthophyll, anthocyanin, and flavonoid content was found with Mlt and PpPf treatment in Cd stressed *B. juncea* seedlings, which was corroborated by a spectrophotometric analysis. Furthermore, scanning electron microscopy (SEM) analysis of the abaxial surface of leaves showed enhanced stomatal size and density under treatments of ameliorators when compared to Cd-stressed seedlings. Using confocal microscopy, autofluorescence imaging of photosynthetic pigments such as chlorophyll, carotenoids, and total phenols revealed that Mlt and PpPf exhibited the highest fluorescence. Also, the application of Mlt and PGPR improved the gene expression of key photosynthetic genes (psb A for D1 subunit PSII, psb B for CP 47 subunit of PSII, CHS for chalcone synthase, PAL for phenylalanine ammonialyase, PSY for phyotene synthase). Hence, the current study recommends a dual application of Mlt and PGPR to reduce Cd-induced toxicity in *B. juncea* seedlings.

sciforum-084231: Metabolomic Approach in *Vitis vinifera* Varieties with Different Stress Tolerance in Alentejo Region

Lénia Rodrigues [1], Mónica Soeiro [2], Marta Silva [2], Carlos Cordeiro [2], João Barroso [3] and Ana Elisa Rato [3]

[1] MED—Mediterranean Institute for Agriculture, Environment and Development & CHANGE—Global Change and Sustainability Institute, Instituto de Investigação e Formação Avançada, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal.

[2] Laboratório de FTICR e Espectrometria de Massa Estrutural, Biosystems and Integrative Sciences Institute (BioISI), Faculdade de Ciências, Universidade de Lisboa, Campo Grande, 1749-016 Lisboa, Portugal.

[3] MED—Mediterranean Institute for Agriculture, Environment and Development & CHANGE—Global Change and Sustainability Institute, Escola de Ciências e Tecnologia, Departamento de Fitotecnia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Port

Grapevine (*Vitis vinifera* L.) is globally recognized as the most extensively grown and economically significant crop, primarily due to its association with the wine industry. This species possesses a remarkable ability to adapt to various abiotic stresses, like extreme temperatures or UV radiation, and the response is determined by several regulatory mechanisms, with changes in metabolite composition.

Metabolomics is an omics technology that holds promise in agricultural research, becoming an indispensable tool in various plant sciences studies, such as to elucidate adaptive responses under abiotic stresses for use in crop improvement. In this study, different grapevine cultivars were distinguished using metabolomics tools and the active role of metabolites under heat stress conditions was also elucidated.

Leaves from three different grapevine cultivars were collected from field-growing plants at different periods during ripening, under high summer temperatures. Metabolite extraction was performed using 100 mg of ground leaves with 1 mL methanol/water (1:1), followed by three cycles of vortex / ice for 1 min each. After centrifugation, metabolites were recovered and analyzed by FT-ICR-MS (Maia et al., 2020).

The metabolite extracts from the different *V. vinifera* cultivars were analyzed by FT-ICR-MS following an untargeted metabolomics approach. Principal component analysis (PCA) showed that all the different cultivars were separated, with all time-points clustering together, further confirmed by hierarchical clustering analysis (HCA).

Metabolomics can be utilized as a phenotyping tool for distinguishing cultivars by analyzing key signatory metabolic markers and elucidate the mechanisms that confer tolerance to high temperatures in grapevine.

Acknowledgments: This work was financially supported by national funds through the Foundation for Science and Technology (FCT) under Project UIDB/05183/2020.

sciforum-080162: Metal Interactions in the Ni Hyperaccumulating Population *Noccaea caerulescens* Monte Prinzera

Elisa Fasani [1], Antonella Furini [2] and Giovanni DalCorso [2]

[1] Dept. of Biotechnology—University of Verona
[2] Dept. Biotechnology—University of Verona

Hyperaccumulation is a fascinating trait displayed by few plant species that are able to accumulate high amounts of metal ions in above-ground tissues without symptoms of toxicity. *Noccaea caerulescens* is a recognized model system used to study metal hyperaccumulation and hypertolerance. A *N. caerulescens* population naturally growing on serpentine soil of the Italian Apennine Mountain, Monte Prinzera, was chosen for this study. Plants were grown hydroponically and treated with different metals, in excess or limiting concentrations. Accumulated metals were quantified in shoots and roots by means of ICP-MS. Using real time PCR analysis, the expression of metal transporters and Fe deficiency-regulated genes was compared in shoots and roots of treated plants. The metal chelator nicotianamine was also quantified in tissues. *N. caerulescens* Monte Prinzera confirmed its ability to hypertolerate and hyperaccumulate Ni but not Zn, in contrast with the close relative *N. caerulescens* Puy de Wolf. Moreover, differently from other Ni-tolerant species, such as *Noccaea japonica*, it adapted to a serpentine soil, and evolved an interesting mechanism of tolerance that prevents Ni accumulation in the root tissues by downregulating IREG2 expression in the roots and keeping its expression in the shoot, the final destination of Ni translocation. The study indicates the high plasticity of related plant taxa to adapt independently to highly selective environments, enacting different, and sometimes contrasting, strategies to cope with similar challenging edaphic conditions.

sciforum-084105: Micromorphology and Silicon of the Leaf Epidermis in the Psammophyte *Alyssum desertorum* Are Sensitive to Soil Flooding

Olena M Nedukha [1], Elizabeth Kordyum [1] and Olga A Artemenko [2]

[1] Institute of Botany, National Academy of Sciences of Ukraine, Kyiv, Ukraine
[2] Institute of Botany by M.G.Kholodny of NASU

The ultrastructure of the leaf epidermis, localization, and content of silicon inclusions in the epidermal cells of the leaves of psammophyte *Alyssum desertorum* (Brassicaceae) seedlings grown in control and under 10-day soil flooding were studied by electron and laser confocal microscopy. The peculiarity of the structure of the adaxial and abaxial epidermis of the leaves of control samples was the presence of radially branched star-shaped trichomes with 5–6 rays. Trichomes, like the main cells of the epidermis, are covered with small waxy structures. The presence of silicon inclusions in trichomes and ordinary epidermal cells of the adaxial and abaxial surfaces of the leaves of control samples was established. The study of the effect of root flooding on the structure of *A. desertorum* leaves showed that flooding caused thickening of the anticlinal walls of the main epidermal cells on both leaf surfaces, an increase in the number and thickness of trichome branches, as well as an increase in the size and density of waxy structures on the surface of trichomes, stomata, and periclinal walls of epidermis. The flooding of plants also increased the silicon content in the periclinal walls of the abaxial surface and in the trichomes. Based on the results of our experiments and literature data, it can be concluded that under adverse conditions, trichomes, changing their structure, maintain the optimal thermal and water status of the waterlogged plants. The increased content of silicon inclusions contributes to the optimal absorption and reflection of sunlight, which leads to changes in the intensity of photosynthesis and thus helps to optimize the function of leaves in flooded plants.

sciforum-080382: Necrotrophic Fungus *Alternaria brassicicola* Infection Influences the Photosynthetic Efficiency of *Sinapis alba* Similarly as in Other *Brassicaceae*

Violetta Katarzyna Macioszek

[1] Laboratory of Plant Physiology, Depattment of Biology and Plant Ecology, Faculty of Biology, University of Bialystok, Poland

[2] Faculty of Biology and Environmental Protection, University of Lodz, Poland

Many popular crop species from the *Brassicaceae* family, such as *Brassica juncea*, *Brassica napus*, and *Brassica oleracea*, are in use, mostly as human food, fodder, and green manure. Among such crops is white mustard *(Sinapis alba*); its seeds are mainly utilized as a seasoning and a source of edible oil, and it is also used as a postharvest plant. However, many *S. alba* cultivars show different levels of susceptibility to one of the most devastating fungal necrotrophs to all Brassicas, *Alternaria brassicicola.* Nevertheless, the main fungal virulence factors responsible for the induction of host cell death are unknown. As described in previous research, this fungus affects photosynthetic performance in Brassicas, inducing changes in photosynthetic parameters, chloroplast damage, and reprograming the transcription of many photosynthesis- and defense-related genes. Some *S. alba* cultivars show resistance against *A. brassicicola*. Therefore, in the present research on *S. alba* plants infected with *A. brassicicola,* early changes in photosynthetic parameters, chlorophyll, carotenoid, and phenolic compound contents were investigated in two common cultivars, "Maryna" and "Borowska", mainly cultivated in Poland. Similarly, as in *Brassicas* infected with *A. brassicicola*, the infection's progression was time- and leaf-position-dependent; the older the leaf, the larger the necrotic spot. A leaf-position-dependent decrease in chlorophyll and carotenoid contents was observed in both infected *S. alba* cultivars. Photosynthetic parameters such as, among others, QYmax, Fv/Fm, NPQ, Rfd, qL, analyzed with a FluorCam, showed different levels of reduction in infected leaves compared to control leaves and uninfected areas of infected leaves. Phenolic content decreased in the oldest infected leaves and remained at the control level in the youngest ones. These results indicate a uniformity of the *A. brassicicola* infection process in the *Brassicaceae* family and host cell reactions.

sciforum-084154: Nitrogen Fertilization for the Management of Powdery Mildew of Barley Caused by *Blumeria graminis* f. sp. *hordei*

Hanane EL Wazziki, Siham Ourinich and Brahim El Yousfi

National Institute of Agricultural Research (INRA), Morocco

Powdery mildew caused by *Blumeria graminis* is one of the most widespread diseases in the world, especially in countries with humid and temperate climates. It is a major constraint for barley cultivation. In a strip block design, a greenhouse experiment was conducted in different contrasting environments during the growing seasons of 2019–2020 and 2020–2021. The study investigated the effect of nitrogen fertilization to manage powdery mildew in four Moroccan barley cultivars with different resistance levels: Taffa, Oussama, Rabat 071, and Amalou. Disease severity was assessed weekly as a percentage of the covered leaf area compared to the healthy one to calculate the area under the disease progress curve (AUDPC). Additionally, two agronomic parameters; grain yield and total dry weight were also obtained. Analysis of variance revealed significant environment, genotype, treatment, and their interaction effects on the AUDPC of powdery mildew. The data showed that the application of nitrogen fertilization; N 21%, N33%, and N46%, led to a significant increase in susceptibility to disease compared to non-fertilization. Environments 1 and 2 were more significantly involved in disease severity than environments 3 and 4, and AUDPCs were increased when humid conditions were associated with N21% and N33% supply. This held true for two cultivars, Oussama and Rabat 071, which differed in their susceptibility to the disease. However, the Amalou variety was moderately affected compared to Taffa, which is resistant to powdery mildew disease. Additionally, applying nitrogen supply increases yield under favorable pathogen growth conditions but decreases it under unfavorable conditions. Despite contrasting environmental conditions, these results demonstrate that the effect of nitrogen fertilization on disease management depends on the level of pathogen attacks, the forms of nitrogen fertilizers used, and the growing conditions of both the plant and the pathogen.

sciforum-084211: Olive *Endochitinase EP3*-Like Gene Mediates Plant Responses against *Colletotrichum nymphae* Infection

Diogo Inácio [1], Tomás Monteiro [2], Maria do Rosário Félix [3], Catarina Campos [4], Mariana Patanita [4], Joana Ribeiro [4], André Albuquerque [4], Filipa Santos [3], Augusto da Rosa [1], Augusto Peixe [3] and Maria Doroteia Campos [2]

[1] Master student in Agronomic Engineering, Universidade de Évora.
[2] MED—Mediterranean Institute for Agriculture, Environment and Development & CHANGE—Global Change and Sustainability Institute, Institute for Advanced Studies and Research, Universidade de Évora.
[3] MED—Mediterranean Institute for Agriculture, Environment and Development & CHANGE—Global Change and Sustainability Institute, Departamento de Fitotecnia, Escola de Ciências e Tecnologia, Universidade de Évora.
[4] MED—Mediterranean Institute for Agriculture, Environment and Development & CHANGE—Global Change and Sustainability Institute, Institute for Advanced Studies and Research, Universidade de Évora

One of the most economically important fruit trees in Mediterranean countries is the olive tree (*Olea europaea* L.). Foliar and fruit fungal pathogens are responsible for economically important diseases in most olive-growing areas. Within these pathogens, we highlight *Colletotrichum* spp., the causal agent of the serious anthracnose disease. Under favourable conditions, the disease can devastate entire production fields. Symptoms typically occur in fruits at maturation under wet autumn conditions, causing severe quantitative and qualitative yield losses of olive oil and fruits. The best control strategy currently relies on the use of synthetic fungicides, but there is regulatory pressure in agriculture worldwide to limit their use.

In search of a sustainable approach to disease management, the present study reports the transcriptional changes of genes that encode enzymes actively involved in the olive tree's defence response to *C. nymphaeae* infection. 'Galega vulgar', an olive cultivar known to be highly susceptible to the disease, was selected for the studies. The plants used in the experiments were grown in vitro to ensure their health status, transplanted into pots, and grown under controlled conditions. Leaf samples were collected before fungi inoculation, and in different timepoints after inoculation with a spore suspension of *C. nymphaeae*. Transcriptomic studies revealed a general upregulation of the selected target genes, but only *Endochitinase_EP3-like* (*CHI*) presented a significant upregulation in response to *C. nymphaeae* infection. *CHI* is a promising candidate to be used in functional analysis. We stress the importance of this study for the incorporation of new sources of resistance of olive trees to anthracnose for the promotion of sustainable management strategies.

Acknowledgments and Funding: Patanita and J.A. Ribeiro are supported by Portuguese National Funds through FCT/MCTES under the PhD scholarships 2022.13638.BD and SFRH/BD/145321/2019, respectively. This work is also funded by National Funds through FCT under the Project UIDB/05183/2020 and under the project INOVCIRCOLIVE PRR-C05-i03-I-000208.

sciforum-080678: Pharmacognostic Study of the Rare *Saponaria sicula* Raf. in Relation to Different Pedo-climatic Conditions

Paola Malaspina [1], Antonella Smeriglio [2], Mariarosaria Ingegneri [2], Federica Betuzzi [1], Emilio Di Gristina [3], Domenico Trombetta [2] and Laura Cornara [1]

[1] Department of Earth, Environment and Life Sciences, University of Genova, 16132 Genova, Italy
[2] Department of Chemical, Biological, Pharmaceutical and Environmental Sciences, University of Messina, 98166 Messina, Italy
[3] Department of Agricultural, Food and Forest Sciences (SAAF), University of Palermo, 90128 Palermo, Italy

Saponaria sicula (Caryophyllaceae) is a perennial wild plant that grows exclusively on limestone cliffs on the Madonie Mts. and on the volcanic soil of Etna Mt., Sicily. This research aims to analyze the effect of pedo-climatic conditions on the leaf anatomy, micromorphology and phytochemistry of this species, sampled in the two above-cited sites. Moreover, the antioxidant and anti-inflammatory activities of leaf extracts were evaluated. Light microscopy analyses showed a higher amount of calcium oxalate druses in the leaves of Madonie plants (M). This is probably due to the higher CaCO3 and Ca richness in the soil with respect to that of Etna Mt. Toluidine blue O staining highlighted a positive reaction to polyphenols, mainly in the M leaves. These data agreed with the higher content of total phenols and flavonoids detected in the M hydroalcoholic extract (MHE) in comparison to that obtained from Etna plants (EHE). Furthermore, the evaluation of flavan-3-ols and proanthocyanidins content highlighted a low presence of polymeric tannins in both HEs. The phytochemical profile, evaluated using LC-DAD-ESI-MS analyses, revealed the presence of 64 compounds. Although, in both extracts, the most abundant compounds were the same (propelargonidine dimer, 1-synapoyl-2-feruloylgentiobiose and caffeoil glucose), statistically significant differences in terms of peak area percentage were recorded between MHE and EHE. According to the higher polyphenol content, MHE showed the highest biological activity, both from an antioxidant and anti-inflammatory point of view, with statistically significant differences in terms of half-inhibitory activity. In conclusion, this study experimentally demonstrates that pedo-climatic differences can affect the pharmacognostic features of this plant species.

sciforum-084168: Plant Responses to Global Warming: an Experimental Approach in an Urban Park in Madrid

David Fernández-Sousa, Juan Antonio Delgado and María Dolores Jiménez

Departamento de Biodiversidad, Ecología y Evolución, Universidad Complutense de Madrid

Plant communities of urban parks are subject to intense management, with frequent sowing, watering and fertilizing affecting their community assembly. Additionally, plants are subjected to other anthropogenic stress factors such as pollution or climate change. In order to know how urban plants respond to increased temperatures, two experiments were carried out, one under field conditions and the other in a germination chamber. The field experiment was developed in an urban park in Madrid, Spain, where open-top chambers (OTCs) were used to assess the germination, survival and morpho-physiological parameters of five herbaceous species. The same species were studied using a germination chamber and two warming treatments were tested to study germination rate. The results showed different responses depending on the species. Under field conditions, an increase in germination in the warming treatment was observed in *Diplotaxis tenuifolia* and *Valerianella locusta*, and a decrease in survival was observed in *Linum perenne* and *Vicia sativa*. In the germination chamber, germination rates were significantly higher under warming treatments in four species. Regarding morpho-physiological parameters, they could only be measured in two species that survived low precipitation during the study period. A lower development was observed in the warming treatment (significant for *Linum perenne*), along with a photosynthetic down-regulation. The different observed responses in the studied species could have consequences for the establishment of herbaceous communities in urban environments, and their biodiversity, with implications for management.

sciforum-083991: Response of Psammophyte *Alyssum desertorum* Stapf to Soil Flooding

Liudmyla Kozeko [1], Maria Rudnitska [1], Yulia Ovcharenko [1], Tamara Vorob'ova [2], Elžbieta Jankovska-Bortkevič [3] and Elizabeth Kordyum [1]

[1] M.G.Kholodny Institute of Botany, National Academy of Sciences of Ukraine
[2] M.G.Kholodny Institute of Botany, National Academy of Sciences of Ukraine, Kyiv
[3] Nature Research Centre

Growing on sands, *Alyssum desertorum* does not need to adapt to long-term waterlogging. To assess the ability of this psammophyte to tolerate excessive moisture, we studied the responses of plants to root flooding. Seeds were collected from plants of the dry sandy areas of ravine forests in the Steppe Zone of the Dnipropetrovsk region, Ukraine. Three-week-old plants grown on sandy soil were subjected to soil flooding for 10 days. Heat shock protein HSP70 as a marker of stress reaction, alcohol dehydrogenase (ADH) as a key enzyme of anaerobic adaptation, photosynthetic pigment level, and ethylene as a phytohormone of hypoxic response and senescence were analyzed. A weak differential induction of two HSP70 isoforms (70 kDa and 73 kDa) simultaneously with the absence of significant changes in the total protein spectrum was determined, which indicates the role of chaperones in maintaining cellular proteostasis. At the same time, the rapid temporary activation of ADH synthesis in leaves during the first two days showed short-term systemic anaerobic metabolic adaptation to root hypoxia. On the other hand, the progressive increase in ethylene emission and decrease in pigment content were, rather, associated with induced plant senescence. The obtained data showed that this psammophyte has adaptive molecular mechanisms that enable it to survive short-term soil flooding.

sciforum-084138: Review: Occurrence, Spread, and Management Possibilities of Citrus Bacterial Canker (*Xanthomonas citri* subsp. *citri*) in Sudan

Elshafia Ali Hamid Mohammed [1,2], Abdelhakam Esmaeil Mohamed Ahmed [3,4], Azza Siddig Hussien Abbo [5], Magdoline Mustafa Ahmed Osman [6,7] and Siddig Mohamed Elhassan [8]

[1] Agricultural Research Corporation, Integrated Pest Management Research Center, Wadmadani, P.O. Box 126, Sudan
[2] University of Debrecen, Faculty of Agric., Food and Science and Environmental Management, Debrecen, Hungary
[3] University of Debrecen, Faculty of Agric., Food and Science and Environmental Management, Debrecen, Hungary
[4] University of Khartoum, Faculty of Forestry, Khartoum North, Postal Cod 13314, Sudan
[5] University of Khartoum, Department of Crop Protection, Faculty of Agriculture, Sudan
[6] National Center for Research, National Resources and Desertification Res. Institute, Khartoum, Sudan
[7] University of Debrecen, Faculty of Agric., Food and Science and Environmental Management, Debrecen, Hungary
[8] University of Khartoum, Department of Crop Protection, Faculty of Agriculture, Khartoum North, Sudan

Bacterial citrus canker disease (BCCD), caused by *Xanthomonas citri* subsp. *citri* (*Xcc*) is considered one of the most damaging factors to the citrus industry worldwide. Recently, based on the host range and pathogen interactions, five different pathovars of the BCCD have been extensively investigated, in which pathotype A (the Asiatic form of *X. citri* subsp. *citri*) being the most devastative and widespread among almost all citrus varieties and their relative. The disease causative agent (*Xcc*) induces varying symptoms depending on the citrus species, plant part, age, geographical area, and climate conditions. The symptoms ranging from small and raised yellowish to necrotic lesions containing corky tissues surrounded by watery and clear yellow rings on leaves, stems, and fruits. In a high level of BCCD, severe symptoms may occur such as die-back, defoliation, severe fruit dropping, and blemished, which remarkably reduce fruit production and quality. Based on all published articles about BCCD in Sudan from the first detection in 2003 to date, the current study aimed to highlight the starting point of BCCD in a specific region in eastern Sudan, the path of spread to cover almost all citrus-producing areas in Sudan, Symptomatology, *Xcc* identity, ecology, and assessing the efficacy of various chemical compounds and plant extracts against *Xcc* through both in vivo and in vitro examinations to establish an effective strategy to manage this disease

sciforum-082603: Role of *THT* and *Twi* on the Volatilome Profile of Tomato Plants Upon Wounding

Cynthia Andrade-Cárdenas, Lucía Martín, Ismael Rodrigo, José María Bellés, Francisco Vera-Sirera, María Pilar López-Gresa and Purificación Lison

Universitat Politècnica de València

In response to stress situations, such as wounding, plants trigger the release of a series of Volatile Organic Compounds (VOCs), which play a fundamental role in their defense, including the plant communication. In addition, the accumulation of hydroxycinnamic acid amides (HCAAs) and flavonoids in response to stress, was observed. The last stage of HCAA biosynthesis involves the activity of the enzyme tyramine hydroxycinnamoyl transferase (THT) (Zacarés et al. in 2007). Besides, most flavonoids can accumulate in the form of glycoconjugates, by the action of glycosyltransferases. In particular, Twi1 glycosyltransferase show in vitro activity toward the flavonoids quercetin and kaempferol. Both THT and Twi1 are involved in plant defensive mechanisms against pathogens, since tomato plants that overexpress THT (*35S:THT*) are more resistant to the bacterium *Pseudomonas syringae* (Campos et al., 2014), while tomato plants that silence Twi1 (*RNAi_Twi1*) are more susceptible to the Tomato spotted wilt virus (Campos et al., 2019). Both genes, *THT* and *Twi1*, are induced in tomato plants in response to wounding, although their role in this type of stress has not been studied in detail to date.

To study the possible role of *THT* and *Twi* in plant communication, a metabolomic study was carried out to determine the volatilome induced by mechanical wounding of both transgenic tomato lines *35S:THT* and *RNAi_Twi1*.

This research provides evidences that mechanical wounding of *35S:THT* or *RNAi_Twi1* transgenic plants leads to differential effects on the metabolomic profiles of VOCs, suggesting that *THT* and *Twi* could be playing a role in plant communication. Specifically, we have identified that some volatiles, such as (Z)-3-Hexenyl butyrate, (E)-2-hexenal and (Z)-3-hexen-1-ol, show significant variations in their emission upon wounding in the transgenic tomato plants.

sciforum-082595: Role of Salicylic Acid in the Volatilome Profile of Tomato Plants Upon *Citrus exocortis viroid* Infection

Marc Balanzá, Francisco Vázquez-Prol, Ismael Rodrigo, José María Bellés, Francisco Vera-Sirera, María Pilar López-Gresa and Purificación Lison

Universitat Politècnica de València

Despite its non-coding nature, *Citrus exocortis viroid* (CEVd) interacts with host elements within plant cells, leading to symptoms which consist of epinasty, stunting, leaf rugosity, midvein necrosis and chlorosis, and triggering the defense response to biotic stress [1]. This interaction enhances the biosynthesis of specific secondary metabolites, including salicylic acid (SA). This phenolic compound has been described to play an important role in tomato's defense against CEVd, since transgenic tomato plants accumulating lower levels of SA—through the overexpression of the bacterial salicylate hydroxylase transgene (*NahG*)—are more susceptible [1], while transgenic tomato plants accumulating higher levels of SA—through the silencing of salicylate 5-hydroxylase (*RNAi_S5H*)—have been described to be more resistant to CEVd [2].

Apart from SA, there are some secondary metabolites produced by the plant upon CEvd infection that are capable of being released into the atmosphere to play an important role in plant communication: Volatile Organic Compounds (VOCs).

In order to identify the specific VOCs associated with the tomato response to CEVd, a metabolomic analysis using gas chromatography–mass spectrometry (GC-MC) was performed from both *NahG* and *RNAi_S5H* transgenic tomato plants (*Solanum lycopersicum* 'Moneymaker') upon viroid infection. This approach will allow for an exploration of the role of SA and its correlated plant symptomatology in the volatilome profile of tomato plants upon CEVd infection.

sciforum-082585: Salinity Stress-Mediated Phenotypic, Biochemical and Microscopic Assessment of Two Flaxseed Cultivars Having Contrasting Lignan Content

Anirban Jyoti Debnath [1], Eva Ivanišová [2], Veronika Mistríková [3] and Katarína Ražná [1]

[1] Institute of Plant and Environmental Sciences, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, 949 76 Nitra, Slovakia
[2] Institute of Food Sciences, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture in Nitra, 949 76 Nitra, Slovakia
[3] Institute of Plant Genetics and Biotechnology, Plant Science and Biodiversity Centre, Slovak Academy of Sciences, 950 07 Nitra, Slovakia

On the verge of the United Nations' predicted upcoming food scarcity, research regarding plants' potentiality to withstand environmental stresses to provide better yield has immense importance. In this context, plant lignans are such substances of great potential that possess multifunctional roles towards different organisms including plants and humans. Lignans accumulate in plants and primarily act as defence substances during abiotic stresses. Flaxseed (*Linum usitatissimum* L.) is a rich source of lignans. However, the lignan contents are dependent on plant genotypes. Therefore, this report searched for the answer to the question—"under salinity stress, how much better a high lignan-containing flaxseed genotype adapt than a low lignan-containing flaxseed genotype?". Various phenotypical, biochemical and microscopic assays were applied to determine the salinity stress-responsiveness between the two chosen flaxseed genotypes, Flanders and Astella, having contrasting lignan content. Comparative phenotypic analyses for shoot length, root length, root diameter, root volume, root branches, leaf number and leaf relative water content revealed a differential morphological expression between the two genotypes under stress. ROS-related biochemical assays depicted higher quantities of total contents of antioxidants, polyphenols and phenolic acids in Flanders under stress, indicating a better ROS mitigation capability. FDA-PI staining-coupled fluorescence microscopy of stressed root visualized stress-induced cell damage, especially in the peripheral sections of the roots. However, despite salt stress-induced cell death, the root tip was alive, possibly to mitigate the harmful effect of salt stress and to search for nutrients to keep the plant alive. The results depict that flaxseed genotypes having contrasting lignan content react differently under stress. More biochemical and genomic analyses are needed to assess the actual stress-mitigating capabilities of these two genotypes.

sciforum-082651: The Cryopreservation of Dormant Buds of Raspberry (*Rubus idaeus* L.)

Olena Bobrova [1], Alois Bilavčík [2], Jiri Zamecnik [3] and Milos Faltus [3]

[1] Plant Physiology and Cryobiology Team, Crop Research Institute, Czech Republic Cryobiophysics Department, Institute for Problems of Cryobiology and Cryomedicine of the NAS of Ukraine
[2] Plant Physiology and Cryobiology Team, Crop Research Institute, Czech Republic
[3] Plant Physiology and Cryobiology Team, Crop Research Institute, Czech Republic

Cryoconservation provides the possibility of the long-term preservation of genetic resources of vegetatively propagated plants. For frost-resistant woody plants, the cryobanking of dormant buds is a cost-effective option which allows the plant to be effectively regenerated by grafting. The aim of this study was to develop a method of cryopreservation of dormant buds by pre-dehydration and two-step freezing for raspberry (*Rubus idaeus* L.), which cannot be grafted but can be regenerated in vitro. Shoots of raspberry (varieties Sanibelle and Willamette) were harvested in a dormant state in the midwinter season. Uniform cuttings of uninodal segments were dehydrated in a freezer. The low-temperature phase transitions, water state and water content were studied to determine the optimal level of dehydration of raspberry buds. The regeneration of plant material was carried out by rehydration in wet peat and regrowth in perlite. It was revealed that the melting point gradually decreased with dehydration as the concentration of solutes in the bud tissues increased. The crystallization temperature strongly decreased with increasing dehydration time, which indicated a significant increase in the tendency of water to supercool with a decrease in bud moisture. From certain level of dehydration, no crystallization was observed during the cooling phase, and the percentage of crystallized water was less than 1% during the heating phase. Dehydration to water activity below 0.9 significantly changed the dynamics of water activity decline, which correlated with the disappearance of water crystallized during the cooling phase. This water activity below 0.9, where crystallization no longer occurred in the cooling phase, only an insignificant melting peak was recorded in the heating phase, and the rate of decrease in water activity in the buds was significantly reduced, should be used for the cryopreservation of raspberry buds. This approach makes it possible to obtain up to 74% of viable raspberry buds after cryopreservation.

sciforum-080212: The Nano-Priming of *Eleusine coracana* Seeds and an Evaluation of Salinity Stress Tolerance

Vikash Kumar, Pooja Yadav, Mohini Yadav and Saurabh C. Saxena

Central University of Haryana, Mahendergarh

One of the biggest threats to agriculture worldwide is salinity, which inhibits crop growth and yield. Soil salinization directly impact the physiological and molecular processes of plants. The plants use a variety of tolerance mechanisms, including complicated physiological features, metabolic pathways, and molecular or gene networks, to battle salt stress. Genetic engineering, plant breeding, and other methods have been used to increase plant growth and productivity. Priming techniques, on the other hand, have a lot of potential as a "stress reliever" in agricultural crop production due to their economic viability and simplicity of use. Seed priming improves seed germination and seedling growth by activating several physiological and metabolic processes. Through enhanced expressions of numerous stress-related genes and proteins, priming controls molecular pathways which accelerate the stress responses and maintain cross-tolerance. Seed nano-priming has shown enhanced antioxidant activity in *Eleusine coracana* seedlings after challenging them with salinity stress. Nano-primed seedlings showed better salinity stress tolerance, as revealed by many stress markers like proline content, H_2O_2 content, chlorophyll content, etc. The use of copper oxide nanoparticles (CuONPs) via seed priming is a novel and cost-effective approach that improves seed germination and subsequent plant growth in *Eleusine coracana* by strengthening the antioxidant system and providing resistance against salinity stress.

sciforum-082507: The Use of the Duckweed *Lemna minor* to Assess the Toxicity of Oxidized Pesticides in Clay-Containing Aqueous Media

David Dewez

University of Quebec at Montreal

The environmental contamination of pesticides can lead to by-product derivatives after oxidation with specific toxicological properties. To evaluate the toxicity of pesticide derivatives, it is important to develop a standardized laboratory testing method. In this study, we investigated the toxicity of two pesticides, diazinon (DAZ) and atrazine (ATR), before and after montmorillonite-catalyzed ozonation by using the duckweed *Lemna minor* as a primary producer bioindicator. The obtained results showed that the conversion of both pesticides exceeded 94% after 30 min of ozonation with Na^{+}- and Fe^{2+}-exchanged montmorillonites. This conversion was correlated with the toxicity data on *L. minor* plants, which were indicative of the pesticide degradation. The toxicity assessment was based on toxicity biomarkers related to cell growth and the physiological state of the plant. The inhibition of plant growth was mainly caused by oxidative stress related to the pesticide degradation level, by-product derivatives' concentration, molecular structure, and chemical properties. In addition, we found that, during ozonation, pesticide adsorption and/or conversion on clay surfaces significantly reduced the toxicity of pesticide derivatives on *L. minor* plants, especially with Fe(II)-exchanged montmorillonite. These results showed a correlation between the pesticide toxicity and the catalytic activity of clay minerals, the duration of ozonation, and the chemical properties of generated derivatives. With an appropriate testing method, this study contributed to a better understanding of how the oxidative degradation of pesticides can modify their toxicity impact, depending on the generated mixture of derivatives and the properties of the host media.

sciforum-084033: Type II Metacaspase Mediates Light-Dependent Programmed Cell Death in Chlamydomonas Reinhardtii

Lou Lambert [1], Félix De Carpentier [2], Phuc André [3], Christophe Marchand [3,4] and Antoine Danon [3]

[1] Institut de Biologie Paris Seine, UMR 7238, CNRS, Sorbonne Université
[2] University of California, Berkeley, Department of Plant and Microbial Biology
[3] Institut de Biologie Paris Seine, UMR 7238, CNRS, Sorbonne Université, 75005 Paris, France
[4] Centre National de la Recherche Scientifique (CNRS), Institut de Biologie Physico-Chimique, Plateforme de Protéomique, FR550, F-75005 Paris, France

The most crucial processes that preside over the destiny of cells from any type of organism involve self-destruction. If this process is very well characterized and conceptually logical to understand in multicellular organisms like animals and plants, the levels of knowledge and comprehension of its existence are still quite enigmatic in unicellular organisms. In our lab, we use Chlamydomonas reinhardtii to lay the foundation for understanding the mechanisms of programmed cell death (PCD), in a unicellular photosynthetic organism. In a nitrosative stress context induced by S-nitrosoglutathione (GSNO), we recently showed that while PCD induces the death of a proportion of cells, it allows the survival of the remaining population. Quantitative proteomic analysis studies have aimed to unveil the proteome of PCD in chlamydomonas, allowing us to identify key proteins deregulated during PCD that have led to the discovery of essential mechanisms. We show that in Chlamydomonas, PCD relies on the light dependence of a photosynthetic organism to generate reactive oxygen species (ROS), here singlet oxygen, and induce cell death. Finally, we have obtained and characterized mutants for the two metacaspase genes present in Chlamydomonas and showed for the first time that a type II metacaspase is essential for PCD execution.

sciforum-080236: Unveiling Protein Changes in the Context of Climate Change: Revelations from a Historical Wheat Seed Collection

Iris Aloisi [1], Giovanni MAria Poggi [2], Simona Corneti [2], Stefano Del Duca [2] and Francesca Ventura [3]

[1] University of Bologna
[2] Department of Biological, Geological and Environmental Sciences, University of Bologna
[3] Department of Agricultural and Food Sciences, University of Bologna

The study of cereals' nutritional quality in relation to climate change is crucial for predicting future food security. There is a growing need for qualitative research focusing on nutritional and nutraceutical traits, alongside crop yields. Meteorological parameters, especially temperature, have a significant influence on plant phenology, which in turn affects kernel quality, including protein, sugars, fiber, and secondary metabolite content. Wheat, in particular, is highly sensitive to changes in its grain-filling stage.

While the literature extensively describes how rising temperatures impact wheat physiology and performance, comprehensive information on the effects of climate change on wheat phenology and its consequences for kernel quality remains limited. To address this gap, we conducted a case study in the Bologna plain (in the north of Italy). We analyzed daily weather data from a historical series spanning from 1952 to the present to evaluate climate change effects in the area and compared them with historical phenological data.

To explore the relationship between phenology and grain gluten quality, we examined a valuable collection of historical seeds harvested from the Bologna plain between 1951 and 1973. These seeds, stored in the Laras (Seed Research and Analysis Laboratory of the Department of Agricultural and Food Sciences, University of Bologna, Italy), were compared to modern seeds of the same cultivar currently grown in the area. This comparison highlighted the impact of the significant increase in mean annual air temperature in the area, resulting in a shortened duration required to reach major wheat phenological phases in the present period compared to the past period, ultimately affecting gluten accumulation.

In conclusion, our study provides deeper insights into the nutritional changes in wheat kernels resulting from phenological shifts, contributing to a better understanding of the implications for food security.

sciforum-085033: *Zingiber Officinale* antioxidant Activity and Immunomodulatory Effects on Human Polymorphonuclear Neutrophils

Zaynab Ouadghiri [1], Othman El Faqer [1], Hicham Wahnou [1], Elbatoul Elatlassy [1], Samira Rais [1,2] and El Mostafa Mtairag [1]

[1] Laboratory of Immunology and Biodiversity, Department of biology, Faculty of sciences Ain Chock, University Hassan II, Casablanca, Morocco

[2] Department of biology, Faculty of sciences Ben M'sik, University Hassan II, Casablanca, Morocco

Human beings are constantly exposed to microorganisms attacks, hence the development of a complex immune system. The first line of defense: innate immunity maintains protection, mainly by polymorphonuclear neutrophils (PMNs) being the first to react. However, sometimes these cells' responses are exaggerated or inappropriate, requiring their modulation. Indeed, throughout history, societies have utilized medicinal plants for their healing abilities and nowadays researchers have also marked a profound interest in the immunomodulatory effects of medicinal plants such as *Zingiber Officinale (Z. officinale)*.

In order to deepen our understanding of the biological properties of *Z. officinale*, we were specifically interested in studying the in vitro antioxidant and immunomodulatory effects of its aqueous extract (ZOAE) on PMNs.

The phytochemical composition of ZOAE was firstly investigated using colorimetric assays, and then its antioxidant effects were examined in vitro using a DPPH• radical scavenging assay, nitric oxide radical inhibition, and the total antioxidant capacity method. As for the immunomodulatory effect of ZOAE, the measurement of human PMNs degranulation was carried out, monitoring the release of lysozyme, subsequent to an extract treatment of isolated PMNs, with increasing concentrations of 250, 500, and 1500 μg/mL followed by fMLP (N formyl-methionyl-leucyl-phenylalanine) stimulation (10^{-6} M).

The phytochemical screening of ZOAE revealed the presence of different components. Nitric oxide radical inhibition did not show any significant activity, whereas this extract showed antioxidant activities by scavenging both DPPH• radical and phosphomolybdate, and inhibited PMNs degranulation significantly. in a dose-dependent manner, starting with an inhibition of lysozyme release of 28.6% and reaching 63.61%, suggesting the immunomodulatory effect of ZOAE on PMNs.

Our study showed that ZOAE has both an in vitro antioxidant activity and an immunomodulatory effect on human PMNs. Further investigations are required to develop our knowledge on ZOAE, concerning its in vivo immunomodulatory effects on human PMN and the signaling pathways involved in these effects.

Abstracts

SESSION 4. Phytochemistry, Phytoremediation, and Plants in Urban Ecosystems

sciforum-082592: Sustainable Green Synthesis of Silver Nanoparticles from *Hippophae rhamnoides* and *Viburnum opulus* Plant by-Product Extracts and Their Antimicrobial Activity and Photochemical Analysis

Vaide Sakalauskienė, Jonas Viškelis and Aiste Balciunaitiene

Lithuanian Research Centre for Agriculture and Forestry

As an alternative to conventional antimicrobial therapy, nanoparticles of metals such asAg, Au, Zn, Ti, etc., have become known. Of these, the green synthesis of silver nanoparticles (AgNPs) received considerable attention due to their strong efficiency and the high spectrum of antimicrobial activity. Green synthesis is economical, environmentally friendly, and does not require the use of high pressure, temperature, and toxic chemicals. Plant metabolites, such as terpenoids, phenols, tannins, flavonoids, terpenoids, alkaloids, and polysaccharides, have been shown to contribute to reducing Ag ion levels in AgNPs. The novelty aspect of these studies is the secondary use of by-products from the processing of fruit and berries. After the extraction and use of biologically active compounds, the remaining substance will be used as a raw material to produce organic NPs. By-product extracts of *Hippophae rhamnoides (H. rhamnoides)* and *Viburnum opulus* berries were used in this work. The aim of this study was to synthesize AgNPs using an aqueous extract of by-products of *H. rhamnoides* and *Viburnum opulus*. The morphology of the synthesized AgNPs was carried out using SEM/EDS and TEM microscopy. Antioxidant activity analysis was performed for the raw and *H. rhamnoides* /AgNPs and *Viburnum opulus*/AgNPs extracts using different methods: ABTS, DPPH•, CUPRAC, and FRAP assays. Raw and *H. rhamnoides* /AgNPs were spherical, 10–25 nm in size, with total phenolic compound (TPC) content levels of 2288,83 mg GAE/100g and 1854,97 mg GAE/100g. Raw and *Viburnum opulus*/AgNPs were spherical, ~45 nm in size, with TPC content levels of 3396,90 mg GAE/100 g and 3016,83 mg GAE/100 g. It can be concluded that AgNPs synthesised in extracts have a wide variety of biological uses, and can be used as organic substances without adverse effects.

sciforum-084072: *Artemisia herba-alba*: A Promising Approach to Combating Arthritis Progression

Hicham Wahnou [1], Martin Ndayambaje [2], Salma Benayad [2], Hicham Elattar [3] and Mounia Oudghiri [4]

[1] Laboratory of Immunology and Biodiversity, Faculty of Sciences Ain Chock, Hassan II University, B.P2693, Maarif, Casablanca, Morocco.
[2] Laboratory of Immunology and Biodiversity, Faculty of Sciences Ain Chock, Hassan II University, B.P2693, Maarif, Casablanca, Morocco
[3] Annasr Pathology Center, El Jadida 24000, Morocco
[4] Laboratory of Immunology and Biodiversity, Faculty of Sciences Ain Chock, Hassan II University, B.P2693, Maarif, Casablanca, Morocco

Arthritis, a widespread and debilitating inflammatory condition, affects millions globally and poses a significant treatment challenge, particularly in the search for interventions with minimal side effects. This study conducted a comprehensive investigation into the potential of *Artemisia herba-alba (AHA)*, a medicinal plant, in addressing arthritis progression. *(AHA)*, a plant deeply ingrained in Moroccan culinary traditions has long been utilized by locals for its anti-inflammatory, antibacterial, and analgesic properties. We explored the protective effects of *AHA* in a novel chronic arthritis model, induced by the combination of carrageenan (CGN) and incomplete Freund's adjuvant (IFA). Our findings revealed a significant reduction in arthritis progression, suggesting its potential as an anti-arthritic agent. Impressively, *AHA* exhibited no adverse effects on liver health, in contrast to indomethacin, a widely-used anti-inflammatory drug known for its hepatotoxicity. Furthermore, histological analysis of affected joints indicated the plant's ability to mitigate bone damage by reducing vascular and trabecular bone hyperplasia. It also resulted in a significant reduction in the number of osteoclasts, suggesting its potential to inhibit bone resorption and prevent further joint degradation. These findings highlight the therapeutic promise of *AHA* in managing chronic arthritis and preserving joint health. Further research is needed to explore its underlying mechanisms and clinical applications.

sciforum-084135: *Orbea variegata* (L.) Haw. (Apocynaceae) Attenuates the Progression of UV/Sulfuric Acid-Induced Skin Carcinogenesis in Swiss Albino Mice

Oumaima Chgari [1], Martin Ndayambaje [2], Hicham Wahnou [2], Fatimazahra Moukhfi [2], Ouafae Benkhnigue [3], Farida Mernissi [4] and Mounia Oudghiri [2]

[1] Laboratory of Immunology and Biodiversity, Faculty of Sciences Ain Chock, Hassan II University, B.P2693, Maarif, Casablanca, Morocco.
[2] Laboratory of Immunology and Biodiversity, Faculty of Sciences Ain Chock, Hassan II University, B.P2693, Maarif, Casablanca, Morocco
[3] Department of Botany and Plant Ecology, Scientific Institute, Mohammed V University in Rabat, Avenue Ibn Batouta, P.B. 703, Rabat-Agdal, 10106, Morocco.
[4] Pathological Laboratory, Ibn Rochd Hospital. Casablanca, Morocco

Skin cancer is the most common type of malignant tumor, and poses a substantial risk to human health. According to the World Health Organization, skin cancer ranks among the top five most common cancers worldwide. Our study aims to evaluate the curative effect of *Orbea variegata,* an ornamental plant widespread in the Mediterranean region, notably in Morocco. Recent studies have revealed that several plants have anticancer properties on human cell lines associated with acute promyelocytic leukemia, chronic myeloid leukemia, and hepatocellular carcinoma. However, in vivo evidence of the anticancer activity of *Orbea Variegata* is currently lacking. Our study characterized the hydroethanol extract of *Orbea variegata,* evaluated its antioxidant activity, and tested its curative effect on UV/sulfuric acid-induced skin carcinogenesis in immunocompetent mice. Based on the analysis, our extract was found to be abundant in phenolic compounds (29,435 mg GAE/g), flavonoids (6711 mg GAE/g), and tannins (274.037 mg EC/g). Additionally, the extract demonstrated significant antioxidant activity, as confirmed by IC_{50} values of 8.803 mg/mL and 3.160 mg/mL for FRP and TAC, respectively. The oral administration of this plant extract at doses of 1 g/kg and 2 g/kg showed a considerable reduction in induced skin hyperplasia, fibrosis, and inflammation. This positive effect was closely linked to a notable decrease in oxidative stress, as evidenced by lower levels of lipid peroxidation and the restoration of endogenous antioxidant enzyme activity. This research provides a promising avenue for exploring the mechanisms of action and signaling pathways targeted by *Orbea variegata* extract, which has potential implications for the field of dermatology.

sciforum-082801: Algae and Duckweed Offer Sustainable Solutions to Mitigate Impacts of Water and Food Insecurity

Simrat Kaur [1], Brad Reddersen [2] and TIM Loncarich [3]

[1] Climate Survival Solutions India Private Limited
[2] CEO, Climate Survival SOlutions
[3] CEO, Climate Survival SOlutions, Inc

Earth is losing massive chunks of its freshwater reserves at unimaginable scales. Additionally, the conversion of evergreen forests into monoculture farmlands, for feed crops, is eroding soil ecosystems. Therefore, two crucial natural resources, namely water and soil, are being polluted and irreversibly lost, consequently leading to worldwide food and urban water insecurities. In this regard, algae and duckweed play marvelous roles in nutrient recycling and wastewater transformations as well as in directly and indirectly supporting the food pyramid. Due to their cosmopolitan distribution, microalgae can be grown worldwide. Some of the characteristic microalgae, such as mat-forming cyanobacteria or blue-green algae are potential scavengers of inorganic nutrients, which play crucial roles in urban wastewater management. We have isolated mat-forming blue-green algae called *Oscillatoria* that showed above 90% removal rates for both nitrogen and phosphorous when grown in a synthetic wastewater medium. Other species of microalgae, such as *Desmodesmus*, *Scenedesmus*, *Ankistrodesmus* and *Botryococcus*, which are also rich sources of lipids and fatty acids, are being tested for their nutrient recovery potential from different types of wastewater. We also cultivate and conduct R&D on various species of duckweed such as *Lemna minor*, *Spirodella* sp and *Wolffia globosa* with particular focus on the latter species. The *W globosa* grown in indoors under the uncontrolled natural sunlight and temperatures achieved a growth productivity of 33 gm/m^2/day. The biomass of *W. globosa* consists of 30.09%, 41.2% and 6.25%carbohydrates, proteins and fats, respectively. Owing to its high nutritional value, we promote *W. globosa* as a nutritional alternative to soybean for livestock feed and as a protein-rich non-conventional nutrient source for humans. We have discussed the need to adopt algae and duckweed as two urgent and relevant solutions to mitigate the issues related to water and food insecurity.

sciforum-082713: Anti-Phytoviral and Cytotoxic Activity of Hydrosol and Methanolic Extract of the Species *Seseli tomentosum* Vis.

Željana Fredotović, Elma Vuko, Ema Topalović, Juraj Kamenjarin and Sanja Radman

University of Split, Faculty of Science, Croatia

Sesseli tomentosum Vis. is a species belonging to the Apiaceae family, whose members have been used in traditional medicine since ancient times due to the significant content of biologically active secondary metabolites. It is a species endemic to Croatia and Bosnia and Herzegovina, widely distributed in the coastal areas of the Dinarides. We present the first report on the chemical analysis of the volatiles of *S. tomentosum*. Headspace solid-phase microextraction (HS-SPME) followed by GC-MS analysis identified the following constituents as the most abundant in the fresh plant material: β-caryophyllene (13.58%), α-copaene (9.78%), germacrene D (6.99%), tetradecanal (6.89%), germacrene D (6.99%), δ-cadinene (5.29%) and dodecan-1-ol (4.29%). This investigation was motivated by the chemical composition of the volatiles and the complete lack of data on the biological activities of *S. tomentosum* extracts. We investigated the antiphytoviral activity of *S. tomentosum* extracts against tobacco mosaic virus (TMV) infection and its cytotoxic activity in one healthy and three cancer cell lines. Plants of *Nicotiana tabacum* L. treated with hydrosol showed a significant reduction in virus concentration (50.05%) compared to control plants. The results indicate that the hydrosol of *S. tomentosum*, as an environmentally friendly and nontoxic byproduct of water distillation, is rich in biologically active constituents with significant antiphytoviral potential. The methanolic extract of *S. tomentosum* showed a significant cytotoxic effect on osteosarcoma (U2OS) and cervical adenocarcinoma (HeLa) cell lines, with IC_{50} values of 452.305 μg/mL and 294.93 μg/mL, while it showed a weaker effect on colon cancer (HCT116) and human retinal pigment epithelial-1 (RPE1) cell lines, with IC_{50} values of 892.65 μg/mL and 772.41 μg/mL, respectively. Research on this valuable and unexplored species, its various extracts and individual biologically active compounds needs to be continued to fully explore its potential for use in the cosmetic, food and medical industries.

sciforum-079802: Antifungal Activity of Ethanol Extract of Thyme (*Thymus vulgaris*) and Almond (*Terminalia catappa*) against ATCC Strains of *Candida albicans*

Roxana Reyes Ríos [1], Brandon Gómez-Noriega [2], Giovani Martínez-Hernández [2], Aldo Franscesco Serrano-Villalobos [2], Dolores Vargas-Alvaréz [3] and Antonio Juan Cortez-Guzman [3]

[1] Universidad Autónoma de Guerrero
[2] Faculty of Natural Sciences
[3] Faculty Biological Chemical Sciences

In this investigation, the in vitro effectiveness of ethanol extracts from fresh and dried leaves of almond (*Terminalia catappa* L.) and the aerial part of thyme (*Thymus vulgaris* L.) was evaluated against ATCC strains of *Candida albicans*. (the most prevalent fungus in opportunistic fungal diseases today). The use of herbal remedies to combat this fungal infection is the objective of this study, aiming to identify potential active compounds for future drugs. Extracts of thyme and almond were used against ATCC 14053 and ATCC 24433 strains of *Candida albicans* to observe the antifungal activity of thyme and almond. A total of 20 experimental units were used, with 5 replications per treatment group. Fresh thyme extract: 125 g/500 mL. Fresh almond extracts: 10 g/90 mL, 20 g/80 mL, and 30 g/70 mL. Dried thyme extract: 125 g/500 mL. Dried almond extracts: 10 g/90 mL, 20 g/80 mL, and 30 g/70 mL. Positive control: Nystatin at a concentration of 100,000 U/mL. Negative control: 0.9% saline solution. The inhibition percentage of the 8 treatments was determined in both strains, with notable results for almond Treatment 3 (AF3) (30 g/70 mL) resulted in an 83.1% inhibition rate against the ATCC 24433 strain and 81.9% against ATCC 14053; treatment 2 (AS2) (20 g/80 mL) and treatment 3 (AS3) (30 g/70 mL) resulted in a 70.6% inhibition rate against ATCC 14053; and treatment 3 (AS3) (30 g/70 mL) yielded a 78.3% inhibition rate. On the other hand, thyme had different results. Treatment (TS) (125 g/500 mL) exhibited29.4% inhibition against ATCC 24433 and treatment (TF) (125 g/500 mL)exhibited 28.6% inhibition against ATCC 14053. Based on the results, we can assert that in the ongoing search for alternatives to treat fungal infections, plants such as almond and thyme, which exhibit antifungal activity, stand out as a natural option to combat such infections.

sciforum-079491: Antioxidant Properties of Freshly Collected Leaves of *Diplotaxis tenuifolia* (L.) DC

Sofija Kilibarda [1], Sandra Vuković [2], Đorđe Moravčević [2], Danijel D. Milinčić [2] and Aleksandar Ž. Kostić [2]

[1] Faculty of Agriculture

[2] University of Belgrade-Faculty of Agriculture

Diplotaxis tenuifolia (L.) DC, recognized by its common name of wild rocket, has a notable role within the Brassicaceae family. The leaves of this plant offer a unique flavor that enhances culinary preparations, alongside their influence on improvement in overall human well-being due to their nutrient and bioactive compound content. Wild rocket possesses a wide range of antioxidants, incorporating vitamins such as C and E, along with carotenoids, glucosinolates, and flavonoids. The objective of this study was to assess the antioxidant properties of the fresh leaves from three wild rocket hybrids: *Marte* F1, *Venere* F1, and *T&T* F1. Using an 80% acetone solution as the solvent, powdered plant material was subjected to a 3-h extraction period at a ratio of 1:10 (plant material/solvent). After the extraction process, the antioxidant properties of the extracts were assessed spectrophotometrically using four distinct assays: DPPH•, ferric reducing power (FRP), in vitro phosphomolybdenum total antioxidant capacity (TAC), and cupric reducing antioxidant capacity (CUPRAC). Phytochemical analyses disclosed a variation in the quencher assay results among hybrids, ranging from 5.42 to 6.19 μmol Trolox/g. Nevertheless, the statistical analysis indicated a lack of statistically significant differences among the hybrids within this specific quencher assay. Similarly, no statistically significant differences were found among the samples in relation to the TAC results. The *T&T* hybrid achieved the highest results in both the FRP and the CUPRAC assays (2.79 mg/g AAE and 17.73 mg/g AAE respectively). Notably, there were no statistical differences observed between the *T&T* and *Venere* hybrids. However, both the *T&T* and *Venere* hybrids exhibited statistically significant differences when compared to the *Marte* hybrid. The overall results showed variations among the chosen hybrids regarding their antioxidant properties, while indicating the potential of fertilization in the enhancement of the bioactive compound profile and biological activity.

sciforum-082803: Aromatic Profile and Phytochemical Analysis of Comprehensive Fractions in the Aromatic Extraction of Damask Rose

Nutthawut Charoimek [1,2], Ratchuporn Suksathan [3], Sasithorn Sirilun [1], Piyachat Sunanta [2,4,5], Taepin Junmahasathien [1], Sarana Rose Sommano [2,4] and [6]

[1] Department of Pharmaceutical Science, Faculty of Pharmacy, Chiang Mai University, Chiang Mai 50200, Thailand
[2] Plant Bioactive Compound Laboratory (BAC), Faculty of Agriculture, Chiang Mai University, Chiang Mai 50200, Thailand
[3] Queen Sirikit Botanic Garden, The Botanical Garden Organization, Chiang Mai 50180, Thailand
[4] Center of Excellence in Agro Bio-Circular-Green Industry (Agro BCG), Faculty of Agro-Industry, Chiang Mai University, Chiang Mai 50100, Thailand
[5] Multidisciplinary Research Institute, Chiang Mai University, Chiang Mai 50200, Thailand
[6] Department of Plant and Soil Sciences, Faculty of Agriculture, Chiang Mai University, Chiang Mai 50200, Thailand

Damask rose (*Rosa damascena* Mill.), a fragrance flower from the Rosaceae family, is renowned for its aromatic fraction, which has applications in the cosmetic and medicinal industries. Nonetheless, during the extraction process, several by-products are generally disposed to the environment. Mon Dang Prasert (MD), Mon Klai Kangwon (MK), and Bishop's Castle (BC) are the most commonly grown varieties in Thailand with commercial potential. In this work, their aromatic profiles were described via SPME-GC-MS. The rose essential oil primarily consisted of phenylethyl alcohol, with concentrations of 1.03% for MD, 1.03% for BC, and 1.31% for MK. This compound is responsible for the characteristic flowery, sweet, rosy, and bready fragrance. Following this is furfural, a compound known for its unique sensory profile, featuring a fresh, fragrant, and almond fragrance. Followed by the conventional extraction process, three different fractions of by-products were produced, namely distilled water (D), hydrosol (H), and rose dreg (R). Subsequently, the antioxidant properties of these by-products were evaluated. The H fraction exhibited the highest total phenolic content with values of 10.08, 10.28, and 8.14 mg GAE/g dried sample for MD, MK, and BC samples, respectively. The results were consistent, with the total flavonoid content also being highest in the H fraction. The H and R fractions demonstrated positive antioxidant activity, as indicated by the results obtained in the DPPH, ABTS, and FRAB assays. An anti-microbial assay of these fractions against *Staphylococcus aureus, Propionibacterium acnes, S. epidermidis, Pseudomonas aeruginosa, Escherichia coli,* and *Candida albicans* illustrated no positive activity in any of the fractions. Consequently, MK flower provided the strongest intensity of floral fragrance. The antioxidant capacity of the by-product indicated that the H fraction contained significant advantages for antioxidants, rendering it suitable for the utilization of intermediate material in the production of cosmetic and medicinal products.

sciforum-082776: Assessment of the Antimicrobial, Antioxidant Activities and Total Phenolic Contents of Crude Extracts from *Senna italica,* Sudan

Ahmed Ali Mustafa [1], Haifa A.A Omer [2] and Sakina Yagi [3]

[1] Department of Botany and Microbiology, Faculty of Science, University of Gezira
[2] Department of Botany, Faculty of Science, Sudan University of Science and Technology
[3] Department of Botany, Faculty of Science, Khartoum University

The objective of the present study was to the assessment of the antimicrobial and antioxidant activities of *Senna italica*, from n-hexane, chloroform, ethyl acetate and methanol extracts. In addition, the total polyphenolic, flavonoids and tannins contents of these extracts were determined. were screened for their antimicrobial activity by cup diffusion assay against four standard strains bacteria, two Gram-positive (*Bacillus subtilis* and *Staphylococcus aureus*), two Gram-negative bacterial strains (*Escherichia coli* and *Pseudomonas aeruginosa*) and two fungal strains (*Aspergillus niger* and *Candida albicans*). Antioxidant activity when screened using 2,2-Di(4-tert-octylphenyl)-1-picryl-hydrazyl stable free radical (DPPH). Total polyphenolic, flavonoids and tannins contents were determined by spectrophotometric assays. Generally, the results of antimicrobial activity showed that extracts of the plant exhibited better antifungal activity than antibacterial. The highest antifungal activity against *A.niger* and *Candida albicans*, was recorded from the methanolic extract of *Senna italica*, (inhibition zone (IZ) = 22 ± 1.4 and 20± 1.1 mm respectively), flowed by ethyl acetate extract against *C. albicans*, (IZ = 14 ± 0.2 mm). While the highest antibacteria activity of the methanolic extract against E.coli., gave the best activity (IZ = 13 ± 0.4mm), flowed by methanol and ethyl acetate extracts against Pseudomonas aeruginosa., and Bacillus sabtilis (IZ = 12 ± 0.3 mm) from the disc diffusion method. The highest scavenging radical activity was obtained from the methanol extract gave (24%).Quantitative analysis revealed total polyphenolic the highest value shown in ethyl acetate (188.6 mg gallic acid equivalent (GAE)/g), flowed methanol extract (70.6 ± 0.04 mgGAE)/g). The total flavonoids content was highest value recorded from the chloroform extract (356.66 ± 0.43 mg quercetin equivalent/g), flowed by methanolic extract (269.33 mg quercetin equivalent/g). While the total tannins content was highest value found in methanol extract (38 ± 0.03 mg tannic acid equivalents/g).

sciforum-084156: Assessment of the Antimicrobial, Antioxidant Activities and Total Phenolic Contents of Crude Extracts from *Senna italica.,* Sudan

Ahmed Ali Mustafa [1], Haifa A.A Omer [2] and Sakina Yagi [3]

[1] Department of Botany, Faculty of Science, University of Gezira, Sudan
[2] Department of Botany, Faculty of Science, Sudan University of Science and Technology
[3] Department of Botany, Faculty of Science, Khartoum University

The objective of the present study was to the assessment of the antimicrobial and antioxidant activities of *Senna italica.,* from n-hexane, chloroform, ethyl acetate and methanol extracts. In addition, the total polyphenolic, flavonoids and tannins contents of these extracts were determined. were screened for their antimicrobial activity by cup diffusion assay against four standard strains bacteria, two Gram-positive (*Bacillus subtilis* and *Staphylococcus aureus*), two Gram-negative bacterial strains (*Escherichia coli* and *Pseudomonas aeruginosa*) and two fungal strains (*Aspergillus niger* and *Candida albicans*). Antioxidant activity when screened using 2,2-Di(4-tert-octylphenyl)-1-picryl-hydrazyl stable free radical (DPPH). Total polyphenolic, flavonoids and tannins contents were determined by spectrophotometric assays. Generally, the results of antimicrobial activity showed that extracts of the plant exhibited better antifungal activity than antibacterial. The highest antifungal activity against *A.niger* and *Candida albicans.,* was recorded from the methanolic extract of *Senna italica.,* (inhibition zone (IZ) = 22 ± 1.4 and 20 ± 1.1 mm respectively), flowed by ethyl acetate extract against *C.albicans.,* (IZ = 14 ± 0.2 mm).While the highest antibacteria activity of the methanolic extract against *E.coli.,* gave the best activity (IZ = 13 ± 0.4 mm), flowed by methanol and ethyl acetate extracts against *Pseudomonas aeruginosa.,* and *Bacillus sabtilis* (IZ = 12 ± 0.3 mm) from the disc diffusion method. The highest scavenging radical activity was obtained from the methanol extract gave (24%).Quantitative analysis revealed total polyphenolic the highest value shown in ethyl acetate (188.6mg gallic acid equivalent (GAE)/g), flowed methanol extract (70.6 ± 0.04 mgGAE)/g). The total flavonoids content was highest value recorded from the chloroform extract (356.66 ± 0.43 mg quercetin equivalent/g), flowed by methanolic extract (269.33 mg quercetin equivalent/g). While the total tannins content was highest value found in methanol extract (38 ± 0.03 mg tannic acid equivalents/g).

sciforum-081088: Biennial Plant Cirsium Vulgare Savi Ten. Comparison of Chemical Composition and Antioxidant Activity during Two Years Grow

Urtė Griškevičienė [1], Mindaugas Marksa [1], Rimanta Vainorienė [2] and Liudas Ivanauskas [1]

[1] Department of Analytical and Toxicological Chemistry, Lithuanian University of Health Sciences, 13 Sukilėliai Avenue, 50161 Kaunas, Lithuania

[2] Vilnius University Šiauliai Academy Botanical Garden, 4 Pataičiai Street, 77175 Šiauliai, Lithuania

Cirsium vulgare is a bennial plant from a family of Asteraceae. Scientists studied other species of the *Cirsium* found that these plants accumulate large amounts of phenolic compounds and amino acids. Essencial amino acids are importart for all life forms, it is also known, that phenolic compounds often have particularly good antioxidant properties, so it was important to investigate this as well. The main goal of our research was to investigate how chemical composition of the plant and antioxidant activity differs in different phenological stages of the plant throw the year.

The HPLC method was used for the determination of phenolic compounds in the ethanolic extracts of the first and second year raw material. Quantitative determination of amino acids was performed using the GC-MS method using derivatization with MTBSTFA. The antioxidant effect was determined using CUPRAC method.

After carrying out a two-year quantitative determination of the active compounds from ethanolic extracts of *Cirsium vulgare* leaves, flowers and roots, it was found that the highest yields were detected of chlorogenic acid and apigenin-7-*O*-glucoside. The highest yields of chlorogenic acid were found in extracts made from the leaves. In the raw material of the first year, higher yields were determined of chlorogenic acids during the mass flowering, in the second year—phenological stage—the end of plant rest. The yield of apigenin-7-*O*-glucoside was found to be the highest in extracts of the leaves than other parts of the plant. Quantitative composition of amino acids in the flowers of the plant had the highest diversity and the highest yields of amino acids, compared to the extracts made from other parts. During the antioxidant test, it was found that the raw material, which was collected at the dormant period, had an exceptionally higher antioxidant activity.

sciforum-084084: Bioprospection of the *Artemisia* Genus: Phytochemical Profile and Antioxidant Activity of Five *Artemisia* spp. from the Lessini Mountains

Fabio Pietrolucci [1,2], Stefano Negri [1,2], Mauro Commisso [1,2], Carolina Ramos [1], Sebastiano Andreatta [3], Linda Avesani [1,2] and Flavia Guzzo [1,2]

[1] Department of Biotechnology, University of Verona, 37134 Verona, Italy
[2] National Biodiversity Future Center (NBFC), 90133 Palermo, Italy
[3] Museo di Storia Naturale, Comune di Verona, 37126 Verona, Italy

The *Artemisia* genus, belonging to the Asteraceae family, is known for its wide distribution throughout temperate regions of the northern hemisphere and extensive use in traditional medicine. Plants from the *Artemisia* genus contain a huge and varied amount of secondary metabolites, which contribute to a broad spectrum of bioactivities, i.e., anti-inflammatory, antimicrobial, and antiparasitic properties. One of the most significant uses of *Artemisia* species is in the treatment of malaria, where the compound artemisinin, isolated from *A. annua* leaves in 1972, has emerged as the most potent antimalarial drug. Nowadays, the discovery of new plant-derived products to be used as food supplements or drugs has been pushed by the exploitation of bioprospection approaches, even including the modern -omics techniques and targeted bioactivity assays.

In this work, we selected and sampled five *Artemisia* species (*A. absinthium* L., *A. alba* Turra, *A. annua* L., *A. verlotiorum* Lamotte and *A. vulgaris* L.), with ascribed medicinal properties, growing wild in the natural areas of the Verona province (Italy). The phytochemical profiles of the five species were characterized through the application of an UPLC-HRMS based on an untargeted metabolomics approach and, in order to identify potential bioactive metabolites, we correlated their composition to the in vitro antioxidant activity data (FRAP and DPPH). In parallel, the occurrence of the leading drug compound artemisinin was investigated in the five *Artemisia* species. Here, we report for the first time the detection of sesquiterpenoids from the artemisinin biosynthesis pathway in the species *A. alba*. In addition, *Artemisia* spp. were used to generate cell cultures lines. The corresponding phytochemical profiles were characterized by UPLC-HRMS and compared with those of the original plants. *Artemisia* spp. cell cultures showed a simplified but still interesting specialized metabolome, probably resulting from cellular dedifferentiation processes.

sciforum-084565: Essential Oils of Different Populations of *Baccharis halimifolia* L. from USA

Rubén Abad-Calderón [1], Mikhail Belichenko [2], Adrián Lázaro-Lobo [3] and Jesús Palá Paúl [4]

[1] Dpto. de Química en Ciencias Farmacéuticas. Unidad Docente de Edafología., Facultad de Farmacia, Universidad Complutense de Madrid, 28040-Madrid, Spain.
[2] Dpto. Biodiversidad Ecología y Evolución, Facultad de Ciencias Biológicas, Universidad Complutense de Madrid, 28040-Madrid, Spain
[3] Biodiversity Research Institute (IMIB), CSIC-University of Oviedo-Principality of Asturias, Mieres, Spain
[4] Dpto. Biodiversidad, Ecología y Evolución

Baccharis halimifolia L. is a bush species belonging to the *Asteraceae* family. It is native to the Southeastern region of North America. It is a heliophilic, dioecious plant with capitula inflorescencescontaining numerous whitish flowers that blooms from August to November. It has a high seed production rate, with a single adult plant capable of reaching 1.5 million seeds per year. It also draws attention due to its great capacity for regrowth, through root shoots, which allows it to quickly reestablish itself after a fire. The essential oils from three populations along a latitudinal gradient from Louisiana and Mississippi states were extracted by hydro-distillation in a steam current with cohobation and analyzed using gas chromatography (GC) and gas chromatography—mass spectrometry (GC/MS). Five individuals were sampled in each population. The yield of the analyzed samples, based on dry weight, ranged from 0.4% to 1.1%. The observed differences among the three populations appear to show a positive correlation with soil pH. Regarding the chemical composition, a total of 60 compounds have been identified, representing between 74.8% and 89.4% of the total analyzed oils. The major compounds were β-pinene (5.5–21.9%), caryophyllene oxide (5–11.2%), and δ-cadinene (5.5–10.2%). Variations in sesquiterpenes were evident, displaying an apparent correlation with the geographic location of the studied populations.

sciforum-084226: Evaluation of Inhibitory Effect of *Clitorea ternatia* Flower Extract on the Growth of Keratinophilic Fungi Isolated from Siliguri, West Bengal, India Using Foldscope as a Research Tool

Neha Mathur [1,2], Rohit Joshi [3], Manish Mathur [4] and Chandragiri Siva Sai [2]

[1] Associate Professor
[2] Amity Institute of Pharmacy, Amity University Lucknow Campus, Near Malhaur Railway Station, Gomti Nagar Extension, Lucknow 226028, Uttar Pradesh, India
[3] Project fellow, Amity Institute of Pharmacy, Amity University Uttar Pradesh Lucknow Campus.
[4] Dept. of Academic Affairs, Amity University Uttar Pradesh, Lucknow campus 226028

Objectives: This study aimed to evaluate the inhibitory effect of *Clitorea ternatia* flower extract on the growth of Keratinophilic fungi isolated from Siliguri, West Bengal, India, using Foldscope as a research tool. **Methods:** A genus of fungi known as keratinophilic fungi is important to the environment because they can break down keratin protein. These keratinophilic fungi can also cause cutaneous infections (dermatophytosis) of keratinized tissues in humans and animals. Siliguri, situated in the northern part of west Bengal, has a latitude and longitude of 26°42′36″ N and 88°25′48″ E, respectively, and its tropical climate geographic diversity make it an area of interest. Six samples from various sites in Siliguri were collected using Foldscope, an incredibly affordable paper microscope modeled using origami, wherein some species of keratinophilic fungi were identified. **Results:** *Clitorea ternatia* flower extract was prepared and assayed for the antifungal bioassay. There was a significant reduction in the weight of fungal mycelium and the diameter of the fungal colony. **Conclusions:** It was concluded that *Clitorea ternatia* flowers can inhibit the growth of keratinophilic fungi responsible for many skin infections, and, as such, they can be a significant tool used within therapeutic intervention for dermatophytic fungus-related superficial skin disorders.

sciforum-080131: Evaluation of the Biocidal Effect of Some Plant Extracts against *Pseudomonas aeruginosa* and Selected Microorganisms Promoting Plant Growth (PGPM)

Weronika Kursa [1], Agnieszka Jamiołkowska [1], Mariolina Gullì [2], Marina Caldara [2], Ada Ricci [2] and Francesca Degola [2]

[1] Department of Plant Protection, Faculty of Horticulture and Landscape Architecture, University of Life Sciences in Lublin, 7 St. Leszczyńskiego Street, 20-069 Lublin, Poland

[2] Department of Chemistry, Life Sciences and Environmental Sustainability, University of Parma, Parco delle Scienze 11/A, 43124 Parma, Italy

In agricultural practice, there is a need to disseminate new solutions in plant protection, while maintaining production results, and preferably with their improvement. Moreover, reducing the use of chemicals is a process that will require an increasingly well-thought-out selection of preparations. The aim of the study was to assess the effect of alcoholic plant extracts: from hemp (H) and a mixture of extracts from sage, hemp and tansy (M) in concentrations: 0.5%, 1%, 5%, 10% and 20% on the growth of *Pseudomonas aeruginosa* and selected microorganisms promoting plant growth (PGPM), mainly bacteria: *Azotobacter chroococcum* (LS132), *Azotobacter vinelandii* (DSM2289), *Bacillus amyloliquefaciens* (LMG 9814), *Bacillus* sp. (BV84), *Burkholderia ambifaria* (MCI7), *Pseudomonas fluorescens* (DR54), *Pseudomonas granadensis* (A23/T3c), *Rahnella aquatilis* (BB23/T4d), *Rhodococcus kyotonensis* (DSM45159) and actinomycete *Komagataella pas*toris (PP59). The control combinations used an antibiotic for *P. aeruginosa*—kanamycin, and for PGPM—G418 disulfate salt (5mg/mL). The antimicrobial activity of the extracts was determined by the disc diffusion method. The antimicrobial efficacy of the extracts was calculated using Abbott's formula. 20% hemp extracts were more effective in inhibiting the growth of *P. aeruginosa* (50% growth inhibition vs. control), *B. amyloliquefaciens* (20% growth inhibition vs. control), *B. ambifaria* (73.9% growth inhibition vs. control). The remaining microorganizyms did not show reaction to the tested concentrations of hemp extracts. The mixture of plant extracts was most effective at a concentration of 20% and inhibited the growth of *P. aeruginosa* the most (25% growth inhibition vs. control), but did not inhibit the growth of the tested microorganisms promoting plant growth. The selective action of the tested plant extracts confirms their biocidal potential and wide range of applications in plant protection. Data were analyzed using analysis of variance (Duncan's test) at a significance level of $p \leq 0.05$ using the Statistica 12.6 program (StatSoft Polska, Kraków, Poland).

sciforum-084172: GC–MS Profiling, Assessment of Antioxidant and Anti-Bacterial Activity of the Essential Oil of *Cestrum nocturnum*, and Formulation and Evaluation of Herbal Toothpaste

Nishtha Paul [1] and Narayan Singh [2]

[1] Chandigarh University, Gharuan, Mohali, Punjab

[2] Department of Botany, Sai School of Biosciences, Sri Sai University, Palampur, Himachal Pradesh, India-176081

The main objective of this research was to extract essential oil (EO) from a plant named *Cestrum nocturnum* and to analyze its various properties from a medicinal point of view. Gas Chromatography–Mass Spectrometry (GC–MS) profiling of oil revealed the presence of 18 components amongst which Diethylphthalate (31.88%), α-terpineol (31.52%), benzylacetate (11.61%), γ-terpineol (9.78%), and linalool (2.63%) made up the bulk of the composition. The 1,1-diphenyl-2-picrylhydrazyl (DPPH) technique (ascorbic acid as positive control) was used to assess the samples' potential as antioxidants by inhibiting free radicals. The IC_{50} value of *C. nocturnum's* oil was assessed to be 15.78 ± 0.510 µL/mL. The EO at various concentrations (6.25 µL/mL–100 µL/mL) was further evaluated for its anti-bacterial activity against the bacterial strains of *Clostridium botulinum*, *Klebsiella pneumoniae*, *Proteus mirabilis*, and *Shigella flexneri*. The oil exhibited maximum growth inhibition against *C. botulinum* (zone of inhibition (ZOI) = 38.1 ± 0.15 mm) followed by *K. pneumoniae* (33.9 ± 0.25 mm), *S. flexneri* (30.8 ± 0.2 mm), and *P. mirabilis* (24.3 ± 0.5 mm). As the oil has a significant antibacterial property, it was used to prepare a formulation of herbal toothpaste for maintaining oral hygiene and preventing tooth decay. Different aspects of the formulated herbal toothpaste, such as homogeneity, spreadability, foaming power, stability, pH, moisture, volatile matter, and others, were evaluated and found to be similar to the commercial toothpaste available on the market. Herbal toothpaste was checked for its antibacterial activity against tooth-decaying bacteria, i.e., *Porphyromonas gingivalis.* The formulation showed a considerable inhibitory effect with a ZOI = 40.05 ± 0.12 mm at a MIC of 25 µg/mL, which was higher than the commercial dabur toothpaste (ZOI 34 ± 0.17 mm at a MIC of 25 µg/mL) as well as amoxicillin (positive control; 38 ± 0.20 mm). Therefore, our study suggested that the herbal formulation from the *C. nocturnum* oil can be commercialized as a toothpaste to prevent gingivitis.

sciforum-084155: Impact of Heavy Metal Contamination on *Taxiphyllum Barbieri*: A Comprehensive Study of Physiological and Biochemical Responses

Zaira Khalid and Bhaskar Singh

Central University of Jharkhand

Contamination of aquatic environments by heavy metals (HMs) poses a significant concern due to their potential toxicity and persistent accumulation in aquatic ecosystems. Various aquatic bryophytes have proven effective as bioindicators due to their ability to accumulate substantial amounts of contaminants in water. Despite this, the phytoremediation potential of Hypnales aquatic mosses remains insufficiently explored, especially when compared to their macrophyte counterparts. Investigating the remediation capabilities of these mosses could unveil a valuable and sustainable approach to addressing HM contamination in aquatic environments. This paper presents a comprehensive investigation involving the replication of elevated HM conditions to explore the physiological and biochemical effects of HM contamination on *Taxiphyllum barbieri*. A thorough review of the available literature was conducted to identify the maximum concentrations of HM discharged in effluents by various industries. The moss was exposed to the HMs (Fe-25 mg/L, Cu-6.5 mg/L, Zn-56 mg/L, Ni-6.5 mg/L, Cd-6.5 mg/L, Cr-4.9 mg/L) for a period of three months. To assess the impact, comparative analyses were conducted between moss samples exposed to HMs and those without exposure. The moss' responses were analyzed with respect to total chlorophyll, carotenoid, protein, carbohydrate, proline, superoxide dismutase (SOD), malondialdehyde (MDA), and catalase (CAT). This study reveals that *Taxiphyllum barbieri* exhibits a high tolerance towards HMs. Notably, the moss demonstrated a high tolerance to 4.5 mg/L of copper compared with other metals and the control sample without HM. This enhanced tolerance resulted in enhanced growth, increased pigment levels, and elevated protein content. These findings underscore the phytoremediation potential of Hypnales aquatic mosses, suggesting a promising and sustainable approach for mitigating HM contamination in aquatic environments, with broader implications for environmental conservation.

sciforum-084995: In Vitro and In Silico Evaluation of the Immunomodulatory Effects of *Laurus nobilis* L. Essential Oil and Eucalyptol on Polymorphonuclear Neutrophils

Othman EL FAQER [1], Zaynab OUADGHIRI [1], Abdelmoiz EL FAQER [2], Hicham WAHNOU [1], Samira RAIS [1,3] and El Mostafa MTAIRAG [1]

[1] Immunology and Biodiversity Laboratory, Faculty of Sciences Ain Chock, Hassan II University
[2] Team of Microbiology and Molecular Biology, Plant and Microbial Biotechnology, Biodiversity and Environment Research Center, Faculty of Sciences, Mohammed V University
[3] Department of Biology, Faculty of Science Ben M'Sick, Hassan II University

The exaggerated activation of Polymorphonuclear neutrophils (PMNs) can lead to a harmful cycle of persistent inflammation. This study aims to investigate the in vitro and in silico immunomodulatory effects of *Laurus nobilis* essential oil (LEO) and its main compound, eucalyptol, on PMNs functions involved in inflammatory processes. The immunomodulation effects of LEO and eucalyptol have been studied on both fMLP-PMNs-stimulated degranulation and oxidative burst, in addition to their antioxidant, anti-hemolytic and antiplatelet aggregation activities. We also performed an in silico analysis for LEO and eucalyptol to evaluate their potential inhibitory pathways. Firstly, we showed that LEO and eucalyptol have immunomodulatory activities on PMNs functions. Thus, LEO and eucalyptol inhibit, in a dose-dependent manner, fMLP-induced degranulation of PMNs with maximal percentages of inhibition of 50.44% and 74.69%, respectively, and in the same way, reduce oxidative burst with maximal percentages of inhibition of 61.07% and 51.29%, respectively (p *0.001*). Secondly, in silico docking of LEO studies showed that its selected major compounds (eucalyptol, α-terpinyl acetate, and β-phellandrene) have an energy change ranging between –4.2 and –7.4 kcal/mol on NADPH oxidase, its subunits, and PKC. In addition, LEO and eucalyptol were found to possess significant antioxidant activity with various IC_{50} and protective capabilities against H_2O_2-induced hemolysis in erythrocytes (p *0.001*), and also inhibited collagen-induced platelet aggregation. The collective findings of this research shed light on the immunomodulatory effects on PMNs functions by LEO and eucalyptol that provide new insights for studying the mechanism pathways of *Laurus nobilis* L., particularly in the modulation of innate immunity and inflammatory responses

sciforum-079477: Invasive Plants as a Source of Biologically Active Lipids

Maris Klavins [1], Oskars Purmalis [2], Laura Klavina [2] and Linda Dobkevica [3]

[1] University of Latvia
[2] assistant professor
[3] researcher

Invasive plants can be considered a major threat to the biodiversity and provision of ecosystem services worldwide, and thus their eradication and control are an important tasks in many countries and even globally. Still, the knowledge of many invasive species is limited and thus the efficiency of control activities often has limited resultativity. Thus, to develop knowledge-based solutions of invasive plant eradication and control strategies, it is essential to gain knowledge of their composition as well as methods of their safe biomass utilisation, at the same time promoting the use of valuable biomass components. In this study, the biochemical composition of widely distributed invasive plants including Canadian goldenrod (Solidago canadensis), Sosnowsky's hogweed (*Heracleum sosnowskyi*), Himalayan balsam (*Impatiens glandulifera*), Japanese knotweed (*Fallopia japonica)* and other knotweed species were studied. Using extraction with subsequent gas/liquid chromatography–mass spectrometry the substances present in these plants have been studied. As groups of substances with allelopathic activity, possibly affecting the invasiveness of studied plants, polyphenolics, lipids, and essential oils have been identified and their concentrations in different parts of studied plants have been compared. Amongst lipids, these have also included unsaturated fatty acids, phytol, unsaturated alkanes (n = 18–26) and others. Several parts of the invasive plants studied, for example, the rhizomes of Japanese knotweed, have high concentrations of polyphenolics (resveratrol, emodin, and others), with application potential. Thus, the eradication of invasive plants can be combined with the use of their biomass to achieve plant control aims.

Acknowledgement of project Nr. lzp-2022/1-0103.

sciforum-084202: Phylogenetic-Guided Bioprospection of the Italian Flora: From the Exploitation of Bioactive Phytochemicals to the Study of Chemo-Evolutionary Dynamics

Stefano Negri [1,2], Mauro Commisso [1,2], Leonardo Bisson [1,2], Gianluca Zorzi [1,2], Fabio Pietrolucci [1,2], Valentina Dusi [1,2], Carolina Ramos [1], Fabio Pinzauti [1], Sebastiano Nigris [3,4], Barbara Baldan [3,4], Sebastiano Andreatta [5], Daniele Zanini [6], Roberto Fiorentin [7], Maria Carmela Caria [2,8], Alfredo Maccioni [2,8], Emmanuele Farris [8], Simonetta Bagella [2,8], Francesco Sgadari [9], Rosario Schicchi [9], Anna Geraci [9], Alfredo Carratello [9], Emanuela Martino [2,10], Nicola Maria Giuseppe Ardenghi [10,11], Francesco Bracco [10,11], Valeria Cavalloro [2,10], Alice Fossati [2,10], Linda Avesani [1,2] and Flavia Guzzo [1,2]

[1] Università di Verona
[2] National Biodiversity Future Center
[3] Università di Padova
[4] Orto Botanico di Padova
[5] Museo Civico di Storia Naturale di Verona
[6] Orto Botanico del Monte Baldo
[7] Veneto Agricoltura
[8] Università di Sassari
[9] Università di Palermo
[10] Università di Pavia
[11] Orto Botanico di Pavia

During their history, plants have evolved various physiological adaptations and a vast arsenal of biomolecules to thrive in diverse environments and coexist with other living organisms. The extensive diversity in terms of structures, functions, and bioactivities found within the specialized metabolisms of plants represents a powerful asset for bioprospection-based drug discovery approaches. At the same time, it poses a significant challenge in understanding the chemo-evolutionary dynamics of plant biodiversity, intended as the intricate relationships between the distribution and synthesis of plant metabolites and the evolutive diversification of the various taxa of land plants. In the frame of the National Biodiversity Future Center, dedicated to the monitoring, conservation, restoration and valorization of biodiversity, we set up a wide bioprospection plan including about 700 plant species representing all the vascular and non-vascular Italian flora. To cover the extensive phytochemical diversity expressed within it, species from all the Italian botanical families were selected on a phylogenetic basis, maintaining the original proportions among the various families (e.g., for the Angiosperms, in order: Asteraceae, Poaceae, Fabaceae, Rosaceae, etc.). Following their characterization through UPLC-HRMS, the species with the most interesting phytochemical profiles entered a downstream bioactivity screening program focused on non-communicable diseases and crop protection. This screening aims to identify specific phytochemicals or phytocomplexes that could be exploited to produce drugs, nutraceuticals, cosmetics and products for more sustainable agricultural practices. Moreover, the comparison of all the plant species through untargeted metabolomics will also be performed to chart the specialized metabolisms through all the families of Italian flora in order to gain greater knowledge of the relationships of their occurrence and biosynthesis with the evolution of land plants.

sciforum-083365: Phytoprofiling of *Achillea millefolium* Morphotypes

Lina Raudone [1], Gabriele Vilkickyte [2,3], Mindaugas Marksa [3] and Jolita Radusiene [4]

[1] Lithuanian University of Health Sciences
[2] Institute of Pharmaceutical Technologies of the Faculty of Pharmacy of Lithuanian University of Health Sciences, Sukilėlų av. 13, LT-50162 Kaunas, Lithuania
[3] Department of Analytical and Toxicological Chemistry, Faculty of Pharmacy, Medical Academy, Lithuanian University of Health Sciences, 13 Sukilėlių av. 50162 Kaunas, Lithuania
[4] Laboratory of Economic Botany, Nature Research Centre, Akademijos Str. 2, 08412 Vilnius, Lithuania

Achillea millefolium, commonly known as yarrow, is a versatile and widely distributed plant species known for its therapeutic and pharmacological potential. Two prominent morphotypes, distinguished by their distinct pink and white inflorescences in Lithuanian natural habitats, were selected for an in-depth phytoprofiling study. This investigation aimed to characterize and compare the phenolic and triterpenic profiles of these morphotypes in different plant parts (inflorescences, leaves, and stems) through high-performance liquid chromatography (HPLC) analysis. Our findings revealed that the caffeoylquinic acid complex predominated in the phenolic profiles of both pink and white morphotypes of *Achillea millefolium.* However, significant variations in the concentrations of phenolic compounds were observed between the morphotypes and plant parts. These variations highlight the plant's dynamic and adaptive nature in response to its local environment. Furthermore, the triterpenic profile analysis revealed several biologically active compounds, with the predominance of betulinic acid derivatives in all plant parts tested. These triterpenic compounds exhibited variability in their concentrations within the tested samples, with potential implications for the medicinal properties of *Achillea millefolium*. This study provides valuable insights into the phytochemical diversity of *Achillea millefolium* morphotypes in Lithuanian natural habitats, elucidating perspectives for further investigations into this versatile plant's ecological, medicinal, and pharmaceutical potential. It highlights the importance of conserving and understanding the phytochemical variations in *Achillea millefolium*, revealing dynamic chemophenetic interplay.

sciforum-084074: Rwanda-Native *Tetradenia riparia* (Hochst.) Codd: Phytochemical Profile, Antioxidant Toxicity, and Anti-Inflammatory and Immunomodulatory Effects

Martin Ndayambajea [1], Aimable Nsanzurwimob [2], Oumaima Chgari [3], Pacifique Ndishimye [4], Farida Mernissi [5], Mehdi Karkouri [5], Younes Zaid [6], Abdallah Naya [3] and Mounia Oudghiri [7]

[1] Laboratory of Immunology and Biodiversity, Faculty of Sciences Ain Chock, Hassan II University, B.P2693, Maarif, Casablanca, Morocco.
[2] Department of Biotechnologies, Faculty of Applied Sciences, INES-Ruhengeri, B.P.155 Ruhengeri, Rwanda
[3] Laboratory of Immunology and Biodiversity, Faculty of Sciences Ain Chock, Hassan II University, B.P2693, Maarif, Casablanca, Morocco.
[4] Department of Microbiology and Immunology, Faculty of Medicine, Canadian Centre for Vaccinology CCfV, DalhousieUniversity, Halifax, NS, Canada, and Rwanda Biomedical Center (RBC), Kigali, Rwanda.
[5] Pathological Laboratory, Ibn Rochd Hospital. Casablanca, Morocco
[6] Botany Laboratory, Department of Biology, Faculty of Sciences, Mohammed V University in Rabat, Rabat, Morocco.
[7] Laboratory of Immunology and Biodiversity, Faculty of Sciences Ain Chock, Hassan II University, B.P2693, Maarif, Casablanca, Morocco

Tetradenia riparia is a Rwanda-native plant used in traditional medicine. The crude extracts have multiple in vitro effects, but studies on their in vivo effects are limited. Therefore, this work aimed to explore the toxicity, anti-inflammatory, and humoral immune response effects of a hydroalcoholic extract of *T. riparia* in vivo. The phytochemical characterization indicated 17.67 mg GAE/GW for polyphenols and 7.87 mg QE/GW for flavonoids. The oral administrations of various doses (0.25–5 g/kg/w) of the extract to Wistar rats in single doses for the acute toxicity studies, or daily for 28 days for sub-acute toxicity showed no toxicity. The hematological and biochemical parameters showed an increase in the number of white blood cells, lymphocytes, and basophils and a decrease in urea and creatinine values compared to controls. The histological analysis showed no significant structural damage in the spleen, liver, and kidney. LD50 was >5 g/kg/w. The extract suppressed the carrageenan-induced paw edema swelling with a reduction of white blood cells and inhibition of NO in the air pouch animal model, and it did not substantially affect the humoral response for all concentrations tested. An antioxidant activity was observed using the DPPH, FRAP, and Phosphomolybdate methods. Finally, computational findings underscore the strong binding affinity between luteolin and stigma sterol to TNF-α, which is implicated in inflammatory processes. In conclusion, the hydroalcoholic extract has shown no toxicity with antioxidant or anti-inflammatory activities and the activation of cellular immune responses.

sciforum-083950: The Effect of Substrate and Nutrients on the Quality of Essential Oils of *Lavandula angustifolia* Mill. cv 'Sevtopolis'

Gabriela-Alina Ștefan [1], Anca Miron [2], Ana Clara Aprotosoaie [2], Mihai Brebu [3], Lăcrămioara Ivănescu [4], Maria-Magdalena Zamfirache [4], Irina Boz [1,5] and Lucian-Dragoș Gorgan [4]

[1] "Stefan cel Mare" University of Suceava, Faculty of Medicine and Biological Sciences, Suceava, Romania
[2] "Grigore T. Popa" University of Medicine and Pharmacy Iasi, Faculty of Pharmacy, Iasi, Romania
[3] Petru Poni Institute of Macromolecular Chemistry, Physical Chemistry of Polymers Laboratory, Iasi, Romania
[4] "Alexandru Ioan Cuza" University of Iaşi, Faculty of Biology, Iasi, Romania
[5] NIRDBS/Institute of Biological Research, Department of Experimental and Applied Biology, Iasi, Romania

Plants of the *Lavandula* species are highly valued aromatic plants renowned for their distinct fragrance and therapeutic properties attributed to specific elements within the essential oil.

The quality of lavender essential oils is primarily affected by the oil's unique aroma, which is defined by particular monoterpenes. This study's objective is to examine, by way of comparison, the chemical composition of the essential oils produced by the *L. angustifolia* 'Sevtopolis' cultivar in order to draw attention to the variations that have been detected.

The experiment was carried out in both a protected (greenhouse) and unprotected (field) space. To achieve the objectives proposed in this experiment, plants of the species *Lavandula angustifolia* Mill cv. 'Sevtopolis' were used, with four experimental variants: watered with H_2O (v1); watered with standard Hoagland nutrient solution (v2); watered with Hoagland nutrient solution containing a double amount of K (v3); and watered with Hoagland nutrient solution containing a double amount of P (v4). The plant material was collected, during the flowering period, in June 2019. The essential oil was extracted via hydrodistillation according to the European Pharmacopoeia standards. The separation and the identification of the components were carried out using GC-FID (gas chromatography-flame ionization detection).

A chemical analysis of essential oils of the 'Sevtopolis' cultivar has led to the identification of over 90 organic compounds. Notably, the most abundant chemicals found were linalool, accounting for 24–33.6% of the total compounds, and linalyl acetate, comprising 13–24% of the total compounds. Additional significant chemicals present in the oil's composition included lavandulyl acetate (2.6–4.3%), eucalyptol (1.5–4.9%), terpinen-4-ol (1.8–2.4%), α-terpineol (2.6–3.8%), and borneol (1.3–3.9%).

It can be concluded that the nutrient solution influenced the quality of essential oils of *L. angustifolia* Mill. cv. 'Sevtopolis'.

sciforum-084117: Valorisation of the Italian Biodiversity: Specialised Metabolism in the Rosid Clade

Leonardo Bisson [1,2], Gianluca Zorzi [1,2], Carolina Ramos [1], Fabio Pinzauti [1,2], Fabio Pietrolucci [1,2], Valentina Dusi [1,2], Stefano Negri [1,2], Mauro Commisso [1,2], Linda Avesani [1,2] and Flavia Guzzo [1,2]

[1] Department of Biotechnology, University of Verona, 37134 Verona, Italy
[2] National Biodiversity Future Center (NBFC), 90133 Palermo, Italy

The prosperity and survival of living organisms depend on their ability to adapt to their environment. Plants are exposed to abiotic and biotic stimuli by producing phytochemicals classified as secondary/specialised metabolites. To date, more than 400,000 different specialised metabolites have been identified in plants, and this number might be greatly underestimated since only a few species have been analysed so far. The largest part of the world global flora, which includes more than 400,000 vascular species and 20,000 bryophytes, is still chemically underexplored, constituting a precious source of novel secondary metabolites. This project aims to valorise the Italian biodiversity flora by using a bioprospection strategy on the Rosid cluster, in order to gain insights on how plant secondary/specialised metabolic pathways have spread, evolved, and diversified within this clade. The Italian flora include more than 12,000 species and 2427 species belonging to the Rosid clade, representing 20% of the total. Rosid clade can be further split in two main branches, as suggested by the recent APGIV classification. In Italy, most of the species belong to the Malvids crown clade, representing the 54.3% of total Rosid, whereas Fabids include less species (45.0%). Based on these data, we decided to sample 169 Rosid species (102 belonging to the first branch and 65 belonging to the second one). Bioprospection has been performed by sampling plants in nature, in botanical gardens, and in nurseries. In particular, bioprospection in nature was carried out in Sicily (Palermo's zone), Sardinia (Sassari's zone), Lombardy (Pavia's and Mantova's zone), and different areas of Veneto, such as Verona, Padua, Altopiando of Asiago, Monte Baldo, and Monti Berici. Untargeted metabolomics analysis based on UPLC-HRMS is still in progress.

Abstracts

SESSION 5. Plant Nutrition and Plant–Soil–Microorganism Interactions

sciforum-083093: *Funneliformis mosseae* Improves Growth and Nutrient Accumulation in Wheat by Facilitating Soil Nutrient Uptake under Elevated CO_2 at Daytime, Not Nighttime

Songmei Shi [1] and Xinhua He [2]

[1] Yunnan Agricultural University
[2] Southwest University

Almost all reports of plant responses to elevated CO_2 (eCO_2) concentrations have been executed under equal CO_2 concentrations over daytime and nighttime, while ambient CO_2 (ACO_2) can be 10–20% greater during nighttime than during daytime. A simulation of currently atmosphere daytime or nighttime CO_2 concentrations would provide a closer observation on how plants could respond to forthcoming CO_2 rising. Arbuscular mycorrhizal fungus (AMF) always improves plant nutrient absorption and growth. However, interactive effects of eCO_2 and AMF on accumulations of carbon (C), nitrogen (N), phosphorus (P) and potassium (K) in plant and soil, and thus plant growth are rarely elucidated. To understand mechanisms of eCO_2 and AMF on crop growth and soil fertility, wheat (*Triticum aestivum* cv. Yunmai) were grown over 12-weeks under AMF (*Funneliformis mosseae)* inoculation and four CO_2 concentrations, i.e., (1) daytime/nighttime ACO_2 (410/460 ppm), (2) sole daytime eCO_2 ($DeCO_2$, 550/460 ppm), (3) sole nighttime eCO_2 ($NeCO_2$, 410/610 ppm), and (4) dual daytime+nighttime eCO_2 ($(D+N)eCO_2$, 550/610 ppm). Biomass of shoot and root, accumulations of plant C, N, P and K, activities of soil invertase and urease generally significantly enhanced, while concentrations of shoot and root N, P and K, and soil available N, P and K decreased under $DeCO_2$, $NeCO_2$ and $(D+N)eCO_2$. Compared with non-AMF control, effects of *F. mosseae* on above-mentioned characteristics were significantly positive under ACO_2, $DeCO_2$ and $(D+N)eCO_2$, while on accumulations of plant biomass, C, N, P and K were negative under $NeCO_2$. *F. mosseae* association generally mitigated soil nutrient restraints on wheat's response to $DeCO_2$, while $NeCO_2$ reduced AMF's positive effects on wheat. These results demonstrated that integrations of AMF's benefits to crops growing under natural habitats of $DeCO_2$ and/or $NeCO_2$ are vital in managing potential long-term consequences of forthcoming CO_2 rising on worldwide farming systems.

sciforum-082790: A New Soilless Cultivation System for Tomato Production in Southern Italy

Giovanni Gugliuzza [1], Giuseppe Pachino [2], Simona Prestigiacomo [3] and Giuseppe Di Miceli [4]

[1] CREA, Research Centre for Plant Protection and Certification, Palermo, Italy
[2] CREA Research Centre for Plant Protection and Certification, Palermo, Italy
[3] Università degli Studi di Palermo
[4] Dep. of Agricultural, Food and Forest Sciences, University of Palermo, Viale delle Scienze, Build. 4, Palermo, Italy

Southern Italy boasts the second-largest greenhouse horticultural production area in Europe, covering around 9000 hectares. Fresh market tomatoes are a significant greenhouse crop in Sicily, with nearly 3038 hectares and a total production of 203,223 tons. Greenhouse tomato cultivation involves both soil and soilless systems with various substrates. Effective management of water and fertilizer in this context hinges on a comprehensive dataset encompassing environmental, soil, and crop information, crucial for informed decision-making. To avoid resource waste, environmental damage, and unstable yields, it is imperative to develop sustainable greenhouse systems, especially considering the growing global population and increased food demand. Among the methods that do not require a substrate, there is an innovative approach known as "agriponic." In this approach, tomato plants (1.5 plants/m^2) were positioned above closed polystyrene channels. Their roots, partially suspended and in contact with the channel's bottom, receive intermittent fertigation sprays, with excess solution recaptured for reuse, forming a closed-loop system. These systems contribute to reduced water and nutrient consumption. The study was aimed at evaluating the performance and resource efficiency of the "agriponic" closed-loop system in a 1200 m^2 greenhouse in southern Italy, comparing it to a traditional soil-based system. Data on greenhouse climate, water, and nutrient inputs were gathered during the experiment. Plant growth, phenology, and leaf gas exchange and production data were registered during the tomato life cycle (January to July). In the "agriponic" system, in the first months, plant growth was slower compared to the soil-based system, which was consistent with photosynthetic measurements. However, there were no differences in phenological stage timing between the two systems. The first harvest, carried out 122 days after transplanting, revealed a higher tomato yield in "agriponic" in comparison to the soil-based system. The "agriponic" system demonstrated a decrease in water and nutrient usage, showcasing its strong environmental sustainability and efficient capability for tomato production.

sciforum-080137: A Novel Plant "Wire Communication" Process after Infection by Foliar Necrotrophic Pathogens: The First Description of *Trichoderma* as an Interplant Communicator

Jorge Poveda [1], Víctor M. Rodríguez [2], Rosaura Abilleira [2] and Pablo Velasco [2]

[1] University of Valladolid
[2] CSIC

For several decades, the question of how mycorrhizal fungi have the ability to colonize the roots of neighboring plants, connecting them through a fungal network, has been studied and demonstrated. This group of hyphae is used as a "wire communication" between plants that allows the transmission of signals between plants regarding biotic (pathogens and pests) and even abiotic (fire) stresses, widely known as "the internet of forests". Although this mechanism is widely known in mycorrhizal fungi, it has not been described in other groups of fungi, such as endophytic fungi. Within this group, *Trichoderma* is a genus of filamentous fungi widely studied and used as a biological control agent in agriculture, with no capacity described so far as an inter-plant communicator. To study this possibly biological phenomenon, we used the model plant *Arabidopsis thaliana*, the species *Trichoderma hamatum*, isolated from kale roots (*Brassica oleracea* var. *acephala*), and the pathogens *Sclerotinia sclerotiorum* and *Xanthomnas campestris* (necrotrophic fungus and hemibiotrophic bacterium, respectively). Through the analysis of foliar infection by pathogens, root colonization by *Trichoderma* and systemic plant defense responses, we have been able to identify for the first time the ability of *Trichoderma* to act as an inter-plant communicator. This is due to a systemic foliar increase of jasmonic acid-mediated defenses, which cause an antagonistic increase in salicylic-acid-mediated defenses in roots. In turn, root defenses control and respond to *Trichoderma* colonization levels, a mechanism used by the fungus to signal between neighboring plants. However, it is important to note that this mechanism only works with necrotrophic pathogens, without developing in response to the hemibiotrophic pathogen.

sciforum-083068: Community Response of Arbuscular Mycorrhizal Fungi between Subsoil and Topsoil Layers to 15-Year Long-Term Fertilizer Amendments in an Intensively Managed Arable Purple Soil

Xie Luo [1], Bo Zhu [2], Siyue Li [1] and Xinhua He [3]

[1] Wuhan Institute of Technology
[2] Institute of Mountain Hazards and Environment, Chinese Academy of Sciences
[3] Southwest University

Crop growth and productivity are generally enhanced by arbuscular mycorrhizal fungi (AMF) through improved soil nutrient uptake. Nonetheless, how changes in AMF communities at different soil depths in managed farmlands can actively respond to long-term contrasting fertilization regimes or treatments are rarely known. Next generation sequencing was employed to shape AMF communities in 0–15 cm topsoil and 15–30 cm subsoil from a typical arable purple soil (Eutric Regosol) in Yanting County, southwest China. Soils were collected during after harvest of wheat (*Triticum aestivum* cv. Chungmai 44) and maize (*Zea mays* cv. Zhenghong 505) after five 15-year long-term fertilizations at an equal nitrogen (N) rate: no-N-fertilization control (CT), chemical N+phosphorus+potassium fertilization (NPK), crop straw return (CR), NPK+biochar (NPKBC), and NPK+CR (NPKCR). Compared to CT, under NPK, CR, NPKCR and NPKBC, AMF's Shannon-Wiener indices, not Sobs and Chao, significantly decreased at topsoil, but increased at subsoil, beneath wheat and maize. AMF community composition shifted between contrasting fertilizations at topsoil and subsoil. Structural equation modeling analysis showed that AMF communities at both topsoil and subsoil were positively significantly affected by climate variable beneath wheat, but no significant effect beneath maize; while negatively or positively affected by fertilization beneath wheat or maize. Fertilization treatments and soil organic carbon were the important factors in shaping AMF community composition and diversity at topsoil and subsoil of wheat, but soil available phosphorus significantly affected AMF community at topsoil and subsoil of maize. Stochastic processes dominated AMF community assembly under different fertilization regimes, with dispersal limitation and undominated processes being the main process. These findings revealed that there was a rapidly local scale dispersal, which could allow plants to establish effective AMF associations under environmental change and human intervention. Our results promote better understandings of changes in AMF communities for maintaining long-term managed agroecosystems.

sciforum-082917: Differential Responses of Soil Microbial Communities to Elevated CO_2 in Two Root Crop Radish Cultivars

Songmei Shi [1], Xue Zhu [1], Xinju Wang [1], Jiajun Song [1], Zhengan Yang [1] and Xinhua He [2]

[1] Yunnan Agricultural University
[2] Southwest University

In terms of climate change, the increasing atmosphere CO_2 (aCO_2) or elevated CO_2 (eCO_2) concentrations have led to far-reaching impact on the environment and global economy. However, information about such an impact on the plant–soil–microorganism interactions of root crops is limited. We thus studied the impact of eCO_2 (300 ppm higher than current aCO_2) on their yield, soil nutrient and soil microbial community structure of two most widely cultivated radish (Raphanus sativus L. cv. Xinlimei and 501) grown on soil (Eutric Regosol) between November 15, 2021 and March 25, 2022 in environmentally auto-controlled growth chambers. Results showed that aboveground and belowground biomass, and total biomass production of 130-day-old Xinlimei or 501 at harvest were respectively increased by 26%, 29% and 32% or 77%, 22% and 77% under eCO_2 than under aCO_2. eCO_2 also significantly increased enzyme activities of soil sucrase, amylase and phosphatase, but decreased soil NO_3^--N and available potassium for both cultivars. Compared to aCO_2, soil bacterial diversity was significantly decreased while fungal diversity was significantly increased under eCO_2. The community compositions of both soil bacteria and fungi differed between aCO_2 and eCO_2 for both cultivars. The relative abundances of Proteobacteria, Bacteroidetes and Actinobacteria in bacteria, and Ascomycota and Anthophyta in fungi were changed by eCO_2. Pearson's correlation analysis showed that α-diversity of bacterial and fungal were significantly associated with soil NO_3^--N, available potassium, activities of amylase, sucrase, protease, and total biomass. Analysis of redundancies revealed that the community composition of bacteria and fungi was significantly affected by soil available phosphorus, available potassium, activities of urease, protease and phosphatase. Results from the present study provide insights into how bacteria and fungi communities in radish soil could be altered under eCO_2, which are valuable for a sustainable root crop production under global CO_2 rising scenarios.

sciforum-084196: Enhancing Fertility in Acid Luvisol and Sunflower (*Helianthus annuus* L.) Yield with Fly Bioash Application

Jelena Horvatinec [1], Filip Kranjčec [1], Ivan Išasegi [2] and Gabrijel Ondrasek [1]

[1] University of Zagreb Faculty of Agriculture
[2] Tehnical high school Antuna Horvata

Fly bioash is a solid, complex by-product from biomass-fuelled plant facilities with specific physico-chemical and mineralogical properties. As it is very alkaline (pH > 12) and contains a high concentration of nutrients, fly bioash emerges as a promising transformative solution for revitalizing acidic nutrient-deficient agricultural soils, ultimately increasing crop production yields. This study investigated the impact of fly bioash application at increasing rates (0–17.2 t/ha) on chemical pedovariables and sunflower (*Helianthus annuus* L.) yield during one vegetation season in an acidic Luvisol (pH = 4.3) under open-field conditions (Ivan Dvor, Slavonia, Croatia). The results demonstrate a significant positive increase in soil pH (up to 7.6) and macronutrients (P up to 1.6-fold, K up to 4.8-fold, Ca up to 4.2-fold) with fly bioash addition. Moreover, fly bioash substantially enhanced the sunflower grain yield (by 60%) and vegetative growth parameters, including root biomass (by 89%) and shoot biomass (by 142%), compared to unamended control soil. These findings underscore the potential of fly bioash to ameliorate soil acidity, replenish phytonutrients, and boost both crop grain yield and vegetative growth parameters. For sustainable fly bioash application, extensive long-term field experiments are crucial, evaluating additional soil variables, including physical properties and microbiomes, to comprehensively address potential negative environmental impacts and ensure responsible agricultural practices.

sciforum-081856: Exploring the Possibility of Reducing Nitrate Content of Baby-Leaf Lettuce through Flushing the Nitrate Solution 24 h Prior to Harvest Compared to Limiting the Nitrate Concentration Throughout the Cultivation Period in a Vertical Farm

Orfeas Voutsinos-Frantzis [1], Nikoleta Antoniadou [1], Theodora Ntanasi [1], Ioannis Karavidas [1], Georgios Liakopoulos [2], Leo Marcelis [3], Dimitrios Savvas [1] and Georgia Ntatsi [1]

[1] Agricultural University of Athens, Department of Crop Science, Laboratory of Vegetable Crops, Iera Odos 75, 11855 Athens, Greece
[2] Agricultural University of Athens, Department of Crop Science, Laboratory of Plant Physiology, Iera Odos 75, 11855 Athens, Greece
[3] Wageningen University and Research, Horticulture and Product Physiology Group, P.O. Box 16 6700AA, Wageningen, The Netherlands

Vertical farming, is a relatively new technology that utilizes soilless culture methods to cultivate vegetables on multiple horizontal layers using artificial lighting. Leafy vegetables can accumulate high levels of nitrates which are linked to gastric cancer. In an effort to produce safe-for-consumption leafy greens, several cultivation techniques can be implemented. The aim of this research was to reduce nitrate levels in "baby-leaf", butterhead lettuce in vertical farming conditions while maintaining high productivity. This goal was primarily achieved through the manipulation of the nutrient solution (NS). The control solution had a nitrogen content of 12 mmol/L (12N), whereas the solution with the reduced content, had a nitrogen level of 4 mmol/L (4N). The possibility of replacing the NS of the 12N treatment with tap eater for 24 h before harvest (TW24) was also investigated. During the experiment, Butterhead lettuce plants (cv. Cecilia RZ) were grown at a density of 1600 plants/m^2 on rockwool plug-sheets until the first 6–8 true leaves. The light intensity was 400 umols m^{-2} s^{-1}, and the photoperiod was 12 h long. The leaf number (LN), leaf area (LA), the fresh weight (FW), and the dry weight (DW) of the leaves were measured during harvest. Subsequently, the dried leaves were used for chemical analysis for the determination of the leaf nitrate content. The results indicated that all agronomic characteristics were compromised with the reduction of nitrogen from 12N to 4N. The nitrate levels were the highest under 12N, followed by the 12N-TW24, and lowest under 4N conditions.

sciforum-082854: Impact of Soil Microbiota and Tillage Practices on the Long-Term Sustainability of Agroecosystems in Climate Change

Vaida Steponavičienė

Vytautas Magnus university

The sustainability of agroecosystems is vital for maintaining their condition, productivity, biodiversity, and integrity over time, especially against the backdrop of climate change and an increasing consumption of natural resources. The European Environment Agency and Environment Research Centre prioritize research on improving the water-holding capacity of soils, which is increasingly crucial in a drier climate. A long-term field experiment, initiated in 1999 on Planosols, explored the effects of varied tillage intensities and agricultural practices on agroecosystem sustainability. This study utilized both conventional and reduced tillage systems, combined with cover crop treatments. One segment of the study removed straw post harvest, while another chopped and spread it. The crops rotated were winter oilseed rape, winter wheat, and spring barley.

Over the 21-year period, it was observed that sustainability in agroecosystems is directly related to the stability of their productivity. Analyzing crop productivity from 2000 to 2020, there was minimal variation in long-term measures of different intensities when compared to deep ploughing. A noteworthy finding was that consistently spreading plant residues and using white mustard as green manure positively impacted winter wheat productivity. Interestingly, these measures did not significantly affect spring barley. Microorganisms have also had a very important impact on the sustainability of agroecosystems. This study concludes that reduced soil tillage, combined with the use of plant residues and green manure, ensures stable productivity in agroecosystems, highlighting the potential of this approach in promoting sustainable farming amidst environmental challenges.

sciforum-081512: Increasing Arbuscular Mycorrhizal Fungi Diversity Shows a Weakening Trend of Growth Promotion

Yunjian Xu, Junhua Liu and Zhe Chen

Yunnan University

Arbuscular mycorrhizal fungi (AMF) are widely distributed in grasslands, playing important roles in grassland restoration. However, it is still unclear whether the increase in AMF species is beneficial for grassland plants. In this study, grass species of *Lolium perenne* L., *Dactylis glomerata* L., and *Trifolium repens* L were selected and grown in pots filled with degraded grassland soil. We added five AMF species, either separately or in combination with grassland plants, and analyzed the effects of each treatment on plant performance and rhizosphere microbes. The addition of AMF improved nutrient uptake and plant growth, whereas the growth-promoting effect of AMF symbiosis did not always increase with the increase of AMF species. Plants inoculated with the mixture of three AMF species achieved the greatest benefit. Soils co-added with three AMF species showed higher activities of nitrogenase, ammonia monooxygenase, pyrroloquinone synthase, and phytase activities than other treatments. Furthermore, the co-addition of three AMF species recruited three core bacterial genera of *Citrifermentans*, *Rhodococcus*, and *Flavisolibacter*, which were positively correlated with nitrogen fixation and mineralization, organic phosphorus mineralization, and inorganic phosphorus solubilization. These findings provide insights into the contribution of the AMF community regarding plant growth, for AMF management and the use of bio-inoculants for grassland restoration.

sciforum-083979: Investigation of the Effects of Foliar Fertilization on Two Maize Hybrids' Physiological Characteristics under Irrigated Conditions

Brian Ssemugenze, Csaba Bojtor, Arpad Illes, Janos Nagy, Ocwa Akasairi and Brigitta Toth

University of Debrecen

Exponential population growth requires increased food production amidst several crop stresses like drought and soil infertility that impact plant growth and production. Maize is globally recognized as a salient cereal crop. Foliar fertilisation and irrigation are among the precision practices that deter crop stress. Therefore, this study objectively evaluated the effects of foliar fertilization on different physiological parameters of two maize hybrids (FAO 490 and FAO 290) under irrigated conditions at Látókép Crop Experimental Site, University of Debrecen, Hungary, during the year 2023. The experimental design was a randomized complete block design. Foliar fertilizer treatments consisted of nitrogen (10 g/L), zinc (8 g/L), K_2O (8.5 g/L), P_2O_5 (0.83 g/L) and sulphur (8.93 g/L). Surface drip irrigation lines were laid in every row near the plants at the intensity of 3 litres per hour, controlled by the hydra wise app, managed by a nearby meteorological station. Data on selected physiological parameters, namely plant height, leaf area index, NDVI (Normalized Difference Vegetation Index) and relative chlorophyll content (Soil Plant Analysis Development values), were collected at V12, VT, R4 and R6 stages. Data analysis comparing foliar fertilization effect was carried out using a *T*-test. There was no significant difference in LAI, NDVI, SPAD and plant height for the two hybrids due to foliar application when compared with control. However, comparing hybrid and trait interactions showed that plant heights differed significantly (p *0.001*) between the two hybrids. At R6 and V12 stages, lower values of all traits were recorded, whereas at R4 and VT stages high values of NDVI, plant height, SPAD and LAI were recorded. FAO290 had higher LAI values than FAO490 at both V12 and VT stages; however, there were no significant differences when compared to control. The findings imply that the physiological growth of maize mainly depends on the ways in which hybrids and traits interact when exposed to foliar fertilization.

sciforum-082730: Lettuce Performances as Influenced by Different Nitrogen Dosages and *A. brasilense* Strains

Beppe Benedetto Consentino, Lorena Vultaggio, Salvatore La Bella and Leo Sabatino

Department of Agricultural, food and Forest Sciences (SAAF), University of Palermo

Nitrogen (N) supply is an imperative agricultural technique for enhancing and safeguarding yield of vegetable crops. However, synthetic N fertilizers have a negative impact on environment and human health. At this regard, introducing new eco-friendly tools capable of increasing resource use efficiency could be useful to reduce nitrogen application rate and to preserve the ecosystem. The current study was accomplished to evaluate the combined effect of two *A. brasilense* strains [(from the German collection of microorganisms (DSM)] (DSM 1690 and DSM 2298) and different N fertilization doses—administered using ammonium nitrate—(0, 30, 60 or 120 kg ha^{-1}) on yield, dry matter content, ascorbic acid, total phenols, carotenoids, chlorophyll, nitrogen and nitrogen use efficiency (NUE) index of lettuce plants cultivated under polyethylene-covered tunnel. Our data pointed out that yield was significantly enhanced by *A. brasilense* DSM 2298 inoculation when plants were exposed to medium/low N levels (30 or 60 kg ha^{-1}). Overall, ascorbic acid, total phenolics, carotenoids and chlorophyll were increased by the combined effect of *A. brasilense* DSM 1690 and a N dose of 30 or 60 kg ha^{-1}. Both *A. brasilense* strains enhanced N concentration, especially in plant inoculated with DSM 1690 strain. Interestingly, the NUE index was significantly increased by both microorganisms, however, the best results were showed by plants treated with the strain DSM 2298. Our data highlighted that both plant growth promoting bacteria tested are able to improve lettuce yield, qualitative parameters and NUE index, especially when combined with a mild N dose (30 or 60 kg ha^{-1}).

sciforum-083812: Mycorrhizal Inoculation Affects Oxidative Stress Response in Wheat Plants under Manganese Stress

Rafaela Sousa [1], Amaia Nogales [2], Lénia Rodrigues [3], Hélia Cardoso [4], Maria Doroteia Campos [3] and Catarina Campos [3]

[1] Escola de Ciências e Tecnologia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal
[2] Sustainable Plant Protection Program. Institute of Agrifood Research and Tecnology. Cabrils Center. Cabrils, Barcelona, Spain
[3] MED (Instituto Mediterrâneo para a Agricultura, Ambiente e Desenvolvimento) & CHANGE—Global Change and Sustainability Institute, IIFA (Instituto de Investigação e Formação Avançada), Universidade de Évora, Pólo da Mitra, Ap. 94, 7002-554 Évora, Portugal
[4] MED—Mediterranean Institute for Agriculture, Environment and Development & CHANGE—Global Change and Sustainability Institute, Escola de Ciências e Tecnologia, Departamento de Biologia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portug

The symbiotic relationship between arbuscular mycorrhizal fungi (AMF) and the majority of terrestrial plants is one of the most beneficial interactions that occurs in nature. AMF play a major role in plants' nutrient uptake from soil, and can protect plants from a variety of both abiotic and biotic stresses. Manganese (Mn) is a micronutrient element essential for normal plant growth and development. However, excessive levels of Mn in the soil can be damaging to the plants. High levels of Mn are often associated with acidic soils, and it has been observed that wheat plants can exhibit symptoms of Mn toxicity if grown in these conditions. This work aimed to determine the effect of AMF inoculation on wheat (*Triticum aestivum* L. var. Ardila), in a context of manganese toxicity, as well as on the expression of genes related to oxidative stress responses and on total oxygen reactive species (ROS) production. Wheat plants were grown in greenhouse conditions, in pots with sterilized soil, and half of the plants were inoculated with the AMF *Rhizoglomus irregulare*. Half of the pots were supplemented with 7.5 ppm of Mn to promote a Mn stress condition. The weight of the plants was measured after 7 weeks, and the samples of aerial parts were taken for the real-time qPCR analysis of genes related to oxidative stress response (*SOD1*, *GPx*, *APx*, and *Trx*).

AMF colonization enhanced wheat growth, more evident in the Mn addition treatment. Furthermore, AMF increased *SOD1* expression in the Mn treatment, whereas *GPx* and *TRx* showed a decreasing trend in inoculated plants, for both Mn conditions. *APx* showed no differences amongst treatments. AMF significantly decreased total ROS in the Mn treatment. This work underscores that AMF have an impact on wheat oxidative stress responses, offering insights into the broader goal of developing crop varieties more tolerant to abiotic stresses.

sciforum-082739: Radial Oxygen Loss by *Vallisneria spiralis* Affects Microbial Diversity and Activity and Pore-Water Chemistry in Organic Sediments

Leonardo Morini [1], Claudio Ferrari [1], Marco Bartoli [1], Mindaugas Zilius [2], Elias Broman [3] and Giovanna Visioli [1]

[1] Università di Parma
[2] Klaipeda University
[3] Stockholm University

Submerged macrophytes provide a wide range of ecosystem services, including sediment retention, the reduction of nutrient recycling, nutrient loss and an improvement of pore water chemistry. The latter depends on the direct uptake of solutes and radial oxygen loss (ROL), increasing the volume of sediments where aerobic microbial metabolism is allowed. ROL is regulated by multiple factors, among which are the organic matter content of sediments and the plasticity of macrophytes, and specifically their response to chemically reduced conditions. By actively increasing aerenchyma macrophytes, we can enhance ROL and contrast potential sediment toxicity. In this work, the effects of ROL by *Vallisneria spiralis* in organic sediments were tested, focusing on N-related microbial communities, potential nitrification and denitrification and pore-water chemistry. To this end, control and organic-enriched (21% vs. 9%) vegetated and unvegetated microcosms were realized, acclimatized under control conditions and then characterized.

Results suggest that ROL by *V. spiralis* significantly modified the composition of the microbial community and stimulated aerobic nitrification in both control and organic enriched sediments. They also suggest that ROL and the macrophyte uptake significantly decreased the pore-water nutrient concentrations, by at least five-fold. *V. spiralis* increases the oxic subsurface sediment volume where aerobic microbes can grow, thereby favoring the oxidation of reduced end metabolites and the assimilation of nutrients, decreasing concentration gradients and fluxes to the water column. Due to its easy transplantation, plasticity and adaptive capacity to grow in organic sediments, V. spiralis represents an interesting option as a nature-based solution to contrast eutrophication.

sciforum-083894: Review: Arbuscular Mycorrhizal Fungi and Phosphorus Solubilizing Bacteria: Plausible Candidates or *Striga hermonthica* Management in Sorghum

Magdoline Mustafa Ahmed [1,2], Rania Alrasheed Abakeer [1,3], Mohammed Mahgoub Hassan [1], Elshafia Ali Hamid Mohammed [4,5], Ratonyi Tamas [6] and AbdelGabar Eltayeb Babiker [7]

1 Environment, Natural Resources and Desertification Research Institute, National Center for Research, Khartoum, Sudan
2 Debrecen University, kerpely kálmán, Crop Production and Horticultural Sciences, Debrecen, Hungary
3 McGill University, Agricultural and Environmental Sciences, Plant Science Department, Quebec, Canada
4 Agricultural Research Corporation, Crop Protection Research Center, Wadmadani P.O. Pox. 126, Sudan
5 Debrecen University, Faculty of Agric., Food and Sci. and Envi. Management, Dept. of Animal Science, Debrecen, Hungary
6 Debrecen University, kerpely kálmán, Crop Production and Horticultural Sciences, Debrecen, Hungary
7 Environment, Natural Resources and Desertification Research Institute, National Center for Research, Khartoum, Sudan

Striga spp. root hemi parasitic weeds on major staple food crops including sorghum maize, pearl millet and rice, have been reported to threaten food security in sub-Saharan Africa. Among *Striga* spp., S. *hermonthica* is the most important and most prevalent in the region and thrives best under low soil fertility. *Striga* germinates in response to stimulants exuded by host roots. Following germination the parasite attaches, penetrates the host roots, establishes connection with the host xylem, grows parasitically and remains subterranean for 6–8 weeks. During the subterranean phase the parasite inflicts most of its damage. Several control tactics including cultural, chemical and biological methods have been released for combating the parasite. However, adoption rate of available control technologies remains minimal. Low adoption rate of the released technologies is attributable, mainly, to the mismatch of the technologies and the prevalent low-input subsistent farming system. The need for simple, inexpensively environmentally benign methods of control that affect the parasite at early stages of development is imperative. In nature, the *Striga* germination stimulants, collectively named strigolactones, are the hyphal branching factors of arbuscular mycorrhiza fungi (AMF) and their production and release from host roots are promoted by low soil fertility. The link between low soil fertility, *Striga* infection and mycorrhization promoted research on AMF as *Striga* antagonists with positive effects. However, AMF colonization was influenced by a multitude of variables including plant species, genotypes, drought, cultural practices, pesticides, initial soil fertility and the rhizospheric microbes, particularly phosphorus-solublizing bacteria and growth-promoting Rhizobacteria, where both synergistic and antagonistic interactions were reported.

sciforum-072884: Rhizobia and Arbuscular Mycorrhizal Fungi (AMF) as the Microbiota Potentially Improving the Growth of Legumes in Heavy Metal Polluted Areas

Marzena Sujkowska-Rybkowska

Warsaw University of Life Sciences SGGW

The metalliferous tailings in southern Poland are spontaneously colonized by metal-tolerant *Anthyllis vulneraria* L. (*Fabaceae*), which can form simultaneously symbiotic association with nitrogen-fixing rhizobia and phosphorus-acquiring arbuscular mycorrhizal fungi (AMF). So far, the diversity of symbiotic microbiota of legumes colonizing the tailings have been poorly studied.

The aim of this study was to characterize the rhizobia, their plant growth promoting (PGP) traits, and AMF associated with *A. vulneraria* calamine ecotype. The results indicated that plants were nodulated by metal-resistant *Bradyrhizobium liaoningense* and *Rhizobium metallidurans, which showed* that PGP traits thus might induce *A. vulneraria* growth on metal contaminated sites directly by nitrogen fixation, IAA and ammonium production, phosphate solubilization, siderophore formation or lowering ethylene levels. Moreover, the nodulated roots where intensively colonized by AMF (86.3% of root mycorrhizal colonization and 20.53% of relative mycorrhizal intensity) with the *Arum*-type of mycorrhiza. Molecular identification of AMF using PCR-DGGE analysis based on the 18S rDNA ribosomal gene by nested-PCR revealed *Rhizophagus* sp., *R. fasciculatus*, and *R. iranicus* in *Anthyllis* roots. Heavy metal excess had no negative effect on the number of AMF spores, amounts of glomalin-related soil proteins (GRSP) and AMF species composition. AMF might influence the plant growth directly providing nutrients and/or decreasing metal uptake and translocation by GRSP production. Metal ions were accumulated mainly in nodules and intraradically fungal structures rather than thick plant cell walls.

The results of this work indicate that the presence of unique symbionts, which can enhance *A. vulneraria* tolerance to heavy metal stress and plant adaptation to extreme conditions on calamine tailings.

sciforum-079944: Soil Microalgae and Cyanobacteria Characterization in a Differentially Managed Olive Orchard

Rosangela Addesso [1], Carmine Crecchio [2], Luigi Lucini [3] and Adriano Sofo [1]

[1] Department of European and Mediterranean Cultures: Architecture, Environment, Cultural Heritage (DiCEM), University of Basilicata, Via Lanera 20, 75100 Matera (MT), Italy
[2] Department of Soil, Plant and Food Sciences, Università degli Studi di Bari Aldo Moro, Via Amendola 165/a, 70126 Bari, Italy
[3] Department for Sustainable Food Process, Università Cattolica del Sacro Cuore, Via Emilia Parmense 84, 29122 Piacenza, Italy

Soil microalgae and cyanobacteria offer potential benefits for sustainable and resilient agriculture. Fixing the CO_2 level through photosynthesis, they contribute to the enrichment of the soil in biomass and organic carbon, as well as to the enhancement of its aggregation and porosity. Being in synergic interaction with other soil microorganisms, they exchange nutrients and contribute to make the plants' development microenvironment more hospitable, through bioactive compounds production promoting their growth, as well as through the prevention of pathogens. Moreover, (N)-fixing cyanobacteria provide nitrogen, an essential nutrient for plant growth. In order to explore the potential biofertiliser, biostimulatant and biopesticide actions of microalgal communities in agricultural soils, the aim of this research was to characterize soil microalgae and cyanobacteria in a Mediterranean olive orchard located in a semi-arid climate (Ferrandina, Basilicata, Italy), with differentially managed sustainable (Smng) or conventional (Cmng) land use for 22 years. The Smng soils had significantly higher algae (2.210×104 g^{-1} soil in Smng and 0.872×104 g^{-1} soil in Cmng), and the same trend was observed for cyanobacteria (0.408×102 g^{-1} soil in Smng and 0.240×102 g^{-1} soil in Cmng). Using light microscopy, with two selective liquid media (with and without N), microalgae and cyanobacteria dominant species were observed and identified by morphological features; Trebouxia, Euglena, Chaetophora green algae genus and Cymbella diatom genus were detected in the conventionally managed soil samples, whereas Anabaena cyanobacterial genus, Oedogonium and Scenedesmus green algae genus and Navicula and Pinnularia diatom genus were identified in the sustainably managed soil samples. Their metabolic activities and the profiling of metabolites were also evaluated; the type of soil management approach produced a distinctive metabolic profile, suggesting a specific influence of the agriculture management type used on the metabolic activity of the soil algae and cyanobacteria. This study was carried out within the Agritech National Research Center and received funding from the European Union Next-GenerationEU (PIANO NAZIONALE DI RIPRESA E RESILIENZA (PNRR)—MISSIONE 4 COMPONENTE 2, INVESTIMENTO 1.4—D.D. 1032 17/06/2022, CN00000022). This manuscript reflects only the authors' views and opinions, neither the European Union nor the European Commission can be considered responsible for them.

sciforum-082734: Synergistic Effect between Different Plant Growth-Promoting Bacteria and Various Nitrogen Rates on Production and Quality of Fennel Grown in Open Field

Lorena Vultaggio, Beppe Benedetto Consentino, Salvatore La Bella and Leo Sabatino

Dipartimento Scienze Agrarie, Alimentari e Forestali, University of Palermo

Fennel [*Foeniculum vulgare* Miller var. azoricum (Mill.) Thell.] is a typically Mediterranean biennial herbaceous plant belonging to the *Apiaceae* family. Nitrogen (N) fertilisation is a conventional agricultural practice used to increase the yield and yield components of vegetables. However, synthetic nitrogen fertilisers, commonly adopted by farmers, have several negative effects on the environment and humans. Against this backdrop and in line with the European Green Deal strategies, biostimulants, including plant growth-promoting bacteria (PGPBs), are considered eco-friendly tools to enhance the growth, development and quality of vegetable crops. Based on the above considerations, the aim of the present study was to evaluate the interactive effect between four different N levels (0, 45, 90 and 180 kg ha^{-1}) and three PGPBs (*Azospirillum Brasiliense* DSM 2298, *Bacillus subtilis* DSM 10 and *Streptomyces violaceoruber*) on the quanti-qualitative traits of 'Leonardo' F_1 fennel grown in an open field. The results showed that sub-optimal levels of N (45 and 90 kg ha^{-1}) in combination with PGPBs improved growth traits (plant height, stem diameter and number of leaves) and the production of fennel plants. In non-inoculated plants, N concentration in plant tissues increased as the N dose supply increased. However, the use of PGPBs, especially *A. brasilense*, resulted in a reduction in N concentration in plant tissues compared to the non-inoculated plants. Furthermore, the use of PGPBs significantly increased the sugar content, as well as the content of functional compounds such as ascorbic acid and polyphenols. Our results suggest that the tested PGPBs can be considered an eco-friendly tool to improve fennel productivity and quality, particularly when combined with sub-optimal N doses (45 or 90 kg ha^{-1}).

sciforum-080133: The Characterization of the Glutamate Dehydrogenase Enzyme in Selected Marchantiophyta: A Study to Explore Nitrogen Management in Liverworts

Martina Brambilla [1], Giorgio Chiari [1], Mauro Commisso [2], Luca Nerva [3], Rita Musetti [4], Alessandro Petraglia [1] and Francesca Degola [1]

[1] Dept. of Chemistry, Life Science and Environmental Sustainability, University of Parma, Italy
[2] Dept. of Biotechnology, University of Verona, Italy
[3] Council for Agricultural Research and Agricultural Economy Analysis (CREA-VIT), Italy
[4] Dept. of Land, Environment, Agriculture and Forestry, University of Padova, Italy

Glutamate dehydrogenase (GDH) is a ubiquitous enzyme that catalyzes the reversible amination of 2-oxoglutarate in glutamate, contributing to both the amino acid homeostasis and the management of intracellular ammonium. It is considered to be one of the key players at the junction of carbon and nitrogen assimilation pathways in plants. To date, all the available information about the GDH of terrestrial plants refer to a very few vascular plant species only. In addition, due to biochemical and molecular aspects involved in its enzymatic activity, its role in the plant metabolism is still considered intriguingly controverted. By focusing on selected Liverwort species belonging to different orders, we provided the first panoramic overview of GDH in non-vascular land plants; from the species- and organ-specific isoenzymatic profile to the protein's thermal stability, from the post-translational pattern to the ammonium-dependent response, some characterizing features of this fascinating and not yet completely understood enzyme have been unraveled. A multifaceted approach that exploited proteomic and metabolomic techniques, as well as electrophoretic analyses and electron microscopy investigations, has been used. Our results offer an accurate portrait of the GDH enzyme in Liverworts, addressed to provide a better understanding of the Bryophytes metabolism strategic to survival and adaptation, and to shed light on some key properties of the enzyme that could have contributed to their success in colonizing extremely varied environments.

sciforum-080234: The Development of Strategies for the Use of Rhizosphere Microorganisms to Reduce the Use of Fertilizers and to Control Biotic and Abiotic Adversities: Experiences of the FERTLESS Project

Marco Albertini [1], Riccardo Nicoli [1], Carla Corticelli [2], Antonio Barreca [1], Graziano Salsi [2], Andrea Demontis [3], Roberta Rosta [3], Luigi Marabini [4], Danilo Zanarini [5], Andrea Dall'Olio [6], Stefano De Franceschi [7], Michele Tonelli [8], Daniele Pederzoli [9], Giorgio Chiari [10], Francesca Degola [10], Ada Ricci [10] and Mariolina Gullì [11]

[1] AgriTeS s.r.l., Via Marconi 4/2, 40057, Granarolo dell'Emilia (BO)
[2] Progeo S.C.A, Via Asseverati 1, 42122 Reggio Emilia
[3] Co.Na.Se, Via Selice, 301/A, 48017 Conselice (RA)
[4] Az. Agr. "Marabini Luigi", Via Stradelli Guelfi 1385, 40024 Castel San Pietro Terme (BO)
[5] Soc. Agr. S.S. "Il Bosco di Zan" Via I. Lambertini 39, 40068 San Lazzaro di Savena (BO)
[6] Società Agricola S.S. "Dall'Olio Pietro e Andrea", Via Madonnina 3671, 40024 Castel San Pietro Terme (BO)
[7] Azienda Agricola "De Franceschi Stefano", Valsamoggia (BO)
[8] Coop. Agr. Soc. "Coltivare Fraternità», Via Galilei, 40064 Ozzano dell'Emilia (BO)
[9] SERBIOS s.r.l., Via Enrico Fermi 112, 45021 Badia Polesine (RO)
[10] Dept. of Chemistry, Life Science and Environmental Sustainability, University of Parma, Parco delle Scienze 11/A, 43125 Parma
[11] Dept. of Chemistry, Life Science and Environmental Sustainability, University of Parma, Parco delle Scienze 11/A, 43125 Parma

The attention paid to environmental protection and soil biodiversity has driven the need to identify new tools for reducing the use of technical means by agricultural producers within the agri-food chain. The use of natural biostimulants like beneficial rhizosphere microorganisms could limit the supply of fertilizers or pesticides and the release of pollutants, improving crops' resilience to water and thermal stress; as a result, the adaptation of cropping systems to the impact of climate change might be achieved, preserving and implementing the safeguarding of yields, quality, and the profitability of harvesting. The FERTLESS Project, funded by the Emilia Romagna Rural Developing Program (PSR 2014–2020), aims to define a best practice model with low environmental impact applicable at farm level, which includes the use and valorization of rhizosphere microorganisms for the cultivation of economically prominent crops in the Emilia Romagna region; in fact, an agricultural system aiming to address the reduction of pesticides and fertilizers is expected to obtain the recognition of added value on the markets, operating an important function in terms of food safety and consumer awareness. Additionally, best practice models could allow new market opportunities linked to the ever-increasing appreciation for agricultural products made with more environmentally friendly techniques, also solving the following problems:

1. The development of low-impact strategies to reduce/replace synthetic fertilizers and pesticides, ensuring the greater safety of workers and improving the consumers' health;
2. Theachievement of increased yields and improved quality of food and feed products;
3. Economic and environmental savings due to the reduced use of technical means and water resources. Activities are focused on the validation of new biofertilisers applied in seed coatings or as microgranular products. Their effects have been evaluated in terms of different agronomical parameters to assess the efficacy in ameliorating plants' resilience to abiotic stresses; investigations have been performed in laboratory conditions and experimental fields.

sciforum-084071: The Effect of Insect Frass on Tomato Transplant Growth and Nutrient Content

Margit Olle

NPO Veggies Cultivation

Sustainable insect manure is a 100% natural fertilizer that includes nutrients that plants can obtain easily and metabolize well. Manure produced by insects is a high-quality and innovative organic fertilizer that is obtained from plants fully digested by insects and therefore combines a balanced fertilizer and biostimulator in one product. Insect manure components support plant growth; they are of natural origin, stimulate plant growth, and support root development. The tomato variety used underwent seven treatments, with three replications. The experiment was repeated twice. The growing technology used, Bugimine Ltd., did not want to provide an accurate recipie as they wished to retain their property. Treatments: 1. Matogard substrate + Insect frass, 2. Matogard substrate + Insect frass + spraying with insect frass solution; 3. Matogard substrate + insect frass + spraying with water; 4. Control: Matogard substrate; 5. Matogard substrate + Insect frass + EM (effective microorganisms); 6. Matogard substrate + Insect frass + UBP; 7. Matogard substrate until pitching, then Matogard substrate + insect frass. The height of the plants, the number of leaves, and the stem diameter were the lowest in the control treatment. The content of N, P, K, Ca, and Mg was lowest in the control treatment. It can be concluded that the use of insect frass makes tomato transplants grow better (plants were higher and the stem diameter was larger) and contain more nutrients, making them perfect to use as transplants to obtain a good yield.

sciforum-084563: The Role of Microorganisms in Improving Linseed Yield

Ali S. Hassoon [1], Ahmed Adnan Kadhim [2], Muataz Mohammed Gazi [3], Madeha H. Hussein [4] and Hiba Yousef Saleh [5]

[1] Al-Mussaib Technical College-Iraq
[2] Al-Furat Al-Awsat Tech. University, Almusaib Technical College, Iraq
[3] Baghdad University, College of Science, Iraq
[4] Ashur University College, Pharmcy Department, Iraq
[5] Midlle Tech. Universit, Al-Mansour Medical Instiute Tech, Iraq

A field experiment was carried out in the winter season 2020–2021 in Al-Mahaweel District (25 km north of Babil Governorate) in order to study the effect of bio fertilizer in flax yield and its components for several varieties of flax. A factorial experiment was applied bassed on a Randomized Complete Block Design (R.C.B.D) with three replications. The experiment included two factors, the first included eight varieties of flax (Indian Variety, Giza 11, Giza 10, Sahka 5, Sahka 6, Giza 8, Syrian Variety,and Thorshansity 72), while the second factor, bio fertilizer includes four levels: (control, bacterial fertilization, fungal fertilization and a bacterial-fungal mixture). The following traits were measured (number of capsules per plant, number of seeds per capsules, 1000 seed weight, total seed yield, biological yield and harvest index). The results showed that Giza 10 Varity was significantly superiority to other varieties in all studied traits, while Thorshansity 72 Varity gave lowest means in most of the yield traits and its components. The bio fertilization also achieved a significant increase in all traits with the superiority of the fertilization treatment (Bacterial fertilizer + Mycorrhiza). The interaction between the variety and the bio fertilization (Giza 10 + Bacterial fertilizer + Mycorrhiza) achieved highest means for all studied traits, as number of capsules per plant was (76.22) [1], the number of seeds per capsule (9.95), weight of 1000 seeds (13.79) g, total seeds yield (1681.40) kg,the biological yield (6542.70) kg and the harvest index was(30.87) %.

sciforum-083340: The Use of Bacterial Consortia Improves Seed Tuber Production in Potato Varieties for Frying

Rodrigo Mauricio Ramírez [1], Pedro Rodriguez-Grados [1], Jean Piere Quiliche Durán [2], Sergio Contreras-Liza [1], José Montemayor Mantilla [1] and Edison Goethe Palomares Anselmo [1]

[1] Universidad Nacional Jose Faustino Sanchez Carrion

[2] Universidade São Paulo

Objective: To determine the effect of a consortium of growth-promoting rhizobacteria on potato varieties for frying under controlled conditions. Methodology: The research was conducted at the Universidad Nacional José Faustino Sánchez Carrión, Huacho, Peru. The experiment was carried out in pots in a greenhouse using a completely randomized design with six replications, under a factorial arrangement. Four potato genotypes were used for frying (cv. Bicentenaria, advanced clones UH-9, CIP 396311.1, and CIP 399101.1), and four inoculant treatments *(Azotobacter* sp. (T1), *Azotobacter sp.+ Bacillus simplex* (T2), *Azotobacter* sp.+ *B. subtilis* (T3), and *Azotobacter sp.+ B. subtilis+ B. simplex* (T4)) and an uninoculated control (T0) were also used. The variables studied were vegetative vigor, plant height, the number of stems per plant, the number of leaves per plant, fresh and dry weight per plant, tuber diameter, and the number and weight of tubers per plant. Data were statistically processed and analyzed by performing Scott—Knott's comparison of treatments and principal component analysis. Results: The inoculation alone with *Azotobacter* sp. (T1) or with the consortium *Azotobacter sp.+ B. simplex+ B. subtilis* (T4) significantly promoted potato growth with respect to the number of stems and the number of leaves per plant, as well as the weight and number of tubers per plant; for vegetative vigor, the control treatment (T0) obtained differences in comparison with the inoculated treatments. Plant height, the number of shoots, the fresh and dry weight of foliage, and tuber diameter did not show significant differences due to the effect of the inoculation. Interactions between varieties and treatments were found for vegetative vigor, and the number of leaves and tubers per plant was positive for the inoculation with some bacterial consortia. Conclusion: Bacterial consortia with *Azotobacter* sp. were found to promote the growth and productivity of potato varieties for processing under greenhouse conditions.

sciforum-079949: Use and Management of Plant-Associated Microorganisms to Improve Soil Fertility and Date Palm Productivity in an Arid Climate

Mohamed OU-ZINE

Laboratory of Microbial Biotechnology and Bioactive Molecules, Faculty of Sciences and Techniques, Sidi Mohamed Ben Abdellah University, Fez, Morocco

Soil fertility and plant productivity could be improved by using alternatives to chemical products such as compost and soil microorganisms, namely plant-growth-promoting rhizobacteria (PGPR) and arbuscular mycorrhizal fungi (AMF). A study was conducted under field conditions for two growing seasons at a conventional farm located in the Drâa-Tafilalet region in Morocco, characterized by an arid climate. This study was carried out to investigate the effect of four indigenous PGPR strains on nutrient cycling and plant nutrition, the influence of sorghum cultivated in a mixed-cropping system with date palm on soil nutrients and organic matter content as well as on AMF density and infectivity, and the interactive impact of PGPR and mixed cropping on soil fertility and date palm nutrition and productivity. Four treatments were established in this study: compost; compost and sorghum; compost and PGPR; and finally compost, sorghum, and PGPR. Results revealed that mixed cropping with sorghum significantly increased AMF colonization frequency and intensity in date palms, as well as AMF spore density. Sorghum association resulted in a significant increase in soil organic matter concentrations as compared to monocropping soils. In addition to the yield, the mineral composition and caliber of date fruits were significantly improved under the integrated biofertilization approach as compared to the control. The enhancement of soil fertility and date palm productivity under harsh environmental conditions represents a first step towards the adoption of sustainable practices in the region and in similar areas.

Abstracts

SESSION6. Plant Molecular Biology and Plant Genetics, Genomics and Biotechnology

sciforum-084230: Evaluation of the Induction of *Silybum marianum* (L.) Gaertn Polyploidization *Using Colchicine and Oryzalin* and Preliminary Phenotypic Observations

Marcin Ożarowski [1], Aleksandra Deja [2], Anna Forycka [3], Małgorzata Podwyszyńska [4] and Ryszard Słomski [5]

[1] Institute of Natural Fibres and Medicinal Plants
[2] Department of Biotechnology, Institute of Natural Fibres and Medicinal Plants—National Research Institute, Wojska Polskiego 71b, Poznań, Poland
[3] Department of Breeding and Botany of Crops, Institute of Natural Fibres and Medicinal Plants—National Research Institute, Kolejowa 2, Plewiska near Poznań, Poland
[4] Institute of Horticulture—National Research Institute, ul. Konstytucji 3 Maja 1/3, 96-100 Skierniewice, Poland
[5] Department of Biotechnology, Institute of natural Fibres and Medicinal Plants, Wojska Polskiego 71b, Poznań, Poland

Enhancing the quality of crop plants by obtaining more fertile varieties is an important task in world agriculture, and progress in this area is possible thanks to work aimed at improving the adaptive capacity of plants in response to environmental changes. Interesting techniques used in agriculture include biological and biotechnological methods, leading to the induction of genomic mutations by chemical polyploidization using antimitotics.

The aim of thisexperiment is to develop an effective method of inducing polyploidy inSilybum marianum (milk thistle, SILMA variety IWNiRZ-PIB), which is an important medicinal plant of high economic, horticultural and pharmaceutical importance.

In our study, colchicine and oryzalin in various concentrations (0.01%, 0.1%, 0.5%, 1%, 3%) were tested. Seeds and young plants were soakedin solutions of antimitotics in different time periods (48 and 20 h for seeds and 20 and 120 min for young plants). Seed germination and plant survival were observed in terms of the type of antimitotic and its concentration, the exposure time to antimitotics and the plant material. Polyploidization was tested by using flow cytometry.

Results showed that 100% of plants soaked in colchicine and oryzalin (0.1% and 0.01%) survived after minutes, and 80% of plants soaked in colchicine (0.1%) and oryzalin (0.1%) survived for 60 and 120 min, respectively. However only 42% and 40% of seeds sprouted after soaking in colchicine in concentrations at 0.5% and 1%, respectively (100% in control group). The epidermal cells and stomata did not show any negative changes, with a tendency to increase the number of stomata (digital and scanning microscopy). Cytometric analysis showed that in 21.52% of plants with an altered genome (2x + 4x and 4x + 8x and 2x + 4x + 8x), including 17.72% of mixoploid plants, polyploid chimeras (sectoral and mericlinal plants) were obtained. The method using colchicine is more effective for seeds than for young plants (11:3).

sciforum-082626: Influence of He Chitosan—Xerogel Ratio on Rinderol Production and Biomass Proliferation in Transgenic Root Cultures of *Rindera graeca*

Kamil Wierzchowski [1], Bartosz Nowak [1], Mateusz Kawka [2], Katarzyna Sykłowska-Baranek [2] and Maciej Pilarek [1]

[1] Faculty of Chemical and Process Engineering, Warsaw University of Technology, Waryńskiego 1, 00-645 Warsaw, Poland

[2] Department of Biology and Pharmacognosy, Faculty of Pharmacy, Medical University of Warsaw, Banacha 1, 02-097 Warsaw, Poland

A plant's secondary metabolites have vast potential for practical application in pharmaceutical, cosmetic, food, and agricultural industries. The low concentration of secondary metabolites in plant biomass harvested from natural resources limits their use in industrial production. However, modern techniques proposed by biotechnologists and bioengineers allow for the increased efficiency of secondary metabolites production. In the literature, much attention is paid to in situ techniques, which can be applied for bioproduct separation via the absorption of metabolites using additional solid-phase scaffolds incorporated into the culture system.

The study aimed to investigate the influence of chitosan concentration in TEOS-based xerogel (i.e., solid-phase extraction agent) on rinderol production and biomass proliferation of *Rindera graeca* transgenic roots. Cultures were maintained for 28 days in darkness. Biomass was cultured in six independent culture systems:

· (i) biomass without any xerogel (as reference),

· (ii–vi) biomass cultured with a disintegrated form of xerogels enriched by 0%, 5%, 10%, 20%, and 40% of chitosan.

Quantitative analysis was performed to determine the yield of rinderol production in relation to dry biomass weight and the increase in fresh biomass.

The results show the positive impact of chitosan-enriching xerogel on both biomass proliferation and secondary metabolite production. The highest biomass proliferation was observed for the culture containing xerogel with 5% of chitosan. Unexpectedly, this level of concentration of chitosan also stopped the de novo production of rinderol, which was observed in other xerogel-containing culture systems. The highest yield of rinderol, i.e., 762 μg/μgDW, was noticed for the culture containing xerogel with 40% of chitosan.

Funding: This research was funded by the National Science Centre (NCN), Poland, grant no. 2021/41/N/ST8/00958.

sciforum-084223: A Metabolic Engineering Approach to Study the Biological Role of the Indolamines Tryptamine and Serotonin in the Model Species *Solanum lycopersicum*

Gianluca Gambacorta, Stefano Negri, Linda Avesani, Flavia Guzzo and Mauro Commisso

Università degli Studi di Verona (UNIVR—Department of BIotechnology)

Tryptamine (TAM) and serotonin (SER) are secondary metabolites belonging to the class of tryptophan-derived compounds known as indolamines. In recent years, a substantial body of scientific literature has provided evidence that plant indolamines are involved in various biological processes, including biotic and abiotic stress responses, plant morphogenesis, and reproductive events such as flowering and fruit ripening. Although TAM and SER accumulate at high levels (μg/g fw) in the edible fruits and seeds of many plant species, their biological functions in reproductive organs remain unclear, and the metabolic pathways have not yet been characterized in detail. In plants, TAM and SER are generally produced from tryptophan via consecutive decarboxylation and hydroxylation reactions catalysed by the enzymes tryptophan decarboxylase (TDC) and tryptamine 5-hydroxylase (T5H). Recently, we functionally characterized a 3-member *TDC* gene family and a unique *T5H* gene that are involved in the biosynthesis of TAM and SER in tomato. Our findings suggest a model in which the gene *SlTDC1* enables TAM accumulation in fruits, the gene *SlTDC2* allows TAM production in aerial vegetative organs, the gene *SlTDC3* enables TAM production in roots and seeds, and the gene *SlT5H* is responsible for the conversion of TAM into SER throughout the entire tomato plant. Here, we propose a metabolic engineering approach to study the biological role of these two metabolites in the model species *Solanum lycopersicum*. In particular, we are applying both traditional transgenesis and CRISPR/Cas9-mediated gene knockout to produce several transgenic and edited tomato lines in which the normal levels of TAM and SER have been modified. Following the phenotypic characterization of *sltdc*1 knockout mutants, a reduction in the number of reproductive organs was observed compared to the wild-type control. These preliminary results suggest a potential involvement of TAM and SER in reproductive development.

sciforum-079041: A Phylogenetic Survey of Polygalacturonase-Inhibiting Protein1 (PGIP1) in Different Plant Orders

Majid Shouri [1], Samin Seddigh [2], Mahnaz Hourshad [1] and Mehran Zolfaghari [1]

[1] Department of Plant Pathology, Varamin-Pishva Branch, Islamic Azad University, Varamin, Iran
[2] Department of Plant Protection, Varamin-Pishva Branch, Islamic Azad University, Varamin, Iran

Polygalacturonase inhibiting protein 1 (PGIP1) is a protein that is found in plants and plays a major role in plant defense against fungal infections. Phylogenetic analysis of PGIP1 in plants have shown this protein is highly conserved among different plant species. However, there is also evidence of genetic variation in PGIP1 among certain plant species, possibly as a result of the ongoing competition between plants and fungal pathogens. Understanding the evolutionary relationships of PGIP1 can help in the selection of plant species with specific genetic variations that confer enhanced resistance to fungal infections. In current study, the PGIP1 protein reference sequences (RefSeq) belonging to various plant species of different orders including Asterales, Brassicales, Caryophllales, Cucurbitales, Fabales, Malvales, Nymphaeales, Poales, Rosales, Sapindales and Vitales were retrieved from NCBI. Phylogenetic analyses were done using Molecular Evolutionary Genetic Analysis (MEGA; version 11.0). The phylogenetic tree was constructed with the Maximum-Likelihood method, ClustalW algorithm, JTT Matrix-based model and 1000 bootstrap replications. The results showed that all PGIP1 proteins were divided into six different groups, designated as Groups I–VI. Most of the designated groups were supported by more than 30 bootstrap values. Based on the tree, all the samples categorized in different groups. All the species of Brassicales, Cucurbitales and Fabales orders were predominantly found in groups II, III and IV, respectively. Interestingly, species from the same order tended to cluster together within the same sub-branches of the phylogenetic tree. Rosales species were separated in a sub-branch in group I while Poales species were separated as a sub-branch in group V. Phylogenetic analysis showed that evolutionary relationships among different groups of PGIP1 were inevitable. Moreover, within each group, similar amino acid sequences suggested strong evolutionary relationships among different orders. These results indicated that, in plants, PGIP1 are possibly inherited from a common ancestor.

sciforum-079481: CRISPR/Cas-Mediated Genome Editing in Legumes

Sadhana Singh

U.P. Rajarshi Tandon Open University, Prayagraj, India

Legumes are considered one of the important family of angiosperms, which provides significant source of dietary proteins, dietary fibers and minerals, and carbohydrates to the world. They are mainly grown for human consumption, forage, green manure. Legumes also play key role in crop rotation as most of them have symbiotic nitrogen-fixing bacteria in their root nodules. However, legumes are hugely affected by different biotic and abiotic stresses, which limits their growth and productivity. Some of the common legume diseases include downy mildew, Fusarium root rot, Southern blight, common leaf spot etc. On the other hand, drought, and salinity are the major abiotic stresses which limits legume food crops productivity. Thus, considering the nutritional and economic benefits of the legume crops, it is important to equip them with a system that can contribute to multi-stress tolerance and sustainable agricultural productivity. Over the years, sustainable approach against these stresses has been carried out via breeding tolerant cultivars. Despite nature-friendly, long screening and cross breeding protocols confined its usage to control stress and accomplish the objective of global food security. To this end, genomic editing approaches has enabled to master the constraints of conventional breeding methods in identifying the factors and unzipping the barrier which leads to loss of crop yield. Therefore, editing in legume plants in highly accurate and precise manner to perform genome manipulation for improving the desired traits or inducing novel traits towards climate-resilient crop varieties is the targeted goal to fulfill the demand of increasing population. The present study summarizes genome editing in legume crops to manipulate or to perform site specific modification with special emphasis on advancement in CRISPR (clustered regularly interspaced short palindromic repeat) /Cas-mediated (CRISPR-associated) editing of legumes towards attributing resilience against different stressors and increasing the yield.

sciforum-084185: Dissecting the *Sinapis alba* L. Defense Transcriptome, a Potential Donor of Resistance to Alternaria Blight

Reshma Ahmed and Priyadarshini Bhorali

Department of Agricultural Biotechnology, Assam Agricultural University, Jorhat-785013, Assam, India

Crop wild relatives (CWRs) are close weedy relatives of plant species which are generally underestimated because of their undesirable characters and lesser yield potential. However, these species carry many useful alleles and agronomic traits and therefore, could serve as significant resources for transfer of such genes to cultivated germplasms. *Sinapis alba* L. or white mustard is a member of the *Brassicaceae* family and a CWR of the oilseed *Brassica* spp., that possesses resistance to biotic/abiotic stresses like Alternaria blight and drought. The attempts to introgress such traits from *S. alba* to cultivated rapeseed and mustard germplasms have largely been unsuccessful, which necessitates the utilization of modern biotechnological tools to develop resistant cultivars. In our study, we validated the resistance in *S. alba* against the common and serious necrotrophic fungal pathogen *Alternaria brassicicola*, and characterized the interaction between the two. Subsequently, we performed a transcriptomic analysis to dissect the defense responses in *S. alba*, against the pathogen. The study established *S. alba* to be resistant to the Alternaria pathogen and presented new insights into its defense machinery in the form of a comprehensive dataset of genes and transcription factors modulated specifically in response to *A. brassicicola*, paving a way towards the development of Alternaria resistant oilseed Brassicas.

sciforum-084274: Effect of UV-C Radiation on Genomic Variation in Chlamydomonas Reinhardtii

Rosa Paola Radice [1,2], Vincenzo De Fabrizio [3], Luigia Gravino [1], Antonio Scopa [1], Marios Drosos [1] and Giuseppe Martelli [1]

[1] University of Basilicata
[2] Bioinnova srls
[3] University of Salerno

Microalgae are unicellular organisms characterized by a genome with all the information necessary to cope with normal physiological functions, as well as very strong selective pressures such as light and pH variation or nutrient starvation. Therefore, it is possible to hypothesize that they possess molecular tools (e.g., methylation, acetylation, mutagenesis or recombination) that allow them to reorganize the genomic and transcriptomic apparatus to support selective pressures of different natures. Furthermore, generally, mutagenesis represents a force capable of inducing a modification in the genomic structure, which can be lethal if not well managed. The present work implemented a mutagenesis protocol through UV-C radiation on the microalgal Chlamydomonas reinhardtii. Usually, UV-C is used to sterilise and kill microorganism, so we tried to manage the time exposure to induce genomic variation and evaluate the survival capacity of C. rehinartdtii. In this way, we obtained different mutated genotypes efficiently and selected the ones with the best biomolecular characteristics, specifically surviving ability and growth rate. These studies highlight a genetic distance between the wild type and the probable mutants exposed for three different times on UV-C (96 min, 48 min and 12 min). Furthermore, the irradiation directly affects the chlorophyll concentration, mirroring the genetic differentiation obtained during mutagenesis.

sciforum-079788: Efficient Dual-Gene Targeting AGAMOUS-Like Genes in Domestic Apple

Amy Leigh Klocko

University of Colorado Colorado Springs

Targeted genome editing has made it possible to obtain precise changes in one or more genes of interest across a variety of plant species. The application of this technique will benefit from increased knowledge of the efficacy of the approach and the potential impact of a retained CRISPR-Cas9 editing system in species where breeding away the transgene is not practical. One example is domestic apple, a valuable fruit crop with an extended juvenile period and obligatory outcrossing. Here, we used CRISPR-Cas9 constructs with two guide RNAs to target two *AGAMOUS*-like genes in two cultivars of domestic apple. Of the 38 CRISPR-Cas9-transformed events obtained, most events (35, 92%) had at least one genetic change, and 13 events (37%) had changes to all four target alleles. The characterization of mutation types revealed that most changes were large or small deletions. We did not observe any inversions or large insertions. Many of the mutations obtained were predicted to alter the reading frame and lead to early stop codons. As trees varied in both the number and type of altered alleles, the full phenotypic impact of the genetic changes will likely cover a spectrum of phenotypes. As both targeted genes are predicted to be key for floral organ identity and floral meristem determinacy, it is anticipated that the flowers will vary in form and morphology. The trees are currently in their juvenile phase, and thus it will be some time before floral features can be observed. As the trees have a retained CRISPR-Cas9 editing system, this additional time will provide an opportunity for determining whether there is continued CRISPR-Cas9 activity in trees with currently un-edited alleles.

sciforum-080102: Enhancing the Potential of Plant Microbial Fuel Cells: The Influence of Botanical Characteristics on Bioelectrical Performance

Ilaria Brugellis [1], Silvia Assini [1], Marco Grassi [2] and Piero Malcovati [2]

[1] Department of Earth and Environmental Science, University of Pavia
[2] Department of Electrical Computer and Biomedical Engineering, University of Pavia

Plant microbial fuel cells (PMFCs) represent an innovative type of microbial fuel cell technology, utilizing plant rhizodeposition to fuel electrochemically active bacteria on the anode surface, thereby generating bioelectricity. This review delves into various botanical aspects of plant species employed in PMFCs, aiming to investigate whether their electrical performance varies based on distinct life forms and root systems.

For each plant species, we conducted a thorough investigation encompassing three key aspects: (I) nomenclature; (II) Raunkiær life form; and (III) root architecture. To compile pertinent information, we conducted an exhaustive search for original articles detailing PMFC experiments, utilizing the Clarivate search tool. Every plant name and Raunkiær life form underwent rigorous verification against the POWO database and cross-referenced with the flora native to the species' origin. Root architecture was categorized into three main groups: (1) taproot; (2) adventitious; and (3) fibrous, as confirmed by the TRY Plant Trait Database.

Regarding the collection of electrical performance data, we excluded species under specific conditions: (a) when only voltage or current values were provided; (b) when average power and peak power values were exceedingly similar; and (c) when power density values fell below 1 $\mu W/m^2$ or exceeded 950 mW/m^2. Ultimately, our study involved 46 plant species and 42 documents.

Our analysis unveiled noteworthy disparities, with the epiphyte/chamaephyte/nanophanerophyte group differing significantly from geophytes, and therophytes and hemicryptophytes exhibiting the highest median values. Additionally, we observed significant differences among the root architecture groups, with the taproot group registering the highest median value. These findings underscore the impact of plant life forms and root systems on electrical performance in PMFCs. Nevertheless, we acknowledge that our results may be subject to limitations due to the absence of a standardized benchmark for electrical measurements, necessitating approximations of power density values.

sciforum-084006: Evaluating the Effect of Different Self-Pollination Methods on Nut Set and Nutlet Abscission in Macadamia

Palakdeep Kaur, Joanne De Faveri, Max Cowan, Mobashwer Alam and Bruce Topp

Queensland Alliance for Agriculture and Food Innovation, The University of Queensland, St. Lucia, QLD, Australia

Nut set is an important component of yield and is one of the key factors determining the orchard profitability. The intricate process of nut setting is influenced by numerous factors, with pollination being a pivotal mechanism. Macadamia exhibits both self- and cross-pollination. While pollinators contribute significantly to cross-pollination, their role in improving nut set in self-pollinating cultivars remain unexplored. To ensure sustainable yield in the absence of pollinators, macadamia breeding program focuses on the development of self-fertile cultivars, which emphasises the need of evaluating nut setting by different self-pollination methods. Hence, this study was aimed to investigate nut setting and nutlet abscission in three controlled self-pollination methods. The treatments were: (i) Autogamy, AG (bagging before anthesis, no hand-pollination), (ii) Geitonogamy 1, GG1 (bagging followed by hand pollination using pollens from the same raceme), and (iii) Geitonogamy 2, GG2 (bagging followed by hand pollination using pollens from different raceme of the same cultivar), which were compared with open pollination, OP (natural pollination). In September 2022, this experiment was conducted on four cultivars 'HAES 791', 'HAES 741', 'HAES 344' and 'A16'. Results revealed that nut setting in OP was significantly higher than that of self-pollination methods, suggesting the contribution of cross-pollination to the productivity. 'HAES 741' and 'HAES 791' exhibited self-fertility with an average of 0.53 and 1.0 final nut set per raceme respectively. In contrast, 'HAES 344' and 'A16' were self-infertile. Interestingly, no significant differences in nut set and nutlet abscission were observed between AG, GG1 and GG2. Therefore, artificial pollination or pollinators may not be required for sustainable yield in self-pollinated macadamias AG, GG1 and GG2. Therefore, artificial pollination or pollinators may not be required for sustainable yield in self-pollinated macadamias.

sciforum-084229: Genome-Wide Analysis of Cation/Proton Exchanger (CAX) Gene Family in *Vitis vinifera* L.

Catarina Estêvão [1], Raquel Mendes [2], Lénia Rodrigues [1], Catarina Campos [1], Mónica Marques [1] and Hélia Cardoso [3]

[1] MED—Mediterranean Institute for Agriculture, Environment and Development & CHANGE—Global Change and Sustainability Institute, Instituto de Investigação e Formação Avançada, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

[2] Escola de Ciências e Tecnologia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

[3] MED—Mediterranean Institute for Agriculture, Environment and Development & CHANGE—Global Change and Sustainability Institute, Escola de Ciências e Tecnologia, Departamento de Biologia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portug

Cation/proton exchangers (CAX) are proteins that export cations from the cytosol to maintain optimal ionic concentrations in cells. Being associated to calcium homeostasis and signalling, CAX are essential for plant growth, development, and stress response. CAX family members are grouped into three subfamilies named CAX type I, II, and III. Plants are characterized by the presence of members only belonging to CAX type I (similar to *Arabidopsis thaliana* CAX1) subfamily.

In *Vitis vinifera* L., genome-wide analysis allowed the identification of five CAX genes (VviCAX) homologous of AtCAX sequences (sequences retrieved from *A. thaliana* were here used as queries at grapevine genome databases and the resulting sequences as secondary queries). Sequence analysis revealed a conservation of gene structure with three VviCAX genes exhibiting the most common structure composed by eleven exons, while the other two genes presented twelve and fourteen exons due to events of intron gain.

To classify the identified five VviCAX sequences, a phylogenetic tree was constructed using CAX sequences of different *Magnoliophyta* species, and *Saccharomyces cerevisiae*'s and *Escherichia coli*'s CAXs as outgroup sequences. Phylogenetic tree showed a clear separation of VviCAX sequences in the two main clusters of plant CAXs: type I-A and type I-B. As expected, the CAXI-A cluster integrates AtCAX1, AtCAX3, and AtCAX4, and I-B integrates AtCAX2, AtCAX5, and AtCAX6. While two VviCAX members were clustered in the CAXI-A, three members were grouped in the CAXI-B.

Aiming to correctly classify the VviCAX members, a comparison with the known members integrated in the same cluster was done. However, a lack of consistency in the labelling of CAXs genes was noted. With the goal of establishing a consistent standard pipeline for CAX gene annotation, we here propose a new classification scheme according to identified trends, based on protein phylogenies and sequence harmony method.

sciforum-084235: Genome-Wide Identification and Expression Analysis of *PIN* Gene Family during Adventitious Rooting of *Juglans regia* L. Microcuttings

Mónica Sofia Marques [1], Rita Pires [1], Catarina Estevão [1], Lénia Rodrigues [1], Valeriya Ustymenko [1], Catarina Campos [1], Augusto Peixe [2] and Hélia Cardoso [3]

[1] MED—Mediterranean Institute for Agriculture, Environment and Development & CHANGE—Global Change and Sustainability Institute, Instituto de Investigação e Formação Avançada, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

[2] MED—Mediterranean Institute for Agriculture, Environment and Development & CHANGE—Global Change and Sustainability Institute, Escola de Ciências e Tecnologia, Departamento de Fitotecnia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Port

[3] MED—Mediterranean Institute for Agriculture, Environment and Development & CHANGE—Global Change and Sustainability Institute, Escola de Ciências e Tecnologia, Departamento de Biologia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portug

Walnut tree *(Juglans regia* L.) is one of the most widely spread crops worldwide, highly valued for its fruits. The propagation of *J.regia* cultivars is mostly done through grafting based on seed propagation or through in vitro microcuttings. However, even when used optimized in vitro protocols several walnut cultivars exhibit a recalcitrant behavior upon the stimulus of adventitious roots development (AR). The auxin indole-3-butyric acid (IBA) is the phytohormone most used in AR protocols. Genes involved in IBA metabolism, including auxin influx/efflux transporters, have been widely characterized in several plant species due to their involvement in AR formation (Velada et al., 2020).

PIN-Formed Auxin Efflux Carrier genes encode one of the most important group of polar auxin transporters in plants, being involved in many developmental processes (Cardoso et al., 2022). To further investigate the involvement of *PIN* in AR efficiency in walnut genotypes, an in silico characterization of this gene family was performed. *PIN* sequences retrieved from *Olea europaea* were used as queries in walnut tree genome databases (https://plants.ensembl.org/index.html), and the resulting sequences were used as secondary queries.

In total, fourteen *JrPIN* genes were identified, exhibiting a well-conserved exon-intron structure, with most members comprising six exons. To classify the identified *JrPIN* sequences, a phylogenetic tree was constructed using *PIN* sequences of nine Magnoliopsida species. Cluster analysis showed a distribution of the *JrPIN* members across 5 *PIN* subfamilies, with some members belonging to the canonical proteins, characterized by larger sequences comprising a central hydrophilic intercellular loop (HL) (named *JrPIN1a* to *JrPIN1f*, *JrPIN2a* to *JrPIN2b* and *JrPIN3a* to *JrPIN3b*), and 4 members grouped as non-canonical proteins (*JrPIN5* and *JrPIN8a* to *JrPIN8c*), characterized by shorter sequence lacking the HL. Details related with protein features and exon-intron sequence analysis will be presented.

sciforum-084221: Optimization of Enzymatic Production in Tamarillo (*Solanum betaceum* Cav.) Cell Suspension Cultures Using Chemical Elicitation

Bruno Miguel Ferreira Casimiro [1], Jorge Canhoto [1], Paula Veríssimo [2] and Sandra Correia [1,3]

[1] University of Coimbra, Centre for Functional Ecology, TERRA Associate Laboratory, Department of Life Sciences

[2] Centre for Neuroscience and Cell Biology, University of Coimbra, Faculty of Medicine, Polo I, 1st floor, 3004–504, Coimbra, Portugal

[3] InnovPlantProtect CoLAB, Estrada de Gil Vaz, 7350-478 Elvas, Portugal

Plant cell suspensions (PCSs) are sustainable and efficient systems for producing high-quality molecules characterized by rapid growth and protein consistency within controlled bioreactors and contained environments. Integrating molecular farming platforms, these systems address contamination issues associated with viral or bacterial toxins. Nonetheless, challenges persist, including scalability for mass production in specific systems and a limited diversity of PCS cultures, which hinders the exploration of novel compounds with biological interest.

Histone acetylation is closely linked to heightened transcription levels. Consequently, the application of histone deacetylase inhibitors, such as suberoylanilide hydroxamic acid (SAHA), is anticipated to elevate mRNA and protein levels. In a previous study (doi: 10.3390/plants12010190), we successfully established tamarillo-induced callus line (ICL) PCS cultures. Using various biotic elicitors, we induced the production of hydrolytic biocatalysts and low molecular weight peptides (>20 kDa), specifically glycosidases, alkaline phosphatases, and proteases, in tamarillo ICL PCS cultures.

In the present work, we aimed to optimize the previously employed elicitation strategy, specifically testing the effect of the histone deacetylase inhibitor SAHA to further enhance the production of hydrolytic biocatalysts. The results demonstrated a significant enhancement in specific biocatalyst production in SAHA-elicited tamarillo PCS cultures, complementing the effects of previously used elicitors.

This study reports, for the first time, the use of a histone deacetylase inhibitor as an elicitor for hydrolytic biocatalyst production in ICL PCS, optimizing the elicitation strategy and contributing to overcoming the typical low-yield biocatalyst production of PCS. This advancement is a crucial step forward in the potential scale-up of these systems for bioreactor production.

sciforum-082760: Presence of Tomato Brown Rugose Fruit Virus (ToBRV) in Tomatoes from the Southern Peruvian Coast

Pedro Rodriguez-Grados [1], Carla L Saldaña [2], Richard Estrada [3], Wilian Salazar [3], Sergio Contreras-Liza [1] and Carlos I. Arbizu [2]

[1] Universidad Nacional José Faustino Sánchez Carrión
[2] Universidad Nacional Toribio Rodríguez de Mendoza de Amazonas
[3] Instituto Nacional de Innovación Agraria

Tomato (*Solanum lycopersicum*) (Solanaceae) is an important vegetable crop worldwide that contains significant amounts of vitamins A and C. It also possesses a powerful antioxidant, lycopene, which can help prevent the development of many forms of cancer. However, this vegetable is highly susceptible to a number of emerging viruses. Since the first report of ToBRFV in Jordan, this emerging virus has been detected in Germany, Israel, Italy, Mexico, Palestine, and the United States, but its incidence was not reported in Peru. We collected 56 samples of fresh leaves of tomato plants with viral symptoms and 13 without symptoms as control from two regions that comprise more than 50% of tomato production in Peru, Lima and Ica. Mosaic, mottling, plant stunting and brown rugose symptoms were observed in collected leaves that were preserved in liquid nitrogen until processing. We extracted RNA using a commercial Kit. For virus identification, we used the reverse transcription polymerase chain reaction (RT-PCR) technique for the amplification of the capside protein (cp) gene. Specific primers were designed using the NCBI tool by collecting all available cp sequences from Peru Tomato mosaic virus (PToMV) and Tomato Brown Rough Fruit Virus (ToBRV). Results were observed on 1.5% agarose gels using Gelred(Biotium®, Fremont, CA, USA) and by standard spectrophotometry. We observed the presence of ToBRFV in 24 samples, PToMV in 8 samples and 11 samples presented a mixed infection with ToBRV and PToMV. To the best of our knowledge, this is the first report of ToBRFV in Peru.

sciforum-082647: Proliferation of *Rindera graeca* Hairy Roots on Polymeric Scaffolds

Szymon Bober [1], Kamil Wierzchowski [1], Rafał Podgórski [1], Piotr Kowalczyk [1], Mateusz Kawka [2], Katarzyna Sykłowska-Baranek [2], Tomasz Ciach [1] and Maciej Pilarek [1]

[1] Faculty of Chemical and Process Engineering, Warsaw University of Technology, Waryńskiego 1, 00-645 Warsaw, Poland

[2] Department of Biology and Pharmacognosy, Faculty of Pharmacy, Medical University of Warsaw, Banacha 1, 02-097 Warsaw, Poland

Plants are the greatest source of anticancer medicaments all over the world. The application of in vitro methods to plant tissue cultures allows increasing biomass proliferation and maximizing the productivity of secondary metabolites. Various in vitro techniques are proposed to intensify plant biomass cultures for anticancer metabolite production. Literature data indicate that plant biomass immobilization is one of the most efficient techniques to significantly increase biomass proliferation and the yield of secondary metabolite secretion. The application of polymeric-based scaffolds for plant biomass immobilization may be an easy and inexpensive way of supporting culture systems for hairy roots bioengineering.

The aim of the study was to quantitatively identify the influence of four various polymeric constructs on biomass proliferation and naphthoquinone derivative secretion in cultures of *Rindera graeca* hairy roots. Biomass was independently immobilized on polymeric constructs made of pure and certified polylactic acid (PLA), acrylonitrile styrene acrylate (ASA), acrylonitrile butadiene styrene (ABS), and nylon (N). Different shapes and surfaces of scaffolds were applied. As a reference system, a culture of non-immobilized biomass without any polymeric constructs was performed. The increases in the fresh biomass and naphthoquinone derivative concentration in culture systems were determined quantitatively.

The immobilization of hairy roots on PLA greatly increased fresh biomass, while immobilization on N had no significant impact on biomass proliferation. The application of ASA and ABS even decreased the level of fresh biomass in comparison to the reference culture system. The most effective in increasing proliferation was the polymeric scaffold made of PLA 90, which stands for an overhang angle in 3D printing. Naphthoquinone derivatives have been noticed only in the culture immobilized on a ball-shaped PLA. In other cultures, naphthoquinone derivative concentration did not reach the detection threshold.

Funding: This research was funded by the National Science Centre (NCN), Poland, grant no. 2021/41/N/ST8/00958.

sciforum-084433: Search for Polymorphisms Responsible for Shifting Fatty Acid Biosynthesis in Sea Buckthorn Fruits

Anastasia A. Turba [1], Roman O. Novakovskiy [1], Ekaterina M. Dvorianinova [1], Pavel A. Predushchenko [1], Yury A. Zubarev [2], Nataliya V. Melnikova [1] and Alexey Dmitriev [1]

[1] Engelhardt Institute of Molecular Biology, Russian Academy of Sciences

[2] Lisavenko Research Institute of Horticulture for Siberia

Sea buckthorn (*Hippophae rhamnoides* L.) has valuable nutritional and medicinal properties. Biologically active oils of sea buckthorn are contained in the seed and pulp of the fruit. The high content of palmitic acid (C 16:0) in the pulp (about 36%) limits the development of sea buckthorn production, but this characteristic can be improved. Thus, through chemical mutagenesis of seeds of the variety Panteleevskaya, varieties Elizaveta (treatment with diethyl sulfate) and Inya (treatment with nitrosodimethylurea) were obtained. These varieties have reduced palmitic fatty acid (FA) content (23% and 19%, respectively) and increased valuable palmitoleic (FA) content (C 16:1, 56% and 62%, respectively) in the pulp. At present, the genetic basis of the shift in oil FA composition in Elizaveta and Inya is unknown. To investigate this question, we sequenced the genomes of Panteleevskaya, Elizaveta, and Inya using the Illumina platform and obtained 93, 86, and 81 million reads of 150 + 150 bp, respectively, which corresponds to approximately 30-fold genome coverage. The resulting reads were trimmed for quality and filtered for length (trimmomatic) and mapped to the sea buckthorn reference genome (http://hipp.shengxin.ren/) using the BWA. The percentage of the reference genome coverage was 94% for each variety. The search for polymorphisms with BCFtools revealed that Elizaveta had 21872 SNPs and 6295 InDels and Inya had 196064 SNPs and 5605 InDels compared to the parental variety, Panteleevskaya. Further analysis will be focused on identifying mutations in genes involved in FA synthesis. Our data are needed to understand the mechanisms of palmitoleic FA synthesis and to develop marker-assisted selection of sea buckthorn to create varieties with high palmitoleic FA and low palmitic FA in fruit pulp. This work was financially supported by the Russian Science Foundation, grant 23-46-00026.

sciforum-084152: The Effect of BAP Concentration and Salt Strength of MS Medium on the In Vitro Shoot Growth and Multiplication of *Passiflora edulis* var. Horana Gold

Devindee Lakdika Senanayake and Tara D. Silva

Department of Plant Sciences, Faculty of Science, University of Colombo, Sri Lanka

A high-yielding passion fruit variety named *Passiflora edulis* var. Horana Gold was developed in Sri Lanka, aiming to boost profitability in commercial cultivation. Testing the micropropagation of the new variety was intended to produce quality planting materials affordably.

In vitro shoot growth and multiplication are influenced by the presence of plant growth regulators and the salt strength of the medium. In this investigation, different concentrations (0.00, 3.00, 4.00, 5.00, 10.00 mg L^{-1}) of the cytokinin 6-Benzylaminopurine (BAP) were employed on full-strength Murashige and Skoog media (MS) and on half strength MS media (½ MS) to identify optimal conditions for shoot tip culture. A minimum of 15 replicate bottles per treatment, each containing four shoots, were maintained in a completely randomized design. After six weeks of incubation, shoot height and the number of shoots and leaves per explant were obtained. The data were analyzed using Minitab Statistical Software (Version 21).

Shoot growth parameters significantly varied with BAP concentration and salt strength ($p \leq 0.05$). In terms of both mean shoot height (1.4–2.2 cm) and mean number of leaves per explant (1.3–4.5), shoots performed better on MS than on ½ MS (1.5–1.9 cm, 1.2–2.8). The interaction between BAP concentration and salt strength was not significant ($p > 0.05$) for the mean number of shoots per explant, although concentrations of 3.00, 4.00 and 5.00 mg L^{-1} of BAP consistently resulted in significantly higher mean shoot numbers per explant on both MS (3.8–4.6) and ½ MS (3.0–3.5).

In summary, BAP concentrations of 3.00, 4.00 and 5.00 mg L^{-1} can be recommended for the optimum shoot multiplication of shoot tip culture of *P. edulis* on MS and ½ MS media to obtain cost-effective superior planting materials.

sciforum-084684: The Effect of Sucrose and a Gelling Agent on the Direct Somatic Embryogenesis Capacity of Decaffeinated Genotypes of *Coffea arabica* L.

Julieta Andrea Silva de Almeida [1], Maria Bernadete Silvarolla [1], Julio César Mistro [1], Paulo Sérgio da Silva Coelho [2] and Elaine Mantovani Satorres [1]

[1] Centro de Café "Alcides Carvalho", Instituto Agronômico de Campinas, Campinas, São Paulo, Brasil
[2] Centro de Horticultura, Instituto Agronômico de Campinas, Campinas, São Paulo, Brasil

The global coffee market is prosperous and can grow further with the availability of low-caffeine coffees created with genetic improvement. However, the multiplication of these plants by seed germination is avoided due to genetic segregation, and indirect or direct somatic embryogenesis is recommended. In the direct route, *Coffea arabica* forms few somatic embryos. The osmotic concentration of the culture medium can affect the somatic embryogenesis of different species. This study aimed to evaluate the effect of sucrose and a gelling agent on the direct somatic embryogenesis of low-caffeine genotypes. Leaves collected from thirteen genotypes of *C. arabica* plants in the F3 generation and from the Obatã and Catuaí Vermelho cultivars belonging to the low-caffeine breeding program of the Instituto Agronômico de Campinas, SP, were used. Explants obtained from these leaves were subjected to the direct route. For this purpose, a culture medium with half the concentration of MS salts with 10 μM of 2-Isopentenyladenine and the addition of 20 or 30 g/L of sucrose and gelled with 5 g/L of agar or 2 g/L of Phytagel was used. Each treatment consisted of ten replications. Explants of all genotypes formed somatic embryos, but 2, 7 and 14 had lower responses. Explants of the 13 genotypes in the presence of 20 g/L of sucrose with agar or Phytagel formed a total of 1821 and 2645 somatic embryos, respectively. However, those treated with 30 g/L sucrose and Phytagel had 3775 embryos. The combination of 20 g/L of sucrose and agar is standard for direct pathway induction in *C. arabica*. However, Phytagel combined (or not) with 30 g/L of sucrose caused a change in the osmotic concentration of the culture medium, which promoted the direct genotype pathway. These results indicate that the osmotic concentration may participate directly or indirectly in the control of the direct somatic embryogenesis of *C. arabica*.

sciforum-084209: Zucchini *TINY4* Gene Regulates Plant Development through Brassinosteroid Signalling Pathway

Lorena Asensio, Carmen Capel, Ricardo Lebrón, Ana Suárez-Alcaraz, Rafael Lozano and Juan Capel

Area of Genetics, Dept. of Biology and Geology, University of Almeria

Brassinosteroids (BRs) are steroid plant hormones necessary for the regulation of physiological processes essential for plant growth and survival. The analysis of mutants altered in these responses has provided insight into the genes involved in the BRs signalling pathway, identifying the molecular components essential for perception and transmission of this hormonal signal. The characterization of a collection of EMS mutants of *Cucurbita pepo* morphotype Zucchini allowed us to select five mutants that show alterations in vegetative development, which we have called *tiny* (*tin1*/5) due to their small plant size. In this work, by combining whole-genome sequencing and mapping of molecular markers of codominant inheritance, it has been possible to identify the first known mutant allele of the zucchini *TINY4* gene, homologous to the *SERK* (*SOMATIC EMBRYOGENESIS RECEPTOR-LIKE KINASE*) gene of *Arabidopsis thaliana*. *SERK* encodes a protein kinase with leucine-rich repeats (LRR-RLK) located in the plasma membrane, which together with two other LRR-RLK proteins, namely BRASSINOSTEROID-INSENSITIVE1 (BRI1) and BRI1-ASSOCIATED KINASE1 (BAK1), form a complex for perception and signalling of brassinosteroid. The *bri1* mutant is characterized by short petioles and inward-curved leaves. The *serk* mutation enhances these phenotypic traits, and thus the *bri1 serk* double mutant show reduced petiole length, smail rosette size and excessive leaf curl. The zucchini *tin4* mutant exhibits severe compaction of the vegetative organs of the plant, caused by reduced petiole size of leaves and stems, a phenotype that resemble the *Arabidopsis bri1 serk* double mutant. To confirm that the *tin4* mutation is responsible for the mutant phenotype, new loss-of-function alleles of this gene are being generated using CRISPR-Cas9 gene editing technology. These results will contribute to the functional genomics of this species and provide further insight into the functionality of the *TIN4* gene in the brassinosteroid perception pathway and thus in vegetative morphogenesis of zucchini.

Abstracts

SESSION7. Plant Modeling and Bioinformatics

sciforum-076952: Conserved Motifs Identification of Polygalacturonase-Inhibiting Protein1 (PGIP1) in 19 Species of Plants

Majid Shouri [1], Samin Seddigh [2], Mahnaz Hourshad [1] and Mehran Zolfaghari [1]

[1] Department of Plant Pathology, Varamin-Pishva Branch, Islamic Azad University, Varamin, Iran
[2] Department of Plant Protection, Varamin-Pishva Branch, Islamic Azad University, Varamin, Iran

Polygalacturonase-inhibiting proteins1 (PGIP1) is a plant protein found in plants that plays a crucial role in plant defense against pathogenic microorganisms. Motifs of PGIP1 binds to and blocks the activity of polygalacturonases, which are enzymes produced by plant pathogens to degrade plant cell walls. The conservation of PGIP1 suggests that it may have a fundamental function in plant biology. Generally, the conserved motif of PGIP1 plays a vital role in plant immunity, development, and stress responses. The identification and characterization of conserved motifs are critical for understanding the molecular mechanisms and evolutionary relationships of proteins. In this research, a total of nineteen PGIP1 protein sequences of eleven different orders in plants (Asterales, Brassicales, Caryophllales, Cucurbitales, Fabales, Malvales, Nymphaeales, Poales, Rosales, Sapindales and Vitales) were retrieved from NCBI. The motifs of protein sequences were found using the program of Multiple Em for Motif Elicitation (MEME; version 5.5.2) and Motif Alignment and Search Tool (MAST; version 5.5.2) at website https://meme-suite.org. A protein conserved motif refers to a specific amino acid sequence pattern that appears in multiple proteins across different species. The parameters of MEME analyses were applied as follows: minimum width for each motif, ten; maximum width for each motif, thirty; maximum number of motifs to find, eight and number of repetitions, zero or one per sequence. Based on the results, only two motifs (motif 4 and motif 5), were common in all sample:

Motif 4: IPSSLSTLPNLEALHLDRNKLTGTIPESFG

Motif 5: WTNLSGPVPDFLSQLKNLTFLDLSFNNLSG

All motifs width was 30aa except motifs 6 and 7 with 25 and 21 residues, respectively. Motifs seven, eight and six had the most E-value among all motifs which were 3.7e-123, 2.2e-148 and 6.6e-180, respectively.

Motif 7: SLTILDLNHNKIYGSIPVQLT

Motif 8: FKGKVPYLYLSHNQLSGKIPASLGNVDFNR

Motif 6: PYHLASWDPETDCCDWYCVECDDTT

Common conserved motifs among different plant species confirmed PGIP1 protein functional similarities.

sciforum-082749: Effect of Planting Density on *Pinus radiata* Growth and Branch Diameter before Canopy Closure

Daniel Bozo [1,2], Rafel Rubilar [1,2], Juan Carlos Valverde [3], Timothy Albaugh [4], Rachel Cook [5], Otavio Campoe [6], David Carter [7], Matias Pincheira [8], Juan Carlos Valencia [8] and Oscar Jara [2,3]

1 Cooperativa de Productividad Forestal, Departamento de Silvicultura, Fac. Ciencias Forestales, Universidad de Concepción, Concepción, Chile
2 Centro Nacional de Excelencia para la Industria de la Madera (CENAMAD), Pontificia Universidad Católica de Chile, Vicuña Mackenna 4860, Santiago, Chile
3 Cooperativa de Productividad Forestal, Departamento de Silvicultura, Fac. Ciencias Forestales, Universidad de Concepción, Concepción, Chile
4 Forest Productivity Cooperative, Virginia Tech, Department of Forest Resources and Environmental Conservation, 228 Cheatham Hall, Blacksburg, VA 24601, United States
5 Forest Productivity Cooperative, Department of Forestry and Environmental Resources, North Carolina State University, Raleigh, NC 27695-8008, USA
6 Forest Productivity Cooperative, Universidade Federal de Lavras, Departamento de Ciências Florestais, Lavras, Minas Gerais, Brazil
7 Forest Productivity Cooperative, Virginia Tech Department of Forest Resources and Environmental Conservation, 228 Cheatham Hall, Blacksburg, VA 24061, USA
8 Forestal Mininco S.A., Avenida Alemania 751, Los Ángeles, Chile

Initial planting density is probably one of the most important silvicultural decisions affecting forest productivity and value. Although lower planting densities generate less total volume, a larger number of final crop trees reach larger diameters at a younger age for sawtimber. However, low densities may result in larger branches due to individual tree crown expansion and reduced stem quality, and require modelling branch growth to adjust the time of pruning to obtain better quality wood products. The objective of this research was to evaluate the annual growth and branch diameter growth of *Pinus radiata* until the onset of canopy closure for three initial planting densities. This study was established in July 2016, on a well-drained sandy soil site, with a mean temperature of 13.2 °C and precipitation of 851 mm, in the central valley of Chile. The experimental design consisted of a complete randomized block design with three replicates, comparing 1242, 816 and 649 tree ha^{-1} initial planting density treatments. Each year since establishment, individual tree measurements of diameter at breast height (DBH) and total height (HT) were completed. In each plot, three trees were selected considering site treatment diameter distribution, and all branch diameters (BDs) were measured along the stem until 5 m height. At age 7, there were no differences betweenplanting densities in terms of HT and survival ($p > 0.05$). The best DBH was 10.4 cm for 649 tree ha^{-1} and the lowest DBH was 9.1 cm for 1242 tree ha^{-1}. However, the best volume response was at the highest density, with 29.4 for 649 trees ha^{-1}, versus 20.2 m^3 ha^{-1} for 1242 trees ha^{-1}. Interestingly, a linear relationship was observed between DBH and mean BD ($r^2 = 0.89$), with the highest BD in the lowest planting density with 5% of branches >3 cm; contrastingly, the highest density showed only 0.9% of branches >3 cm.

sciforum-082835: Hot and Cold: Mathematical Modeling of Temperature Sensing in Arabidopsis and Wheat

Pablo Gonzalez Suarez [1], Julia Qüesta [2], Steven Penfield [3], Laura Dixon [1] and Rea Antoniou-Kourounioti [4]

[1] University of Leeds
[2] Centre for Research in Agricultural Genomics
[3] John Innes Centre
[4] University of Glasgow

Plants have sophisticated strategies to perceive environmental stimuli and adapt their development accordingly. Specifically, temperature is one of the main cues that impact plant development and, as such, various thermosensing mechanisms exist in the plant kingdom. Most signals involved in thermosensing have been identified through experiments performed under laboratory conditions on the model plant Arabidopsis thaliana. However, not much is known about how these operate under realistic conditions or in crops such as hexaploid wheat (Triticum aestivum). Here, we have combined bioinformatic and mathematical modelling approaches to better understand plant responses to realistic temperature experiences in both A. thaliana and T. aestivum. First, we have characterized the whole-transcriptome profile of A. thaliana plants exposed to realistic cooling scenarios and identified potential candidate components for the thermosensing machinery. These have been used to guide the development of a mathematical model aiming to describe the cold sensing mechanism quantitatively. In a separate field experiment, wheat plants have been exposed to distinct winter experiences and their response has been studied at the transcriptomic level. Based on this and using the model previously designed for A. thaliana as a reference, we now aim to characterize the mechanism that underlies temperature sensing in T. aestivum. Wheat is the primary arable crop in the United Kingdom and, as such, a better understanding of its developmental response to realistic temperature experiences and, particularly, warming, is fundamental to ensure future food security. The framework presented here provides a key starting point to achieve this and will be key to direct further research in the field.

sciforum-080365: Synthesis of Acibenzolar-S-Methyl Analogs Derived from Salicylic Acid and 4-Hydroxybenzaldehyde: DFT B3LYP Computational Study and Molecular Docking against Enzymatic Targets of Biological Interest

Diego Quiroga, Daniel Rodriguez and Ericsson Coy-Barrera

Universidad Militar Nueva Granada

One of the primary challenges in Colombian flower exports at the agricultural level is the prevalence of quarantine pests, specifically Frankliniella occidentalis. These pests have resistance to a broad spectrum of insecticides commonly employed for their control. Acibenzolar-S-methyl is a stimulant for Systemic Acquired Resistance (SAR) in plants. Its efficacy has been substantiated in the treatment of various crops, including tomatoes, cucumbers, tobacco, rice, and cocoa, exhibiting protective properties against fungal, bacterial, viral, and nematode attacks. The synthesis of two categories of acibenzolar-S-methyl analogs was performed. The first category encompasses derivatives of alkyl benzo[d][1,2,3]oxadiazole-7-carboxylate from salicylic acid. The second category comprises (E)-1-(benzo[d][1,2,3]oxadiazol-5-yl)-N-arylmethanemine compounds. Our synthetic approach involved an initial nitration of the precursor under conventional conditions, yielding between 45 and 75% reduction using Bechamp conditions, and the diazotization of the amino group via sodium nitrite. To facilitate intramolecular cyclization, the crude reaction was cautiously added drop by drop to a 0.1 M potassium hydroxide solution at an alkaline pH and 0 °C. The subsequent purification of each product was accomplished using column chromatography, yielding between 23 and 60%. Structural elucidation was performed using spectroscopic techniques. Additionally, we employed the DFT B3LYP method at the 6-311++G** level and molecular docking to calculate various computational descriptors. Our results indicated that the presence of amino groups in the ester fragment of derivative 1 and the imine group of derivative 2 significantly influenced favorable intermolecular interactions with evaluated enzymatic targets (such as L-fucose mutarotase, Ferredoxin reductase, Pectate Lyase from Acidovorax avenae), enhancing stability in the synthesized molecules. However, these fragments also rendered the molecules more polarizable, endowing them with a heightened capacity for favorable ligand interactions and competitive inhibition. Products derived from the IMP-CIAS-3739 project, financed by the Vicerrectoria de Investigaciones of the Universidad Militar Nueva Granada. Period 2023–2025.

sciforum-082756: Use of Soil Respiration as a Trial of Drought Susceptibility in Eucalyptus Genotypes

Juan Carlos Valverde [1], Rafael Rubilar [2], Daniel Bozo [3], Alex Medina [4], Matias Pincheira [5], Verónica Emhard [5], Alvaro Zapata [4] and Otavio C. Campoe [6]

[1] Cooperativa de Productividad Forestal, Departamento de Silvicultura, Facultad de Ciencias Forestales, Universidad de Concepción
[2] Cooperativa de Productividad Forestal, Departamento de Silvicultura, Facultad de Ciencias Forestales, Universidad de Concepción. Centro Nacional de Excelencia para la Industria de la Madera (CENAMAD), Pontificia Universidad Católica de Chile.
[3] Facultad de ciencias forestales, Universidad de Concepción
[4] Forestal Mininco S.A.
[5] Forestal Mininco S.A
[6] Forest Productivity Cooperative, Departamento de Cîencias Florestais, Universidade Federal de Lavras

Soil respiration (Rs) is important in the carbon cycle; it is regarded as an indicator of plant metabolism due to its close relationship with biological activity in the soil. However, this component lacks rigorous experimental studies considering its use as a drought indicator. This study evaluated the Rs and increment diameter breast height (iDBH) of *Eucalyptus globulus* and *E. nitens x globulus* (high and low yield), *E. nitens, E. badjensis*, *E. smithii,* and *E. camaldulensis* x *globulus* in drought conditions (~25% over the permanent wilting point). Measurements were carried out from 2020 to 2023 (7 to 9-year-old plants); Rs was measured monthly with a chamber LICOR-8200s; iDBH was evaluated seasonally. The results showed an annual Rs of 0.75 to 1.42 gC/m^2 and iDBH of 0.4 to 14.4 mm, with maximum values in the summer (December to February) and minimum in the winter (June to August). Also, a strong correlation between Rs and DBH increment (r-value = 0.88) is explained with the equation iDBH = 1.29*Rs (R^2 = 0.85, *p*-value = 0.002). This resulted in three groups: (i.) *E. globulus* and *E. nitens* x *globulus* (low productivity) hads high drought susceptibility with minimum Rs and iDBH values (average 0.83 gC/m^2/yr and 0.85 mm/yr, respectively); (ii.) *E. nitens, E. badjensis*, *E. smithii,* and *E. camaldulensis* x *globulus* with moderated drought susceptibility with average Fs of 1.08 gC/m^2/yr and iDBH of 9.60 mm/yr.; and (iii.) *E. globulus* and *E. nitens x globulus* (high productivity) were classified as low drought susceptible maximum Rs and iDBH (average 1.38 gC/m^2/yr and 13.8 mm/yr, respectively). Our results suggest that Rs is an ideal trait to differentiate *Eucalyptus* genotype susceptibility to drought and its effect on growth.

Abstracts

SESSION 8. Plant Ecosystem Services and Public Outreach

sciforum-084180: An Assessment of the Chemical Composition and Physical Parameters of *Phaseolus vulgaris* and *Phaseolus lunatus* Beans

Elizabete Andersone-Trēziņa and Tatjana Kince

Latvia University of Life Sciences and Technologies

The European market in 2022 showed potential for common dry beans and their products. Consumers were interested in plant-based products that were high in protein, high in fibre, gluten-free, free of preservatives and additives and organic (1). The aim of the study was to evaluate the physical–chemical parameters of four colourful beans (*Phaseolus vulgaris* and *Phaseolus lunatus*) grown in Latvia, harvested in 2022, with an assessment of their future in pasta production. As a control sample we analysed white common beans from the local market. Standard methods were used for nutritional assessment, and the Kjeldal method for protein determination, ISO 6492 for lipids, AOAC 985.29 for total dietary fibre (TDF), ISO 2171:2007 for ash, ICC Standard No 110/1 for moisture determination and a calculation for carbohydrates were used. The energetic value was calculated using conversion factors according to (EU) No 1169/2011. For physical parameters, 1000 seed weight was determined using ISO 520:2010, bulk density according to LVS 275, and colour analysis using the CIE L*a*b* system. All experiments were carried out in three replicates; results were expressed as average value ± standard deviation. Generally, the quality of beans is assessed by protein content and seed coat colour. The results showed that biologically grown beans in Latvia as a raw material have high protein and TDF content. *Phaseolus lunatus* had the statistically highest TDF, ash content, colour brightness and bulk density compared with other samples, and also the energetic value was 21% of the reference intake of an average adult. In conclusion, beans grown biologically in Latvia could be potential raw materials to use in obtaining new products.

sciforum-082680: From Big Data to Micro Morphology: an Experimental Approach to Ecosystem Services Calculation

Chiara Suanno [1], Marco Montanari [2], Silvia Gherardi [1], Alice Domini [1] and Iris Aloisi [1]

[1] University of Bologna, Department of Biological, Geological, and Environmental Sciences
[2] University of Bologna, Department of Computer Sicences and Engineering

The great amount of field work required to collect vegetational data for the calculation of ecosystem services, often hinders the possibility to investigate other parameters involved. This pilot study faced this issue by (I) exploring the potential of open data to calculate the ecosystem services provided by the urban vegetation, in terms of air pollution removal; (II) reworking vegetational data and ecosystem services in a website accessible and comprehensible to the public; (III) integrating the results with measurements on the field. To do so, the arboreal vegetation of the ring road around Bologna city centre was analysed using the software iTree-Eco. Vegetation data supplied to the software were either downloaded from the open data portal of the municipality, or calculated in QGIS on recent orthophotos. Hence, iTree estimated the potential air pollutant removal for each species. Eventually, those indicated by the software as the most efficient species were furtherly investigated with an empirical approach, evaluating their photosynthetic efficiency and leaf micromorphology as proxies for their capability to remove gaseous and particulate pollutants, respectively. These data were compared with plants of the same genera or species grown in a green area nearby (the Botanical Garden). While the photosynthetic efficiency, calculated as Fv/Fm, did not show any significant difference between the Botanical Garden and the roadside vegetation, the stomatal density of some species from the ring road resulted significantly higher (*p*-value 0.05) than those of the Botanical Garden, an unexpected result since stomatal density is thought to decrease with high CO_2 levels and drought stress. Differences in trichome density and waxes texture between individuals from the two areas were investigated as well. Summarising, this study demonstrated the potential of open data for the analysis and dissemination of the ecosystem services provided by the vegetation, and integrated iTree results with empirical observations.

Academic Open Access Publishing
since 1996