XVII International Colloquium on Plant Ecophysiology

Katalapi Park
January 17-20, 2024

Organizers: Patricia Sáez - Lohengrin Cavieres - León A. Bravo

XVII International Colloquium on Plant Ecophysiology

Parque Katalapi, Puerto Montt, Chile; January 17-20, 2024

We aim to foster an environment conducive to lively and relaxed discussions—a space where scientific conversations flow effortlessly. Our goal is to create an atmosphere of ease that encourages the exchange of ideas, the sharing of experiences, and the establishment of valuable connections among graduate students and professors specializing in Plant Ecophysiology. In preserving your noteworthy contributions, we have compiled a record of your participation in the XVII International Colloquium on Plant Ecophysiology 2024 at Katalapi Park. This colloquium was conceived as a platform for knowledge exchange with students.

The organizing committee extends heartfelt gratitude to our international participants, both those who joined us physically and those who contributed virtually from abroad. We appreciate each one of you for your keen interest, constructive critiques, and the time dedicated to meaningful discussions. It is through the collective efforts of individuals like you that the community propels forward, advancing the field of plant ecophysiology.

Your contributions have played a pivotal role in making this event a success, and we look forward to continuing our collaborative journey in the exploration of Plant Ecophysiology.

Thank you!

Special recognition goes to the event sponsors whose support has been invaluable:

Universidad de Concepción, Universidad de La Frontera, Instituto de Ecología y Biodiversidad & Parque Katalapi.

Organizing Committee
Patricia Sáez (UFRO), patricia.saez@ufrontera.cl
Lohengrin Cavieres (UdeC), lcaviere@udec.cl
León A. Bravo (UFRO), leon.bravo@ufrontera.cl

Katalapi Administration & Logistics: Luis J. Corcuera, Ana María Vliegenthart.

Links of interest:
www.antarcticplantscience.cl
www.parquekatalapi.cl
https://ieb-chile.cl

General Program

Time	Wednesday 17th	Time	Thursday 18th	Time	Friday 19th	Time	Saturday 20th
		8:00-9:00	**Breakfast**	8:00-9:00	**Breakfast**	8:00-9:00	**Breakfast**
		9:00-9:45	**Conference 1** Marilyn Ball	**9:00-9:45**	**Conference 4** Jaume Flexas	**9:00-9:45**	**Conference 7** Jeroni Galmés
		9:45-10:30	**Short Communications 1**	**9:45-10:30**	**Short Communications 3**	**9:45-10:30**	**Short Communications 6**
		9:45-10:00	Humberto Gajardo	9:45-10:00	Pedro Flores	9:45-10:00	Dariel López
		10:00-10:15	Rodrigo Viveros	10:00-10:15	David Alonso Font	10:00-10:15	Carolina Hernández
		10:15-10:30	Valentina Vallejos	10:15-10:30	Carolina Sanhueza	10:15-10:30	Camila Cifuentes
		10:30-11:00	**Coffee Break**	**10:30-11:00**	**Coffee Break**	**10:30-11:00**	**Coffee Break**
		11:00-11:45	**Conference 2** Claudio Pastenes	11:00-11:45	**Conference 5** Alejandra Zuñiga	11:00-11:45	**Conference 8** José I. García-Plazaola
		11:45-12:40	**Mini-Conferences 1**	**11:45-12:40**	**Mini-Conferences 2**	11:45-12:15	**Final Conference** Lohengrin Cavieres
		11:45-12:10	Eduardo Marchiori	11:45-12:10	Beatriz Fernández-Marín	11:45-12:15	
		12:10-12:40	Laurine Chir	12:10-12:40	Marc Carriquí		
		13:00-14:30	**Lunch**	**13:00-14:30**	**Lunch**	**13:00-14:30**	**Lunch**
15:00	**Arrivals and accommodation**	15:00-15:45	**Conferences 3** Antonio Díaz-Espejo	15:00-15:45	**Conferences 6** Ingo Esminger (ONLINE)	15:00-17:00	**Departures**
		15:45-16:25	**Short Communications 2**	**15:45-16:25**	**Short Communications 4**		
		15:45-16:00	Juan F. Alfaro	15:45-16:00	Enrique Ostria		
		16:00-16:15	Luisa Bascuñán	16:00-16:15	Andrea Ávila		
		16:15-16:45	**Coffee Break**	**16:15-16:45**	**Coffee Break**		
		16:45-19:00	***"Caminando con Alerces"***	**16:45-17:15**	**Short Communications 5**		
				16:45-17:00	Betsy Rivera		
				17:00-17:15	Carolina Álvarez		
				17:15-17:30	Felipe Defavari		
				17:30-18:30	Cristian Carrasco Demonstration Flow sap meter and Psycrometry		
19:00-20:00	**Cata in Kata/Dinner**	19:00-20:00	**Dinner**	19:00-20:00			

ABSTRACTS BOOKLET

CONFERENCES

Conference 1:

Canopy uptake of atmospheric water: the morning after the night before.

Marilyn C. Ball
Plant Science Division, Research School of Biology, Australian National University, Canberra, A.C.T. 2601 Australia.
e-mail: marilyn.ball@anu.edu.au

Shoot absorption of atmospheric water was studied in the mangrove, *Avicennia marina*, to identify pathways for liquid water uptake, capacities and sites of water storage, contributions to plant water balances, and effects on plant function. Uptake occurred in both leaves and bark mainly via symplastic pathways associated with specialized epidermal structures: salt secretion glands, trichomes and lenticels. MicroCT analyses showed that rehydration of dehydrated stems via bark water uptake caused stem cross sectional area to increase by as much as 5%, due mainly to corticular swelling. Water relations analyses revealed osmotic and structural adjustments enabling turgor maintenance with increasing salinity. Nevertheless, decline in soil water potential with increasing salinity limited the hydration level that could occur with root water uptake alone. This hydration deficit implied increasing requirements for shoot absorption of atmospheric water, and was reflected in greater structural capacity for water storage with increase in growth salinity. Hydraulic analyses showed absorption of liquid water from shoot surfaces reversed dehydration-induced decline in hydraulic conductance. Further microCT analyses revealed that shoot rehydration via absorption of liquid water could enable repair of embolized xylem vessels. Field-based studies demonstrated that absorption of liquid water from shoot surfaces enhanced leaf and stem rehydration, inducing higher leaf assimilation rates while elevating stem water potentials above those of soil water for as much as eight hours during daytime transpiration. Such rehydration thus increased turgor and leaf carbon gain while reducing exposure of stem xylem to tensions that could induce loss of hydraulic function under hypersaline conditions.
Acknowledgments: *Australian Research Council Discovery Projects DP150104437 and DP180102969.*

Conference 2:

Responses to a mild water stress in grapevines, in relation to their stomatal sensitivity.

Claudio Pastenes[1] and Luis Villalobos[1*]
1. Laboratorio de Fisiología del estrés en Plantas, Facultad de Ciencias Agronómicas, Universidad de Chile. *Present Address, Centro de Estudios Avanzados en Fruticultura.
e-mail: cpastene@uchile.cl

Besides reducing CO_2 assimilation through reductions in stomatal conductance, water deficit has been pointed out as a triggering factor for photoinhibition. However, some other mechanisms might take place to deal with the excess absorbed energy, such as photorespiration. On the other hand, grapevine varieties are known to differ in their stomatal sensitivity to water deficit, so that under a given shortage, responses might be also different. In order to assess the impact of a mild water deficit on photoinhibition and photorespiration on grapevines, we have carried out an experiment with Cabernet Sauvignon (CS), Sauvignon Blanc (SB), Chardonnay (CH) and Carmenere (CM), grown in 20L pots, outdoors. Plants were irrigated, by weight, maintaining filed capacity (FC) in control plants (WW) and 85% of FC in water deficit plants WD. WD resulted in reductions in stem as well as pre-down water potential in plans, and in reductions of fresh and dry weigh of plant parts. Also, contrasting stomatal sensitivities were confirmed, where CS was the most sensitive, opposed to CH. Under WD conditions, photorespiration is an important process, maintaining a safe proportion of PSII reaction centres in an open state. Regarding the capacity for carboxylation, the more sensitive varieties were more affected by WD. As for NPQ, in WD plants it saturates at 750 μmol PAR $m^{-2}s^{-1}$, irrespective of the variety, which coincides with PAR from which NPQ photoprotective effectiveness declines and qP reaches a value of 0.5, indicated as a threshold for long term photoinhibition. Also, that same PAR intensity is intercepted by WD leaves from highly stomatal sensitive varieties, due to a modification of the leaf angle in those plants.

Acknowledgments: *Fondecyt 1190792*

Conference 3:

Deciphering Necessity: The evolutionary impetus for angiosperms to adopt ABA-mediated hydroactive stomatal regulation.

Antonio Diaz-Espejo, Javier Pichaco, Celia M. Rodríguez-Domínguez
Irrigation and Ecophysiology Group. Instituto de Recursos Naturales y Agrobiología (IRNAS), Consejo Superior de Investigaciones Científicas (CSIC), Avda Reina Mercedes, 41012 Seville, Spain.
e-mail: a.diaz@csic.es

Higher plants have two mechanisms for regulating stomatal opening: one is hydropassive, and the other is hydroactive. In truth, considering the efficiency of the hydropassive mechanism in ferns and, to a large extent, in gymnosperms in response to hydraulic disturbance, the need for angiosperms to include a hydroactive mechanism that complements the hydropassive one is not evident. However, whether out of necessity or to acquire new capabilities, the hydroactive mechanism played a key role in the dominance of angiosperms over other plant groups during evolution. The need to incorporate a hydroactive mechanism may have been related to the race to increase their photosynthetic capacity and, consequently, their growth potential. This process, associated with the miniaturization of cell size, had a side effect: the mechanical advantage of epidermal cells over guard cells. The inability to close stomata upon turgor loss, e.g., when the air's water vapour pressure deficit increased, necessitated the incorporation of a hydroactive mechanism that could independently modify the turgor of the guard cells. Another challenge that may have driven angiosperms to develop a hydroactive mechanism is the coordination of CO_2 and H_2O fluxes in the leaf. In hydropassive species, photosynthesis has little influence on stomatal regulation. This prevents their stomata from responding to abrupt changes in light or CO_2 and, as a result,

from achieving high water use efficiency. In this case, the driving force for the incorporation of the hydroactive mechanism in angiosperms was the colonization of nutrient-rich, arid environments that basal plant groups had not been able to reach.
Acknowledgments: *IRRIWELL, Programa PRIMA 2020, PCI2021-122078-2A*

Conference 4:

How "*cojines*" do *Azorella* species survive in the Andes Altiplano?

Jaume Flexas[1]; Francesc X. Castanyer[1]; Jeroni Galmés[1]; David Alonso[1]; Marc Carriquí[1]; Patricia L. Sáez[2]; León Bravo[2]; Maritzia Mihok[3]; Rodrigo Viveros[3]; Rafael, Eduardo, Katerina & Tineo Coopman[4]; Lohengrin Cavieres[3]
1. Universitat de les Illes Balears, Spain. 2. Universidad de La Frontera, Chile. 3. Universidad de Concepción, Chile. 4. I'm as free as a bird now … Whenever and Wherever.
e-mail: jaume.flexas@uib.es

"Llaretas" (*Azorella* sp.) are typical exponents of the Andes Altiplano landscape. These 'Martian-like' plants present an almost spherical, compact cushion aspect – compact to the extent of being rock-like. Some *Azorella* species are pioneers in those ecosystems and/or plant-plant facilitators. Considering that the sphere is the worst geometry for dissipation of excess radiation, and that epiphytic hosts might develop long roots across the *Azorella* cushions (often with heights > 1 m) to reach the below-*Azorella* soil, we wondered how "*cojines*" (untranslatable, ~"how the hell") do they survive in a high elevation, dry-prone environment with the largest global and UV-B radiations worldwide, and how can they offer facilitation to plants growing on top of their spherical structure (i.e. highly exposed to radiation plus highly visible for potential herbivores).
We hypothesize that the peculiar structure and compactness of *Azorella* species joined to other features, like the reported larger diversity of arthropods and other organisms below than 'outside' *Azorella* or the fact that they keep old leaves being decomposed and dried over the stems – i.e. like palm trees but 'below' a closed spherical structure – could perhaps result in high CO_2 concentrations within these compact cushions. This would result in a strong photosynthetic advantage for *Azorella* itself in an environment with elevation-related low CO_2 partial pressure, plus surplus CO_2 supply for epiphytes if the gradient between inside and atmospheric CO_2 was large enough to generate an efflux despite plant compactness.
In this talk we will present the first empirical evidence in relation to these hypotheses.
Acknowledgments: *project POPEYE (Spanish Ministry of Science), the entire Chilean ecophysiology community and Parque Katalapi. You all know why!*

Conference 5:

Plant soil interactions on recent volcanic substrates in Southern Andes Mountains.

Alejandra Zúñiga-Feest[1], Andrea Ximena Silva[2], Julieta Orlando[3], Gastón Muñoz[4]
1. Laboratorio de Biología Vegetal, Instituto de Ciencias Ambientales y Evolutivas, Facultad de Ciencias, Universidad Austral de Chile, Valdivia, Chile. 2.AUSTRAL-omics, Vicerrectoría de Investigación, Desarrollo y Creación Artística, Universidad Austral de Chile. 3. Laboratorio de Ecología Microbiana, Facultad de Ciencias, Campus Juan Gómez

Millas, Universidad de Chile, Santiago, Chile. 4. Facultad de Ciencias, Universidad Católica de la Santísima Concepción, Concepción, Chile.
e-mail: alejandrazunigafeest@gmail.com

In the challenging environments of the Andes in southern South America, characterized by extreme nutritional, hydrological, and thermal conditions, certain plants successfully colonize recent volcanic substrates, accompanied by a rich diversity of root-associated microorganisms. While the ameliorative effects of these plants on local vegetation patches are recognized, the specific impact of their root exudates on shaping the rhizosphere microbiota remains less explored. Our research investigates the abundance and diversity of microbiota in vegetation patches on recent volcanic substrates, specifically at three elevations on two volcanoes (Antuco and Mocho-Choshuenco). We hypothesize that plants with complementary root adaptations establish positive nutritional relationships, enhancing microbiota diversity and soil fertility within the patches. Quantification of archaea, bacteria, and fungi using qPCR, along with massive sequencing of bacteria and fungi, revealed highest abundances in the rhizosphere of Orites myrtoidea (proteoid roots) at Antuco's highest elevation and Gaulteria poepigii (Ericoid mycorrhizae) at Mocho-Choshuenco's lowest elevation. Vegetation presence increased alpha diversity of bacteria on both volcanoes, but responses were site-specific. Our results emphasize that plants on recent volcanic substrates selectively influence certain microbial taxonomic groups, suggesting pivotal roles in vegetation nutrition and plant survival. Controlled pot experiments demonstrated that Proteaceae (Embothrium coccineum, Orites myrtoidea) generally enhances the survival of other species (Sophora cassioides, Gaulteria poepiggi). Contrasting root adaptations in plant individuals further influence these outcomes, emphasizing the potential underestimation of carboxylate exudation dynamics in vegetation succession on recent volcanic substrates. These findings contribute to a comprehensive understanding of plant-soil interactions in extreme environments.
Acknowledgments: *Nodo ANID LN Andes del Sur de Chile LN007 y Fondecyt 1180699.*

Conference 6:

Phenological responses of northern trees to a changing world.

Ingo Ensminger
Department of Biology, University of Toronto Mississauga, Mississauga, ON, Canada.
e-mail: ingo.ensminger@utoronto.ca

Seasonal changes in physiological processes of trees, such as the timing of phenological events, are perhaps the most sensitive indicators of the effects of a changing climate on terrestrial ecosystems. In higher-latitude trees, temperature and photoperiod control the beginning and the end of the photosynthetically active season. While photoperiod remains unchanged, changing climate has advanced spring warming and autumn cooling. Expected shifts in phenophases, such as start and end of photosynthetic activity, have a strong impact on plant productivity and growth-related traits and are important determinants of plant fitness. Understanding phenological responses to warming and monitoring shifts in phenophases is key to forecasting tree responses and vegetation dynamics to future warmer

climate. Phenology of deciduous species can be easily tracked using structural and chlorophyll-sensitive remote-sensing indices, while tracking phenology of evergreen conifers is far more challenging since evergreens retain their needles and most of their chlorophyll over the year. In this presentation I will describe how carotenoid-based vegetation indices such as the photochemical reflectance index (PRI) and chlorophyll/carotenoid index (CCI) can be used to remotely track the invisible phenology of photosynthesis in conifers by assessing carotenoid pigment dynamics. I will further demonstrate that this approach is also useful for detecting early tree physiological responses to drought in evergreen conifers. I will conclude with a brief discussion of the technical challenges of using optical sensors when monitoring complex canopies and next steps in using carotenoid-based vegetation indices for better understanding carbon cycle dynamics and impacts of climate warming in natural forests.

Acknowledgments: *NSERC (RGPIN-2020-06928), the Canadian Foundation for Innovation (CFI) (grant no. 27330), and the Ontario Ministry of Research and Innovation (grant no. ER10-07-015). Genome Canada (241REF), Genome British Columbia, and 16 other sponsors (https://coadaptree.forestry.ubc.ca/sponsors/) and seed contributors http://adaptree.forestry.ubc.ca/seed-contributors/. Funding for the FastPheno project is provided by Genome Canada and Ontario Genomics (OGI-211), and by the Ministère de l'Économie et de l'Innovation du Québec through Génome Québec. We also acknowledge the contribution of Natural Resources Canada, the Ministère des Ressources Naturelles et des Forêts du Québec, the University of Toronto, Université Laval, and Headwall Photonics Inc.*

Conference 7

Mediterranean tomato landraces: an untapped resource under worsening climate

Jeroni Galmés[1], Aina Juan-Cabot[1], Xisco Castanyer[1], Pedro Cerdà1, Mateu Fullana-Pericàs[1], Christopher D Muir[2], Miquel Àngel Conesa[1]
1. University of the Balearic Islands-INAGEA. 2. University of Hawaii.
e-mail: jeroni.galmes@uib.es

The Mediterranean long shelf-life (LSL) tomatoes are a group of landraces with a fruit remaining sound up to 6–12 months after harvest. Most have been selected under semiarid Mediterranean summer conditions with poor irrigation or rain-fed and thus, are drought tolerant. Besides the convergence in the latter traits, local selection criteria have been very variable, leading to a wide variation in fruit morphology and quality traits. The different soil characteristics and agricultural management techniques across the Mediterranean denote also a wide range of plant adaptive traits to different conditions. Despite the notorious traits for fruit quality and environment adaptation, the LSL landraces have been poorly exploited in tomato breeding programs, which rely basically on wild tomato species. In this presentation, we resume most of the information currently available for Mediterranean LSL landraces to highlight the importance of this genetic resource. We focus on the origin and diversity, the main selective traits, and the determinants of the extended fruit shelf-life and the drought tolerance. Altogether, the Mediterranean LSL landraces are a very valuable heritage to improve fruit quality and shelf-life in tomato, and to breed for more resilient cultivars under the predicted climate change conditions.

Acknowledgments: *Millora en l'ús eficient de l'aigua en el cultiu de la tomàtiga de ramellet, Direcció General de Política Universitària i Recerca de la Conselleria d'Educació, Universitat i Recerca del Govern de les Illes Balears. SEQ-LIFE, Direcció General de Política Universitària i Recerca de la Conselleria d'Educació,* *Universitat i Recerca del Govern de les Illes Balears.VEGADAPT, Comisión Europea (Programa PRIMA) y Agencia Estatal de Investigación del Gobierno de España.TOMRES, programa H2020 de la Comisión Europea.*

Conference 8:

How green was my valley: The challenge of measuring chlorophyll content in natural canopies.

José Ignacio García-Plazaola[1], Albert Porcar-Castell[2], Beatriz Fernández-Marín[1], Melissa Llerena[1], Marina López-Pozo[1]
1. Departamento de Biología Vegetal y Ecología, Universidad del País Vasco (UPV/EHU), Barrio Sarriena s/n, E-48940 Leioa (Bizkaia), España. 2. Optics of Photosynthesis Laboratory, Forest Sciences / INAR, University of Helsinki.
e-mail: joseignacio.garcia@ehu.eus

Vegetation-related remote sensing signals are generated by the interaction of sunlight and plant canopies, and vary with pigment composition, environmental conditions and physiological performance. Pigment composition in photosynthetic organs, mainly leaves, is remarkably stable across the plant kingdom, with a few exceptions to the basic composition of 8 pigments (two chlorophylls and six carotenoids). As most pigments molecules are invariably bound to photosynthetic proteins in specific binding sites, the pigment stoichiometry is a reflection of the structure of the light harvesting apparatus. Pigment composition has been described with sufficient analytical detail in more than 500 studies, with a marked bias towards model plants, crops and temperate ecosystems. However the deficient analytical accuracy and quality of many of those studies hampers the inter-comparison among them. Even for the apparently "simple protocols" for chlorophyll determination, the use of incorrect equations or the occurrence of degradation processes during sample preparation, results in a large amount of inconsistent results. Consequently interpretation of remote sensing data encounters a limitation in the absence of reliable ground-based information on plant pigment composition, particularly from the upper canopy positions, which mostly contribute to the generation of optical signals. Some methods to improve the quality of chlorophyll measurements are described.

Acknowledgments: *Research Grant POPEYE (PID2022-139455NB-C32) funded by MCIN/AEI/ 10.13039/501100011033 and by "ERDF A way of making Europe".*

Final Conference:

Cambia todo cambia: Ecophysiological changes of a high-Andean herb species along an elevational gradient in the central Chile Andes.

Lohengrin A. Cavieres[1,2]; Carolina Hernández-Fuentes[2]; Claudia Reyes[2,4]; Frida Piper[2,4] & León A. Bravo[5].
1. Dpto. de Botánica, Universidad de Concepción. 2. Instituto de Ecología y Biodiversidad-IEB. 3. Bioforest S.A. 4. Instituto de Ciencias Biológicas, Universidad de Talca. 5. Lab. de Fisiología y Biología Molecular Vegetal, Departamento de Ciencias Agronómicas y Recursos Naturales, Facultad de Ciencias Agropecuarias y Medioambiente, Universidad de La Frontera. Temuco.
e-mail: lcaviere@udec.cl

The elevation gradient in the Andes of central Chile presents various environmental changes, including temperature decreases, altered growing season duration, increased irradiance, and precipitation fluctuations. This diverse range of conditions prompts an exploration of ecophysiological distinctions among plant populations at different elevations and whether these variances stem from plasticity or ecotypic differentiation. Our research delves into these inquiries, focusing on the seed germination ecology, growth patterns, non-structural carbohydrates (NSC) accumulation, and photosynthetic characteristics of *Phacelia secunda*, a perennial herb, across elevational gradients. Three study locations were selected at 1,600, 2,800, and 3,600 meters, representing habitats both below and above the treeline. Lower elevation plants exhibit taller stature, fewer inflorescences, and reduced leaf trichomes compared to their higher elevation counterparts. Notably, seeds from low elevation plants do not necessitate cold stratification for germination, unlike high-elevation counterparts requiring a minimum of 6 months of cold stratification. This leads to the formation of persistent soil seed banks at higher elevations and transient ones at lower elevations, indicating ecotypic differentiation. Photosynthetic and growth activities at low elevations primarily occur from October to December, whereas high elevations experience these processes from December to April. NSC accumulation mirrors these periods. Common garden experiments highlight that NSC accumulation is prioritized in high-elevation populations, aiding in endurance during the extended summer drought at low elevations. In summary, the observed ecophysiological differences, based on plasticity and ecotypic differentiation, have significant implications for fitness maintenance across varying elevational habitats.
Acknowledgments: *Anillo (ACT210030); IEB (FB210006).*

MINI-CONFERENCES

Mini-conference 1:

Changes in biochemical and anatomical issues are involved with the sugarcane acclimation to low light.

Paulo Eduardo Ribeiro Marchiori
Laboratório de Fisiología de Plantas Cultivadas, Departamento de Biologia, Instituto de Ciências Naturais, Universidade Federal de Lavras, Lavras, Brasil.
e-mail: paulo.marchiori@ufla.br

C4 plants commonly present higher photosynthesis than C3 one, therefore, several of the most yield commercial species are NADP-ME C4 grasses, such as sugarcane (Saccharum spp.). However, the decarboxylation metabolism shows three metabolic ways, which are used to classify the C4 metabolism: NADP-malic enzyme (*NADP-ME*), NAD-malic enzyme (NAD-ME) and phosphoenolpyruvate carboxykinase (*PEPCK*). It is well established the advantages of the C4 cycle are most evident under high than low light, as the CO2 concentrating mechanism comes at the expense of additional ATP. Here, we studied the effects caused by shade on the photosynthetic metabolism and ultrastructure of sugarcane leaves, a Poacea classified as NADP-ME C4 plant. Distinct sugarcane varieties were cultivated under full sunlight or under shade conditions and the physiological, biochemical and anatomical assessments were performed in leaves totally developed in these conditions. It was identified activities of the three decarboxylases operating at the same time during photosynthesis, either under full sunlight or shade. *In vitro PEPCK* activity increased in plants grown under low light, suggesting an upregulation of this decarboxylation pathway attached to a reduction in the other pathways. Also, the chloroplast arrangement of bundle sheath cells changed from centrifugal to evenly distributed. Our data suggest that a high plasticity in both, biochemical and anatomical issues, presented by the sugarcane grown under shading is important to maintain the quantum efficiency of CO2 assimilation. For the complete studies: https://doi.org/10.1016/j.envexpbot.2023.105351; https://doi.org/10.1016/j.envexpbot.2023.105351.
Acknowledgments: *CNPq 312663/2021-8*

Leaf burn in grapevine under high temperature: which physiological determinants drive genetic variability?

Laurine Chir[1], Lison Lepilleur[1], Romain Boulord[1], Stéphane Berhézène[1], Renaud Fournier[1], Llorenç Cabrera-Bosquet[1], Thierry Simonneau[1], Aude Coupel-Ledru[1]
1. UMR LEPSE, INRAE, Institut Agro, Montpellier, France.
e-mail: laurine.chir@inrae.fr

Climate change critically challenges viticulture. Among other threats, extreme and increasingly frequent heatwaves cause irreversible burns on leaves and bunches. A series of

observations and experiments was conducted to better understand how leaf burns originate and whether genetics or management practices can mitigate them.
In 2019, a panel of 279 potted cultivars of *Vitis vinifera* L. grown outdoors suffered a heat peak and a genetic origin of leaf burn variability was demonstrated. To deeper explore this variability, fourteen cultivars were selected for their contrasting responses to high temperatures, and detached leaves were submitted to a controlled increase in temperature up to 50 °C in a growth chamber. A significant genotypic effect on leaf burn was confirmed on detached leaves like on whole plants outdoors, although with a different ranking of the varieties. As the air temperature in the growth chamber and during the 2019 heat peak evolved similarly, we hypothesized that other conditions, including light or evaporative demand, may have differentially favored one or other of the different physiological determinants of leaf burn. Therefore, in parallel with the development of burns on detached leaves exposed to high temperature in the growth chamber, changes in leaf temperature, transpiration rate, membrane damages and chlorophyll fluorescence were monitored. Significant differences between cultivars in leaf temperature, in the reduction of maximum photosynthesis yield and in stomatal closure were highlighted. Next step will consist in looking for correlations between burns and these physiological measurements in order to identify conditions and/or genotypes with minimal symptoms.
Acknowledgments: *INRAE; Occitanie Region; ERASMUS+; ANR G2WAS; Doctoral School GAIA*

Mini-conference 2:

"Occult precipitation" and "thirst" in Antarctic tundra.

Beatriz Fernández-Marín[1], Abel Torre[1], Miren Irati Arzac[1], José Manuel Laza[2], Leire Ruiz[2], Jose Luis Vilas[2], José Ignacio García-Plazaola[1], Alicia Victoria Perera-Castro[1]
1. Department of Plant Biology and Ecology, University of the Basque Country (UPV/EHU), Barrio Sarriena sn, 48940 Leioa, Spain. 2. Department of Physical Chemistry, University of the Basque Country (UPV/EHU), Barrio Sarriena sn, 48940 Leioa, Spain.
e-mail: beatriz.fernandezm@ehu.eus

While “occult precipitation” also referred to as “horizontal precipitation” (fog, but also snow, or rain with strong wind) is probably a key source of available water for the Antarctic tundra ecosystem in Maritime Antarctica, its occurrence and relevance are, so far, understudied. Thus, we aimed at evaluating how changes in water availability may affect the ecophysiological performance of some of the most prominent photosynthetic species of the Antarctic tundra, with especial emphasis on horizontal precipitation and on lichen and moss flora. For this purpose, we are (i) monitoring the potential contribution of occult precipitation to the ecosystem, (ii) studying the anatomical and physicochemical properties of the thalli involved in the capture, absorption and retention of water and (iii) evaluating interspecific differences on biophysical and physiological traits involved on them. Our preliminary results reveal that (i) occult precipitation may represent a significant source of available water during summer time and particularly at moderated elevations (>200m asl); (ii) there are remarkable interspecific differences the water relations, in the wettability of photosynthetic surfaces and in their capability to delay desiccation; (iii) most of the evaluated species show elevated glass transition temperatures indicating a very low molecular mobility when in the dry state. This research is part of DROPLET project supported by a 2022 Leonardo Grant for Researchers

and Cultural Creators, BBVA Foundation; and included in the Spanish Antarctic Campaigns 22/23, 23/24 organised by the CPE and funded by the MCIN.
Acknowledgments: *Research Grant POPEYE (PID2022-139455NB-C32) funded by MCIN/AEI/10.13039/501100011033 and by "ERDF A way of making Europe".*

Ontogenetic plasticity in drought resistance: an underrated factor for predicting the success in seedling recruitment. The case of *Hypericum balearicum* L.

Marc Carriquí[1,2], Miquel Capó[2,3], Carles Cardona[4,5], Antoni Josep Far[2], Jaume Flexas[2], Pere Miquel Mir-Rosselló[2], Ramón Perea[3], Ismael Aranda[1].
1. Instituto de Ciencias Forestales (ICIFOR-INIA), CSIC, Carretera de La Coruña k.m. 7.5. Madrid 28040. 2. Grup de recerca en Biologia de les Plantes en Condicions Mediterrànies, Departament de Biologia, Universitat de les Illes Balears (UIB), Carretera de Valldemossa k.m. 7.5. Palma 07122. 3. Departamento de Sistemas y Recursos Naturales, Universidad Politécnica de Madrid, Ciudad Universitaria s/n, 28040 Madrid. 4. Centre Forestal de les Illes Balears (CEFOR-Finca de Menut), Institut Balear de la Natura (IBANAT), C/Gremi de Corredors 10 (Polígon Son Rossinyol), 07009, Palma, Spain 5. Grup d'Ecologia Interdisciplinar, Departament de Biologia, Universitat de les Illes Balears (UIB), 07122, Palma, Spain.
e-mail: mcarriqui@gmail.com

Given the urgent need to predict how plants are likely to respond to climate change, a significant effort is being made to understand the processes underlying plant drought resistance. However, studies focusing on up to one-year-old seedlings, a critical phase for successful regeneration and continuity of populations, are particularly scarce. Therefore, the relevance of potential differences related to ontogeny in the response to drought is largely unknown. Here, we evaluated the ontogenetic plasticity in drought resistance of *Hypericum balearicum* L., a Mediterranean shrub with limited seedling recruitment at early ages, but negligible adult drought-related mortality. Physiological and anatomical traits associated to drought resistance at seedling and adult stages were evaluated. Additionally, to test if hydraulic disfunction is a major cause of seedling mortality under natural conditions, we performed an experimental plantation. *H. balearicum* presented a strong ontogenetic shift from a drought-vulnerable strategy in seedlings, to a more slow-growing drought-tolerant strategy in adults. Seedlings presented larger photosynthesis but lower water use efficiency and drought tolerance, closing stomata at higher water potentials than adults. Once stomata closed, seedlings not only dehydrated faster due to a larger minimum conductance but also presented a surprisingly lower resistance to embolism. Findings were confirmed under natural conditions, in which reported massive seedling mortality was associated with drought-related vascular hydraulic failure. As seedlings are more prone to die due to hydraulic failure compared to adults in *H. balearicum*, findings highlight that drought resistance from ontogeny is a major -but underrated- factor influencing recruitment success of the species.
Acknowledgments: *project POSTDOC-UIB-2020-2; JdlC fellowship FJC2020-042856-I; Vicenç Mut fellowship PD-047-2022.*

SHORT COMMUNICATIONS

Short Communications 1:

Living in the Atacama Desert: unraveling molecular strategies of three extremophyte woody species to cope with a multi-stress environment.

Humberto A. Gajardo[1], Melanie Morales[2], Giovanni Larama[1], León A. Bravo[1]
1. Laboratorio de Fisiología y Biología Molecular Vegetal, Departamento de Ciencias Agronómicas y Recursos Naturales, Facultad de Ciencias Agropecuarias y Medioambiente & Scientific and Technological Bioresource Nucleus, Universidad de La Frontera, Temuco, Chile. 2. Department of Evolutionary Biology, Ecology, and Environmental Sciences, Faculty of Biology, University of Barcelona, Avinguda Diagonal 643, 08028, Barcelona, Spain.
e-mail: h.gajardo.balboa@gmail.com

Plant species have developed different adaptive strategies to live under extreme environmental conditions. Hypothetically, extremophyte species present a unique configuration of physiological functions that prioritize stress-tolerance mechanisms while carefully managing resource allocation for photosynthesis. This could be particularly challenging under a multi-stress environment, where the synthesis of multiple and sequential molecular mechanisms is induced. Studies exploring this relationship in the literature are scarce; therefore, we explored this hypothesis in three phylogenetically related woody species co-occurring in the Atacama Desert, *Strombocarpa tamarugo*, *Neltuma alba,* and *Neltuma chilensis*, by analyzing their dehydration and freezing tolerance at the leaf level and by characterizing their photosynthetic performance under natural growth conditions. A transcriptomic profiling, biochemical analyses of leaf pigments, and untargeted metabolomic were conducted to study gene expression and metabolite synthesis within this multi-stress environment. *S. tamarugo* showed a higher photosynthetic capacity and leaf stress tolerance than the other studied species. In this species, a multifactorial response was observed, which involves high photochemical activity associated with a higher content of chlorophylls and β-carotene. The photosynthetic apparatus oxidative damage is probable attenuated by the synthesis of complex antioxidant molecules in the three species, but *S. tamarugo* showed the highest antioxidant capacity. The differential expression of genes involved in the biosynthetic pathways of key stress-related metabolites was highlighted. Moreover, the synthesis of non-nitrogen osmoprotectant molecules, such as ciceritol and mannitol in *S. tamarugo*, would allow the allocation of nitrogen to support its high photosynthetic capacity without compromising leaf dehydration tolerance and freezing stress avoidance.
Acknowledgments: *NEXER NXR17-0002, ANID National Doctoral Scholarship 21181972, FAPESP-UFRO 2020/07578-1 and ECOS200058.*

Elevational variation in the limitations to photosynthesis in zonal and azonal alpine plants in the Andes of central Chile.

Rodrigo Viveros [1,2], Constanza Ramírez [1], Francisca Fuentes [3], Noemí Labra [1,2], Patricia Sáez [2,3], Lohengrin Cavieres [1,2].1. Departamento de Botánica, Universidad de Concepción, Concepción, Chile. 2. Instituto de Ecología y Biodiversidad, Santiago, Chile. 3. Universidad de la Frontera, Ciencias agropecuarias y de medio ambiente, Temuco, Chile.

e-mail: cortinablanca01@gmail.com

For photosynthesis to occur, the ambient CO_2 must enter through the stomata inside the leaf and then be transported throughout the leaf mesophyll to the chloroplast where the Rubisco is located. Three potential limitations occur during this process: stomatal, mesophyll, and biochemical. Plants inhabiting broad elevational gradients in mountainous regions are exposed to changes in environmental conditions (e.g., lower temperature, partial pressure, solar radiation etc.). This increase in environmental severity with elevation has been associated with increases in leaf mass per area (LMA) and Increases in LMA had also been associated to increases in the mesophyll limitation to photosynthesis, Thus, mesophyll limitation may play a significant role in high-elevation plants. We aimed to assess the magnitude of different limitations to photosynthesis and identify the impact of leaf characteristics on the photosynthetic performance of plants at different elevations but also from different plant types: zonal plants, subject to seasonal drought, and azonal plants, which have full water availability. For this, we selected two zonal and three azonal species at 2600 and 3550 m a.s.l. and evaluated gas exchange and chlorophyll fluorescence as well as structural characteristics that could explain the adaptations experienced by these plants. Our results show that photosynthesis of zonal and azonal plants respond differently to elevation but, in general, mesophyll conductance was the major photosynthetic limitation. Mesophyll limitation was mostly determined by chloroplast arrangements and not by cell-wall thickness as LMA and gm are disengaged, probably due to low partial pressure and light availability in high elevation environments.

Acknowledgments: *ANID Scholarship, Fondecyt 1211197, Anillo (ACT210038), Fondecyt 1211231.*

Leaf hydraulic responds differentially between Antarctic vascular plant species to *in situ* environmental changes, but always in a coordinated way with photosynthesis.

Valentina Vallejos[1,6], Domingo Sancho-Knapik[3], Constanza F. Ramírez[1,6], Betsy K. Rivera[4], Lohengrin A. Cavieres[5,6], León A. Bravo[4], José Javier Peguero-Pina[3], Eustaquio Gil-Pelegrín[3], Jeroni Galmés[2], Patricia L. Sáez[4,6]
1. Laboratorio Cultivo de Tejidos Vegetales, Centro de Biotecnología, y Facultad de Ciencias Forestales, Universidad de Concepción, Concepción, Chile. 2. Research Group on Plant Biology under Mediterranean Conditions. INAGEA-Universitat de les Illes Balears, Balearic Islands, Spain. 3. Departamento de Sistemas Agrícolas, Forestales y Medio Ambiente, Centro de Investigación y Tecnología Agroalimentaria, Gobierno de Aragón, Zaragoza, España. 4. Laboratorio de Fisiología y Biología Molecular Vegetal, Instituto de Agroindustria, Departamento de Ciencias Agronómicas y Recursos Naturales, Facultad de Ciencias Agropecuarias y Medioambiente, Universidad de La Frontera. Temuco, Chile. 5. ECOBIOSIS, Departamento de Botánica, Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción. Barrio Universitario s/n, Concepción. Concepción, Chile. 6. Instituto de Ecología y Biodiversidad-IEB. Concepción, Chile.
e-mail: valevallejosaravena@gmail.com

Warmer temperatures improve water transport efficiency at leaf (K_{leaf}) and whole plant (K_{plant}) levels, correlating with adjustments in carbon assimilation. These responses aligned with changes in leaf vascular anatomy, revealing distinct strategies for each Antarctic species under laboratory conditions. At higher temperature, *Colobanthus quitensis* decreased the number of xylem vessels but increased their diameter, while *Deschampsia antarctica* maintains vessel diameter but increases their number. However, these traits under field conditions remain unclear. To fill this gap, we used an *in situ* experimental manipulation established in 2012 at the Polish Antarctic Station. We measured hydraulic and photosynthetic parameters in plants inside open-top chambers (OTCs) and open areas as control plots (OAs) to investigate how leaf hydraulic properties respond to *in situ* environmental changes and whether these responses coordinate with photosynthesis. Preliminary results reveal unexpected climatic variations between OTCs and OAs, which probably lead to the opposite responses observed in both Antarctic species. *D. antarctica* exhibited a decrease in photosynthesis (A_N), $K_{leaf,}$ and K_{plant}, accompanied by a change in leaf xylem anatomy, including a decrease in hydraulic diameter (D_h) and a higher frequency of smaller vessels. Conversely, *C. quitensis* inside OTCs increased A_N and hydraulic efficiency, with changes in leaf anatomy (lower cell wall), leaf xylem vessel (higher vessel number, D_h, and frequency of greater diameter classes), and water relation traits (higher capacitance and lower modulus of elasticity). Despite species-specific adjustments, the coordination between hydraulic and photosynthetic remains positive, suggesting a robust interplay in water supply and loss capacities within leaves.

Acknowledgments: *INACH RT_13-16, INACH DG_09-21, ANID Scholarship 21181268, Fondecyt 1211231, ANILLO 210038, FB 210006, REDES-CONICYT 170102.*

Short Communications 2:

Rootstock increases the physiological defense of tomato plants against *Pseudomonas syringae* pv. *tomato* infection.

Alfaro-Quezada, Juan F.[1*]; Martínez, J.P.[2]; Molinett, S.[3]; Valenzuela, M.[5]; Montenegro, I.[6]; Ramírez, I.[5]; Dorta, F.[5]; Ávila-Valdéz, A.[7]; Gharbi, E.[8]; Zhou, M.[9]; Dailly, H.[8]; Quinet, M.[8]; Lutts, S.[8]; Seeger M.[3,4]

1.Instituto de Investigaciones Agropecuarias (INIA), Centro Regional Quilamapu. 2. Instituto de Investigaciones Agropecuarias (INIA) Centro Regional Rayentue, Rengo, Chile. 3. Instituto de Investigaciones Agropecuarias, Centro Regional La Cruz, Chile. 4. Laboratorio de Microbiología Molecular y Biotecnología Ambiental, Departamento de Química, Universidad Técnica Federico Santa María, Valparaíso, Chile. 5. Centro de Biotecnología Dr. Daniel Alkalay Lowitt, Universidad Técnica Federico Santa María, Valparaíso, Chile. 6. Escuela de Obstetricia y Puericultura, Facultad de Medicina, Universidad de Valparaíso, Viña del Mar, Chile. 7. Facultad de Ciencias Agronómicas, Universidad de Chile, Santiago, Chile. 8. Groupe de Recherche en Physiologie Végétale (GRPV), Earth and Life Institute – Agronomy (ELI-A), Université Catholique de Louvain, Louvain-la-Neuve, Belgium. 9. Biology Centre, Czech Academy of Sciences, Institute of Plant Molecular Biology, Ceske Budejovice, Czech Republic.

e-mail: felipealfaro88@gmail.com

Climate change has intensified the infection of tomato plants by pathogens such as *Pseudomonas syringae pv. tomato* (*Pst*). Rootstocks may increase plant tolerance to leaf phytopathogens. The aim of this study was to evaluate the effects of the tolerant Poncho Negro (R) tomato rootstock on physiological defence and the role of hydrogen sulfide (H_2S)

in susceptible Limachino (L) tomato plant responses to *Pst* attack. Ungrafted (L), self-grafted (L/L), and grafted (L/R) plants were infected with *Pst*. Rootstock increased the concentration of antioxidant compounds including ascorbate in the scion. Tolerant rootstock induced an increase of H_2S in the scion, which correlated with enhanced expression of the *SlAPX2* gene. A high accumulation of salicylic acid was observed in *Pst*-inoculated grafted L/L and L/R plants, but this was higher in L/R plants. The increase of H_2S during *Pst* infection was associated with a reduction of ethylene in L/R plants. Our study indicates that the Poncho Negro rootstock reduced the symptoms of bacterial speck disease in the Limachino tomato plants, conferring tolerance to *Pst* infection. This study provides new knowledge about the impact of rootstock in the defence of tomato plants against leaf pathogens that could be used in sustainable management of tomato cultivation.
Acknowledgments: *Conicyt PhD fellowship, USM 131562 (MS), Fondecyt 1151174 y 1110992 (MS) y proyect FIA PYT 20140227, Fondecyt 1180958 (JPM). Wallonie – Bruxelles International (WBI) internships, Anillo ACT172128 GAMBIO grant.*

Nitrogen sources preferences in Andean and Lowland ecotypes of *Chenopodium quinoa* Willd (Amaranthaceae family).

María Paz Jerez[1], José Ortiz[1], Catalina Castro[1], Elizabeth Escobar[1], Carolina Sanhueza[1], Néstor Fernández Del-Saz[1], Teodoro Coba de la Peña[2], Enrique Ostria-Gallardo[1], and **Luisa Bascunan-Godoy**[1]
1. Laboratorio de Fisiología Vegetal, Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Chile. 2. Centro de estudios avanzados en zonas áridas (CEAZA).
e-mail: lubascun@udec.cl

Chenopodium quinoa Willd. is a native species that originated from the Altiplano, and many landraces are cultivated today the south of Chile. Because of the different edaphoclimatic characteristics of both regions, soils from Altiplano accumulated higher levels of nitrate (NO_3^-) than in the south of Chile, where soils favor ammonium (NH_4^+) accumulation. We are interested in to understand if *C. quinoa* ecotypes Socaire (from Altiplano) and Faro (from Lowland/South of Chile) differ in their preference of inorganic N sources. We performed studies using $NO_3^-$and NH4+ as unique N source, and different proportions of these two N sources, including: 75:25; 50:50 and 25:75 of NO_3^-: NH_4^+ to understand metabolomic shifts under the different N conditions. Measurements of biomass productivity, protein synthesis, oxygen consumption, and the changes in the principal enzymes of N metabolism including Nitrate reductase (NR), Glutamine synthetase (GS) and Glutamate dehydrogenase (GDH) in (roots and leaves) are indicating a differential sensitivity of both quinoa ecotypes to NH_4^+. The higher sensitivity towards increment of NH_4^+ proportion observed in Socaire but not in Faro contributes to a better understanding of their adaptation to different soils.
Acknowledgments: *ANID Fondecyt Regular 1211473.*

Short Communications 3:

Uniqueness of the Photosynthetic and Hydraulic Ecophysiological Traits of Antarctic Vascular Plants.

Pedro Flores Branttes[1], Francisca I. Fuentes[2], Valentina Vallejos[2,5], Constanza F. Ramírez[2,5], León A. Bravo[2], Lohengrin A. Cavieres[3,5], Jeroni Galmés[4], Patricia L. Sáez [2,5]
1. Laboratorio Cultivo de Tejidos Vegetales, Centro de Biotecnología, Facultad de Ciencias Forestales, Universidad de Concepción, Concepción, Chile. 2. Laboratorio de Fisiología y Biología Molecular Vegetal, Instituto de Agroindustria, Departamento de Ciencias Agronómicas y Recursos Naturales, Facultad de Ciencias Agropecuarias y Medioambiente, Universidad de La Frontera. Temuco. 3. ECOBIOSIS, Departamento de Botánica, Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Concepción, Chile. 4. Research Group on Plant Biology under Mediterranean Conditions, INAGEA-Universitat de les Illes Balears, Balearic Islands, Spain. 5. Instituto de Ecología y Biodiversidad (IEB), Santiago, Chile.
e-mail: pedrofloresbranttes@gmail.com

Deschampsia antarctica and *Colobanthus quitensis* are the only two vascular plant species that have successfully colonized the extreme climatic conditions of Antarctica. In addition to being widely distributed across almost the entire Maritime Antarctica from 62°S to 68°S, there are also reports of their presence along the Andes Mountain range up to 56°S. Under Antarctic conditions, these plants exhibit morphological and biochemical characteristics adapted to stressful environmental conditions such as freezing, drought, nutrient scarcity, and intense radiation. They also display strongly xerophytic leaf adaptations with thick and lignified cell walls. This results in a substantial reduction in CO_2 conductance during photosynthesis, compensated by a Rubisco highly specific for CO_2. Therefore, the photosynthetic performance of Antarctic plants is predominantly governed by diffusion components associated with g_m, along with biochemical determinants linked to the kinetic traits of Rubisco.
Despite extensive knowledge of the physiological traits of Antarctic vascular plants, gaps persist regarding the uniqueness of these features. Specifically, it remains unclear whether these physiological traits are solely determined by the Antarctic climate, making them unique to species growing in Antarctica, or if they are also present in populations outside Antarctica or in phylogenetically related species inhabiting similarly hostile climates. The objective was to compare the photosynthetic and hydraulic characteristics of Antarctic vascular plant populations with those of related species growing in subantarctic and Antarctic environments. Evaluations included anatomical features, photosynthetic functional traits (g_s, g_m, v_{max}), and hydraulic characteristics (K_{leaf}, hydraulic diameter, vein architecture) in plants cultivated in chambers under different thermal regimes.
Acknowledgments: *FONDECYT 1211231; ANILLO ACT210038.*

Adapting to drought: contrasting strategies in coexisting Mediterranean oaks.

David Alonso-Forn[1,2], José Javier Peguero-Pina[1] and Eustaquio Gil-Pelegrín[3]
1. Departamento de Sistemas Agrícolas, Forestales y Medio Ambiente. Centro de Investigación y Tecnología Agroalimentaria de Aragón (CITA) Avda. Montañana 930, 50059 Zaragoza (Spain). 2. Research Group on Plant Biology under Mediterranean Conditions, Institut d'Investigacions Agroambientals i d'Economia de l'Aigua, Universitat de les Illes Balears, Illes Balears, Spain. 3. Plant Biology Department, Estación Experimental de Aula Dei (EEAD), CSIC. Avda. Montañana 1005. E-50059 Zaragoza, Spain.
e-mail: davidalonsoforn@gmail.com

Nowadays, within Mediterranean climates, two different types of oak (*Quercus* L.) trees thrive side by side: the evergreen sclerophyllous with a Palaeotropical origin and the winter-deciduous malacophyllous with an Arcto-tertiary origin. *Quercus ilex* subsp *rotundifolia* and *Q. faginea* serve as prime examples of contrasting leaf habits and diverse approaches in adapting to cope with the challenges posed by summer drought. Our study delved into an analysis of the photosynthetic, photochemical, and hydraulic traits exhibited by these oaks, subjecting them to varying watering conditions and severe drought scenarios. We imposed a severe water stress on both species, mimicking the conditions experienced during the summer in Mediterranean-like climates to explore how effectively plants can supply water to transpiring leaves, a process often severely constrained. Our findings showcased an intriguing dynamic: the winter-deciduous oak, *Q. faginea*, compensates for its comparatively shorter leaf lifespan by demonstrating a higher photosynthetic capacity under well-watered conditions. However, this increased productivity comes at the expense of higher water consumption.
During drought periods, both oak types reveal unique adaptive strategies. *Q. faginea* adjusts by significantly reducing its hydraulic conductance and photosynthetic traits, effectively avoiding extensive xylem embolism. Conversely, *Q. ilex* subsp. *rotundifolia* exhibits a contrasting response, presenting effective photoprotective mechanisms and showcasing a higher resistance to drought-induced cavitation, attributed to its longer-lasting foliage. Our study underscores the crucial variations in adaptation strategies between these Mediterranean oaks, shedding light on their importance in devising effective forest management strategies within an ever-evolving environmental landscape.
Acknowledgments: *Scholarship BES-2017-081208; POPEYE (PID2022-139455NB-C31).*

Assessing the drought tolerance of halophyte and non-halophyte species from the Atacama salt-flat.

Noemí Labra[1,2], **Carolina E. Sanhueza**[1,2,3], Lohengrin A. Cavieres[1,2]
1. Departamento de Botánica, Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Concepción, Chile. 2. Instituto de Ecología y Biodiversidad (IEB), Concepción, Chile. 3. Universidad de las Américas, Facultad de Medicina Veterinaria y Agronomía, Avenida Chacabuco 539, Concepción.
e-mail: csanhuez@udec.cl

Native plant species inhabit the southern part of the Atacama Salt flat due to the outcrop of groundwater forming an azonal vegetation. These species share several anatomical characteristics to deal with overall aridity of the environment but differ in their classification regarding salinity tolerance: halophyte and non-halophyte species. The southern part of the Atacama Salt flat has been experiencing reductions in the groundwater outcrops, and climate forecasts predict that plant species inhabiting this zone will face more intense drought in the future. With the aim to determine the drought tolerance of different species inhabiting the Atacama salt flat, we evaluated the photosynthesis, growth, and survival of eight species growing in the southern area of the Atacama salt flat when irrigated with different levels of water deficit. We hypothesized that halophytes species, which have specialized mechanisms to withstand salinity, may be better prepared to tolerate water deficits. Regardless of their salt tolerance, all the species analyzed demonstrated the ability to endure extended periods of different levels of water deficit. However, as the stress became more prolonged and severe, the varying degrees of tolerance to soil dehydration appeared to be species-specific. The capacity to sustain photosynthesis and maintain water balance emerges as a crucial requirement for maintaining growth and it is proposed as an important indicator of drought tolerance in these ecosystems.

Acknowledgments: *This study was funded by Albemarle Company and ANID FB 210006.*

Short Communications 4:

Nitrogen availability improves the photochemistry and water use efficiency of *Amaranthus cruentus* under water deficit.

Enrique Ostria-Gallardo[1]; Valentina Cabrera[1]; Estrella Zúñiga-Contreras[2]; León Bravo[3]; José Ortiz[1]; Luisa Bascuñán-Godoy[1].
1. Laboratorio de Fisiología Vegetal, Departamento de Botánica, Universidad de Concepción. 2. Centro de Estudios Avanzados en Zonas Áridas, CEAZA. 3. Laboratorio de Fisiología y Biología Molecular Vegetal, Instituto de Agroindustria, Universidad de La Frontera.
e-mail: eostria@udec.cl

Water scarcity is a significant concern in agriculture, and understanding the mechanisms by which plants can adapt to limited water resources is crucial for sustainable crop production. *Amaranthus cruentus*, a drought-sensitive species, was subjected to water deficit conditions, and the effects of nitrogen supplementation on its photochemical performance and water use efficiency were examined. The experiment involved the application of sufficient- and deficient-nitrogen concentrations to assess the plant's response under water deficit stress. Measurements of key physiological parameters, including chlorophyll fluorescence, gas exchange, and metabolome analysis, were conducted to evaluate the impact of nitrogen availability on the ability of *A. cruentus* to maintain photosynthetic activity and water use efficiency during water deficit conditions. The results indicate a significant improvement in the photochemical efficiency of *A. cruentus* when supplied with adequate nitrogen under water deficit stress. Enhanced chlorophyll fluorescence parameters suggest a more efficient utilization of light energy in photosynthesis, contributing to improved plant performance. Additionally, sufficient nitrogen supplementation positively influenced water use efficiency, optimizing the balance between carbon assimilation and water loss under limited water. At the metabolic level, there is an accumulation of ascorbic acid and aromatic amino acids in *A.*

cruentus with sufficient-nitrogen under water deficit. Although preliminary, these data provide insights into the interactive effects of nitrogen availability and water deficit on the physiological responses of *Amaranthus cruentus*, shedding light on possible metabolic routes and physiological mechanisms for optimizing *A. cruentus* performance under limited water.
Acknowledgments: *Fondecyt Iniciación 11201086; Fondecyt Regular 1211473.*

How does the native Chilean potato 'Michuñe Negra' respond to heat waves?

Andrea Ávila-Valdés[1], Muriel Quinet[2], Stanley Lutts[2], Carolina Lizana[3], Claudio Pastenes[1]
1. Departamento de Producción Agrícola, Facultad de Ciencias Agronómicas, Universidad de Chile, Santiago, Chile; 2. Groupe de Recherche en Physiologie végétale (GRPV), Earth and Life Institute - Agronomy, Université catholique de Louvain, Louvain-la-Neuve, Belgium. 3. Instituto de Producción y Sanidad Vegetal, Facultad de Ciencias Agrarias y Alimentarias, Universidad Austral de Chile, Valdivia, Chile.
e-mail: a.avila.valdes@gmail.com

The heat waves are predicted to increase in frequency and severity in many regions of the world, including the areas where potatoes are grown. Considering this, native Chilean potatoes could have a comparative advantage due to their high concentrations of antioxidants. In the present study, we evaluated the response of the native Chilean potato "Michuñe Negra" (*Solanum tuberosum* ssp. *tuberosum*) and commercial variety "Asterix" to a heat wave during tuber bulking under greenhouse conditions. Two treatments were applied: (i) C, at ambient temperature; (ii) HW, at a high temperature (c. 33°C) for 3 hours (13:00 to 16:00) daily, for five consecutive days, using a polyethylene chamber equipped with thermostatic electric heaters. The results showed that the applied heat wave did not induce changes in tuber yield; however, leaf gas exchange, membrane thermostability, and antioxidant activity were modified during the heat wave and the recovery period. The photosynthetic rate of the commercial potato decreased rapidly with the heat wave, along with carboxylation rate, light compensation point, and membrane stability. Additionally, this variety exhibited little antioxidant response in the leaves, unlike the native potato, which showed minimal changes in its photosynthetic parameters but increased its antioxidant content in leaves. During the recovery period, Asterix did not show improvement in its photosynthetic parameters, while "Michuñe Negra" maintained high antioxidant concentrations for one week after the heat wave and then decreased. Consequently, the native Chilean potato "Michuñe Negra" would have a comparative advantage over "Asterix" in heat wave events and would be a good choice for cultivation in areas prone to extreme high-temperature events.
Acknowledgments: *FONDECYT Postdoctorado 3210259 (AAV)*

Short Communications 5:

Anatomical and biochemical evolutionary ancient traits of *Araucaria araucana* (Molina) K. Koch and their effects on carbon assimilation.

Betsy K. Rivera[1], Patricia L. Sáez[1,5*], Lohengrin A. Cavieres[2,5], Sebastià Capó-Bauçà[3], Concepción Iñiguez[3], Eugenio Sanfuentes von Stowasser[4], Francisca Fuentes[1], Constanza F. Ramírez[1], Valentina Vallejos[1], Jeroni Galmés[3]

1. Laboratorio Cultivo de Tejidos Vegetales, Centro de Biotecnología, Departamento de Silvicultura, Facultad de Ciencias Forestales, Universidad de Concepción, Concepción 4030000, Chile. 2. ECOBIOSIS, Departamento de Botánica, Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Barrio Universitario s/n, Concepción 4030000, Chile. 3. Research Group on Plant Biology under Mediterranean Conditions, INAGEA-Universitat de les Illes Balears, Balearic Islands 07122, Spain. 4. Laboratorio de Patología Forestal, Facultad Ciencias Forestales y Centro de Biotecnología, Universidad de Concepción, Concepción, Chile. 5. Institute of Ecology and Biodiversity (IEB), Concepción, Chile.
e-mail: betsyriverabriones7@gmail.com

The study of living fossils provides valuable information about the evolution of specific adaptations to past and current environmental conditions. *Araucaria araucana* is the oldest species in South America and one of the oldest genus in the world, despite this, there are few studies focused on its physiology and its responses to changes in environmental conditions. We performed an integrated approach aimed to characterize their stomatal, mesophyll and biochemical traits which govern its carbon assimilation under past and present levels of atmospheric CO_2. Results indicated that *A. araucana* presents typical traits of ancient species, such as large stomata and low density, which trigger a low g_s and slow stomatal responsiveness to changing environmental conditions. However, interestingly, the quantitative analysis shows that A_N is equally limited by both diffusive and biochemical components. The Rubisco catalytic properties preserve ancient traits, probably because of the different environmental selective pressures during its diversification. The increase in the measurement temperature induced stomatal and biochemical limitations, which together with a lower Rubisco affinity for CO_2 can compromise their photosynthetic capacity in warmer conditions.

Acknowledgments: *FONDECYT 1191382; CONICYT Magister scholarship; Project grant PGC2018-094621-B-I00.*

Stomatal closure precedes turgor loss and the onset of hydraulic dysfunction on anisohydric and isohydric cultivars of *Prunus dulcis*.

Carolina Álvarez-Maldini[1], Manuel Acevedo[2], Daniela Estay[3] y Simón Sandoval[4].
1. Departamento Silvicultura, Facultad de Ciencias Forestales, Universidad de Concepción, Concepción, Chile. 2. Centro Tecnológico de la Planta Forestal, Instituto Forestal, San Pedro de la Paz, Chile. 3. Instituto Ciencias Agroalimentarias Animales y Ambientales (ICA3), Campus Colchagua, Universidad de O´Higgins, San Fernando, Chile. 4. Departamento de Manejo de Bosques y Medio Ambiente, Universidad de Concepción, Concepción, Chile.
e-mail: caalvarez@udec.cl

The anisohydric–isohydric concept has been widely used to describe stomatal regulation during drought, simply in terms of variation of minimal water potential (Ψ_{min}) in relation to pre-dawn water potential (Ψ_{pd}). However, its simplicity has failed to deliver consistent results in describing a complex behavior resulting from the coordination of several functional traits. While *Prunus dulcis* is known as a drought tolerant species, the underlying mechanisms

explaining such behavior are unclear. Here we show a sequence of plant stomatal, hydraulic, and wilting responses to drought in almond cultivars, and the main differences between an/isohydric behavior. In a pot desiccation experiment with three almond cultivars, we observed that stomatal closure is not driven by loss in turgor or onset of xylem cavitation, but instead, occurs early in response to decreasing Ψ_{min} that could be related to the protection of the integrity of the hydraulic system, independently of cultivar. Anisohydric cultivars are characterized by maximum stomatal conductance, lower water potentials for stomatal closure (P_{gs90}) and turgor loss (Ψ_{TLP}), and lower vulnerability to xylem cavitation. Anatomically, anisohydric cultivars had a lower hydraulic diameter, evidencing a trade-off between higher resistance to cavitation with lower capacity for water transport. Unexpectedly, pit and pit-membrane structure was similar irrespectively of cultivar behavior. Our results demonstrate that *P. dulcis* presents a strategy to avoid cavitation by closing stomata during the early stages of drought and by leaf shedding. Future research should also focus on below-ground hydraulic traits and the occurrence of hydraulic segmentation.

Acknowledgments: *Fondecyt 11200807.*

Short Communications 6:

Gene differential expression in *Deschampsia antarctica* (Poaceae) upon cold deacclimation induced by nocturnal warming.

Dariel López[1,2], Giovanni Larama[2] y León A. Bravo[1].
1. Laboratorio de Fisiología y Biología Molecular Vegetal, Departamento de Ciencias Agronómicas y Recursos Naturales, Facultad de Ciencias Agropecuarias y Forestales & Scientific and Technological Bioresource Nucleus, Universidad de La Frontera, Temuco, Chile. 2. Laboratorio de Biocontrol, Scientific and Technological Bioresource Nucleus, Universidad de La Frontera, Temuco, Chile.
e-mail: dariel.lopez@gmail.com

Asymmetric warming is characterized by a greater increase in minimum nocturnal than in maximum diurnal temperature. This phenomenon leads to *Deschampsia antarctica* cold deacclimation in the laboratory. We hypothesize that *D. antarctica* cold deacclimation is related to the downregulation of transcription factors such as CBFs and their target genes, with the upregulation of vegetative growth genes. Therefore, our objective was to determine the effect of cold deacclimation induced by nocturnal warming on gene differential expression of *D. antarctica* plants, under laboratory conditions. Fully cold-acclimated *D. antarctica* plants (0/8°C) were transferred to 4 treatments for 14 days: control (0/8°C), nocturnal warming (6/8°C), diurnal warming (0/14°C) and diurnal-nocturnal warming (6/14°C) in growth chambers. After 14 days of treatment, samples for RNA extraction were collected just before the nocturnal period, at 2h, and 6h at the nocturnal period end. RNA-seq was performed and gene differential expression was bioinformatically analyzed, real-time PCR was realized to validate RNA-seq results and analyzed gene expression during the night. Nocturnal warming downregulated CBF-like gene expression, UDP-glycosyltransferase and Sucrose synthase, and Dehydrins, and upregulated IAA-amino acid hydrolase, RuBisCO, and Triose phosphate/phosphate translocator, among others. Consequently, nocturnal warming not only induces the cold deacclimation process in *D.*

antarctica, by the downregulation of CBF transcription factors but also by the upregulation of growth promotion and photosynthetic genes.
Acknowledgments: *NEXER NXR17-0002; INACH RT_18-18, ANID Scholarship 21170470.*

Thermography as a predictor of rooting in *Eucalyptus* cuttings.

Hernández-Fuentes C, Muñoz X. and Avilés F.
Subgerencia de Viveros & Biotecnología, ARAUCO.
e-mail: carolina.hernandez@arauco.com

Propagation by cuttings ensures and maintenance of the purity of planted genotypes. It consists of the establishment of clonal mini-gardens populated by donor plants. The hydric management in cuttings is important for ensure the rooting. For this reason, found techniques that allow predict the rooting before than fist roots are visible outside the tube, is essential to improve the cuttings propagation and achieve a good plant quality. The cuttings recently installed close stomata and depending of irrigation. However, when cutting is rooting, can open stomata and are able to regulate water loss. Our objective was determinate if the changes in stomata conductance are correlates with the emergence of the first roots, and it is possible identify these changes with thermography. We selected and mark 20 cutting in 20 donor plants of two clones. Then measured gas-exchange and thermography of cutting at different times (cuttings attached donor plant, recently installed, and 1, 2, 3 and 4 weeks after installed). In each time we register the gas-exchange parameters, thermography and visible root percentage. Our results showed than it is possible relate changes in stomata conductance and thermography with cutting rooting, allow us to predict between 1-2 weeks the rooting in *Eucalyptus* cuttings.
Acknowledgments: *ECOBIOSIS laboratory to facilitate the use of a thermal imaging camera.*

The role of Gaultheria poeppigii for soil microbial recovery in temperate Araucaria Araucana forest after severe wildfire.

Camila Cifuentes C.[1], Francisco Matus[2], Alejandra Zúñiga F.[3]
1. Escuela de Graduados, Universidad Austral de Chile. 2. Laboratorio de Dinámica y Conservación de Suelos Volcánicos, Universidad de La Frontera, Chile. 3. Laboratorio de Fisiología Vegetal, Instituto de Ciencias Ambientales y Evolutivas, Universidad Austral de Chile.
e-mail: camila.cifuentes@gmail.com

High severity forest wildfires are increasingly frequent in the temperate forests of the southern cone, however their impacts on soil microbial communities are not yet well understood. Here we study the recovery of soil microbial communities in the China Muerta National Reserve in southern Chile with a stand of pure *Araucaria araucana* forest, severely affected by a fire in 2015. Soil samples from *Gaultheria poepigii* rhizosphere soil and adjacent soil without plants were obtained in low and high severity sites, including a control not burned. The abundance of bacteria (16S), archaea and N_2-fixing bacteria (nifH) was determined by qPCR. Microbial activity was evaluated by enzymatic activity determination, associated with nutrient fixation and cycling. Both 16S and nifH were more abundant in the

control site, while archaea were more abundant in low fire severity site. In all sites a greater abundance of archaea and nifH was found in the rhizosphere soil. These differences were consistent with enzymatic activity, where the control samples of the rhizospheric soil presented higher activity values. Furthermore, acid phosphatase and fluoresin diacetate activity, associated with P release and microbial activity, were significantly higher in the rhizospheric soil. Our results suggest that *G. poeppigii* is a promoter of the recovery of these soils, since there was a correlation between the abundance of microorganisms and the enzymatic activity associated with the fixation of N and decomposition of soil organic matter.
Acknowledgment: *ANID PhD scholarship 21200724; Proyecto Anillo ACT210060.*

In this tapestry of insights, our shared commitment to unraveling the intricacies of plant ecophysiology paints a vibrant picture of collaborative discovery and growth. Together, we've woven these threads at the XVII International Colloquium on Plant Ecophysiology, marking a pivotal moment in advancing our collective understanding of the plant biology world.