39th SCAPE meeting
PRIEGO DE CÓRDOBA (SPAIN)

23-26 October 2025

Organizers

Mohamed Abdelaziz
Esther Funes Ligero
Yanire Vázquez-Benítez
Melissa Viveiros Moniz
Universidad de Granada

Marcos Méndez
Universidad Rey Juan Carlos

39th SCAPE - PRIEGO DE CÓRDOBA (SPAIN)
SHORT PROGRAMME

Thursday 23th October
21:00 Carolin Mayer - (FLASH TALK) Journal of Pollination Ecology Newsflash - Chair: Marcos Méndez
21:15 Dinner

Friday 24th October
8:30 SENIOR PLENARY TALK - Chair: Marcos Méndez
Luisa Carvalheiro - Pollinators in a changing world: advances, gaps, and future directions

9:20 Short break

9:30-11:30 1st session - Chairs: Marcin Zych and Stefan Dötterl
9:30 **Océane Bartholomée** - An Arctic facing changes: Land use change and climate warming effects on the pollination of bilberry and lingonberry
9:45 **Johan Svedin** - Will experimental phenological mismatch alter seed set in two *Vaccinium* species along an elevation gradient?
10:00 **Chatura Vaidya** - Interactive effects of drought and plant biodiversity loss increase floral resources and impact plant-pollinator interactions in drought-tolerant lemon beebalm (*Monarda citriodora*) in Central Texas
10:15 **Rufus Isaacs** - Extreme heat affects blueberry pollen, pollination, and pollinator nutrition
10:30 **Catarina Siopa** - Do pollinator declines translate into increasing crop pollinator deficits? Evidence from global temporal trends in crops
10:45 **Hanna Thosteman** - Better steering bees for better crop pollination
11:00 **Maaike van den Hil** - *Lasioglossum* (Halictidae) species as pollinators of lettuce
11:15 **Femke Verweij** - Differences in visitation of honeybees and bumblebees to ornamental plant varieties can be explained by floral traits

11:30-12:00 Coffee break

12:00-13:30 2nd session - Chairs: Yuval Sapir and Paolo Biella
12:00 **Eva Matoušková** - Learning to forget: Experience-driven shifts in hoverfly foraging fidelity
12:15 **Melissa León-Osper** - Evolutionary drivers and ecological roles of red flower coloration across pollination systems
12:30 **Marielle Schleifer** - Does pollen nutritional composition explain differences in pollen collection between alpine bumblebees and hoverflies?
12:45 **Benjamin Lazarus** - Fast or furious? How pore shape tunes pollen release from poricidal flowers
13:00 **Beth Nicholls** - Quantifying the energetic costs of flower handling
13:15 **Lydia Thompson** - Impacts of non-lethal sample methods on bumblebee foraging behaviour

13:30-14:30 Lunch

14:30-15:30 Excursion

15:30 JUNIOR PLENARY TALK - Chair: Marcos Méndez
Emiliano Pioltelli - Pollination through the lens of nutrition: from floral resources to human well-being

16:10-16:55 3rd session - Chair: Marcos Méndez
16:10 **Jane Devlin** - Choice of commercial pollinator can reduce fruit loss and improve harvest in Scottish sweet cherry
16:25 **Ola Olsson** - Pollinator mediated Allee-effects in populations of *Arnica montana* (Asteraceae)
16:40 **Wilhelm Osterman** - The reciprocal relationship between polyploidy and plant reproduction

16:55-17:55 Coffe break with posters

17:55- 19:25 4th session - Chairs: Casper van der Kooi and Javier Valverde

17:55 **Jennifer Rose** - The effects of landscape heterogeneity and floral resources on wild bee reproductive success: a meta-analysis
18:10 **Bastiaan Star** - Spatial connectivity between pollinator populations in northern Europe investigated by genomics and bioclimatic models
18:25 **Sophie Hecht** - Linking land-use related pollination patterns to floral trait evolution
18:40 **André Krahner** - FIT for purpose? Using flight interception traps for sampling bees in flowering tree canopies
18:55 **Leon Marshall** - Mapping what we don't know: knowledge gaps in wild bee diversity
19:10 **Edina Török** - Landscape and local scale drivers of cavity-nesting Hymenoptera in rural villages

19:25-19:35 Leg stretching break

19:35-21:10 5th session - Chairs: Nina Sletvold and Jon Ågren

19:35 **Anna-Sophie Hawranek** - 3D floral syndromes in *Aquilegia* (Ranunculaceae)
19:50 **Constantin Kopper** - Pollination syndromes shape evolutionary rates, floral disparity and modularity
20:05 **Aarushi Susheel** - Pollinator-mediated floral evolution in the pollination-generalised plant *Viscaria vulgaris*
20:20 **Yedra García** - Flower power: How co-flowering species can shape floral evolution
20:35 **Lisette van Kolfschoten** - Getting hooked? Testing the function of anther spurs in *Vaccinium myrtillus*
20:50 **Sam McCarren** - Negative frequency-dependent selection through pollen export, not seed set maintains equal morph ratios of mirror-image flowers
21:05 **Yuping Zhong** - (FLASH TALK) AI-powered classification model for German syrphid pollinators: a step towards rapid automated pollinator identification

21:15 Dinner

Saturday, 25th October

8:30 SENIOR PLENARY TALK - Chair: Mohamed Abdelaziz

Jordi Bosch - Solitary bees in a toxic world

9:20 Short break

9:30-11:00 6th session - Chairs: Renate Wesselingh and Carolin Mayer

9:30 **Carmen Nebauer** - Mitigating pesticide effects on *Bombus terrestris*: Comparative benefits of clover fields and diverse flower strips
9:45 **Jørund Johansen** - Fluoride exposure in pollinating insects near an aluminium smelter in Norway: a pilot study
10:00 **Anke Dietzsch** - Site-specific weed management can boost food resources for pollinators
10:15 **Maureen Page** - Honey bee competition reduces bumble bee reproduction in field cage experiment
10:30 **Megan Reilly** - Bees and multiple stressors: The impact of a pyrethroid insecticide and nutrition on the red mason bee (*Osmia bicornis*)
10:45 **Kenneth Kuba** - Micro plastics effects on wild bee larvae

11:00-11.30 Coffe break

11:30-13:30 7th session - Chairs: Cala Castellanos and José Mª Gómez

11:30 **Magda Karlo** - Pollinator interaction with flower strips varies across different bioclimatic zones
11:45 **Natalia Timuş** - The effects of different management types on plant–pollinator interactions in Transylvanian semi-natural grasslands

12:00 **Willem Proesmans** - The effects of nitrogen deposition on the vegetation and the pollinator community in calcareous grasslands
12:15 **Nick Rosenberger** - Climate warming restructures subalpine plant community composition with consequences for bumble bee populations
12:30 **Yuval Sapir** - Is flower colour variation adaptive?
12:45 **Nina Sletvold** - The role of secondary pollinators in the evolution of complex colour signals in a bimodal pollination system
13:00 **Larissa de Paola** - Colour and chemistry: how flowers signal reward-quality to pollinators
13:15 **Casper van der Kooi** - Covert communication? On the visual ecology of Mediterranean red flowers

13:30-14:30 Lunch

14:30 JUNIOR PLENARY TALK - Chair: Mohamed Abdelaziz
Blanca Arroyo - Scaling up from individuals to complex plant-pollinator networks

15:10-16:55 8th session - Chairs: Ainhoa Magrach and Amparo Lázaro
15:10 **Manuel Ankel** - Flower-bee interactions along land use and climatic gradients: a large-scale study for Central Europe
15:25 **Brandon S. Whitley** - From South to North: Plant–Pollinator Networks Across 1100 km of Arctic Kalaallit Nunaat Greenland
15:40 **Luis J. Chueca** - Coupling diet and pollen metabarcoding with field surveys to reveal plant-pollinator interactions
15:55 **Huan Liang** - Spatiotemporal dynamics and multi-scale drivers of plant–pollinator networks along an urbanization gradient
16:10 **Ugo Mendes Diniz** - Addressing the “nocturnal problem”: the role of non-sphingid moths and nocturnal bees in tropical pollination networks and how they respond to disturbance
16:25 **Diana Michael** - Individuals matter: habitat factors and plant traits shape individual-level pollinator interactions in a semi-arid landscape
16:40 **Jakub Štenc** - Drivers of pollen deposition on *Succisa pratensis* in a dynamic plant-pollinator network

16:55-17:55 Coffe break with posters

18:10-19:10 9th session - Chair: Magne Friberg
18:10 **Marta Barberis** - Insect-flower interactions in the Mediterranean area: a Citizen Science dataset collated within the LIFE 4 Pollinators project
18:25 **Janine Griffiths-Lee** - Sow Wild! A citizen science project to assess the effectiveness of sown mini-meadows in recruiting beneficial insects in urban green spaces
18:40 **Rosa Ranalli** - Designing pollinator-friendly cities: the role of flower traits, native species, and meadow management
18:55 **Gaya ten Kate** - Comparing methods to quantify floral resources in cities: a meta-analysis

19:10-19:20 Leg stretching break

19:20-20:20 10th session - Chair: Stein Joar Hegland
19:20 **Vidisha Bansal** - Intraspecific floral trait plasticity varies with plant community structure along a land-use gradient
19:35 **Maria Clara Castellanos** - Phylogeography of an invasion to track rapid floral evolution
19:50 **Magne Friberg** - Ploidy-level and range position determines the intensity and outcome of a coevolving plant-pollinator interaction
20:05 **Jon Ågren** - Plant mating patterns in small populations

20:30 Congress dinner

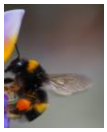
FLASH TALK

Journal of Pollination Ecology Newsflash

Carolin Mayer*[1] & Maria-Clara Castellanos[2]

[1] Journal of Pollination Ecology, Belgium; [2] Department of Ecology & Evolution, University of Sussex, UK

The *Journal of Pollination Ecology* (JPE) is a non-profit, open access, peer-reviewed, online journal that aims to promote the exchange of original knowledge and research in any area of pollination and pollinator ecology. In this short talk, we would like to share the latest news with the SCAPE community.

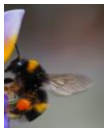


SENIOR PLENARY TALK

Pollinators in a changing world: Advances, gaps, and future directions

Luísa G. Carvalheiro
Departamento de Ecologia, Universidade Federal de Goiás, Brasil

When discussing pollinator decline, the usual suspects—habitat loss, climate change, and pesticides—inevitably take the spotlight. The evidence on these drivers continues to mount, and with each passing day, their far-reaching consequences for ecosystem functioning and the provision of pollination services become harder to ignore. Yet, substantial knowledge gaps remain, limiting our capacity to design effective management strategies and policies for pollinator conservation. Moreover, focusing solely on these familiar culprits risks overlooking additional drivers—some equally pervasive—that may operate in synergy with the usual suspects, further exacerbating pollinator decline. In this talk we will discuss some of these gaps and additional drivers.



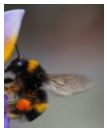
1ST SESSION

An Arctic facing changes: Land use change and climate warming effects on the pollination of bilberry and lingonberry

Océane Bartholomée*[1], Anne Bjorkman[2], Liam Kendall[1], Vigdis Vandvik[3], Emily Baird[4] & Henrik G. Smith[1,5]

[1] Centre for Environmental and Climate science, Lund University, Sweden; [2] Department of Biological & Environmental Sciences, University of Gothenburg, Sweden; [3] Department of Biological Sciences, University of Bergen, Norway; [4] Department of Zoology, Stockholm University, Sweden; [5] Department of Biology, Lund University, Sweden

Global changes, including climate warming and habitat change, are posing unprecedented and accelerating threats to biodiversity and functioning of high-altitude and -latitude ecosystems. Nonetheless, little is known about how global changes affect biotic interactions in these regions. Here, we investigate the effects of habitat opening due to anthropic management on the bilberry pollination by comparing closed sub-alpine birch forests with a human-created open habitat – a ski-slope in northern Sweden. We further aimed to assess the effects of climate warming on the pollination of lingonberry by comparing the pollinator communities along an altitudinal gradient using a space-for-time substitution design. We focus on two charismatic keystone plants species, bilberry (*Vaccinium myrtillus*) and lingonberry (*V. vitis-idea*), which require buzz pollination for maximising their reproductive outputs. Bumblebees, abundant at high-altitude and –latitude are able to perform buzz pollination and are the main pollinators of these plants. We performed fieldwork on Mount Nuolja, a mountain in Abisko National Park during spring and summer 2025. We describe the pollinator communities of these two ericaceous dwarf-shrubs in the Arctic. We found significant differences in community composition between the flower-visitor communities of bilberry between the birch forest and the ski slope, highlighting the influence of human-induced habitat change on insect communities and biotic interactions. Nonetheless, the assessment of impacts of climate warming on lingonberry pollination communities was hampered by the longest heatwave in northern Sweden in over 100 years. We also investigated differences in functional composition of bumblebee communities as well as differences in flower traits (on-going analyses). We interpret the results of our analyses in the regard of the consequences of anthropic pressures – direct through habitat management and indirect through climate warming – on plant pollinator interactions in an Arctic ecosystem.

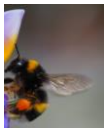


1ST SESSION

Will experimental phenological mismatch alter seed set in two Vaccinium species along an elevation gradient?

Johan Svedin
Department of Civil Engineering and Environmental Sciences, Western University of Norway, Norway

Climate warming has advanced the onset of spring, causing earlier flowering in many plant species. However, pollinator emergence has shifted less, leading to potential temporal mismatches that may reduce plant reproductive success. Experimental manipulations of flowering phenology, such as snow removal or potted plants, are often labour-intensive and can artificially prolong flowering at the site level, complicating interpretation. Here, we use a novel low-effort approach to simulate phenological mismatch by experimentally excluding pollinators from flowers and selectively exposing them during different flowering phases. Study plots were split between semi-exclosure plots, which reduce pollinator abundance, and control plots. Within each plot, six ramets of *Vaccinium myrtillus* and *V. vitis-idaea* were selected prior to flowering. Two ramets were bagged with fine mesh from the onset of flowering until peak bloom (late exposure), two were bagged from peak bloom until flowering ended (early exposure), and two were left uncovered as open-pollinated controls. To complement these treatments, we use a highly customizable automated camera system to monitor pollinator visitation, providing detailed data on insect activity patterns throughout the flowering period. At the end of the season, fruit set and seed numbers was recorded to quantify reproductive success. We predict that reproductive success will be reduced more in late-exposure plants than in early-exposure plants, with stronger effects in *V. myrtillus* and at higher elevations. We further predict that these effects will be amplified under reduced pollinator abundance. This experiment provides insight into how climate-driven shifts in phenology and pollinator declines interact to influence reproductive success in insect-pollinated dwarf shrubs. Our results will improve understanding of plant–pollinator resilience to climate change and inform conservation strategies for pollination-dependent ecosystems.

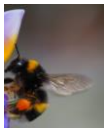


1ST SESSION

Interactive effects of drought and plant biodiversity loss increase floral resources and impact plant-pollinator interactions in drought-tolerant lemon beebalm (*Monarda citriodora*) in Central Texas

Chatura Vaidya*, Damla Cinoglu, Sarah Ortiz, Caroline Farrior, Shalene Jha & Amelia Wolf
Department of Integrative Biology, University of Texas at Austin, USA

Climate change can affect plant-pollinator interactions via phenological mismatches, geographical range shifts and changes in the floral resources. Decreased precipitation due to climate change has resulted in severe and prolonged droughts. Additionally, with biodiversity declining globally, it is important to understand the interactive effects of plant biodiversity loss and water stress on plant-pollinator interactions. Using a focal plant species, we investigated the combined effects of drought and plant biodiversity loss on the reproductive success of *Monarda citriodora*, an annual wildflower abundant and commonly found in the Texas grasslands, and visited by several pollinators. This study was conducted in an existing Biodiversity-Ecosystem-Function field experiment consisting of 12 grassland species native to Texas, in treatments of plant richness of 1 (*Monarda* monoculture), 2, 4, 6, and 12 species (*Monarda* + 11 spp.), and watering (ambient, +100% average rainfall). We recorded floral traits, pollinator visitation rates and seed set of *Monarda* and found that water stress advanced onset of flowering, increased flower production but produced smaller flowers, and reduced pollinator visitor richness. Plant species richness increased stigmatic pollen deposition, and that plant species richness and water availability interactively affected seed set in *Monarda*. Our study demonstrates that *Monarda citriodora* is drought-tolerant in Central Texas and an excellent candidate for pollinator habitats, especially in the face of climate change.



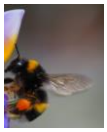
1ST SESSION

Extreme heat affects blueberry pollen, pollination, and pollinator nutrition

Rufus Isaacs*[1], Steven Van Timmeren[1] & Jenna Walters[2]

[1] Department of Entomology, Michigan State University, USA; [2] School of Ecology and Biology, University of Maine, USA

Extreme weather conditions have the potential to disrupt plant-insect interactions in many ways, including effects on the plants, insects, or their interactions. Recent growing seasons in the Great Lakes region of the United States have included short periods of very high temperature conditions. Some of these extreme heat events have occurred during blueberry flowering, followed by poor yields across the region's blueberry farms. We investigated the response of blueberry (*Vaccinium corymbosum*) to field-relevant periods of high heat, and the subsequent effects on the blue orchard bee (*Osmia lignaria*) provided pollen from those heat stressed plants. Experiments conducted *in vitro* found that blueberry pollen germination and tube growth were inhibited by conditions exceeding 32ºC, and that a brief exposure of 4 h caused irreversible damage to the pollen. These effects were consistent among various cultivars of this crop. Varying the timing of heat stress relative to flower development revealed that bud swell was a particularly sensitive period of development. We also used a no-choice cage study design to show that *O. lignaria* foraging on plants previously exposed to brief extreme heat had lower fecundity, disrupted development, and lower survival to adulthood when larvae consumed pollen from these plants compared with cages containing bushes without extreme heat exposure. Finally, we used a laboratory-based artificial feeding method to confirm that mason bee larvae fed pollen from heat-stressed plants had significantly greater mortality than those without this stress. The implications of these results for managing crops through extreme heat conditions will be discussed, along with our current research to develop mitigation strategies to warn farmers of extreme heat and to protect crop yields through increasingly variable weather conditions.



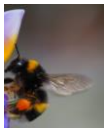
1ST SESSION

Do pollinator declines translate into increasing crop pollinator deficits? Evidence from global temporal trends in crops

Catarina Siopa*[1,2], Marcelo Aizen[3], Sílvia Castro[2], João Loureiro[2] & Agustín Sáez[3]

[1] Chair of Nature Conservation and Landscape Ecology, University of Freiburg, Germany; [2] Centre for Functional Ecology, Department of Life Sciences, University of Coimbra, Portugal; [3] Grupo de Ecología de la Polinización (ECOPOL), Instituto de Investigaciones en Biodiversidad y Medio Ambiente, CONICET-Universidad Nacional del Comahue, Argentina

Approximately 75% of crops benefit from biotic pollination, accounting for over one-third of global food production. Given the widespread decline in pollinator populations, it is important to better understand the potential impact of pollinator decline on crop yields and which drivers impact the observed trends. For this, we assessed the global temporal trends in pollination deficits of crops and evaluated the roles of pollinator management and crop pollinator dependence. Overall, inadequate pollination services account for 36% of crop losses. Yet, contrary to expectations, we found that pollinator deficits have significantly decreased over time, with a 47% reduction between the 1980s and the 2010s. This decline is largely explained by the use of managed pollinators: fields supplemented with managed pollinators showed a consistent decrease in pollination deficits, while those without management exhibited no such trend. Crop reproductive traits also influenced pollination deficits, as crops with autogamy capacity consistently displayed lower levels of pollination deficits than those reliant on animal pollinators. However, for both cases, pollination deficits remained stable over time. Despite evidence of pollinator population declines, our results reveal that pollination limitation in pollinator-dependent crops has diminished over recent decades. This improvement highlights the effectiveness of current practices in mitigating crop losses, particularly managed pollination. However, substantial potential remains to further enhance pollination services and secure food production in the face of ongoing environmental change.



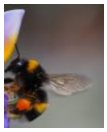
1ST SESSION

Better steering bees for better crop pollination

Hanna Eriksdotter Thosteman*[1], Paul G. Becher[1], Åsa Lankinen[1], Rufus Isaacs[2], Lotta Fabricius Kristiansen[1,3], Johan A. Stenberg[1] & Paul A. Egan[1]

[1] Department of Plant Protection Biology, Swedish University of Agricultural Sciences, Sweden; [2] Department of Entomology, Michigan State University, USA; [3] National Competence Centre for Advisory Services, Swedish University of Agricultural Sciences, Sweden

As the climate changes, biodiversity loss accelerates, leading to increasingly unreliable pollination. This threatens global food security, forcing crop producers to rely more heavily on commercial pollinators, such as honeybees (*Apis* spp.), to meet the growing demand for flowering-crop-based products. Although effective pollinators of many crops, honeybees are generalist foragers and are known to have low or even absent affinity for target crops such as strawberries and pear. To mitigate this effect and avoid pollination deficit, farmers typically increase stocking density of honeybee hives, an approach that is not only economically unsustainable but may also have ecological drawbacks as competition with wild pollinators intensifies. Thus, there is a pressing need to enhance honeybee pollination efficiency for target crops, ensuring a more sustainable solution both economically and ecologically for farmers. To achieve this, the first step is to increase the attractiveness of the target crop to the honeybee forager. Here we present a recently commenced project aimed at evaluating a two-step method to enhance pollinator attraction to strawberry flowers, a crop known to have low attractiveness to honeybees. Using olfactory bioassays and free-foraging preference tests in semi-field environments, we investigate how (1) nectivorous flower-volatile-emitting yeasts and other olfactory attractants and (2) dietary conditioning enhance floral constancy and better steer pollinators toward target crops. Better steering honeybees to crops can help reduce stocking rates, minimizing the ecological impact of beekeeping while enabling beekeepers to provide more precise crop pollination for farmers. If successful, this two-step approach could contribute to more sustainable crop-pollination and beekeeping practices with honeybees.

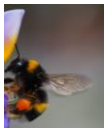


1ST SESSION

Lasioglossum (Halictidae) species as pollinators of lettuce

Maaike van den Hil
Naturalis Biodiversity Center, The Netherlands

The production of seeds of most horticultural crops such as lettuce, onions and leeks, leafy vegetables and kitchen herbs requires insect pollination. The aim of this research is to find suitable pollinators for lettuce and related crops for which available managed pollinators such as honeybees, bumblebees and mason bees are unsuitable. We investigated the wild pollinator community of lettuce to identify potential candidate species for pollinating lettuce. We conducted observations and collected specimens at 20 locations in the Netherlands, 5 in Spain and 11 in Australia. Our results demonstrate that *Lasioglossum* (Hymenoptera: Halictidae) species were the most frequent visitors at all study sites, accounting for over 70% of the almost 2000 observations. We recorded a high diversity of these bees and identified 25 different *Lasioglossum* species in total: 12 species in the Netherlands, 13 in Spain, and 5 in Australia. All of these species share a small body size and a preference for foraging during the morning, which aligns with the flowering phenology of lettuce. The observed species are a mixture of generalists with broad diets and specialists focused on Asteraceae. Observations of the behaviour of Lasioglossum spp. in Australia show that the bees stay on the lettuce flowers for an extended period to collect both pollen and nectar. This study shows that *Lasioglossum* species consistently visit lettuce in different climates and biogeographical regions and identifies *Lasioglossum* species as key pollinators of lettuce. This highlights the potential for their use as a more viable alternative to currently used managed pollinators, as well as surprisingly uniform pollinator community assemblage regardless of geographic location.



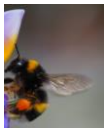
1ST SESSION

Differences in visitation of honeybees and bumblebees to ornamental plant varieties can be explained by floral traits

Femke Verweij*[1,2], Koos Biesmeijer[2] & Saskia Klumpers[2]

[1] Institute of Biology, Leiden University, The Netherlands; [2] NL Biodiversity and Society, Naturalis Biodiversity Centre, The Netherlands

Global bee populations are rapidly declining. One way of supporting bee populations is by enhancing urban green spaces with plants attractive to bees. Plant breeding has introduced a high degree of variability in floral traits, which can affect the attractiveness and usefulness of ornamental plants to bees. In this study, we investigated how variation in floral traits, including nectar sugar content, corolla tube depth, flower colour, UV-presence and the number of flowers, affected the attractiveness of 119 cultivars from eight ornamental plant genera (*Agastache hybrida*, *Delosperma cooperi*, *Gaillardia aristata*, *Lavandula angustifolia*, *Lavandula stoechas*, *Perovskia atriplicifolia*, *Salvia nemorosa* and *Sedum telephium*) to honeybees and bumblebees. Our results show that differences in bee visitation rate among cultivars were directly related to variation in floral traits. For most plant genera, cultivars of the same species varied significantly in attractiveness. Honeybees and bumblebees generally did not find the same cultivars and plant genera attractive. Nectar sugar content and flower colour were important for cultivar attractiveness to both honeybees and bumblebees, with corolla tube depth also being an important factor for honeybees. We found that flower colour was often related to the favourability of other floral traits that promote more rewarding or easily accessible flowers. However, most cultivars were considered unattractive and only a small number of cultivars were highly attractive to honeybees (6%) and bumblebees (10%). Overall, our study gives valuable insights for plant breeders, emphasising how different floral traits affect the attractiveness of ornamental plants which helps to select for floral traits that result in more attractive ornamental plants for bees.



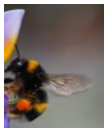
2ND SESSION

Learning to forget: Experience-driven shifts in hoverfly foraging fidelity

Eva Matoušková*[1], Alice Haveldová[1], Lucie Sedláčková[1], Jakub Štenc[2, 3], Martin Freundenfield[1] & Zdeněk Janovský[4]

[1] Department of Botany, Charles University, Czech Republic; [2] Department of Zoology, Charles University, Czech Republic; [3] CREAF, Spain; [4] Svatý Jan t. Krsovice, Czech Republic

Hoverflies are among the most widespread and abundant pollinators, visiting flowers with a striking diversity of floral traits. Yet when we examine their choices closely, an intriguing pattern emerges: naïve individuals show a pronounced colour preference and corresponding floral fidelity, whereas field-caught individuals exhibit weak or absent colour preferences and sometimes also low fidelity to any particular floral morph. What drives this shift? To explore this question we first tried to understand the differences between the naïve and experienced individuals. We conducted controlled experiments with naïve hoverflies and artificial flowers to establish their baseline preferences for not only colour, but also symmetry, and size. We then compared these findings with the behaviour of experienced individuals observed in the field. Finally, we exposed both naïve and experienced hoverflies to controlled learning trials to quantify how experience alters their preferences and fidelity. We hypotethise that for the animal it is beneficial to diversify it's foraging options and be able to change behaviour according to availabile plants. But still key question remains: how many rewarding or unrewarding encounters are required for a hoverfly to move from a strong innate attraction to colour indifference or to a new floral preference? In still ongoing experiment we are in the process of finding answers to this question. In this talk, I will present a series of controlled experiments designed to address these questions.



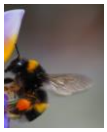
2ND SESSION

Evolutionary drivers and ecological roles of red flower coloration across pollination systems

Melissa León-Osper*[1], José C. del Valle[2], Mª Luisa Buide[1], Montserrat Arista[2], Pedro L. Ortiz[2], Amelia Fuller[3], Katie Conrad[4], Victor Rossi[4], Justen B. Whittall[4] & Eduardo Narbona[1]

[1] Department of Molecular Biology and Biochemical Engineering, Pablo de Olavide University, Spain; [2] Department of Plant Biology and Ecology, University of Seville, Spain; [3] Department of Chemistry and Biochemistry, Santa Clara University, USA; [4] Department of Biology, Santa Clara University, USA

Red-flowered species have long attracted the interest of evolutionary biologist, primarily as these exemplify convergent evolution towards hummingbird pollination in western North America flora. In this region, multiple independent origins of red flowers coupled with ornithophily have occurred across the angiosperm tree of life. However, red flowers are not exclusive to bird-pollinated systems. In southern Spain, where is bird-pollination is absent, red-flowered species are mainly pollinated by bees. Hummingbirds and bees possess markedly different color vision systems; hummingbirds exhibit a red photoreceptor that bees lack. These contrasting visual abilities to perceive red flowers have led to two non-exclusive hypotheses regarding red flower evolution. The bee-avoidance which posits hummingbird-pollinated red flowers reduce visitation by less efficient pollinators, such as bees; and the bird-preference hypothesis, which proposes that red is the most attractive color to hummingbirds. In this thesis we investigated the (i) spectral and biochemical differences between red flowers pollinated by hummingbirds and by bees; (ii) the coevolution of anthocyanins and carotenoids across multiple plant lineages; (iii) strategies enhancing the visibility of red flowers to bees in communities lacking hummingbirds; and (iv) pigment pathways towards the evolution of red hummingbird-pollinated flowers. Our approach integrates pigment biochemistry, phylogenetic comparative analyses, and floral reflectance modelling within both bee and hummingbird visual systems. Our results reveal key differences in the ability of red flowers to reflect ultraviolet (UV) light, which impacts flower visibility to both hummingbirds and bees; distinct pigment compositions between hummingbird- and bee-pollinated red flowers; and strong convergence in pollinator-perceived hue despite pigment differences. This work improves our understanding of how floral color traits evolve under contrasting pollinator regimes, providing insights in evolutionary patterns in flower color.



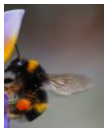
2ND SESSION

Does pollen nutritional composition explain differences in pollen collection between alpine bumblebees and hoverflies?

Marielle C. Schleifer*[1, 2], Fabian A. Ruedenauer[1], Laura Castiglioni[1], Alexander Keller[3], Johannes Spaethe[2] & Sara D. Leonhardt[1]

[1] Plant-Insect Interactions, Department of Life Science Systems, Technical University of Munich, Germany; [2] Department of Behavioral Physiology and Sociobiology, Biocenter, University of Würzburg, Germany; [3] Cellular and Organismic Networks, Ludwig Maximilans University Munich, Germany

Pollinator foraging behavior is shaped not only by flower availability but also by the nutritional quality of floral resources, such as pollen. Bumblebees and hoverflies, two key pollinators in alpine ecosystems, depend on pollen, though to different extents and for different purposes. Bees rely on pollen as a crucial resource for raising their brood, whereas in hoverflies, especially the females rely on pollen for ovarian development. Pollen varies greatly in nutrient composition—referred to as pollen quality—both among different plant species and within the same species. This nutrient spectrum includes amino acids, fatty acids, sterols, vitamins, minerals, and plant secondary metabolites. Hence, pollen availability and composition vary among plant species, and at the same time nutritional requirements differ between pollinator groups. These different nutritional perspectives both on the plant and pollinator side likely shape the pollen foraging patterns of pollinators. In this study, we investigated whether the nutrient composition of pollen correlated with the foraging behavior of two alpine pollinator groups, bumblebees and hoverflies. Pollen samples were collected from a range of alpine flowering plants in the Hohe Tauern National Park throughout the season. We analyzed pollen nutrient composition using gas chromatography-mass spectrometry (GC-MS) for fatty acids and sterols and ion exchange chromatography (IEC) for amino acids. Additionally, we gathered pollen loads from alpine bumblebees and hoverflies and identified their taxonomic origin through metabarcoding. We investigated whether (i) bumblebees and hoverflies collected pollen from different plant species, and ii) if these differences correlated with variation in the pollen's respective nutrient compositions. This study sheds light on the complex connections between nutrient availability, and pollinator foraging behavior.



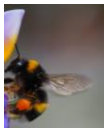
2ND SESSION

Fast or furious? How pore shape tunes pollen release from poricidal flowers

Benjamin S. Lazarus*[1], Fabian Polz[1], Fabián A. Michelangeli[2] & Agnes S. Dellinger[1]

[1] Department of Botany and Biodiversity Research, University of Vienna, Austria; [2] Center for Biodiversity & Evolution; New York Botanical Garden, USA

Approximately 10% of angiosperm species spanning 87 families have flowers that restrict pollen access to a narrow pore. In these species, pollen is often expelled forcefully into the air when pollinators apply high frequency vibrations to the flowers or when they compress air-filled tissue inside the stamens. In this study, we use experimental high-speed video to explore how pore shape plays a major role in the spatial pollen release patterns of poricidal flowers. We suggest that modifications to the pore have a significant effect on how pollen is likely placed on a pollinator and propose that poricidal flowers may have more targeted pollen placement than previously thought. We also propose that these modifications, or lack thereof, may allow for variable levels of specialization in poricidal flowers. Finally, we outline different functional pore shapes and examine their occurrence across poricidal lineages.



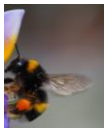
2ND SESSION

Quantifying the energetic costs of flower handling

Natacha Rossi[1], Mario Vallejo-Marín[2] & Elizabeth Nicholls*[1]

[1] Department of Ecology & Evolution, University of Sussex, UK; [2] Department of Ecology and Genetics, Uppsala University, Sweden

Floral handling can impose substantial energetic costs on bees, yet these costs have rarely been directly measured. Pollen provides no direct energetic reward for foraging bees and often requires complex behaviours for extraction. For example, in flowers with poricidal anthers, bees use their indirect flight muscles to produce high-frequency vibrations that eject the pollen, a behaviour known as sonication or buzz-pollination, that is hypothesised to be particularly costly, especially given such flowers rarely offer nectar rewards. Here we present a novel method for measuring the cost of flower handling using a combination of flow-through respirometry and laser vibrometry, providing the first direct quantification of energetic expenditure during pollen collection. We measured the energetic cost of floral buzzing in Bombus terrestris and compared it with flight take-off, a well-studied, high-intensity behaviour. Floral buzzing required extreme muscular effort, with power outputs up to 293 W/kg and an average per-event cost of ~0.10 J. This expenditure is ~33 times greater than resting metabolic rates. Metabolic rate scaled with body mass, indicating heavier bees incur greater costs during sonication. Metabolic traits were consistent within individuals, and colony identity significantly influenced performance, suggesting potential physiological or heritable variation. We also estimated the volume of nectar required to fuel buzzing, and found it exceeded that of take-off, particularly for flowers with low sugar concentrations. These results show that floral buzzing imposes previously unquantified costs comparable to flight, representing a significant cumulative burden with ecological and evolutionary consequences for bee foraging and plant–pollinator interactions.



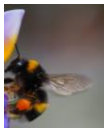
2ND SESSION

Impacts of non-lethal sample methods on bumblebee foraging behaviour

Lydia Thompson*[1, 2], Moya Owens[1], Catriona Barry[1] & Dara Stanley[1, 2]

[1] School of Agriculture and Food Science, University College Dublin, Ireland; [2] Earth Institute, University College Dublin, Ireland

Non-lethal sampling is central to pollinator conservation genetics, yet the short-term behavioural costs of common techniques are poorly quantified. We tested how chilling (cold narcosis) and two tissue-removal methods—tarsal clipping and whole-leg removal—affect recovery and foraging behaviour in the buff-tailed bumblebee *Bombus terrestris*. Fifteen queenright colonies were observed in outdoor flight cages provisioned with *Lavandula* under controlled conditions in July 2024. Foragers were captured at nest emergence and randomly assigned to one of four treatments (control handling, chill, tarsal clip, whole-leg removal), individually marked, and released for observation. Across all colonies, 160 workers were treated; 60 marked foragers from 11 colonies yielded detailed behavioural records. Chilling, tarsal clipping, and leg removal each significantly prolonged post-treatment recovery relative to controls, with no differences among the three manipulations. Core floral behaviours—time on flowers, time between flowers, and resting—did not differ across treatments, indicating resilience of handling performance under semi-natural conditions. In contrast, tarsal clipping reduced grooming duration, and limb-removal treatments decreased foraging trip frequency compared with chilled bees. Trip duration was longer after chilling than after limb removals, suggesting temporary thermophysiological impairment versus more chronic locomotor costs. Activity-budget analyses corroborated these patterns: treated bees devoted a greater proportion of time to recovery, while proportional time spent foraging and flying was broadly similar among groups. Our results show that widely used “non-lethal” methods impose measurable, behaviour-specific costs: chilling causes transient delays, whereas limb removal elicits persistent reductions in grooming and trip frequency. We recommend standardising handling protocols to account for recovery effects, minimising tissue removal when possible, and reporting behavioural endpoints alongside survivorship in pollinator studies. These adjustments will improve ethical practice and data interpretability in conservation genetics and behavioural ecology.



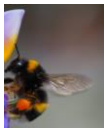
JUNIOR PLENARY TALK

Pollination through the lens of nutrition: From floral resources to human well-being

Emiliano Pioltelli

Department of Biotechnology and Biosciences, University of Milano-Bicocca, Italy; NBFC, National Biodiversity Future Center, Italy

From cells to ecosystems, nutrition is a fundamental driver of life. It shapes organismal physiology, behaviour, ecological interactions, and ecosystem processes. Its multi-faceted nature bridges fields such as chemistry, molecular biology, behavioural ecology, and conservation science. Pollinators stand out as a particularly compelling model within this framework as the pollination ecosystem service they provide represents a key foundation of human food systems. Understanding the interplay between environmental features, pollinators nutritional ecology and crop quality is then pivotal for addressing the intertwined crises of biodiversity loss and food security. As part of my doctoral research, through a multi-scale and multidisciplinary approach, I investigated how changes in land use and land cover influence the nutritional ecology of pollinators and how different pollination modes could affect not only crops yield but also their nutritional quality. Through the presentation of several case studies spanning floral chemistry, pollinator foraging ecology, and the nutritional profiling of crops exposed to differential pollination treatments, I provide an overview on how ecological processes influence both pollinator and human nutritional aspects. The applied relevance of this perspective will also be supported by presenting PollinAId, a decision-support tool that integrates aspect linked to nutritional ecology into the design of pollinator-friendly Nature-based Solutions. Taken together, these insights highlight how strengthening the nutritional link between plants, pollinators, and people can foster ecosystem resilience, enhance pollination services, and support both food security and human well-being.



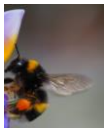
3RD SESSION

Choice of commercial pollinator can reduce fruit loss and improve harvest in Scottish sweet cherry

Jane Devlin*[1], D. Williams[2], A. Karley[3], R. Henry[1] & F. Manfredini[1, 4]

[1] Department of Biological Sciences, University of Aberdeen, Scotland; [2] Department of Cell and Molecular Science, The James Hutton Institute, Scotland; [3] Department of Ecological Sciences, The James Hutton Institute, Scotland; [4] Department of Food, Environmental and Nutritional Sciences, University of Milan, Italy

In Scotland sweet cherry undergo a natural phenomenon known as June drop, a process by which immature fruit are abscised from the tree. June drop is unpredictable and can dramatically affect fruit yields, driving the need to understand factors influencing June drop. The main aim of this study was to assess the role played by insect pollinators (species and density) in fruit loss. Twelve time-lapse cameras were deployed during the spring of 2024 and 2025. They were positioned within two distinct pollinator treatments designed to contain either commercial bumblebees or mason bees. Higher pollinator densities were found to significantly decrease the amount of fruit dropped. Areas with commercial bumblebees experienced distinctly more pollinator activity compared to areas with mason bees. Consequently, the former dropped proportionally less fruit in both 2024 (76.1%) and 2025 (59.9%) compared to the latter in 2024 (90.7%) and 2025 (83.5%). This resulted in the commercial bumblebee treatment having a higher fruit yield in both years compared to the mason bee treatment. Increased understanding of how pollination influences June drop can provide growers with the ability to mitigate and stabilise fruit loss through pollinators management.

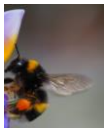


3RD SESSION

Pollinator mediated Allee-effects in populations of *Arnica montana* (Asteraceae)

Sophie Hecht, Magne Friberg & Ola Olsson*
Biodiversity and Evolution Division, Department of Biology, Lund University

Through the tight link between plants and their pollinators, plant species often decline when their pollinators decline and vice versa. Small populations also suffer disproportionate fitness loss compared to larger populations, know generally as Allee-effects. In animal pollinated plants, Allee-effects may be mediated by pollinator composition and behaviour. We investigated such pollinator-mediated Allee-effects in the plant species *Arnica montana* (Asteraceae), in Scania, Southern Sweden, and attempted to disentangle them from other detrimental effects of low population density, especially mate limitation. At 20 sites with population sizes of *Arnica* ranging from 5 – 500 flowering stems, we recorded the composition of pollinators visiting our focal plant and pollinators in the surrounding area, estimated the effectiveness of different pollinators by analysing their pollen loads, and estimated female fitness of *Arnica* through seed counts. Our results suggest an increasing proportion of pollinators specializing on Arnica with increasing population size of the plant. As a consequence, a larger proportion of pollen loads contained a high proportion of *Arnica* pollen in larger populations, possibly suggesting increased floral constancy of the pollinators in large plant populations. The reproductive success of *Arnica* was lower in small populations, and it increased with population size in parallel with changes in pollinator composition and behaviour. Hence, this study finds evidence for potential pollination-mediated Allee-effects on *Arnica*.



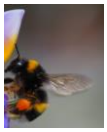
3RD SESSION

The reciprocal relationship between polyploidy and plant reproduction

Wilhelm Osterman*[1], James G. Hagan[1], Jeannette Whitton[2] & Anne D. Bjorkman[1]

[1] University of Gothenburg, Sweden; [2] University of British Columbia, Canada

Polyploidization events are key mutations found throughout angiosperms, influencing both the ecology and evolution of plants. By affecting floral traits and reproductive systems, polyploidy can directly alter plant–pollinator relationships and may facilitate shifts in pollinator interactions. The reproductive strategy a plant has, likewise, an impact the probability of polyploids to initially establish in a population. As polyploids and diploids cannot cross, polyploids are expected to rely on self reproduction. The relationship between polyploidy and reproduction is therefore expected to be reciprocal. Determining traits are caused by polyploidy and which traits are common simply because they facilitate polyploid establishment. Furthermore, there is no consensus on whether polyploids truly suffer from an establishment disadvantage, as they often have specific types of self-incompatibility such as unisexuality. In this talk, I will discuss contradictions in our understanding of the relationship between polyploidy and plant reproduction. I will show that, although polyploids often possess self-incompatibility, which seems to contradict theoretical expectations, unisexuality is likely to have evolved after the polyploidization event.



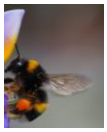
4TH SESSION

The effects of landscape heterogeneity and floral resources on wild bee reproductive success: a meta-analysis

Jennifer Rose*[1, 2], Philip A. Martin[2,3] & Ainhoa Magrach[2,3]

[1] University of the Basque Country, Spain; [2] Basque Centre for Climate Change, Spain; [3] Ikerbasque, Basque Foundation for Science, Spain

Wild bees are vital pollinators facing global declines, primarily driven by anthropogenic threats like habitat loss and reduced floral resources. While their ecological importance is well-established, the mechanisms through which these threats impair reproductive outcomes remain understudied, as most research focuses on adult-stage metrics measures such as total abundance and species richness. Here, we address these critical knowledge gaps by conducting a meta-analysis of 77 studies from 20 countries across five continents. We assessed the effects of landscape heterogeneity and floral resource availability on wild bee reproductive success across key life stages, from nest establishment to emergence using Hedge's g as an effect size. Our analysis reveals a significant taxonomic bias toward species in the families Apidae and Megachildae, highlighting a substantial gap in research on other families with different nesting strategies. Preliminary results suggest that landscape types (e.g., agricultural vs. semi-natural) and floral abundance influence both the probability of survival to adulthood and rates of parasitisms. We also find that landscape type and proximity to semi-natural habitat affect both the probability of nest establishment and the sex ratio of offspring. Understanding the drivers of fitness across all wild bee life stages is crucial for developing effective, targeted conservation strategies to mitigate population declines.



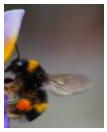
4TH SESSION

Spatial connectivity between pollinator populations in northern Europe investigated by genomics and bioclimatic models

Bastiaan Star*[1], Lauren Cobb[1], Emma F. Eriksen[1], Anders Nielsen[2] & Markus A.K. Sydenham[3]

[1] Centre for Ecological and Evolutionary Synthesis, Department of Biosciences, University of Oslo, Norway; [2] Department of Landscape and Biodiversity, Norwegian Institute of Bioeconomy Research, Norway; [3] Norwegian Institute for Nature Research, Norway

Insect populations are increasingly at risk from habitat loss, intensification of land use, pollution, and climate change. These pressures reduce population sizes and fragment habitats, potentially leading to isolation, loss of genetic diversity, and heightened extinction risk. Understanding how habitat fragmentation affects dispersal and connectivity is therefore vital for conservation. This research combines population genomics and habitat suitability modelling to investigate a range of wild bee pollinators, including *B. lapidarius*, *B. pascuorum*, *B. consobrinus* and *A. haemorrhoa*, across the Scandinavian peninsula. We use an in-house developed library protocol to generate high-quality, genome-wide data from small insect tissue samples with minimal specimen damage and low economical costs for all four species. Our results show low but significant genetic structuring in *B. lapidarius* and *B. pascuorum*, with decreasing diversity at higher latitudes, reflecting post-glacial histories. Intriguingly, *B. pascuorum* putatively harbours a large chromosomal inversion with highly elevated divergence, which may be associated with local adaptation. Habitat models revealed that grasslands and deciduous forests support connectivity, while coniferous forests and farmland hinder it. *B. consobrinus* and *A. haemorrhoa* showed lower amounts of spatial structure, and —in the case *B. consobrinus*— reduced levels of diversity, implying recent population contraction. By integrating genomic and ecological approaches, we aim to provide new insights into how landscapes shape wild bee populations and highlights strategies for conserving pollinators in fragmented environments.



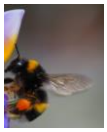
4TH SESSION

Linking land-use related pollination patterns to floral trait evolution

Sophie Hecht*[1], Sandra Blasiusson[1], Ciara Dwyer[1], Hannah Flink[1], Felipe Torres-Vanegas[1], An-Sofie Vastenavondt[2], Ola Olsson[1], Magne Friberg[1] & Øystein H. Opedal[1]

[1] Department of Biology, Lund University, Sweden; [2] Department of Biology, KU Leuven, Belgium

Human land-use has been shown to affect ecosystems in a multitude of different ways. Among other impacts, human land-use change connects to changes in species composition of both plants and pollinators and may directly alter insect behaviour or plant life cycles. These examples suggest the existence of evolutionary adaptations to land-use induced changes, but this is less well studied, especially in pollination-generalised plants. My PhD project links human land-use to floral trait evolution of a wild plant species (*Viscaria vulgaris*, Caryophyllaceae). Through the collection of multi-year, multi-site data on pollinator community composition and visitation rates, floral pollinator-attraction and pollinator-fit traits, and finally plant fitness, we aim to build a modelling framework to predict changes in plant trait optima. This would enable predictions of the evolutionary time it would take a population to reach new, human land use-driven optima, which could inform management decisions. Preliminary results show variation in pollinator community composition at sites with different land-use in Southern Sweden, as well as variation in selection on floral traits at different sites. These findings underscore the importance of linking the impact of land-use over changes in pollinator composition to varying selection and, ultimately, adaptation of floral traits.

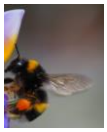


4TH SESSION

FIT for purpose? Using flight interception traps for sampling bees in flowering tree canopies

André Krahner* & Anke C. Dietzsch
Institute for Bee Protection, Julius Kühn-Institute - Federal Research Center for Cultivated Plants, Germany

Tree canopies can provide floral resources for bees in abundance. However, bee researchers often do not consider these resources, because they are difficult to access. Flight interception traps (FITs) can be used for collecting bees from elevated resources like flowering canopies. FITs are not attraction-based and may thus have the potential to assess activity density. In a pilot study, we investigated the suitability of two FITs, i.e. window traps and aerial Malaise traps, for sampling bees from flowering canopies. We sampled in canopies of four different tree taxa (*Salix*, *Malus*, *Robinia*, *Tilia*) in Braunschweig between March and June 2024. Moreover, we compared samples from pan trap triplets (fluorescent blue, white, and yellow) with FIT in flower strips in July 2024. In total, we collected 596 bee individuals from 9 genera, including 298 honeybees. Communities sampled in tree canopies showed marked differences in the ratio of honeybee to wild bee individuals. In contrast to the bottom collector units, top collector units of both the window traps and the aerial Malaise traps did not collected any bee individuals at all. Samples from pan traps contained more bee individuals than window traps after 2 days of trap exposure, and this was also true when exposure of window traps was extended to 5 days. Differences in sampled community composition between window traps and pan traps may indicate a complementarity of the methods. We discuss our findings in a wider context, based on a systematic literature search in the Web of Science for studies using interception traps for sampling bees and other hymenopterans, and review methodological options for using FITs to sample bees.



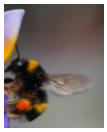
4TH SESSION

Mapping what we don't know: knowledge gaps in wild bee diversity

Leon Marshall*[1], Nicolas Leclercq[2], Luísa G. Carvalheiro[3, 4], Holger H. Dathe[5], Bernhard Jacobi[6], Michael Kuhlmann[7], Simon G. Potts[8], Pierre Rasmont[9], Stuart P.M. Roberts[2]& Nicolas J. Vereecken[2]

[1] Naturalis Biodiversity Center, The Netherlands; [2] Agroecology Lab, Université libre de Bruxelles, Belgium; [3] Departamento de Ecologia, Universidade Federal de Goiás, Brazil; [4] Center of Ecology, Evolution and Environmental Changes, Universidade de Lisboa, Portugal; [5] Senckenberg Deutsches Entomologisches Institut, Germany; [6] Oberhausen, Germany; [7] Zoological Museum of Kiel University, Germany; [8] Centre for Agri-Environmental Research, School of Agriculture, Policy and Development, University of Reading, UK; [9] Laboratory of Zoology, Université de Mons, Belgium

Understanding and reversing biodiversity decline in the Anthropocene requires robust data on species identity, distribution, ecology, and population trends. Despite advances in biodiversity informatics, major knowledge gaps remain for wild bees. Using the framework of shortfalls and a unique digital dataset of wild bee occurrence and ecology across Europe, we identify and quantify knowledge gaps ranging from geographic distributions and trait variation to phylogenetic history and interactions with flowering plants. We present this information using *BeeFall,* an interactive Shiny app designed to visualize and map these gaps. Our results revealed that these knowledge gaps are highly correlated across spatial scales, with knowledge gaps for trends and interactions being particularly high. We also identified a key gap affecting multiple shortfalls, the lack of high-quality, accessible photographic images, a barrier we coined as the Keartonian Impediment. This European-focused framework demonstrates a scalable methodology for identifying and addressing data shortfalls. Building on this work, we aim to extend the approach globally. Firstly, by integrating global datasets with expert-driven contributions, to quantify and map knowledge gaps worldwide. While a future project focused in sub-Saharan Africa aims to digitize museum collections, transcribe metadata, and share records publicly to build baselines and strengthen taxonomic capacity. These efforts represent critical steps toward more complete and accessible resources of global wild bee data. By encouraging discovery, digitization and mobilization of data across scales, we aim to enable more effective research and to safeguard wild bee diversity and the ecosystem services they support.



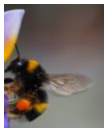
4TH SESSION

Landscape and local-scale drivers of cavity-nesting Hymenoptera in rural villages

Edina Török*[1], Zoltán László[2] , Dorota Kotowska[1], Riho Marja[1], Katalin Szitár[1] & Péter Batáry[1]

[1] ”Lendület” Landscape and Conservation Ecology, Institute of Ecology and Botany, MTA- HUN-REN Centre for Ecological Research, Hungary; [2] Hungarian Department of Biology and Ecology, Babeş-Bolyai University, Romania

Cavity-nesting Hymenoptera are typically small-bodied insects with short foraging ranges, and because their communities include both hosts and associated parasitoids, they provide excellent model systems for studying the combined effects of local and landscape-scale factors. Villages represent small-scale forms of urbanisation, where both landscape context and spatial position within the settlement may influence Hymenoptera communities. In this study, we investigated the biodiversity and nesting success of cavity-nesting bees, wasps, and their natural enemies in 56 Hungarian and Romanian villages. Villages were located either in semi-natural forested or agricultural landscapes, and differed in their proximity to mid-sized cities: villages close to cities in the agglomeration were typically characterised by ornamental gardens, whereas villages far from cities retained more traditional rural gardens. We also considered landscape variables such as spring and summer vegetation productivity (measured by NDVI) and road density within a 200 m buffer. Trap nests were deployed in village centres and edges (N = 224 trap nests). Across all sites, we reared larvae from 19,032 bee brood cells belonging to 25 species, 14,999 wasp cells representing 31 species, and 5,681 parasitoid cells from 38 species. Community composition was shaped by both landscape type and transect position: the highest abundance occurred at forested village edges, while the lowest occurred in agricultural village centres. Bee abundance showed no significant response to these factors, whereas wasps and parasitoids were strongly affected. Additionally, higher summer NDVI values were positively associated with nesting success for both wasps and parasitoids. Our results highlight the dual role of local (centre vs. edge) and landscape-scale (forested vs. agricultural) factors in shaping cavity-nesting Hymenoptera communities. For insect conservation, we suggest enhancing and maintaining green infrastructures in village centres and agricultural landscapes, while preserving the more favourable conditions already present at village edges and in forested landscapes.



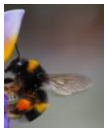
5TH SESSION

3D floral syndromes in *Aquilegia* (Ranunculaceae)

Anna-Sophie Hawranek*[1], Anne Le Maître[2], Maria von Balthazar[1], Gregor Traun[1], Leon Schönenberger[1], Susanne Pamperl[1], Jürg Schönenberger[1], Marion Chartier[1]

[1] Department of Botany and Biodiversity Research, University of Vienna, Austria; [2] Department of Evolutionary Biology, University of Vienna, Austria

The function of flowers in their interplay with pollinators is constrained by the three-dimensional arrangement as well as the shape and size of their floral organs. *Aquilegia* flowers are polysymmetric and their perianth comprises an inner whorl of five conspicuous petals that conceal their nectar reward in spurs. The spurs of different species differ in length and shape, likely as an adaptation to their specific pollinators. Indeed, previous studies have shown selection for spur length to ensure pollination success. In this study, we hypothesise that not only the length of the corolla spurs but also their shape reflects pollination systems in *Aquilegia*, thus defining three-dimensional (3D) floral syndromes. To test this hypothesis, we scanned flowers of twelve *Aquilegia* species pollinated by either a single functional group of nectar-collecting pollinators (large bees, hummingbirds or hawkmoths) or by two of these functional groups together (large bees and hummingbirds or hummingbirds and hawkmoths). By applying 3D geometric morphometrics, we study landmark- and semilandmark-sets defining the spur curvature as well as the spur opening where the pollinators insert their probing parts (proboscis or beak/tongue). A preliminary morphospace analysis showed a clear association between flower shapes and functional groups of pollinators, thus supporting our hypothesis. For example, the petal spur entrances differ in their shapes: while being laterally compressed in hawkmoth flowers, spur entrances are more or less isodiametric in bee flowers. With the advances of 3D geometric morphometrics, we expect to be able to refine the definitions of floral syndromes in *Aquilegia*, which so far largely relied on categorical data and linear measurements of floral organs.

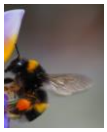


5TH SESSION

Pollination syndromes shape evolutionary rates, floral disparity and modularity

Constantin Kopper*, Agnes Dellinger & Jürg Schönenberger
Department of Structural and Functional Botany, University of Vienna, Austria

Flowers are composed of distinct developmental modules (perianth, androecium, gynoecium), each serving specialized functions. While these modules must act in concert to ensure reproductive success, studies have shown that they can evolve relatively independently. Such modular independence may lead to differences in disparity and rates of trait evolution among floral modules, potentially facilitating adaptation to different functional pollinator groups. In this study, we assembled a dataset of 44 floral traits scored across 326 species within the Melastomataceae family. We use this dataset to investigate three key questions: (1) do floral modules differ in their morphological disparity and rates of evolution; (2) can differences in disparity and rates of module evolution be linked to distinct functional groups of pollinators; and (3) do these pollinator groups differentially influence the tempo and mode of floral evolution. We find (1) that floral modules differ in their disparity and rates of trait evolution and that (2) these differences depend on pollination syndromes. We also find (3) that flowers can evolve in a modular manner in response to shifts in selection regimes and that these modules differ not only in the extent of diversification but also in the timing of diversification across evolutionary history. Specifically, floral modules can evolve independently and in a correlated fashion, in different combinations depending on pollination syndromes and at different times in the evolutionary history of lineages. Our findings highlight how shifts in selective regimes, such as those driven by pollinator transitions, shifts in abiotic environment and biotic interactions, can promote the evolution of divergent floral phenotypes. Furthermore, we show that shifts in selection regimes can drive elevated rates of floral module evolution, occurring either in different combinations or independently. It is plausible that major bursts of floral diversification in angiosperms were similarly driven by shifts in selection regimes.



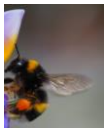
5TH SESSION

Pollinator-mediated floral evolution in the pollination-generalised plant *Viscaria vulgaris*

Aarushi Susheel*, Felipe Torres-Vanegas, Ciara Dwyer, Yedra Garcia, Sophie Hecht, Magne Friberg & Øystein H. Opedal

Department of Biology, Lund University, Sweden

Pollinator-mediated selection can lead to large variation in floral traits. This has been well researched in specialist systems, where one pollinator species interacts with a flowering species. In generalist systems, where one flowering plant interacts with several pollinator species, changes in the size and composition of the pollinator community can alter the patterns of selection acting on the plant. Through my PhD, I will study how a pollination-generalised flowering plant, Viscaria vulgaris, adapts to a functionally diverse pollinator community that varies both spatially and temporally. The study involves measurement of plant and pollinator phenotypes, pollinator visitation, pollinator effectiveness, and plant fitness. Combining these data with selection studies across multiple years in multiple populations, I aim to quantify the importance of functionally distinct pollinators in pollination and floral divergence. Initial data analysis has revealed functionally diverse pollinator assemblages within each plant population, along with evidence for phenotypic selection on floral traits. I plan to link these patterns by presenting findings from single-visit efficiency experiments and pollinator visitation rates to quantify the 'importance' of each pollinator in the local pollinator community of various populations. This would pave the way for constructing models that will assess the impact of functionally diverse pollinator assemblages on floral evolution.



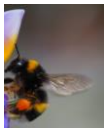
5TH SESSION

Flower power: How co-flowering species can shape floral evolution

Yedra García*[1], Giovanni Pascucci[2], Sofía Moreno de la Cuesta[1], Magne Friberg[1] & Øystein H. Opedal[1]

[1] Department of Biology, Lund University, Sweden; [2] Department of Life, Health and Environmental Sciences, University of L'Aquila, Italy

Co-flowering species within a community often interact through shared pollinators, which can influence individuals' reproductive success in varying ways depending on whether interactions are positive (pollinator-mediated facilitation) or negative (pollinator-mediated competition). Such indirect reproductive interactions may also alter the strength and direction of natural selection on floral traits, potentially leading to nonadditive patterns of selection. Yet, empirical studies addressing selection on floral traits in a context of multispecies communities remain rare. Here, we applied recent statistical models within the Hierarchical Modelling of Species Communities (HMSC) framework to estimate phenotypic selection on three co-flowering species and quantify potential indirect effects of community context. We focused on three co-flowering orchid species on the island of Öland (Sweden). These orchid species are primarily pollinated by bumblebees and usually occur intermixed in communities with varying species abundances. Over two consecutive years, we recorded pollination-related traits, floral abundance, and reproductive success of each orchid species across 77-85 one-meter radius patches differing in species composition. We also recorded the composition of the immediate co-flowering community of animal-pollinated species surrounding each orchid individual. By explicitly incorporating community context, our analyses accounted for potential pollinator-mediated reproductive interactions among species. Our findings suggest that co-flowering species can not only influence each other's reproductive success but also shape selective regimes, underscoring the importance of community-level dynamics in floral evolution. More broadly, our approach provides a flexible framework to integrate the complexity of multispecies communities into studies of phenotypic evolution.

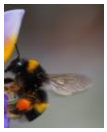


5TH SESSION

Getting hooked? Testing the function of anther spurs in *Vaccinium myrtillus*

Lisette van Kolfschoten* & Mario Vallejo-Marín
Department of Ecology and Genetics, Evolutionary Biology Centre, Uppsala University, Sweden

Flowers exhibit extraordinary diversity, much of it shaped by interactions with pollinators. In buzz-pollinated plants, bees use vibrations to extract pollen, and anther morphology can strongly influence pollen release. Many buzz-pollinated species bear poricidal anthers with spur-like projections, but their function remains unclear. We investigated the role of anther spurs in *Vaccinium myrtillus* (Ericaceae) using two complementary experiments: bumblebee (*Bombus terrestris*) foraging trials and standardized artificial vibrations mimicking bee buzzes. Bumblebees buzzed during 90% of visits, removing more pollen (60 ± 29%) during short visits (21.7 ± 24 s) than during non-buzzing, longer visits (23 ± 43%, 63.8 ± 70.5 s). Artificial 1 s buzzes released an average of 23% of pollen. Removing anther spurs increased pollen release in both bee and vibration experiments, suggesting that spurs may function as pollen-dispensing mechanisms. These findings highlight how floral microstructures shape pollen presentation strategies and invite further study on their role in interactions with diverse pollinators.



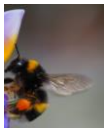
5TH SESSION

Negative frequency-dependent selection through pollen export, not seed set maintains equal morph ratios of mirror-image flowers

Sam McCarren*[1, 2], M. Saltini[3], J. Smit[2], N. Illing[1] & Bruce Anderson[2]

[1] Department of Molecular and Cell Biology, University of Cape Town, South Africa; [2] Department of Botany and Zoology, Stellenbosch University, South Africa; [3] Plant Science Group, Mathematical and Statistical Methods (Biometris), Wageningen University, The Netherlands

Floral diversity is often shaped by selection pressures that influence pollination success, yet the mechanisms maintaining rare floral forms like mirror-image flowers remain poorly understood. Species with mirror-image flowers have reproductive structures which are positioned in opposite orientations, pointing either to the left or to the right. This striking arrangement is thought to promote cross-pollination and reduce self-pollination, potentially enhancing reproductive success. A proposed mechanism maintaining equal ratios of left and right morphs within populations is negative frequency-dependent selection, where the rarer morph gains a reproductive advantage over the more abundant morph. However, empirical evidence for this process, particularly considering reproductive success through the lens of both seed production and pollen export remains limited. In this study, we tested whether reproductive success varies with relative morph frequency in the South African endemic Wachendorfia paniculata. We experimentally altered the ratios of left- and right-styled flowers and consequently assessed patterns of pollen transfer (male fitness) and seed production (female fitness) using quantum-dot pollen tracking. Our results show that reproductive success through seed set was not influenced by morph ratio. In contrast, reproductive success through pollen export increased as a morph became rarer, following a negative exponential relationship. These findings provide strong evidence that negative frequency-dependent selection in this species acts primarily through pollen export. This underscores the importance of considering all reproductive functions when investigating the evolutionary maintenance of floral form and diversity.



5TH SESSION

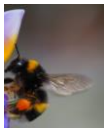
FLASH TALK

AI-powered classification model for German syrphid pollinators: a step towards rapid automated pollinator identification

Yuping Zhong*, Maximilian Sittinger, Valentin Stefan & Tiffany Knight

German Centre for Integrative Biodiversity Research, Germany;[2] Helmholtz Centre for Environmental Research, Germany

Traditional methods for collecting plant-pollinator interaction data are labor-intensive, time-consuming, and require taxonomic expertise. With recent advances in artificial intelligence (AI), computer vision models can now rapidly detect and identify pollinators from images. In this study, we developed and evaluated an AI-based classifier for the ecologically important but understudied pollinator group Syrphidae (hoverflies), comparing model outputs with human visual classification. Using image data retrieved from the GBIF database, we assembled a dataset covering 312 Syrphid species observed in Germany. From these, 76 taxa—including 7 higher-level groups, 30 genera, and 39 species—were selected for classification based on consistent visual characteristics. We trained a YOLO model, a real-time object detection algorithm built on convolutional neural networks (CNNs), to distinguish these taxa. The model achieved a high mean precision of 92.7% on unseen test images. Grad-CAM visualizations revealed specific image regions the model relied on for classification, suggesting that AI may detect subtle features overlooked by human observers. These differences highlight how machine learning can complement traditional taxonomy, particularly for morphologically variable groups like Syrphidae. Our findings demonstrate the feasibility of automated identification of fly pollinators in complex visual environments and support the integration of AI tools into ecological monitoring frameworks.

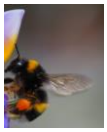


SENIOR PLENARY TALK

Solitary bees in a toxic world

Jordi Bosch
Centre for Ecological Research and Forestry Applications - CREAF, Spain

Pesticide exposure is considered one of the main drivers of bee declines. Our knowledge on the effects of pesticides on bees comes mostly from studies on the highly social western honey bee, *Apis mellifera*. However, the vast majority of bee species worldwide are solitary. Due to fundamental differences in life history traits, social and solitary bees experience different routes and levels of pesticide exposure. Social and solitary bees also differ in specific pesticide sensitivity and vulnerability at the population level. For these reasons, to better comprehend the effects of pesticide exposure on the full range of bee diversity, ecotoxicological studies on solitary bees are much needed. This presentation will provide an overview of the ecotoxicology program currently being developed at CREAF to improve our understanding of the impact of pesticide applications on solitary bees. In the last years, we have been using mason bees, *Osmia* spp., in a series of laboratory, semi-field and field experiments focussing on sublethal effects, exposure to combinations of pesticides and interactions between pesticides and other stressors, such as climate change and suboptimal diet. The implications of our findings for pesticide risk assessment and regulation will be discussed.

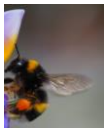


6TH SESSION

Mitigating pesticide effects on *Bombus terrestris*: Comparative benefits of clover fields and diverse flower strips

Carmen A. Nebauer* & Sara D. Leonhardt
Plant-Insect Interactions, Technical University of Munich, Germany

Floral resources have become increasingly scarce in many agricultural landscapes. Together with pesticide exposure, these are some of the driving factors of pollinator decline (besides habitat fragmentation, climate change, pathogens, etc.). There have been some efforts to increase floral diversity in agricultural landscapes by introducing flower strips at the field margins or using clover fields as a rotational feed crop. Moreover, in honeybees, specific pollen diets were found to mitigate negative pesticide effects. We therefore tested in a semi-field experiment whether the floral resources of a clover field (3 flowering species, 6 species total) or a flower strip seed mixture (KULAP, 41 flowering and total species) can support Bombus terrestris workers exposed to field-realistic concentrations of three systemic pesticides (Sivanto Prime – Bayer, Closer - Corteva and Amistar - Syngenta) to better mitigate the negative effects of these pesticides. The following results are preliminary but show some interesting trends: Bees foraging on KULAP flowers showed a higher overall brood success than bees foraging on clover, especially in the later development stage. However, Sivanto Prime and Amistar-treated bees had a higher larval count in the clover fields and a higher pupae count in the KULAP fields, while the control and Closer-treated colonies had more larvae and pupae in the KULAP fields. The overall survival rate of worker bees did not differ between the flower fields. However, Amistar-treated workers survived better in clover fields and control bees in the KULAP fields.

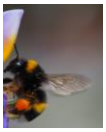


6TH SESSION

Fluoride exposure in pollinating insects near an aluminium smelter in Norway: a pilot study

Jørund Johansen* & Anders Nielsen
Department of Landscape and Biodiversity, Norwegian Institute of Bioeconomy Research, Norway

The effect of environmental fluoride pollution on insects, including pollinators, has received little scientific attention to date. Still, experimental studies on insects have shown reduced reproduction and development, increased mortality and impairments in learning and memory. However, these studies have focused on lab organisms like the domesticated silkworm and *Drosophila*, which respond differently than their wild relatives. Aluminium smelters contribute to fluoride pollution mainly by emitting hydrogen fluoride (HF) gas, which enters nearby plants through their stomata. Even though HF tends to accumulate in leaf tips, it is reasonable to assume that pollinators, through their intimate relationship with flowers, are exposed when consuming pollen and nectar. Earlier field studies have found very high fluoride levels in bumblebees and honeybees near smelters. In honeybees, this was not linked to changes in reproduction, mortality or honey production, but the authors did not distinguish between fluoride absorbed into tissues versus fluoride on body surfaces or passing through the digestive tract. This is relevant, since both fluoride absorption and tolerance can vary widely between insect groups and even between closely related species. Despite these studies, our understanding of the effect of fluoride on pollinators remains limited. This is especially relevant in Norway, the largest aluminium producer in Europe, with seven aluminium smelters across the country. Previous work in Norway has established a significant negative effect of fluoride on nearby vegetation and in deer grazing close to these smelters. Building on this, I present preliminary findings on fluoride levels in insects and flowers collected near a smelter in Årdal (Norway), and discuss why pollinators might be more exposed than other insect groups.



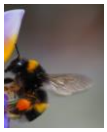
6TH SESSION

Site-specific weed management can boost food resources for pollinators

Anke Dietzsch*[1], Mona Schatke[2], Christoph von Redwitz[2] & Lena Ulber[2]

[1] Julius Kühn Institute, Federal Research Centre for Cultivated Plants, Institute for Bee Protection, Germany; [2] Julius Kühn Institute, Federal Research Centre for Cultivated Plants, for Plant Protection in Field Crops and Grassland, Germany

Diverse weed communities can play a key role in providing resources for pollinators and other beneficial insects in often-impoverished agricultural landscapes. One new approach to enhance weed diversity in conventional agriculture is site-specific weed management (SSWM). SSWM uses fine-scaled, in-field weed distribution maps to differentiate between weed species and infestation areas that pose high risks of yield losses (high disservice potential) and areas that potentially provide ecosystem services (high service potential). Herbicide applications are then constricted to high disservice potential areas only. However, such species-specific treatment decisions rely on knowledge about (functional) weed traits (e.g., flowering time, nectar production, pollinator assemblages). To test and improve the categorization of (dis)service potential, we investigated weed diversity, functional traits, and pollinator assemblages at two sites grown with winter wheat in the south of Braunschweig, Germany. By means of spatial distribution maps for each weed species and their functional traits from the literature, we monitored ten 1-m² plots per site along a disservice potential x service potential gradient between April and July 2025. In each plot, we recorded floral phenology, abundance and individual flower visitors of all weed species for 15 min every two weeks. In addition, two transect walks were conducted per site per sampling date and flower visitors collected, and three pan trap sets were placed per site thrice during the season. Body-bound pollen of individually caught flower visitors were prepared, and insects were pinned before identification. Pollinator abundance varied significantly between weeks and weed species. Bumblebees showed a preference for one of the weed species (*Papaver rhoeas* L.) and were recorded otherwise at very low counts. Honeybees were absent during the majority of observation sessions. We will use these field results (pollinator diversity, abundance, flower constancy) to test whether the measured species-specific weed traits may be used as indicators for (dis)service potential in the application of SSWM. Furthermore, we will investigate whether SSWM contributes to the preservation of ecosystem services without negatively affecting wheat yield.



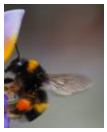
6TH SESSION

Honey bee competition reduces bumble bee reproduction in field cage experiment

Maureen L. Page*[1, 2], David Sossa[1], Leah Valdes[1], Emily Wahlenmayer[1], Tallisker Weiss[1] & Scott H. McArt[1]

[1] Department of Entomology, Cornell University, USA; [2] Chair of Nature Conservation and Landscape Ecology, University of Freiburg, Germany

Managed honey bees (*Apis mellifera*) are known to compete with bumble bees and other pollinators for floral resources, but less is known about when, where, and how honey bee competition impacts bumble bee fitness. Using experimental hive additions in a field-realistic cage study, we show that honey bee introductions competitively reduce nectar and pollen availability across multiple plant species, leading to changes in bumble bee foraging activity and reduced bumble bee fitness. In cages with honey bees, bumble bees visited more *Lobelia siphilitica* flowers, displayed increased rates of nectar robbing, and collected less pollen. From an applied conservation management perspective, it is important to note that honey bee competition dramatically lowered bumble bee reproduction across all three rounds of our experiment, even though pollen and nectar resources were never fully depleted. As such, negative impacts of resource competition can occur before resources are fully exhausted, and this should be taken into consideration when setting sustainable honey bee pasturing guidelines in natural areas.



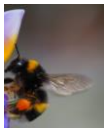
6TH SESSION

Bees and multiple stressors: The impact of a pyrethroid insecticide and nutrition on the red mason bee (*Osmia bicornis*)

Megan Reilly*[1], Alison O Reilly[2] & Dara Stanley[1]

[1] School of Agriculture and Food Science, University College Dublin, Ireland; [2] Centre for Environmental and Climate Science, Lund University, Sweden

Bees exist in complex environments where they encounter multiple stressors regularly. Previous research investigating the effects of these stressors have mostly focused on social species and single stressors (e.g. neonicotinoid insecticides and honeybees). Most bee species are solitary with drastically different life histories to social species, which may affect their sensitivity to pesticides and other stressors. Pyrethroid insecticides are commonly used in Ireland and have different modes of action to neonicotinoids which may differ in their effects on bees. Therefore, it is necessary to broaden both the species studied and the types of insecticides studied to gain a more accurate picture of real-world risk. This project investigated the effects of nutritional stress and a pyrethroid insecticide on the foraging behaviours of *Osmia bicornis*. Using a semi-field environment, bees were exposed to a pyrethroid insecticide through treated plants and varying nutritional treatments through adjusting floral resource diversity. This research addresses knowledge gaps around the effects of multiple stressors on solitary bees, and how nutrition may interact with the effects of insecticides on these species.

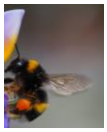


6TH SESSION

Microplastics effects on wild bee larvae

Kenneth Kuba*, Raquel Morell Kessler, Kim König & Sara D. Leonhardt
Chair of Plant-Insect-Interactions, Technical University Munich, Germany

Microplastics, polymer particles with sizes smaller than 5mm (especially size ranges of 100-1µm), have recently been shown to have negative effects on bees. Microplastic particles can disrupt the gut, impair cognitive functions and increase mortality. However, studies testing effects of microplastics, especially of compound mixtures, on bee larvae are still lacking. In our study, we tested two common model wild bee species (*Bombus terrestris*, *Osmia bicornis*) larvae which were exposed to the same pollen mixed with two doses of a microplastic mixture. *B. terrestris* adults and larvae were observed over 4 weeks, and *O. bicornis* larval development and emergence was monitored until pupation and during emergence. Surprisingly, no effects were visible on adult mortality in *B. terrestris*, but the lower concentration resulted in a lower pollen consumption rate. However, pupae numbers were reduced especially by the low concentration. In *O. bicornis*, the development time was altered by both treatments (low conc. increased, high conc. decreased) and body weight after emergence was also increased in the low concentration. Overall, microplastics had an obvious negative effect on larvae, though the effects differed depending on the tested species and concentration of micro plastics. While our results in *B. terrestris* generally support previous results testing one specific microplastic, the effects observed in our study were less severe, indicating that mixtures of microplastic can lead to different responses.



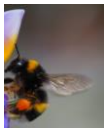
7TH SESSION

Pollinator interaction with flower strips varies across different bioclimatic zones

Magda Karlo*[1], Erik Trond Aschehough[2], Line Johansen[1], Annette Bär[1], Marie Vestergaard Henriksen[1]

[1] Department of Landscape and Biodiversity, Norwegian Institute of Bioeconomy Research, Norway; [2] Ecology and Natural Resource Management Section, Norwegian University of Life Sciences, Norway

Agricultural intensification and human-induced habitat loss have led to a global decline in wild pollinator communities and the pollination services they provide. To address the issue of pollinator decline, flower strips are proposed as an agri-environmental scheme (AES) designed to support pollinators in agricultural landscapes. The problem with most commercial seed mixtures used in the flower strips is that they are produced in temperate climates due to the high demand from AES programs. To use flower strips as a conservation method, the flowers in the mixtures must be adapted to both the climate and the pollinators they aim to support. We compared the effectiveness of a commercial annual flower mixture sown at three locations in different Norwegian bioclimatic zones. We recorded the abundance of flowers and pollinator visits (bumblebees, hoverflies and flies) over a three-year period, along with the corresponding weather conditions. We observed that the mixture performed differently across years and sites. Bootstrap confidence intervals (92% and 97%) for the interaction of average daily temperature and plant species abundance showed significant effects for *Phacelia tanacetifolia* (CI: 0.17–0.49), *Trifolium alexandrinum* (CI: 0.47–0.84), and *Trifolium resupinatum* (CI: 181 0.46–0.79), indicating that a 1°C increase in temperature increases abundance by factors of 1.39, 182 1.92, and 1.87, respectively, compared to the *Fagopyrum esculentum*. Interactions for *Linum usitatissimum* (CI: -0.30–0.06) and *Trifolium incarnatum* (CI: -0.005–0.31) were not significant. These results suggest temperature differentially affects species abundance, with stronger positive effects for *Trifolium* species and *Phacelia*. Pollinator groups have been shown to have different flower preferences across locations, and their visitation rates was affected by temperature. Hoverflies and bumblebees seemed to increase their visits with the temperature increase, while flies showed the opposite pattern.



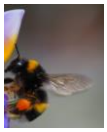
7TH SESSION

The effects of different management types on plant–pollinator interactions in Transylvanian semi-natural grasslands

Natalia Timuş*[1], Iulia Muntean[1], Zoltán László[1], Jonna Heuschele[2, 3], Cristina Craioveanu[1], Andreea-Maria Oros[1] & Carla-Andrada Kovacs[1]

[1] Department of Taxonomy and Ecology, Babeș-Bolyai University, Romania; [2] Department of Species Interaction Ecology, UFZ-Helmholtz Centre for Environmental Research, Germany; [3] iDiv - German Centre for Integrative Biodiversity Research Halle-Jena-Leipzig, Germany

Semi-natural grasslands harbour highly biodiverse habitats, created and maintained through extensive farming practices. Consequently, plant and pollinator communities, as well as the structure of plant-pollinator interactions, are very susceptible to alterations in the land use management. Evaluating the effects of grassland management types on plant and pollinator populations is essential for developing effective conservation strategies and implementing sustainable agricultural practices to support biodiversity, food security, and ecosystem health. In Transylvanian semi-natural grasslands, intensive grazing or long-term cessation of traditional management practices have major impacts on several aspects of plant and butterfly diversity. However, other taxonomic groups, such as other pollinators, have received less attention. We examined the impact of low-intensity grassland management on plant and pollinator diversity, composition, and the structure of plant-pollinator interactions. The assessment was conducted in 2024 and 2025 across various land management types, including hay meadows mown annually, recently abandoned, and moderately sheep-grazed grasslands in the Eastern Hills of Cluj (Romania), part of the Natura 2000 network. We recorded the identity and abundance of flowering plants and conducted transect walks to observe pollinator interactions. Preliminary findings indicate higher pollinator diversity in hay meadows compared to abandoned or moderately grazed grasslands. Plant diversity did not show substantial variation across management types, while plant abundance and species composition were notably affected by the type of management. Network analysis revealed a shift in the plant-pollinator systems from 2024 to 2025, where the hay meadows experienced the most dramatic structural change, becoming less stable and less organised in 2025 compared to the more stable communities in abandoned and grazed sites. These results highlight the necessity of integrating long-term functional stability of plant-pollinator networks into sustainable grassland management practices.



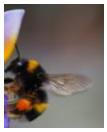
7TH SESSION

The effects of nitrogen deposition on the vegetation and the pollinator community in calcareous grasslands

Willem Proesmans*[1, 2], Adam Vanbergen[2] & Denis Michez[1]

[1] Laboratory of Zoology, Research Institute for Biosciences, University of Mons, Belgium; [2] Université de Bourgogne Europe, Institut Agro Dijon, INRAE, UMR Agroécologie, France

Anthropogenic nitrogen deposition from traffic, agriculture and industry disturbs the nitrogen cycle and has a thorough effect on terrestrial biodiversity through acidification and eutrophication. While several studies have assessed the effect of excess nitrogen availability on the vegetation, research on the pollinator community is very limited. Calcareous grasslands are hotspots for plant and insect biodiversity, but they are often fragmented and susceptible to anthropogenic disturbances. While calcareous soils are well-buffered, the effects of nitrogen eutrophication are still expected to cause a shift from forbs towards grasses, a decrease in floral resources and hence a decline in pollinator abundance and diversity. We studied plant-pollinator networks in 105 calcareous grasslands in seven European regions and used mosses as bio-indicators for nitrogen deposition. We looked at floral resource availability and species richness and abundance of wild bees, hoverflies and butterflies. Against our expectations, we found that nitrogen deposition led to a slight increase in nectar availability. This was mainly driven by an increased share of Caprifoliaceae and Boraginaceae, mainly represented by Knautia arvensis and Echium vulgare respectively, both species that produce high amounts of nectar. Nectar availability was in turn associated with a strong increase in pollinator abundance in all groups, except for butterflies. Nitrogen deposition mainly acted on the vegetation and had little noticeable effect on the pollinator community, although sites with higher nitrogen deposition were associated with a lower share of oligolectic bees. We conclude that the effects of nitrogen deposition on pollinators in calcareous grasslands are limited, as these habitats are less susceptible to the adverse effects of acidification. Future research on ecosystems with poorly buffered soils is necessary.



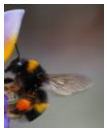
7TH SESSION

Climate warming restructures subalpine plant community composition with consequences for bumble bee populations

Jeremy Hemberger[1], Nick Rosenberger[*2], Jane Ogilvie[4] & Paul CaraDonna[3]

[1] Department of Entomology, University of Minnesota, USA; [2] Chair of Nature Conservation and Landscape Ecology, University of Freiburg., Germany; [3] Chicago Botanic Garden, USA; [4] Rocky Mountain Biological Laboratory, USA

The composition of ecological communities is shifting rapidly in response to climate change and this reshuffling is hypothesized to disrupt interspecific interactions. However, we do not know how such changes influence the stability of the populations involved over time. We used a long-term dataset of subalpine bumble bees and their food plants in the Rocky Mountains of Colorado to identify the mechanisms driving community reshuffling. We found that warming summers are rapidly shifting the composition of bumble bee food plant communities toward warm-adapted plant species (i.e., warmer diet composition). Such changes underlie shifts in bumble bee community composition, and our results suggest that shifting plant communities are impacting bumble bee species population stability over time. Our results identify the potential mechanisms driving insect community change in this system and will ultimately help us to predict future community composition and identify which species can and cannot persist into the future given continued climate change.



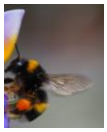
7TH SESSION

Is flower colour variation adaptive?

Yuval Sapir*[1], Tzlil Labin[1, 2], Esther Senden[1, 3], Merav Lebel Vin[1] & Yamit Bar-Lev[1]

[1] Yehuda Naftali Botanic Garden, School of Plant Sciences and Food Security, Tel Aviv University, Israel; [2] Haifa University, Israel; [3] University of Amsterdam, the Netherlands

The evolution of flower colour and its variation is argued to be driven by pollinators. While most flowering species are colour uniform, a minority exhibit within-population colour variation. A few mechanisms have been proposed to drive within population flower colour variation, including heterozygote advantage, frequency-dependent selection, and balancing selection. The dominant hypothesis of balancing selection assumes that flower colour is an adaptive trait, but a few evidences suggest that flower colour variation can be neutral. We argue that types of colour variation are driven by different mechanisms. Uniform within population flower colour can be the outcome of directional selection. Dimorphism or polymorphism of discrete flower colours are hypothesized to be the result of balancing selection, driven by multiple selection agents. For example, differential pollinator behavior balances fitness of two colour morphs in *Linum pubescens*. Species with spatial pattern of variation suggest a more complex selection regime. For example, populations of Anemone coronaria in the arid climate region are red-monomorphic, while in the Mediterranean climate colour polymorphism is maintained through admixture due to partial partitioning of pollinators. The wide range of continuous flower colour variation in Iris petrana results from differential expression levels of a few genes in the anthocyanin biosynthesis pathway, with no selection on flower colour, likely because lack of discrimination by pollinators. These pieces of evidence suggest that flower colour variation is largely associated with either of three selection regimes: monomorphic populations are under directional selection, populations with discrete colour polymorphism are under balancing selection, and continuous colour variation is the hallmark of neutral or no selection on flower colour. Studying the rare cases of continuous flower colour variation can shed light on the evolution of flower colours and its role in communicating with pollinators.



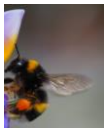
7TH SESSION

The role of secondary pollinators in the evolution of complex colour signals in a bimodal pollination system

Katharine L. Khoury[1], Jon Ågren[2], Craig I. Peter[1], Nina Sletvold[*2] & Ethan L. Newman[1]

[1] Department of Botany, Rhodes University, South Africa; [2] Plant Ecology and Evolution, Department of Ecology and Genetics, Evolutionary Biology Center, Uppsala University, Sweden

Flower colour is recognized as a key trait influencing pollinator visitation and behaviour, evolved to match the sensory system of a particular pollinator group. However, some flowers combine colours associated with different pollinators, suggesting bimodal adaptation. The perennial herb *Cyrtanthus obliquus* produces red corollas with yellow tips and is pollinated by birds, but also by bees. To assess the role of the two pollinator categories in shaping selection on the bi-coloured corollas, we examined bee choices in arrays in which the colour signals of plants had been manipulated, and we quantified total as well as bird-mediated phenotypic selection on flower colour using both bird and bee visual models. Bees preferred flowers with a yellow signal over all-red flowers. The analysis of phenotypic selection indicated that both birds and bees influence net selection on flower colour, resulting in conflicting selection on the colour contrast between corolla and corolla tip. Our findings show that the optimal phenotype should depend on the relative importance of the two categories of pollinators in a given population, and are consistent with bimodal adaptation.



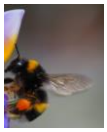
7TH SESSION

Colour and chemistry: how flowers signal reward-quality to pollinators

Larissa De Paola*, Casper J. van der Kooi & Kira J. Tiedge

[1] Groningen Institute for Evolutionary Life Sciences, University of Groningen, The Netherlands

The majority of flowering plants depends on animal pollinators for their reproduction and many animal pollinators rely on floral rewards (pollen and nectar) for their daily nourishment. Angiosperms attract pollinators through flowers that display different colours (visual signals) and complex floral fragrances (olfactory cues). In my PhD project we aim to characterize how floral signals and rewards evolve in a pollinator shift and how signals provide pollinators with reliable information about the quantity and quality of the reward offered. To answer this question we investigate at a broad taxonomic scale how floral signals and rewards evolve to match different pollinator sensory systems and nutritional requirements in plant sister-species that underwent independent pollination transitions. We analyse the optical properties of floral displays and through different visual models we evaluate how colours are perceived by pollinators. Floral scents and nutritional profile of nectar and pollen will be characterized and matched with the existing literature on pollinator physiology and ecology. Finally, we will assemble our results to understand which aspects of visual and olfactory signals are more informative about the rewards, if signals are correlated and if a common pattern of floral trait evolution is shared in unrelated angiosperm lineages. I will present our data on the optical properties of Solanaceae (*Nicotiana* and *Petunia*), the volatile profiles of different species and the hypotheses framework.

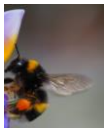


7TH SESSION

Covert communication? On the visual ecology of Mediterranean red flowers

Casper J. van der Kooi
University of Groningen, The Netherlands

Red flowers are exceedingly rare across most of the European flora, though in the Mediterranean basin red flowers have evolved repeatedly in unrelated plant groups. Examples of these so-called “poppy guild” flowers can be found in *Papaver*, *Anemone*, *Tulipa* and *Ranunculus.* These poppy guild flowers in Europe are linked to pollination by glaphyrid beetles. Poppy guild flowers and Glaphyridae present an emerging model system for studies on specialisation/generalisation in pollination, insect visual ecology and evolutionary tuning of floral signals to pollinator sensory systems. In this talk, I present our ongoing studies on the visual ecology of red flowers in the Mediterranean basin. Optical studies have shown that red flower colours are created through a fascinating combination of extreme amounts of anthocyanin pigment and strongly scattering floral interior structures. Behavioural and electrophysiological experiments reveal how glaphyrid beetles can see and respond to red colours. Field-based experiments with glaphyrids and bees indicate that beetles are more effective pollinators than bees. Together, these results explain observed patterns of local adaptation to beetles and sensory exclusion of bees, yet many intriguing questions remain.

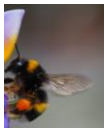


JUNIOR PLENARY TALK

Scaling up from individuals to complex plant–pollinator networks

Blanca Arroyo-Correa
Leibniz-IGB, Germany; Estación Biológica de Doñana-CSIC, Spain

Understanding how ecological patterns emerge across scales remains one of the central challenges in ecology. Mutualistic networks, such as those involving plants and their pollinators, exhibit relatively consistent structures at large scales, yet they are built from locally context-dependent interactions among individuals that collectively shape communities. Drawing on recent advances in empirical data collection, mathematical modeling, and data–theory integration, I highlight how fine-scale processes at the individual level, such as those related to individual niches, traits, and behaviors, cascade upward to shape the structure and dynamics of complex plant–pollinator networks within communities. Bridging the gap between individuals and communities requires fostering dialogue across levels of organization and integrating niche and network theories into a more unified framework. I discuss how advancing this perspective calls for both methodological and conceptual shifts. This approach moves us toward a more mechanistic and predictive understanding of plant–pollinator systems and their responses to global change, thereby enhancing our ability to design effective conservation strategies.



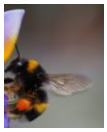
8TH SESSION

Flower-bee interactions along land use and climatic gradients: a large-scale study for Central Europe

Manuel Ankel*[1], Sabine Schoder[2], Thomas Rupp[1], Johannes Pfrommer[2], Corinna Etl[1], Bärbel Pachinger[2] & Stefan Dötterl[1]

[1] Department of Environment & Biodiversity, Paris-Lodron University Salzburg, Austria; [2] Institute of Integrative Nature Conservation Research, University of Natural Resources and Life Sciences Vienna, Austria

Bees play a crucial role both for agricultural and natural ecosystems, enhancing the fruit and seed set in wildflowers and economically important crops. Since most bee species depend on floral rewards such as nectar and pollen for their own food supply and larval provision, landscapes must provide sufficient floral resources that match the preferences of the different bee species. In Europe, however, a large portion of the land cover has been transformed into cultural landscapes in which the type and intensity of land use varies between climatic regions. In Austria, for example, the country that hosts the highest number of bee species in Central Europe (ca 700 spp.), the Pannonian lowlands and hills are dominated by intensively managed arable land, whereas the inner alpine region is mainly used for (extensive) grazing. Although floral preferences and habitat requirements of the European bee species are well known, flower-bee interactions along climatic and land-use gradients are still poorly understood. This information is essential for predicting the resilience of plant-pollinator interactions in a changing environment. To investigate how flower-bee interactions are changing across Austria, we sampled over 200 sites, which included cultural landscapes and national parks, using a standardized transect approach. We analyse how interactions between flowers and bees change in relation to land use type / intensity, conservation status (cultural landscapes versus national parks) and across the prominent climatic gradients (longitude, altitude, ecoregion). Our results will provide valuable implications for agricultural management and conservation measures.



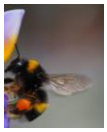
8TH SESSION

From South to North: Plant–pollinator networks across 1100 km of Arctic Kalaallit Nunaat Greenland

Brandon Samuel Whitley*[1], Jakob Abermann[2], Inger Greve Alsos[3], Elisabeth M. Biersma[1], Viktor Gårdman[4, 5], Toke Thomas Høye[6], Laura Jones[7], Nora Meriem Khelidj[8], Zhao Li[1], Gianalberto Losapio[9], Thomas Pape[1], Katrine Raundrup[4], Paula Schmitz[4], Tiago Silva[2], Jordan Twombly Ellis[10], Helena Wirta[10], Natalie Iwanycki Ahlstrand[1], Tomas Roslin[5] & Natasha de Vere[1]

[1] Natural History Museum of Denmark, University of Copenhagen, Denmark; [2] Dept. of Geography and Regional Science, University of Graz, & Austrian Polar Research Institute, Austria; [3] The Arctic University Museum of Norway, The Arctic University of Norway, Norway; [4] Greenland Institute of Natural Resources, Greenland; [5] Dept. of Ecology, Swedish University of Agricultural Sciences, Sweden; [6] Dept. of Ecoscience & Arctic Research Centre, Aarhus University, Denmark; [7] National Botanic Garden of Wales, UK; [8] Institute of Earth Surface Dynamics, University of Lausanne, Switzerland; [9] Dept. of Biosciences, University of Milan, Italy; [10] Dept. of Ecology and Environmental Science, Umeå University, Sweden

The Arctic is on the front line of the climate change crisis. Changes to local climate and increased variability in growing season length have already driven species turnover, changes to flowering phenology, and altered species interactions. Given the extremity of Arctic environments, the short flowering season, limited pollen availability, and the impacts of a changing climate, understanding the structure of plant-pollinator communities is essential for anticipating their responses to disturbance. Kalaallit Nunaat Greenland (KNG) allows to study plant-pollinator interaction networks, as it contains all Arctic bioclimate zones and offers a natural gradient along which to sample communities. We sampled interaction networks across sites in Southwestern KNG, using DNA metabarcoding of pollen carried on individual pollinators. The fine-scale, individual-level data allows to answer fundamental questions about both the structure of visitation networks across an ~1100 km latitudinal gradient, and about the degree of hidden individual-level specialisation. We present initial findings on the structure of Arctic plant-pollinator networks. We expect a lower pollinator diversity, but each species will visit more plants (rewiring through increased link number), with increasing latitude. At the individual level, we expect that pollinators will act as generalist at the species level while specialising as individuals. Studying the properties of these Arctic plant-pollinator interaction networks will reveal how vulnerable they are to the disturbances associated with a rapidly changing Arctic climate.



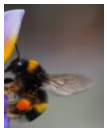
8TH SESSION

Coupling diet and pollen metabarcoding with field surveys to reveal plant-pollinator interactions

Christian Gostout[1, 2], Luis J. Chueca[*1], Jon Poza, Xabier Salgado-Irazabal[1], Estefanía Tobajas[1], Jennifer Rose[1, 2], Maddi Artamendi[1, 2], Brais Hermosilla[1], Marion Donald[3], Manpreet Dhami[3], Ainhoa Magrach[1, 4]

[1] BC3 Basque Centre for Climate Change, Spain; [2] Universidad del País Vasco, Spain; [3] Manaaki Whenua Landcare Research, New Zealand; [4] IKERBASQUE, Basque Foundation for Science, Spain

Pollination's benefits for the plant community, entire ecosystems, and society have been clearly outlined, but plant-pollinator interactions also have critical implications for the pollinators, including both nutrition and a microbial exchange that supports both plant and pollinator health. With the growing pressure on global pollinators, there is clear demand for expanding research on the biodiversity necessary to support pollinators. Studying interaction networks from the pollinator perspective highlights pollinators' needs. While the inclusion of the pollinator perspective and the use of molecular tools in characterizing interaction networks have already advanced our understanding of this topic, most recent research has focused on the study of external pollen loads on bees. There is an important discrepancy between the implications of the interactions resulting in pollen carried externally by pollinators and the plant material they actually consume. Pollinator intestinal tracts ("guts") allow for observation of interactions resulting in consumption of plant material. We examine how metabarcoding of pollinator gut contents complements and challenges the characterization of plant-pollinator interaction networks described by more common methodologies, including field surveys of plant pollinator interactions and external pollen load metabarcoding. We compare interaction networks for a single model pollinator, Bombus pascuorum, constructed from each of these methodologies to evaluate whether a combined methodological approach provides further insights into plant-pollinator interaction networks. We reveal a complementary dynamic between interaction methodologies. Gut content metabarcoding shows high sampling efficiency and reveals a diverse interaction network. Interactions across functional groups detected in gut contents also reveal potential seasonal forage dynamics. We also explore metabarcoding's capacity to provide insights at the individual level. Our research indicates directions for future interaction network studies, employing gut content sampling within combined methodological approaches.



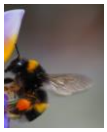
8TH SESSION

Spatiotemporal dynamics and multi-scale drivers of plant–pollinator networks along an urbanization gradient

Huan Liang[1, 2], Yong-Deng He[1, 3], Feng Su[1, 3], Xiao-Hua Ni[1, 3], Chen Zhou[4], Qiang Yang[2], Hui Wang[4], Tiffany Knight[2, 5 ,6, 7], Panagiotis Theodorou[2, 6] & Chun-Feng Yang[1]

[1] State Key Laboratory of Plant Diversity and Specialty Crops, Wuhan Botanical Garden, Chinese Academy of Sciences, China; [2] German Centre for Integrative Biodiversity Research, Germany; [3] University of Chinese Academy of Sciences, China; [4] College of Horticulture & Forestry Sciences/Hubei Engineering Technology Research Center for Forestry Information, Huazhong Agricultural University, China; [5] Department of Community Ecology, Helmholtz Centre for Environmental Research, Germany; [6] General Zoology, Institute of Biology, Martin Luther-University Halle-Wittenberg, Germany; [7] Department of Science and Conservation, National Tropical Botanical Garden, USA

Urbanization is a major anthropogenic driver of global biodiversity change, and understanding how urban biodiversity is assembled and maintained is essential for effective management and long-term conservation. Yet, the ways in which urbanization shapes the spatiotemporal dynamics of plant–pollinator networks, and the relative contributions of local versus landscape factors, remain unclear. In this study, we quantified environmental, spatial, and temporal turnover of plant–pollinator interactions (interaction β-diversity) along an urbanization gradient in the megacity of Wuhan (China), and evaluated the relative importance of 14 local and landscape variables in shaping interaction diversity and dissimilarity. Our analyses revealed that seasonality and environmental filtering were more important than spatial distance in explaining variation in interaction β-diversity. Moreover, urbanization amplified seasonal dynamics, with stronger temporal turnover in urban than rural sites, largely driven by the replacement of non-native plant species. Although the magnitude of responses varied among Diptera, Hymenoptera, and Lepidoptera, the overall pattern was consistent: urbanization and landscape heterogeneity reduced interaction diversity by lowering plant and pollinator richness, whereas local management and temperature enhanced floral resources that indirectly supported interaction diversity. Together, these findings demonstrate that urbanization reshapes the spatiotemporal dynamics of plant–pollinator networks, and they provide a mechanistic basis for urban planning and conservation strategies aimed at sustaining pollinator communities and their interactions in increasingly urbanized landscapes.



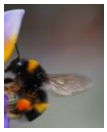
8TH SESSION

Addressing the "nocturnal problem": The role of non-sphingid moths and nocturnal bees in tropical pollination networks and how they respond to disturbance

Ugo Mendes Diniz*[1], Sabine Viteri Lalama[1], Kilian Frühholz[1], Julia Windl[1], Maximilian Pitz[1], Claus Rasmussen[2], Alexander Keller[3], Gunnar Brehm[4] & Sara D. Leonhardt[1]

[1] School of Life Sciences, Technical University of Munich, Germany; [2] Department of Agroecology, Aarhus University, Denmark; [3] Faculty of Biology, Ludwig-Maximilians-Universität München, Germany; [4] Phyletisches Museum, Friedrich-Schiller-Universität Jena, Germany

There is a significant bias towards diurnal taxa in ecological research that warps our understanding of broad ecological patterns, constituting the so-called "nocturnal problem". In pollination ecology, there is a notable knowledge gap regarding nocturnal floral visitors, their role in pollination networks, and their vulnerability to disturbance. While some flagship groups, such as bats and hawkmoths, are fairly well-researched, the interaction ecology of, e.g., non-sphingid moths and nocturnal bees is largely unknown. In the lowland rainforests of NW Ecuador, we sampled nearly 25000 individuals from 504 species of pollinators, including tiger moths (304 species), diurnal eusocial and solitary bees (147), hawkmoths (41), nocturnal bees (*Megalopta*) (4), and anthophilous bats (8) within a recovery chronosequence. We aimed to build a comprehensive pollination network via pollen DNA-metabarcoding to disentangle the role of neglected nocturnal pollinators in network structure and their recovery trajectories along forest recovery. We found that, due to their incredible diversity and frequent pollen carryover, settling moths were the most common pollinators in the network, being more generalized and more central than any other taxonomic group. Furthermore, they were the most frequent connectors between network modules, ensuring network cohesiveness by visiting plants from different pollination systems. Although rarer, nocturnal bees were also highly central and generalized. Moreover, our molecular assessment provides the first robust evidence of a broad diet breadth in the group. However, both moths and nocturnal bees were sensitive to disturbance, as their diversity and abundance were higher in late secondary or old-growth forests, particularly in canopies, than in early succession forests. In fact, nocturnal bees may take more than four decades to fully recover after disturbance. Our results highlight the role of nocturnal floral visitors in pollination network structure and connectivity, calling for more research effort to overcome the diurnal bias in pollination ecology.

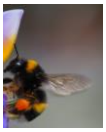


8TH SESSION

Individuals matter: habitat factors and plant traits shape individual-level pollinator interactions in a semi-arid landscape

Diana Michael*, Kunjan Joshi & Shivani Krishna
Department of Biology, Trivedi School of Biosciences, Ashoka University, India

Plant-pollinator networks are vital for understanding ecological processes influencing reproductive success in plant communities. While species-level pollinator interaction networks are important for predicting community stability, it remains equally crucial to understand individual-level interactions of keystone species in the community. This study examined the role of habitat factors and floral traits in shaping individual-level pollinator interactions of *Maytenus senegalensis*, a dominant native species in the semi-arid Aravalli Hills (NW India). We measured flower production, nectar sugar concentration, flower diameter, and external factors such as percentage soil moisture, distance to habitat edge, and density of co-flowering conspecifics to assess their impact on pollinator interactions and reproductive success. We found significant variation in reproductive investment in the form of flower production and a trade-off with reward quality, where plants with higher flower production were found to have a lower nectar sugar concentration. Higher flower production negatively influenced reproductive success, suggesting the likelihood of increased within-plant visitation. *Eristalinus* and *Apis* were the dominant pollinator genera, and overall, dipterans were found to play a critical role in maintaining the network stability. The presence of flowering conspecific plants in the neighborhood reduced the pollen deposition, suggesting competitive interactions. Moreover, individual plants were found to show some amount of specialization in their interaction niches. We predict that this could lead to further divergence of interaction niches due to pollinator-mediated competition. Any perturbation to interactions of plants with a high degree of pollinator connectance was found to disproportionately influence the network. Overall findings suggest that the individual variation in reproductive investment and trade-off with reward quality had an impact on the plant-pollinator interactions and reproductive success. In semi-arid systems, which are undergoing considerable anthropogenic and climatic changes, our study provides insights into individual pollinator interaction niches and the role of microhabitat factors in species persistence within a community.



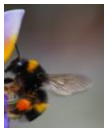
8TH SESSION

Drivers of pollen deposition on Succisa pratensis in a dynamic plant-pollinator network

Petr Švanda[1], Martin Freudenfeld[1], Eva Matoušková[1], Jiří Hadrava2, Michael Mikát[2], Tadeáš Ryšan[2], Helena Pijálková[2], Eva Hořčičková[3], Zdeněk Janovský[4] & Jakub Štenc[*1, 2, 5]

[1] Department of Botany, Charles University, Czech Republic; [2] Department of Zoology, Charles University, Czech Republic; [3] Department of Environment, Jan Evangelista Purkyně University in Ústí nad Labem, Czech Republic; [4] Svatý Jan t. Krsovice Czech Republic; [5] CREAF, Spain

Plant reproductive success is intrinsically linked to the composition of its surrounding community, particularly through interactions mediated by shared pollinators. Heterospecific pollen deposition can impose significant fitness costs, yet the primary drivers of its variation are often complex. This study aimed to disentangle the factors influencing pollen deposition on the stigmas of *Succisa pratensis*, a key species in our study system ecosystems. We hypothesized that pollen loads would be primarily shaped by the local plant community structure and pollinator sharing among plant species. Over 3 years, we collected stigmas from *S. pratensis* and quantified conspecific and heterospecific pollen loads. Concurrently, we monitored the abundance of co-flowering plant species and recorded pollinator visitation within the network. With still ongoing analysis, our preliminary results suggest that the strongest predictor of pollen composition on *S. pratensis* stigmas is the shifting abundance of surrounding plant species, which drives the pattern of pollinator sharing among plants. We also identified significant variation in deposition patterns among years, mirroring annual changes in the broader plant community structure. Surprisingly, variation among different sampling days within a single year was consistently low. This suggests that once the community and its associated pollinator foraging patterns are established for a season, the daily pollination environment for an individual plant remains relatively stable. In conclusion, our findings reveal that for *S. pratensis*, the broader community context and its annual fluctuations are more influential in determining stigmatic pollen receipt than short-term temporal changes. This underscores the critical importance of network-level interactions and neighbor identity in shaping plant reproductive conditions.



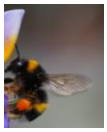
9TH SESSION

Insect-flower interactions in the Mediterranean area: a citizen science dataset collated within the LIFE 4 Pollinators project

Marta Barberis

[1] Department of Biological, Geological and Environmental Sciences, University of Bologna, Italy; [2] Research Centre for Agriculture and Environment, Italy; [3] Department of Plant Biology and Soil Science, University of Vigo, Spain; [4] Laboratory of Biogeography and Ecology, Department of Geography, University of the Aegean, Greece; [5] Global Change Research Group, Mediterranean Institute for Advanced Studies, Spain

Pollinators play a vital role in most terrestrial ecosystems, supporting wild plant communities and enhancing agricultural yields. However, despite their ecological and economic importance, they have been experiencing an alarming decline over the past decades. The Mediterranean region, known for harboring highly diverse communities of plants and pollinators, is particularly vulnerable due to intense anthropogenic pressures. Furthermore, the ecological roles of many floral visitors remain poorly understood, hindering conservation efforts. In response, in recent years, growing attention has been directed toward the contribution that citizens can give in support of pollinator research. An increasing number of projects have adopted a Citizen Science approach to enable large-scale data collection. The LIFE 4 Pollinators project (LIFE18/GIE/IT/000755) aims to promote the conservation of pollinating insects and entomophilous plants across the Mediterranean region by fostering progressive changes in human practices that threaten wild pollinators. In addition to the implementation of several actions to raise awareness, the project launched a web platform to collect photographic records of insect-flower interaction from the public. The platform is expected to remain active for at least ten years. The current dataset, comprising more than 2300 records, will be publicly available, and it will be periodically updated. Records cover a range of climates and elevations, in different levels of urbanization and protection, making the dataset a valuable contribution to research and conservation efforts. Though qualitative, the plant-pollinator networks derived from this dataset may help conservation measures, supporting an approach where species interactions are the units to protect within ecosystems.



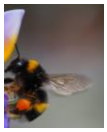
9TH SESSION

Sow Wild! A citizen science project to assess the effectiveness of sown mini-meadows in recruiting beneficial insects in urban green spaces

Janine Griffiths-Lee*[1, 2], Elizabeth Nicholls[2] & Dave Goulson[2]

[1] Kew Royal Botanic Gardens, UK; [2] School of Life Sciences, University of Sussex, UK

Urban green spaces are often overlooked yet have considerable potential for pollinators. Protecting biodiversity in urban landscapes is essential for ecosystem services, such as pest control, decomposition and pollination services. However, a common barrier to habitat management or wildlife gardening is the perceived lack of space. We used citizen science to investigate the effectiveness of small 4m2 sown wildflower 'mini-meadows' in UK gardens and allotments in recruiting beneficial insects. Over two years citizen scientists collected data in their gardens, and samples were returned for identification by trained researchers. Mini-meadows provided resource-rich habitats, increasing wild bee richness and supporting, on average, 111% more bumblebees, 87% more solitary bees and 85% more solitary wasps in the year following seed-sowing, compared to Control plots. The verification of data collected by citizen scientists allowed analysis of limitations, sampling bias and effective methods in pollinator-focused experimental citizen science. For bumblebees and honeybees, identification proficiency was similar between researchers and citizen scientists, but solitary bees were misidentified as social wasps or hoverflies. Small-scale floral enhancements can attract more beneficial insects in fragmented urban landscapes, supporting urban biodiversity. We recommend that verification of data by taxonomic experts and increased training is a valuable component of hypothesis-led citizen science projects.



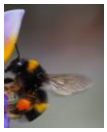
9TH SESSION

Designing pollinator-friendly cities: the role of flower traits, native species, and meadow management

Rosa Ranalli*[1, 2], Andrea Galimberti[1, 2], Isabelle Dajoz[3], Lucie Shurr[3], Massimo Labra[1, 2] & Paolo Biella[1]

[1] Department of Biotechnology and Biosciences, University of Milano-Bicocca, Italy; [2] National Biodiversity Future Center, Italy; [3] Institute of Ecology and Environmental Sciences, Sorbonne Université, France

Pollination is an essential ecosystem service that supports plant diversity, agriculture, ecosystems, and human well-being. However, wild bee populations are increasingly threatened worldwide by various anthropogenic pressures, including urbanisation. Although urban expansion reduces habitat availability and increases environmental stressors, well-managed green spaces can serve as valuable refuges for pollinators in cities. To protect and enhance pollinator biodiversity, effective strategies that ensure sufficient food and nesting resources should be adopted. Among the most promising actions are the creation of flower strips and the management of urban meadows through infrequent mowing. In this study, the efficiency of flower strips and unmown meadows as key measures for supporting urban pollinators was assessed. Four management scenarios were compared: frequently mown meadows, unmown meadows, flower strips, and unmown meadows adjacent to flower strips. Pollination networks were analysed to understand which strategy is most effective in boosting pollinator abundance and species richness. Floral traits were also examined to identify the most attractive plant features, with plant origin considered by comparing native species to non-native and ornamental ones. Fieldwork was carried out in the urban parks of Milan during 2024 and 2025, using standardised methods to monitor pollinators and analyse plant–pollinator interactions. Results showed that unmown meadows hosted more individuals and higher pollinator diversity than frequently mown lawns. Flower strips further increased pollinator numbers and richness where large, radially symmetric inflorescences in pink to purple shades were the most visited floral traits. Moreover, native species attracted significantly more visits than non-native and ornamental plants. These findings offer practical guidance for creating urban green spaces that better support pollinators, helping to strengthen urban biodiversity through targeted planting and thoughtful management.



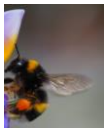
9TH SESSION

Comparing methods to quantify floral resources in cities: a meta-analysis

Gaya ten Kate*[1], A.N. Sexton[2], J. Casanelles-Abella[2], M. Egerer[2] & Sara D. Leonhardt[1]

[1] Plant-Insect Interactions chair, Technical University of Munich, Germany; [2] Urban Productive Ecosystems chair, Technical University of Munich,Germany

Over the past years, scientific interest in the effects of urbanization on insect pollinators has increased rapidly. Many studies conclude that the availability of floral resources plays an important role in the wellbeing of insect pollinators in cities, but there seems to be no standardized way to quantify floral resources. In this meta-analysis, we compared the effect size of different metrics of floral resources on the abundance, richness and diversity of different pollinator orders in urban environments. Out of 92 studies, we identified 21 different metrics of floral resources, which we divided into three categories focusing on floral rewards, floral community or landscape. Only five studies measured floral rewards directly, whereas the remaining 87 studies derived the floral resource availability from the floral community (e.g. floral abundance or richness) or the surrounding landscape (e.g. NDVI). In a meta-analysis of the raw data of a subset of 40 studies, we found that all floral resource metrics had a positive effect on the abundance, richness and diversity of all pollinator orders, but that floral rewards focused metrics had a significantly stronger positive effect than floral community focused metrics or landscape focused metrics. Moreover, we found that the effect size of floral community focused metrics increased with imperviousness, indicating that with increasing urbanization insect pollinators depend more on the floral community. Our results show that direct measurements of floral rewards are more effective than deriving the floral resources from the floral community or surrounding landscape and highlight the need for more studies measuring floral rewards in cities.



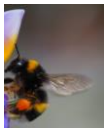
10TH SESSION

Intraspecific floral trait plasticity varies with plant community structure along a land-use gradient

Vidisha Bansal*[1, 2], Alexander Keller[2], Casper J. van der Kooi[3] & Sara D. Leonhardt[1]

[1] Plant-Insect Interactions chair, Technical University of Munich, Germany; [2] Cellular and Organismal Networks, Ludwig Maximillian University, Germany; [3] Groningen Institute of Evolutionary Life Sciences, University of Groningen, The Netherlands

Changes in land-use management, caused by varying intensity of fertilization, grazing, and mowing, can alter the biotic and abiotic conditions in a plant's environment. Land-use practices, for example grazing or mowing, can directly impact floral traits such as flower height and size, as well as the plant community, and by extension, the pollinator community of an area. In this study, we investigated the direct effects of land-use intensity (LUI) as well as indirect effects of LUI-induced changes in surrounding plant communities on the intraspecific variation of floral traits within populations, focusing on floral morphology and rewards in two common meadow species - *Ranunculus acris* and *Trifolium pratense*, in three regions of Germany. Our results show that land-use management directly affected floral morphology, which in turn impacted floral rewards. However, flower size, height, number of open flowers and nectar volume were even more strongly and positively correlated with the abundance of our focal species - likely driven by intraspecific competition. Floral morphology generally showed lower intraspecific variation than variation in floral rewards. Taken together, our results highlight the indirect effects of land-use, particularly through shifts in floral communities, on the expression of the floral traits of exclusively cross-pollinated species. These changes in floral traits are likely mediated by alterations in pollinator composition and preferences across landscapes with varying plant communities.



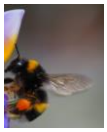
10TH SESSION

Phylogeography of an invasion to track rapid floral evolution

Andrés Romero-Bravo, Juliette O'Flaherty, Jessica Green, Lucy Unwin & Maria Clara Castellanos*

Department of Ecology & Evolution, University of Sussex, UK

Recent plant range expansions where pollinators change provide a unique opportunity to study the potential and speed of floral adaptive change. We have been studying the common foxglove, *Digitalis purpurea*, to investigate convergent floral changes after the addition of hummingbirds as pollinators when naturalised in tropical mountains. In addition to our previous reports of morphological changes, we now have new evidence of changes in nectar traits consistent with bird pollination. To confirm the convergent nature of these changes, here we use a phylogeographic approach to reconstruct the invasion of focal Colombian and Costa Rican populations from the native European range. We used genotyping-by-sequencing on individuals from eleven native populations in Europe and three populations in the introduced range. Our phylogeographic reconstruction points at Central Europe as the source of two recent and independent introduction events to South and Central America. Within the native range, population structure is consistent with a historic northward expansion from southern European populations and the colonisation of Norway from Britain across the North Sea. Our phylogeographic analysis provides the most comprehensive insight onto the colonisation history and the genetic relationships across populations of *Digitalis purpurea*, an emerging model species to study adaptive changes in novel pollinator environments.



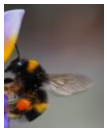
10TH SESSION

Ploidy-level and range position determines the intensity and outcome of a coevolving plant-pollinator interaction

Magne Friberg*[1], John N. Thompson[2] & Karin Gross[3]

[1] Department of Biology, Lund University, Sweden; [2] Department of Ecology and Evolutionary Biology, University of California at Santa Cruz, USA; [3] Department of Environment and Biodiversity, Paris Lodron University of Salzburg, Germany

Large genomic rearrangements, such as polyploidization may impose direct effects on phenotypic traits involved in species interactions. Polyploidization is particularly common in flowering plants, and here we combine range-wide field studies with detailed field experiments in a mixed ploidy population to evaluate how polyploidization in *Lithophragma bolanderi* structures interactions between this plant and their specialized and generalized pollinators. We study spatial variation both in the intensity (i.e. specialization) and in the outcome (seed/fruit set) of the interaction. The results show that the interaction with specialized *Greya politella* moths, which pollinate the plants while ovipositing into the floral tissue, is highly variable across the *L. bolanderi* range. Whereas almost all pollinated flowers in some populations had been visited by *G. politella*, this pollinating seed parasite contributed only little to pollination in other sites. Seed and fruit set was significantly higher near the range center, whereas the abundance and clutch size of *G. politella*, as well as the presence of polyploidy, were higher in peripheral populations. Thus, *G. politella* was more abundant in polyploid populations than in diploid populations, and to disentangle the spatial autocorrelation between polyploidy and range positions we further show how *G. politella* preferred to oviposit in tetraploid *L. bolanderi* over diploid individuals also at a mixed-ploidy site. Collectively, these results show the variability of species interactions and the opportunity for spatially variable pollinator-mediated selection to act upon floral traits. In addition, the outcome and intensity of these species interactions are influenced also by range position as predicted by the centre-periphery paradigm, and by non-adaptive processes such as large genomic rearrangements. Thereby, this study pinpoints the spatial variability of species interactions even in specialized systems and serves as a rare empirical example that quantifies the variability of the pollinator community surrounding different populations of the same plant species.

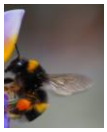


10TH SESSION

Plant mating patterns in small populations

Jon Ågren & Nina Sletvold
Dept of Ecology and Genetics, Evolutionary Biology Centre, Uppsala University, Sweden

Understanding the processes that influence mating patterns in natural populations is fundamental for understanding both population dynamics and evolutionary trajectories, and is therefore also of considerable interest in applied areas such as conservation biology and plant breeding. The mating system can affect both fecundity and the quality of offspring produced and thereby whether plant populations will grow or decline. Moreover, the mating system will influence population genetic structure and the potential for adaptive evolution. In this review, we outline how and why small historical and contemporary population sizes are expected to influence ecological and evolutionary processes governing mating patterns and mating-system evolution. We also discuss the effects of mating patterns and the evolution of self-fertilization on population viability. We examine the extent to which theoretical predictions are upheld by empirical evidence, and identify important gaps for future work.



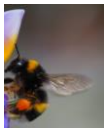
POSTER

The importance of bumblebee buzz-pollination for blueberries – Investigating the soundscape

Laura Briggs*[1, 2], James Windmill[1], Andy Reid[1], Jenni Stockan[2], Carolyn Mitchell[2] & Mario Vallejo-Marin[3]

[1] Centre for Ultrasonic Engineering, University of Strathclyde, UK; [2] The James Hutton Institute, Scotland; [3] Evolutionary Biology Centre, Uppsala University, Sweden

Many soft fruit crops, including tomatoes, kiwi, aubergine and blueberries achieve increased pollination through sonication, also known as buzz pollination. Buzz pollination requires bees to apply vibrations to flowers; this technique is restricted to a subset of bee species, including bumblebees. Blueberries have a low ability to self-pollinate and therefore particularly benefit from buzz pollination. Supplemental pollination in commercial blueberry crops is currently predominantly provided by honeybees, with nascent use of bumblebees. Changing climate is likely to affect foraging behaviour in bees, however there is limited knowledge about the effects of temperature change on buzz pollination. Previous research on sonication in crop pollination has largely focused on tomatoes; limited studies on blueberries focus on number of bee visitations, not length or quality of the sonication. This research will provide important information for growers to optimise pollination strategies. The study utilises acoustic and environmental sensors with visual observations to record climatic conditions and the length and frequency of bumblebee sonication on individual blueberry flowers. Initial findings suggest that buzz pollination occurs in approximately 20% of foraging visits on blueberry crops and that there are likely optimum environmental operating conditions for bumblebee sonication. Further data is now required to support these assessments.



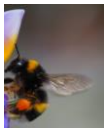
POSTER

Restoring functionality: Plant–Lepidoptera interaction networks in re-grassed grasslands of the White Carpathians

Filip Bužleta*[1], Jana Jersáková[2] & Ondřej Mudrák[3]

[1] Department of Ecosystem Biology, University of South Bohemia, Czech Republic; [2] Department of Ecosystem Biology, University of South Bohemia, Czech Republic; [3] Department of Botany, University of South Bohemia, Czech Republic

Re-grassing of agricultural fields to restore former species-rich grasslands has become a common ecological practice. While plant diversity is often successfully re-established, little is known about how effectively re-grassing restores plant–animal interaction networks. Within the SEPPI project (Standardised European monitoring of plant- pollinator interactions), we investigated plant–Lepidoptera interaction networks in the White Carpathian Mts. (Czechia), where around 600 hectares of grasslands have been restored since 1990 using regional seed mixtures. We conducted surveys at 12 pairs of restored and semi-natural grasslands, recording plant–Lepidoptera interactions using the transect method, and assessing flower richness and abundance using the Braun-Blanquet cover-abundance scale. The calculated network metrics (Modularity, Connectance, Web Assymetry, Nestedness, H_2 index, Shannon- Wiener index, Robustness of plants and pollinators) and community parameters (Species richness of plants and pollinators, and abundance of interactions) were compared between the two grassland types. No significant differences were found in either network or community parameters. These findings suggest that restoration efforts using regional seed mixtures may have an overall positive effect on the recovery of plant-Lepidoptera communities. Although some specialized interactions are still missing in the restored grasslands, they may have been re-wired by generalist species, indicating that functionality of restored grasslands is similar to that of semi natural ones.



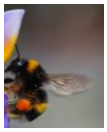
POSTER

Reproductive effort of the invasive California poppy (*Eschscholzia californica* Cham.) in Tenerife (Canary Islands)

Ruymán David Cedrés-Perdomo*[,1], Agustín Naranjo-Cigala[2], Cristina González-Montelongo[1] & José Ramón Arévalo Sierra[1]

[1] Department of Botany, Ecology and Plant Physiology, University of La Laguna, Spain; [2] Geography Department, University of Las Palmas de Gran Canaria, Spain

Biological invasions pose a significant threat to biodiversity, particularly on islands, where ecological communities are highly susceptible to disturbance. The California poppy (*Eschscholzia californica*), native to western North America, has become a successful invader in Mediterranean-type ecosystems worldwide. In the Canary Islands, it forms conspicuous populations, yet little is known about its reproductive strategies in these novel habitats. Understanding how resources are invested in reproduction is crucial to explaining invasion success and potential spread. We investigated the reproductive effort (RE) of *E. californica* in Tenerife by sampling three invaded localities (Arafo, Chipeque, and Vilaflor). At each site, a 10 m transect was established, and 20 plants were collected at 0.5 m intervals (n = 60). Morphological traits (diameter, height, number of flowers, and number of fruits) were measured, and dry biomass was obtained after 72 h at 70°C. RE was calculated as the proportion of reproductive biomass (flowers + fruits) relative to total biomass. RE varied among sites, with the highest values at Vilaflor (19.23 ± 8.91%) and lower values at Arafo (12.19 ± 3.73%) and Chipeque (12.75 ± 6.49%). Absolute reproductive output (fruit number and reproductive biomass) scaled strongly with plant size (r = 0.84 with total biomass), whereas proportional investment (RE%) showed a weak negative trend with size (r = –0.34). Vilaflor plants were significantly smaller and occurred under harsher climatic conditions, yet exhibited the highest relative reproductive investment. Our results demonstrate that *E. californica* in Tenerife allocates a substantial share of biomass to reproduction, supporting its invasive potential through high propagule pressure. The observed spatial variability, particularly the increased RE under limiting conditions, highlights the plasticity of reproductive strategies in this species and underscores the importance of considering local environments when assessing invasion risk in island ecosystems.



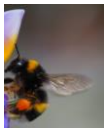
POSTER

Does *Crassula multicava* Lem. lose its sexual reproduction outside its native range? Insights from its invasion in the Canary Islands

Ruymán David Cedrés-Perdomo*[,1], Agustín Naranjo-Cigala[2], Cristina González-Montelongo[1] & José Ramón Arévalo Sierra[1]

[1] Department of Botany, Ecology and Plant Physiology, University of La Laguna, Spain; [2] Geography Department, University of Las Palmas de Gran Canaria, Spain

Crassula multicava, a succulent native to South Africa, exhibits a dual reproductive strategy: sexual reproduction via seeds and vegetative propagation through plantlets that develop on inflorescences or from detached leaves and stems. In its native range, flowering is accompanied by visits from generalist insect pollinators, particularly bees, enabling regular seed set in addition to clonal spread. In several invaded regions, bibliographic records and management reports indicate a shift towards predominantly vegetative reproduction. Populations in places such as New Zealand and Australia are described as largely clonal, with little or no seed formation reported. By contrast, in Hawaii, occasional seed production has been observed, suggesting that introduced pollinators, such as the European honeybee (*Apis mellifera* Linnaeus, 1758), may facilitate some level of sexual reproduction. In the Canary Islands, where *C. multicava* invades laurel-forest understories and disturbed humid habitats, the species forms extensive carpets maintained by profuse vegetative growth. Whether these invasive populations retain functional sexual reproduction remains uncertain, as seed set has not yet been documented, and reproduction appears to rely primarily on plantlets and fragments capable of rapid rooting. Several hypotheses may explain this apparent reduction in sexual reproduction, including limited pollinator visitation in shaded habitats, founder effects and low genetic diversity, or the ecological advantages of clonal propagation in non-native sites. These observations highlight the need for further research to determine whether the loss or reduction of sexual reproduction is a recurring feature in ornamental succulents that become invasive. Understanding such potential shifts in reproductive strategy is crucial for evaluating invasion dynamics and for designing effective management and eradication strategies.



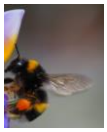
POSTER

Chronic effects of the pesticide mixture acetamiprid and tebuconazole on *Bombus terrestris*

Natalia Davila[1]*, Charlie Nicholson[1, 2], Inés Prieto-Ruiz[1], Sanne de Jong[1], Zélie Jodogne Del Litto[1], Ola Olsson[1], Maj Rundlöf[1], David O'Carroll[1] & Lina Herbertsson[1]

[1] Department of Biology, Lund University, Sweden; [2] Department of Biology, Marine Biology, and Environmental Science, Roger Williams University, USA

Bees are essential for pollinating ~78% of flowering plants and for supporting global food security, yet wild populations are declining due to habitat loss, agrochemical exposure, and climate change. Neonicotinoids like imidacloprid disrupt learning and foraging, and while acetamiprid is deemed lower-toxicity, its chronic, field-realistic effects—especially in combination with fungicides—remain unclear. Here we asked two questions: (1) Does chronic exposure to acetamiprid or tebuconazole alone impair Bombus terrestris foraging and colony metrics? (2) Are combined exposures to acetamiprid plus tebuconazole as detrimental as imidacloprid treatment? Using 40 commercial bumblebee colonies, we administered five sucrose-spiked treatments (control; imidacloprid 2 ppb; tebuconazole 56 ppb; acetamiprid 92 ppb; acetamiprid + tebuconazole) for seven days. Workers were tagged and monitored over 1- and 4-week deployments for survival, body mass, foraging trips, and pollen loads; colonies were dissected to assess reproductive output. Survival declined sharply over time but did not differ among treatments. Surviving imidacloprid-exposed bees were significantly larger than controls (0.276 g vs. 0.231 g; $p = 0.0013$), suggesting that smaller individuals may be more sensitive to pesticide stress. The acetamiprid + tebuconazole group also trended toward larger surviving bees (+0.026 g), though this did not reach statistical significance ($p = 0.069$). Given this near-significant effect, continued investigation is critical to determine whether chronic, combined exposures impose hidden selective pressures on body size and colony performance. These findings reveal transient, sublethal impacts of pesticide cocktails and underscore the need to incorporate both chronic and combined exposures in pollinator risk assessments.



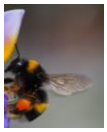
POSTER

Visual ecology of two key Mediterranean beetle pollinators

Sander B. de Hoop*[1], Jonathan Heinze[2], Gregor Belušič[3], Johannes Spaethe[2] & Casper J. van der Kooi[1]

[1] University of Groningen, The Netherlands; [2] University of Würzburg, Germany; [3] University of Ljubljana, Slovenia

Beetles are by far the most species-rich insect order and a primeval pollinator group, but much remains unknown about their sensory ecology. Glaphyrid beetles have a strong association with specific Mediterranean flowers, including red, bowl-shaped flowers, suggesting an ability to see red colours. Our aim is to determine the visual capabilities of two Glaphyridae species that are common flower visitors in Greece: *Pygopleurus chrysonotus*, which visits red-flowered *Anemone* and *Papaver* species, and *Eulasia pareyssei*, which visits primarily yellow-flowering Asteraceae. After identifying red sensitive receptors in the eyes of both species through electrophysiology, we used behavioral experiments to confirm that these beetles distinguish coloured stimuli from achromatic ones. We also tested fine colour discrimination and colour preference in *E. pareyssei*, showing that this species prefers orange stimuli over yellow or red ones, which raises tantalizing thoughts on local adaptation of flower colour. Our study is the first one to experimentally validate the use of colour vision in a beetle. This opens the door to using Glaphyridae as a model system for studies on beetle visual ecology and evolutionary tuning of (flower) signal production and detection by pollinators.

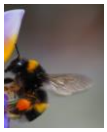


POSTER

***PreguntadoR*: an interactive learning tool for pollinator identification**

Esther Funes-Ligero*, Mohamed Abdelaziz & A. Jesús Muñoz-Pajares
BioChange Network, Department of Genetics, Universidad de Granada, Spain

Recognizing different pollinator species can be a challenging task for students, often requiring considerable time, effort, and continuous guidance from instructors. To support this learning process, we have developed PreguntadoR, an interactive application programmed entirely in R. The tool is designed to make the acquisition of both basic and advanced knowledge related to pollinator identification more engaging and efficient. PreguntadoR offers multiple modes of use and personalized exercises that allow users to study and practice flexibly. Through repeated questioning and interactive tasks, students progressively internalize key morphological traits and taxonomic distinctions, enhancing their ability to identify pollinators accurately and confidently. It can be used to support both structured training and self-directed study. PreguntadoR represents an innovative interdisciplinary educational tool that facilitates the learning and recognition of pollinators in an accessible and motivating way.



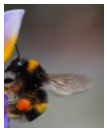
POSTER

ANTENNA: Models for predicting pollinator populations in Europe

M. Muñoz-Mohedano[1], A. Allen-Perkins[2], J.M. Pastor[2] & Javier Galeano*[2]

[1] Deptartamento de Informática y Estadística, Universidad Rey Juan Carlos, Spain; [2] Complex system Group, Universidad Politécnica de Madrid, Spain

Crop pollination, essential for food security, largely depends on insects whose populations are in decline. To identify areas at risk of insufficient pollination and optimize land management, it is crucial to monitor pollinator populations and their trends. The ANTENNA project aims to develop innovative technologies for integrated, transnational pollinator monitoring, expanding the range of taxa and regions assessed across the EU. A key goal is to create a monitoring framework that combines multiple data streams to build predictive models, providing the basis for early warning systems and informed decision-making. In this context, ANTENNA focuses on modeling pollinator population trends, adapting to the specificities of insects and their rapid life cycles while explicitly quantifying predictive uncertainty. Several modeling techniques will be explored, including machine learning approaches and mechanistic models, which will be integrated into ensemble frameworks to improve accuracy and uncertainty estimation. Following studies such as Harris et al. [2018] and Chevalier and Knape [2020], our work considers the application of simple models as a starting point for forecasting pollinator abundances. These studies suggest that simple statistical models often outperform complex ones in predictive performance. While complex models can capture important processes for decision-making, evidence shows that they may struggle to consistently outperform trivial benchmarks. Our initial results are based on predictive models inspired by weather forecasting, using a pollinator dataset from Doñana and focusing on short-term presence predictions. We seek to balance model complexity and predictive power, recognizing that simpler approaches may be more effective in avoiding overfitting. Ultimately, ANTENNA aims to enhance the assessment of pollinator decline impacts and support evidence-based conservation and restoration policies by integrating predictive models into early warning systems and visualization tools, combining traditional and novel monitoring data.

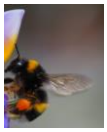


POSTER

The effect of body size and reward volume on the foraging ecology of bumblebees (*Bombus terrestris audax*)

Joseph Gillson*, Jonathan Pattrick & Geraldine Wright
Department of Biology, University of Oxford, UK

Bumblebee workers vary considerably in size, which is purported to influence their cognition. This is often explained by larger bumblebees having larger sensory organs (e.g. larger eyes) and larger brains (with more neurons) than smaller individuals. However, the extent to which they are more 'intelligent' is debated. Larger bees also have larger crops, in which they store foraged nectar, and so are able to visit more flowers during a foraging trip (assuming equal nectar provision across flowers). This, I hypothesised, might significantly influence learning speed. To investigate this, I designed two free-flight foraging experiments, one examining the learning performance of large vs small bees, the second examining the learning of medium-sized bees when rewarded with either 5 µL or 15 µL of sucrose solution per flower. These experiments examined learning (measured as a proportion of 'correct' flower visits) over three different metrics: successive foraging trips, time, and equalised 'bins' of choices. Large bees learned the foraging task in less time and fewer foraging trips than small bees. However, both groups required the same number of floral visits (learning opportunities) to reach the same asymptotic level of association, indicating that size did not influence ability to learn. This is supported by the results of the second experiment, where I found that bees feeding on flowers offering 5 µL (therefore making more floral visits during each foraging trip) learned faster than those feeding on 15 µL per flower. While large bees in these experiments learned faster than small bees, it was not because they were cognitively superior, but was instead because they could collect more nectar and make more choices in each foraging trips, which enabled them to learn faster.



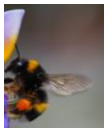
POSTER

Biodiversity and pesticide concentrations in hoverflies (Syrphidae) in a fruit growing region of Western Norway

Sara Rodrigues de Miranda[1], Roger Holten[2, 3], Sven Roar Odenmarck[2] & Bjørn Arild Hatteland*[2]

[1] Department of Biological Sciences, University of Bergen, Norway; [2] Department of Pesticides and Natural Products Chemistry, Norwegian Institute of Bioeconomy Research, Norway; [3] Department of Plant Sciences, Norwegian University of Life Sciences, Norway; [4] Department of Invertebrate Pests and Weeds, Norwegian Institute of Bioeconomy Research, Norway

During the latter years there has been an increasing focus on effects of pesticides on pollinating insects. However, there is still a lack of knowledge of how different insects are exposed and potentially affected by various pesticides in agroecosystems. This project aims to investigate what pesticides are present in semi-natural vegetation close to fruit orchards and what concentrations can be found in hoverflies (Syrphidae). In addition, we describe what taxonomic- and functional groups of hoverflies are present in a fruit growing region of Western Norway during spring, summer and early fall, respectively. Preliminary results show that *Xylota*, *Ferdinandea* are the most common hoverflies, while also the genera *Cheilosia*, *Platycheirus*, and *Melanostoma* are abundant. Many hoverflies are natural enemies of aphids during their larval stage including aphids on fruit trees. However, as a group hoverflies occupy a wide array of larval habitats, ranging from rot-wood, herbaceous plants to aquatic systems. Due to this range of larval habitats, these insects are suited as model organisms for detection of water-soluble pesticides in insects. Although the presented project includes analyses of pesticides in air, soil, vegetation and water, we will be presenting results on pesticide concentrations in hoverflies along with analyses of the hoverfly fauna for the purpose of this poster.



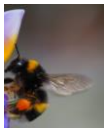
POSTER

Herbivory resistance in dwarf shrubs combines with simulated warming to shift phenology and decrease reproduction

Mark A.K. Gillespie & Stein J. Hegland*

Department of Civil Engineering and Environmental Sciences, Western Norway University of Applied Sciences, Norway

Warmer temperatures advances plant phenology in a range of systems. Other stressors, such as herbivory, can modify plant phenology, but studies on combined effects are rare. We warmed plots with open top chambers (OTCs) and simulated herbivory resistance with methyl jasmonate (MeJA), along an elevational climatic gradient. We recorded phenology in key dwarf shrubs, the deciduous *Vaccinium myrtillus* (bilberry) and the evergreen *V. vitis-idaea* (lingonberry). We expected larger phenological responses at higher elevations and for bilberry. A year after MeJA application, both bilberry and lingonberry delayed vegetative and reproductive phenology, but bilberry responded stronger. Warming with OTCs weakly advanced phenology in both species. Structural equation modelling revealed that MeJA-driven changes to phenology affected berry numbers, particularly in OTCs. Our results demonstrate the need to study combined pressures to understand impacts of global change on plants and highlight that multiple drivers may have unidentified synergetic effects on species phenology and reproduction.



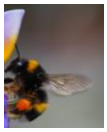
POSTER

Synergistic fungicide-insecticide effects and sensitivity differences in *Osmia* species

Alicia Kling*[,1], Julia Osterman[2,3], Rita Födelsi[1], *WP2 WildPosh consortium*, Alexandra-Maria Klein[1] & Dimitry Wintermantel[1]

[1] Nature Conservation and Landscape Ecology, University of Freiburg, Germany; [2] Department of Biological and Environmental Sciences, University of Gothenburg, Sweden; [3] Department of Biological and Environmental Sciences, Gothenburg Global Biodiversity Centre, Sweden

Pesticides are considered an important driver of bee species loss. Although sensitivity to pesticides varies between species, studies and regulatory risk assessments have primarily focused on human-managed *Apis mellifera* and, to a lesser extent, on other generalist bees. However, the suitability of *A. mellifera* as a model species is questioned due to substantial ecological differences from other species, particularly solitary and oligolectic ones (i.e., species specialised on collecting pollen from a single plant family or genus), which may alter pesticide impacts. Moreover, pesticide toxicology is predominantly evaluated based on individual compounds, although pollinators are often exposed to multiple pesticides simultaneously. This approach is problematic due to potential interactions among compounds. For instance, studies have demonstrated that fungicides can enhance the toxicity of insecticides (i.e., synergistic interaction). We conducted a laboratory study to analyse, for the first time, the sensitivity of the oligolectic *Osmia brevicornis* compared to the polylectic *Osmia bicornis*, the solitary species most often used in pesticide research. The acute oral and contact toxicity of two insecticides, acetamiprid (neonicotinoid) and cypermethrin (pyrethroid), and the triazole fungicide tebuconazole, along with their combinations, were analysed to assess species sensitivity and potential interactions in mixture treatments. Our results indicate that *O. brevicornis* is more sensitive than *O. bicornis* to pesticides. This was particularly pronounced when exposure was via contact, suggesting that morphological traits such as a thinner cuticle in *O. brevicornis* may contribute to the higher sensitivity. Additionally, cypermethrin and tebuconazole interacted synergistically across species and exposure pathways. The fungicide appeared to be relatively safe alone, indicating that it may harm bees by inhibiting the detoxification of the insecticide. The results highlight the need for a broader range of test species and consideration of pesticide interactions in risk assessment.



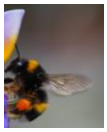
POSTER

Best practices in flower colour research

Marjan Kraaij*[1]; Lindani Buthelezi[2]; Steven D. Johnson[2] & Casper J. van der Kooi[1]

[1] University of Groningen, The Netherlands; [2] University of KwaZulu-Natal, South Africa

Earth's natural flora is resplendent with flower colours. The mesmerising diversity of floral colours has fascinated mankind for centuries. Aristotle commented on how colours aid a flower's visibility to insects, and Darwin's writing on how flowers attract pollinators is still inspirational for many people today. To understand the optical properties of flowers, and how floral optics attain visual signals that are attractive to pollinators, it is imperative to obtain reliable flower reflectance spectra. However, flowers of interest do not always occur close to the laboratories where they are investigated. The floral pigments and (interior) structures that create floral colour may decay during the transport. How does flower wilting impact floral colour, and what is the best way to preserve flowers during transport to the lab? Here, we present first results of a study on decay of floral optical properties upon picking. Sampling a suite of species with varying pigmentation, thickness, size and shape, and using different ways of storing flowers, we quantified how fast different types of floral structures and pigments degenerate. For fridge and room-temperature conditions, we provide estimates of how long after picking one can still obtain reliable reflectance spectra. Although some of us deal with this almost every day, and one may have their own (intuitive) standards, to the best of our knowledge we are the first to provide guidelines on how to preserve flowers before they reach the spectrometer.



POSTER

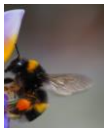
A large-scale and long-term monitoring of bee diversity in German agricultural landscapes

André Krahner*[1], Wiebke Kämper[2], Oleg Lewkowski[1] & Severin Polreich[1]

[1] Institute for Bee Protection, Julius Kühn-Institute - Federal Research Center for Cultivated Plants, Germany; [2] Functional Agrobiodiversity & Agroecology, University of Göttingen, Germany

As part of a nationwide monitoring of biological diversity on agricultural land in Germany (MonViA), we have been working on a monitoring scheme for bees and other flower visiting insects. In spring 2023, we piloted this scheme at a large scale, covering the nort-eastern quarter of Germany, i.e. 5 out of 16 federal states. Sampling with pan-trap triplets (UV fluorescent blue, white and yellow) at 54 sites from the High Nature Value farmland monitoring, we counted 6956 Anthophila individuals in total. Following DNA-metabarcoding, the BLAST search generated 1288 matches for Anthophila, the consensus resulting in 88 taxon matches at family, 82 at genera and 48 at species level. At 22 sites, we assessed the effects of exposure time (24h, 48h, 72h) and ambient temperature on pan-trap samples. Based on our results, we advocate for a pan trap exposure time of 48h in order to maximize trap efficacy in terms of number of sampled bee individuals and sampled bee taxa, while limiting unnecessary bycatch. Accordingly, we have been piloting the monitoring scheme since 2024 at a smaller scale, but using 4-5 sampling rounds per year in order to account for seasonal species turnover. To this end, we sampled 16 agricultural sites in two study areas in the German federal states of Lower Saxony and Saxony-Anhalt. In order to ensure comparability of community data across sites and years, sampling rounds targeted phenological events spread over the bee season. Our pilot study demonstrates the feasibility of standardized, phenologically fixed monitoring events over large areas for establishing long-term trends of the diversity of bees and other pollinators.

This publication was prepared within the framework of MonViA 'Monitoring of Biodiversity in Agricultural Landscapes' (*www.agrarmonitoring-monvia.de/en*). MonViA is funded by the German Federal Ministry of Agriculture, Food and Regional Identity (BMLEH).

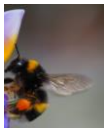


POSTER

Do's and don't's for nectar measurements

Kenneth Kuba*, Vidisha Bansal, Paula Prucker, Carmen Nebauer, Gaya ten Kate, Ada Doga Özkir, Ling Xu & Sara D. Leonhardt
Chair of Plant-Insect-Interactions, Technical University Munich, Germany

Nectar, the sweet liquid pollinator reward plants produce primarily in flowers, is a crucial resource for a plethora of (adult) insects. It is one of the driving forces that shape pollination interactions and for the attractiveness of plants. Flowers have developed various strategies to restrict nectar access to consumers to ensure that spent energy is allocated to "beneficial" flower visitors. This range of adaptations, often morphological, also makes it hard for researchers to collect nectar in a standardized way, which becomes even more apparent, when comparing the few records of broader sets of nectar measurements. We have developed a nectar sampling protocol applicable across most plant families by testing and comparing common methods "Pre-treatment" applied (i) before the extraction (Bagging, Watering) and (ii) to extract nectar (centrifuge, capillary). We tested the effect of these methods on volume, sugar concentration and total sugar content. Pre-treatments altered especially nectar volumes of herbaceous plants. Therefore, it is important to select the pre-treatment based on the question at hand. Extraction with centrifuge was advantageous, as more nectar was extracted, without changing the sugar concentration. Especially the newly designed protocols and the designed 3D printed extraction devices were important for the centrifuge extraction. Overall, we hope that our results will increase comparability across studies and labs to addressing broader questions requiring a standardized approach.



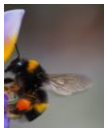
POSTER

Plants in danger: floral and other plant traits as drivers of vulnerability in Mediterranean countries

Amparo Lázaro[1], Anastasia Stefanaki[2], Martha Charitonidou[3], Joana Cursach[4], Maria Panitsa[5], Ioannis Bazos[6], Rosa Ranalli[7], Mauro Fois[8], Marta Galloni[9], Gianluigi Bacchetta[8], Sílvia Castro[10], João Loureiro[10], Katerina Goula[6], Luis Navarro[11], Magda Bou Dagher Kharrat[12], Rhea Kahale[13], Nathalie Machon[14], Gabrielle Martin[15], Udayangani Liu[16], Giovanna Aronne[17], Živa Fišer[18] & Theodora Petanidou[19]

[1] Mediterranean Institute for Advanced Studies, Spain; [2] Utrecht University Botanic Gardens, The Netherlands; Naturalis Biodiversity Center, The Netherlands; Wageningen University & Research, The Netherlands. [3] University of Ioannina, Greece; [4] University of Balearic Islands, Spain; [5] University of Patras, Greece; [6] National and Kapodistrian University of Athens, Greece; [7] University of Milano-Bicocca, Italy; [8] University of Cagliari, Italy; [9] University of Bologna, Italy; [10] University of Coimbra, Portugal; [11] University of Vigo, Spain; [12] European Forest Institute, Spain; [13] Saint Joseph University, Lebanon; [14] Centre d'Écologie et des Sciences de la Conservation, France; [15] Université Toulouse III - Paul Sabatier, France. [16] Kew Royal Botanic Gardens, UK; [17] University of Naples Federico II, Italy; [18] University of Primorska, Slovenia; [19] University of the Aegean, Greece

Plants with complex floral morphologies are adapted to be pollinated by restricted pollinator assemblages and may suffer pollinator limitation. Understanding how floral traits and other variables relate to plant vulnerability can provide a powerful tool for predicting the conservation status and prioritizing the assessment of plants with scarce field data. Using ca. 3,000 records of rare and threatened (*sensu* IUCN) entomophilous plant taxa from seven Mediterranean countries, we evaluated how six floral traits and eight intrinsic and extrinsic variables were related to plant vulnerability. Besides, we analyzed 29 experts' opinions regarding the floral traits most related to floral complexity. Floral shape, reproductive unit, and flowering duration were good vulnerability indicators. Taxa with lip- and flag-shaped flowers were the most threatened, which agrees with the opinion of experts who considered lip- and flag-shaped flowers to have more complex morphologies. Also, plants with cylindrical inflorescences or solitary flowers were more threatened than those with flat-spherical inflorescences. Longer flowering durations reduced the probability of being threatened. Coastal and freshwater habitats, heavily impacted by human activities, had the highest percentage of highly threatened taxa. Yet, plant vulnerability decreased with maximum elevation and total distribution range. These results serve as a basis for managers and practitioners when field data are scarce or unavailable, so that, depending on their traits, species could be provisionally listed in Red Lists as deserving priority for assessment to ascertain conservation status and actions.



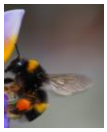
POSTER

Temporal trends in gut microbiota composition of *Bombus pascuorum* wild bee at Gorbeia Natural Park (Northern Iberian Peninsula)

Luis Javier Chueca[1], Jon Poza[1], Manpreet Dhami[2, 3], Marion Donald[2], Brais Hermosilla[1], Jennifer Rose[1], Xabier Salgado[1] & Ainhoa Magrach*[1, 4]

[1] BC3 Basque Centre for Climate Change, Spain; [2] Biocontrol & Molecular Ecology, Manaaki Whenua Landcare Research, New Zealand; [3] School of Biological Sciences, Waipapa Taumata Rau, University of Auckland, New Zealand; [4] IKERBASQUE, Basque Foundation for Science, Spain

Pollinators are essential for both natural and agricultural systems, supporting the diversity of plant communities and the productivity of crops around the globe. However, different global change drivers increasingly threaten these pollinator populations, leading to declines in population numbers and cascading effects on ecosystems and human food security. One critical but understudied aspect of pollinator health is their microbiome. The microbiome, a community of microorganisms living within and on pollinators, plays a significant role in digestion, immune function, and disease resistance, amongst others. However, environmental changes and pesticide exposure can disrupt these microbial communities, compromising pollinator health and survival. Most research on pollinator microbiomes has focused on managed species like honeybees, leaving significant gaps in our understanding of wild pollinators. This study investigates the microbiome composition of the common carder bee (*Bombus pascuorum*) across different floral environments throughout the flowering season. By analyzing the gut microbiomes of these bees, we aim to uncover how environmental factors shape their microbial communities, providing crucial insights into their resilience and adaptability in the face of global change. This knowledge is essential for guiding conservation efforts to protect pollinator populations.



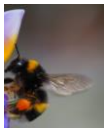
POSTER

Reduced herkogamy predicts breakdown of dimorphic enantiostyly

Sam McCarren*[1, 2], Alice Fairnie[3], Olivia Page-Macdonald[2], Sinead Watchorn[4], Spencer Barrett[3], Bruce Anderson[1], Robert Ingle[2] & Nicola Illing[2]

[1] Department of Botany and Zoology, Stellenbosch University, South Africa; [2] Department of Molecular and Cell Biology, University of Cape Town, South Africa; [3] Department of Ecology and Evolutionary Biology, University of Toronto, Canada; [4] Paleo-Research Institute, University of Johannesburg, South Africa

Selection on reproductive success drives the evolution and diversification of floral traits, resulting in striking diversity and the repeated gain and loss of traits. Among these, stylar polymorphisms have received particular attention due to their spatial separation and reciprocal positioning of reproductive organs, which promotes outcrossing by reducing selfing and increasing disassortative mating. These polymorphisms are typically maintained by negative frequency-dependent selection, yet populations with skewed morph ratios or homostylous variants, where organ separation is lost, can be found in nature. In this study, we examined how floral morphology and mating system dynamics influence the maintenance or breakdown of dimorphic enantiostyly, a stylar polymorphism where the style is deflected either to the left or to the right, focusing on three species of the South African genus *Wachendorfia*. We collected data on morph ratios and reproductive organ separation across 35 populations, as well as pollinator visitation, pollen-ovule ratios, patterns of seed set, pollen tube growth, and pollen movement between and within plants for a subset of the populations. Our findings show that greater spatial separation of sexual organs promotes disassortative pollination and stable morph ratios, supporting the persistence of enantiostyly. In contrast, reduced separation is strongly associated with skewed morph ratios, suggesting a breakdown of the polymorphism. These patterns are consistent with a shift toward selfing under conditions of pollinator limitation, where even homostyly may emerge as an adaptive strategy that increases reproductive success by enhancing autonomous selfing.

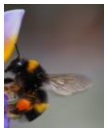


POSTER

Uncovering interactions between drivers of floral longevity: latitude and season

Ariadna Puig-Alaminos & Marcos Méndez*
Area of Biodiversity and Conservation & IICG, Universidad Rey Juan Carlos, Spain

Floral longevity, the time spent from opening to wilting of a flower, is a key component of floral display. Among the ecological drivers of floral longevity, pollinator activity or its environmental correlates, such as temperature, elevation, latitude or period in the season have been widely studied. As a general rule, floral longevity should increase in scenarios of low pollinator activity, low temperatures, high elevation and latitude or flowering early in the reproductive season. Comparative studies using literature data have regularly tested the influence on floral longevity of all or many of these ecological drivers. Surprisingly, the period of the season has rarely been found to influence floral longevity. However, there are good theoretical reasons to expect that plant species flowering in early spring will face a poor pollinator environment and show long floral longevities. We argue that the influence of this driver can be masked by the interaction with latitude in multispecies empirical tests. We used data for 203 plant species to specifically address interactions between ecological drivers and found that there was an interaction between latitude and period in the season, such that the influence of period in the season on floral longevity increased with increasing latitude, but only in the South hemisphere. Future multispecies tests of drivers of floral longevity should include interactions between drivers, and not only test for the main effects of drivers. Otherwise, our understanding of floral longevity will remain incomplete.

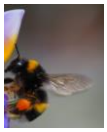


POSTER

Generalized plant-pollinator phenological climate-driven advances still lead to a decline in phenological overlap

Nerea Montes-Pérez*, Francisco P. Molina & Ignasi Bartomeus
Department of Ecology and Evolution, Estación Biológica de Doñana, Spain

Climate change is altering the phenology of interacting species, leading to a potential mismatch between them which could result in the loss of crucial ecosystem functions such as pollination. Although plants and pollinators are embeded into complex webs of interactions, it remains unresolved how species-specific phenological shifts scale up at the community level and the role biodiversity could play in buffering potential negative outcomes. We used an 8-year time series of seasonal abundance data for plants and pollinators, sampled in an area experiencing increased droughts and extreme high temperatures, to assess potential changes in phenological overlap. We found that overlap between interacting species has decreased over time, with a steeper trend for pollinators. Furthermore, biodiversity is not buffering the reduction in overlap at the community level. Therefore, promoting biodiversity alone will not be sufficient to prevent the loss of pollination services due to climate change.



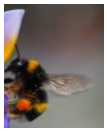
POSTER

The influence of flowering groundcover on pollination of apple in apple orchards

Hedda Ørbæk*[1, 2], Joseph Chipperfield[1], Ørjan Totland[2], Jens Åstrøm[1], Erik Stange[1] & Julien Vadnais[2]

[1] Norwegian Institute for Nature Research, Norway; [2] Department of Biological Sciences, University of Bergen, Norway

Pollination success in apple orchards is influenced by the presence of co-flowering plants that may alter pollinator behavior and pollen transfer. In Norwegian orchards, dandelion (*Taraxacum* spp.) and apple flowering often overlaps, raising questions about whether it competes with or complements apple pollination. To address these questions, we employ a multi-scale methodological framework. Drone-based recordings are used to map the abundance and distribution of flowering *Taraxacum* and apple across orchards. Pollinator communities are sampled using flight intercept traps (FIT traps), and direct field observations quantify visitation rates to apple flowers. Apple stigmas are examined for deposition of both apple and *Taraxacum* pollen, and controlled hand-pollination experiments are performed to test whether *Taraxacum* pollen interferes with apple pollen germination. Finally, initial fruit- and seed sets are measured to evaluate downstream effects of pollen deposition. In this poster, I will present the methodological approach and invite discussion on how these tools can contribute to understanding the role of co-flowering species in pollination services across insect-pollinated crops.



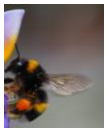
POSTER

Arctic bumblebees in a warming world: Population change and competition over 30 years

Maria Pavolotskaia*, Wilhelm Osterman, Cristina Rodriques Otero, Åslög Dahl, Vanessa Quaye & Anne Bjorkman

Department of Biological and Environmental Sciences, University of Gothenburg, Sweden

Bumblebees are cold-adapted pollinators, with several species specialized to the Arctic tundra. Rapid warming in the Arctic raises concerns for the future of these unique pollinators, as well as for the plants that depend on them. As temperatures rise, warm-adapted pollinators are expanding their ranges northward, potentially competing with native Arctic bumblebees. While such range expansions have been observed, it remains unclear how frequent these new pollinators are, to what extent they compete with native species, and how Arctic pollinator communities have changed over recent decades. To address these questions, we conducted a classical capture–recapture experiment to estimate population sizes of different bumblebee species at our field site in Latnjajaure, northernmost Sweden. We compare these estimates with data from a historical study performed at the same site 30 years ago. To assess competition for floral resources, we also analyze pollen collected from bumblebees today and compare it with pollen data from the historical study. In this poster, we present our experimental design, preliminary findings where available, and invite feedback to help refine this pilot study into a full-scale investigation next year.



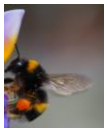
POSTER

Pollinators of beaver territories: How the return of beavers affects the pollinator spectrum

Helena Pijálková*[1], Magdalena Gajdošová[2], Jan Náhlovský[1], Ely Kosnicki[3], Zuzana Matějková[2], Ivan Pavle[1], Jakub Štenc[1, 4, 5], Pavel Munclinger[1] & Jiří Hadrava[1]

[1] Department of Zoology, Charles University, Czech Republic; [2] Department of Ecology, Charles University, Czech Republic; [3] Macroinvertebrate Ecology Consultant; [4] CREAF, Spain; [5] Department of Botany, Charles University, Czech Republic

The European beaver (*Castor fiber*) has been absent from central Europe for many decades. Over the past 40 years, we have observed its return to its original habitats and the consequent effect it had on local river ecosystems. Many insect pollinator species are known to have aquatic or semi-aquatic larvae, while others breed in decaying wood. The aquatic larvae of insects also differ in their requirements for various types of water, including still or flowing water, and water that is either deep or shallow. All of these conditions can be met in beaver territories. The areas cleared out near the beaver dams also provide a suitable environment for many species of flowering plants. The aim of this preliminary project is to investigate the diversity of insect pollinators in the surrounding of beaver territories and the impact of beaver activities on the composition of local pollinator communities and plant-pollinator networks.



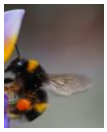
POSTER

Effects of semi-natural habitat on crop pollination depend on drought stress and regional climate

Paula Prucker *[1, 2], Johannes Kollmann[1] & Sara D. Leonhardt[2]

[1] Restoration Ecology, Technical University of Munich, Germany; [2] Plant-Insect-Interactions, Technical University of Munich, Germany

Semi-natural habitats (SNHs) provide essential food and nesting resources for pollinators, supporting biodiversity and stabilizing pollination services vital for crop yields. While climate is known to alter crop-pollinator interactions by affecting floral cues and pollinator behaviour, its interplay with landscape structure, such as the proportion of SNH, remains poorly understood. To fill this gap, we conducted a space-for-time field study in two climatically different regions (cool-moist vs. warm-dry) with oilseed rape as a model crop. Potted plants were either drought-stressed or regularly watered before flowering and then placed in agricultural landscapes when flowering began. Pollinator visitation and seed number per pod were recorded and analysed in relation to the surrounding SNH area. Preliminary results show that regularly watered plants generally attracted more pollinators, particularly in landscapes with low SNH cover in the cool-moist region. However, the effect of watering decreased with increasing SNH cover. Although pollinator abundance on rapeseed plants declined with increasing SNH, seed set per pod increased, especially in non-stressed plants. In the warm-dry region, seed set was unaffected by drought or SNH. These findings suggest that pollinators generally favour more rewarding flowers in intensively managed landscapes. They also indicate that less mobile pollinator species which depend on SNH may be more efficient pollinators of rapeseed but suffer particularly in a warmer (future) climate. In the future, landscape features other than SNH area – such as resource availability and connectivity – may become increasingly important for shaping crop-pollinator interactions and maintaining crop yield.



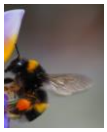
POSTER

Flower integration and modularity in a coevolved system

Pamela C. Santana*[1], Karin Gross[1, 2], John N Thompson[3] & Magne Friberg[1]

[1] Department of Biology, Lund University, Sweden; [2] Department of Environment and Biodiversity, Paris Lodron University of Salzburg, Austria; [3] Department of Ecology and Evolutionary Biology, University of California, USA

Interactions between flowering plants and their pollinators drive evolutionary change through natural selection. Most plant–pollinator systems exist within complex ecological networks where specialists and generalists interact across heterogeneous environments. Bolander's woodland star, *Lithophragma bolanderi* (Saxifragaceae), is a perennial herb endemic to California's Sierra Nevada. Some *L. bolanderi* populations attract many generalist pollinators, while others populations are primarily pollinated by the specialized moth *Greya politella* (Prodoxidae), which uniquely pollinates while ovipositing in flowers. Because *G. politella* abundance varies geographically—and can be tracked through larval presence in fruit capsules—this system offers an opportunity to compare how generalized versus specialized pollination influences the evolution of floral traits. We combined linear measurements of 19 floral traits in a common garden experiment with field surveys of *G. politella* from 21 populations. We asked whether reliance on the moth is associated with trait variation, integration, and modularity. Traits most strongly related to *G. politella* abundance were linked to pollinator fit, including flower width, nectary disc length, stigmatic lobe diameter and corolla opening diameter, which all increased with moth presence. Beyond individual traits, we examined floral modularity and integration. Modularity may enhance the potential to respond to selection by allowing subsets of traits to respond independently, while integration maintains functional coherence. Our results suggest that specialized pollination promotes trait refinement while preserving evolutionary potential through the organization of floral traits. Overall, specialized interactions with *G. politella* shape floral form, reduce variation in selected traits, and influence the way traits are structured, while generalist pollinators maintained floral trait flexibility across populations, but decreased trait evolvability. This duality highlights how interactions with specialized partners can simultaneously foster specialization and maintain evolvability within heterogeneous ecological contexts.



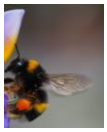
POSTER

The cost and benefits of being heterosporous

Guillermo Santos-Rivilla*[1], Lucía DeSoto[1] & Marcos Méndez[2]

[1] Department of Biodiversity, Ecology and Evolution, Complutense University of Madrid, Spain; [2] Area of Biodiversity and Conservation, Universidad Rey Juan Carlos, Spain

Heterospory, the production of microspores and megaspores, has evolved at least eight times in land plants and is a key innovation preceding the evolution of seeds and pollen. In addition to the bimodal variation in spore size, heterospory entails two other traits: (1) unisexuality, both in spores and sporangia, and (2) endospory, since gametophytes remain inside the spore, limiting its growth. The order of appearance of the three traits has been debated in the past and remains unanswered. The Haig and Westoby model considers heterospory as a bet-hedging strategy of gametophytes to overcome unfavorable environments by the independent optimization of male and female fitness. In accordance with the size advantage model, the female function will benefit more from larger spore size, while smaller spores, predominantly expressed as males, may also be selected for better dispersal. The Haig-Westoby model is an evolutionary explanation based on bimodal spore size to understand the order of evolution of heterospory, where the endospory could be the result of greater dependence on spore nutrient reserves for reproduction and sporophyte survival. However, empirical studies to test this model are very scarce. We will use two model systems: (i) lycophytes, comparing Lycopodiales (homosporous) with Selaginellales (heterosporous), and (ii) the genus Pteris, which exhibits incipient heterospory in P. platyzomopsis. First, we will compare the spore production and size normalized by sporophyte biomass to test the compensation of cost of producing large female spores. Second, we will experimentally test the advantage of sex specialization as male gametophytes derived from small spores and as female gametophytes derived from large spores under contrasting -benign vs. stressing- environments. Third, we will experimentally address the self-fertilization capacity predicting that both selfing and inbreeding depression are higher in heterosporous, compared to homosporous species.



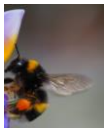
POSTER

Agroforestry - More trees, more bees?

Tessa Elliott[1], Lisa Spreng[1], Liz Lethal[2], Thomas Middelanis[3], Marielle Schleifer*[1], Paula Prucker*[1], Sara D. Leonhardt[1]

[1] Plant-Insect Interactions, Technical University of Munich, Germany; [2] Department of Ecology, Brandenburg University of Technology Cottbus-Senftenberg, Germany; [3] Applied Landscape Ecology and Ecological Planning, University of Münster, Germanu

Insect-mediated pollination is a vital ecosystem service, particularly within agricultural landscapes. However, pollinator populations have experienced significant declines in recent decades, primarily due to reduced food and nesting resources caused, among others, by decreased structural heterogeneity in agroecosystems. Agroforestry systems offer a promising approach to support pollinators in agricultural systems, as they can enhance habitat connectivity, increase habitat heterogenity, and increase flowering plant diversity and hence resource availability. However, their effect on pollinators has still been little investigated. We studied the impact of silvoarable agroforestry systems – with and without flowering resources – on pollinator abundance and diversity. Transect walks were conducted in May, June, and July 2024 to sample wild bees, hoverflies, and butterflies. Additional flowering plant species on the ground layer were recorded. Four plot types were compared: agroforestry alone (AFO), agroforestry with flowering stripes (AFS), in-control sites (< 2 km distance to AFO and AFS, ICS), and out-control sites (> 2 km distance to AFO and AFS, OCS). Our results show significantly higher pollinator abundances in AFS plots, while tree rows alone (AFO) did not have a visible effect. Across all pollinator groups, abundance and species diversity were positively correlated with flowering plant diversity. These findings underscore the importance of diverse pollen and nectar sources in supporting pollinators, also within agroforestry systems. Consequently. flowering stripes or alternative approaches to maintain/provide floral resources in agroforestry can significantly enhance the ecological value of agroforestry systems for pollinators. Future research should address long-term effects, the role of tree species and management intensity, and the potential of agroforestry systems as nesting habitats for pollinators.



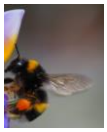
POSTER

Factors influencing temporal stability in plant-pollinator communities

Estefanía Tobajas*[1], Maddi Artamendi[1], Luis J. Chueca[1], Paula Domínguez-Lapido[2], Christian Gostout[1], Brais Hermosilla[1], Jon Poza[1], Jennifer Rose[1], Xabier Salgado-Irazábal[1], Martina de Simón[1] & Ainhoa Magrach[1, 3]

[1] BC3 - Basque Centre for Climate Change, Spain; [2] eNeBaDa, Spain; [3] Ikerbasque, Basque Foundation for Science, Spain

Temporal stability refers to the ability of an ecosystem to buffer environmental fluctuations while maintaining key ecological functions. Although the factors driving temporal stability have been extensively explored in plant communities, few studies have focused on the stability of pollination services. The stability of pollinator visits over time may be determined by factors such as species richness, species asynchrony, or the stability in the populations of either plants and pollinators species. These dynamics may ultimately influence ecosystem functions, such as plant reproductive success. In this study, we focus on understanding the drivers of temporal stability in visitation frequencies. To do this, we used a dataset on floral resource availability and plant-pollinator interaction frequencies, which includes five years of data collected at five sites in Gorbea Natural Park (Bizkaia). Preliminary results show that the availability of floral resources, measured as richness, asynchrony, and stability, does not affect the stability of visit frequency. In the case of pollinators, we observed that a more stable community leads to greater stability in visit frequency. We will continue to disentangle these relationships at different levels and understanding how they influence plant reproductive success. These findings will be crucial to increase our knowledge about the mechanisms underlying the temporal stability of plant-pollinator communities in natural systems.



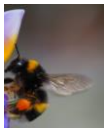
POSTER

Automated vs. manual: Tracking pollinators in sand grassland restoration – preliminary results

Edina Török*[1], Cseperke Csonka[2], Katalin Török[2], Melinda Kabai[1], Maximilian Sittinger[3] & Péter Batáry[1]

[1] ”Lendület” Landscape and Conservation Ecology, Institute of Ecology and Botany, MTA- HUN-REN Centre for Ecological Research, Hungary; [2] Restoration Ecology Research Group, HUN-REN Centre for Ecological Research, Institute of Ecology and Botany, Hungary; [3] Species Interaction Ecology, German Centre for Integrative Biodiversity Research, Germany

Effective monitoring of plant–pollinator interactions is vital for understanding biodiversity trends and sustaining the ecosystem service of pollination. Yet large-scale assessment remains challenging due to the complexity of insect identification and the time-consuming nature of traditional methods. The SEPPI project (*seppi-pollinate.weebly.com*) addresses these limitations by testing automated, image-based sampling using machine learning alongside conventional netting to evaluate their comparative effectiveness. Our research focuses on dry sand grasslands in the Pannonian region, where we selected restored, control, and reference sites to assess pollination dynamics along ecological gradients. Fieldwork included floristic surveys and insect sampling targeting four key pollinator groups: bees, wasps, hoverflies, and butterflies. In parallel, for automated monitoring we deployed the Insect Detect DIY camera trap, enabling real-time detection and tracking of flower-visiting insects. Preliminary results reveal distinct patterns: automated cameras captured 6,446 pollinator images across 17 plant species during 54 sessions, while netting yielded 1,932 direct interaction records involving 31 plant species. Notably, traditional sampling identified 687 individuals from 51 species in restored sites, 670 individuals from 49 species in control sites, and 606 individuals from 20 species in reference areas. Ongoing annotation of the image dataset will refine detection algorithms and accuracy assessments. By comparing methods across habitat types and land-use contexts, we aim to determine where automated techniques best complement existing practices. These findings highlight the promise of automated monitoring in pollination ecology, offering scalable and cost-effective tools to support restoration evaluation and long-term biodiversity tracking, particularly in habitats undergoing active management or recovery.



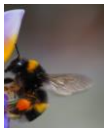
POSTER

Pollinator and herbivore mediated different effects of co-flowering on two primroses congeners along an elevational gradient

Jie Zhang[1], Tao Zhang[1], Judith Trunschke[*2], Yong-Peng Cha[1], Yin-Mei Ma[1], Jian-Li Zhao[1]

[1] Yunnan Normal University, China; [2] University of Iceland, Iceland

Floral evolution is influenced not only by interactions with flower visitors and the abiotic environment but also by interactions with co-flowering species. Yet the extent to which coexistence among closely related species shapes biotic selection remains underexplored, and is likely to vary in response to the spatial variation of co-flowering patterns. We experimentally manipulated pollination and herbivory regime, over two years on two *Primula* congeners at three sites along an elevation gradient in the southeastern Tibetan Plateau. We measured floral traits, female fitness, pollen limitation, opportunity for selection, net selection and pollinator- and herbivore-mediated selection, and summarized their differences among sites and between species. We found that *Primula florindae* was consistently facilitated, while *P. alpicola* experienced facilitation depending on interannual variation in pollination services. Furthermore, the facilitative effect of co-flowering could be offset by interspecific interference. Both pollinator- and herbivore-mediated selection exhibited strong variation across the three sites, and differed between species in response to different co-flowering patterns, yet we found no obvious effect of co-flowering on pollinator-herbivore interactions. Notably, interspecific difference in selection on flowering time and corolla length was evidenced, which could be crucial in reshaping the dynamics of coexistence. Our study demonstrates that co-flowering had differing effects on coexisting congeners, and underscores the significance of coexisting species and their co-flowering patterns in shaping floral trait evolution.



POSTER

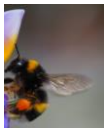
Pesticide risk to *Osmia bicornis* in landscapes dominated by orchards and rapeseed fields: Assessing the role of landscape structure

Dominika Twaróg*[1], Elżbieta Ziółkowska[2], Barbara Jaśkowiec[2] & Agnieszka Bednarska[1]

[1]Institute of Nature Conservation Polish Academy of Sciences, Poland; [2] Institute of Environmental Sciences, Jagiellonian University, Poland

Arthropod populations, including key pollinators, are declining worldwide due to human-driven factors such as land-use change, intensive agriculture, and pesticide use. This is particularly concerning because pollinators are essential for the reproduction of many wild plants and crops, supporting both biodiversity and global food production. Managed honey bees (*Apis mellifera*) are widely used for pollinating crops, but their high density can sometimes interfere with wild pollinators, such as the red mason bee (*Osmia bicornis*) being more effective at pollinating certain crops. Understanding pesticide exposure in wild bees is crucial for safeguarding both pollinator health and crop productivity. This study assessed pesticide residues in provisions collected by the red mason bees as a food for their offspring at two cropping systems—oilseed rape and apple orchards—with varying proportion of surrounding semi-natural areas (forest, extensively managed permanent grasslands, field borders, etc.) to allow exploration of the potential mitigation effect of such areas and their contribution to reducing exposure of bees to pesticides. Thus, artificial nests of the red mason bee, *Osmia bicornis*, were placed either on the perimeter of apple orchards or oilseed rape fields along a gradient of semi-natural areas within a 500 m radius, with the central point being the nest. GC-MS/MS and LC-MS/MS analyses revealed pesticide residues in all *O. bicornis* nests, with a total of 37 different compounds detected. The Pesticide Risk Index (PRI) calculated for each nest to capture the combined hazard and exposure levels of multiple substances indicated that provisions in nests located near apple orchards may pose a greater threat to bees than provisions in nests located near oilseed rape fields. The dependence of PRI on landscape structure will be examined in more detail and presented.

This research was part of the EU project PollinERA (HORIZON-RIA No. 101135005).

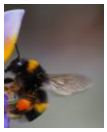


POSTER

Floral trait thermal plasticity in a common crop

Lucy A. Unwin*, E. K. Millerchip & Mª Clara Castellanos
Department of Ecology & Evolution, University of Sussex, UK

Plasticity in floral traits, particularly those related to pollinator reward and attraction, can influence both the types of pollinators that visit a flower and the nature of those interactions. As flowers commonly exhibit suites of traits that align with pollinator preferences, environmentally driven (=plastic) changes in floral traits can alter plant-pollinator interactions in both crop and wild plants. Whilst floral nectar traits have frequently been cited as 'highly plastic', many studies do not measure true plasticity - that is, variation in trait expression across environments within the same genotype. Consequently, the true extent of plasticity in floral nectar traits remains poorly understood. Understanding this is central to predicting the resilience of plant–pollinator interactions in the face of environmental change. We used an experimental setup to measure plasticity in response to temperature in floral nectar volume, flower size, and nectar sugar characteristics in the common bean *Phaseolus vulgaris* L., a globally important crop in the Fabaceae family. P. vulgaris individuals were grown in controlled greenhouse conditions, then allowed to flower at temperatures of 16, 23, and 30°C for 3-day periods. Individual plants experienced multiple temperature treatments to assess plasticity in floral traits. Both nectar volume and flower size show significant plasticity in response to temperature. For both traits, the response to temperature was quadratic, consistent with the presence of a thermal optimum. Interestingly, plants varied in their baseline nectar production, but the shape of the plastic response was highly consistent across plants, suggesting plant-level physiological control of this trait. For flower size, plastic responses were less consistent and there was variation across flowers within plants. Understanding the plasticity of floral traits in crop species provides key information on the potential to breed cultivars with stable reward production that can benefit both yields and pollinators.



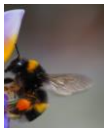
POSTER

Does pollinator specialisation translate into greater pollinator effectiveness? The case of *Andrena solenopalpa* (Andrenidae) and *Lithodora fruticosa* (Boraginaceae)

Javier Valverde*[1], Tia-Lynn Ashman[2] & Conchita Alonso[3]

[1] Departmento de Biología Vegetal y Ecología, Universidad de Sevilla, Spain; [2] Department of Biological Sciences, University of Pittsburgh, USA; [3] Estación Biológica de Doñana, Spain

Andrena solenopalpa (Andrenidae) is an unusual bee species within its genus due to its extremely long mouthparts. Its individuals forage exclusively on the flowers of *Lithodora fruticosa*, a self-incompatible Boraginaceae with tubular flowers. The aim of this study is to determine whether what appears to be a textbook example of adaptation is reflected in greater pollination success for the plant. To this end, the effectiveness of each pollinator's visit to a flower was calculated in two populations of *L. fruticosa* from the Sierra de Cazorla mountains (SE Iberian Peninsula). Three descriptors of visitation quality were calculated using single-vist experiments to virgin flowers: the amount of deposited pollen grains on stigmas, the number of pollen tubes, and the pollen tube success to pollen grains. The visitation quantity was measured as the probability of a flower being visited along the flowering season. Our preliminary results show a higher pollinator efectiveness of *A. solenopalpa*, although it depends on the quality descriptor and its interpretation, and on the relative visitation rates at each population.



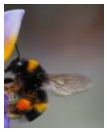
POSTER

How much of pollinator visitation rate and diversity can be inferred from pollen receipt and pollen tubes?

Javier Valverde*[1, 2], Mónica Medrano[2], Esmeralda López[2] & Conchita Alonso[2]

[1] Departmento de Biología Vegetal y Ecología, Universidad de Sevilla, Spain; [2] Estación Biológica de Doñana, Spain

The relationship between pollen receipt on stigmas and the number of growing pollen tubes operates at the interphase between pollination and fertilisation. This offers a unique opportunity to hypothesise about the effect of pollinators on pollination using parameters that measure the quantity and quality of pollen receipt. The quantity component could be measured as the proportion of pollinated stigmas and the amount of conspecific pollen grains on pollinated stigmas. The quality component could be measured as the proportion of conspecific vs. heterospecific pollen on stigmas and the pollen tube success to conspecific pollen. In this study, we explore the correlations of these parameters with pollinator visitation rate and diversity in four flowering plant species from the Cazorla mountains (SE Spain) and address whether such associations are consistent across plant species. Our results suggest that, while the information obtained at the pollination-fertilisation interface partly reflects pollination services, the magnitude of correlations are not universal. Further plant and environmental features, such as floral architecture and microhabitat, could contribute to explain the observed variation.



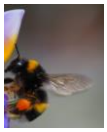
POSTER

Patterns of genetic diversity and structure in *Tithonia diversifolia*

Yannire Vázquez-Benítez[*,1], Antonio Jesús Muñoz Pajares[2], Mohamed Abdelaziz Mohamed[2] & Rocío Santos Gally[1]

[1]Universidad Nacional Autónoma de México, Mexico; [2] BioChange Network, Department of Genetics Universidad de Granada, Spain

Tithonia diversifolia (Asteraceae) is a species native to Mexico and Central America, mainly distributed in tropical ecosystems such as evergreen rainforest, cloud forest, and pine-oak forest. It has a generalist entomophilous pollination system, offering nectar and pollen rewards to 46 morphospecies of insects across five orders, making it an ecologically important component of plant communities. We analyzed genetic diversity and population structure in 177 individuals from 32 localities using SNP markers. Genetic diversity indices (H_O, H_E, F_{ST}, F_{IS}) were estimated, and genetic relationships among populations were assessed through dendrograms and population structure analyses (STRUCTURE, TESS3). Our results revealed genetic differentiation associated with geographical and environmental factors. These findings provide insights into the microevolutionary processes shaping genetic variation in *T. diversifolia*.



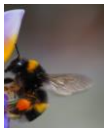
POSTER

Island journeys and ecological adaptations: Colonization patterns of *Erysimum* in Macaronesia

Melissa Viveiros Moniz[*,1], Modesto Berbel[1], Ana García Muñoz[2], José Maria Fernandez-Palacios[3], Miguel Menezes De Sequeira[4], Silvia Castro[5], João Loureiro[5], Mohamed Abdelaziz[1] & Antonio Jesús Muñoz Pajares[1]

[1] BioChange Network, Department of Genetics, University of Granada, Spain; [2] Area of Biodiversity and Conservation, Rey Juan Carlos University, Spain; [3] Island Ecology and Biogeography Group, University Institute of Tropical Diseases and Public Health of the Canary Islands, University of La Laguna, Spain; [4] Madeira Botanical Group, University of Madeira, Portugal; [5] Centre for Functional Ecology, Department of Life Sciences, University of Coimbra, Portugal

The colonization of oceanic islands is a major driver of species diversification, often leading to high levels of endemism, as seen in the Macaronesia region. We explored the evolutionary history, speciation patterns, and reproductive ecology of the genus *Erysimum* across these islands by integrating phylogenomic analyses, population structure, and ecological niche modeling. Whole genomes were sequenced and analyzed using both maximum likelihood and Bayesian inference approaches, while population structure was examined using TESS3. Historical biogeography was reconstructed using MEGA and BioGeoBEARS and environmental niches were characterized with the MaxEnt software. Our findings indicate that Macaronesian *Erysimum* species derive from a continental ancestor that first reached Madeira, followed by expansion into the Canary Islands and Cabo Verde, with polyploidy likely enhancing colonization success. On the Canary Islands, species have diverged into contrasting habitats—high-altitude mountains versus shaded lowland forests—and display markedly different reproductive strategies, including distinct pollinator communities and varying levels of outcrossing versus self-fertilization. Gene flow among populations of the same species across islands, together with distinct climatic niches, underscores how ecological specialization and reproductive traits have shaped the diversification of *Erysimum* in Macaronesia.

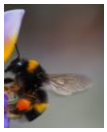


POSTER

Olfactory communication between the invasive bee *Megachile sculpturalis* and its host plants

Julia Witter*, Julia Lanner & Stefan Dötterl
Department of Environment and Biodiversity, University of Salzburg, Germany

In recent decades, an increasing number of species have been introduced to non-native regions as a result of human activities. Some of them have become invasive and affect native species negatively, among them *Megachile sculpturalis*, the first invasive bee in Europe. This bee species visits a wide range of native and ornamental plant species for nectar and pollen, including the highly invasive kudzu (*Pueraria montana* var. *lobata*). In this project we aim to understand the olfactory communication between *M. sculpturalis* and selected host plants in Europe. Floral scent was collected from 17 plant species, using Dynamic Headspace Sampling and analysed via GC-MS (gas chromatography coupled to mass spectrometry). To identify the compounds detectable by the bees´ olfactory system, these samples were also tested by gas chromatography coupled to electroannetographic detection (GC-EAD) on the antennae of the bees. The floral scents were highly variable among the plant species with many species-specific compounds and some of them occurring in several host plant species. The antennae responded to many of these compounds, including several fatty acid derivatives, terpenoids, benzenoids and nitrogen-containing compounds. Overall, our preliminary data suggest that the plants visited by the invasive *M. sculpturalis* do not have a common scent profile despite some of the compounds are shared among the tested species.



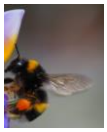
POSTER

Viewing land-use change through the eyes of pollinators: How land-use intensity shapes flower color diversity and composition for bees and flies.

Felicitas Wolf*[1, 2, 3], Demetra Rakosy[4] & Tiffany M. Knight[1, 2, 3, 5]

[1] Department of Community Ecology, Helmholtz Centre for Environmental Research, Germany; [2] German Centre for Integrative Biodiversity Research, Germany; [3] Institute of Biology, Martin Luther University Halle-Wittenberg, Germany; [4] Thünen Institute of Biodiversity, Germany; [5] National Tropical Botanical Garden, USA

Semi-natural grasslands in Europe are hotspots for biodiversity, particularly for vascular plants. However, these ecosystems are increasingly threatened by shifting land management practices, such as the conversion of traditional hay meadows into pastures or land abandonment. These changes are known to reduce plant species diversity, alter plant community composition, and act as strong ecological filters, favoring species adapted to high-disturbance regimes combined with high nutrient input or successional processes. While the impacts of land-management change on plant species diversity and composition are relatively well documented, much less is known about its effects on floral traits, especially those relevant to pollinators. Floral traits strongly influence how pollinators perceive and access resources, potentially affecting pollinator diversity and community composition. Yet, most trait-based approaches do not account for the sensory capabilities of pollinators. In this study, we assess how different land-management regimes affect the diversity and composition of floral traits as perceived by different pollinator groups (e.g., bees and flies). We then compare these sensory-based trait patterns with the taxonomic diversity and composition of the plant community. By focusing on pollinator perception, our approach offers new insights into how changing land-management regimes influence plant–pollinator interactions, with implications for understanding the resilience and stability of grassland communities in the face of continued environmental change.



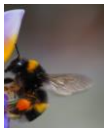
POSTER

How diverse reproductive strategies maintain plant community coexistence: A community-scale analysis of the pollination cascade

Zhong-Ming Ye*[1, 4, 5], Yong-Deng He[1, 2, 5], Xiao-Fang Jin[3], Chun-Feng Yang[1] & Anna Traveset[4]

[1] State Key Laboratory of Plant Diversity and Specialty Crops, Wuhan Botanical Garden, Chinese Academy of Sciences, China; [2] University of Chinese Academy of Sciences, China; [3] College of Life Sciences, Wuhan University, China; [4] Mediterranean Institute for Advanced Studies, Spain

Understanding how hundreds of co-flowering species achieve reproductive success remains a fundamental challenge in plant ecology. We present a comprehensive community-level investigation tracking the complete reproductive cascade from pollinator visitation through pollen deposition to seed production across > 120 alpine plant species over two flowering seasons in Shangri-La (NW Yunnan, China). We developed an integrative analytical framework examining how floral traits, pollination processes, and abundance context jointly shape reproductive outcomes. Two composite floral indices (distinctiveness, reflecting trait differentiation from co-flowering neighbors, and attractiveness, reflecting display + rewards) were evaluated alongside reproductive organ traits (stigma area, stigma exsertion) and life-history attributes (selfing ability, vegetative reproduction). Flower abundance served as a critical axis contrasting rare versus dominant species strategies. Analysis of more than 20,000 flower visitors and 2,600 stigmas revealed context-dependent benefits of floral strategies. While attractiveness universally increased visitation, distinctiveness only enhanced conspecific pollen receipt when combined with high attractiveness, demonstrating synergistic rather than independent effects. Strikingly, abundant species with high distinctiveness experienced dramatically reduced heterospecific pollen loads, while rare distinctive species gained minimal protection, suggesting trait-based solutions to pollen interference scale with population dominance. Reproductive assurance mechanisms buffered different bottlenecks: selfing species converted conspecific pollen into fruit more efficiently with reduced saturation effects, while vegetatively reproducing species showed weaker dependence on abundance for fruit set. These patterns reveal that species occupy complementary positions in a multidimensional strategy space, with coexistence emerging through diverse pathways to reproductive security rather than single optimal solutions.



Some basic statistics for the 39th SCAPE meeting:

116 attendants, including two companion attendants

Based on filiation of the attendants, 21 countries were represented: Austria, Belgium, Brazil, China, Czech Republic, Denmark, Hungary, Iceland, India, Ireland, Israel, Italy, the Netherlands, Poland, Romania, South Africa, Spain, Sweden, UK and USA.

Number of talks: 64 (4 invited, 58 regular and 2 flash)

Number of posters: 35