



ECOFLO[®]R

COIMBRA 2024



21ST ANNUAL MEETING OF THE SPANISH GROUP FOR FLORAL ECOLOGY

DEPARTAMENTO DE CIÊNCIAS DA VIDA
UNIVERSIDADE DE COIMBRA

BOOK OF ABSTRACTS



GENERAL PROGRAMME

Feb 1st

8H30: **Registration of the participants**

9H00: **Opening ceremony**

9H15: **Plenary session**

10H00: **Session 1**

10H30: **Coffee Break**

11H15: **Session 2**

12H30: **Lunch**

14H30: **Session 3**

16H00: **Coffee Break**

16H45: **Session 4**

17H30: **Poster session**

20H00: **Dinner**

Feb 2nd

9H00: **Plenary session**

9H45: **Session 5**

10H15: **Coffee Break**

11H00: **Session 6**

12H30: **Lunch**

13H30: **Visit to the Botanical Garden of the University of Coimbra / Herbarium of the University of Coimbra**

14H30: **Session 7**

16H00: **Coffee Break**

16H30: **Visit to the Herbarium of the University of Coimbra**

Feb 3rd

9H00: **Workshop – Marcos Méndez**

How to write your introduction and discussion: overcome the panic of the blank page

10H00: **Workshop – Hugo Gaspar**

Introduction to Pollinator Identification in a Mediterranean System - Part I

12H00: **Lunch**

13H00: **Workshop – Hugo Gaspar**

Introduction to Pollinator Identification in a Mediterranean System - Part II

DETAILED PROGRAMME

February 1st

8H30 – 9H00

Registration of the participants

9H00 – 9H15

Opening ceremony

9H15 – 10H00

Plenary session 1

Chair: João Loureiro

K1 – The role of plant polyploidy in the structure of biotic communities.

Tia-Lynn Ashman

10H00 – 10H30

Session 1

Chair: João Loureiro

O1 – *Can changes in ploidy drive the evolution to allogamy in a selfing species complex?*

Ana García-Muñoz

O2 – *Plant polyploidy effects on floral traits and the pollination niche.*

Nathália Susin Streher

10H30 – 11H15

Coffee Break

11H15 – 12H30

Session 2

Chair: Maria Clara Castellanos

O3 – *The first (candidate) example of a selfing-to-outcrossing mating system transition in angiosperms: a philosophical overlook.*

Carlos Olmedo-Castellanos

O4 – *Interplay between population mating system and temporal variation of pollination reliability in Dalechampia vines.*

Juan Isaac Moreira-Hernández

O5 – *Flower allometry and its relationship with pollinators along an altitudinal gradient of the tropical Andes of Bolivia.*

Sissi Lozada-Gobilard

O6 – *Divergent patterns of phenotypic selection on floral traits in response to variation in the local pollinator assemblages, despite generalized plant-pollinator interactions.*

Felipe Torres-Vanegas

O7 – *Dispersion, speciation and diversification patterns of the Erysimum genus across the Macaronesia.*

Melissa Viveiros Moniz

12H30 – 14H30

Lunch

14H30 – 16H00

Session 3

Chair: Mohamed Abdelaziz

O8 – *Are flowers adapting to a warming climate?*

Andres Romero-Bravo

O9 – *Functional traits and shifting flowering phenology in Mediterranean communities.*

Daniel Pareja Bonilla

O10 – *Is biodiversity buffering plant-pollinator communities phenological asynchrony caused by climate change?*

Nerea Montes Perez

O11 – *Pollination ecology of Teucrium capitatum subsp. majoricum: effects of natural habitat loss.*

Joshua Borràs

O12 – *The role of forests and large urban parks in sustain pollinator diversity and efficiency.*

Rosa Ranalli

O13 – *The role of birds as dual mutualists in highly invaded forests.*

Mauro Nereu

16H00 – 16H45

Coffee Break

16H45 – 17H30

Session 4

Chair: Ruben Heleno

O14 – *Pollination deficits and their relation with insect pollinator visitation are cultivar-dependent in an entomophilous crop.*

Maxime Eeraerts

O15 – *Flower morphology in blueberry cultivars influences the behaviour of flower visitors.*

Helena Castro

O16 – *Supporting plant and pollinator biodiversity: the role of citizen scientists in the Life4Pollinators project.*

Fortunato Fulvio Bitonto

17H30 – 18H30

Poster session

20H00: Dinner

POSTER SESSION

P01 – *Riparian habitat effects on pollinator diversity through network analysis in an agricultural landscape*

António Santos

P02 – *Dynamics of flower resources across habitats and seasons in human-dominated agro-ecosystems: the case of Zvimba district in Zimbabwe*

Gugulethu Tarakini

P03 – *Your neighbor matters: co-flowering community effects on the reproductive success of a food-deceptive orchid.*

Yedra Garcia

P04 – *Introduced plants in Mediterranean islands: a risk for pollination and seed dispersal?*

Miquel Capó

P05 – *A tale of heavy metals, railways, plants and pollinators: the promise of phytoremediation in urban areas*

Rosa Ranalli

P06 – *Plant reproductive traits to investigate biodiversity between core and stepping stones areas in an urban ecological network*

Rosario Rummo

P07 – *Effect of fire on florivory in the Pantanal*

Joana Roxinsky Teodoro

P08 – *What is the value of biotic seed dispersal in post-fire forest regeneration?*

Sérgio Timóteo

P09 – *Effects of fire on plant-pollinator interactions in Pantanal*

Danilson da Costa Lima

P10 – *Plant strategies to recover from wildfires: fight or flight*

José M. Costa

P11 – *Effects of fire and flooding on the pollen loads of floral visitors in the south Pantanal*

Magno Sá de Souza

P12 – *Plant reproduction on Campo Rupestre: relationship between total and heterospecific pollen deposition in a fire-prone habitat*

Gudryan Jackson Baronio

P13 – *Comparing the diversity and composition of pollen carried on the hind legs and in the digestive system in six species of solitary bees*

Jan Klečka

P14 – *Pollen carryover effectiveness comparison across a wide range of functional pollinators groups*

Martin Freudenfeld

P15 – *Mutualistic multilayer plant-Lepidoptera interactions in the Brazilian Campos Rupestres*

Lucas Benício de Castro

P16 – *Do floral traits drive Interactions in a tropical urban garden from Brazil?*

Luis Gustavo de Sousa Perugini

P17 – *Range-shifting lowland plant species and their competition for pollinators with mountain plants*

Karolína Jackwerth

P18 – *The importance of knowing who is next to me? Growing with relatives and their impact on direct (and indirect) female fitness on plants*

Camilo Ferrón Martínez

P19 – *Early flowering enhances performance among conspecifics*

Patricia Moreno-Colom

P20 – *The effect of pollinator identity and diversity on mating system and pollen limitation in an alpine plant community*

Wilhelm Osterman

P21 – *The role of the breeding system in the distribution of *Microlicia* species.*

F. Javier Jimenez-Lopez

P22 – *Exploring the impact of sexual systems on reproductive success in gynodioecious plant species: a comparative study in *Thymus* section *Mastichina**

Regina Berjano

P23 – *Investigating the longstanding mystery of stigma length differences between morphs of distylous plants*

Renata Trevizan

P24 – *Finding Bermuda buttercup (*Oxalis pes-caprae*): understanding the evolutionary and ecological processes and patterns of biological invasions in the Mediterranean region*

Staša Simcic

P25 – *The role of herbaria in biodiversity studies*

Macarena Marín-Rodulfo

P26 – *Analysis of changes in plant reproductive structures as a consequence of climate change*

Juan Linares

P27 – *Historical data of fruiting phenology for 4,462 spontaneous and cultivated plant taxa in Portugal (1926 – 2013)*

Ruben Heleno

P28 – *Dry air, long hair! Insights on a putative climate-driven strophiole size variability in the Iberian endemic rupicolous genus *Petrocoptis* A. Braun ex Endl.*

Jorge Calvo-Yuste

P29 – *The predictive use of floral scents to identify pollinator mechanisms: Orchids and aroids as study cases*

Carlos Martel

P30 – *Deciphering bee avoidance hypothesis in red flowers: The key is in the pigments*

Melissa León-Osper

P31 – *Effects of pollinator density on the patterns of selection on floral traits*

Camille Jolivel

P32 – *Effect of ploidy variation and mating system strategy on the reproductive investment across whole plant life*

Esther Funes-Ligero

P33 – *Root infection in a selfing Erysimum species drive changes in the reproductive strategies and output*

Celia Vaca-Benito

P34 – *Do all bees respond the same way to fire? Functional responses of Mediterranean bee communities to fire severity and floral resources*

Georgios Nakas

P35 – *Variation in body size and plant-pollinator interactions in three Apidae bee species over a century*

Lucia Lenzi

P36 – *Bumblebee parasites and pathogens: assessing fitness implications through literature review and metaanalysis*

Sofia Dartnell

P37 – *Variation barcodes for monitoring genetic diversity in the anthropocene*

Mireia Bustos-Aibar

P38 – *Genetic characterization of the honeybee (Apis mellifera L.) populations in Estonia*

Eva Povkhanych

February 2nd

9H00 – 9H45

Plenary session 2

Chair: **Sílvia Castro**

K2 – *Kinship effects on plant-pollinator interactions: where pollination ecology meets social evolution.*

Rúben Torices

9H45 – 10H15

Session 5

Chair: **Sílvia Castro**

O17 – *Introduction of plant and animal species cause disruptions on the pollination interaction networks of The Ogasawara Islands, Japan.*

Marta Quitián

O18 – *Pollinator sharing of co-flowering Rhexia: case study of Rhexia mariana.*

Karolina Gwardiak

10H15 – 11H00

Coffee Break

11H00 – 12H30

Session 6

Chair: **Marcos Méndez**

O19 – *Two years testing automated pollination monitoring without human presence in community-level studies.*

Pau Enric Serra

O20 – *New tools for the study of sex reciprocity and pollen transfer in stylar-polymorphic plants, and their application in Linum.*

Violeta I. Simón-Porcar

O21 – *Diurnal stratification of pollen presentation structure the pattern of pollen transfer and mitigate competition for pollinators.*

Jakub Štenc

O22 – *Patterns and drivers of pollen co-transport networks vary across pollinator groups.*

Liedson Tavares Carneiro

O23 – *Effects of pollinator sharing on pollen deposition in Brazilian Campos Rupestres.*

Marsal Danrlei de Amorim

O24 – *Grooming behavior and stigma position alter the mating network between plant individuals.*

Vanessa Gonzaga Marcelo

12H30 – 14H30

Lunch

14H30 – 16H00

Session 7

Chair: Violeta Simón-Porcar

O25 – *How to build a buzz pollinated flower?*

Mario Vallejo-Marin

O26 – *Revisiting Vickery: stable colour polymorphisms may not result in pollinator switches in monkeyflowers (Mimulus).*

Kelsey JRP Byers

O27 – *Global overview of the flower visits of velvet ants (Hymenoptera: Mutillidae and Myrmosidae) as a case of study on neglected pollinators.*

Jairo Robla

O28 – *The role of networks in flower (co)evolution: Lithophragma bolanderi as the focal species.*

Pamela Cristina Santana

O29 – *Pollinators, but not predators, indirectly affect endophagous florivores in Cirsium arvense (Asteraceae).*

Yogita Karpate

O30 – *Is the red leaf colour of Carex (Cyperaceae) in New Zealand an adaptation to browsing by the extinct moas? A study of the dissuasive effect on herbivory by extant ratite birds.*

Santiago Martín-Bravo

16H00 – 16H45

Coffee Break



PLENARY SESSIONS

K1 – The role of plant polyploidy in the structure of biotic communities

Ashman T-L¹

¹Department of Biological Sciences, University of Pittsburgh

Evolution has a pervasive role within ecological communities, but we are only beginning to link evolutionary processes to species interactions that create network structure and function. Polyploidy, or whole genome duplication, is a major evolutionary process in plants with far reaching genomic and phenotypic effects, suggesting it may impact ecological communities, yet its ecological consequences remain poorly understood. Here I will report on work from the lab addressing this gap. First, assessing the role of polyploidy in the broader context of plant-pollinator communities and whether there are cascading effects of plant polyploidy on the structure of pollination networks or on the robustness of these communities to perturbation. And second, whether plant polyploidy affects the diversity and composition of the plant microbial community. These projects represent steps toward understanding the role polyploidy plays in shaping biotic communities and the ways these may feedback to shape continued plant evolution.

K2 – Kinship effects on plant-pollinator interactions: where pollination ecology meets social evolution

Torices R¹

¹Biodiversity and Conservation Area, University Rey Juan Carlos

To be available soon



ORAL COMMUNICATIONS

O1 – Can changes in ploidy drive the evolution to allogamy in a selfing species complex?

García-Muñoz A¹, Ferrón C^{1,2}, Vaca-Benito C¹, Martínez-Gómez MN¹, Castro S³, Castro M³, Loureiro J³, Muñoz-Pajares AJ^{1,4}, Abdelaziz M¹

¹Department of Genetics, University of Granada

²Biodiversity and Conservation Area, Departments of Biology, Geology, Physics and Inorganic Chemistry, Rey Juan Carlos University (URJC)

³Centre for Functional Ecology, Associate Laboratory TERRA, Department of Life Sciences, University of Coimbra

⁴Research Unit Modeling Nature, University of Granada

The evolution of mating systems in plants is central for understanding the rise of their diversity on Earth. The transition towards self-fertilization is a well-known example of convergent evolution and, in fact, the opposite direction is expected to be forbidden according to evolutionary theories. The mating system is often shaped by the action of biotic drivers as pollinators in outcrossing plants. Here, we suggest that the ploidy could also promote changes in the reproductive strategies through its effect on traits related to pollination. For this purpose, we used several populations from the *Erysimum incanum* species complex, which has been described as predominantly selfing. We performed over 7,000 controlled crosses to evaluate the inbreeding depression. Additionally, we measured mating traits as floral size, herkogamy and the relative investment between male and female reproductive components (i.e. pollen:ovule ratio). We described three ploidy levels -the hexaploid level was unknown until now- and estimated the genomic diversity of each ploidy. We found significant differences in the self-pollination success among ploidies and, even, among populations within the same ploidy. A certain degree of inbreeding depression was present in higher ploidies, which were also accompanied by bigger flowers, a more accentuated herkogamy and a higher allocation in pollen production related to the ovule amount. These findings suggest that ploidy could be promoting alternative reproductive strategies to selfing, driving mating system diversification within a selfing species, which has not been described in the wild before.

Keywords: *Erysimum*, self-pollination, herkogamy, inbreeding depression, pollen:ovule ratio

O2 – Plant polyploidy effects on floral traits and the pollination niche

Streher NS^{1,2}, Halabi K^{1,2}, Mayrose I^{1,2}, Ashman T-L^{1,2}

¹Department of Biological Sciences, University of Pittsburgh

²School of Plant Sciences and Food Security, George S. Wise Faculty of Life Sciences, Tel Aviv University

Polyploidy (whole genome duplication) is a major evolutionary process in flowering plants yet the consequences for interactions with pollinators are unclear. Polyploidy causes larger cells and slower cell division, which can impact floral phenotype and flowering phenology. Thus, it may affect pollination generalization and the structure of plant communities. By leveraging herbarium specimens and plant-pollinator networks, we aim to elucidate the effects of polyploidy on pollination niche by answering three questions: 1) do polyploids have larger flowers and broader pollination niches than diploids or does this depend on the mating system? 2) does the route to polyploidy (allopolyploidy or autopolyploidy) influence the phenotypic and phenological shifts that occur? And 3) does the percentage of polyploids within communities affect plant-pollinator network structure? For the first question, our results indicated that mating system moderated the influence of ploidy on floral traits in 40 Brassicaceae species but the response in pollination generalism (diversity of pollen/stigmas) was more variable. For our second question, we are sampling flower size and phenology on a phylogenetically diverse set of 11 auto- and 16 allopolyploids and their diploid parents, totaling 64 species within 16 genera. For the third question, we analyzed 337 bipartite plant-pollinator networks and revealed that polyploid-rich communities exhibit higher connectance and nestedness. These effects were mostly indirect, being mediated by the self-compatibility frequency in the community. Taken together, our work is revealing the myriad and nuanced ways that polyploidy affects species and their roles within pollination networks.

Keywords: flowering time, heterospecific pollen, mating system, plant-pollinator networks, polyploidy route, whole genome duplication

Funding: This work was funded by National Science Foundation (DEB-2027604 to TLA), by the U.S.-Israel Binational Science Foundation (BSF 2020625 to IM), and by the Israel Science Foundation (1843/21 to IM)

O3 – The first (candidate) example of a selfing-to-outcrossing mating system transition in angiosperms: a philosophical overlook

Olmedo-Castellanos C¹, García-Muñoz A¹, Muñoz-Pajares AJ¹, Abdelaziz M¹

¹BioChange Network, Department of Genetics, Faculty of Sciences, University of Granada (UGR)

Mating systems in flowering plants are said to evolve from crossed fertilization to self-fertilization. Theoretic models and the absence of known examples of the reverse transition support the selfing as an evolutionary dead-end hypothesis (SEDE) for history of plant populations. However, what if an example of this reverse transition were found? This is the case of *Erysimum incanum* and *Erysimum wilczekianum*, two Brassicaceae species from Iberian Peninsula and Morocco. Being the first a selfing species, *E. wilczekianum* presents an outcrossing mating system. Phylogenetic analysis points to *E. incanum* as the ancestor of *E. wilczekianum*, which would indicate a reverse transition to outcrossing in a selfing clade. Scientific progress is not a linear accumulation of knowledge, but a concatenation of ground-breaking questions which need new answers and perspectives. Those questions defy settled theories and concepts (a crisis of paradigms) and promote the establishment of new principles (a scientific revolution). Is this process possible at a small scale, just involving a specific theory? Can we talk about a crisis, or can we continue accepting the theory? These questions are essential to understand the impact of newly found examples, which are a common thing in Ecology and Evolution. In this talk, our aim is proposing a common reflection about this new example of a reverse mating system transition, its potential impact of the SEDE hypothesis and, for extension, in our perception of mating system evolution in plants, and how can we define it using the tools offered by Philosophy of Science.

Keywords: *Erysimum*, evolutionary transitions, mating system, philosophy of science, SEDE hypothesis

Funding: University of Granada, Banco Santander, Ministry of Science and Innovation, Athenea-3i MSCA

O4 – Interplay between population mating system and temporal variation of pollination reliability in *Dalechampia* vines

Moreira-Hernández JI¹, Rodríguez-Otero C¹, Opedal R¹

¹Speciation, Adaptation, and Co-evolution Research Group (SPACE), Department of Biology, Lund University (LU)

The ongoing worldwide decline of pollinators and the ecosystem services they provide raises the urgent need to understand how angiosperms respond evolutionarily to changing pollination environments. In plants with mixed mating systems, significant interpopulation variation in local mating system and the floral traits that mediate it has been revealed by several studies, but it remains unknown how such variation is related to temporal changes in pollination reliability and reproductive success. Using multiyear data from tropical *Dalechampia* vines, we propose a framework to link interpopulation variation in local mating system with temporal changes in pollination reliability. Our results show that highly herkogamous (i.e. more outcrossing) populations exhibit greater absolute change in pollination reliability between years than populations with low herkogamy and which more prone to selfing. In contrast, proportional variation in pollination reliability was negatively correlated with herkogamy. We found that low herkogamous populations experience higher percentage annual changes in reliability, with corresponding greater fitness losses when pollination is unreliable. However, these same conditions increase the reproductive assurance value of herkogamy and allow for the long-term maintenance of selfing. Taken together, our results suggest that the locally adapted mating system of a population can reflect long-term patterns of pollination reliability, with traits facilitating selfing being more advantageous for populations exposed to greater fitness losses due to high fluctuations in the pollination environment.

Keywords: herkogamy, pollination, reproductive assurance, trait variation, environmental change

Funding: Funding for this project was graciously provided by the Swedish Research Council, the Crafoord Foundation, and the Royal Physiographic Society of Lund.

O5 – Flower allometry and its relationship with pollinators along an altitudinal gradient of the tropical Andes of Bolivia

Lozada-Gobilard S¹, Opedal O¹

¹Biodiversity Unit, Department of Biology Lund University

Flower traits have been shown to be related to breeding systems (outcrossing vs. selfing), pollinators and can vary along abiotic conditions. Environmental variation along altitudinal gradients is commonly associated with changes in the diversity of plants and animals, making them ideal systems to study variation in flower traits and its relationship with pollinators. We measured flower traits of 20 species of plants and observed their pollinators (flower visitors that touched reproductive parts of the flower) along an altitudinal gradient (1000-4500 m) in the tropical Andes of Bolivia. Flower traits included flower size, entrance diameter, flower length and anther-stigma distance. In particular, we compared allometries of stigma-anther height along the gradient. In this study, we test the hypothesis that anther-stigma correlations are stronger at higher altitudes, assuming that at higher altitudes the conditions are harder, there are less available pollinators and therefore selfing plants species would be more common. Additionally, we tested whether anther-stigma height correlations are related to more generalist plant species or a particular guild of pollinators.

Keywords: Flower traits, allometry, altitudinal gradient, tropical Andes, pollinators, Bolivia

Funding: Royal Physiographic Society

O6 – Divergent patterns of phenotypic selection on floral traits in response to variation in the local pollinator assemblages, despite generalized plant-pollinator interactions

Torres-Vanegas F¹, Temesvári V¹, Hildesheim LS¹, Rodríguez-Otero C¹, Müller V¹, Aukema E¹, Friberg M¹, Opedal RH¹

¹Department of Biology, Biodiversity Unit, Lund University

In the context of generalized plant-pollinator interactions, there is a critical need to understand the importance of spatial and temporal variation in the local pollinator assemblages as a factor that can exert convergent or divergent consequences for the patterns of phenotypic selection on floral traits. In this study, we related spatial and temporal variation in the local pollinator assemblages to divergence in the patterns of phenotypic selection on flower and inflorescence traits of *Viscaria vulgaris*, a plant that interacts with a broad taxonomic and functional diversity of diurnal and nocturnal pollinators. We detected consistent phenotypic selection on floral traits involved in the attraction of pollinators, while phenotypic selection on floral traits involved in the mechanics of pollen removal and deposition fluctuated. We demonstrated that particular floral traits can experience spatio-temporal variation in the strength and direction of phenotypic selection. We observed that an increase in the expected level of divergence between the local pollinator assemblages was associated with disparities in phenotypic selection on floral traits. We revealed that diurnal and nocturnal pollinators, when considered in isolation, can exert divergent patterns of phenotypic selection on floral traits. We argue that generalized plant-pollinator interactions can exert phenotypic selection on floral traits and that distinct local pollinator assemblages can generate divergent patterns of phenotypic selection. We suggest that divergent patterns of phenotypic selection on floral traits are not exclusive to specialized plant-pollinator interactions, and that such outcome can occur across a local geographic scale. Together, these outcomes can generate and maintain the diversity of particular floral traits and resemble other study systems with more specialized plant-pollinator interactions.

Keywords: diurnal and nocturnal pollinators, fitness functions, Grant-Stebbins model, pollinator-mediated selection, selection gradients, spatiotemporal variation

Funding: The study was supported by a Postdoctoral Scholarship to FT-V by the Sven and Lilly Lawski's Foundation for Natural Science Research, and by a Research Grant from the Royal Physiographic Society of Lund and the Elly Olsson Foundation to RHO.

07 – Dispersion, speciation and diversification patterns of the *Erysimum* genus across the Macaronesia

Viveiros Moniz M¹, Berbel M¹, García-Muñoz A¹, Fernandez-Palacios JM², Menezes de Sequeira M^{3,4}, Abdelaziz M¹, Muñoz-Pajares AJ¹

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²Island Ecology and Biogeography Group, Instituto Universitario de Enfermedades Tropicales y Salud Pública de Canarias, Universidad de La Laguna (ULL), Spain

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⁴InBio, Research Network in Biodiversity and Evolutionary Biology, CIBIO-Azores, Ponta Delgada, Portugal

Dispersal and local colonizations have a significant role in the dispersion of species from continents to oceanic islands and among these islands. A high degree of endemic biodiversity is a typical characteristic of oceanic archipelagos, such as the ones that form the Macaronesia biogeographic unit. Combining genomic and climatic data, the evolutionary trends and speciation patterns of the *Erysimum* species inhabiting the Macaronesia were established based on phylogenetic analyses with ancestral reconstructions, population structure analyses, and niche modelling. Phylogenetic analyses were performed for single nucleotide polymorphisms (SNP) from whole nuclear genomes and whole plastidial DNA sequences using two methods: maximum likelihood (ML) and Bayesian inference (BI), with the RAxML and MrBayes software, respectively. SCalable pOPulation structure inference (SCOPE) was used to perform a model-based clustering analysis on SNP data. The ecological contribution of several environmental variables was assessed using the MaxEnt software and niche overlapping indices were calculated in R. *Erysimum* colonizations in the Macaronesia appear to have started in Madeira and after speciation in the Canary Islands, it spread across the archipelago and later to Cabo Verde. Our results suggest that *Erysimum* has also speciated in the Canary Islands to adapt to different habitats (high mountain vs. shadowed lower altitude areas) and generated a singular pattern of flower coloration across species. Climate modelling results showed that the species present in the same islands have their own distinct ecological boundaries.

Keywords: Climate modeling, *Erysimum*, island colonization, oceanic islands, phylogenetic analysis, population structure

Funding: Ministerio de Ciencia e Innovación, Ministerio para la Transición Ecológica, Athenea-3i MSCA

O8 – Are flowers adapting to a warming climate?

Romero-Bravo A¹, Castellanos MC¹, Levo M², Antão L^{2,3}, Hyvärinen M⁴, Koivusaari S³, Kotilainen A², Laurila M², Mattila A⁴, Opedal R⁵, Pietikäinen L², Hällfors M^{2,6}

¹Plant Evolutionary Ecology Lab, University of Sussex

²University of Helsinki

³University of Oulu

⁴Finnish Museum of Natural History

⁵Lund University

⁶Finnish Environment Institute (SYKE)

Under current climate change, an increase in average temperature as well as a higher frequency of extreme weather events is likely to affect plant-pollinator interactions around the globe. The ability of plants to adapt their reproductive strategies to new environmental conditions is crucial to maintaining their fitness. Temperature-induced changes in the floral phenotype might affect visitation rates and potentially hinder plant sexual reproduction. Focusing on *Hypericum perforatum*, we assessed the effect of temperature on floral and flowering traits using a multi-treatment common garden setup. Contemporary and historical seed accessions, collected across the native distribution of the species, were grown under 4 different temperature treatments. We tested for differences in population-level floral plasticity between temporal (historical vs. contemporary) and geographical (trailing, core, and leading part of range) origins to reveal potential changes in plasticity over the last decades and how these vary across space. Our results show that higher temperature is associated with a reduction in floral size, flower display size and date of first flowering. Furthermore, patterns of flower thermal plasticity differ between historical and contemporary accessions. Consistently higher thermal plasticity in contemporary accessions could indicate that floral plasticity has been adaptive during the last decades. Additionally, a reduction in fitness linked to a decrease in flower size, display, or date of flowering could highlight detrimental effects of higher temperature on plant sexual reproduction and plant-pollinator networks. Understanding the evolution of thermal plasticity and floral adaptation to higher temperatures will help improve predictions on how plant-pollinator interactions respond to climate change.

Keywords: Adaptation, climate change, flower evolution, thermal plasticity.

Funding: The presented work has been funded by the Academy of Finland and UK Research and Innovation (UKRI)

09 – Functional traits and shifting flowering phenology in Mediterranean communities

Pareja D¹, Arista M¹, Cerdeira Morellato PL², Ortiz PL¹

¹Universidad de Sevilla

²Universidade Estadual Paulista "Júlio de Mesquita Filho" (UNESP)

Plants in the Northern Hemisphere are advancing their flowering phenology in response to global warming, but studies with long data series and considering entire communities are scarce. In the Mediterranean region, the effects of climate change are higher than the global average and, therefore, there is an urgent need to understand how biodiversity will be affected in this area. We studied how the flowering phenology of a species-rich community on the SW Iberian Peninsula has changed over the last 35 years (1980 and 2020 decades) and how functional traits conditioned this change. We focused mainly on reproductive traits (such as flower size, pollination system and fruit type), which are underrepresented in phenological studies, but are directly involved in reproductive success. We also included the flowering season as a trait, as some studies have suggested that it is an important factor in explaining differences in phenological responses, but this has not been directly and properly addressed. Our models are phylogenetically informed because evolutionary history is a trait worth considering for predicting the phenological responses of plants to climate change but rarely taken into account. We recorded data for >400 species, with 270 species being present at both study periods, ensuring that we have sufficient coverage of all traits selected. Preliminary results indicate that the advancement in flowering phenology is generalized among species, and that the most important trait predicting the shift in flowering time is the season in which each species flowers.

Keywords: Climate change, community, functional traits, phenology

Funding: Universidad de Sevilla [VI-PPITUS]; Junta de Andalucía [PY18-3651]; Ministerio de Ciencia e Innovación [PID2020-116222GB-I00]; Coordenação de Aperfeiçoamento de Pessoal de Nível Superior-PRINT, Ministério da Educação [88887.194785/2018-00]; Conselho Nacional de Desenvolvimento Científico e Tecnológico [#401577/2022-8, 306563/2022-3]; Fundação de Amparo à Pesquisa do Estado de São Paulo [#2021/10639-5].

O10 – Is biodiversity buffering plant-pollinator communities phenological asynchrony caused by climate change?

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Climate change alters the phenology of mutualistic species, leading to the potential loss of ecosystem functions as important as pollination. Temperature mediated phenological variations have been widely studied at species level, showing that increased temperatures lead to earlier activity periods of both plant flowering and pollinator emergence. In addition, some classic examples tracking pairs of interacting species show pairwise phenological mismatches between plants and pollinators. Although plants and pollinators are embedded in a complex web of interactions, there is scarce literature that explored the implications of these findings at the full community level. Our aim in this study is to understand how climate change impacts plant-pollinator networks and their phenology, and to assess the potential changes in their phenological synchronization in a scenario of increased droughts and extreme high temperatures. To do so, we use an 8-year time series of plants and pollinators seasonal abundance, with samplings performed in 12 sites in an area that has gradually entered a status of water scarcity over time. We assessed species specific phenological responses to temperature and precipitation shifts and how these are reflected at the community level. We also studied the implications of these phenological changes on the interaction network, how interactions are lost, or new interactions appear as species' overlap changes. This allows us to understand whether diverse communities are capable or not of buffering phenological mismatch found at the species-level in a context of global warming.

Keywords: Asynchrony, climate change, phenology, plant-pollinator communities, time series

O11 – Pollination ecology of *Teucrium capitatum* subsp. *majoricum*: effects of natural habitat loss

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Habitat loss is a major threat to biodiversity, particularly in insular ecosystems. Our study focuses on *Teucrium capitatum* subsp. *majoricum*, a shrub endemic to the Balearic Islands with both female and hermaphrodite individuals, but which pollination ecology remains largely unexplored. We conducted detailed pollinator censuses on 30 individuals across six sites on Mallorca island. These sites are located in a gradient of natural habitat loss, measured as the percentage of crop area within a 2 km radius. In addition to the censuses, we bagged two branches on each individual to assess anemogamy and passive self-pollination and marked another branch, open pollinated, as control. From them, we recorded fruit and seed sets. Our observations identified Hymenoptera and Diptera as the primary visitors of *T. capitatum* subsp. *majoricum*, with *Apis mellifera* being the most abundant species. Interestingly, plants in sites with moderate levels of habitat loss (40-60% crop area) exhibited higher visitation rates. Moreover, the control fruit set increased with habitat loss, ranging from $14.38\% \pm 2.08$ (with 24.59% crop area) to $39.77\% \pm 3.26$ (with 72.75% crop area). However, seed set remained unaffected, with most fruits producing just one out of four seeds (1.23 ± 0.01 seeds per fruit). Our findings suggest that pollinators of *T. capitatum* subsp. *majoricum* are more abundant in sites with moderate habitat loss, which is reflected in an increase in fruit set. Further experiments are needed to determine if habitat loss negatively impacts plant germination and recruitment, potentially posing an unexplored threat to the species' reproductive cycle.

Keywords: landscape fragmentation, land-use changes, Mediterranean ecosystems, reproductive ecology

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O12 – The role of forests and large urban parks in sustain pollinator diversity and efficiency

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Human activities have significantly shaped pollinator biodiversity, but sometimes urban environments offer opportunities as refuges for pollinators and large urban parks, having diverse habitats, could serve as both refuges and sources of biodiversity. This study, conducted under the National Biodiversity Future Center initiative on urban biodiversity, assesses the relationship between the pollination ecosystem service and urban greening actions. Relationships between forest spatial characteristics and pollinator abundances across an urbanization gradient and pollinator efficiency near old urban forests were tested. The landscape analysis examines forest size and fragmentation in relation to the pan-trapping of wild bees and beetles in 2019 and 2020. In Milan's urban parks, flower-visiting bees and beetle sampling was conducted between May and July 2021 along fixed transects using hand nets. Flower visitors were washed, and their pollen was counted with image analyses. The study also evaluated the presence and quantity of available wood for wood-nesting pollinators, considering different categories, such as decaying and non-decaying logs, wood on the ground, and standing trees of varying lengths. The results indicated direct relationships between forest patches and the amount of pollinators, emphasizing the importance of forest fragments. The pollen analysis demonstrates that traits such as body size and dependency on wood positively influence pollen load, clarifying the importance of forest management for the pollination service. Therefore, it is necessary to manage and maintain urban green spaces as pollinator refuges while sourcing areas that ensure the stability and diversity of pollinator communities.

Keywords: forests, landscape, pollen, pollinators, urban biodiversity

Funding: Project funded under the National Recovery and Resilience Plan (NRRP), Mission 4 Component 2 Investment 1.4 - Call for tender No. 3138 of 16 December 2021, rectified by Decree n.3175 of 18 December 2021 of Italian Ministry of University and Research funded by the European Union – NextGenerationEU

O13 – The role of birds as dual mutualists in highly invaded forests

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Invasive alien species are the world's fifth major threat to biodiversity and can cause significant shifts in ecosystem structure, creating 'novel ecosystems.' Biological invasions impact ecological processes by disrupting species interactions, affecting critical processes for the maintenance and dynamics of plant communities, such as pollination and seed dispersal. While species interactions are crucial for community structure and dynamics, the consequences of invasive species on multitrophic networks remain largely unclear. Our study focused on the forests of Central Portugal, which are heavily dominated by non-native species. We aimed to understand how novel ecosystems affect these two mutualisms and assess the role of bird species as double mutualists. To that end, we constructed multiplex networks, combining seed dispersal and bird-mediated pollination, in native forests and in two novel forest types, one dominated by *Eucalyptus globulus* and the other by *Acacia dealbata*. Native forests displayed greater species richness, featuring 47 species in 11 modules, while *Acacia* forests comprised 34 species distributed in 9 modules, and *Eucalyptus* forests contained 22 species in 5 modules. The proportion of species shifting modules between pollination and dispersal in the native and *Acacia* forests is relatively close, but it does not occur in *Eucalyptus* forests. Native forests had more bird species acting as double mutualists, but the frequency of double interactions did not change between forests. Our results suggest that although only a few bird species provide both ecological processes, these species seem to maximize the use of the available resources in novel ecosystems.

Keywords: Invasive Alien Species, Multilayer Networks, Novel Forest Ecosystems, Pollination, Seed-Dispersal

Funding: Mauro Nereu was supported funded by Portuguese Science Foundation—FCT/MCTES through grant 2020.07175.BD.

O14 – Pollination deficits and their relation with insect pollinator visitation are cultivar-dependent in an entomophilous crop

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Insects contribute considerably to global crop pollination, with pollination deficits being documented for multiple entomophilous or pollinator-dependent crops. Different cultivars of crops are being cultivated within and across production regions, so it is essential to understand the cultivar variability of pollination deficits. Here, we used a dataset from 286 sites from multiple production regions to develop a synthesis on pollination deficits in two widely cultivated highbush blueberry cultivars, 'Bluecrop' and 'Duke'. Additionally, we determined if bee visitation or bee richness reduces pollination deficits in these cultivars. On average, neither cultivar showed pollination deficits regarding fruit set. However, for 'Bluecrop' we found pollination deficits for berry weight and seed set, which was not the case for 'Duke'. Increasing total bee visitation reduced pollination deficits of both berry weight and seed set for 'Bluecrop'. More specifically, a non-linear, negative exponential model best predicted this relation between bee visitation and pollination deficits. Our results highlight that pollination deficits and responses to pollinator visitation are variable between different cultivars of a single crop, which suggests opportunities to use certain cultivars that are less dependent on insect-mediated pollination in landscapes and regions where pollination services have been compromised. In addition, the non-linear response between bee visitation and pollination deficits suggests that optimal bee visitation rates need to be determined to improve pollination management and crop yield and to support accurate economic valuations of pollination services.

Keywords: Crop production, highbush blueberry, fruit weight, fruit set, seed set, *Vaccinium* spp.

Funding: ME was supported as a Belgian American Educational Foundation postdoctoral fellow and as an FWO postdoctoral fellow (grant no. 1210723N).

O15 – Flower morphology in blueberry cultivars influences the behaviour of flower visitors

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Highbush blueberry is a globally important fruit crop with a growing demand that depends on insect pollinators to produce market-quality fruits. However, pollination is far from a simple process and is affected by several interacting factors. Among these factors, flower morphology plays a key role in determining pollinator efficiency, visitation rates, as well as the occurrence of nectar robbing. In this study, we seek to identify the main pollinators for 19 blueberry cultivars and relate floral visitors and visitation rates to flower morphology. For this, we selected five individuals from each blueberry cultivar growing under the same conditions at an experimental field in the Centro region, Portugal. Plant-pollinator interactions were obtained by direct observations in the field, and floral visitor identity, as well as the number of flowers visited, were recorded in five-minute periods distributed throughout the day. Flower morphological traits related to pollination, such as corolla length, width and opening, revealed significant differences among many of the cultivars, ranging from short to long corollas, thus impacting the access to nectar rewards. *Bombus terrestris*, *Anthophora plumipes* and *Apis mellifera* were the main floral visitors and their behaviour and visitation rates were influenced by flower morphology, likely driven by the proboscis length compared with the flower sizes of blueberry cultivars.

Keywords: Corolla size, Pollination, Nectar robbing

O16 – Supporting plant and pollinator biodiversity: the role of citizen scientists in the Life4Pollinators project

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The EU Biodiversity Strategy for 2030 set the ambitious goal of reversing the decline of pollinators. “Mobilising society and promoting strategic planning and cooperation at all levels” is one main priority of the EU New Deal for Pollinators, encompassing citizen science (CS) and public participation in monitoring and conservation. The LIFE 4 Pollinators project (www.life4pollinators.eu; LIFE18 GIE/IT/755) proposes different actions towards civil society to elevate public awareness and understanding of wild pollinators and their crucial ecological role, and so bolster their safeguard in the Mediterranean region, by means of a CS approach. A main tool is a web platform to collect photo-records of insects on flowers: through a double-check validation process, a panel of taxonomists determines the plants and insects to the lowest possible taxonomic level. To date, 156 contributors have uploaded 1778 images. Among many common taxa, also several alien, and rare or endangered species have been recorded. Beside the biodiversity information obtained, qualitative pollination networks may be useful for conservation purposes. More than 20 “polli-bioblitzes” have been organized in N200 sites in Italy, Spain, Greece and Slovenia, with more than 600 participants in total. Moreover, an educational project was proposed to secondary schools, reaching more than 800 pupils. Following each event, a questionnaire is sent to participants. Overall, 1070 replies have been received, of which 243 by citizens (43% of attendees), 480 by students (30%). Key Performance Indicators show an improvement in all parameters (72% knowledge, 44% awareness, 31% behaviour), demonstrating the success of these actions.

Keywords: biodiversity conservation, citizen science, dissemination, environmental education, plant-pollinator interactions

Funding: The project is coordinated by the University of Bologna and is co-financed by the LIFE European fund. Bitonto F. F. was supporting by a Ph.D grant from the University of Bologna and is co-financed by FSE REACT-EU resources.

O17 – Introduction of plant and animal species cause disruptions on the pollination interaction networks of The Ogasawara Islands, Japan

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Introduction of invasive species can cause strong imbalances in ecosystem functioning, especially in sensitive oceanic islands with high number of endemic species. The Ogasawara Islands of Japan is an oceanic archipelago of World Heritage status (~1,000 Km South of Tokyo), which in recent decades has faced increasing disturbance from invasive plant and animal species including the insectivore Green anole (*Anolis carolinensis*) and the European honey bee (*Apis mellifera*). These invasive species can have strong direct and indirect effects through predation and competition, causing disturbances that travel across the trophic chain on the native island pollination system. In this study, we use structural equation models and ecological networks to identify the principal drivers that caused the acute pollinator decline and to explore its effects on the pollination system. We present results on how these invasive species have affected the original island pollinator community and how this has influenced pollination interaction networks in different islands of the archipelago.

O18 – Pollinator sharing of co-flowering *Rhexia*: case study of *Rhexia mariana*

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Co-flowering may facilitate pollination services. Diverse communities may lead to higher abundance and diversity of local pollinators by providing more flowers and resources, with increased pollinator visitation rates. On the other hand, sharing pollinators involves costs such as interspecific pollen transfer which may reduce flower fitness, or increase competition for pollinators. These processes may be particularly pronounced among closely related species since they are likely to share similar floral traits and may hence be particularly negatively impacted by heterospecific pollen transfer. The objective of this study is to determine how co-flowering affects pollination performance (pollen removal and receipt), visitation rates and pollinator composition using 10 populations of *Rhexia mariana* as an example. *R. mariana* is a species of the North American genus *Rhexia* within the otherwise mostly tropical plant family Melastomataceae. The majority of Melastomataceae have a functionally specialized pollination system named buzz-pollination, where pollinating bees apply vibrations to the flowers that cause the stamens to swing and release pollen through small apical pores. The only major group of pollinators which can produce the required vibrations are bees, and approximately 96% of Melastomataceae, and all *Rhexia*, are buzz pollinated. Our preliminary results show that co-flowering *Rhexia* species share the same bee pollinators despite clear differences in flower morphology. At EcoFlor, I will present new data on the positive or negative effects of co-flowering on pollination performance, and discuss additional strategies such as temporal shifts in visitation patterns and biomechanical adaptations which may help *Rhexia* partition the niche of buzzing bee pollinators.

Keywords: co-flowering, buzz-pollination, pollinators shifts

O19 – Two years testing automated pollination monitoring without human presence in community-level studies

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Pollination services are crucial for healthy ecosystems. Despite this, pollinating insect populations are declining globally. Acquiring plant-pollinator interaction data is time-demanding and expensive, but crucial for conservation. Thus, it is essential to implement effective methods that increase the efficiency of field sampling. Deep learning is an optimal solution to reduce mechanical tasks like reviewing videos and automatically detecting the presence of a pollinator, even automatic identifications in the future. We developed automatic cameras and deep learning algorithms (artificial intelligence) to record plant-pollinator interactions automatically. We censused four coastal sites in Cabrera Island (Balearic Islands) with direct observations and with the cameras from April to June in 2022 and 2023. Deep learning algorithms showed promising results for identifying the presence of pollinators automatically, with an 89% accuracy. This achievement reduced video reviewing. The automatic cameras recorded interactions and pollinator behaviours (for butterflies and lizards) that we did not record with direct observations. Consequently, these cameras yielded a wealth of data, enhancing the resolution of the plant-pollinator network by providing valuable information in the absence of human presence. Moreover, this study provided pollinator community data from Cabrera Island for the first time. This methodology could enhance the data collection efficiency for sites with difficult access.

Keywords: Automated cameras, Deep learning algorithms, pollinators, community studies, Cabrera Island

Funding: Primer estudio sistemático de los polinizadores y divulgación de su importancia para el mantenimiento de la biodiversidad en los dos Parques Nacionales Marítimo-Terrestres (PolinIsas). ORGANISMO AUTÓNOMO PARQUES NACIONALES MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO. Subvenciones para la realización de proyectos de investigación científica en la Red de Parques Nacionales.

O20 – New tools for the study of sex reciprocity and pollen transfer in stylar-polymorphic plants, and their application in *Linum*

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Stylar-polymorphic plants promote cross-pollination between two or three distinct floral morphs with (more or less) reciprocal positions of stigmas and anthers. Darwin proposed that such reciprocity evolved as an efficient mechanism to increase outcrossing by means of a precise pollen transfer between morphs in different parts of the pollinator. In this talk, I will explain and illustrate the use of methodological updates in two common approaches to test this Darwinian hypothesis: the use of reciprocity indexes and studies of pollen transfer. Reciprocity indexes, assessing the one-dimensional variation in the location of sex organs, have been a common approach to measure selection at the population level in common heterostylous species. We have adapted the existing reciprocity indexes to multidimensional data for their potential application to other stylar polymorphisms, and we illustrate their use in the three-dimensional heterostylous *Linum suffruticosum* and the enantiostylous *Wachendorfia paniculata*. Studies of pollen transfer in stylar-polymorphic species have been largely hindered by the difficulty of tracking pollen grains along their path from anthers to stigmas. Labelling pollen grains with Quantum dots is a relatively recent methodological technique that overcomes such difficulty. We illustrate the use of Quantum dots to compare the predicted patterns of pollen segregation in the body of pollinators in *Linum suffruticosum* (three-dimensional heterostyly) and in *Linum tenue* (common one-dimensional heterostyly). Our experimental trials showed significant pollen segregation of each morph and species in the body of short-tongued generalist pollinators.

Keywords: enantiostyly, heterostyly, *Linum*, pollen transfer, reciprocity index, stylar polymorphism

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O21 – Diurnal stratification of pollen presentation structure the pattern of pollen transfer and mitigate competition for pollinators

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Pollen presentation and release strategies are believed to affect the pollination efficiency and therefore play a crucial role in pollen transfer. However, only limited evidence links pollen release and temporal changes in the pollen load carried by pollinators. In the present study, we aim to investigate how different pollen presentation strategies affect both the quantity and quality of pollen transferred by plant pollinators. We investigated pollen load on pollinators collected on three co-flowering species during the daytime with known pollen presentation strategy: *Succisa pratensis* releasing pollen early in the morning, *Centaurea jacea* which employs a gradual pollen presentation and *Trifolium hybridum* with explosive pollen release during pollinator visit. We compared the pattern in the amount of conspecific pollen grains on the pollinator body (pollen of visiting plant species, i.e., pollen quantity) and the proportion of conspecific pollen grains from the total pollen load (pollen quality). Then we investigated pollinator visitation pattern during the day. The three plant species differed in the pattern of pollen transfer by their pollinators. Pollinators of *Succisa pratensis* carried the majority of the pollen in the morning after the pollen has been released, followed by a drop in both pollen quantity and quality. Pollinators of *C. jacea* and *T. hybridum* carried more stable pollen load in time, which we explain by plant density and flower morphology, respectively. By linking the diurnal pattern of pollen transfer with pollinator visitation pattern, our results demonstrate diurnal structuring of pollen transfer and plant's ability to mitigate the negative effect of pollinator sharing.

Keywords: Pollen transfer, Pollen load, Pollination, Pollination networks, Syrphidae

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O22 – Patterns and drivers of pollen co-transport networks vary across pollinator groups

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The patterns and drivers of pollen transport on insect bodies can have important consequences for plant reproductive success and floral evolution; however, they remain little studied. Recently, pollinator bodies have been further described as pollen competition arenas, where pollen grains compete for space, which can have implications for the evolution of pollen dispersal strategies, plant reproductive success and plant community assembly. However, the identity, strength, and diversity of pollen competitive interactions and how they vary across pollinator groups is not known. Here, we integrate information on the number and identity of pollen grains on individual insect pollen loads with network analyses to uncover novel pollen co-transport networks and how these vary across pollinator groups. We further evaluate differences in pollen load size, diversity and their phenological and phylogenetic attributes among insect groups and how these relate to body size and sex. Pollen co-transport networks were diverse and highly modular, with groups of pollen species interacting more often with each other on insect bodies. However, the number and identity of competitors that pollen grains encounter on insect bodies varies across pollinator groups. Other aspects of pollen loads such as their size, richness and phylogenetic diversity were shaped by bee size and sex, with females carrying larger but less phylogenetically diverse pollen loads than males. Our results show that the number, identity and phylogenetic relatedness of pollen competitors changes across different pollinators. Therefore, pollinator groups impose vastly different competitive landscapes during pollen transport, with so far unknown consequences for plant community assembly.

Keywords: Functional traits, Heterospecific pollen, Phylogenetic diversity, Plant–pollinator interactions, Pollen competition, Pollinator niche breadth

Funding: National Science Foundation, Division of Environmental Biology (DEB 1931163)

O23 – Effects of pollinator sharing on pollen deposition in Brazilian Campos Rupestres

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Sharing floral visitors may lead to an increase in the number and diversity of pollinators for plant species. This increase can be associated with the quantity of heterospecific and conspecific pollen deposited on stigmas, influencing plant reproductive success. Here, we described a plant-pollinator network in the Campos Rupestres from Brazil, known for its high plant diversity and pollinators. Additionally, we determined if heterospecific (HP) and conspecific pollen deposition (CP) are associated with the acting degree and closeness between plants. Over the peak flowering period (October-April/2022-2023), we observed visitors and collected stigmas to quantify heterospecific and conspecific pollen deposition. We registered 404 interactions involving 32 plant species and 9 animal groups. The network has shown non-nested (WNODF = 15.43; $p = 0.999$), modular (Modularity = 0.53, $p = 0.001$), and specialised ($H_2' = 0.61$; $p = 0.001$) structure. The conspecific pollen increased with both acting degree (estimate = 17.04; $p = 0.02$) and weighted closeness (estimate = 449.43; $p = 0.02$). Similarly, heterospecific pollen increased with acting degree (estimate = 6.74; $p = 0.001$) and weighted closeness (estimate = 194.02; $p = 0.007$). Therefore, plants that are more central and share more pollinators in the network receive greater conspecific and heterospecific pollen deposition. This suggests that sharing pollinators facilitates pollen deposition. This increase in pollen deposition could enhance the reproductive success of the plant species.

Keywords: Bees pollinator, Biodiversity, Floral interactions, Plants reproductive success

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O24 – Grooming behavior and stigma position alter the mating network between plant individuals

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The pathway to male success is affected by events that potentially affect the chance of individual pollen grains reaching the stigma, such as grooming behavior by pollen vectors and the variation in the positioning of reproductive organs. However, due to difficulties in tracking individual pollen grains, we do not know how these factors can alter mating among individuals in a flower population. Therefore, our objective was to understand how grooming, and the positioning of reproductive organs can alter the structures of mating networks in the population and how grooming associated with visiting order can affect the interactions of each sexual function in flowering plants. For that, we simulate visits of pollen vectors to a sequence of different flowers in a population, using spatially explicit agent-based modelling. We accessed the mating matrices between individuals and used network metrics to assess the effect of these factors in populations and individuals within populations. Grooming makes populations reproductively less connected and more specialized. But variation in the positioning of the stigma, associated with the absence of grooming, makes populations more connected and generalist. The order of visits has a great effect in the absence of grooming, so that some few individuals are reproductively dominant. With grooming, the relationships among individuals are more evenly distributed. Flower individuals visited by vectors without grooming are more generalists, mainly with the variation in stigma position. In conclusion, grooming reduces the effect of variation in stigma position, so we hypothesize that this variability should be favored in non-grooming animal-pollinated species.

Keywords: floral morphological variation, floral traits, networks metrics, pollen deposition, pollen transfer, spatially explicit agent-based model.

Funding: Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) and Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq)

O25 – How to build a buzz pollinated flower?

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Buzz pollination, the pollination of certain types of flowers by vibration-producing bees, has evolved multiple independent times in the evolutionary history of both bees and flowering plants. Buzz-pollinated flowers are usually nectarless, produce pollen as the main or only reward to floral visitors, and keep their vast pollen riches inside tube-like structures. Here I will present work from my Lab on how different plants build buzz-pollinated flowers. I will focus on recent analyses of the material properties and biomechanics of buzz pollinated flowers using *Solanum* as a case study.

Keywords: Bees, buzz pollination, floral evolution, morphology, pollen, *Solanum*

Funding: Human Frontier Science Program

O26 – Revisiting Vickery: stable colour polymorphisms may not result in pollinator switches in monkeyflowers (*Mimulus*)

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Animal pollinators are attracted to flowers by a complex set of cues and signals presented by the flower, including visible cues such as colour as well as "invisible" cues such as floral scent. I will discuss how a potential incipient pollinator switch in different populations of two species of monkeyflowers (*Mimulus* s.l.) might be driven by changes in floral colour and scent between the ancestral red and derived yellow populations. The two studied populations in each species differ in their colour and scent, which has been hypothesized to lead to pollinator switches. We have shown that potential novel bumblebee pollinators perceive the morphs' floral scent equally strongly, but that they prefer the yellow populations in behavioural assays. However, they are ineffective pollinators, making limited contact with the reproductive organs and damaging the flowers, suggesting that while stable colour polymorphisms can persist, they may not always lead to pollinator switches.

Keywords: behaviour, electroantennography, floral colour, floral scent, pollination, polymorphism

Funding: John Innes Centre start-up funding

O27 – Global overview of the flower visits of velvet ants (Hymenoptera: Mutillidae and Myrmosidae) as a case of study on neglected pollinators

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Plant-animal interactions constitute a recurrent and central focus in ecological research, with pollination representing one of its most extensively studied aspects. While certain insect orders have traditionally received considerable attention due to their abundance and efficiency, it is undeniable that the significance of other less popular flower visitors in pollination processes cannot be overlooked. Therefore, further research is imperative to gain insights into the floral interactions of these often neglected groups. In this regard, focusing on velvet ants (Hymenoptera: Mutillidae and Myrmosidae) as a case study, we conducted a comprehensive global review of their floral visitation patterns using citizen science data, literature records and unpublished data and explored the potential role of this wasp group as pollen vectors. Our analysis revealed that velvet ants visited almost 40 plant families worldwide and the existence of disparities in the plant species visited by male and female velvet ants, as well as regional variations according to the bioregion. The availability of plants and the different biology of both sexes could play an important role in explaining such differences. Furthermore, approximately 43% of the documented photographic records (likely an underestimation) indicate that these insects carry pollen in the same way as other arthropods. Nevertheless, there remains ample scope for ongoing investigation to comprehensively assess the importance of numerous arthropods, not only as floral visitors but also as potential pollinators.

Keywords: Apiaceae, interaction network, pollination vector, sphecophily, velvet ant ecology

Funding: No external fundings. Self-funding.

O28 – The role of networks in flower (co)evolution: *Lithophragma bolanderi* as the focal species

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Mutualistic interactions are key ecological and evolutionary processes, having an important role in shaping species phenotypes in ecological communities and across evolutionary timescales. Mutualisms are interactions that provide fitness benefits to interacting individuals of both species, and consequently, impose natural selection on traits mediating the mutualistic interactions. As a dynamical system, mutualistic interactions can generate reciprocal selective pressures and subsequently coevolution. In ecological communities, species are embedded in networks and the evolutionary changes are influenced not only by the direct interactions but also by indirect interactions. Therefore, the evolution of a species will also be affected by its partners' interactions, which may create a cascade of evolutionary changes. *Lithophragma bolanderi* and *Greya politella* represent a coevolved mutualism, in which the moths pollinate *L. bolanderi* flowers passively when they are ovipositing. In this process, pollen adheres to *G. politella* abdomen and after is deposited on the stigma, when the moth pushes the abdomen to oviposit. Previous results indicate that for *L. bolanderi* and *G. politella* interaction, the cost to the plant (the seed damage) is scaled to the benefits (pollination) and it is an effective pollinator only when ovipositing. However, an important point into this pairwise interaction is that the fitness of its host depends on the relative abundance of copollinators. In cases of high copollinator density, the pollination contribution by the moths can be masked, whereas seed consumption remains unchanged, indicating that the community network may affect the direction and the strength of selection directly and indirectly. *L. bolanderi* is visited by a broad spectrum of visitors, as bee flies, bees and moth species (Dipteras, Hymenopteras and Lepidopteras). We sampled more than 300 individuals of *L. bolanderi* along two trails, in which we have data on their flower morphology, female fitness, surrounding community and interacting network. In this talk, I will show preliminary results on how coevolutionary dynamics may be affected by the surrounding community.

Keywords: pollination, mutualism, fitness, net selection, ecological community

Funding: Carl Triggers Foundation

O29 – Pollinators, but not predators, indirectly affect endophagous florivores in *Cirsium arvense* (Asteraceae)

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Invertebrate predators foraging on flowers can affect plant fitness by feeding or changing the visitation behaviour of pollinators and endophagous florivores. This net cascading effect will depend on pollination efficiency, seed predation rate, pollinator and florivore communities, and their interaction. We tested the effect of predators on plant fitness, pollinator, and florivore communities. We hypothesise that predator exclusion increases pollinator and florivore visits, and an artificial predator model would reduce pollinator and florivore visits. Furthermore, we also considered the effect of pollinator exclusion on plant and florivore fitness. We used functionally dioecious *Cirsium arvense* as our model plant species. We set up an experiment with four treatments: predator exclusion, pollinator exclusion, predator model addition, and control, on 196 plant individuals at four sites. We observed pollinators and reared florivores for all plants. Our results show that predators do not affect plant fitness, pollinator visitation rate, or florivore abundance. However, in the absence of pollinators, florivore emergence is reduced while florivores still feed on more seeds. This shows that most florivores depend on fertilised seeds as a food resource to complete development. The proportion of fertilised seeds reduces in the absence of pollinators. This reduces the food resources for florivores. However, the proportion of predated seeds increases because the florivore larvae try to complete their life cycle by feeding on unfertilised seeds, yet they fail to emerge. There is no cascading effect of predators in *Cirsium arvense*. The fitness of endophagous florivores depends on pollinators.

Keywords: plant fitness, cascading effect, indirect effect

O30 – Is the red leaf colour of *Carex* (Cyperaceae) in New Zealand an adaptation to browsing by the extinct moas? A study of the dissuasive effect on herbivory by extant ratite birds

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The moas were giant flightless birds (ratites) endemic to New Zealand, where they were the largest herbivores before their rapid extinction after colonization by maori people (c. 1440). Its herbivory pressure is considered a major force in the evolution of native vegetation. Colour-based plant defence has been proposed as a strategy to avoid herbivory. Genus *Carex*, which has a hotspot of diversity and endemism in New Zealand, has red-leaved species in four different lineages. Despite this is a unique feature not found elsewhere in this megadiverse cosmopolitan genus, its evolution has not been investigated yet. In order to evaluate if red foliage could have helped *Carex* to escape from herbivores, a cafeteria-type experiment was conducted at Jerez zoo using the moas' close-related species *Dromaius novaehollandiae* (emus) as a proxy. We exhibited green-leaved and red-leaved morphotypes of two *Carex* species (subgen. *Carex*, sect. *Spirostachyae*) to evaluate emus' preference on the different colour morphotypes. We studied different growth parameters in control and bird-exposed plants (e.g., dry biomass, specific leaf area, root-shoot ratio, etc), and the interaction of birds with plants (time, peck number) through phototrapping, during three two-week cafeteria presentations. Our results show that emus clearly interacted and consumed the green plants over the red ones, which was also evident from several significant measured plant variables. This suggests that red-leaved plants could be less visually attractive and/or palatable to ratite birds. Our study supports the hypothesis that red-leaved *Carex* foliage could have adaptively evolved to avoid herbivory by moas in New Zealand.

Keywords: Cafeteria experiment, Herbivory, Moa, New Zealand, Ratites, Red-leaved

Funding: Spanish Research Agency of the Ministry of Science and Innovation (DANZ, Project PID2020-113897GB-I00)



POSTER COMMUNICATIONS

P01 – Riparian habitat effects on pollinator diversity through network analysis in an agricultural landscape

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Insects are a main component of a stable ecosystem and influence crop production. Pollinators, in particular, by regulating pollination between flowers, shape and secure plant communities around crop fields. They are also essential for food provisioning by sustaining the pollination of crops. Studies in recent decades have been covering the mixture of effects that various factors have on pollinators. However, there is still a gap in understanding how different taxa in pollinator guilds respond to these pressures and how the network structure is affected by it. Therefore, here we tried to further uncover the complex relationship between habitat suitability and pollinator biodiversity in an agro-riparian matrix. Using bipartite network analysis and geographical information systems (GIS) in four sites with different land cover configuration, we assessed faunal and floral diversity, land cover differences and network metrics. Hymenoptera were responsible for most of the visits, while also exhibiting higher levels of richness across sites. Lepidoptera, on the other hand, were the order less represented. Overall, agricultural practice (fallow vs non-fallow fields) and amount of *Arundo donax* were determinant in differences in the number of visits for both orders, with Diptera and Coleoptera being less affected. Sites characterized by a higher area of tillage and *A. donax*, showed lower levels of nestedness and diversity across taxa. The results suggest that intensive agriculture and exotic species infestation can impact pollinator taxa differently, thus influencing network structure. By scoping network metrics, we can better determine what species are more affected by agricultural expansion and assess ecosystem resilience.

Keywords: agricultural matrix, land cover, network analysis, pollinators, riparian

Funding: Funding provided by MERLIN project - "Mainstreaming Ecological Restoration of freshwater-related ecosystems in a Landscape context: INnovation, upscaling and transformation" H2020-LC-GD-2020-3, 101036337/2021

P02 – Dynamics of flower resources across habitats and seasons in human-dominated agro-ecosystems: the case of Zvimba district in Zimbabwe

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Pollinators offer important ecosystem services to crops and wild plants, and hence they are vital for food security and the stability of natural ecosystems. However, these important species are declining, partly due to inadequate forage. This study attempts to estimate the amount of flower resources across habitats (homesteads, pastures, croplands, gardens and natural woodlots) and seasons: hot-wet (November to April), cold-dry (May to July) and hot-dry (August to October) to explore spatio-temporal dynamics in availability of food for many pollinator species in an agroecosystem of Zimbabwe. Vegetation surveys were conducted across the habitat types and seasons to quantify potential floral resources from flowering plants. This was complimented by a desktop survey to establish the flowering periods of each plant species. The number of plant species potentially flowering and crown volume in flowers/fluorescent across habitats and seasons were analysed using generalized mixed effects models. Greater floral resources were generally found during the hot-wet season, but in homesteads it was in the hot-dry periods. The cold-dry season had the least flowering plants as well as flower resources. Pastures also had the least flowering plants, and few trees were recorded on them. It is therefore recommended that floral resources that bloom during cold-dry season are boosted and pastures prioritized in pollinator conservation activities.

Keywords: flower resources, crown volume in flowers, pollinators, Zimbabwe

Funding: The Explorers Club

P03 – Your neighbor matters: co-flowering community effects on the reproductive success of a food-deceptive orchid

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Pollinator-mediated facilitative or competitive interactions among co-flowering species are common and may modify plant reproductive success, yet studies at the community level are rare. Novel statistical approaches such as hierarchical latent-variable joint models allow testing the influence of the co-flowering community on plant fitness. Food-deceptive orchids provide suitable models to test for community effects on fitness, as they often depend on rewarding co-flowering species to attract pollinators. We addressed the effects of the co-flowering community on the reproductive success (pollinator visitation and fruit set) of the food-deceptive orchid *Dactylorhiza majalis* subsp. *lapponica*. We implemented the Hierarchical Modelling of Species Communities (HMSC) framework by fitting hierarchical latent-variable joint models with relative fitness as response. Together with phenotypic traits, we included the animal-pollinated co-flowering community as a predictor by using a reduced-rank regression approach to reduce the number of dimensions of the community data. We modelled the fitness effects of the non-animal pollinated co-flowering community as an alternative model. We found a strong effect of the animal-pollinated co-flowering community on pollination success via pollinator visitation. In contrast, the impact on relative fruit set was indirect and mediated through effects on plant traits and visitation, which both affected plant fruit set. By using a reducing-rank regression approach within the HMSC framework, we yielded new insights on the factors affecting different fitness components in a deceptive pollinated species. This approach can be extended to other pollination systems and plant communities, and highlights the importance of considering the community-context in pollination studies.

Keywords: biotic interactions, community context, co-flowering species, pollinator sharing, reduced rank regression, reproductive success

P04 – Introduced plants in Mediterranean islands: a risk for pollination and seed dispersal?

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Biological introductions and their invasive are increasing worldwide. The establishment of alien plants in natural areas poses a severe threat to native species and ecosystem functioning. Some of the most threatened functions of the ecosystems by alien species are pollination and seed dispersal because newly established species might be more attractive to pollinators and dispersers than natives. Mediterranean ecosystems are one of the most threatened by global change, while insular ecosystems are more vulnerable than the mainland to those effects. For this reason, we aimed to explore exhaustively two islands of the western Mediterranean basin: Mallorca and Menorca (Balearic Islands). For this, we divided each island into grids of 10x10 Km² (53 in Mallorca and 11 in Menorca), and eight different habitats were assessed for the presence and abundance of alien plants within each grid: dunes, rocky coastline, wetlands, shrublands, cliffs, crops, roadside, and torrents. For each habitat, grid and island, we visited three sites (192 sites in total) and listed the alien species with a categorized scale of abundance using the DAFOR method. After collecting these data, we gathered from literature several traits related to pollination and seed dispersal for each species. Then, we obtained indexes related to entomogamous pollination and zoochory separated by each habitat and island as well as geographic distribution of the introduced flora considering their floral and fruit traits. This information allows us to detect which species are more likely to compete for pollinators or seed dispersers and to evaluate their geographic patterns.

Keywords: pollination, seed dispersal, islands, invasive, introductions, allochthonous

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P05 – A tale of heavy metals, railways, plants and pollinators: the promise of phytoremediation in urban areas

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An ecological approach to the restoration of cities' polluted areas is fundamental for the preservation of urban biodiversity. Within the National Biodiversity Future Center (NBFC), this research aims at addressing the impact of urbanisation on biodiversity by evaluating the effects of highly degraded landscapes on the ecosystem services quality. These knowledge advancements will constitute a baseline to design optimal restoration strategies. The study focuses on polluted areas in Milan (Italy): three dismissed railway sites contaminated by heavy metals and organic pollutants. Monitoring activities contributed to assessing the ecological value of these sites from both a floristic and pollinator perspective in response to a phytoremediation approach implemented through the planting of different species, trees, and shrubs mainly. During the spring and summer of 2023, floristic surveys were conducted, resulting in the identification of over 150 species, with a significant portion being non-native. The vegetation cover featured mixed woodlands, shrublands, and dry grassland patches. Simultaneously, entomological samplings were carried out, targeting wild bees, wasps and hoverflies. The results showed the collection of 390 wild bee specimens from 14 genera, with *Halictus* and *Anthidium* being prominent. Additionally, 134 hoverflies and other flower visitors were recorded. This study shows how sites such as railway yards, degraded from a landscape and aesthetic perspective, instead play an important ecological role in supporting plants and pollinator communities in urban areas. Ecological regeneration efficiency will be assessed by post-operation biological samplings to provide useful indications on how to improve contaminated sites, accounting as well for wild plants and pollinators.

Keywords: phytoremediation, pollinators, reforestation, urban biodiversity

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P06 – Plant reproductive traits to investigate biodiversity between core and stepping stones areas in an urban ecological network

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Urban biodiversity is generally approached by analyzing species diversity. However, other aspects, such as species reproductive traits, might reveal new insights on urbanization effects. Here, we approached urban plant biodiversity by comparing several plant reproductive traits of species living only in high-nature value urban sites (core area of the city ecological network) with those living also in peripheral urban green sites (stepping stones of the city ecological network). The general aim was to investigate how urbanization filters the distribution of traits. More specifically, we verified if some traits were less represented in the peripheral sites, even if they were abundant in the near core area. Traits collected for each species included information on flower morphology, fruit type, dispersal modes, and more. A multivariate analysis was performed to find groups of species represented by similar traits and the association of groups and traits with core and/or peripheral sites was tested. As expected, we found a wide variety of traits in species living in the core area only and a specific group of traits characterizing species living in both stepping stones and core areas. Focusing on single traits, species producing indehiscent dry fruit were positively associated with peripheral sites. Traits data add different insights on biodiversity than species richness. Therefore, different species and families can present similar reproductive traits, so high species diversity can hide low trait richness. In an increasingly urbanized world, some plant characteristics (such as the fleshy or dry fruit) might be lost.

Keywords: Urban biodiversity, plant reproductive traits, multivariate analysis

P07 – Effect of fire on florivory in the Pantanal

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Florivory is an antagonistic interaction, broadly defined as any type of damage to flowers or floral parts through tissue consumption, and can directly or indirectly affect the reproductive success of plants. The present study aimed to test whether fire affects the area removed in flowers in the Pantanal. Four collections were carried out between August 2022 and April 2023, in 18 plots distributed across three prescribed fire treatments, considering their time of occurrence (control, early and modal). 80 plant species were identified, the most common being *Melochia parvifolia* and *Richardia grandiflora*. In *M. parvifolia*, 71 flowers were analyzed, 20 flowers in the control treatment, 28 in the modal treatment and 23 in the early treatment. The average floral area was greater in the control treatments (1.50 cm), followed by the modal treatment (1.43 cm), with smaller flowers recorded in the early treatment (1.03 cm). Applying a G test to compare the frequency of florivory, we observed that florivory was significantly higher in the early treatment ($G=10.6$; $p=0.001$), i.e. when the fire occurs at the beginning of the dry season, but did not differ between the control and modal treatments. The occurrence of florivores can be influenced by several floral attributes, such as size and number of flowers, these attributes in turn can be affected by fire differently depending on the season in which it occurs. Our study constitutes a step towards understanding how florivory is affected directly or indirectly by fire.

Keywords: Antagonistic interactions, floral area removed, floral damage, prescribed fire.

Funding: This work was carried out with support from UFMS and CNPq. We thank everyone on the “PELD - Long-term study of the effects of fire along the flood gradient in the Pantanal” team who directly or indirectly contributed to this subproject.

P08 – What is the value of biotic seed dispersal in post-fire forest regeneration?

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World forests face many threats, including wildfires, with tremendous ecological, social, and economic implications. Mediterranean ecosystems have evolved in the presence of fire, but changes to fire regimes associated with other global changes pose new challenges to postfire community regeneration. Forest regeneration largely depends on plant adaptations to survive wildfires or on the recolonization of burnt areas through seed dispersal. However, the value of the service provided by wild animals to postfire forest regeneration remains unevaluated. Here, we estimate the economic value of the biotic seed dispersal service in postfire restoration in Portugal. We combine budgeted costs of governmental Emergency Stabilisation Reports with network analysis that estimates the dependency of the Portuguese flora on biotic seed dispersal and on alternative fire regeneration strategies. Replacing the services provided by seed dispersers during postfire regeneration of Portuguese forests would cost 23,061,621 €/year, highlighting the need for integrative policies that promote resilient forests.

Keywords: Plant dispersal syndromes; ecosystem services; wildfires; fire-related traits; ecological restoration

Funding: FCT PTDC/BIA -ECO/1983/2020; CEECIND/00135/2017; SFRH/BD/144414/2019; UIDB/04004/2020

P09 – Effects of fire on plant-pollinator interactions in Pantanal

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The fire in the Pantanal is an ecological filter that determines the diversity of species and the composition of communities. Here, we intend to contribute to the knowledge of the effects of fire on communities, plants, flowers, and their visitors, as well as their interactions. We performed four samplings between August 2022 and April 2023, in 18 sections, equally distributed in three prescribed fire treatments: control (no burning), premature (burning at the pick of the drought) and modal (burning at the end of the drought). Eight sample units were designed in each section, totalling 576 sample units. Flowering plants in each sample unit have been observed for 10 minutes, and 89 species being included in the sampling, distributed in 31 groups. A total of 282 interactions, including 13 groups of invertebrates, were registered. Bees were the leading group of visitors (49%), followed by beetles (12%), ants (12%) and flies (7%). The visitors acted especially as robbers (48%), but in 31% of the interactions, they acted as pollinators. In the control treatment, 61 interactions were observed, involving 19 plant species from 9 groups; in the modal treatment, 70 interactions were registered, with 18 plant species from 8 groups; in the premature treatment, 45 interactions were registered, with 21 plant species from 11 groups. The identification of visitors was performed in further analysis of the interaction network. With our results, we aim to provide subsidies to improve the handling and management of the fire in this ecosystem.

Keywords: Interaction networks, pollination, prescribed fire.

Funding: The present Project has been developed with UFMS support, CNPq (Process 445354/2020-8), IMASUL (001/2022) and FUNDECT (Process 427/2021). We thank all the team from “PELD- Long-term study of the effects of fire along the flood gradient in the Pantanal”, that directly or indirectly contributed with this project.

P10 – Plant strategies to recover from wildfires: fight or flight

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Wildfires are a major disturbance in Mediterranean ecosystems, shaping the dynamics of plant communities. Many species have strategies to cope with fires, namely resprouting from surviving buds (post-fire resprouters), recruiting from the surviving seed bank (post-fire seeders), and via dispersal from unburned areas (post-fire dispersers). However, since these strategies, especially the latter, are usually studied separately, it is not clear whether they can be independent or act as complementary strategies. To test this question, we tested for associations between the occurrence of distinct seed dispersal syndromes, being a post-fire resprouter and being a post-fire seeder. Data analysis was performed via log-linear models for three-way contingency tables with phylogenetic species richness. It was found that the strategy of post-fire resprouting is negatively associated with post-fire seeding. These two strategies are independent of having seed dispersal syndromes (i.e., there was no association). However, seed dispersal can potentially be a backup mechanism to post-fire vegetation regeneration.

Keywords: Fire, resprouters, seed dispersal, seeders

P11 – Effects of fire and flooding on the pollen loads of floral visitors in the south Pantanal

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Disorders, such as fire and flooding, work as environmental filters structuring biological communities. These events, in some ecosystems, work as pulses of resources, forming populations and promoting complex interactions. Their effects are usually studied separately, but they act synergistically and are still uncomprehended. Here we proposed to evaluate how fire and flood affect plant-pollinator interactions in Pantanal. We performed four collections between August/2022 and April/2023, in 18 portions equally distributed in three treatments of fire: control (no burning), early (burning at the peak of drought) and modal (burning at the end of drought season). In each, through a draw, it has been designed with eight units of samples, resulting in 576 units of samples. In a zoo-centered analysis of the pollination network, the floral visitors have been observed regarding their behavior (pollinator or robbers), collected, kept in sterile tubes. For setting identification of a base pollen catalogues, we have collected flowers in pre-anthesis of 89 species, distributed in 31 families. Asteraceae (28 species), Fabaceae (27), Malvaceae (21) e Euphorbiaceae (13) constituted the richest families. We have prepared slides in gelatin colored with fuchsin and proceeded to light microscopy. We have been morphologically describing the pollen grains for the pollen catalogue, associated with pictures and information of species, flowers, and pollen grains. The results of this study will help us understand how fire and floods affect plant-pollinator interaction networks and will help subsidize actions of conservation and handling of biodiversity in Pantanal.

Keywords: Palynology, pollen catalog, pollination, pollination network.

Funding: The present work has been performed with the support of UFMS, CNPq (Process 445354/2020-8), IMASUL (001/2022) and FUNDECT (Process 427/2021).

P12 – Plant reproduction on Campo Rupestre: relationship between total and heterospecific pollen deposition in a fire-prone habitat

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The interplay between total pollen deposition and heterospecific pollen deposition stands as a pivotal element in deciphering the intricate dynamics of plant reproduction within natural ecosystems. Our research delved into this connection, particularly in fire-affected environments, focusing on the Semper Vivas National Park within Brazil's Cerrado region. Employing rigorous field experiments and meticulous analyses, our investigation unraveled compelling patterns in pollen dynamics, uncovering a notable correlation between total pollen deposition and the presence of heterospecific pollen. Our results underscore a significant association, revealing that fluctuations in total pollen deposition align closely with changes in heterospecific pollen levels. This unveils the intricate relationship between diverse pollen types, underscoring the critical role of total pollen availability in understanding the intricate mechanisms governing heterospecific pollen deposition. Such insights contribute significantly to enhancing our comprehension of plant reproductive success within fire-prone ecosystems.

Keywords: Plant competition, plant reproduction, pollen dynamics, resource availability

Funding: FAPESP grant numbers 2023/04378-0 and 2021/09247-5.

P13 – Comparing the diversity and composition of pollen carried on the hind legs and in the digestive system in six species of solitary bees

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Analyses of pollen loads carried by pollinators can be used to understand foraging biology and mechanisms of diet choice of flower visiting insects, to identify potential pollinators of individual plant species, and to shed light on the structure and dynamics of plant-pollinator networks. Bees have various strategies for collecting and transporting pollen. They accumulate pollen either in scopae or corbiculae on their legs, on their abdomen, or in the digestive system, particularly in the crop. Pollen carried in transport structures on the bee bodies is used to provision their larvae, while pollen in the crop can be regurgitated and added to the larval provision or consumed by the adults. The aim of our study was to test whether the composition and species richness of pollen carried on the hind legs of six species of solitary bees of the genus *Andrena* differs from pollen in their digestive system, specifically in the crop. We analysed individual pollen loads on the hind legs and in the crops of females of six species of bees of the genus *Andrena* using DNA metabarcoding. We found that the two sample types had a very similar composition, species richness, and diversity in all six species. We discuss the implications of these findings for our understanding of adult and larval nutrition and provide methodological recommendations for future research on bee diets.

Keywords: pollinators, plant-pollinator interactions, DNA metabarcoding, foraging, pollen load

P14 – Pollen carryover effectiveness comparison across a wide range of functional pollinators groups

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The functional groups of pollinators should differ in their pollen carryover effectiveness because of their traits. Using pollen load as the measure of carryover efficiency we aim to compare a wide range of functional pollinator groups. We controlled for the effect of the last visited plant due to different floral traits. In addition, we found densities of functional pollinator groups at the study site. We studied pollen loads and densities of 12 pollinator functional groups sampled during two vegetation seasons at a species-rich meadow in its flowering peak. The sampled individuals were swabbed with fuchsine jelly, which was turned into microscopic slides, and the pollen grains were counted using the light microscope. Pollinator functional groups differed in their pollen loads. Honeybee and other bees carried the largest loads, while butterflies and small dipterans carried the smallest. The last visited plant had little effect on pollen loads but indicated that some pollinators are underestimated due to visiting specific plants. Proportion of conspecific pollen carried positively correlated with pollen load. When combining pollen loads, proportions of conspecific pollen and pollinator densities at the study site, the relative pollinator's importance changed, with big and small syrphids and honeybees being the only groups with large pollen transfer in both seasons. Pollen carryover effectiveness estimates combining multiple aspects provide different results than sampling only a single aspect. Our results indicate that even the less efficient pollinator groups can be among the most important pollinator due to their high densities.

Keywords: Conspecific pollen, functional groups of pollinators, last visited plant, pollen carryover effectiveness, pollen load

P15 – Mutualistic multilayer plant-Lepidoptera interactions in the Brazilian Campos Rupestres

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Despite the great importance of plant-pollinator interactions for maintaining biodiversity, knowledge on interactions at the community level is still lacking for biodiverse tropical mountain ecosystems. Here, we characterized interactions between plants and diurnal/nocturnal lepidopterans from the Brazilian Campo Rupestre. Data were collected from February to September/2023 in a 50-ha area of highly biodiverse rocky scrublands. We monthly collected diurnal and nocturnal Lepidoptera and analyzed their pollen load. Morphotyped pollen grains were used to build a two-layers quantitative network. We then calculated multilayer modularity (Q) and identified the central species in the network/layers using the versatility metric for each species (PageRank). Our plant-Lepidoptera network consisted of 42 species (23 butterflies and 19 hawkmoths), 154 pollen morphotypes and 288 interactions. We identified 13 intralayer modules ($p < 0.05$; $Q = 0.38$): 5 exclusive to the diurnal layer, 4 to the nocturnal layer, and 4 mixed modules. We found 4 pollen types with the highest PageRank values: Type B44 and Type 2 (both Asteraceae), Type 53 (Myrtaceae) and Type 15 (Lythraceae). In addition, we did not find significant differences between the diurnal and nocturnal layers for species PageRank values. These results indicate that although there is significant modularity within the layers, the identity of the species connecting the layers did not strongly affect multilayer modularity. Moreover, the plant-Lepidoptera network consists mostly of generalist interactions, which can be related to most plant species showing morphologically open flowers with low restriction to resource access.

Keywords: Campos rupestres, generalist interactions, modularity, multilayer network, PageRank, plant-pollinator interactions.

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P16 – Do floral traits drive Interactions in a tropical urban garden from Brazil?

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Urban garden flowers can play a key role in pollinator conservation, providing resources in the usually inhospitable urban environment. However, different species may have distinct effects on the pollinator community. Here, we investigated the flower-pollinator interaction pattern in an urban garden, whether species roles are influenced by their floral traits, and if legitimate pollination and nectar robbing interactions have similar structures. We recorded plant-flower visitor interactions weekly for thirteen months at a Botanical Garden in Maringá, Brazil. This yielded interaction networks for overall, legitimate and robbing interactions. The roles of plants were defined by their interactions between and within modules. Finally, we examined how floral traits affected interactions. All networks were highly modular, topped by the robbing network. All networks were dominated by peripheral species (more than 85%). No relationship was found between floral traits and species roles or module co-occurrence, except for modules of robbing networks. Most interactions were legitimate, with similar structure for legitimate and overall networks, whereas species always showed less between-module interactions in the robbing network. The functionality of robbing networks shows that different modules were made of unique sets of traits. However, on the other networks, even with a high number of interactions and peripheral species, the inclusion of other explanatory variables are necessary to understand the pattern and species roles. Urban robbing networks can be quite specialized, with different groups of visitors pillaging resources from unique sets of plants. Even when not promoting plant reproduction, these interactions can feed a wide variety of fauna.

Keywords: Modularity, peripheral, robbing, roles

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P17 – Range-shifting lowland plant species and their competition for pollinators with mountain plants

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Many plant species move to higher elevations in response to global warming. However, it is not well known how such elevational range shifts affect plant-pollinator interactions. Thus, we aimed to find out how flower visitation and seed set of range-shifting plants coming from the lowland change after they shift uphill and whether they compete for pollinators with plants originally growing in the mountains. We used two groups of plants for the study. The first group represented lowland species planted in a greenhouse and transplanted to field sites in the lowland and the mountains. The second group were species originally growing in the mountains. We recorded pollinators at lowland sites on planted species and in the mountains on planted and originally growing species. We also placed white, yellow, and blue pan traps close to the experimental plots to collect possible pollinators at the sites. After the experiment, we collected seed set of planted species from the lowland and the mountains to compare reproductive success between elevations. Overall, flower visitation rate was not affected by altitude (except in one species), although total pollinator abundance in pan traps was higher in the mountains. In addition, the pollinator spectrum differed across elevation and among plant species, depending on flower color. Planted species had more seeds when they were placed in their original lowland locality. Finally, we found no evidence that species originally growing in the mountains have reduced flower visitation in the presence of lowland range shifting species.

Keywords: elevation, floral traits, pollination, range-shifting species, reproductive success

P18 – The importance of knowing who is next to me? Growing with relatives and their impact on direct (and indirect) female fitness on plants.

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Recently, it has been shown that the genetic composition of the intraspecific neighborhood can influence its investment in attracting pollinators. Plants surrounded by kin exhibit significantly larger floral displays compared to those grown with non-kin. This increased floral display in kin groups could enhance plant inclusive fitness by attracting shared pollinators to other nearby kin. To investigate this hypothesis, we conducted an experiment using the model plant species *Moricandia moricandioides*. We established an experimental population of 560 plants, divided into 80 groups of seven plants each. Half of these groups consisted solely of half siblings, while the other half contained a random sample of genotypes. We then measured pollinator visitation rates and female reproductive success. Our findings will provide the first experimental insights of the potential effect of kin selection on floral display evolution.

Keywords: Indirect fitness, kin discrimination, kin selection, *Moricandia moricandioides*, magnet effect

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P19 – Early flowering enhances performance among conspecifics

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The timing of phenology determines which phenophase develops in certain environmental conditions. In regions with Mediterranean climate, characterized by harsh summer stress, changes in the phenology can affect plant performance. Within a community, species' flowering can occur for several months (large temporal scale), changes in temperature and water availability could explain variation in species' performance. Alternatively, conspecifics can advance or delay a few days their flowering (short temporal scale), changes in micro-environmental conditions, such resources' availability due to competition, are more likely to explain the variation in the performance of early conspecifics. The study system is an arid environment; thus we monitored the phenology, and three critical aspects of that conditions (water loss, growth, and estimate relative individual reproduction) on 98 individuals of four cooccurring species with similar life-form (*Thymus moroderi*, *Helianthemum syriacum*, *Helianthemum squamatum*, and *Teucrium libanitis*). Relative reproduction was estimated through the combination of number of fruits per infructescence, seeds per fruit, and germination rate, to obtain a measure of relative reproduction comparable across species. To assess whether earlier flowering is a strategy at short and large temporal scales, we scaled data to the community mean or population through z-score index. Early flowering conspecifics show higher growth and relative reproduction, while do not differ in the water loss. However, early flowering species do not show higher relative reproduction than late flowering species, although they differ in water loss. In this co-occurring species, early flowering might be a strategy more likely to reduce intraspecific competition rather than avoid harsh summer conditions.

Keywords: Early flowering, intraspecific competition, performance, phenology, water deficit, water loss

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P20 – The effect of pollinator identity and diversity on mating system and pollen limitation in an alpine plant community

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The contribution of pollinators to wild plants reproduction is a crucial ecosystem function. Different pollinator groups are known to vary in their effectiveness in how they contribute to plant reproduction. However, since most studies often focus on a small set of plant species, or use meta-data analyses to analyse large-scale patterns of pollinator visitation, relatively little is known about how plants differ in their reproductive success and strategies within a community of flowering plants. We use a plant-community perspective to ask: how plants with different pollinator visitor communities vary in terms of reproductive success and selfing-pollination strategy. We did pollination experiments to quantify autonomous selfing and pollen limitations in ca. 40 plant species in a Swedish alpine plant community. In addition, we surveyed the plant species abundance, and collected flower visitors from the plants to determine which functional groups that were the dominant flower visitors to each species. Plant species that were visited by bumblebees (*Bombus* sp.) had low rates of autonomous self-pollination in comparison with the rest of the community, whereas pollen limitation generally could not be explained by flower visitor identity. We show that plants associated with different pollinator functional groups are adapted differently to self-pollination, where bumblebee visited flowers are specialized to outcross. We also discuss the role of pollinator diversity to successful reproduction in plants.

Keywords: Pollen limitation; autonomous selfing; pollinator contribution; *Bombus*

Funding: This project was supported by the Knut and Alice Wallenberg Foundation and the Swedish Research Council

P21 – The role of the breeding system in the distribution of *Microlicia* species

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The Melastomataceae family comprises species with diverse reproductive strategies, which can be self-compatible, apomictic or self-incompatible. Among these, the genus *Microlicia* has a high degree of endemism in the Serra do Cipó (Minas Gerais, Brazil), a region considered to be of great evolutionary importance due to the composition of its landscape and the formation of the Espinhaço Chain, of which it is a part. This study analysed the reproductive strategies of several species of this genus, to understand their influence on the geographical distribution of each of these species. Using five different forms of treatment, fruit, seeds, ovules, and pollen grains were quantified to draw a comparison between the species. Geographical distribution data was obtained from exsiccates available in an online repository (GBIF), where the reproductive phenological stage of the species was also analysed in order to observe the presence of a flowering and fruiting pattern to see if apomictic species, which are independent of the presence of pollinators, have a greater quantity of fruit and if because they have this characteristic, they are more widely distributed than non-apomictic species. The results show that the species *M. congestiflora*, according to the treatments, is not an apomictic species, unlike the other two species analysed, with this species having the smallest distribution in relation to the other two, which confirms the hypothesis that species independent of pollinators have a more diverse geographical distribution and produce more fruit.

Keywords: *Microlicia*, breeding system, rupestrian field, campo rupestre, patterns distribution, flowering phenology

P22 – Exploring the impact of sexual systems on reproductive success in gynodioecious plant species: a comparative study in *Thymus* section *Mastichina*

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Understanding the reciprocal influence of sexual and breeding systems on plant reproductive success is crucial for devising an effective conservation strategies. In gynodioecious species, the percentage of female plants, which are obligate outcrossers, relative to hermaphrodites plays a key role in genetic diversity, population structure, and species distribution. We examined the sexual and breeding systems of *Thymus albicans*, a gynodioecious species native to the southern Iberian Peninsula, in 12 populations across its restricted distribution range. Then, we studied another 12 populations of its closer relative, *Thymus mastichina*, which presents the same sexual system but show a broader distribution range that spans the entire Iberian Peninsula. For each population, sex ratios and reproductive success were analyzed. Although population sex ratios of the two species were variable, *Thymus albicans* frequently exhibited a more female-biased sex ratio, whereas for *Thymus mastichina* it was more variable depending on the population. We seek to discern putative correlation patterns between sex ratio and reproductive success. Our study attempts to shed light on how interdependent traits, such as the abundance of female plants, may influence the fitness and long-term persistence of a species, which is particularly important for endangered species in the current global change scenario.

Keywords: *Thymus albicans*, sex ratio, reproductive success, conservation

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P23 – Investigating the longstanding mystery of stigma length differences between morphs of distylous plants

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Longer stigmas in short-styled morphs of distylous plants have been considered an adaptive characteristic that increases intermorph pollen deposition. The greater pollen deposition in short-styled stigmas may be a by-product of their larger length, making deposition effectiveness comparison between morphs unfeasible. Thus, investigating which morph has the relatively most efficient stigma (i.e., pollen deposition per unity of length) can boost our understanding of the adaptive significance of longer stigmas. In this study, we compared the pollen deposition between morphs relative to stigma length and assessed whether short-styled stigmas are more, less, or equally effective in receiving pollen grains per unit of length. We reviewed the literature to characterize the extent of stigma length differences between morphs, using the two largest distylous genera as model systems: *Palicourea* and *Psychotria* (Rubiaceae). Then, we conducted a between-morph comparison of raw and relative pollen depositions in a *Palicourea rigida* population. We confirmed that short-styled stigmas were longer than long-styled ones both in *Palicourea* (194.78% longer) and *Psychotria* (52.90% longer) flowers. Furthermore, in the focal *P. rigida*, although short-styled stigmas were 268.04% longer and received 101.75% more pollen grains than long-styled ones, the relative pollen deposition had a reversed pattern, with short-styled stigmas being twice less efficient in receiving pollen. Our results indicate that the longer length of the short-styled stigmas may have a compensatory effect, increasing the chances of pollen grains reaching the stigma and probably maintaining disassortative intermorph pollination in distylous plants.

Keywords: ancillary characteristics, distyly, floral polymorphisms, pollen deposition, stigma dimorphism.

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P24 – Finding Bermuda buttercup (*Oxalis pes-caprae*): understanding the evolutionary and ecological processes and patterns of biological invasions in the Mediterranean region

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Invasive plant species are considered one of the greatest threats to biodiversity and human society. Their establishment and spread into new areas depend on their abilities to overcome different barriers. Reproductive strategies have an important impact on characteristics of invasive populations, and it has been observed before that shifts in reproductive traits might occur in new invaded areas. *Oxalis pes-caprae*, a tristylous plant native to South Africa with a complex reproductive strategy, is an invasive species in Mediterranean climates worldwide. While in its native area the populations are represented by all three flower morphs, which enables the plant to reproduce sexually, populations in the invaded ranges are less diverse, composed (predominantly) of short-styled morphs and reproduce asexually. However, latest research has shown the presence of other floral morphs in some invasive populations, as well as occasional sexual reproduction. The aim of this study is to better understand the changes in the reproductive system of *O. pes-caprae* in the Mediterranean basin. To do so, with the help of the Finding Bermuda buttercup team, we conducted a floral morphometric analysis of populations across the European part of the Mediterranean area, measuring the position of the style, stamens and size of the corolla. Moreover, we used epifluorescent microscopy to observe pollen loads on stigmas, germination of pollen grains and growth of pollen tubes towards the ovules. The preliminary results of this study show novelties in the distribution of morphs and possible shifts of reproductive strategies. The results will help us understand evolutionary patterns in the Mediterranean in light of human-induced changes in ecosystems.

Keywords: biological invasions, fluorescence microscopy, heterostyly, morphometry, pollen germination

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P25 – The role of herbaria in biodiversity studies

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Herbaria as collections of preserved plants contain large amount of data and prominent information, both on the labels and on the specimens themselves. Currently, there are 400 million specimens preserved in herbaria worldwide, with great potential for studies in conservation or effects of global change on plants. In this study, we investigate the array of herbaria uses through a systematic review of the scientific literature in SCOPUS covering the period 1842-2022. We reviewed a total of 2,901 papers and classified them in different areas of knowledge, as well as the taxonomic level studied. Our results show that taxonomic use is the most relevant over time. This taxonomic use, together with the use as a primary source of plant diversity data, is essential for documenting, planning, and acting on the conservation of threatened plants. Furthermore, our results have shown that new and diverse uses have emerged since 1990, mostly related to ecological issues, as herbaria provide a historical record of plant diversity and distribution, as well as their ecological and evolutionary responses, allowing scientists to track changes over time. This contributes to improving the knowledge of biodiversity and to increasing the effectiveness of conservation strategies and policies, which are a priority to cope with the current global change. Therefore, our study shows the relevance and potential of herbaria in conservation biology, including new or forthcoming uses, which are different from the uses originally by collectors. Thus, their preservation is critical, as the unique and exceptional record for the knowledge of changes in biodiversity over space and time

Keywords: Plant conservation, biodiversity, global change, herbarium, taxonomy

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P26 – Analysis of changes in plant reproductive structures as a consequence of climate change

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As a consequence of climate change, a series of modifications have been observed in certain biological cycles, such as plant flowering phenology, as well as morphological changes in certain reproductive traits, such as flowers or seeds. In my PhD project I will analyze whether climatic variations have modified the size of floral characters focusing on flowers size. Climate change is causing a decrease in the availability of water for plants and some researchers have already concluded that flowers size show significant negative responses to drought stress. In this project, I will be measuring the floral size of multiple individuals of different species using herbarium sheets, so I will be able to compare those reproductive traits over the years and conclude whether they have changed due to climate change.

Keywords: Phenology, climate change, reproductive traits, flower size

P27 – Historical data of fruiting phenology for 4,462 spontaneous and cultivated plant taxa in Portugal (1926 – 2013)

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Species phenology - the timing of key life events - is being altered by ongoing climate changes, with yet underappreciated consequences for ecosystem stability. While flowering is generally occurring earlier, we know much less about other key processes such as the time of fruit ripening, largely due to the lack of comprehensive long-term datasets. Here we provide information on the exact day and site where seeds of 4,462 taxa were collected for the Index Seminum (seed exchange catalogue) of the Botanic Garden of the University of Coimbra, between 1926 and 2013. Seeds were collected from spontaneous and cultivated individuals across Portugal, including both native and introduced taxa. The database consists of 127,747 curated records with information on the species, or infraspecific taxa (including authority), and the day and site where seeds were collected. All records are georeferenced and provided with a confidence interval for the collection site. The taxonomy was first curated manually by in-house botanists and then harmonized according to the GBIF backbone taxonomy.

Keywords: big data, historical records, fruit, climate change, seed dispersal,

Funding: Portuguese Foundation for Science and Technology (FCT) through project LIFE AFTER FIRE PTDC/BIA-ECO/1983/2020, and grants UIDB/04004/2020, CEECIND/00135/2017 (ST), and 2020.07175.BD (MN).

P28 – Dry air, long hair! Insights on a putative climate-driven strophiole size variability in the Iberian endemic rupicolous genus *Petrocoptis* A. Braun ex Endl.

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Seed structural features have been the subject of a myriad of works that have tried to explain their adaptive value related to plant diaspora, particularly in rocky habitats, where seed dispersal and progeny establishment are difficult. Other hypotheses have remained overlooked, although they need to be investigated on a case-by-case basis in search of empirical evidences. Here, we use a seed morphometric analysis of the endemic Iberian chasmophytic genus *Petrocoptis* A. Braun ex Endl. with the aim of exploring correlations between seed traits and local climate. For this study, we measured 2773 seeds (557 individuals) from 84 populations, covering the entire distribution and climatic ranges of the genus. We used linear mixed effects models (lme) to trace the relationship between local climate predictor variables and 1) strophiole area, 2) seed area, and, 3) the ratio between both. We also quantified the amount of variability explained by the environment. The best seed area model did not include any of the considered variables, and suggested that there is no evidence for a climate-driven seed size plasticity. Nevertheless, the best strophiole models showed that both its area and relative size are sensitive to dry and warm climate conditions. On the light of our data and considering the interpretation of the biological role of the strophiole of *Petrocoptis* proposed by previous authors, we suggest reinterpreting it as a structure involved in seed water uptake and germination regulation, which is specially relevant in the cliffs where the species of *Petrocoptis* grow.

Keywords: Chasmophyte, climate, LMEs, *Petrocoptis*, seed, strophiole

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P29 - The predictive use of floral scents to identify pollinator mechanisms: Orchids and aroids as study cases

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Floral traits have been extensively used to predict the pollinator guild identity of diverse plants. Whereas the relationship of floral shape and colour with pollinator guild has been extensively studied, that between floral scents and pollinator identity has not been explored deeply. Furthermore, although floral shape and colour can help to predict the identity of the pollinator guild (i.e. bee, fly, moth, etc.), it may not be useful in plants shifting between closely related pollinator groups (e.g. different types of beetles). Here, I used the genus *Amorphophallus* (Araceae) and the family Orchidaceae, two plant groups that have been well sampled in terms of floral scent chemistry, to test the relationship between floral scent chemistry and pollinator identity. Based on species with known pollinators, I developed models based on floral scent chemistry which can predict the pollinator functional group identity in the analysed plants. In the case of *Amorphophallus*, sulphur compounds were the most important to discriminate between plants with different pollinator functional groups, whereas aliphatic esters helped to identify potential non-yet-described pollination mechanisms. In orchids, both pollinator guilds and pollinator reward could be linked to floral scent chemistry. Interestingly, the most common volatile compounds (e.g. linalool, ocimene) were also the ones that allowed discrimination among orchids with different pollinator guilds and rewards. For both aroids and orchids, we reconstructed the evolution of the main chemicals in a phylogenetic tree, which helped to shed light on the potential evolution of plants and their pollinator shifts.

Keywords: Floral chemistry, pollinator guild, floral reward, Orchidaceae, *Amorphophallus*

P30 – Deciphering bee avoidance hypothesis in red flowers: The key is in the pigments

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The ‘bee avoidance’ hypothesis (i.e., red flower color to reduce visits from hymenopterans) has been invoked to explain the association of red flowers with bird pollination around the world. The main way flowers control their color is through pigments. Therefore, we hypothesized that red bird-pollinated flowers should have a particular pigment composition that would make them highly conspicuous to birds and invisible to bees. We used red-flowered species from California (hummingbird-pollinated) and Spain (bee-pollinated) to know the relationship between pollinator color perception and pigment composition. We specifically identify main pigment classes and the anthocyanin type and composition, and test for differences in pollinator conspicuousness related to pigment composition. We obtained the reflectance spectra of red-flowered species from California and Spain. Then, we carried out spectral analyses and determine the color perception of red flowers by hummingbirds and bees to assess the conspicuousness of red flower stimuli. Finally, we identified the main floral pigments using LC-MS analyses. Flowers visited by birds mainly contain pelargonidins, or pelargonidins coupled with carotenoids, which make them more conspicuous to the avian vision. On the contrary, bee-pollinated flowers, mainly accumulated other cyanidins and delphinidins, with and without carotenoids. Red flowers from California and Spain show different pigment composition that might reflect dissimilar strategies to target their main pollinators. We suggest that the mixture strategy to accumulate pelargonidins and carotenoids could be responsible for ‘bee-avoidance’ strategy on hummingbird-pollinated flowers from California.

Keywords: anthocyanins, carotenoids, red flowers, conspicuousness, hummingbird pollination, bee pollination

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P31 – Effects of pollinator density on the patterns of selection on floral traits

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In most angiosperms, access to sexual partners is mediated by pollinators. If some floral traits confer an advantage in terms of pollinator attraction, and if this advantage translates into an advantage in terms of the number of offspring left to the next generation, then these floral traits should be under selection. With land use change, plant-pollinator interactions could be altered, potentially leading to an increase in pollen limitation. In this case, one possible prediction is that the selection of attractive floral traits should intensify within both sexual functions in an anthropic environment compared to a natural environment, which is more favourable to pollinators. However, the intensification of selection could differ between sexual functions, due to the numerical difference in gametes between them, a question yet unstudied in the literature. In this study, we test this hypothesis in a dioecious species, *Silene dioica*. Six natural populations in northern France, located in two contrasting environments, a semi-natural environment and an agricultural environment, were studied. Within these sites, the floral traits and reproductive success of male and female plants were measured, to estimate and compare the selection exerted on these traits, between sexes and between environments. In addition, pollinator communities were characterized at each site, and hand pollination experiments were carried out to quantify pollen limitation. This communication presents the initial results of this study.

Keywords: anthropization, pollinator, selection

P32 – Effect of ploidy variation and mating system strategy on the reproductive investment across whole plant life

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Variations in reproductive investment during plant life are related to different mechanisms of compensation and inform us about the reproductive strategies of these organisms. Thus, this investment would be directly affected by plant mating system evolution, and indirectly by other traits as ploidy changes. Here we used plants of *Erysimum incanum* and *E. wilczekianum*, two close related species with contrasting mating systems, being the first a selfing species complex and the later an outcrossing species. *Erysimum incanum* also presents three ploidy levels. We performed over 7400 hand-controlled crosses in plants growing in greenhouse conditions. We then quantified the number of ovules produced per flower along the flowering stalk of 470 plants of both species and all ploidies. In a subset of these plants, we also quantified the pollen grains produced per flower along the plant life. We found no difference between ploidies in the variation of reproductive investment, but we did find significant differences when we compared mating system strategies. The outcrossing species reduces the number of ovules produced along its life, but not the number of pollen grains. While the selfing species kept constant the number of ovules and pollen grains produced across the plant life. Our results suggest that the changes in ploidy did not generate compensation strategies of these plants when they are autogamous. However, when compared with allogamic plants we can see how a strategy of compensation rises, probably because of the reductions of resources at the end of the reproductive period.

Keywords: *Erysimum incanum*, *Erysimum wilczekianum*, ovules, pollen grains, reproduction, reproductive compensation

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P33 – Root infection in a selfing *Erysimum* species drive changes in the reproductive strategies and output

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Ecological interactions are one of the main drivers of evolution due to their influence on selective pressures. These selective pressures can promote the reproductive strategies of the interacting organisms. However, it is not common that antagonist interactions generate phenotype changes promoting a mutualistic interaction that modify basic strategies. For two years we monitored an *Erysimum repandum* population where some individuals were infected by a Curculionidae species and we measured floral and vegetative phenotype, as well as fitness components of selfing and outcrossing hand-crosses. We found an increment in the floral size and nectar production in plants exhibiting a root with galls. These results were consistent for the two years, so the root infection seems to be causing an intra-population variation in traits related to cross-pollination, while non-infected plants retain the small flowers with a reduced nectar production commonly found in this species. We also found that infected plants showed lower tolerance to selfing reproduction, associated with the size of plants. Even when *E. repandum* is commonly described as self-compatible species, a high frequency of pollinator visits was found in “infected” plants, leading to a potential gene flow which could have an impact in the genetic structure of the population. The asymmetry in gene flow between infected and non-infected plants could promote the rise of differentiation in mating strategies, thus, the Evolution of an outcrossing mating system into a selfing clade.

Keywords: antagonistic, ecological interactions, flower size, fitness, mutualistic, pollinator visit.

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P34 – Do all bees respond the same way to fire? Functional responses of Mediterranean bee communities to fire severity and floral resources

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Fires in the Mediterranean are known to have positive impacts on bees, especially during the first post-fire years. However, not all bee species are equally affected by fire, as the populations of some species may increase in the post-fire conditions while others may decline. In animals, contrary to many plant species, most traits associated with post-fire adaptations are mostly behavioral rather than morphological with some studies reporting variations in bee susceptibility to fire depending on sociality, nesting behavior, and feeding habit among others. In this work, we present the results of a 3-year study after a wildfire (viz. 2013-2015) carried out on Chios Island, Greece, in which we examine the spatial effect of fire on four bee functional traits (viz. sociality, nest location, nest construction and trophic specialization). We did this by comparing burnt with unburnt sites and using fire severity, i.e., the degree of environmental change caused by fire by using dNBR, derived from satellite imaging, and floral resources as metrics. The temporal effect was examined by comparing bee communities in the three post-fire years. We found that burnt sites had larger populations of below-ground nesting bees, excavators, and polylectic bees; and lower populations of oligolectic bee species. All the differences were best predicted by fire severity, along with the spatial heterogeneity which was increased in the burnt sites. Yet, for some bee species, these differences were also related to floral resources which were found to positively affect the populations of oligolectic and above-ground nesting species.

Keywords: Bees, Fires, Functional traits, Mediterranean ecosystems, Pollination

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P35 – Variation in body size and plant-pollinator interactions in three Apidae bee species over a century

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Wild bees are important pollinators of both native and cultivated plants, but they are facing many threats due to climate change and variation in land use. Bees (Apiformes) comprise ca. 20.000 species worldwide, grouped in 6 families, and characterized by different ecological traits. Within the bee families, the Apidae is the wider, accounting for 6,000 species with a large variation in body size, sociality level and plant fidelity. Determining how these traits drive bees' responses to environmental change is fundamental to assess the current and future status of bee populations and develop mitigation actions. In the present study we analyze body size and pollen load of three Apidae species with different ecological traits, *Bombus pascuorum*, *Anthophora plumipes* and *Eucera nigrescens* by comparing specimens collected in 2021 and 2022 with those present in the "Guido Grandi Collection" of the University of Bologna collected between 1925 and 1935 in the same areas near Bologna. Our aim is to determine whether intraspecific body size, taken as ITD, and pollen load of these species have changed after almost 100 years, indicating environmental changes and alteration of landscape plant composition, as well as the response to these changes by different Apidae species.

Keywords: Pollinators; wild bees; ecological traits; plant-pollinator interaction

Funding: PhD funded by European PNRR

P36 – Bumblebee parasites and pathogens: assessing fitness implications through literature review and metaanalysis

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Bumblebees (Apidae: *Bombus*) are host to a diversity of parasites and pathogens, including internal protozoans and nematodes, Dipteran and Hymenopteran parasitoids, honeybee-transmitted viruses, and social parasites (i.e. cuckoo bumblebees). While numerous papers record the prevalence of parasites and pathogens in bumblebee populations worldwide, very few studies document the population-level impacts of these parasites and pathogens on bumblebee health and reproductive success. Our study aimed to compile and assess the fitness risks posed by bumblebee parasites and pathogens. We conducted a systematic literature search using Web of Science and SCOPUS in March 2022. Of the 609 papers returned by these databases, less than 10% directly assessed fitness effects. Measures of parasite and pathogen fitness impacts varied widely throughout the literature. For parasites with sufficient data, we conducted a metaanalysis for overall effect sizes. Our study highlights the gaps in our current understanding of bumblebee parasites and calls for continued research into their influence on bumblebee population health.

Keywords: *Bombus*, fitness, reproductive success, survival

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P37 – Variation barcodes for monitoring genetic diversity in the anthropocene

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It is estimated that taxa are currently disappearing at rates comparable to the great mass extinctions occurred throughout the Earth's history. In this scenario of global change, it is vital to monitor species to identify early patterns of diversity loss, allowing early intervention. DNA barcoding postulates that we can identify any species from a small region of its DNA. Over time, the barcoding concept has been established as a robust methodology for taxonomic identification and many other purposes. In this work, we test the existence of variation barcodes, that is, short DNA regions consistently showing genetic diversity values similar to those obtained at the genomic level. We downloaded all the plastidial whole genome DNA sequences (cpDNA) and all the whole genome mitochondrial sequences (mtDNA) available in Genbank and, after aligning sequences from the same genus, we scan the accuracy of short regions to provide diversity values proportional to those obtained for the entire alignment. The objective of this work is to determine the existence (and the accuracy, if it is the case) of short DNA regions that give diversity values proportional to those obtained with the complete cpDNA and mtDNA molecules. We discuss the accuracy of the different potential diversity barcodes found across genera. We conclude that variation barcodes may provide inexpensive genetic diversity estimates using a large number of individuals.

Keywords: DNA barcoding, genetic diversity, monitoring

Funding: Monitorization of Endemic ENdangered Ecosystems Registering genomic VArIation through time (MEENERVA), ref: PID2022-139405OB-I00; and Understanding evolutionary transitions in plant mating systems: the “forbidden” path from selfing to outcrossing species (OUTevolution), ref: PID2019-111294GB-I00, both funded by the Spanish Ministry for Science and Innovation.

P38 – Genetic characterization of the honeybee (*Apis mellifera* L.) populations in Estonia

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The honeybee *Apis mellifera* Linnaeus, 1758 has a worldwide distribution with more than 30 subspecies recognized by morphological and genetic methods. Estonia is within the distribution area of the European dark honeybee (*A. m. mellifera*), although other subspecies have been imported by humans over the years. We aimed to perform a comprehensive assessment of the genetic diversity present in Estonian honeybee populations. We analysed the mitochondrial DNA (mtDNA) “COI-COII intergenic region” from 156 honeybees collected from 35 stationary apiaries during July 2023. We found that the Estonian honeybee population is mostly composed of two subspecies within the mitochondrial lineage C: *A. m. ligustica* (55.1%) and *A. m. carnica* (35.9%), both native subspecies to southern Europe (Italy and Balkans). The Estonian native subspecies (*A. m. mellifera*; lineage M) was only detected in 7.7% of the samples. A single colony of *A. m. iberiensis* (native to Africa and Iberian Peninsula) was identified. The phylogenetic analyses revealed eleven mtDNA haplotypes organized in three clearly distinct clusters: *A. m. mellifera*, *A. m. iberiensis* and *A. m. ligustica* + *A. m. carnica*. The haplotype diversity was similar to other world regions, suggesting similar breeding practices. Overall, the Estonian honeybee population is mainly composed of commercial C-lineage honeybees, possibly imported from southern Europe. The native *A. m. mellifera* subspecies is rare, despite representing a potential reservoir of unique combinations of genes adapted to local conditions. The new data may contribute to the implementation of conservation projects and to better understand the hybridization between honeybee subspecies.

Keywords: Estonian beekeepers, honeybee conservation, introgression, maternal lineages, mitochondrial DNA

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