34th European Congress of Arachnology

25th-30th August 2024

Rennes, Brittany, France

34th ECA
2024
Rennes-FR

Welcome speech by Eric Hitti

Hello everyone and welcome to Rennes to this 34th European Congress of Arachnology.

We're delighted to welcome you here in Rennes where we have one of the two leading French research units on arachnids, along with the Museum. This field of research has a long history in Rennes with Ecobio, thanks in particular to Alain Canard,

and today it's Julien Pétillon and all his team who have worked hard to welcome you in the best possible conditions. THANK TO THEM And even the weather seems to want to take part in the event, but we can never guarantee the arrival of our famous ‘Crachin Breton”.

Your research is fully in line with the concerns of the Brittany region and Rennes metropolis.

Rennes was elected French capital of biodiversity in 2016. On 25 May 2022, it set up the Metropolitan Council for Biodiversity and Water to co-construct a policy to recover biodiversity with associations, institutions and academics. On 1 February 2024, Rennes metropolis adopted its biodiversity and water strategy. It aims to preserve species and their natural habitats in the area.

Our beautiful university contains 6 campuses, 3 in Rennes and 3 campuses in Lannion St Brieux and St Malo. We also have two biological stations, one of which is an island. So many green spaces, landscaped to act in favor of biodiversity and to make students aware that biodiversity is everywhere, especially in their place of study. The preservation and development of biodiversity mobilizes the teams in charge of maintaining the green spaces, but this approach also relies on the students, teacherresearchers, staff, etc. who use these spaces as learning, awareness, research and observation areas.

This is particularly true on campus of Beaulieu, which you will discover during your symposium. You will be able to discover the arboretum or a Miyawaki forest of 900 trees that have been planted 2 years ago, spaces that lend themselves to experiments such as the biobliz or smartobs that have allowed new sensors to be tested. Indeed, several BioBlitzes have been carried out on our various campuses over the years.

Our university, with its 37 000 students, 19 faculty or institutes, and 34 research units, is at a turning point and is transforming itself with the major schools on the site and the research organizations, and the Agro Institute is fully participating in this transformation by placing the environment as one of its founding pillars with our observatory OSER Rennes.

But our greatest challenge is to transform ourselves so that we can transform the world and meet the major challenges that lie ahead. Together, we must build the University of Rennes 2030 to meet the challenge of living in a fair, safe, sustainable and desirable world, based on collective intelligence and cooperation. We decided to involve all the decision-makers at our university, students, partners and elected representatives (150 people) in a nine-month process, with six sessions corresponding to ten days of training based on the model of the Citizens' Conventions. The aim is to get our entire community on board. And of course, biodiversity was at the heart of the first session of this program.

I hope the results of this convention will be inspiring.

Your work shows just how important it is to preserve biodiversity, which is unfortunately in danger. And beyond the fear that our spider friends may inspire, they can also be magnificent environmental markers and so much more.

I just have to wish you a very good conference and a pleasant stay in Rennes and on our campuses.

Thank you very much,

Eric Hitty.

--

Dr Eric Hitty, Associate Professor

Vice-President of Rennes University in charge of ecological transition for a sustainable development

Acknowledgements by Julien Pétillon

Sponsors:

We would like to warmly thank the following institutes, societies and companies for supporting us (hereby reducing registration fees) and providing travel grants and prices for students (hereby promoting the renewal of arachnology):

Université de Rennes, Centre National de la Recherche Scientifique, Observatoire des Sciences de l'Univers de Rennes, Unité Mixte de Recherche 'Ecosystèmes, Biodiversité, Evolution', Rennes Métropole, Région Bretagne.

European Society of Arachnology, American Society of Arachnology, British Society of Arachnology, Czech Society of Arachnology.

Pensoft Publishers.

Organizing committee:

Valérie Briand, Valentin Cabon, Axel Hacala, Ghassen Kmira, Mariette Nivard, Julien Pétillon, Isabelle Picouays, Aurélien Ridel, Gabriele Uhl, Nathan Viel.

On-site helpers:

Maëlys Alletrut, Helwan Areski, Sarah Carpentier, Bastien Clémot, Kaïna Privet.

Scientific committee:

Miquel Arnedo, Samuel Danflous, Efrat Gavish-Regev, Sarah Goodacre, Vlad Ivanov, Julien Pétillon, Elena Piano, Christine Rollard.

Dr Julien Pétillon, Full Professor

Deputy-Director of the UMR CNRS ECOBIO

Chair of the 34th European Congress of Arachnology

Prices and Awards

Student travel grants:

Ondrej Vanek, Helena Rothova and Viktos Strestik

Panagiotis Kontos

Marco Tolve, Živa Vehovar, Zeana Ganem

Hsiang-Yun Lin, Rishikesh Tripathi

Best student posters:

1) Léo Laborieux

2) Mattes Linde

3) Aleksandra Rozumko

Best student talks:

1) Hsiang-Yun Lin

2) Yuri Simone

3) Carolina Ortiz Movliav

Photo competition:

Public vote:

Tomáš Hamřík (General photography category)

(“*Synema globosum* feeding on *Apis mellifera*”)

Sarah Karikó (Microscopy photography)

(“FeatherField”)

Panel of judges:

Léo Laborieux (General photography category)

("*Buthus occitanus* in the heat of a French summer")

Fatemeh Hosseini (Microscopy category)

(“Pinned the Ghostly Runner”)

Work of Jagoba Malumbres-Olarte

Dear all,

It was a real pleasure to attend the 2024 ECA in Rennes and to have the chance to illustrate your research. Some of you have already heard about my work but I would like to take this opportunity to present it properly.

As a researcher and ecologist myself, I know how necessary it is to communicate and disseminate our work inside and outside academia. That is why I work with researchers from a wide range of natural and social sciences who need **original illustrations or infographics** to portray their scientific work. I work in a wide variety of media types and styles, which I select depending on the subject, purpose and audience of the image: highly realistic portraits and stylized depictions for **taxonomic publications**; schematic **diagrams** for process-based research; creative illustrations to **promote scientific publications** and projects (summarising the take-home message for non-specialist audiences); **educational images** for readers of all ages; **conference illustrations**, in which I summarise the take-home message of a given seminar; or **visual facilitation** of scientific **workshops**. My illustrations may be used to advertise a conference in the local and (in)national media, inform about specific research or projects in the academic community, promote young researchers and their work, facilitate the understanding of the conclusions reached in workshops, illustrate scientific articles in conference proceedings, or as part of awards for recent outstanding research work. You can find some examples of my recent work in my **online portfolio here** (and my seminar and conference illustrations here).

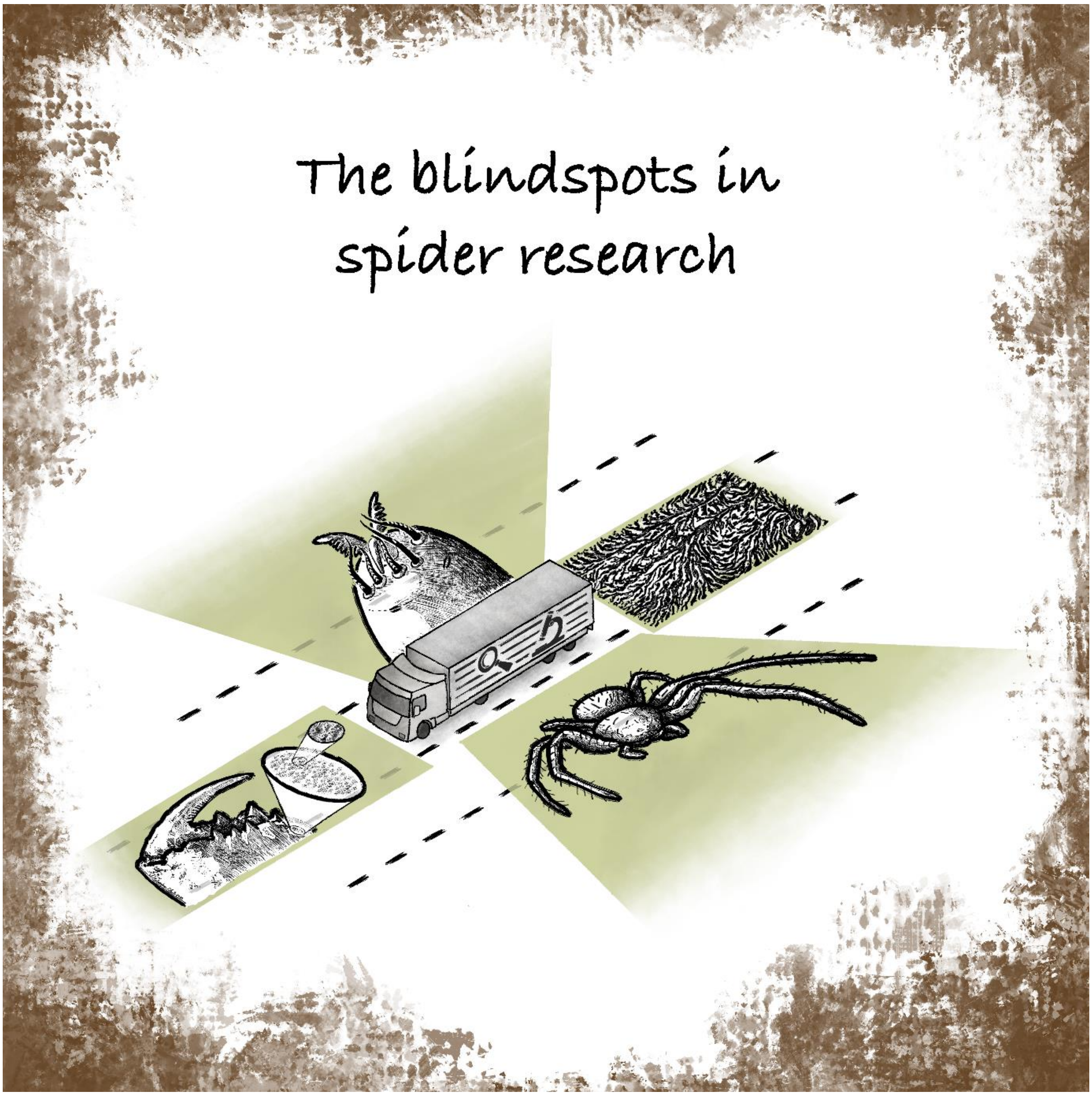
If you are already thinking that such illustrations could be beneficial to explain, educate about, disseminate or promote your research, just contact me.

Jagoba Malumbres-Olarte (jagoba.malumbres.olarte@gmail.com, Instagram: @jmalumbresolarte)

Here you can find the six illustrations that I created to summarise the four plenary sessions and two of the symposia from the 34th European Arachnology Congress (Rennes, 2024). The illustrations were created for the congress and to promote it, and to explain and disseminate the work of the attendees, **so the organisers give you the right to use them however you want to (no copyrights issues here)**.

S. Pekar: This image shows the main 15 defense strategies that different arachnids can use (from top left, down to the centre and back up to the right): transparency, warning, background matching, anachoresis, chemical, countershading, Mullerian, thamatosis, behavioural, Batesian, camouflage, mechanical, startling, deflection and disruptive colouration, with the cornucopia that represents their diversity in the background.

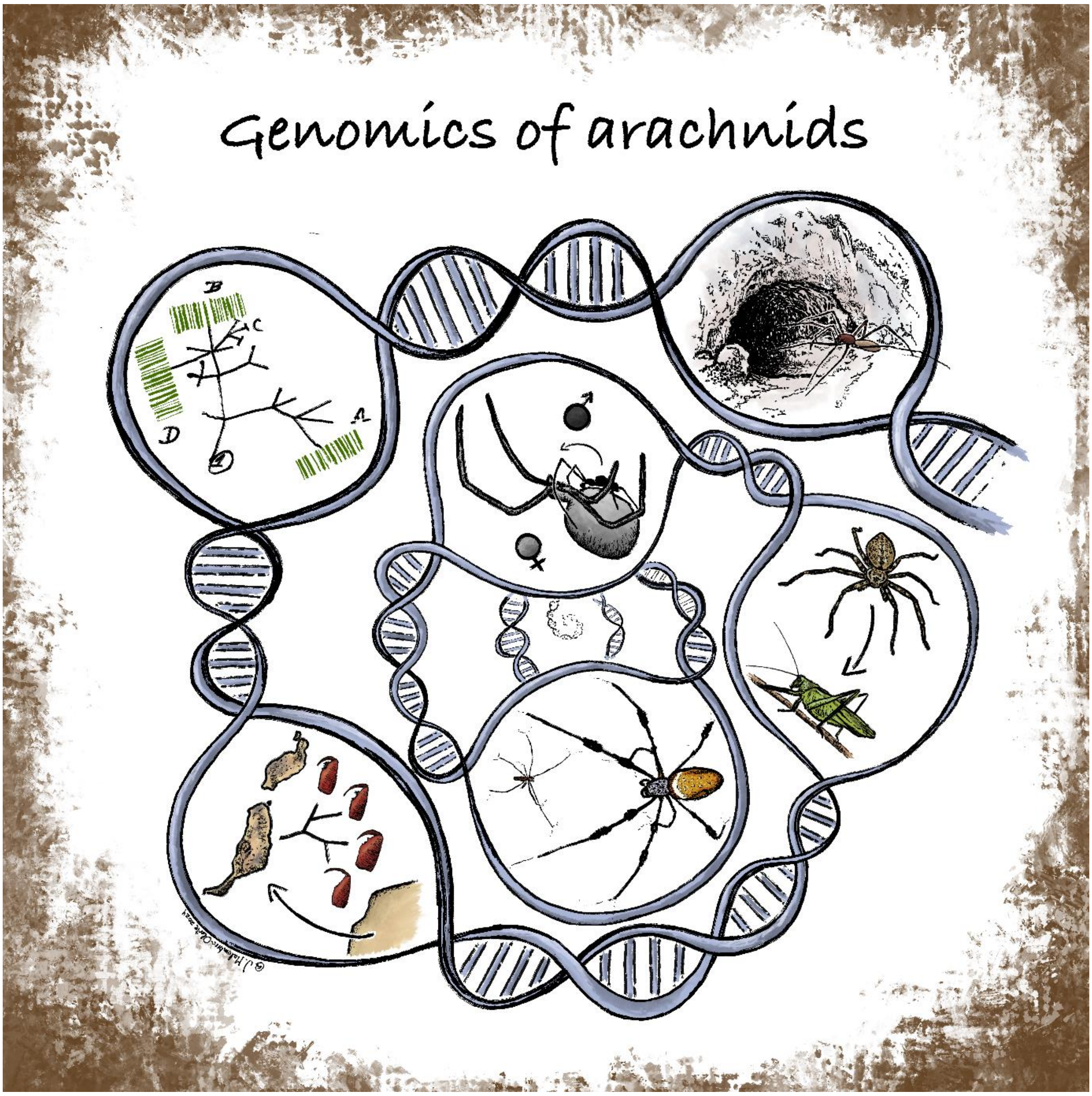
R. Foelix: Just like the signs that indicate the blinspots of trucks, this image shows some examples of the blindspots of the “truck of spider research” (clock-wise): the pore fields where supposedly a special gland (cheliceral gland) opens to the outside (in the front), the handling of silk threads by the different claws (on the right), the structure and composition of spider cuticle (on the back) and the structural colors in spiders (on the left).



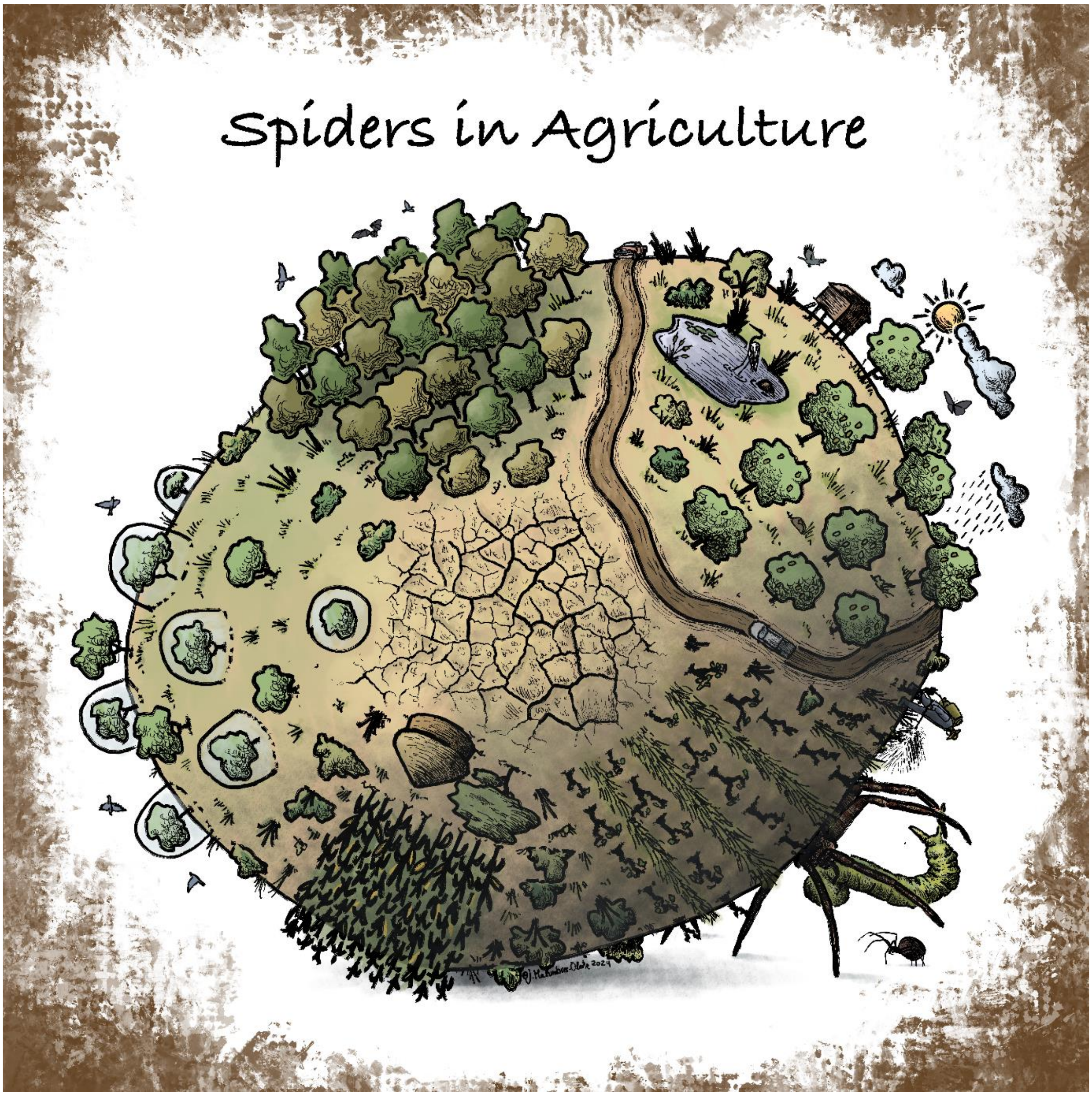
R. Gillespie: Here we can see a coin with the two sides of speciation (focused on islands), with Alfred Russell Wallace (the father of biogeography) in the background. In ecological speciation, as colonisation happens, there is an increase in the number of ecotypes, which occurs through the interactions with their environment. In geographic speciation, each island may have the same number if ecomorphs, which is driven by the interactions with close relatives.

N. Dupérré: The famous “One ring to bring them all” phrase from “The Lord of The Rings” is the reference for this illustration. The ring has images of the different spider families that share a common morphologic feature: the sustentaculum, a seta that has been missed or ignored in many species.

Symposium on arachnid genomics: The DNA strand in the image contains six of the subjects that genomics could potentially help investigate (from outside to inside of the spiral): the adaptation to new habitats (e.g. caves), DNA barcoding and phylogenetics, changes in DNA through colonisation and selection, predation and trophic interactions, mating behaviour and sexual dimorphism.



Symposium on spiders in agriculture: This image shows a spider that is preying on a caterpillar (representing the predatory role of spiders in agroecosystems) and holds five messages on its huge abdomen: the role of agroforestry in supporting spider diversity (top left), the effects of landscape factors on food webs (top right), the effects of fungicides on them (bottom right), the effects of farming techniques and droughts on them (bottom and centre) and the testing of the effects of birds and spiders through exclusion experiments (bottom left). The small spider at the bottom right of the image represents (in contrast with the large preying spider), the effects of differences in aggressiveness on predation.



Group Photo (please refer to the list of participants below to get the numbers-names correspondence)

Missing on the picture: Narmin Beydizada, Robert Bosmans, Elsa Canard, Marek Chajduk, El Aziz Djoudi, Rainer Foelix, Warbota Khum, Ondřej Košulič, Christian Kropf, Léo Laborieux, János Novak, Sandrine Petit, Manuel Plantegenest, Pavol Purgat, Yuri Simone, Artëm Sozontov, František Šťahlavský, Ondřej Vanek (and accompanying persons).

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Program

Program 34th ECA, Rennes – FR, 25-30th August 2024

Sunday 25th pm

Venue: Building 2 of the 'Campus de Beaulieu', Amphi A (see map on the verso)
Bus: lines C4 & C6, stop at 'Tournebride'
Metro: line B, stop at 'Beaulieu Université'

15:30-22. REGISTRATION DESK OPEN

17-19:15. Symposium: **Genomics of Arachnids** (chair: V. Ivanov & Y. Schöneberg)

Introduction
1. M. Pavlek
2. Y. Schöneberg et al.
3. M. Arnedo et al.
4. A. Sanz et al.
5. S. Simona Kralj-Fišer et al.
6. V. Ivanov et al.
7. H. Krehenwinkel et al.
8. L. Trębicki et al.

Discussion

18:30-22. ICE-BREAKER

Monday 26th

9-9:30. **Welcome words**

9:30-10:30. Key-note: **Defences in arachnids: what do we know and where should we go** (S. Pekar) (chair: S. Kralj-Fišer)

10:30-11. COFFEE BREAK

Ecophysiology and Behavior
(chair: S. Kralj-Fišer)

1. M. Jani et al.
2. J. Dresler et al.
3. A. Quattrocolo et al.
4. J. Krämer et al.
5. Z. Vehovar et al.

12:30-14. LUNCH

Ecophysiology and Behavior
(chair: F. Samu)

1. M. Bartos
2. N. Viel et al.
3. C. Ortiz Movliav
4. J. Wolff et al.
5. L. Sentenska

15:30-16. COFFEE BREAK

Ecophysiology and Behavior
(chair: L. Sentenska)

1. F. Samu
2. S. Kralj-Fišer et al.
3. O. Michálek et al.
4. N. Beydizada et al.
5. Y. Zvik et al.
6. Cabon et al.

18-20. POSTERS AND DRINKS

Tuesday 27th

9:30-10:30. Key-note: **Some blind spots in spider biology** (R. Foelix) (chair: G. Uhl)

10:30-11. COFFEE BREAK

Ecology (amphi A)
(chair: Y. Lubin)

1. E. Gravesen
2. M. Isaia et al.
3. G. Kmira et al.
4. T. Hamřík et al.
5. L. Černecká et al.
6. Z. Ganem et al.

Zoology (amphi B)
(chair: G. Uhl)

1. E. Crepet et al.
2. A. Derdak et al.
3. Y. Simone et al.
4. P. Michalik et al.
5. A. Rivera
6. V. Mackevicius et al.

12:30-14. LUNCH

Ecology (amphi A)
(chair: M. Isaia)

1. F. Cortés-Fossati et al.
2. C. Komposch et al.
3. T. Fusco et al.
4. M. Marquerie et al.
5. M. Segoli et al.
6. A. Melcher et al.

Zoology (amphi B)
(chair: P. Michalik)

1. I. Jędrzejowska et al.
2. E. Propistsova et al.
3. M. Belal Talukder et al.
4. C. Müller et al.
5. S. Karikó et al.
6. L. Dersch et al.

15:30-16. COFFEE BREAK

16-18. Symposium: **Spiders in Agriculture** (chair: K. Birkhofer, M. Entling & R. Michalko)

Introduction
1. M. Edo
2. W. Khum et al.
3. O. Košulič et al.
4. J. M. Reiff et al.
5. E. Canard et al.
6. R. Michalko

Discussion

18-20. POSTERS AND DRINKS

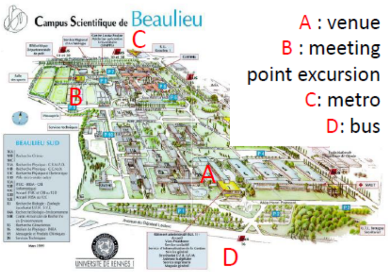
Wednesday 28th

Mid-congress excursion: Mont-Saint-Michel Bay (abbey and salt marshes), Saint Malo

Meeting on the 'Diapason parking' (point B on the map below) at **8:30am**

18:30. Back for the 'Peace Party'

Map of the campus



A : venue
B : meeting point excursion
C: metro
D: bus

Thursday 29th

9-10. Key-note: **Diversification of Spiders in the Remote Islands of Oceania** (R. Gillespie) (chair: M. Arnedo)

10-10:30. COFFEE BREAK

Biogeography and Conservation
(chair: M. Arnedo)

1. R. Tripathi
2. V. Opatova et al.
3. C. Vink et al.
4. M. Huszarik et al.
5. K.-H. Jeong et al.
6. H. Kinga et al.
7. D. Hlebec et al.
8. C. Komposch et al.

12:30-14. LUNCH / GROUP PHOTOGRAPHY

Ecology
(chair: M. Řezáč)

1. A. Bellvert et al.
2. A. Vasiliev et al.
3. E. Gavish-Regev et al.
4. A. Piquet et al.
5. M. Tolve et al.
6. Y. Alioua et al.

Systematics
(chair: P. Jaeger)

1. W. Lourenco
2. K.-P. Yu et al.
3. K. Wiśniewski et al.
4. Arnedo et al.
5. G. Hormiga et al.
6. P. Kontos et al.

15:30-16. COFEE BREAK

Ecology
(chair: A. Zamani)

1. B. Schnerch et al.
2. E. Piano et al.
3. A. Sozontov
4. R. Bucher et al.
5. N. Zarikian et al.
6. F. Hosseini et al.

Systematics
(chair: T. Szűts)

1. R. Shida et al.
2. J. Miller et al.
3. P. Jaeger
4. R. Minjares et al.
5. J. Korba et al.
6. A. Henrard et al.

19-24. CONGRESS DINNER / DANCE

Friday 30th

9:30-10:30. Key-note: **Picturing arachnids in systematics** (N. Dupérré) (chair: C. Rollard)

10:30-11. COFFEE BREAK

11-12:30. Symposium: **Publishing strategies and publishing options** (chair: G. Uhl)

Impulse talk: G. Uhl
Arachnology Journals: profiles by the editors
Peer Community In: D. Bourguet & T. Guillemaud
Discussion

12:30-14. LUNCH

Systematics
(chair: V. Opatova)

1. T. Szűts et al.
2. D. Harms et al.
3. S. Shafaie et al.
4. A. M. Sanz-LaParra et al.
5. T. Blick
6. J. Novák et al.
7. H.-Y. Lin et al.
8. Y. Marusik et al.

15:45-16:15. COFFEE BREAK

16:15-17:30. General Assembly of the ESA

16:15-16:30. Honorary memberships

16:30-17:15. Society matters, election

17:15-17:30. Student prizes for best talks and posters

List of talks (Amphi A)

Sunday 25th pm

17-19:15. Symposium: **Genomics of Arachnids** (chair: V. Ivanov & Y. Schöneberg)

1. M. Pavlek // Why sequence genomes of cave Arachnids?
2. Y. Schöneberg et al. // Developing a standardized multi-locus barcoding approach for spider taxonomy
3. M. Arnedo et al. // We are small, but we are many: comparative genomics of the red devil Dysdera spiders in the Canary Islands
4. A. Sanz et al. // The dwarfs that crossed the Ocean: exploring the diversity of Hawaiian linyphiids
5. S. Simona Kralj-Fišer et al. // Sex-specific maternal effects: Establishing methodological resources in a species with extreme sexual-size dimorphism
6. V. Ivanov et al. // Genomics of mating behavior in closely related black widow spiders (Latrodectus hasselti and L. katipo, Theridiidae)
7. H. Krehenwinkel et al. // Analyzing temporal changes in dietary composition by gut content metabarcoding from archived spider specimens
8. L. Trębicki et al. // Development of cost-efficient method for DNA barcoding of century old museum specimens of spiders and its importance for taxonomic research

Monday 26th

9-9:30. **Welcome words**

9:30-10:30. Key-note: **Defences in arachnids: what do we know and where should we go** (S. Pekar) (chair: S. Kralj-Fišer)

11-12:30. **Ecophysiology and Behavior** (chair: S. Kralj-Fišer)

1. M. Jani et al. // A multimethod approach to study the behavioral utilization of spider silk glands
2. J. Dresler et al. // A roadmap to spider venom enzymes
3. A. Quattrocolo et al. // Comparison of venom efficacy of euryphagous and ant-eating spiders against different prey
4. J. Krämer et al. // Equipped for Sexual Stings? The Male-Specific Venom Profile of Euscorpius italicus
5. Z. Vehovar et al. // Exploring mating system and sexual cannibalism in a raft spider

14-15:30. **Ecophysiology and Behavior** (chair: F. Samu)

1. M. Bartos // How to bite the prey when it is your first hunt?
2. N. Viel et al. // Same-Same but different: common garden experiments in the range-expanding spider *Zodarion rubidum* (Araneae, Zodariidae)
3. C. Ortiz Movliav // Surviving at the edge: Physiological mechanisms and gene expression patterns in a latitudinally range-expanding spider
4. J. Wolff et al. // Targeted capture of weaver ants with a unique power-amplified silk trap in a tropical cobweb spider (Theridiidae: *Propostira* sp.)
5. L. Sentenska // The function of self-sacrificial behaviour in the brown widow spider

16-17:30. **Ecophysiology and Behavior** (chair: L. Sentenska)

1. F. Samu // The key to agrobiont adaptation is a unique response to daylight changes in the cohort splitting wolf spider, *Pardosa agrestis*
2. S. Kralj-Fišer et al. // Transgenerational effects of maternal feeding on reproductive and offspring traits in *Nephilingis cruentata*
3. O. Michálek et al. // Venom composition of two prey-specialised spiders
4. N. Beydizada et al. // Who is likely to cheat? Linking personality to deception in a gift-giving spider
5. Y. Zvik et al. // Springtime Hitchhikers: First Record of Phoresy in Pseudoscorpions on a Scorpion Host
6. Cabon et al. // Inter-specific comparison of temperature-size relationships in spiders along an urbanization gradient

Tuesday 27th

9:30-10:30. Key-note: **Some blind spots in spider biology** (R. Foelix) (chair: G. Uhl)

11-12:30. **Ecology** (amphi A) (chair: Y. Lubin)

1. E. Gravesen // Arthropod food webs in the foreland of a retreating Greenland glacier: Combining molecular gut content analysis with SEM
2. M. Isaia et al. // A tale from the rugged mountains: advances on the conservation ecology of *Vesubia jugorum*, assessed as EN by the IUCN Red List
3. G. Kmira et al. // Ecological Drivers of Riparian Spider Communities (Araneae) in North-Western Tunisia: Unveiling Patterns of Diversity
4. T. Hamřík et al. // Effect of clear-cutting and retention forestry on the biodiversity of ground-dwelling spiders in commercial floodplain forests
5. L. Černecká et al. // Effect of the nutritional quality in the quadri-trophic food web interaction
6. Z. Ganem et al. // Energy source is a good predictor for predator assemblage and food-webs in Levantine caves

14-15:30. **Ecology** (amphi A) (chair: M. Isaia)

1. F. Cortés-Fossati et al. // Evolution of highly toxic venoms in spiders
2. C. Komposch et al. // GLORIA Extended – A new zoological approach for a summit- and climate monitoring! Arachnological results in Austria
3. T. Fusco et al. // Ground spiders (Chelicerata, Araneae) of an urban green space: intensive sampling in a protected area of Rome (Italy) reveals a high diversity and new records to the Italian territory
4. M. Marquerie et al. // Diversity and structure of spider communities are mainly determined by vegetation structure at local spatial scales in a forest
5. M. Segoli et al. // Invasive brown widow spiders (*Latrodectus geometricus*) thwart their parasitoids
6. A. Melcher et al. // Land use effects on the functional role of spiders in German permanent grasslands

16-18. Symposium: **Spiders in Agriculture** (chair: K. Birkhofer, M. Entling & R. Michalko)

1. M. Edo // Agroforestry systems to support spider diversity in European farmland
2. W. Khum et al. // Effect of local and landscape factors on predator-prey food web in mango orchards
3. O. Košulič et al. // Effect of spiders and birds on vitality parameters of pear trees in organic orchards
4. J. M. Reiff et al. // Effects of fungus-resistant varieties and organic management on spider assemblages in vineyards
5. E. Canard et al. // Involvement of spiders in the regulation of sugar beet pests
6. R. Michalko // The impact of intraspecific variability on the biocontrol potential of spiders

Thursday 29th

9-10. Key-note: **Diversification of Spiders in the Remote Islands of Oceania** (R. Gillespie) (chair: M. Arnedo)

10:30-12:30. **Biogeography and Conservation** (chair: M. Arnedo)

1. R. Tripathi et al. // Assessment of spider assemblages and their responses to grazing regulation in the Great Indian Bustard habitat of Desert National Park, Rajasthan
2. V. Opatova et al. // Biogeography and species delimitation of the Western Mediterranean trap-door spider genus *Amblyocarenum* (Araneae, Nemesiidae)
3. C. Vink et al. // Getting rid of unwanted Australians – Developing a pheromone tool for the eradication of *Latrodectus hasseltii* in New Zealand
4. M. Huszarik et al. // Investigating indirect effects of stream pollution on the diet of *Tetragnatha montana* using DNA metabarcoding
5. K.-H. Jeong et al. // Road to cave: speciation hypothesis of *Spelaeochthonius*
6. H. Kinga et al. // Spider Community Composition in Different Forests in Ghana
7. D. Hlebec et al. // Rampant convergent evolution in pseudoscorpions from disparate cave systems: Hawaiian lava tubes and Europe's Dinaric caves
8. C. Komposch et al. // Reaching for the skies – Arachnological canopy research in the Alps (Arachnida: Araneae, Opiliones)

14-15:30. **Ecology** (chair: M. Řezáč)

1. A. Bellvert et al. // May it be a light to you in dark places: understanding distribution and interactions among European subterranean spiders
2. A. Vasiliev et al. // New Spider Families in Moldova: Miturgidae, Oecobiidae, Zodariidae; conservation status of the genus Atypus in Moldova
3. E. Gavish-Regev et al. // Revisiting the pseudoscorpions of Israel – an unexplored diversity
4. A. Piquet et al. // Spider diversity along an urbanization gradient through space and time
5. M. Tolve et al. // Spiders along elevational gradients: who is in danger?
6. Y. Alioua et al. // Spiders and scorpions of the Algerian Sahara: Review and new records (Araneae; Scorpiones)

16-17:30. **Ecology** (chair: A. Zamani)

1. B. Schnerch et al. // Web-building spiders as biocontrol agents in apple orchards under different management practices
2. E. Piano et al. // The importance of being green: increasing green coverage in cities affects taxonomic and functional diversity of spiders
3. A. Sozontov // Digitizing spider biodiversity data: from literature legacy to digital lake
4. R. Bucher et al. // The role of spiders in the cascade from land use to crop yield - a pan-European synthesis
5. N. Zarikian et al. // Urbanization and Spider Diversity in Armenia
6. F. Hosseini et al. // Investigating arthropod biodiversity in the Hyrcanian Caspian Forest using eDNA metabarcoding of spiders' webs

Friday 30th

9:30-10:30. Key-note: **Picturing arachnids in systematics** (N. Dupérré) (chair: C. Rollard)

11-12:30. Symposium: **Publishing strategies and publishing options** (chair: G. Uhl)

Impulse talk: G. Uhl

Arachnology Journals: profiles by the editors

11:50. Peer Community In: D. Bourguet & T. Guillemaud

14-15:45. **Systematics** (chair: V. Opatova)

1. T. Szűts et al. // Opening Pandora's box: Integrative taxonomy of *Eresus*
2. D. Harms et al. // Re-analyzing a true villain of spider taxonomy: biodiversity and toxin analyses for the Sydney funnel-web spider *Atrax robustus*, a deadly arachnid icon
3. S. Shafaie et al. // Taxonomic insights into Iberian *Zodarion* species (Araneae, Zodariidae): morphological documentation and molecular characterization of the *rubidum* and *styliferum* groups
4. A. M. Sanz-LaParra et al. // The dwarfs that crossed the Ocean: exploring the diversity of Hawaiian linyphiids
5. T. Blick // The tools of the World Spider Catalog and of Spiders of Europe and how everybody can contribute
6. J. Novák et al. // Integrative taxonomical approaches in the exploration of the diversity of the Carpathian *Neobisium* pseudoscorpions (Arachnida: Pseudoscorpiones: Neobisiidae)
7. H.-Y. Lin et al. // A temperate group living in a subtropical country: Species delimitation of leaf-litter dwelling *Allochthonius* (Pseudoscorpiones: Pseudotyrannochthiniidae) in Taiwan
8. Y. Marusik et al. // Striking diversity and startling ranges of wandering spiders (Araneae) found in tundra zone in Northeastern Siberia

16:15-17:30. General Assembly of the ESA

16:15-16:30. Honorary memberships

16:30-17:15. Society matters, election

17:15-17:30. Student prizes for best talks and posters

List of talks (Amphi B)

Tuesday 27th

11-12 :30. **Zoology** (amphi B) (chair: G. Uhl)

1. E. Crepet et al. // Across the spiderverse: comparative analysis of metals in spiders' mouthparts
2. A. Derdak et al. // Comparison of the ovary structure in Parasitengona mites (Chelicerata, Acariformes)
3. Y. Simone et al. // Crushers can't be graspers: diversification of scorpion chela diversity toward two opposite functional optima
4. P. Michalik et al. // Directional genital asymmetry and copulatory mechanics in the midget funnel-web spider *Mecicobothrium thorelli* (Araneae, Mecicobothriidae)
5. A. Rivera // Eye-brain system coevolution
6. V. Mackevicius et al. // Molecular identification and symbiont insights in invasive *Mermessus* (Araneae: Linyphiidae) spp. from Israel

14-15 :30. **Zoology** (amphi B) (chair: P. Michalik)

1. I. Jędrzejowska et al. // Pseudoscorpions - an insight into adaptations for matrotrophy
2. E. Propistsova et al. // Retinal Determination Gene Network dynamics in *Tegenaria pagana* C. L. Koch, 1840 (Araneae: Agelenidae) spider embryos
3. M. Belal Talukder et al. // The Nose of Spiders: Olfactory Sensilla in Male Wasp Spiders and Beyond
4. C. Müller et al. // Ultrastructural diversity of trichoid sensilla in a spider: did olfactory sensilla evolve from contact-chemoreceptive sensilla?
5. S. Karikó et al. // Unraveling the mysteries of eggsac construction and silk from the micro to nano scale of the ground-dwelling spider *Castianeira* sp. (Araneae: Corinnidae)
6. L. Dersch et al. // The biological role of linear wolf spider venom peptides: Lessons from activity-guided characterizations

Thursday 29th

14-15:30. **Systematics** (chair: P. Jaeger)

1. W. Lourenco // Curiosities about scorpions trapped in amber
2. K.-P. Yu et al. // Evolution of diverse lifestyles in nursery web spiders (Araneae: Pisauridae)
3. K. Wiśniewski et al. // A snapshot study of the diversity of spiders (Araneae) in the isolated forest patch on Madagascar
4. Arnedo et al. // Too old to date, too young to age: Deep calibrations overestimate colonization time of the Canary Islands in red devil spiders (Dysderidae)
5. G. Hormiga et al. // The spider genus *Juanfernandezia* (Linyphiidae) in the south Pacific Archipelago of Juan Fernández
6. P. Kontos et al. // Hidden residents of Ethiopia: The Assamiidae of Bale mountains and adjacent Volcanoes

16-17:30. **Systematics** (chair: T. Szűts)

1. R. Shida et al. // Exploring hidden diversity: unveiling distinct species groups in the genus *Ariadna* Audouin, 1826 (Araneae, Segestriidae)
2. J. Miller et al. // Global Patterns in Spider Occurrence Data: Monitoring Cryptic Fauna in an Era of Human Observations Networks and Computer Vision Models
3. P. Jaeger // Hidden Treasures in Limestone Caves: Spiders in the Vangvieng Karst of Laos
4. R. Minjares et al. // Patterns of morphological diversification in dwarf red devil spiders (Araneae, Dysderidae, Harpacteinae)
5. J. Korba et al. // Biogeography and systematics of the dwarf tarantula genus *Ischnocolus* (Araneae, Theraphosidae)
6. A. Henrard et al. // Radiation within the Ant-Eating Cryptothelinae (Araneae, Zodariidae) in the Vanilla Islands

Abstracts

Ecology and Faunistic

Spiders and scorpions of the Algerian Sahara: Review and new records (Araneae; Scorpiones)

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Abstract

In Algerian desert ecosystems, spiders and scorpions are understudied, and sufficient information regarding their biodiversity are still lacking. The present survey aims to summarize the global list of Araneae and Scorpiones for the Algerian Sahara. Based on literature citations and the results of our recent samplings (2010- 2024), this region, which covers over 2 million km², is home to 296 species of spiders belonging to 167 genera and 37 families, and 35 species of scorpions belonging to 12 genera and two families. The families with the greatest diversity are Gnaphosidae (Araneae), with 63 Species, and Buthidae (Scorpiones), with 32 species. This list, attests to a very important diversity, with 48 endemic spiders corresponding to more than 16% of the Saharan list and a large part of endemic scorpions (26 species). Our findings have raised the Saharan list of spiders and scorpions with respectively 74 and 14 species. Among the important results, the study reports 20 new records of spiders for the country and the discovery of 11 new species of scorpions for science. Considering the taxonomic complexity of spiders and scorpions, particularly on the morphological level, their discreet habits, and the potential risks of handling them (especially scorpions), we assume that this list is not exhaustive and that there is a strong possibility of the existence of other species that have not yet been identified.

Keywords: Arachnida, Arid ecosystem, Algeria, Diversity, species range.

May it be a light to you in dark places: understanding distribution and interactions among European subterranean spiders

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Understanding biodiversity patterns and how they will be affected by global change is a major global challenge. Based on projected negative trends of biodiversity change, conservation plans have been developed to protect the distributional ranges of threatened species. However, caves and other subterranean habitats has been largely overlooked in global conservation plans, and we still have a poor understanding of subterranean species distribution, their biotic interactions, and how they respond to different anthropogenic threats. A common practice to understand species distributions is the use of species distribution modelling. However, these methods predict species distributions based exclusively on their responses to climatic or other abiotic factors, ignoring possible positive or negative species interactions or other biotic responses that can shape species distributions. Here, we propose using joint species distribution models to understand the distribution and species interactions among European subterranean spiders. These models estimate the distribution of multiple species simultaneously and allow decomposition of species co-occurrence patterns into components describing shared environmental responses and residual patterns of co-occurrence. By considering both climatic interactions and other biotic and abiotic factors, we present the most up-to-date and accurate species richness map of European cave spiders and shed light on how these species interactions shape their distributions. Stemming from these predictions, we will be able to evaluate if the Natura 2000 network of protected areas adequately cover subterranean spiders, and how we can move forward to improve the situation within the “30x30” agenda by the European Union.

Effect of spiders and birds on vitality parameters of pear trees in organic orchards

Bernatová M., Košulič O., Sam K., Purchart L., Michalko R.

Both vertebrate and invertebrate predators can effectively reduce pest populations in agroecosystems. However, studies investigating the combined effects of vertebrate and invertebrate predators, especially their impact on tree physiological vitality, are lacking.

We investigated the impact of microhabitat complexity through manipulative treatments designed to increase invertebrate predators (using cardboard bands on trunks and branches) and/or exclude insectivorous birds and bats. The fitness of pear trees was assessed, including chlorophyll fluorescence measurements, SPAD levels, and the populations of herbivores and predators, sampled by the beating method throughout the growing season in four organic pear orchards. We hypothesized that the complementary effect of arthropod and vertebrate predators would lead to the best vitality parameters in pear orchards.

Contrary to our hypothesis, the best physiological parameters were recorded for trees with a combination of cardboard bands and the exclusion of birds and bats. Similarly, the overall abundance of spiders and various spider hunting guilds significantly increased on trees with the combination of cardboard bands and the exclusion of birds and bats. Herbivores, especially sap-sucking insects, were least numerous under these conditions, with the highest abundance observed on control trees. Therefore, supporting spiders through increased microhabitat complexity and protection against predatory birds led to a reduction in pests, positively affecting physiological vitality parameters.

Our results highlight the importance of supporting natural pest predators, especially spiders, in orchards. However, it is evident that these interactions could be disrupted by insectivorous vertebrates, which can have a negative cascading effect on the vitality of pear trees.

Spider community in cereal–legume association

Valentin Boulais, Yann Tricault, Manuel Plantegenest, Franck Duval, Elsa Canard

Spiders are a major and rich community of generalist natural predators in agricultural landscapes. This community has the potential to provide general and simultaneous natural regulation of several crop pests, depending on the species present and their ecological traits. Many factors can influence their community composition and abundance, and this knowledge could enable us to better assess, predict and manipulate their contribution as crop auxiliaries.

Here, we study the spider community living in cereal-legume fields, a mixed crop that is currently a major challenge in France, as it could make it possible to offset soybean imports, but suffers from multiple pest damage. We describe spider community at different time in the cropping season and at different place in the field (at the border or in the center) and in multiple conventional and organic fields of faba beans-cereal. We make the link between the functional groups of spiders present and their potential involvement in prey consumption, especially of crop pests (aphids, bruchids and sitones).

The role of spiders in the cascade from land use to crop yield - a pan-European synthesis

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Abstract (Symposium: Spiders in Agriculture)

Intensive land use secures food production, but is often detrimental to biodiversity and associated ecosystem services, thus threatening food security in the longer term. It is questionable whether the yield gap from reducing land-use intensity can be closed by enhancing ecosystem services (i.e., ecological intensification). To quantify the direct and indirect links between local and landscape level land-use intensity, several biodiversity metrics, ecosystem services and yield, we re-analyzed 37 datasets including spider community composition and pest control information on European farmland. Increases in land-use intensity reduced the abundance of spiders, supporting recent findings on the detrimental effects of land-use change on arthropod biomass. For datasets including spiders, crop yield was strongly determined by land-use intensity. Spider species richness was the only variable among the taxa studied that was negatively related to a higher percentage of arable land in the surrounding landscape. Our contrasting results provide evidence that spiders benefit from reductions in land-use intensity. However, increases in spider abundance did not improve pest control or crop yield. We suggest that this is due to the complexity of predator-prey interactions, which often include intraguild predation, which can dampen top-down control of pests. Our results suggest that the potential for ecological intensification varies between taxonomic groups and ecosystem services. In the context of current efforts to reduce land-use intensity (e.g. organic farming), our study of several invertebrate groups suggests potential for ecological intensification in crops where pollination limits yield, but not for pest control.

Inter-specific comparison of temperature-size relationships in spiders along an urbanization gradient

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Abstract

Urbanization generates constraining environmental conditions for organisms, in particular due the elevated temperatures, commonly referred to as the urban heat island (UHI) effect. Along urbanization gradients, temperature variations can be measured at scales ranging from the landscape to the microhabitat. As ectotherms, spiders are likely to be affected by UHIs, because warming directly induce physiological effects on their metabolism. Body size is often used to study arthropods' responses to thermal stress, but the determinant scale of temperature variation in the urban context remains to be determined. Furthermore, species' life-history traits may influence responses to urban warming. To investigate patterns of temperature–size relationships across contrasting spatial scales and trait syndromes, we measured 2283 spider individuals collected on 36 grasslands distributed along a broad urbanization gradient in Rennes (France). These measured individuals covered 11 species belonging to the Hahniidae, Linyphiidae, Lycosidae and Tetragnathidae. We found links between body size and temperature in the two Lycosids *Pardosa prativaga* and *Pardosa pullata*, whereas no effects were observed regarding the nine other examined species. In both *Pardosa* species, sex modulated the response to temperature, with females being more affected than males. Our inter-specific comparison indicates that species with particular trait syndrome (i.e., larger body size, low dispersal capacity and univoltine life-cycle) are more constrained by temperature than small and bivotline species that can disperse aerially. These results on spiders highlight that considering species-specific life history traits can help to understand patterns of size-temperature relationships and better predict phenotypic changes among arthropods under anthropogenic warming.

Keywords

Araneae, climate warming, intraspecific trait variation, morphological traits, urban ecology, urban heat island

Involvement of spiders in the regulation of sugar beet pests

Elsa Canard, Pierre Gendron, Ségolène Buzy, Nathalie Prunier-Leterme, Manuel Plantegenest

Spiders are generalist predators present in a multitude of environments, including agricultural ones, and they can consume a wide panel of prey. Their involvement in the natural regulation and control of pest populations has been demonstrated but is not always taken into account. Here we analyze their contribution to the control of aphid populations transmitting sugar beet yellows virus (BYV). We describe their community in these highly unstructured and antropic environments, and reveal their diet along the growing season thanks to molecular analysis of their gut content. Finally, we compare their contribution to that of another main generalist predator community of agricultural environments, the carabid beetle.

Evolution of highly toxic venoms in spiders

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ABSTRACT

Venom is a fundamental tool in the predatory activity of spiders. Although most species have low toxicity venoms, certain lineages present highly toxic cocktails, which can be lethal to animals that are orders of magnitude larger in size than spiders. Natural selection on any trait is ruled by a cost-benefit balance: very expensive traits are optimized in energetic terms and not oversized. The existence of apparently excessive venoms must be due to an evolutionary adjustment of the venom to the needs of the organism. A literature study has been carried out to shed light to the evolution of highly toxic venoms in the order Araneae. Our results show that highly toxic venoms are concentrated in very specific lineages. We present four evolutionary hypotheses that could explain the appearance of these highly toxic venoms in the evolutionary history of spiders. Presence of highly toxic venom may be due to: H1) defensive adaptation against powerful predators; H2) adaptations for the subjugation of unusually strong prey; H3) adaptations for the subjugation of prey in ecological contexts in which prey are very scarce. In addition, H4) the potency of venom is correlated to a more aggressive behavior of the individual, since there must be a compensatory behavioral pattern to avoid the expenditure of that poison that is so costly to produce. Thus, it seems that not any ecological scenario leads to the development of these powerful venoms, but rather there must be specific conditions in which natural selection shapes these unusually high toxic cocktails.

Keywords: evolutionary ecology, spiders, toxins, venom evolution

Horses and sheep grazing influence arachnid assemblages on dry grassland of the Causse Mejean (Lozère, France)

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Spiders are one of the most important zoological groups in the terrestrial biocenosis and found in all environments. The aims of this study were to 1) analyse the distribution of arachnids according to different types of grazing systems, 2) measure the impact of different environmental factors and 3) complete the list of arachnid species present on the dry grasslands of the Causse Mejean (South-Est France). Three sites were studied, grazed by different herbivores: sheep, domestic horses, and Przewalski's horses – introduced for species conservation in order to translocate social groups in Asian steppes. Fifteen pitfall traps were placed on each plot to sample firstly coprophagous Coleoptera and then removed after three days. After sorting and identifying spider species, statistical analyses on Rstudio were carried out. Lycosidae, Gnaphosidae and Opilions were found in greater numbers and our results show that the type of grazing system and the environmental factors influence the abundance and distribution of spider assemblages, especially the most abundant families and species recorded on the study area. We found significantly more Opilions and Linyphiidae on the sheep's plot and the herbaceous cover had a negative effect on Gnaphosidae such as *Gnaphosa opaca* but a positive effect on Lycosidae such as *Pardosa monticola*. Our study gives interesting results on the effects of different grazers on arachnid assemblages but our results remain to be improved and additional analyses should be done.

Key words: conservation biology, Przewalski's horses, spiders, opilions, grazing.

The biological role of linear wolf spider venom peptides: Lessons from activity-guided characterizations

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Venom is one of the primary innovations that spiders use to overpower prey, but much remains to be learned about venom chemistry and function. Spiders of the RTA-clade, and in particular wolf spiders of the genus *Lycosa*, have unique venoms containing linear cytolytic peptides. Despite their simple, linear and amphipathic alpha-helical structure, they can exert a range of activities and thus serve multiple functions. However, only few such peptides have been studied in more detail. Here we explore the bioactivity profile of an entire family of such biomolecules, the A-family of cytolytic peptides previously identified from *Lycosa shansia*. Via *in silico* analyses, we show that they exhibit the typical structural traits of spider cytolytic peptides and are of high similarity to antimicrobial peptides known from frog poisons. We synthesized all members and tested their activity against bacteria, viruses, mammalian cells and potential insect prey thereby revealing activity only against microbes. Our findings refute a biological relevance in hunting or defense but support a role in protecting the venom glands from bacterial infections. Additionally, we explored whether or not the peptides antimicrobial activities can be enhanced through bioengineering approaches. Therefore, we generated a panel of artificial derivatives and screened their activity in comparison to natural versions. On several instances, we successfully increased the antimicrobial effects while retaining low levels of cytotoxicity. Our results show, that even singular amino acid exchanges can dramatically alter the bioactivity profile of such peptides and suggest a tremendous potential for evolutionary tinkering as driver of venom component diversification. Overall, our work sheds new light on the chemical ecology and structure-function relationships within lycosid venoms and adds to our growing understanding of spider venom as source of novel anti-infectives.

Diversity and biomass of spiders in permanent plots of arable land

First results from the Insect Biodiversity Monitoring in the state of Baden-Württemberg (Germany)

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In 2017, the state government of Baden-Württemberg adopted a "special program to strengthen biodiversity" in order to identify possible factors influencing the loss of species observed worldwide (keyword "insect extinction"). As part of this special program, the State Institute for the Environment (LUBW) was commissioned to set up a statewide insect monitoring program in order to create a database on regional population trends of insects and other animal groups such as spiders. As the main location of the State Biodiversity Repository, the State Museum of Natural History Karlsruhe (SMNK) is responsible for the samples from the insect monitoring programs "Biomass Soil", “Forest Ecosystems” and “Black Forest National Park”, which includes the processing of spider material. Another important topic is the preservation and accessibility of data, because the access to data on invertebrate diversity from systematic studies still remains limited. Therefore, all spider data generated during the monitoring program are provided through the ARAMOB data portal in order to make the data available in accordance with the FAIR data principles.

On the poster, we will present detailed information on the methods used for the statewide insect monitoring program and give first insights in the results of spider assemblages.

Agroforestry systems to support spider diversity in European farmland

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Agricultural intensification has greatly modified landscapes throughout Europe. The removal of semi-natural elements, which represent habitats of high value for many taxa, is one of the major causes of the ongoing decline of biodiversity.

By re-integrating structural diversity into agricultural areas, agroforestry systems have the potential to fulfill both productivity and environmental needs by enhancing biodiversity and thus related ecosystem services. However, the effects of agroforestry systems on spiders are poorly investigated, although they play a major role in the natural regulation of crop pests. In this study, ground-dwelling spiders were sampled in fifty-one agroforestry and reference sites across five countries of western Europe using pitfall traps. Agroforestry sites were either silvoarable systems (combining trees with crops) or silvopastoral systems (combining trees with livestock). Reference sites were cropland or pastures, tree plantations and forests.

We expected (1) that the combination of trees and open cropland/pastures in agroforestry systems which enhances habitat heterogeneity and thus microhabitat availability leads to an increase in the abundance and diversity of spider communities, that (2) agroforestry systems provide habitat for both species relying on open habitats as well as forest/woody habitat species and that (3) spider communities depend on vegetation characteristics (e.g. cover and height) and thus, indirectly on the presence of grazing livestock. Preliminary analyses showed a strong influence of habitat type on spider communities. Diversity indices showed that agroforestry systems and cropland/pastures hosted the most diverse spider communities. Furthermore, at the level of community composition, agroforestry systems supported species associated with both open and woody habitats. Our results underline the high potential of agroforestry systems to support diverse spider communities in European farmland as well as the crucial ecosystem functions they provide.

The effects of mosquito control pesticides on the non-target salt marsh spider *Pardosa littoralis*

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The wolf spider *Pardosa littoralis* (Lycosidae) is the dominant predator in salt marshes in eastern North America. It has played a central role in studies on food web dynamics and, more recently, on the effects of sea level rise on salt marsh communities. One of the many anthropogenic impacts on wetlands, such as salt marshes, is the application of pesticides to control mosquitos to minimize disease transmission risks. Modern approaches to combat mosquitos focus on spraying larvicides designed to act specifically on a narrow range of target species (*Bti* protoxins), but also commonly involve the application of broad-spectrum larvicides (insect growth regulators such as S-Methoprene), as well as adulticides (mostly pyrethroids). However, direct effects of IGR- and *Bti*-containing products on non-target species have rarely been tested beyond immediately co-exposed aquatic species and potential interactive effects with pyrethroids are poorly understood. Here we test for the effects of the larvicides VectoBac® (*Bti*) and VectoPrime® (Bti + S-Methoprene), and of the pyrethroid adulticide Sumithrin on mating and prey capture behaviors in *P. littoralis.* We applied pesticides at field concentrations sequentially (larvicides -> adulticides), reflecting their application in the field, and videotaped all trials for detailed frame-by-frame analysis. First results suggest that exposure to VectoPrime® lowered mating propensity but increased prey capture speed and success, while VectoBac® and Sumithrin had no detectable effects. Valent BioScience's proprietary method to combine the *Bti* strain and (S)-Methoprene in a specific toxin ratio in VectoPrime® may involve bio-active compounds, which warrants further study.

The spiders (Arachnida, Araneae) of the Culuccia peninsula (Italy, Sardinia) with new species for the Italian fauna

Spiders (Arachnida: Araneae) represent one of the most varied and ecologically significant arthropod groups, inhabiting a wide range of ecosystems and providing essential ecosystem services. The Italian fauna is relatively well known currently, but there are still gaps in knowledge in some parts of the country. For example, there are still gaps in our understanding of certain Southern regions and in some mediterranean areas. The aim of this work is to increase knowledge of the araneofauna in northern Sardinia, particularly the Culuccia peninsula, thanks to targeted sampling in an area with a homogenous habitat.

Samplings took place from April 2022 to April 2023 during different visits to study area. Different techniques were used to catch spiders at different locations on the island and nearby dunes. Specifically, Berlese extractors, Winkler extractors, soil sieves, pitfall traps, entomological umbrella, sweeping net, light trap, malaise trap and active trapping by means of an aspirator were used.

A total of 61 species were identified, of which 8 species are new records for the Italian fauna and 1 for the Sardinian fauna. The most represented families are the Theridiidae, with 9 species, and the Thomisidae, with 8 species. The traps that caught the most species were the malaise trap (15) and pitfalls (11). 15 Species were captured by active trapping, while only 1 species using the berlese extractor and 2 species using the light trap. Finally, 2 species are endemic to Italy.

Ground spiders (Chelicerata, Araneae) of an urban green space: intensive sampling in a protected area of Rome (Italy) reveals a high diversity and new records to the Italian territory

Urbanisation is a rapidly growing global phenomenon leading to habitat fragmentation, and degradation. However, urban areas can offer opportunities for conservation through the presence of green spaces which can even provide important habitats for imperilled species. Spiders include many species that can successfully exploit urban environments. Italy possesses an exceptionally rich spider fauna, yet comprehensive data on urban spider communities are still limited. More information on urban spiders in Italy would be extremely beneficial to support conservation efforts, especially in central and southern Italy.

The current study focused on the spider diversity of a large protected area (Appia Antica Regional Park) in urban Rome, Italy. A total of 120 spider species belonging to 83 genera and 28 families were identified, with 70 species being new records to the Province of Rome, 39 to the Latium Region, and two (*Pelecopsis digitulus* Bosmans & Abrous, 1992 and *Palliduphantes arenicola* (Denis, 1964)) to Italy. Forty-one species were recorded during autumn/winter sampling and 107 in spring/summer. The most represented families in terms of species richness were Gnaphosidae and Linyphiidae, which accounted for more than 40% of the sampled fauna. Lycosidae were the most abundant family, followed by Zodariidae, Linyphiidae and Gnaphosidae. From a biogeographical point of view, most of the collected species belonged to chorotypes that extend for large areas across Europe and the Mediterranean. The research highlights the role of urban green spaces as refuges for spiders and the importance of arachnological research in urban areas.

The current state of knowledge of the spider fauna of Slovakia (2024)

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The aim of the presentation is to inventory and summarize knowledge about spiders in Slovakia and compare it with the Catalogue of Slovakian Spiders (Gajdoš et al. 1999), which list 927 species (35 ones were questionable) and with the later work Spiders of Slovakia (Gajdoš et al. 2018), which lists 969 spiders. In 1999, the national database contained 72,160 records from 2656 sites, now this number has more than tripled (226,612 records from 7992 sites). In addition, it was necessary to reconsider some of the data in the original Catalogue for several reasons: typing errors, misidentifications, excluding verified dubious species, etc. New finds include alien species that reproduce and spread here due to imports or climate change or due to the recent revisions of species After 2018, 34 new species were confirmed for our fauna. An unexpected number of new species have been shown by researches in synanthropic habitats and in insufficiently studied habitat types such as sand dunes, salt marshes and subterranean communities. To date, we register 1003 spider species from 42 families in Slovakia. The presented database is the basis for the currently prepared Red list and 25 spiders selected from it are listed in the Red Book of Invertebrates of Slovakia will published this year. These data are used in conservation practice. They also serve as a starting point for the prepared commented checklist of spiders of Slovakia. The database also contains data on parasitization of spider groups by hymenopters and on spiders as prey of birds.

Funding: VEGA grant 2/0135/22

Energy source is a good predictor for predator assemblage and food-webs in Levantine caves.

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Caves are unique habitats, characterized by the absence of sunlight and primary producers. Caves are often nutrient limited, and their food-webs rely heavily on external resources such as bat guano. We studied how guano affect food-web structure, trophic position of spiders and their assemblage in twilight and dark zones of nine Levantine caves. We identified 36 spider species and morphospecies belonging to 15 families. The most abundant spider families were Agelenidae, Sicariidae, Pholcidae, Linyphiidae, and Filistatidae (that are absence from caves inhabited by insectivorous bats). Using multivariate analysis, we found that spider assemblage composition is significantly affected by guano and cave ecological zone to some extent. Using stable isotope analysis, we found that spiders collected from caves inhabited by frugivorous bats are in higher trophic position (high δ15N) and have different isotopic signal of food source (high δ13C) compared to spiders collected from caves inhabited by insectivorous bats and caves without bats. We also found that the trophic position (δ15N) and isotopic signal of food source (δ13C) of spiders collected from caves inhabited by insectivorous bats were affected by their position along the cave: deep zone spiders were in a higher trophic level and have a different isotopic signal of food source than spiders from the twilight zone. These results were similar for the spider families Agelenidae, Sicariidae, and Pholcidae, that were collected from all caves and zones. As bats and spiders may be affected by anthropogenic activities and climatic changes, our findings have implications for conservation of Levantine caves.

Revisiting the pseudoscorpions of Israel – an unexplored diversity.

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Psudoscorions of Israel were studied by Beier in the 1960's. In his extensive taxonomic publication, Beier listed 31 species in seven families based on local collections. Additional species were identified and described by Halperin, Mahnert and Ćurčić (The troglobite species *Ayyalonia dimentmani*). These studies raised the local diversity to 52 species in twelve families. Following a vast collection effort in the last decade, in epigean and hypogean habitats, and a course on pseudoscorpion taxonomy supported by the Israel Taxonomy Initiative and the National Natural History Collections (NNHC) at the Hebrew University of Jerusalem (HUJ), the number of pseudoscorpion species found in Israel is now 61 in fourteen families, including two families that are reported from Israel for the first time. By revisiting the NNHC-HUJ, and by establishing local expertise, we were able to identify additional ~20 potential species new to science, mostly from hypogean habitats, as well as new ecological information and distributions. The location of Israel at the junction of three continents (Asia, Africa and Europe) leads to a unique combination of fauna from different zoogeographic origins, including nine endemics. Most species found in Israel are of Palearctic and Mediterranean origins, and only a few are from an Afrotropical origin. Additional excursions in the desert and other poorly sampled habitats such as under bark and leaf litter may indicate that this result is a sampling bias, as was found for the hypogean fauna, that was thought to be poor. In this talk I will present the unique local diversity.

Abstract

Combining DNA gut content analysis with structural equation modeling (SEM) based on arthropod activity-density at a Greenland glacier foreland give us the opportunity to combine qualitative data from the metabarcoding technique with an analysis technique based quantitative data.

SEM shows bottom-up and top-down controlled food chains as bottom-up control was important for spider and harvestman populations while top-down control was important for ground beetle populations. These mechanisms are closely related to hunting strategies of the predators as a bottom-up mechanism are connected to a sit and-wait behavior while top-down mechanisms are related to active-search behavior.

Bottom-up controlled population developments were important in the early phase of the vegetation development while top-down prevail in the later phase of the vegetation development away from the glacier snout. The shift from bottom-up to top-down cascades between arthropod predators and their potential prey populations were mainly driven by increasing temperatures away from the glacier.

A consequence of the strong top-down cascades in the later phase of the succession is high rates of intra-guild predation (IGP) among all arthropod predators. Particularly in the guts of the linyphiid spider,£ *Collinsia holmgreni*£ Thorell 1871, trophic linkages to other linyphiid and lycosid spiders were detected. The IGP-ratio of£ *C. holmgreni*£ was negatively correlated with the activity-density of available ground living prey. Probably as a consequence of the high IGP among the linyphiid spiders, cold adapted linyphiid species like£ *C. holmgreni*£ decreased in numbers downhill and became extinct in the warmer climax vegetation, where lycosid spiders dominated.

Spider knowledge in the archipelago of Saint-Pierre and Miquelon, a subarctic French territory on the east coasts of Canada.

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The archipelago of Saint-Pierre and Miquelon is peculiar due to its mosaic of subarctic habitats regrouped on small islands. Those islands were relatively recently inhabited and by a small population, leading to the understudy of many taxa. Spiders are amongst the taxa that were inventoried only recently, but already displayed a consequent number of species. Up until the year 2021, the knowledge of spiders of the archipelago relied only on opportunistic naturalist data , reaching 74 species. In 2021, a PhD thesis dealing with peatbog ecology and using spiders as a model taxon added 68 new species occurrences. A new recent research on the local boreal forests added 6 more. When comparing with Eastern Canadian fauna, a great correspondence with Nunavut and Labrador region is observed, highlighting the subarctic affinity of the archipelago fauna. When considering the regional checklists of spiders, the family proportion of each region and our data, it highlights how much more might be inventoried in the archipelago, notably in understudied habitats other than peat bogs and forests.

Effect of clear-cutting and retention forestry on the biodiversity of ground-dwelling spiders in commercial floodplain forests

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Floodplain forests are among the most endangered ecosystems worldwide, even though they are hotspots for numerous taxa. The abandonment of traditional management and large-scale timber extraction, such as clear-cutting, has led to a decline in floodplain forest biodiversity. Retention forestry has the potential to facilitate the implementation of an ecologically sustainable forest management approach. Despite the increasing popularity of this method, its potential for spider diversity conservation, especially its comparison with the widespread practice of clear-cutting, is still poorly studied. We studied the short-term effect of forestry treatments (dispersed retention with 60 % retained trees and clear-cutting) on the diversity of ground-dwelling spiders in the floodplain forests along the lower Morava (March) and Dyje (Thaya) rivers in the Czech Republic. Spiders were sampled using pitfall traps during 2021 (pre-harvest year) and 2022 (post-harvest year). A total of 10005 specimens from 167 species were recorded. Both forestry treatments simplified habitat structure compared to pre-harvest conditions, resulting in lower beta-diversity within sites. However, dispersed retention had higher alpha and beta-diversity than clear-cuts, indicating that retention provided a more complex-structured habitat. Dispersed retention and clear-cuts hosted distinct spider assemblages with characteristic indicator species. Species typical of open and significantly disturbed habitats preferred clear-cuts, while species typical of forests and (semi-) open habitats, including threatened species, showed a preference for dispersed retention. Our results demonstrated, for the first time, that dispersed retention forestry could serve as an effective management tool for conserving the ground-dwelling assemblages of spiders in floodplain forests.

Keywords: beta-diversity, Central European woodlands, Czech Republic, forest management, indicator species

Diversity, composition, and distribution patterns of spiders in the sand forest, savanna and an ecotone in Phinda Private Game Reserve, South Africa

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Abstract

Spiders are the dominant representative of the top predator guild in many terrestrial ecosystems, but their diversity and distribution in forests in South Africa are still understudied. This study aimed to determine ground-dwelling spider diversity, composition, and distribution patterns in both sand forest and savanna (and their ecotone) using pitfall traps and to provide a spider species checklist for these three habitats in Phinda Private Game Reserve. A total of 410 individuals from 64 species and 20 families were recorded from the three habitat types. The Lycosidae family and *Pardosa* sp. were the most dominant family and species. Spider abundances were similar between sand forest and the ecotone, but lower in savanna. However, species richness was similar across habitats. Spider species assemblages were similar between sand forest and the ecotone, but differed from the species assemblages in savanna. The structure of the sampled habitats may influence spider diversity and distribution in Phinda Private Game Reserve. Arthropods have important roles in ecosystems as pollinators, pest control, and decomposers, and as such affect ecosystem functioning. Therefore, understanding their diversity and distribution will contribute to the overall understanding of the ecosystem thereby promoting conservation efforts of key habitats such as the endemic and highly threatened sand forest habitat.

Keywords: Arachnida; Biodiversity; Conservation; Habitat; Lycosidae; Maputaland;
Richness

Investigating arthropod biodiversity in the Hyrcanian Caspian Forest using eDNA metabarcoding of spiders' webs

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Keywords: eDNA metabarcoding, spider web, Hyrcanian Forest, arthropod diversity

The green belt of the Hyrcanian Caspian Forest is located south of the Caspian Sea and extends from south-eastern Azerbaijan to the Golestan Province in Iran. This area represents a unique and ancient ecosystem characterized by broad-leaved forests dating back millions of years, and fosters a rich biodiversity including relict and endemic plant species. Because of this remarkably high diversity, little is yet known about the taxonomic composition and ecological relationships of arthropods in this region. Recent studies have underscored the profound capacity of spider webs to act as "biofilters," capturing and retaining environmental DNA (eDNA) from many organisms in the habitat, as well as DNA of the spider and its prey remains. In summer 2023, we collected spiders and their webs in the Hyrcanian Forest located in the protected area in northern Iran. The aim was to characterize the arthropod diversity, as well as to reveal trophic relationships among spiders and other arthropod groups. To do this, we applied an eDNA metabarcoding approach to examine the relationship between the eDNA found on spider webs and the dietary habits of spiders by analyzing both spider webs and their gut contents. Our research has unveiled the presence of previously undocumented arthropod species within the studied area, highlighting the effectiveness of this approach in uncovering hidden biodiversity and advancing ecological understanding. This innovative approach can potentially facilitate biodiversity monitoring, detect invasive species, and offer insights into the distribution and ecological dynamics of the taxa inhabiting this unique environment.

A tale from the rugged mountains: advances on the conservation ecology of *Vesubia jugorum*, assessed as Endangered (EN) by the IUCN Red List

Isaia M., Milano F., Tolve M., Piano E.

Vesubia jugorum (Lycosidae) is a wolf spider inhabiting rocky areas of the Southwestern Alps. Due to its restricted geographic range, its sensitivity to global warming and its continuing decline, this species has been assessed as Endangered (EN) in the IUCN Red List. In this work we provide a comprehensive look into the research carried out on this species, encompassing its life history, biogeography, taxonomy and conservation ecology. Our recent studies combine species distribution modelling, phylogeographic inference and traits in the attempt to describe the past and the future of this species. Phylogenetic analyses based on mtDNA show a strong genetic structure of the populations, likely explicable by a long history of isolation and survival in separate refugia. The projection into past climatic conditions supports these results showing a smaller distribution range compared to present. Future forecasts show a shift in the bioclimatic range towards higher altitudes and latitudes, with drastic decrease of habitat suitability, with consequent loss of haplotype diversity. In parallel, we demonstrated a significant relationship between habitat quality and the individual performance of *Vesubia jugorum*, measured by means of functional traits. On these bases, a long-term monitoring program has been designed for evaluating the ongoing impact of climate change on the species survival and for detecting changes in populations through time. Our results point at providing key information for the conservation and management of this endangered endemic species, highlighting the pivotal role that the protected areas of the SW-Alps could play for its long-term persistence.

Impact of canopy opening on spiders and plants in protected oakwoods

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From a historical perspective, habitat heterogeneity in lowland oakwoods was maintained by coppicing. The abandonment of coppicing practices in the mid-20th century led to habitat homogenization, which negatively impacted biodiversity. This study examined the effects of canopy opening, aimed at restoring coppicing, on taxonomic diversity, functional diversity, species composition, and the relationship between vegetation-dwelling spiders and understory vegetation in the protected oakwoods of Podyjí National Park. Twelve plots were selected based on their years since canopy opening and defined as three successional stages: initial, advanced, and late (control). In each plot, three samples of vegetation and spiders were collected along a transect at 15 m intervals. A phytosociological sample of vegetation was recorded in July 2023, and spiders were collected by sweeping in May, June, and September 2023. A total of 950 spider specimens, belonging to 80 species, were collected, including 17 species of conservation concern. Additionally, 177 plant species were recorded, with 26 species classified as endangered and 16 as invasive. The species richness of both plants and spiders increased after canopy opening in the initial and advanced stages. The species richness of conservation-concerned species of plants and spiders peaked in the advanced stage. The functional diversity was lowest in the late stage. Each successional stage supported different communities of plants and spiders, depending on their habitat preferences. There were positive relationships between the species richness of plants and spiders. These results highlight the effectiveness of coppicing as a management tool for maintaining biodiversity in protected oakwoods.

Title: Effect of local and landscape factors on predator-prey food web in mango orchards

Warbota Khum, Stano Pekár, Thoeun Khum, Sokunthet Sok, & Radek Michalko

Local management, landscape structure, and regional abiotic factors can jointly impact trophic interactions in local communities, which may affect the ecosystem functioning and services such as biological control of pests. However, studies on how these factors influence the changes of predator-prey interactions remain scarce. Here, we assessed the effect of landscape structure, regional climatic conditons and farming management practices on predator-prey food webs in mango orchards in Cambodia. We collected the arthropods in 15 mango orchards of similar age (5-10 years) under different farming management (organic and conventional), region (temperature and precipition regimes), and landscape composition (habitat types) and configuration. During the season, we sampled arthropods with sweeping, and beating from mango trees. We then sorted all arthropods to their functional groups. We also collected leaves to estimate herbivory. Our study found that local, landscape and regional factors significantly influenced the abundances of local predator communities. The results have shown that more diverse landscape enhanced local abundances of predators, which coresponded with decreased densities of herbivores and reduced herbivory. This finding highlights that interaction between predators and prey in local mango orchards are shaped by factors operating at different spatial scales.

Keywords: Biocontrol; Management; Landscape; Region; Predator; Herbivore; Herbivory; Mango

Ecological Drivers of Riparian Spider Communities (Araneae) in North-Western Tunisia: Unveiling Patterns of Diversity

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Abstract

Understanding the environmental mechanisms responsible for shaping biological communities has always been a major scientific challenge broadening our comprehension of biological diversity and its evolution across space and time. This knowledge provides insights into ecological processes and adaptation mechanisms, while also aiding in predicting community responses to environmental changes and disturbances. Spiders, known to be an excellent model group in ecological research, are severely understudied in Tunisia, with no ecological work on them having been conducted in the country. Our study seeks to understand the drivers of taxonomic and functional diversity of spider communities in the wetlands of north-western Tunisia, ecosystems known for their ecological importance but also fragility.

The primary objective of this study is to assess the role of environmental filters and species' life-history traits on the diversity, structure, and composition of riparian spider communities. Standardized sampling methods were used to collect data on spider communities in different wetland types in north-western Tunisia. Environmental variables such as temperature, humidity and vegetation architecture were measured to assess their impact on spider community.

Overall, we anticipate significant correlations between environmental variables and both taxonomic and functional spider diversity. Following the habitat complexity hypothesis, we expect both diversities to be positively correlated with habitat heterogeneity. Reedbeds are expected to present low richness, abundance and functional evenness of spiders due to the seasonal disturbance they are subjected to. This study aims to fill the knowledge gap on spiders in Tunisia and to clarify the role of environmental drivers in shaping biological communities.

In vineyards, management and the surrounding landscape can have different effects on spiders. In temperate regions management (organic vs. conventional) may have less strong effects than for other crops. Nevertheless, spiders can benefit from a more natural landscape surrounding the vineyards. To investigate effects on spiders in vineyards beyond the general management regime, we conducted a study in 32 organically managed vineyards with different landscape configuration (vineyards adjacent to hedgerows vs. surrounded by other vineyards). Additionally, in one half of all vineyards the inter-rows were sown with a species-rich cover crop mixture and in the other half were left to spontaneous vegetation. The spider community was assessed by sampling canopy-dwelling spiders with beat-sheets and ground-dwelling spiders with pitfall traps.

Spider communities, analysed at the family level, showed significant differences between the canopy and ground stratum. The overall abundance of spiders in both strata was neither effected by the inter-row vegetation nor by the surrounding landscape. The diversity of spider families in the canopy was positively influenced by adjacent hedgerows. However, spider families responded differently to hedgerows; for example, we found more Araneidae in vineyards without adjacent hedgerows.

The ground-dwelling community was dominated by a single species (*Pardosa agrestis*) and no effects on the species diversity were found. Still, species also showed different reactions, for example *Zodarion italicum* benefitted from spontaneous vegetation. These results show that the impact of inter-row vegetation management and hedgerows on spiders in vineyards is variable and sometimes unexpected.

GLORIA Extended –
A new zoological approach for a summit- and climate monitoring!

Arachnological results from a pilot project in an Alpine National Park in Austria

Julia LAMPRECHT & Christian KOMPOSCH

Abstract

Global warming and its consequences on the fauna and flora are a main research issue. High mountain environments with little to no direct anthropogenic influences provide perfect sites for climate change investigations. Moreover, mountain peaks are hotspots for endemism with an outstanding nature conservation value.

Therefore, the Global Observation Research Initiative in Alpine Environments (GLORIA) developed a standardized method for long-term climate monitoring based on mountain vegetation. Thusfar, about 130 "GLORIA Target Regions" have been established on summits on all continents outside Antarctica. To help understand the causes of vegetation changes, knowledge on the fauna in the monitoring areas is important. However, following the standard GLORIA method, these data were lacking. The time was ripe for the zoological amplification "GLORIA Extended". Arthropods as highly diverse, ectothermic organisms vulnerable to climate warming; thus, stenotopic arachnids and insects act as excellent bioindicators.

We present a standardized, comparable, repeatable and affordable zoological monitoring method for climate change research in high alpine areas, linked to the existing botanical programme.

The zoological sampling sites are set within the summit areas of the well-established GLORIA summit sites. Zoological sampling plots are similar to the botanical ones in terms of relief, structure and vegetation. A zoological cluster, each in a cardinal direction per summit, consists of a main plot with 4 pitfall traps and 3 G-Vac plots.

Within the developed method, on 3 summits in the Gesäuse National Park in Austria a total of 563 spider specimens representing 52 species was trapped, including endemics like *Diplocephalus komposchi*, *Mughiphantes pulcher*, *M. rupium*, *M. styriacus*, *M. variabilis* or *Troglohyphantes noricus*. Also the alien species *Mermessus trilobatus* was detected at an altitude of over 1.800 metres a.s.l.! The new and well-proven zoological methodology hopefully will be soon included in the GLORIA manual.

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Reaching for the skies – Arachnological canopy research in the Alps

(Arachnida: Araneae, Opiliones)

Christian Komposch & Julia Lamprecht

Abstract

Central European forest canopies are – aside from the deep soil strata – the last extensive unexplored habitats of terrestrial ecosystems. In contrast to Central and South America, there are surprisingly few studies in Europe that have focused on these habitats. Although forests cover 48% of the area of Austria and are therefore the most extensive habitat type, the higher stratum fauna has not been studied at all. Knowledge of the treetop fauna is essential for developing an overview of regional species diversity as well as for understanding forest ecosystems; both requirements for establishing sustainable ecological forest management. The chance for gaining an initial insight into the invertebrate fauna of the higher strata of different forest habitats in the Pichl area in the Styrian Mürz valley in Austria made us feel a bit like the German explorer Alexander von Humboldt.

In 2023, zoological sampling was carried out with modified pitfall traps, shelter traps and branch samples in 16 study areas, by professional tree climbers using alpine mountaineering techniques. A total of 30 individual trees across 13 tree species were investigated. We collected 16 invertebrate groups, including Araneae, Opiliones and Pseudoscorpiones.

The most abundant taxon group was spiders with a total of 1.179 specimens recorded, including 5 Endangered and Critically Endangered Red List species. Unsurprisingly the majority were arboreal spiders. Some of them prefer specific tree species: *Moebelia penicillata* and *Salticus zebraneus* were found exclusively or mainly on conifers. The most abundant species was *Lathys humilis*, followed by *Anyphaena accentuata*, *Amaurobius fenestralis* and *Segestria senoculata*. A total of 410 collected harvestman specimens covered 9 species; extreme climatic fluctuations in treetops lead to unsuitable living conditions for sensitive hygrophilic species. Remarkable is the finding of the rare forest-species *Opilio dinaricus*. Some of the species were found at heights of up to 43 metres – a European record!

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Arachnid observations by Pehr Kalm during his journey to North America, 1748-51

Pehr Kalm (1716-79) was a Finnish-born professor of economics at the Royal Academy of Turku (Åbo) in Finland, belonging at that time to Sweden. Carl Linnaeus organized the research journey to North America where Kalm's base was near Philadelphia. He made two long, demanding and dangerous journeys to Canada and to the Niagara Falls. Kalm's main focus was on plants and their economic use, but he observed and collected all kind of nature items, including arachnids.

Kalm described and named five spider species in his travelogue. His species are not valid due to their descriptive "pre-Linnean" names. One example is *Aranea nigra, macula alba in medio dorsi abdominis, maxillis viridibus, pedibus nigris, apice fuscis* (black spider, dorsally white dot on middle of abdomen, maxillas green, legs black, tip brown). Kalm mentioned also pseudoscorpion, harvestman and several mite species. He described and named a tick *Acarus ovalis planus ruber, macula dorsali alba* (flat oval red mite, white dorsal spot) in 1754. Linnaeus named it, based on Kalm's data, in 1758 as *Acarus americanus* (now *Amblyomma americanum),* the well-known "Lone star tick".

Analyzing temporal changes in dietary composition by gut content metabarcoding from archived spider specimens

Henrik Krehenwinkel, Sven Weber, Tim Hörmann, Marie Schneider, Peter Jäger, Anja Melcher

As most important predator of terrestrial arthropods, spiders are a central element of terrestrial food webs. Understanding the dietary preference of different spider species is hence a critical task in ecological research. This task, however, has been notoriously difficult, as it requires the visual observation and taxonomic identification of individual predation events. Recent developments of DNA metabarcoding now provide an efficient alternative to visual observation for dietary characterization in spiders. By sequencing prey DNA from a spider's gut content, its dietary compositions can be rapidly characterized. Gut content metabarcoding for dietary assessment is commonly used in freshly collected spiders with good DNA preservation. Yet another promising source for information on the dietary preference of spiders is found in archived spider specimens. The characterization of the dietary composition of spiders in natural history collections would provide critical insights into the temporal assembly of terrestrial food webs. We here analyze the utility of spiders from different biological collections to provide information on dietary diversity by gut content metabarcoding. The analyzed spiders originate from a natural history museum, an ecological long term monitoring program and a university collection and comprise specimens between a decade and a century of age. Our results show that archived spiders can be used for gut content metabarcoding, but that their utility for this purpose rapidly declines with age and level of preservation. Gut content metabarcoding of biological archives may provide important novel insights into temporal patterns of food web assembly in terrestrial ecosystems and underlines the great importance of natural history collections as biodiversity archives.

Title: Variation of the trophic niches in a community of riparian spiders

Aquatic ecosystems are connected to adjacent terrestrial ecosystems by providing emerging aquatic insects (and amphibians) as high-quality prey for riparian predators. Spiders are major consumers of these subsidies. However, the use of aquatic subsidies is expected to vary among spiders based on hunting mode, the stratum they occupy, and whether they are riparian specialists or habitat generalists. We used gut content metabarcoding on eight spider species from a riparian area to determine the variation in their trophic niche. Metabarcoding enables the examination of ingested food on a fine scale, often species level, as opposed to morphological identification. We expected that riparian specialists and web-building spiders would consume more aquatic prey compared to generalist and free-hunting spiders. Additionally, we hypothesized that plant-dwelling spiders would have a higher proportion of herbivores in their diet compared to ground-dwelling spiders, which would prefer terrestrial detritivores. Preliminary results confirm that all tested spiders feed on aquatic insects, especially non-biting midges (Chironomidae). However, the proportion of aquatic prey varied strongly between spiders, and terrestrial detritivore as well as herbivore prey had variable importance depending on the spider group.

Spiders (Araneae) of the Šumava National Park and Protected Landscape Area (Czech Republic)

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Data on the spider fauna (Araneae) of the Šumava (Bohemian Forest, Böhmerwald) National Park and Protected Landscape Area (southwest Bohemia), gathered in the period 1858–2023, were summarized. We abstracted faunistic data from all available literature and our own research initiated in 1971. In our own research, we focused on all available habitats, both natural ones and those influenced by humans. These included peat bogs, mountains forest, mountain meadows, wetlands, riverbanks and buildings.

Altogether, we identified a total of 455 spider species, many of which belong among rare and endangered in the Czech Republic. Overview of their ecological preferences and importance for nature conservation are provided. Within the Czech Republic, nine species are found only in Šumava: *Carorita limnaea*, *Centromerus dilutus*, *Dictyna major*, *Gnaphosa badia*, *G*. *microps*, *Micaria aenea*, *Pardosa ferruginea*, *P*. *hyperborea* and *Cybaeus tetricus*. The last-mentioned species is also the first record for the Czech Republic.

This research was published monographically in the Journal of the Museum of West Bohemia in Pilsen 129 (ISSN 0232-0738; ISBN 978-80-7247-211-6) and can be ordered at this web page: https://www.zcm.cz/en/e-shop-en/periodic-publications.

This work was financially supported by the Ministry of Culture of the Czech Republic (DKRVO 2019–2023/6.I.a–e and 2024–2028/6.II.a, National Museum of the Czech Republic, 00023272) and by the Pilsen Region (DKRVO 2020–2025, West Bohemian Museum Pilsen, a.o.).

Key-words: faunistics, long-termed research, mountain meadows, mountain forests, new records, peat bogs

Diversity and structure of spider communities is mainly determined by vegetation structure at local spatial scales in a Mediterranean forest.

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Key words: Araneae, community ecology, ecological niche, neutral macroecology, standardized sampling, microhabitats.

Understanding biodiversity patterns is key for informing conservation, especially in areas highly impacted by climate change such as the Mediterranean basin. However, these patterns are known to change according to the grain size at which they are studied at. At higher spatial scales, dispersal processes are more relevant, whereas at lower spatial scales, assembly may be driven by niche filtering. Spiders appear to follow this rule. Previous studies conducted in the Iberian Peninsula have identified geographical distance as the most explanatory at the Iberian scale, with climate being more relevant at the regional scale. In this presentation, we aim to test whether this pattern is fulfilled at lower spatial scales. We conducted standardized samplings to catalog spider communities of 10 different forests in a natural park in the Northeastern Iberian Peninsula. We used vegetation layer-level structured data of cover, climate and topographic distance. Despite the 70% of unidentifiable juvenile spiders, our results show that vegetation structure is the most significant variable for both alpha (local) and beta (regional) diversities, with both the climatic and distance variables not being significant in any analysis. Pine forests are the most diverse and distinct, while lower diversities are recorded at mountain holm oak forests. Focusing the analysis on the communities of each vegetation layer, while the analyses lack statistical significance, there is a clear trend of higher diversity where the vegetation cover is more abundant and complex. Our results confirm that ecological niche diversity drives spider assemblages at finer spatial scales.

Spiders are top predators in temperate grassland biomes, playing a crucial role in shaping arthropod communities and influencing ecosystem functioning. Identifying the factors that determine the composition of spider diets will contribute to an improved understanding of land-use effects on arthropod communities and will facilitate conservation efforts.

In this study, we employed individual gut content metabarcoding on over 1500 spider specimens to analyze the composition of spider diets across 60 permanent agricultural grassland plots. These plots are situated along a land-use gradient in the three regions of the DFG Biodiversity Exploratories in Germany.

Dietary data offer valuable insights into the direct and indirect effects of these environmental drivers. Variations in land-use intensity can lead to shifts in the availability and diversity of prey, which in turn affects spider dietary choices and nutritional ecology. Understanding these dynamics is essential for predicting how changes in land management practices might impact arthropod communities and ecosystem health.

By comparing diet composition with land-use intensity and the taxonomic and trait composition of spider communities in each plot, we aim to provide insights into the relationships between environmental conditions, management practices, and spider diet composition. Our findings indicate that land-use intensity significantly influences both the trait and diet composition of grassland spider communities.

This research highlights the importance of considering both biotic and abiotic factors in conservation strategies. By exploring the complex interactions between spiders, their prey, and their habitats, we can better inform land-use policies that aim to preserve biodiversity and maintain ecosystem resilience.

Gut content metabarcoding has provided important insights into the food web ecology of spiders, the most dominant arthropod predators of terrestrial invertebrates. In small invertebrates, like spiders, gut content analysis is often performed on whole body DNA extracts of individual predators, from which prey sequences are selectively enriched and sequenced.

Since many spider species are generalist predators, a very large number of spider specimens must be processed to recover an exhaustive image of a spider species' prey spectrum, which is costly and time-consuming.

Pooled processing of bulk samples of multiple specimens has been suggested to reduce the necessary workload and cost while still recovering a representative estimate of the prey diversity. However, it is still unclear if pooling approaches lead to bias in recovering the prey spectrum and if the results are comparable to data from individual processing of spiders.

Here, we test the effect of metabarcoding pooled spider gut content on the recovered taxonomic diversity and composition of prey. Using a primer pair which efficiently enriches COI barcode sequences of diverse arthropod prey groups while suppressing spider amplification, we test if pooling leads to reduced taxonomic diversity or skewed estimates of prey composition.

Our results show that pooling and individual processing recover highly correlated taxonomic diversity and composition of prey. The only exception are very rare prey items that were less well recovered by pooling. Our results support pooling as a cost effective and time efficient approach to recover the diet of generalist predators such as spiders.

The impact of intraspecific variability on the biocontrol potential of spiders

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Keywords: Agroecosystem, Araneae, behavioural type, food web, prey selection

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*Speaker

Alien spiders in Italy: a matter of humans

Nicolosi, G Tolve M., Pantini, P., Isaia, M.

Despite the increasing global conservation efforts aimed at addressing the problem of the introduction of non-native species, the number of successful biological invasions and related damage to local ecosystems and economies continues to rise. Among others, alien spiders received poor attention in this sense, despite their role as predators and biological regulators.

We conducted a comprehensive georeferenced literature analysis of established, non-native spiders in Italy, spanning from 1864 to 2023. Our analysis identified the presence of 26 non-native, presumably established spider species in Italy, being mostly Linyphiids (6 species), Theridiids (5), Pholcids (3) and Salticids of American (14) or Asian (7) origin. The most widespread alien in Italy is *Pholcus phalangioides*, followed by *Spermophora senoculata*, *Ostearius melanopygius* and *Mermessus trilobatus*. As for the regional distribution, the highest number of records of alien spiders is found in Sardegna (176), closely followed by Lombardia (174) and Veneto (111).

Based on all available records of alien spiders in Italy, we applied species distribution modeling (SDM) aiming at investigating the environmental and the socio-economic factors influencing the presence and the spread of alien spiders on the Italian territory, particularly to inform future targeted conservation strategies. According to SDM results, proxies of human activity such as human population density and overall human footprint, can be regarded as the main variables driving the distribution of alien species in Italy. Conversely, bioclimatic factors seem to play a minor role in this context, confirming, also for spiders, the strong association between human activity and the spread of alien species.

The importance of being green: increasing green coverage in cities affects taxonomic and functional diversity of spiders

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European urban centers are required to increase the coverage of their green spaces in the upcoming years to face the effects of climate change. Nevertheless, it is still unclear whether this action could also significantly enhance urban biodiversity. To investigate this aspect, we tested the taxonomic and functional response of spider communities collected by means of pitfall traps along an urbanization gradient in large green areas and small, isolated patches within two Northern Italian cities —Torino and Milano— differing in the extension of their overall green cover.

Our results demonstrated a decline in species richness in small, isolated patches and along the urbanization gradient, but no significant differences emerged between the two cities. Species composition of small, isolated patches represented a taxonomic and functional subset of species found in larger green areas, while the species pool of the two cities was taxonomically and functionally different. This difference was due to a higher abundance of ground hunters of higher dimensions in the greener city. These species were also more abundant in large green areas, and decreased along the urbanization gradient, being replaced by smaller, highly dispersive web builders.

Our results suggest that increasing the coverage of large green areas is required for effectively increasing spider diversity, while the integration of small green spaces within buildings and roads is not sufficient. Despite a higher green coverage within a city does not increases species diversity, it may affect the distribution of functional traits with possible cascading effects on ecosystem services, e.g. pest control.

Endemic Enigmas: Assessing Spider Diversity in the Tuscan Archipelago

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Since the time of Darwin's travels, archipelagos have emerged as impressive reservoirs of biodiversity characterized by the presence of endemic species deserving thorough investigation and conservation. In this context, we present the state of the art of the knowledge on the spiders inhabiting the 7 islands included in the National Park of the “Tuscan Archipelago”, between the western Italian coast and Sardinia in the Tyrrhenian Sea. Our literature survey reports 283 species in the Archipelago, representing 165 genera and 40 families. The most represented families are Salticidae, Theridiidae, and Gnaphosidae followed by Linyphiidae, Araneidae, and Thomisidae. Noteworthy, the Tuscan Archipelago hosts 22 Mediterranean species with restricted distribution range, among which 6 species are strictly endemic to the Archipelago. A few species have been reported uniquely in their original description and lack data since more than one century. Specifically, our report highlighted some controversial cases whose taxonomic position needs revision or is known uniquely on one sex. Examples in this sense are found in the spiders of the genus *Nemesia* inhabiting the islands, i.e. *Nemesia pavani* (Montecristo Island) and *Nemesia ilvae* (Elba Island), in *Harpactea oglasana* (Montecristo Island) *Scotophaeus fabrisae* (Elba Island) and *Camillina europaea* (Giglio Island) uniquely known on one sex. This inventory represents a fundamental basis for an ongoing study focusing on the seven islands based on recent field surveys conducted from May to October 2023 by means of pitfall traps and beating trays.

Spider diversity along an urbanization gradient through space and time

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Urbanization affects landscape structure, functions and local environmental conditions, with major impacts on biodiversity and related ecosystem services. A proper evaluation of the effects of urbanization on biodiversity is thus compelling, with a specific focus on taxonomic groups with crucial roles like spiders, renowned regulators of trophic chains and sensitive bioindicators. We assessed the response of foliage-dwelling spiders to urbanization in Torino (Italy), by sampling their communities in urban green areas along an urbanization gradient and in a natural park (control area) a few kilometers from the city. We tested their response in terms of taxonomic (i.e. species richness and abundance) and functional (diversity, abundance, number of feeding guilds, abundance of pollinator feeding spiders) diversity. Species richness and abundance decreased in the city compared to the control area and along the urbanization gradient, similarly to functional diversity. All detected trends confirm our previous results on the ground-dwelling counterpart. Notably, this pattern was mostly due to the loss of specialized foraging guilds, like pollinator-feeders. Species turnover predominantly explained differences in species composition among urban green areas, due to the high frequency of stochastic events. Conversely, urban communities emerged as subsets of semi-natural ones, suggesting an environmental filter favoring species preadapted to urban conditions. Our findings underscore the role of urbanization in shaping spider communities, favoring generalist species and specific functional traits. We projected each variable to future scenarios with slightly increased urban green areas, highlighting the effectiveness of a small increase in enhancing biodiversity.

A web under the Mole: meet the urban spiders of Torino

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Urbanization exerts a strong filtering action on spider communities, favoring generalist species and specific functional traits; despite their ecological significance, spiders in urban environments remain understudied. We present an inventory of the spider species based on literature data issued from the online Catalog of Italian spiders “araneae.it” of Torino and its first hinterland (Piedmont, N-W Italy), covering a surface of approximately 438 km2 and including the city of Torino and 13 nearby municipalities. The publication dates of the analyzed literature range from 1881 to 2024 and most of the data come from recent articles. The studied area is inhabited by 238 species, representing 147 genera and 36 families; within Torino municipality 142 species are known, while the highest number of reported species in the first hinterland regards two municipalities (Druento, 124; Venaria Reale, 95) covering the territory of a regional nature park whose spider fauna was subject of recent studies.The most represented families are Linyphiidae, followed by Lycosidae, Salticidae and Gnaphosidae. The highest number of species (139) is recorded from urban green areas. Most of the species have a Palaeartic distribution, followed by Turanic-European-Mediterranean and European elements. Noteworthy, we recorded three endemic species (*Nemesia pedemontana, N. hastensis* and *Dysdera lantosquensis*) and four species of non-European origin (*Mermessus trilobatus*, *Erigone autumnalis*, *Theridula gonygaster* and *Pholcus phalangioides*). Besides the faunistic contribution, this inventory provides insights into spider diversity in the urban landscape and aims at providing a basis for further studies on the effects of urbanization on spider communities.

New knowledge about the wolf spider *Lycosa singoriensis* in Slovakia

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Wolf spider *Lycosa singoriensis* (Laxmann, 1770) is one of the largest spider species in Europe. It is a species with an eastern Palearctic distribution that has shown a tendency to spread into western part of Europe in recent decades. This important element of the Slovak araneofauna inhabits mostly warm lowland habitats. In our research we compared localities of the species, ecological parameters, period of occurrence, year of species record, etc. We obtained more than 400 records of *L. singoriensis* from more than 170 localities (own records, literature data, citizen science data from the Internet). Among the current records, the occurrence in anthropogenic sites (gardens and surroundings of buildings, including accidental indoor entering, fields, surroundings of industrial sites, etc.) is largely predominant. Within natural and semi-natural habitats, *L. singoriensis* mainly inhabits xerotherms on loess substrates, forest-steppes, grazed or mown meadows, salt marshes and riverbanks. From the summarized records, it is evident that the species in Slovakia inhabits mainly the Danubian Lowland (Pannonian region). In the more northern parts of Slovakia (Carpathian region), the species has been found only sporadically. In the Eastern Slovak Lowland, records of the species are mainly of historical date (first half of the 20th century), only few records have been found at present. The reasons for the low representation of present records of the species in seemingly very suitable localities in eastern Slovakia require further research. Our research has brought new insights into the occurrence and distribution changes of this interesting species.

Funding: VEGA grant 2/0115/21

Pesticides count as a main factor for biodiversity decline in agriculture. Although insecticides are usually most damaging to non-target arthropods, also fungicides can have unintended side effects. Fungus-resistant grape varieties allow to study substantial reductions in fungicide applications under realistic conditions. We compared the effects of reduced fungicide applications across 36 vineyards, which were half fungus-resistant and half susceptible. Of each of the fungicide intensities, half of the vineyards were under conventional and half were under organic management. Spider communities at the family level varied significantly across the three strata (canopy, inter-row vegetation, ground). In the canopy, grape variety played a crucial role, with a significantly higher total spider abundance in resistant grape varieties. Families such as Linyphiidae, Philodromidae, and Theridiidae particularly thrived in resistant varieties. Organic viticulture positively influenced the presence of Philodromidae in the canopy. In the inter-row vegetation, total spider abundance remained unaffected by the type of grape variety. However, Salticidae were more prevalent in susceptible varieties, while Theridiidae were more abundant in resistant varieties. Organic management again had a positive effect on Philodromidae. For ground-dwelling spiders, Linyphiidae benefitted from organic vineyard practices. These preliminary results indicate declining effects of fungicides on non-target spiders from the grape canopy (to which the fungicides are applied) towards the ground. Fungus-resistant varieties are a major opportunity to make viticulture more sustainable.

Follow the spiders - a CMR study on *Pardosa paludicola*

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Keywords: bee tag, movement range, phenology, spider conservation, wolf spider

Locomotory activity of spiders provides valuable information about their biology, as well as habitat requirements. Among the variety of wolf spiders in Europe, there are still some rare and poorly examined species. An example is *Pardosa paludicola* (Clerck, 1757), which has a conservation and rare status in Czech Republic and Great Britain. The spiders of the genus Pardosa neither build hunting webs, nor burrow, which seems to make them more likely to change their hunting site. Together with staying mobile even during brood care, it enables them to achieve relatively large movement ranges, considering their small body sizes. However, *P. paludicola* appears to be a specialized species of a narrow ecological niche, attached to a certain type of habitat. The recently discovered population in Kruszyniany (NE Poland) enabled us to examine this species closer, with focus on its movement ranges and habitat preferences, which are crucial for outlining proper conservation areas. We used capture-mark-recapture method; from 714 marked individuals more than 10% were recaptured (♂ 4.5% and ♀ 14.7%). The median movement range was calculated at 5-6 m for both sexes, and the maximum distances reached 58-69 m in 3-4 days. In the context of conservation efforts for this species, it seems important to provide large open areas of high humidity, with low human interference.

Diversity analysis of spider assemblages and analysis of vegetation structure based on multispectral drone images of five common pastures in the Black Forest Biosphere Reserve, Germany

Schindler, M., Eberhardt, J. & Höfer, H.

Staatliches Museum für Naturkunde Karlsruhe

Common pastures have shaped the cultural landscape in European mountain ranges for centuries. These extensively used areas have the potential to harbour high biodiversity in both flora and fauna. The arthropods and vegetation communities of five common pastures in the Black Forest Biosphere Reserve, Germany have been sampled in 2021 to assess their habitat types and arthropod species spectrum. In 2023, high-resolution images were taken with a multispectral drone to test the extent to which the in-situ vegetation and structure classifications can be extended to the entire study areas. The via pitfall traps collected spiders are assessed in this study. From the 12536 spiders collected, 151 species were identified. The species diversity and sample completeness for the study areas were calculated and extrapolated with iNEXT. The difference of the spider communities between the four main habitat types was determined via NMDS using PAST. The drone images were classified using the Semi-Automatic Classification Plugin for QGIS. The six trained classes were then compared with the area proportions of the previously determined plant communities in order to test the transferability of the small-scale recording areas to the entire study areas.

Web weavers don't like cities!

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Keywords: predation, urbanization

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Web-building spiders as biocontrol agents in apple orchards under different management practices

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Keywords: biological control, molecular gut content analysis, IPM, organic farming, pests, predation

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Aquatic stressors affect terrestrial predators: using enclosures to address aquatic terrestrial interactions

Agnes Schöndorfer, Victoria Sophie Stoll, Alanah Kripp, Klaus Schwenk, Martin Entling, Mirco Bundschuh

Riparian predators like *Tetragnatha extensa* rely mostly on aquatic subsidies. Changes in the emergence pattern of aquatic insects may thus have substantial consequences on prey availability for these predators with potential consequences for associated terrestrial food webs. Bti (*Bacillus thuringiensis* var. *israelensis*), a commonly used mosquito control agent applied to floodplain areas, is known to affect non-target insects including Chironomidae, which can contribute up to 90% of emergence in some ecosystems. A previous study showed that emergence patterns of Chironomidae were altered by Bti-induced stress. To understand the consequences of altered emergence patterns towards riparian predators, we employed the floodplain pond mesocosm (FPM) containing six control ponds and six ponds treated with Bti. Riparian areas and adjacent shallow aquatic systems of each pond were enclosed. After several weeks, spiders of different feeding types, including *Tetragnatha extensa* and *Piratula sp*., and different types of prey have been sampled inside and outside the enclosed system. As samples are still under evaluation, no final results can be provided, however stable isotope analysis and fatty acid composition of both prey and predators will shed light on shifts of prey availability and nutritional quality. We are looking forward to discussing our plans against the experimental design.

Invasive brown widow spiders (*Latrodectus geometricus*) thwart their parasitoids

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Invasive species may possess traits that promote their invasiveness, such as high productivity, short development, and high dispersal ability. In addition, they may be less susceptible to natural enemies such as predators and parasites. The brown widow spider *L. geometricus* (Koch), is a highly invasive species globally. One of the main natural enemies of *L. geometricus*, as well as of other widow spider species, is the parasitoid wasp *Philolema latrodecti* (Fullaway), which lays its eggs inside the egg sac of the spider. The wasp larvae consume the spider eggs, pupate inside the egg sac and emerge as adults. In Israel, we found that *L. geometricus* is less susceptible to parasitism by this wasp than a native species, the white widow spider, *L. pallidus*, under both field and lab conditions. Possible explanations include preference for human habitats where there might be fewer parasitoids, and better defenses of the egg sac by the female spider. We found that the silk spikes and loose threads covering *L. geometricus* egg sacs disrupt wasp oviposition, and that female *L. geometricus* more actively defend their egg sacs against the parasitoid than do *L. pallidus* females. Furthermore, female *L. geometricus* increased the density of silk spikes on subsequent egg sacs in response to previous parasitoid presence, suggesting an induced response to parasitism.

Digitizing spider biodiversity data:
from literature legacy to digital lake

The primary data of biological species occurrences are the basis of numerous studies concerning the environment and ecology. The number of scientific articles grows exponentially, which complicates the manual extraction of these records; moreover, each researcher has to make these efforts independently, wasting time. Various tools have been developed to standardize, store, manage, and explore such data through biodiversity informatics approaches. This can be applied to originally digital and adjusted data only. Therefore, the scientific literature legacy, being huge and valuable, isn't reflected enough in global biodiversity repositories, so is difficult to use. The development of new frameworks and tools for extracting data from literature sources is essential. However, the perfect fit of the large language models to this goal isn't obvious due to the complexity of the ways biodiversity data are represented (text, lists, tables) and their dispersion across article sections.

The discussed project is focused on citizen science, assuming volunteers review scientific literature and fill online forms. Currently, the project has the following stages completed:

1) Interactive pdf-library;
2) Web application to input biodiversity data and convert them to DarwinCore format;
3) Citizen science project roadmap including gamification elements to improve volunteers' motivation.

Project stages remaining to-do:

1) Obtain the dataset itself and develop a platform to explore it;
2) Compare the efficiency of the citizen science (quality, speed) with the data science (quality, costs) approaches;
3) Consider the prospects of expanding the approach to other taxa and regions.

The research was supported by RSF (project No. 24-24-00460)

Keywords:

biogeography; biodiversity informatics; fauna; occurrences; citizen science

Sexual selection in different tribes of Salticid spiders

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During intrasexual selection, males compete for gamete fertilisation, often developing extreme phenomena, suboptimal for survival of the individuals. Textbook examples are the tail of the peacock or exuberantly coloured males in birds of paradise species. The exaggerated characters can play an important role as weaponry if males fight with each other, or it can show the individual's higher access to resources, which can be appealing for the females. Such exaggerated characters are well known in jumping spiders as well, sometimes giving extreme appearance to these spiders. This study focuses on different jumping spider species, in which sexual dimorphism is represented with exaggerated male chelicerae. We examined species in the genera *Bathippus*, *Canama*, *Maltecora* and *Pochita* from tropical islands like New Guinea, Sao Tomé and Principe. The study's aim was to determine whether these extreme male chelicerae are under sexual selection. One way of doing so, is testing whether the character shows positive allometry a good indicator for sexual selection. While founding evidence for sexual selection pressure of male chelicerae in multiple species in these genera, we have noticed several new species in the genus *Bathippus*. Also, the common copulatory organ-based taxonomy is challenged for a species complex which shows similar palps but differ significantly in the chelicerae.

Spiders along elevational gradients: who is in danger?

Tolve M., Piano E., Isaia M.

Examining functional traits is becoming an essential element to investigate how changes in the environment may influence biological communities, with cascade effects on the whole ecosystem. By encompassing a succession of different habitats, elevational gradients represent excellent natural laboratories in this respect. We investigated spider communities along three transects in the Natural Park of Orsiera-Rocciavrè (Western Italian Alps). Spiders were sampled by means of pitfall traps within plots placed every 200 metres of altitude from 1,400 to 2,600 metres a.s.l. in 2018 and 2019. Overall, we collected 1,152 spiders belonging to 128 species. Spider assemblages were characterised in terms of taxonomical (species richness, abundance and beta diversity) and functional diversity (total, dispersion and evenness of functional diversity), the latter computed on the base of functional traits, mostly related to range size, elevational distribution, dispersal ability, foraging guilds and body size. Species richness and abundance appeared to be unresponsive to elevation, while taxonomic beta diversity significantly increased, attesting higher species turnover at higher altitudes. All metrics of functional diversity increased with elevation, due to the increased presence of highly dispersive, widely distributed and tolerant species. Conversely, communities at lower elevation were characterised by lower functional diversity mostly attributable to endemic species. Our findings suggest that spider communities at lower elevations are potentially more vulnerable to habitat and climate change, being generally unkeen to altitudinal migrations than their counterparts at higher elevations. Indeed, we acknowledge the importance of considering functional traits in predicting changes in biological communities in a climate warming scenario.

Spider assemblages in the mires of Polish Pomerania

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Keywords: Diversity, ecological groups, habitat specialists, protecting habitats, species richness, wetlands

Spider assemblages in the mires of Poland have been investigated from about four decades, however little attention was paid to these habitats in the North of this country – Polish Pomerania. In the presented study we fill this gap by studying eight spider assemblages that inhabited four distinct mire types, namely: 2 alkaline mires, 2 peat bogs, 2 poor fens and 2 acidic mires surrounding thehumic lakes. The spiders were sampled all year long, for two consecutive years, with pitfall traps and a sweep net.A set of environmental variables was analysed, including the mire type, vegetation density and mire area. The data on spider species richness, species dominance, ecological group composition, assemblage similarity and indicator species are presented. The richness and composition of spider assemblages was comparable to those from the mires in other regions, however some notable differences were noted. A set of rarely sampled, specialized species was found, including for example *Agroeca dentigera*, *Agyneta mossica*, *Heliophanus dampfi* or *Sibianor larae*. The most distinct spider assemblages inhabited alkaline fens. The least diverse assemblages were found in poor fens, nevertheless they were rich in rarely found species that prefer mires. The winter fauna of spiders was very rich in species, we have observed a very high activity of some species in this season. Mires are one of the most endangered habitats in Poland and our study was also meant to show their extraordinary value and encourage applying protective measures.

Rock, paper, microhabitat: A case study of microclimate around a boulder and its influence on species composition.

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Abstract

Switzerland bares despite its small size over 1000 spider species. The country has a rich fauna and flora within 6 biogeographic regions. One of these six major biogeographic regions is the northern flank of the Alps. It is a unique environment shaped by large annual and spatial variations in temperature and precipitation. A part of the northern flank of the Alps is located in the canton of St.Gallen. The spider diversity in St. Gallen is currently understudied in comparison to other taxonomic groups, leading to a gap in the knowledge about alpine spider diversity. We try to fill in this gap by assessing the diversity of spiders in the canton. From 2020 to 2023 the Museum set 5 Pitfall traps around a Boulder 2300 meters above sea level. From June 2022 data logger for humidity and temperature were installed. The question that was asked was, if microclimate alters the species composition and if yes how. This is only a case study nevertheless it is one of the first that worked with datalogger and high altitude spiders composition in the northern Alps. 366 Individuals composed out of 5 Families and 35 Species were caught and determined during that time. Analysis of species composition per trap and how much microclimate has influence are ongoing.

Vertical stratification of arthropod assemblages in shallow subterranean spaces

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Key Words: underground environment; soil; ecology; arthropods; habitat preferences

In this study the assemblages of selected arthropod taxa with important ecosystem functions (Arachnida: Araneae, Opiliones, Pseudoscorpiones; Insecta: Coleoptera, Hemiptera) of seven research sites in different biotopes of deciduous forests of the Northeast Moravia and Konstantinolázeňsko regions and one mesophile meadow in the Podbeskydí bioregion are investigated. Data on 5840 individuals of the studied groups classified into 354 species were obtained by a methodology focused on epigeic, humicolous and subterranean representatives. Several exclusive inhabitants of soil horizons were recorded (e.g. *Porrhomma cambridgei*, *P. microcavense*, *P. microps*, *Duvaliopsis pilosella stobieckii*), whose distribution is discussed, similarly to the regional conservation value of the studied sites. Trends in the distribution of arthropods were separately analysed according to their different affinities to the subterranean environment (epigeic, edaphoxene and edaphophile/edaphobiont) and taxonomic group. The abundance of animals collected in the leaf litter is positively correlated with the amount of undecomposed organic material per area, but this effect is insignificant for edaphoxenes, which may be explained by their ability to migrate underground. The structure of the subterranean biocenoses at each site and the variation in communities across groups (ecological and taxonomic) depending on depth are described.

New Spider Families in Moldova: Miturgidae, Oecobiidae, Zodariidae; conservation status of the genus *Atypus* in Moldova

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The latest revision of the araneofauna of the Republic of Moldova, jointly published by Vasiliev and Mikhailov in 2023, catalogued 369 species from 32 families. This current research contributes novel findings by documenting new records from three families not previously reported in Moldova. *Oecobius rhodiensis* Kritscher, 1966 (family Oecobiidae), a species often associated with synanthropic environments, was discovered near a windowsill at the Institute of Zoology in Chisinau. Previous literature has noted the windowsill as a common habitat for the species, with recent observations in Odesa (2023) and Donetsk (2021).

Zora nemoralis (Blackwall, 1861), *Z. pardalis* Simon, 1878, and *Z. spinimana* (Sundevall, 1833) are species represent first records of the family Miturgidae in Moldova. These specimens were captured using pitfall traps in the Botanical Garden.

Zodarion rubidum Simon, 1914 (family Zodariidae) was found in the Botanical Garden in Chisinau, collected from a soil trap positioned near the creek and in pine forest.

Species from the genus *Atypus*, listed in numerous European Red Books as endangered, typically inhabit areas characterized by diverse bedrocks. In 2023 *Atypus affinis* Eichwald, 1830, and *A. muralis* Bertkau, 1890 were found in the canyon of the Toltre Mountains, near Duruitoarea (Riscani district). Two males of A. *piceus* (Sulzer, 1776) were found in 2024 in the Botanical garden, Chisinau, in the pine forest. Notably, ongoing efforts to update the Red Book of the Republic of Moldova (2024-2026) will likely discuss the inclusion of species from the genus *Atypus* among the Moldova's red-listed species

A snapshot study of the diversity of spiders (Araneae) in the isolated forest patch on Madagascar

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Keywords: Diversity; ecological groups; endemism; new taxa; rainforest; species richness; sampling methods

The scope of this study was to investigate the diversity of spiders in the Ivohiboro Protected Area in South-Central Madagascar and compare it to the diversity known from other tropical or subtropical forests. It is an isolated and fairly well preserved patch of rainforest, secluded in the highly transformed landscape of Madagascan highlands. Spiders were investigated for 9 days, in 9 plots representing different habitat types, day and night, by four people, using an array of standard sampling methods, i.e. a direct search of spider webs or in cryptic habitats and on litter surface, sweep net, beating bush and lower tree branches, litter sifting and pitfall traps. The work was inspired by the protocols prepared for sampling spiders in tropical forests, however they were substantially modified. The spiders were divided into morphospecies based on adult specimens. In the case of jumping spiders (Salticidae) the whole taxonomical work was already accomplished, thus they will serve as an example for results on a specific level. The database contains more than 3000 spider specimens (including juveniles) and over 30 families. The following questions will be tackled in the presentation: what is the observed and estimated diversity of spiders in the Ivohiboro Forest and how it compares to other rainforests; what is the composition of spider ecological groups; how did the applied methods work in this study; what are the main taxonomic problems concerning spiders of Madagascar; how similar is the species composition of Ivohiboro Forest in relation to other forest patches of Madagascar?

The biogeographic pattern of the scorpion family Ananteridae Pocock, 1900 (Arachnida: Scorpiones)

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Abstract

Comments are proposed on the biogeographic patterns presented by extant and fossil elements of the remarkable family Ananteridae Pocock, 1900 (Arachnida: Scorpiones), supporting a Gondwanian or even older Pangaean pattern of distribution for this ancient lineage of scorpions present since at least the Palaeocene and probably even older. Considerations about the taxonomy and ecology of the scorpions of this family are also proposed and a new altitude record is presented for the genus *Ananteris* Thorell, 1891.

Keywords

Scorpions, Ananteridae, *Ananteris*, taxonomy, biogeography, evolution, ecology, altitude

Urbanization and Spider Diversity in Armenia

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Abstract

The impact of urbanization on biodiversity has become a prominent area of investigation, highlighting the need for comprehensive research in this field. This study focuses on assessing the variation in spider diversity across an urban landscape. Our investigation took place in Yerevan City and suburbs with increasing urbanization, where we aimed to elucidate the diversity of spider species along transects extending from the city center to Jrvej. Through a combination of observational data and specimen collection, we observed a discernible pattern: The total species richness was 111 species belonging to 72 genera, and 21 families. The family Theridiidae had the highest diversity (17 species). The total abundance of spiders was 276, with the highest abundance in the urban zone with a garden (187 specimens). The most abundant species were: *Pholcus phalangioides* (Fuesslin, 1775) (33 specimens) (Pholcidae), *Steatoda paykulliana* Walckenaer, 1805 (20 specimens) (Theridiidae), *Oecobius nadiae* (Spassky, 1936) (8 specimens) (Oecobidae). The highest diversity of spiders was found in the urban zone with a garden (buildings with a garden) (85 species).

These findings contribute to the expanding body of knowledge indicating a decline in spider diversity within urban environments, emphasizing the importance of vegetation cover spaces within urban areas in preserving biodiversity amidst urbanization pressures.

Keywords: Araneae; Ecology; Diversity; Urbanization

Springtime Hitchhikers: First Record of Phoresy in Pseudoscorpions on a Scorpion Host

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Phoresy is a symbiotic association that enables pseudoscorpions to disperse into new habitats on a host. Pseudoscorpions have been recorded phoretic on mammals, birds, insects, harvestmen and spiders. We report the first observation of phoresy on a scorpion host. Pseudoscorpions of the species *Nannowithius wahrmani* (Beier, 1963) (Withiidae) were observed clinging onto the scorpion species *Birulatus israelensis* Lourenço, 2002 (Buthidae) in Israel. Both species are myrmecophiles associated with harvester ants of the genus *Messor* Forel, 1890, and are endemic to Israel. *Nannowithius wahrmani* was previously known from only two localities. The first specimens were collected in 1952 from a nest of the ant *Messor semirufus* (André, 1883) in the Negev desert, southwestern Israel. Additional specimens were found under a stone without a recorded ant association, near the Sea of Galilee, northeastern Israel (Beier, 1963; Mahnert, 1974). Beier (1948) documented over twenty pseudoscorpion species from ant nests and suggested that their dispersal from nest to nest occurs via phoresy. We documented *N. wahrmani* phoresy on *B. israelensis* exclusively in spring (March to May), with some scorpions carrying up to six pseudoscorpions. In spring 2024, we observed approximately 40 scorpions, out of 120 examined, carrying phoretic pseudoscorpions, both inside and outside ant nests, as well as between ant nests. Our observations support the hypothesis of mutual dispersal. We suggest that this phoretic behavior occurs primarily in the spring, coinciding with the peaks of ants' foraging and scorpion dispersal. We suggest that this synchronization is utilized by the pseudoscorpions for dispersal.

EFFECT OF THE NUTRITIONAL QUALITY IN THE QUADRI-TROPHIC FOOD WEB INTERACTION

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The effect of macronutrient intake influences functions during the ontogenetic development of animals. Most studies on nutritional ecology have focused on herbivores or predators, with very few on parasitoids. This study explores the effect of nutritional composition on the fitness of consumers in a quadri-trophic food web. We studied how enrichment of the food of fruit flies transfers to the spider *Phylloneta impressa* (L. Koch) and its parasitoid wasp, *Zatypota percontatoria* Mueller. We reared fruit flies on three different treatments (balanced, protein-enriched, and lipid-enriched diets), and observed several fitness-related traits both in the predator and the parasitoid. In spiders, we did not find significant differences among treatments in their body size and the probability of building a cocoon web. In parasitoids, we failed to find significant differences among treatments in the latency to wasp pupation, the duration of pupation and in morphology changes. However, the sex ratio of hatched wasps differed significantly among treatments from the expected 1:1. In the balanced diet group, the majority of wasps were males. There was a significant positive relationship between the spider prosoma size and the length of the wasp wing. Our results suggest that the quality of the food of the primary consumer had little effect on the fitness of the organism at the fourth trophic level.

The presentation is supported by a grant from the Agency of the Ministry of Education of the Slovak Republic and Slovak Academy of Sciences VEGA grant no. 2/0022/23.

Spiders as potential predators of true bugs used in biological control

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Some true bugs (Hemiptera: Heteroptera), such as minute pirate bugs (Anthocoridae) and plant bugs (Miridae), can be used for biological control of pests, especially aphids and thrips. However, many of these bugs are rather small and seem to lack defences found in other true bug taxa, such as thick cuticle or strong chemical defence. Thus, they can represent a common prey of generalist predators, especially spiders, during intra-guild predation (IGP). We tested this hypothesis using representatives of several major spider families as model predators.

Keywords: agriculture, Heteroptera, intra-guild predation, pest control

Vertical distribution of spiders (Araneae) in Central European shallow subterranean habitats

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Shallow subterranean habitats are among the last habitats in Central Europe to be arachnologically researched. Using stratified pipe traps, we studied the vertical distribution of spiders in soil and interspaces in bedrock (shallow subterranean habitats). Specifically, we sampled fauna in different substrates, including limestone, sandy marlstone, sandy marl, claystone, loess, and artificial gravel accumulation. Employing stratified pipe traps allowed us to identify the depth at which particular species occurred. Across multiple years and sampling sites, we collected 76 spider species, 21 of which showed an affinity for subterranean microhabitats. Some of these species occurred in interspaces in soil and bedrock, whereas others have been previously found in subterranean ant nests and animal burrows. We collected five species (*Iberina microphthalma*, *Centromerus* cf. *piccolo*, *Porrhomma cambridgei*, *P. microcavense*, and *P. microps*) almost exclusively at depths over half a meter, suggesting the strong affinity of these species for a subterranean lifestyle. We provide diagrams of these species' vertical distribution and photo-document eye reduction. Our study demonstrates that poorly studied shallow subterranean habitats harbor diverse subterranean spider fauna, including several previously considered rare species in Central Europe.

Let’s go shopping

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Unsurprisingly, one of the easiest ways for spiders to unintentionally move to Europe is through global trade. Our needs to buy exotic foods and plants bring unexpected visitors, and some of them have the potential to be established here due to climate change. The first preliminary checklist of non-native species of Slovakia was presented at the European Congress of Arachnology in 2015. Of all the listed species, 16 species were classified as alien to Slovakia, and two were alien (established). After nine years, we re-evaluated the previously listed alien species and moved some of them to the synanthropic or alien (established) category. Those species have stable populations in Slovakia and can overwinter outside buildings (e. g. *Holocnemus pluchei*, *Mermessus trilobatus*). In addition, the number of aliens has increased by nine species. In the field (shops and garden centers), we mostly used the method of luring spiders. However, when some specimens could not be collected directly in the locality, we used a controversial method – buying them with goods. Of the newly recorded species, 3 spp. were accidentally transported, 1 sp. could be transported more regularly but may be overlooked due to nocturnal activity or killed by staff, and 5 spp. seem to be transported regularly via plants. Species from the last category have the greatest potential for expansion into natural and anthropogenic habitats such as grasslands, gardens, and the vicinity of garden centers. The project (24-521-00991) has been supported using public funds provided by Slovak Arts Council.

Systematics and Taxonomy

Too old to date, too young to age: Deep calibrations overestimate colonization time of the Canary Islands in red devil spiders (Dysderidae)

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Estimating divergence times is an unavoidable step toward testing alternative hypotheses about the origin of lineages, their rates of diversification, and trait evolution. Recent studies have shown that specific steps of the time estimation inference, such as the clock model or loci selection, may significantly impact the inferred timeframe of diversification. However, the effect of the distribution of calibration nodes across the phylogeny on time estimation has received much less attention. Here, we investigated the time of colonization of the red devil spider genus *Dysdera* in the Canary Islands, where it underwent an adaptive radiation process. With that aim, we generated a robust phylogenetic tree based on mitogenomic data and densely sampled outgroups, and estimate divergence times in a Bayesian framework. We used fossil data and biogeographic events to infer absolute ages. The inferred times of colonization of the Canary Islands by *Dysdera* largely predated the archipelago's origins. However, after removing deeper external nodes, the recovered colonization times better aligned with the geochronology of the islands and substitution rates of the sampled loci based on data available in the literature. Our results suggest that including far-related lineages to maximize the inclusion of calibration points may result in overestimating shallow relationships. Further investigation would be required to identify the main factor responsible for this effect.

We are small, but we are many: comparative genomics of the red devil *Dysdera* spiders in the Canary Islands.

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Abstract

The red devil spiders of the genus *Dysdera* in the Canary Islands provide an unparalleled model system for investigating the drivers of the adaptive radiation process. Approximately 60 endemic species of this genus have been reported, likely resulting from a single colonization event. These island species have independently evolved similar modifications of their mouthparts, which are related to different levels of specialization in feeding on terrestrial woodlice. To understand the genomic basis of this phenotypical convergence, our research group generates new genomic data for island and continental *Dysdera* species. Surprisingly, a comparison of genomic size across species revealed that island genomes are only half the size of their continental counterparts.

Furthermore, genome-wide intraspecific variation analysis revealed exceptionally high nucleotide diversity and recombination levels in island species, well above those observed in the continent and indicative of large historical effective population sizes. This is a counterintuitive observation for an island endemic with a restricted distribution. Upon in-depth analysis of these results, we hypothesized that the reduction in genome size is related to the large effective population size and the associated increase in the efficacy of natural selection, with a predominant role of transposable elements. We also identified several candidate genomic regions under recent positive selection, highlighting relevant biological processes, such as vision and nitrogen extraction, as potential adaptation targets. These processes may drive species diversification of this genus in the Canary Islands. This pioneering genomic study in island endemic spiders paves the way for understanding the genetic mechanisms underlying species diversification.

The tools of the World Spider Catalog and of Spiders of Europe and how everybody can contribute

Theo Blick

Private researcher, Hummeltal, Germany

The tools of the World Spider Catalog (https://wsc.nmbe.ch) and of Spiders of Europe (https://araneae.nmbe.ch) are presented. Probably not everybody is aware of all. Furthermore is shown how everybody can contribute to both online resources.

Scorpions represent an old arachnid order with more than 2800 species. Despite high diversity, the group exhibits uniform morphology that complicates species delimitation. This issue has become evident throughout the last two decades, since genetic data have been increasingly used to delineate species and discrepancies between the outcomes of traditional morphology-based taxonomy and molecular phylogenetic analyses were detected in many instances. Recently, it has also been shown that cytogenetic data can help to delimit scorpion species. Scorpions show considerable karyotype variability (2n=5–175). Even closely related species, indistinguishable based on external morphology, may differ significantly in their karyotypes. So far, the karyotypes of only 16 species out of 111 described taxa have been published within family Euscorpiidae. We analyzed karyotypes of additional species, and our cytogenetic results combined with molecular phylogenetic analyses confirm a significant interspecific variability both in the diploid number of chromosomes and their morphology. We also implemented the Fluorescent in situ hybridization (FISH) approaches in order to localize the gene clusters for 18S rRNA and the telomeric motif (TTAGG)n that in some cases also showed interspecies differences. Our results suggest that cytogenetic characteristics likely have a great potential for species delimitation in the family Euscorpiidae.

This work was supported by the Grant Agency of Charles University (GAUK 263223).

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Picturing arachnids in systematics.

Arachnids represent one of the most diverse groups of organisms on Earth. Despite their significance, our knowledge of their biology, diversity, and evolution remains incomplete. Systematic studies are crucial in addressing these gaps by integrating various scientific disciplines such as biodiversity, taxonomy, and phylogenetics.

For the last 15 years, my research has been dedicated to studying spider diversity, taxonomy, and systematics in South America. To exemplify the diverse aspects involved in the study of arachnid systematics, I will present two of our latest research projects. Our first project explored the diversity, taxonomy, and phylogeny of the genus *Linothele*, a group of mygalomorph spiders (Dipluridae) that is incredibly diverse in the Ecuadorian Andes. We will compare traditional morphological taxonomy with molecular phylogeny to gain a comprehensive understanding of these remarkable creatures.

Secondly, we will delve into a specific morphological trait related to the Araneidae family, the third-largest spider family. The sustentaculum, a single seta on tarsus IV, has been proposed as a synapomorphy that unites the group, with secondary loss in some genera (e.g. *Micrathena*, *Bertrana*). I will be presenting the preliminary results of a comprehensive investigation into this unique trait and its increasing significance in enhancing our understanding of the group's evolution and interrelationships.

Description of *Eratigena mirusha* sp. nov. (Arachnida: Araneae: Agelenidae) from Kosovo based on an integrative approach

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Abstract

New data are provided on agelenids spiders of the Balkans. A new species of the genus *Eratigena* Bolzern, Burckhardt & Hänggi, 2013, *Eratigena mirusha* sp. nov. (♂/♀) from the Koznik Mountain in Kosovo is described, based on molecular and morphological data. The males *Eratigena mirusha* sp. nov. are most similar to *E. agrestis* (Walckenaer, 1802) but possess differently shaped conductor and retrolateral tibial apophysis. Females of both species differ in the shape of the epigyne, oval posterior sclerite, postero- medial copulatory openings and the presence of epigynal pseudo theeth. The genetic divergence calculated based on the barcode region of the cytochrome c oxidase subunit I gene (*COI*) confirm the morphological distinctness and supports *Eratigena mirusha* sp. nov. as a sister species of *E. agrestis*.

Keywords: Barcoding, *COI*, *Eratigena agrestis*, new species, Western Balkans

Re-analyzing a true villain of spider taxonomy: biodiversity and toxin analyses for the Sydney funnel-web spider *Atrax robustus*, a deadly arachnid icon.

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Australia contains some of the most fascinating wildlife on the planet, but also some of the deadliest species. The Sydney funnel-web spider (*Atrax robustus*) holds the Guinness World Record for the world's most venomous spider, and the species is historically responsible for at least 13 fatalities. But what really is this spider? Originally described in 1877 from a juvenile specimen collected in "New Holland", the species is thought to be widespread along the central coast of New South Wales, despite significant differences in habitat, morphology, and ecology between populations. Antivenom is produced from male field-collected specimens without much regard to their origins, so what if the world's most venomous spider really is more than just one species? What are the consequences for human health and for the conservation of their diverse toxins as biological assets? In the present project, we are analyzing species-boundaries in *A. robustus* using a concerted effort of targeted field sampling, molecular genetics, behavioral ecology, and venom analyses. We show that Australia's highly venomous spider is actually a complex of species, each with their own ecology, habitat preference, and venom structure. We predict that some of these species have narrow ranges and occur in areas of conservation concern, such as ongoing anthropogenic habitat loss in metropolitan areas. These species might be considered precious "flagship" taxa for spider conservation and public awareness. The "true" *A. robustus* is an Australian icon and warrants detailed research to untangle the effects of increasing habitat fragmentation on its genetic structure and ecology.

Biogeography and taxonomy of salt lake wolf spiders in Western Australia (Araneae, Lycosidae)

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Salt lakes represent a characteristic part of the Australian arid and semi-arid landscape and are believed to be over four million years old. They are known to have high biological productivity when flooded through a ‘boom’-cycle of abundant crustaceans that attract a large number of water birds preying on them. Much less known is that these lakes, possibly unique at a global scale, are also the home of a highly adapted terrestrial arthropod fauna, which is active when the salt lake is dry (‘bust’ cycle). There is a highly diverse fauna of wolf spiders (Lycosidae), but also jumping spiders (Salticidae) and tube-dwelling spiders (Segestriidae), scorpions (Buthidae and Bothriuridae) in addition to crickets (*Apterogryllus*), and beetles (largely tiger beetles, Cicindelinae). These specialised predators are generally only known from salt lakes, with many of them endemic to single lakes. A recent study on tiger beetles (genus *Pseudotetracha*) has shown that the genetic composition of the genus follows a vicariant pattern in the ancient paleo drainage systems along which these lakes formed independent of the distance of these lakes. Wolf spiders are an abundant and diverse group on Australian salt lakes with life history strategies very different to tiger beetles, with some only known from very small ranges and therefore being of conservation significance. The aim of this study was to improve the knowledge of the salt lake lycosid fauna in the Goldfields region of Western Australia (WA) and test if the distribution pattern of a variety of lineages also follow a vicariant pattern or if it is better explained by distance through dispersal strategies ignoring the ancient river valleys.

We conducted two fieldtrips in the Goldfields region of WA and collected spiders from the playa of twenty-five salt lakes and salt pans in October 2023 and May 2024. The most common species were *Lycosa salifodina* (subfamily Lycosinae) from fifteen lakes and *Tetralycosa alteripa* (subfamily Artoriinae) from six lakes. Based on morphology, we consider the *L. salifodina* complex to consist of at least two species. Current genetic analyses largely of mitochondrial markers will provide further evidence of a species level separation in this complex and also allow testing vicariant patterns in these two lineages, but also *T. alteripa*. These studies will therefore provide fundamental information on the endemicity and therefore conservation significance of Western Australian wolf spiders.

Arnaud HENRARD

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Communication (Systematics):

Radiation within the Ant-Eating Cryptothelinae (Araneae, Zodariidae) in the Vanilla Islands

Arnaud HENRARD & Rudy JOCQUÉ

Madagascar and the surrounding islands, known collectively as the Vanilla Islands, are renowned for their high and often unique biodiversity. Among the ant-eating spiders (Zodariidae), 23 known species, distributed across seven different genera, inhabit these remote islands. Within the Cryptothelinae subfamily (formerly Cydrelinae), only the genus *Aschema* occurs in Madagascar, comprising two species: *Aschema madagascariensis* (Strand, 1907) and *Aschema pallida* Jocqué, 1991 (the type species). Examination of specimens from various institutions has revealed a high diversity of Cryptothelinae found in Madagascar, Mayotte, and Mauritius. More than 20 new morphospecies have been identified, including new species of *Aschema* but also putative new genera. The new taxa will be described and illustrated using drawings, microphotographs, and µCT scans. Additionally, 3D models of male palps will be constructed, enhancing taxonomic information on species.

Rampant convergent evolution in pseudoscorpions from disparate cave systems: Hawaiian lava tubes and Europe's Dinaric caves

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Species inhabiting ecosystems with strong niche filtering tend to exhibit similar phenotypes, regardless of their phylogenetic relatedness. The pseudoscorpion tribe Tyrannochthoniini encompasses six genera, two of which are endemic and share a unique morphological character: the presence of three spine-like setae on the chela. These two genera are *Vulcanochthonius* Muchmore, 2000, described from the lava tubes on the Big Island of Hawai'i, and *Troglochthonius* Beier, 1939, from the Dinaric Karst in Europe. The taxonomic boundaries and even the monophyly of the genera within the tribe have been questioned but never tested in a quantitative framework. To determine whether a common trait evolves independently or, conversely, if the two genera are closely related and inherited the trait from a common ancestor, we conducted a combined, morphological and multi-target gene phylogenetic analysis of the group. We generated a matrix of 133 morphological characters and utilized two mitochondrial (*COI* and *16S* rRNA) along with three nuclear markers (*28S* rRNA, *18S* rRNA, and *H3*). Terminals represented all genera classified within the tribe, including type species whenever possible. The ages of divergence between clades were estimated using a total-evidence tip-dating approach by including three fossils. Our results confirm the monophyly of the tribe, with *Troglochthonius* emerging as a sister lineage. Moreover, we demonstrate that the shared character between Hawaiian *Vulcanochthonius* and Dinaric *Troglochthonius* does not indicate a common ancestry but rather independent evolution, likely due to adaptation to harsh subterranean environments.

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The spider genus *Juanfernandezia* (Linyphiidae) in the south Pacific Archipelago of Juan Fernández

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We report on the systematics and biogeography of the linyphiid genus *Juanfernandezia* in the oceanic archipelago of Juan Fernández. This subtropical volcanic archipelago is in the southeastern Pacific, 667 km west of continental Chile and comprises three islands ranging from 2.2 to 50 sq. km in size and from 3.8 to 1 million years in age. The archipelago has around 48 spider species recorded, spanning 13 families and 27 genera. Approximately 66% of these species are endemic and about half of them are linyphiids. Linyphiidae have independently colonized Juan Fernández multiple times and include the Neotropical genera *Laminacauda* (15 endemic species, 7 of them undescribed) and *Neomaso* (9 endemic species, 7 of them undescribed). The genus *Juanfernandezia* is presumed to be endemic to Juan Fernández and includes two species (one of them new). We have used five genes (the so-called "usual suspects") to investigate the phylogenetic relationships of *Juanfernandezia*: the mitochondrial 16S ribosomal RNA (16S) and the protein-coding cytochrome c oxidase subunit 1 (cox1) genes and three nuclear gene fragments, the protein-coding histone H3 (H3), as well as the small and large subunits of ribosomal RNA genes (18S and 28S, respectively). Our preliminary results suggest that the Juan Fernández islands were colonized once by *Juanfernandezia* and that their close relatives are found in southern South America and in some South Atlantic islands. The Juan Fernández endemics seem to have experienced a significant ecological shift compared to their closest relatives in as much they spin larger webs higher in the vegetation and have longer legs. The relationship between these traits remains to be investigated.

Hidden Treasures in Limestone Caves: Spiders in the Vangvieng Karst of Laos

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Limestone massifs are famous for their caves and their specialised fauna. The Vang Vieng Karst, located in the northern Vientiane Province, is one of the two major limestone mountain ranges in Laos, famous for its many underground caves. Since 2004, the spider fauna of this area has been studied and many new species have been discovered, including strict troglobionts such as cave-dwelling members of the family Phurolithidae (first record worldwide) and the family Ctenidae (first record for Laos), as well as one of the two completely eyeless species of the family Sparassidae. Several of them occur in separate karst networks and show vicariant distributions. It is possible that the current distribution pattern could be explained by surface and underground streams and rivers acting as vicariant barriers.

Variation in mimicry accuracy: evolution and trade-offs in ant-mimicking spiders

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Mimicry is a classic example of the convergent evolution of traits and theory predicts that selection should favour accurate mimicry. However, while many mimics are strikingly accurate, others bear only a vague resemblance to their model. Here, using a large-scale phylogenetic comparative approach, we tested the hypothesis that inaccurate mimicry represents a transitional stage in an evolutionary trajectory toward accurate mimicry. We focused on two spider groups (Salticidae and Corinnidae) that both exhibit strong interspecific variation in the accuracy of mimicking ants (myrmecomorphy). We recorded the expression of nine morphological traits contributing to the myrmecomorphic habitus in 321 individuals and reconstructed their phylogeny using UCE target enrichment sequencing. Our results suggest that ant mimicry evolved in some groups via gradual processes (rather than in jump-like events of strong morphological change) by the slow accumulation of mimicry-contributing traits. However, highly accurate mimicry states were highly unstable at the macroevolutionary scale, with trends towards reversal, and OU-model analysis indicated a global selective optimum at low mimicry accuracy. Focussing on body constrictions, the most impactful modifications to the spider’s body plan, we tested if the trend towards inaccurate mimicry can be explained with life-history trade-offs. Using two closely related jumping spiders – one ant-mimic with a prosomal constriction, and one non-mimic – we quantified the volumes of the central nervous system and the venom glands using micro-computed tomography. We found that the ant-mimic had a relatively smaller central nervous system and venom glands. These results, along with previous results on locomotory abilities and fecundity, suggest that ant-like body constrictions are under competing selection with life-history traits, such as prey capture and cognitive abilities, and may be strongly expressed only in highly selective environments.

Spiders of Tunisia (Araneae) : Past, Present and Future

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Abstract

Despite numerous recent and historical contributions, the Tunisian arachnofauna remains severely understudied due to limited research efforts, taxonomic challenges, scattered literature, and a lack of a review serving as a knowledge baseline.

A comprehensive catalog of all species of the order Araneae from Tunisia is presented. This catalog is the result of a compilation of data from all published sources up to the present. 423 species belonging to 223 genera and 45 families are documented in the country, including 29 endemics. 17 species are removed from the list, with their exclusion discussed. The taxonomic composition, number of records and species distribution in the country are analyzed. The history of araneology in Tunisia is critically reviewed, highlighting current challenges in the study of Tunisian spiders. Relevant identification sources of Tunisian spiders are presented, alongside taxa requiring revision. The present status and future perspectives of araneology in Tunisia are discussed, with recommendations provided for further research and conservation efforts.

This study provides the most detailed and comprehensive documentation of spiders in Tunisia so far, paving the way for future research on these arachnids in the region.

Hidden residents of Ethiopia:

The Assamiidae of Bale mountains and adjacent Volcanoes

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Despite Assamiidae (Opiliones: Laniatores) being one of the species-richest families within Laniatores, it suffers from a lack of taxonomical research, especially in the Afrotropical region. Ethiopian harvestmen, which have been neglected since the 1950s, have once again been thrust into the spotlight due to the recent discovery of a new subfamily in the Bale Mountains, the Filopalpinae. This discovery not only underscores the need for more taxonomical investigation of the Assamiidae but also highlights the Ethiopian highlands as an important evolutionary hotspot. This project aims to investigate the diversity of Assamiidae in the Bale Mountains (highest elevation 4377 m) and the adjacent volcanoes Chilalo (4036 m), Enkuolo (3805 m) and Kaka (4193 m). We examined all available specimens using external and genital morphology and compared them to the available Ethiopian type material. For selected species, a 3D reconstruction model of the genitalia has been obtained with Confocal Laser Scanning Microscopy (CLSM). Overall, 95% of the investigated material is new to science (approximately twelve new species and four new genera) while the rest of the material belongs to two already known Ethiopian species. The high elevation of these volcanoes has created sky-island conditions, which may explain the remarkable diversity and high endemism of assamiids in the Ethiopian mountains.

Keywords: Assamiidae; Ethiopia; Bale mountains; new species; new genera

Biogeography and systematics of the dwarf tarantula genus *Ischnocolus* (Araneae, Theraphosidae)

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The enigmatic pattern of continental-wide disjunction (RAND flora pattern), present among unrelated plant and invertebrate taxa across Afro-Arabia, has attracted the interest of biologists for decades. The pattern is mostly explained as a result of the ecological vicariance, where aridification processes that started in the late Miocene, drove organisms to the climatic refugia on the continental margins of Afro-Arabia. However, this hypothesis is mainly derived from plant taxa with good dispersal abilities, because comprehensive research on non-vagile invertebrates is lacking. Tarantulas are a good model system for biogeographic studies due to their dispersal limitations. The dwarf tarantula genus *Ischnocolus* displays an Afro-Arabian disjunct pattern, but its origin remains unknown. In addition, its phylogenetic position and systematics remains largely unresolved. We conduct phylogenomic analyses (based on UCE data) to resolve biogeographic history and systematics of the genus *Ischnocolus*. The genus was recovered as monophyletic across its Afro-Arabian range, representing the widest distribution among all tarantula genera. Our results suggest that *Ischnocolus* originated in North Africa during the Oligocene and colonized Europe and Asia, each twice independently. Additionally, one back colonization of Africa was also detected. The North Africa-Middle East colonization occurred during the middle Miocene, before the onset of the aridification of the region. The disjunct distribution of the genus in Afro-Arabian is therefore a result of a dispersal and subsequent vicariance which drove the intermediate populations into an extinction. In North Africa, *Ischnocolus* occurs sympatrically with its sister lineage endemic to the region, which consist of four valid species.

The family Buthidae represents a deep evolutionary branch of scorpions, with more than 1250 described species placed into 95 genera. It is the only family of scorpions with holokinetic chromosomes. Moreover, it shows varying degrees of karyotype variability within different groups. While some genera display considerable karyotype uniformity (e.g. *Androctonus*: 2n=24, *Compsobuthus*: 2n=22), other groups may show notable intraspecific variability (e.g. *Tityus bahiensis* 2n = 5–19). Our study analyzes the cytogenetic characteristics of two African genera, *Uroplectes* and *Parabuthus*, to compare their rates of karyotype differentiation. Both genera display a similar range of diploid numbers of chromosomes. However, Fluorescent In Situ Hybridization (FISH) used to detect the genes for 18S rRNA reveals different numbers and patterns of distribution of these gene clusters between the two genera. Moreover, these changes appear to be more frequent and extensive within the genus *Uroplectes*. On the other hand, we detected multivalent associations with high frequencies in both genera. This phenomenon likely enhances the adaptability of scorpions living in extreme conditions and is found in almost all representatives of the Buthidae family. The karyotypes of both analyzed species may display species-specific patterns. In these cases, cytogenetics represents a potential tool in taxonomy.

A temperate group living in a subtropical country: Species delimitation of leaf-litter dwelling *Allochthonius* (Pseudoscorpiones: Pseudotyrannochthiniidae) in Taiwan

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Abstract

Integrating taxonomy facilitates the determination of species boundaries for morphologically conserved taxa with limited dispersal abilities, such as litter-dwelling pseudoscorpions. The genus *Allochthonius* (family Pseudotyrannochthiniidae) is common litter-dwelling pseudoscorpions found in mid-altitude forests in Taiwan. However, preliminary data indicate a high degree of geographic structuring, with specimens from the same locations exhibiting morphological differences in commonly used diagnostic characters, complicating morphological species identification. Therefore, we aimed to integrate molecular data and morphology to delimit *Allochthonius* species in Taiwan and diagnose the taxonomic units. A multi-locus phylogeny based on one mitochondrial and two nuclear genes revealed that *Allochthonius* in Taiwan is monophyletic, yet haplotypes are never shared among the sample localities. Molecular species delimitation based on three tree-based or distance-based methods identified seven, 13 and 15 molecular species units among 54 specimens from 12 locations, with specimens from each location forming a monophyletic group. Consolidating this, we recognize at least seven species with considerable morphological and molecular differences. Morphologically, trichobothria patterns of the pedipalp and setae numbers on the carapace and coxae area are reliable characters for species identification. Overall, the data highlight that litter-dwelling pseudoscorpions living in the mid-altitudes of mountainous regions can form a sky-island distribution pattern with high endemism, presumably resulting from allopatric speciation.

Keywords: Pseudoscorpion, Sky islands, Species delimitation

Curiosities about scorpions trapped in amber

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Being basically a neontologist, I was introduced to fossil scorpions (mostly amber trapped) rather late in my career. However, my zoological experience with extant scorpions proved to be extremely useful for the study of fossils. In the last 30 years, the status of scorpions trapped in amber evolved from rare to almost common; in particular those from the Cretaceous period, mostly found in Myanmar amber also called Burmite. The studies performed since 1995 lead to the discovery and description of many remarkable taxa and the creation of not less than 7 families, 24 genera and 72 species (see Lourenço, 2023 for a synopsis). During these studies a number of curiosities were observed and some are report here. Namely: (1) The abusive cost of pieces containing scorpions. (2) Presence of possible exuviae or only the result of a taphonomic processus. (3) Presence of blind groups (Anophthalmic scorpions). Some are more or less easy to be explained, other are not so. Only the discovery of yet unknown elements will probably lead to better explanations.

Lourenço W. R., 2023. Scorpions trapped in amber: a remarkable window on their evolution over time from Mesozoic period to present days. *Journal of Venomous Animals and Toxins including Tropical diseases*: 1-15 +Addendum: Commented checklist of the known amber scorpion species: 1-9.
https://doi.org/10.1590/1678-9199-JVATITD-2023-0040

STRIKING DIVERSITY AND STARTLING RANGES OF WONDERING SPIDERS (ARANEAE) FOUND IN TUNDRA ZONE IN NORTHEASTERN SIBERIA

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Key words: Arctic, Palaearctic, distribution, range, Gnaphosidae, Philodromidae, Salticidae

There is a general pattern of biodiversity: the number of species in all groups of animals reduces with reduce of heat supply in the Arctic and Subarctic. Our studies in the Kolyma River mouth part located in the tundra zone 68º–69º revealed amazingly high species diversity of Gnaphosidae, Philodromidae and Salticidae compared to other places in the taiga and tundra zones and located on the same latitude. For 32 species, Kolyma River lower reaches is the northernmost known locality. Several species have extensive ranges and occur from the tundra zone (69ºN) to the southernmost edge of the Palaearctic south to 28ºN. Possible reasons of high diversity will be discussed.

This research was funded by a state assignment of the Ministry of Science and Higher Education of the Russian Federation (project FZMW-2023-0006 “Endemic, local and invasive arthropods (Arthropoda) of the mountains of South Siberia and Central Asia: a unique gene pool of a biodiversity hotspot").

Hidden in the Alps: re-examination of museum and private collections reveals a putative new species of *Peponocranium* (Araneae, Linyphiidae) in the Central Alps

Milano F., Pantini P., Isaia M.

Keywords: Alpine fauna, conservation, dwarf spiders, Erigoninae, morphology, taxonomy

Peponocranium Simon, 1884 is a small genus of erigonine spiders (Linyphiidae, Erigoninae) currently comprising five accepted species, four of which are distributed in Europe. Spiders belonging to this genus are rarely found, typically occurring in litter or dwelling on the ground among vegetation. Males have a characteristic large, globular cephalic lobe, with a deep groove in the median part and a pair of eyes at the top of the bulge. In 1989, Ambros Hänggi pointed out that some specimens from Southern Switzerland exhibited some slight differences compared to *P. orbiculatum*, suggesting the existence of a putative new species. The re-examination of old and recent material collected in the Central Alps (Switzerland, Italy, and Austria) stored in private and museum collections confirmed this hypothesis. Here we provide the morphological evidence supporting the existence of the new putative species and present its potential distribution range. Furthermore, we describe its ecological preferences and provide information useful for assessing the extinction risk of the putative new species according to the International Union for Conservation of Nature (IUCN) criteria.

Global Patterns in Spider Occurrence Data: Monitoring Cryptic Fauna in an Era of Human Observations Networks and Computer Vision Models

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Biodiversity; DNA barcoding; GBIF; machine learning; traits; Linyphiidae; Staphylinidae

Records of which species have been observed where and when is becoming increasingly critical to understanding our changing world. Monitoring cryptic and highly diverse groups of organisms is particularly critical at a time when our environment is warming and urbanizing. GBIF, the Global Biodiversity Information Facility, is the largest aggregator of primary biodiversity records, that is the records of which species were observed where and when. Most records in GBIF come from two major source categories. The largest data source category is human observations networks, which tend to produce huge numbers of records but for relatively few species. Museum collections databases provide a more modest number of records, but these include many species not found in the human observations networks data or other sources. Analysis using trait data demonstrates that for the 5.3 million global records of spiders, data from human observations networks have a significantly larger body size compared to museum collections. This suggests that human observations networks may be dominated by relatively conspicuous species compared to museum collections. Semiautomated taxonomic tools such as DNA barcoding and machine learning applications now complement classical expert-based taxonomy. Computer vision models are a form of artificial intelligence/machine learning that are currently being applied in the domain of taxonomic determination. We investigate museum collections as source material for building image libraries to power computer vision models. A blend of classical and semiautomated high-throughput taxonomic determination methods holds promise for biodiversity monitoring that includes cryptic and diverse taxa.

PATTERNS OF MORPHOLOGICAL DIVERSIFICATION IN DWARF RED DEVIL SPIDERS (ARANEAE, DYSDERIDAE, HARPACTEINAE)

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Establishing conservation priorities to address the current biodiversity crisis require understanding the mechanisms governing species richness. However, the history of diversification through time and space of many spider groups remains fragmented due to poor knowledge of the world's arachnofauna, inconsistent characterization of defining synapomorphies, and lack of well-supported and resolved phylogenies.

Here, we explore the patterns of phenotypic variation in different body structures among distinct lineages within a highly somatically uniform spider group. We combined morphometric tools, multi-locus phylogenetic analysis and comparative methods to investigate the morphospace exploration of the different lineages and the phylogenetic informativeness of somatic and genitalic traits.

The dwarf red devil spiders (Harpacteinae) are a subfamily of Dysderidae Koch, 1837 that include small-sized nocturnal wandering and cave-dweller spiders endemic to the western Palearctic. With the exception of troglobitic adaptation, they exhibit a uniform somatic morphology and highly divergent genitalia, which has challenged their high rank classification. Our results confirmed the non-monophyly of most current genera. The morphometric analysis revealed contrasting levels of exploration of the morphospace among the monophyletic lineages identified. Overall somatic traits showed a high phylogenetic signal, while male genitalic palp traits did not, suggesting the potential involvement of sexual selection on genital evolution and ultimate its key role as species diversification driver.

Keywords: Araneae, Palearctic, n-dimensional hypervolume, comparative phylogenetic methods, Harpacteinae

Session: Systematics and Taxonomy

Proposed format: (X) Oral presentation

Integrative taxonomical approaches in the exploration of the diversity of the Carpathian *Neobisium* pseudoscorpions (Arachnida: Pseudoscorpiones: Neobisiidae)

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Pseudoscorpions, the fourth largest order of arachnids with more than 4000 described species, represent a taxonomically difficult group. Despite the fact that pseudoscorpions are important predators in almost all terrestrial habitats, they are not a frequently studied group. They are rather morphologically homogeneous and their species-level determination using external morphology and basic measurements is not easy. However, the taxonomy of the order is predominantly based on these types of characters, despite our relatively poor understanding of their intra- and interspecific variability. Therefore, the delimitation of many pseudoscorpion species is often not clear and the diversity of these arachnids may be underestimated.

The Carpathian Mountains represent an excellent geographic model for studying cryptic diversity via integrative approaches. The Carpathians are the second longest mountain range in Europe forming an arc across Central Europe, constituted by several mountain regions and large rivers, which may act as important geographic barriers.

The species diversity of pseudoscorpions belonging to the genus *Neobisium* from the Carpathians was analyzed using integrative taxonomical methods. Comparison of different characters (karyotype analysis, external morphology, morphometric data, mitochondrial COI and nuclear 28S molecular data) enabled us to evaluate their utility in the species delimitation in this group, which shows a relatively uniform external morphology among closely related species.

Analyzing the combined results of the morphological, morphometric, molecular, and cytogenetic datasets, we have evaluated the informativeness of previously utilized morphological and morphometrical characters in the delimitation of *Neobisium* species, and delimited cryptic lineages. We have also curated the mitochondrial COI gene barcode library of *Neobisium* species living in the Carpathians. Furthermore, we have evaluated the role and possible impact of karyotype changes on speciation. These results contributed to a better understanding of the diversity and biogeography of this taxonomically highly complicated pseudoscorpion genus.

The dwarfs that crossed the Ocean: exploring the diversity of Hawaiian linyphiids

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Oceanic islands are excellent arenas to study evolutionary patterns and species diversification. The Hawaiian archipelago is a great example as it is the most isolated archipelago, and its geological history is well known. These islands are characterized by high level of endemism and many radiations of terrestrial arthropods that have been previously described (e. g. fruit flies, crickets, damselflies, carabid beetles and long-jawed orb weaving spiders). However, considerable fraction of Hawaiian arthropod diversity remains unknown and it is urgent to describe it as the archipelago few remaining native habitats are dwindling. Within the spiders of the family Linyphiidae, the only radiation described so far is the one of the genus *Orsonwelles* Hormiga, 2002, where all species are single-island endemics with small non-overlapping distributions. However, in a recent metabarcoding study, a high diversity of linyphiid species that do not belong to *Orsonwelles* was detected. In the present study we aim to explore these undescribed potential linyphiid radiations. For that we use an approach combining morphology with genomic data. The preliminary results based on the COI molecular marker, revealed a high species diversity within two genera: *Erigone* Audouin, 1826 and *Agyneta* Hull, 1911. Both genera have a complex taxonomy as they are very diverse (111 and 202 species respectively) and present a challenging morphology. Our results show that sequences from the Hawaiian samples appear to be structured by islands suggesting potentially undescribed native species. Currently we are making efforts to increase our sampling and to expand our observation on the ecology of the Hawaiian *Erigone* and *Agyneta* species.

The dwarfs that crossed the Ocean: exploring the diversity of Hawaiian linyphiids

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Oceanic islands are excellent arenas to study evolutionary patterns and species diversification. The Hawaiian archipelago is a great example as it is the most isolated archipelago, and its geological history is well known. These islands are characterized by high level of endemism and many radiations of terrestrial arthropods that have been previously described (e. g. fruit flies, crickets, damselflies, carabid beetles and long-jawed orb weaving spiders). However, considerable fraction of Hawaiian arthropod diversity remains unknown and it is urgent to describe it as the archipelago few remaining native habitats are dwindling. Within the spiders of the family Linyphiidae, the only radiation described so far is the one of the genus *Orsonwelles* Hormiga, 2002, where all species are single-island endemics with small non-overlapping distributions. However, in a recent metabarcoding study, a high diversity of linyphiid species that do not belong to *Orsonwelles* was detected. In the present study we aim to explore these undescribed potential linyphiid radiations. For that we use an approach combining morphology with genomic data. The preliminary results based on the COI molecular marker, revealed a high species diversity within two genera: *Erigone* Audouin, 1826 and *Agyneta* Hull, 1911. Both genera have a complex taxonomy as they are very diverse (111 and 202 species respectively) and present a challenging morphology. Our results show that sequences from the Hawaiian samples appear to be structured by islands suggesting potentially undescribed native species. Currently we are making efforts to increase our sampling and to expand our observation on the ecology of the Hawaiian *Erigone* and *Agyneta* species.

Developing a standardized multi-locus barcoding approach for spider taxonomy

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Taxonomy has greatly profited from the method of DNA barcoding. Currently used barcoding approaches are often based on single markers. However, their taxonomic resolution is often limited, as the evolution of a single gene often does not reflect that of a species. The development of high throughput sequencing technology has made it possible that molecular taxonomic hypotheses can now be based on hundreds or thousands of loci sampled across the genome. However, such high throughput approaches considerably increase the necessary workload and cost for DNA barcoding. For taxonomists who are facing the identification and description of hundreds of new species, such high throughput protocols are often prohibitively expensive and laborious. This becomes especially evident for a hyper diverse taxon like spiders. Therefore, we aim to develop a standardized DNA barcoding protocol to recover genome wide multi locus data for spider taxonomy. Suitable DNA barcode markers will be identified by comparative genomics, amplified by long range PCR and then sequenced using Nanopore technology. Our protocol will be distinguished by its simplicity and cost efficiency at a cost of few Euros per specimen. In this talk, we present our bioinformatic pipeline and the results of the first laboratory tests.

Taxonomic insights into Iberian Zodarion species (Araneae, Zodariidae): morphological documentation and molecular characterization of the rubidum and styliferum groups

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Keywords: Ant, eating spiders, Zodarion, copulatory organs, Iberian Peninsula, genetic divergence, COI, phylogeny

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Exploring hidden diversity: unveiling distinct species groups in the genus Ariadna Audouin, 1826 (Araneae, Segestriidae) from coastal to forest environments throughout the Japanese Archipelago

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The genus Ariadna (Araneae: Segestriidae) comprises 145 nominal species distributed worldwide, predominantly in tropical and subtropical regions, making it the most diverse member of its family. Previous taxonomic studies have largely focused on the diversity of continental regions such as Australasia and the Neotropics, while insular diversity has received limited attention. Investigating the Japanese fauna, with its myriad islands and complex geohistory, may offer a unique opportunity to trace the speciation history within this genus. Our study reevaluates the taxonomic relationships of Japanese species through comprehensive morphological and phylogenetic analyses, incorporating habitat data based on specimens collected from various regions of Japan. Morphological comparisons, focusing on genital characteristics and leg spination, revealed several unidentified species in the Ryukyu Archipelago. These species were subsequently classified into provisional species groups: the A. lateralis species group and the A. insulicola species group. These two groups differ in body coloration (blackish brown vs. reddish brown), body length (over 10mm vs. under 8mm), and habitats (urban afforested lands and secondary forests vs. coastal regions). Molecular phylogenetic analysis using mitochondrial and nuclear genes provided key insights, including the monophyly of both the A. lateralis and A. insulicola groups and their distantly related lineages. Our future studies aim to conduct robust phylogenetic analyses, including species from East Asia. This presentation will discuss current findings and outline future research directions.

Keywords: coastal environment ; distribution ; forest ; habitat ; molecular phylogeny ; morphology ; tube web spiders

Opening Pandora’s box. Integrative taxonomy of *Eresus*

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Species of the genus *Eresus* Walckenaer, 1805 – commonly known as ladybird spiders – are well characterized by the males' distinct abdominal pattern. The bright red background with four to six dots is a rather uniform pattern within the genus with only a surprisingly growing number exceptions. We used both molecular and morphological data to sort out the specimens into species to examine males that have atypical abdominal colours, mainly from the western Mediterranean and Asia, yet placed to Eresus. We present a phylogenetic tree based on COI sequences, which represents the first large scale phylogeny for *Eresus*. Besides the Central-European *E. moravicus, E. kollari*, *E. hermani* and *E. sandaliatus* a larger sampling of the Western “*E. kollari*” species, as well as a diverse Italian clade and the quickly diversified Asian clade is explored. Furthermore, based on the results from our phylogenetic analysis and morphological examinations we discuss cryptic speciation and possible introgressive events. We are pointing out taxonomic problems to solve to avoid conservation issues of the European populations in the future. Seemingly the molecular taxonomy of velvet spider taxa are almost as challenging as the morphology based studies. Possible explanations in comparison of *Loureedia* is presented.

Title: Development of cost-efficient method for DNA barcoding of century old museum specimens of spiders and its importance for taxonomic research.

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Key words: museomics, hDNA, jumping spiders, species delimitation, hidden diversity, Oxford Nanopore sequencing.

The Natural History Museums include unique species collected decades or even centuries ago which are invaluable for morphological and taxonomic research. However, the DNA of historical specimens is degraded, making traditional sequencing techniques inefficient. The aim of our study was development of cost-efficient method for DNA barcoding of up to a century old spider specimens. We selected 96 Australasian *Cytaea* jumping spiders collected from 1900 to 1989, characterised by unclear species borders. For DNA isolation we used non-destructive protocol based on magnetic beads. To amplify degraded DNA, we designed 6 primer pairs to recover a full 650bp COI barcode. We sequenced PCR products on the Flongle flowcell using MinION platform. From one sequencing run we obtained the DNA for 93 specimens. For 18 specimens we obtained full 665bp COI barcodes, for the remaining 75 we obtained barcodes with lengths about 350-550bp. Moreover, we obtained 370-646 bp sequences from six specimens collected in 1904. The sequences obtained allowed us to clarify taxonomic issues and to uncover hidden diversity in *Cytaea*. Finally, we are presenting a protocol allowing to obtain the COI fragments from over century old museum specimens for relatively low price. Our protocol can be applied in a variety of studies of taxonomy, ecology, population genetics based on valuable historical specimens, and further can be adapted for sequencing a variety of animal taxa and other genes as well.

Evolution of diverse lifestyles in nursery web spiders (Araneae: Pisauridae)

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Nursery web spiders, family Pisauridae Simon, 1890, currently contains 52 genera globally. Showing diverse morphologies and lifestyles, some pisaurids are terrestrial wandering spiders, some construct sheet or three-dimensional capture webs in numerous shapes and sizes in terrestrial habitats, and others, notably *Dolomedes* Latreille, 1804, are semi-aquatic. To understand the evolution of pisaurid lifestyles, a robust phylogeny is necessary that would facilitate comparative analyses. Here, we report on a phylogenomic study that addresses these broad questions. Our results suggest that a semi-aquatic lifestyle is ancestral to all pisaurids, with at least three subsequent reversals to terrestrial lifestyle. On the other hand, the ancestral presence/absence of capture web is ambiguous. Our results strongly suggest an independent evolution of lifestyles and capture web. Comparative analyses furthermore suggest that semi-aquatic pisaurids are larger than the terrestrial ones. This interesting pattern may indicate a body size threshold above which surface tension is broken while spiders forage underwater.

Keywords: Fishing spiders; raft spiders; phylogenomics; ancestral reconstruction

Abstract

Is *Tedia* really a *Tedia* or is it belong to the genus *Dysdera*?

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Tedia Simon, 1882 is a Levantine genus of woodlouse hunter spiders (Dysderidae C. L. Koch,1837), that currently includes two recognized species, the type species *Tedia oxygnatha* Simon, 1882 and *Tedia abdominalis* Deeleman-Reinhold, 1988. The taxonomic status of *Tedia* has been debated, with some researchers suggesting that it should be transferred to the genus *Dysdera* Latreille, 1804. In this work, I used morphological and molecular data to investigate the taxonomic status of the two *Tedia* species. I studied 15 *Tedia* specimens and used 11 Dysderidae specimens (of the genera *Dysdera*, *Dasumia* and *Harpactea*) for comparison. Molecular analysis of the mitochondrial gene COI showed that all *Tedia* specimens I sequenced, clustered together in one clade, sister to a clade with other dysderid genera, supporting the hypothesis that *Tedia* is a monophyletic genus. However, one *Dysdera* specimen also clustered in this clade. My molecular analysis suggests two lineages within the *Tedia* clade, which may represent the two distinct *Tedia* species. The morphological analysis showed significant differences between the two *Tedia* species in the average ratio between ALE gap to eye diameter. However, geometric morphometrics analysis of carapace shape did not show clear separation between the two *Tedia* species. Overall, my results suggest that *Tedia* is a valid genus, distinct from its sister-genus *Dysdera*, although further genetic data may reveal a more complex phylogenetic relationship between the two genera. Additionally, my analyses support the existence of two distinct species within the genus *Tedia*, but further research is needed to redescribe them and find synapomorphies.

“New Data on the Spider Fauna of Iran”: an overview of the results from a decade-long large-scale project

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To expedite arachnological research in Iran, I launched a project in 2014 titled “New Data on the Spider Fauna of Iran.” Initially, the project aimed to publish a large number of faunistic records – 25 new country records on average – within a series of collaborative research articles. Additional data such as descriptions of new species and previously unknown sexes, proposals for taxonomic changes, and records of species from nearby countries were included in later parts of the project. As of 2014, eleven parts of this series have been published within nine journals, and a total of 24 collaborators from 20 institutes and 10 countries have contributed to it. The results have been significant, with seven families, 57 genera, and 273 species recorded in Iran for the first time, along with four species newly recorded from five other countries, and illustrations provided for 141 species. These newly recorded species represent over 26% of the total number of known spider species in Iran. Notably, four records mark the first documentation of their respective species in all of Asia. Moreover, 42 species were excluded from the list of Iranian spiders, and four species were removed from the checklists of seven other countries. Additional results from this series include descriptions of nine species new to science and the previously unknown sexes of three species, proposals for three taxonomic changes – one new synonymy, one new combination, and one resurrection from synonymy – and hundreds of new provincial and distribution records.

Morphology and Zoology

Ultrastructural diversity of trichoid sensilla in a spider: did olfactory sensilla evolve from contact-chemoreceptive sensilla?

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Arthropods use cuticular structures to transduce specific environmental stimuli into a bioelectric signal. Among these, hair-equipped (trichoid) sensilla cover a variety of senses, such as mechano-, chemo-, thermo- and proprioreception. To date, our knowledge of sensillar equipment and diversity in arthropods largely pertains to those on insect antennae. Among arachnids, most of what is known about sensilla concerns mechanoreception: there is a large body of evidence, especially for spiders, that sensitivity for touch, airborne and substrate vibration is highly developed. In contrast, olfactory capacities of spiders are poorly understood, especially with regard to which sensilla they use for odor detection.

Therefore, we investigated putative chemoreceptive sensilla on the walking legs of *Argiope bruennichi*, whose pheromone has been identified, synthetized and successfully tested in the field. Proximal podomeres of the walking legs of males are densely equipped with wall-pore sensilla known to be specialized for olfaction in insects. Ultrastructural features, such as the specific configuration of the sensory apparatus and surrounding sheath cells differ from those of insects and other arachnid taxa. Surprisingly, we did not find wall-pore sensilla on the legs of female *A. bruennichi*. Instead, we documented only numerous tip-pore sensilla, that also occur in males. Tip-pore sensilla are contact-chemoreceptors specialized in tasting liquid- or substrate-bound substances, but may also perceive volatile odors.

Our SEM- and TEM-study provides a comprehensive overview of the distribution and ultrastructure of trichoid sensilla present on the walking legs of *A. bruennichi*. We specifically focus on the (sub-)cellular organization of tip and wall-pore sensilla which we found to be similar in many aspects and different from those in insects. Therefore, it seems pertinent to assume that wall-pore sensilla of male *A. bruennichi* derived from tip-pore-like precursors. This, along with preliminary data of chemoreceptive sensilla of other spider species, implicates that wall-pore sensilla have evolved independently several times in arachnids and perhaps also in spiders.

Across the Spiderverse: comparative analysis of metals in spiders' mouthparts

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ABSTRACT

Spiders (Arachnida, Araneae) are a widespread group of generalist predators, principally insectivorous. The main purpose of this study is comparing, through a morpho-functional approach, for the first time the presence of metals and other elements on the feeding structures (fangs, cheliceral teeth and serrula) of Araneomorph spiders and exploring how this feature varies in relation with morphological and ecological traits of the species (body length and functional guild). A total of 127 spiders, belonging to 39 species, distributed among 20 families, were collected and identified. The presence of zinc, manganese, calcium and magnesium was analysed through Energy Dispersive X-ray Spectroscopy (EDS). Calcium was recorded in all mouthparts, whereas magnesium was generally absent only in the fangs. Manganese was found only in the cheliceral teeth, whereas zinc was recorded in all the mouthparts, including the serrula, where its presence is documented here for the first time. The highest levels of zinc and manganese were found in fangs and cheliceral teeth respectively, in accordance with previously published works. Furthermore, the greatest concentration of zinc in the fangs occurs in the family Salticidae. Through General Linear Models, it was found that the % of manganese in the cheliceral teeth was positively associated with body length, whereas calcium % was higher in in the serrula and the fangs of free-hunters than in web-makers, because probably the former require a stronger prey holding. In addition, zinc levels in both fangs and serrula did not significantly vary with the ecological traits, likely due to phylogenetic inertia.

Keywords: body length ; calcium ; chelicerae ; EDS ; functional guild ; magnesium ; manganese ; serrula ; zinc

Comparison of the ovary structure in Parasitengona mites (Chelicerata, Acariformes)

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In Chelicerata, the panoistic ovary predominates, in which all germline cells differentiate into oocytes. In two lineages of mites, Acariformes and Parasitiformes, the panoistic and meroistic ovary (with germline cells differentiated into the oocytes and nurse cells) have been described. Previous research revealed a diverse architecture of the meroistic ovary in various mite taxa, however, the general knowledge of its structure in mites remains incomplete and inconsistent.

The study aimed to analyze the structure of the ovary in Parasitengona mites, including terrestrial representatives of the group and Hydrachnidia. The studies were carried out using light, confocal, and transmission electron microscopes.

Our results provide the first detailed insight into the structure of the ovary in water mites and allow us also to verify the data on the female gonad structure in microtrombidiid *Platytrombium fasciatum*, published by Shatrov (2002).

In all analyzed species, the presence of a meroistic ovary, composed of oocytes bulging on the ovary surface, and nurse cells located in the ovary wall was documented. The connection between oocytes and nurse cells is formed by trophic cords which serve for the transfer of macromolecules and organelles from nurse cells to oocytes in a microtubular dependent manner. It indicates that the general structure of the ovary in the examined Parasitengona mites is uniform. Significant differences in the morphology of the nurse cells observed between the members of terrestrial Parasitengona and of water mites may reflect the present views on the paraphyletic origin of the terrestrial representation of the group.

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Host-parasite interactions between *Trombidium brevimanum* (Trombidiidae) and Pseudoscorpiones – new data on host specificity and stylostome morphology

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In the literature records of parasitism on pseudoscorpions are very scarce. Small body sizes and hidden lifestyles do not make it easy to observe such, relatively short duration, phenomenon in nature. *Trombidium brevimanum* is one of the red velvet mite species whose single cases of parasitism on Pseudoscorpiones has been documented, specifically on two Neobisidae species: *Neobisium bernardi* and *N. crassifemoratum*.

The Trombidiidae species during parasitism produce in the host tissues feeding tubes called stylostomes. Their role is to facilitate food intake and strengthen the connection between parasitic larva and the host. The morphology of stylostomes of different Trombidiidae species is poorly understood.

The aim of the study was to deepen knowledge of the parasite-host interactions between *T. brevimanum* and Pseudoscorpiones and to analyze the structure of the stylostomes. Reared larvae were, under laboratory conditions, combined with representatives of five different species of Pseudoscorpiones. The hosts with parasitizing larvae were preserved and analyzed by light microscope.

Larvae *T. brevimanum* successfully parasitized *Chelifer canroides* (Cheliferidae), while did not parasitize *Neobisium caricinoides, N. erytrodactylum* (Neobisidae), *Pselapochernes scorpioides* or *Dinocheirus panzeri* (Chernetidae). Observation of parasitism under controlled conditions allowed for the first time ecological data relating to measures such rare host-parasite association and to describe stylostome morphology and trace its development. An average four larvae (1–14, n=13) were parasitized on a single host and the parasitic phase lasted 16 days (3–27, n= 48). Larvae parasitize pleural membranes, but in case of high infestation, also between abdominal sternites.

Abstract for ECA 2024, Rennes, France, August 26 – August 30

R.F. Foelix (invited speaker)

Title: Some blind spots in spider biology

Usually, scientific talks present new findings and their interpretation. Here I want to point out certain areas in arachnology which are hardly known but should be studied in more depth in the future. The focus will lie mostly on Functional Anatomy , because this is the field the author has dealt with for over 50 years and therefore knows best what is known, half-known, or not known at all. Some examples are : the occurrence and function of various gland systems (dermal, cheliceral, maxillary glands) in spiders, the structure and composition of spider cuticle, extra-oral digestion (esp. In the Uloboridae), the handling of silk threads by the different claws, structural colors and UV-fluorescence in spiders and scorpions, and finally some selected spiders with highly unusual behaviors will be presented and discussed.

The repeated evolution of eye loss in spiders

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Multi-ocular vision has been a feature of the arthropod body plan for more than 500 million years. Spiders have some of the most diverse and successful multi-ocular systems among living arthropods. Although most species have four pairs of eyes, spiders exhibit a huge variety of configurations in eye size, number, and arrangement. Many taxa have lost one or more pairs in independent phylogenetic events, most commonly, but not exclusively, the anterior median eyes (AME). The variation in eye number is of particular interest in the Synspermiata, an early-diverging clade of spiders with multiple reductions and losses of eyes occurring independently in Caponiidae, Dysderoidea, Scytodoidea, and the Lost Trachea Clade. Among these, caponiids are a highly unusual, enigmatic group with many fascinating morphological traits including their highly variable number of eyes: caponiids may have zero, two, four, six, or eight eyes, making this group the most variable of any epigean family. Unusually, it is the AMEs that are most commonly retained in these taxa. However, almost nothing is known about their visual capabilities or ecology. To address these gaps and assess the impacts of eye loss on caponiids, we present the first study of eye morphology in caponiid species and closely related synspermiatan taxa with different eye numbers. We used synchrotron X-ray tomography and a geometric morphometric approach to investigate their structure and quantify the size, position, and orientation on the carapace. We also explored the internal anatomy and compared it between the principal and secondary eyes. Of particular interest are the relocation of eyes on the carapace to retain optimal field of view coverage, compensation through the reallocation of resources to the remaining eyes, and compensation through increased investment in other sensory modes. Preliminary results on the eye number and diameter of the analyzed species are presented and discussed.

Pseudoscorpions - an insight into adaptations for matrotrophy

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Embryo development is based on two strategies in providing the embryo with nutrients: lecithotrophy and matrotrophy. In the first case, the embryo utilizes reserve materials deposited in the ooplasm during oocyte growth, and in the second case, nutrients are provided by a maternal organism. Among arachnids, lecithotrophy predominates, while matrotrophic development is characteristic exclusively of scorpions and pseudoscorpions. In these taxa, nutrients come from different sources/organs, indicating independent evolution of that developmental strategy. In pseudoscorpions, the nutritive fluid is produced in the female reproductive system. Our studies on pseudoscorpions aimed to find the adaptations for matrotrophy at the cellular and tissue level in a comparative study comprising representatives of four families from three superfamilies Neobisioidea (Neobisiidae), Cheiridioidea (Cheiridiidae) and Cheliferoidea (Chernetidae, Cheliferidae). Except for some common characters, e.g., the production of nutrients by the ovary and oviducts, we showed differences in modifications of the female reproductive system associated with the production of the nutritive fluid that concern 1) the number of cell population involved in the synthesis of nutrients, 2), hypertrophy and polyploidy of cells producing the nutrients, 3) the site of storage of nutrients in the female reproductive system, 4) the amount of nutrients deposited in the ooplasm, and 5) the set of organelles transferred to the embryos.

ECA Abstract 2024 for Presentation

Love on the Rocks: Unraveling the mysteries of eggsac construction and silk from the micro to nano scale of the ground-dwelling spider *Castianeira sp.* (Araneae: Corinnidae) from the Rocky Mountains, USA

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Knowledge of arachnid mating systems and eggsac construction in natural settings are relatively unknown. This multiphase study explores mating behavior, eggsac creation and characterization, and reports upon mitigating actions taken within the spiders' habitat during a bridge permitting process.

The study is novel in that it interweaves ethological field data of eggsac construction with advanced imaging techniques to characterize silk fibers and microstructure of eggsacs at the micro to nanoscale.

The first instance of mating behavior in the field for the genus *Castianeira* Keyserling, 1879 is described from observation of *Castianeira sp*. in northwestern Wyoming. In this species, females build intricate mounds over their eggsacs and mating behavior was observed while the female was building a mound over an existing eggsac, suggesting females may have more than one clutch of offspring during the mating season.

Understanding of eggsac silk is limited (Sethy and Ahi, 2022) and not commensurate with its importance for species survival. This research focuses on characterizing for the first time eggsac construction of *Castianeira sp.* from nano and microstructures to behavioral analysis. Techniques used to date to characterize the chemical signatures of silk include Raman, FTIR Spectroscopy and eggsac structure using Optical Profilometry.

Examining broader implications for this research, this presentation examines microhabitat features and mitigating actions with a case study of a bridge infrastructure project within this spider population's habitat.

Abstract SEB

Title: Comparative anatomy of the spinneret musculature in cribellate and ecribellate spiders (Aranea)

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Silk Production is one of the most prominent characteristics of spiders. The silk is extruded through spigots located on the spinnerets, which are single- to multimembered paired appendages at the end of the abdomen. Most extant spiders have three pairs of spinnerets, and in between either a cribellum (spinning plate) or a colulus (defunct vestigial organ), dividing these spiders into cribellate and ecribellate species. Previous research has shown that cribellate and ecribellate spiders differ not only in the composition of their spinning apparatus but also in the kinematics of spinneret movements during silk spinning. The objective of this study was to determine whether the differences in spinneret movements are solely due to variations in the degrees of freedom of the spinnerets or whether they are based on differences in muscular anatomy. This was accomplished by analyzing micro-computed tomography scans of the posterior abdomen of each three cribellate and ecribellate species. It was found that the number of muscles did not differ between cribellate and ecribellate species, but there were distinct differences between the species within each group. Muscle thickness, particularly of the posterior median spinneret, varied slightly between groups, with cribellate spiders exhibiting more robust muscles, possibly to aid in the combing process during cribellar thread production. Interestingly, the vestigial colulus still possessed muscles, that could be homologized with those of the cribellum. This initial exploration into spinneret anatomy using micro-CT data reveals that despite being small appendages, the spider spinnerets are equipped with a complex musculature that enables them to perform fine-scaled maneuvers to construct different fibre-based materials.

Keywords: Comparative morphology, Araneidae, Agelenidae, Desidae, Eresidae, Hersiliidae, Uloboridae

Biomechanics of venom delivery in South America's first spitting scorpion

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Venom is a metabolically expensive secretion used sparingly in a variety of ecological contexts, most notably predation and defense. Accordingly, few animals use their toxins in ranged attacks, and venom-squirting behaviour is only known from select taxa. In scorpions, species belonging to two genera are known to spray venom when threatened, and previous work in *Parabuthus transvaalicus* shows that venom delivery depends on perceived levels of threat. Here, I describe *Tityus* (*Tityus*) *achilles* sp. nov., a new species of Buthid scorpion from Cundinamarca, Colombia. Remarkably, this species is capable of venom spraying, a first for both the genus and the South American continent. Using frame-by-frame video analysis and ballistic equations, I show that *T. achilles* sp. nov. employs not one, but two types of airborne attacks with dramatic differences in range and venom expenditure. Further, the new species uses an unusually large reserve of prevenom-like secretion for spraying, as opposed to the costly venom used by other spitting scorpions. In light of these key specializations, I propose that venom spraying convergently evolved in response to different selection pressures, laying the groundwork for future investigation.

Do males of fishing spiders with extreme sexual size dimorphism show modifications in sperm production and genital morphology?

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Monogynous mating systems, where a male only copulates with a single female, are particularly common in spider species with pronounced sexual dimorphism, sexual cannibalism or other terminal investment strategies. Previous studies have demonstrated that monogyny is also linked to changes in the reproductive system with males terminating spermiogenesis once reaching adulthood in some orb weavers and cobweb spiders, both belonging to the Araneoidea. However, it is unknown whether such dramatic changes also evolved in non-araneoid monogynous spiders such as the dark fishing spider *Dolomedes tenebrosus*. We investigated the spermatogenesis of monogynous and polygynous fishing spiders and found that spermatogenesis is terminated shortly after reaching adulthood in *D. tenebrosus* and *D. okefinokensis*, but is continuous in the polygynous *D. scriptus* and *D. fimbriatus*. Furthermore, we explored whether the mating systems is also linked to the size of the spermophor (sperm storage site in the male genitalia). It can be hypothesized, that monogynous males evolved an enlarged spermophor to maximize the amount of available sperm to be transferred. Using micro-computed tomography, we demonstrate that *D. tenebrosus* and *D. okefinokensis* have a conspicuously enlarged spermophor in comparison to polygynous species (*D. minor*, *D. aquaticus*, *D. scriptus* and *D. plantarius*). In conclusion, we confirmed that in non-araneoid spiders with terminal investment strategies a termination of spermatogenesis and changes in the genitalia evolved, which suggests that *D. okefinokensis* also has a monogynous mating system. However, the evolution of monogyny among *Dolomedes* spiders is still unclear as it requires a robust phylogeny of this speciose genus.

Keywords: sexual selection, spermatogenesis, male sacrifice, genital evolution

Molecular identification and symbiont insights in invasive *Mermessus* (Araneae: Linyphiidae) spp. from Israel

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Mermessus species originated from the Americas, have been introduced to other parts of the world. Based on morphological characteristics, two alien *Mermessus* species were previously documented in Israel as *M. fradeorum* (Berland, 1932) and *M. denticulatus* (Banks, 1898). However, upon comparing the tibia of local *Mermessus* specimens with those of typed *M. fradeorum* and *M. denticulatus*, we found that their tibia structure does not exactly match the structure of either species, thus questioning the precise identification of this genus in Israel. Therefore, we used DNA barcoding for molecular identification, where two mitochondrial and two nuclear genes were used for phylogeny analysis. Based on the evolutionary relationship, *Mermessus* specimens found in Israel are closely related to *M. fradeorum* from the USA, supporting the presence of only *M. fradeorum* in Israel. Given the invasive nature of this species, we questioned whether bacterial symbionts naturally found in the spider origin, provide an advantage for persisting in new environments. We tested for specific arthropod symbionts in two sympatric Linyphiid species from Israel, the invasive *M. fradeorum* and the native *Erigone dentipalpis* (Wider, 1834). Interestingly, while local *M. fradeorum* lacks a specific symbiont, the native *E. dentipalpis* is infected with two symbiont lines. Our findings confirm the presence of *M. fradeorum* in Israel, however, the role of symbionts in adaptation to novel environments awaits further studies.

Directional genital asymmetry and copulatory mechanics in the midget funnel-web spider *Mecicobothrium thorelli* (Araneae, Mecicobothriidae)

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Mygalomorph spiders are usually characterized by simple male and female genitalia, suggesting that their genital coupling mechanisms are not complex. In contrast, representatives of the monogeneric family Mecicobothriidae (dwarf tarantulas) are characterized by rather aberrant genitalia with male copulatory organs having a heavily-coiled embolus and female genitalia having a pair of cork-screw shaped and a pair of sac-like spermathecae. We investigated, for the first time, the genitalic interaction during mating using micro-computed tomography and thorough morphological examinations of the structures involved in both the cheliceral and genital couplings using the dwarf tarantula *Mecicobothrium thorelli*, which is endemic to Argentina and Uruguay. In all examined females the cork-screw spermathecae are only rotated counter-clockwise (opposite to previous taxonomic descriptions) representing a directional genital asymmetry, while in all examined males, the left embolus rotated counter-clockwise and the right clockwise. Most frequently the left embolus was inserted in the right cork-screw shaped spermatheca. Based on our in-copula analysis, we can show that part of the male embolus has a thin, flexible portion, allowing it to "unscrew" to be inserted into the cork-screw shaped spermatheca. In summary, this is the first reported case of directional genital asymmetry in mygalomorph spiders.

Keywords: Sexual selection, micro-CT, functional morphology, Mygalomorphae

Retinal Determination Gene Network dynamics in *Tegenaria pagana* C. L. Koch, 1840 (Araneae: Agelenidae) spider embryos.

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The Retinal Determination Gene Network (RDGN) controls the process of retinal development in various vertebrate and invertebrate eyes including several spider species, such as *Cupiennius salei* Keyserling, 1877 and *Parasteatoda tepidariorum* (C. L. Koch, 1841). Functional data for the gene copy *soA* (*sine oculis A*) have shown that it's involved in patterning both principal and secondary eyes in the spider *P. tepidariorum* and possibly in many other arachnids. Yet, several aspects of this network remain unexplored, including the genes initiating eye formation during embryogenesis and those specifying eye fate in spiders. Species of the genus *Tegenaria* Latreille, 1804 inhabit caves and present varying degrees of eye development from fully formed eyes to a complete loss of eyes. This makes *Tegenaria* a good model genus for studying eye loss in cave spiders. In our study, using HCR, we investigated embryonic gene expression in the eye-bearing species *Tegenaria pagana* C. L. Koch, 1840 in different developmental stages. Our analysis showed that the genes *eyes absent* and *so sine oculis* are expressed in all eye types in all stages, while *atonal* and *orthodenticle* were detected in all eye types but on later stages of the development, whereas *dachshund* was detected only in the secondary eyes of *T. pagana* starting from stage 11, as in *P. tepidariorum* and *C. salei*. The gene *Six3.1* is expressed in the secondary eyes only at late stages of development in *T. pagana*. Our study is the first investigation of Retinal Determination gene expression in cave spiders.

Vision is a key driver of brain evolution for many animal groups. Spiders are not the exception, having evolved eight eyes whose input is processed in two independent nerve pathways. The visual processing centres occupy most of the brain volume, and their size and complexity vary between spider lineages. My project aims to understand the coevolution of the eye-brain system and its drivers, focusing on three visual hunter families (Deinopidae, Lycosidae and Salticidae). Moreover, my project seeks to generate a fundamental understanding of the evolution of these traits across the whole Order Araneae. Here, I will present the generalities of my project, as well as the preliminary results obtained in collaboration with the MultiplEye team in Berlin: 1) A review of eye loss and reductions in Araneae, and 2) the initial steps toward an analysis of the brain-body allometry.

Authors

Simone Yuri*, Herrel Anthony, Van der Meijden Arie

Title

Crushers can’t be graspers: diversification of scorpion chela diversity toward two opposite functional optima

Abstract

Evolutionary trade-offs and functional integration shape the diversity of morphological traits and constrain adaptive responses to selective pressures. When selective pressures for different functions act simultaneously to shape structures, trade-offs can arise. These trade-offs are believed to constrain trajectories of evolutionary diversification leading to a high degree of covariation among traits toward a single performance optimum.

We studied species representing two morphological extremes in the chela (pincer) architecture of scorpions. Across scorpions, chelae show significant morphological diversity associated with ecology, and their performance is subject to a force/speed trade-off. We built a biomechanical model integrating synchrotron microtomographies, performance, and muscle architecture data.

Our findings reveal a strong integration of muscle architecture and structural elements towards two functional optima of performance: closing force is optimized in the short-fingered species through mechanical advantage of levers and muscles, as well as sarcomere length. In the long-fingered species closing speed is optimized, e.g. by means of early acceleration. Although other functional demands may be at play, one design seems optimized for prey grasping, and the other for prey crushing. These divergent optima, driven by trade-offs, may have had profound impacts on the trophic biology of scorpions, and their venom evolution.

Budget congress ECA 2024

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Type of expenses	Details	Amount	Comments
Inscription	Fees	140.8	Late bird is 176
Travel	Train Antwerp-Paris	110	Through eurostar
	Train Paris-Rennes	40	Through trainline
	Train Rennes-Paris	40	Through trainline
	Train Paris- Antwerp	100	Through eurostar
Lodging and food expenses	89 (per diem)*7(days)	623	
Total		1053.8	

Links	
https://eca2024.sciencesconf.org/	Home page ECA 2024
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The Nose of Spiders: Olfactory Sensilla in Male Wasp Spiders and Beyond

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Chemosensing plays a pivotal role in all species' survival and reproductive success. In insects, olfaction is performed by multiporous wall-pore sensilla (WPS), gustation by uniporous tip-pore sensilla (TPS). Spiders, however, are known to possess tip-pore sensilla, but how they perform olfaction has remained a mystery, despite a wealth of behavioral observations demonstrating the long-distance attraction of males to females. We aimed at unraveling the chemosensory potentials of spiders by examining the orb-weaver *Argiope bruennichi*. Females of this species are known to attract males by a sex pheromone. Behavioral high-speed recordings demonstrated that the proximal parts of the legs never get in contact with the substrate, prey, or mating partner, whereas the distal parts do. We therefore assumed that the proximal parts are likely to host olfactory sensilla whereas distal parts might host mainly contact chemosensilla. We scrutinized the sensilla of males and females with field emission scanning electron microscopy (FE-SEM) and discovered WPS in males. The WPS occur mainly on the proximal half of all walking legs of the male, whereas the TPS are found in the distal parts. Ultrastructural investigation of the WPS revealed that their sensillum shaft contains 1-4 dendrites which are connected to the external environment via the numerous wall pores and canals in the wall cuticle. We tested the response of the WPS to the sex pheromone using single sensillum recordings. The sensilla exclusively responded to the pheromone in a concentration-dependent manner. This study clarifies that spiders possess sensilla for olfaction and that these sensilla are specialized in finding signaling females from a distance. Female *A. bruennichi* do not possess WPS, raising the question if and how they perform olfaction.

A preliminary comparative assessment of WPS across 16 spider families suggests that WPS are present in males of all Araneoidea but absent in Liphistiidae and Avicularioidea. Within Synspermiata and Dionycha some species possess WPS while others do not. This finding suggests multiple independent origins and possibly reduction events during spider evolution.

Ecophysiology and Behavior

The ability to effectively identify environmental stimuli is crucial for all organisms and the accuracy, quick identification and decision-making based on the analysis of obtained information is favored by natural selection. Animals that fail to deal with these tasks effectively are more likely to fall prey to predators or die of starvation, whereas those with advanced sensory organs and efficient information processing systems gain a significant competitive advantage. Jumping spiders (Salticidae) stand out in these aspects, utilizing their excellent vision as their primary sensory organ. However, the perceived information is not always sufficient for decision-making. This can be due to, for example, the high diversity of signals or the lack of experience. This study aims to address both of these difficulties by analyzing the final stage of prey capture in *Yllenus arenarius*, particularly focusing on the problem of which characteristics of their prey the inexperienced jumping spiders use to decide which area on the prey's body to attack. The study employed behavioral analyses of spiders attacking various categories of screen-displayed animations featuring different combinations of prey characteristics. To determine which features inexperienced spiders use to identify the locations of structures affecting the prey's ability to escape (CNS, main locomotory muscle groups), the spiders' responses to different prey body proportions (long, short), the presence and the number of appendages (head, legs, antennae, wings), and prey movement direction (forward, backward) were analyzed.

Who is likely to cheat? Linking personality to deception in a gift-giving spider

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Abstract

When it comes to reproduction males and females rarely share identical biological imperatives, often leading to intersexual conflict. Males of the spider *Pisaura mirabilis* are known to cheat females into mating by offering silk-wrapped nuptial gifts of low nutritional values: alternative to prey, males offer prey remains or plant parts. Hypothetically, a cheating strategy must be a cost-effective option for a male to avoid costs of gift-giving (gift carrying, missed meal). Studies suggest ecological drivers to cheating, yet whether there is consistent individual variation in such male behaviour remains untested. Our study aims to ask whether cheating behaviour in male *Pisaura mirabilis* is part of a behavioural syndrome, with individual levels of aggression and boldness predicting the frequency of cheating in males. In our experiments, male spiders were screened for repeatable personality scores. With the presence of females, sexually stimulated males were then tested for the likelihood of accepting worthless prey for the nuptial gift. We hypothesize that aggressive males may perform better as hunters, investing more effort in mating by producing valuable gifts, while bolder males may engage in dishonest gift preparation due to "effortless", "faster decision-makers", and "risk-takers" traits. In this study, we show spiders were consistent in their personality traits, and the way they accepted worthless prey. We found male likelihood of accepting fake prey increased with aggression score but not with the boldness contrary to our hypothesis. We speculated the results from the point of opportunistic approach with the nature of aggressiveness as a strong competitive drive as well as a preferred mate partner by female which might potentially manifest deceptive tactics.

Keywords: Pisaura, spider, personality, male cheating, worthless prey, sexual conflict

Essential oils as spider repellents

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Spiders are crucial to ecosystems as effective predators, aiding in insect population control and biodiversity maintenance. Their role in biocontrol helps reduce pesticide use and manage pests in agroecosystems, while also mitigating disease spread by controlling insect vectors. Despite these benefits, some spider species can induce significant fear in humans, known as arachnophobia, affecting 2.7% to 6.1% of the global population. Synanthropic spiders, such as *Pardosa hortensis*, often venture into human habitats posing psychological risks. This study explores the repellent properties of ten essential oils (EO) against *P. hortensis* females. Wild *P. hortensis* spiders were collected in Tours, France, and subjected to behavioral tests using 1% EO solutions derived from catnip, cedarwood, cinnamon, citronella, clove, eucalyptus, lavender, lemon, peppermint, and tea tree. The EO compositions were analyzed by GC-MS. Repellent bioassays involved binary choice tests to evaluate the spiders' responses, with data analyzed using generalized linear mixed models. Results showed that five essential oils (cinnamon, clove, catnip, cedarwood, and citronella) exhibited significant repellent effects, with cinnamon, clove, and catnip being the most effective. The remaining oils did not significantly impact spider behavior. The study highlights the potential of specific essential oils as natural spider repellents, suggesting further exploration for practical applications in managing spider-human interactions.

A roadmap to spider venom enzymes

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Spiders rely heavily on venom for prey subjugation and defense. Despite this pivotal role, many details and nuances of spider venom biology, as well as the biomolecular inventory across the taxonomic space of spiders remain unclarified. Traditionally, it had been thought, that spider venoms are heavily dominated by small cysteine-rich neurotoxins but recent works suggested widespread occurrence of high molecular weight components, particularly enzymes. To investigate this potential paradigm shift in spider toxinology, we re-analysed all so far generated spider venom datasets. Thereby, we identified that 144 enzyme families from the entire range of known enzyme classes are distributed across the venoms of the spider kingdom. The potential functional implementation of spider venom enzymes includes precursor activation, defense and pre-digestion among others. Widespread multifunctionality suggests, that these enzymes are important components serving multiple functions during envenomation, venom toxin maturation and beyond. However, little experimental data on spider venom enzymes is available and more research in this direction is needed. As a first step, we expressed an astacin-like metalloprotease from the medically relevant spider *Loxosceles intermedia* in *E. coli* as a fusion protein bound to thioredoxin and investigated its activity in vitro after factor Xa cleavage. Our work shows, for the first time, that previous assumptions about the molecular composition and functionality of spider venoms have been largely misguided by the neglect of high molecular weight components from venom biodiscovery programs, and that a large array of novel biomolecules is awaiting discovery. Thereby, we will derive a deep and so far unmatched understanding of an important, yet so far overlooked element of spider ecophysiology.

Comparative Analysis of the Mechanical Properties of Silk Products in Pholcidae

Paula Heinz, Maitry Jani, Siripanyo Promnil, Jonas Wolf

Spiders spin silk into different products, such as fibres, threads and sheets, tailored for specific functionalities and to fulfil a variety of ecological roles. Examples include draglines and bridging lines for structural support, as well as webs and sticky threads for prey capture. Most silk products are made of a combination of different silk fibres with contrasting material properties. The most common silk types are minor ampullate, major ampullate and aciniform gland silk. Spider silks exhibit characteristic mechanical properties, including extensibility and tensile strength. How these properties vary between spider species, gland origins and thread structures as poorly understood. This study aimed to compare the mechanical properties of different silk products in Pholcidae, with a particular focus on the cosmopolitan cellar spider (Pholcus phalangioides). P. phalangioides constructs irregular three-dimensional webs comprising of unique mechanically interesting silk products. This include capture threads called ‘gumfoots’ which are vertical sticky prey traps designed to undergo spontaneous deformation and utilizes ‘draglines’ and airborne ‘bridging lines’ which serves for in locomotion and display distinct tensile strength and toughness to hold spider’s weight. Each of these silk structures were hypothesized to show specific mechanical adaptations. Preliminary results of tensile test show a significant variety in mechanical properties across different silk types with varying extensibility, tensile strength and toughness. Further study will focus on interspecific variation of the structural and mechanical properties of silk products between pholcid species with different ecology and silk compositions and the composition of fibres in Pholcidae.

Two sister species of black widow spiders from Australia (*Latrodectus hasse*lti) and New Zealand (*L. katipo*) are well known for their differences in mating behavior. The males of *L. hasselti* perform a somersault during copulation, provoking the female to eat them, a behavior that increases their chances of successful mating, whereas the males of *L. katipo* do not exhibit this behavior. The invasion of *L. hasselti* into New Zealand has shown that hybridization between these species is possible, and the somersaulting behavior is absent in hybrids (literature data). The system of two closely related species with distinct differences that are capable of producing hybrids is ideal for studying genetics of complex traits such as sexual selection and conflict, and specifically mating traits in spiders.

In our study, we collected egg sacks of both species, raised the spiders until maturity and conducted crossing experiments. First, we obtained interspecific hybrids, and then we backcrossed them to the pure species. Only female hybrids were used for backcrossing. The somersaulting behavior reappeared in the backcross males but only in part of them. All matings were filmed and the somersaulting behavior was quantified.

To study the genetic basis of this pattern, we sequenced DNA and assembled the genomes of both *L. hasselti* and *L. katipo*. We then mapped multiple specimens of pure species and male backcrosses with and without the somersaulting behavior, using *L. katipo* as a reference genome.

The preliminary results of the genetic analysis suggest that this complex behavior might be linked to relatively narrow regions on the chromosomes. In particular, elevated differences between somersaulting and non-somersaulting backcross males were located on the X chromosomes. Future analysis with a larger sample size, as well as additional transcriptomic data, will shed more light on the genetic basis of these behavioral and somatic traits, as well as the nature of sexual selection in black widow spiders.

The wonderful care - maternal behaviour and egg sac chemistry in *Pardosa paludicola* (Lycosidae)

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Female wolf spiders are characterized by their highly developed offspring care. The factors determining this care may be related to both the physiology of the female and chemical signals from the egg sac. In addition, the chemical compounds in the egg sac may exhibit antimicrobial properties that are crucial for proper egg development. The aim of this study was to analyze maternal care in *Pardosa paludicola* (Aranea: Lycosidae) by verifying the following hypotheses: 1) the caring behaviour of the female changes during egg sac care depending on the developmental stage of her offspring, 2) the chemistry of the egg sac changes during the development of offspring, 3) the egg sac contains chemical compounds with antibacterial and antifungal properties.

Pardosa paludicola females were reared in the laboratory and the development of their offspring in egg sacs was monitored. The behaviour of 10 females that carried egg sacs at specific age was recorded and analyzed for the time spent by the females moving, resting, manipulating the egg sac and grooming. Chemical compounds from 53 egg sacs at different ages were identified by GC-MS.

It has been shown that the later the day after the egg sac was made, the less time the female caring for the egg sac spends resting and manipulating the egg sac, and the more time on locomotion. The chemical profile of the egg sac contains approximately 100 compounds, such as amino acids, alcohols, and fatty acids, which have a broad spectrum of protective properties.

Keywords: egg sacs; GC-MS; maternal care; *Pardosa paludicola*; wolf spiders

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Title: A multimethod approach to study the behavioral utilization of spider silk glands.

Maitry Jani, Siripanyo Promnil, Paula Heinz, Jonas Wolff.

In recent years, research on spider silk has increased, focusing on its mechanical, medicinal, and commercial applications. Despite this, our understanding of the behavioral utilization of distinct silk types and their functions remains limited. Moreover, there is a notable gap in methodologies to comprehend the use of spider silk glands. This study focuses on *Pholcus phalangioides*, commonly known as Daddy long-legs spiders, known to build three dimensional irregular webs with unique behaviours. These include using sticky prey wraps to capture airborne prey, and viscous-sticky traps to ensnare ground-dwelling prey and dragline and bridging lines for locomotion. We employed multiple methodologies on live individuals as well as silk fibres collected for in-depth understanding of silk glands uses for these behaviours. Methods included spigot morphology analysis, gland dissections for morphology, light microscopy for identifying silk fibre types, high-speed video recording for behavioral study, shock freezing to observe spider behavior under Scanning Electron Microscopy and mechanical tests for single fibres to understand their role in ecological uses. Results suggest that a multi-methodology approach offers a comprehensive understanding of silk gland behavioral use. This study provides a unique perspective beyond the prevalent focus on orb weavers, offering insights into lesser-known species. The study highlights the limitations of single techniques, emphasizing the need for a diverse methodology. Additionally, it presents a protocol applicable to studying any spider's behavioral use of silk glands.

Sex-specific maternal effects: Establishing methodological resources in a species with extreme sexual-size dimorphism

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The two sexes largely share a genome but may show important phenotypic differences. These are known as Sexual Dimorphisms (SD) and are often attributed to sex-specific gene expression. In addition to the influence of an individual's own genotype on SD, another way in which it can arise is through so-called 'maternal effects'. This refers to the influence of a mother on her offspring's phenotype and it is determined by her genotype or by genotype/environment interactions. The spider *Nephilingis cruentata*, with females being ~75 times heavier than males, is an excellent model system for studying sex-specific maternal effects in explaining size variation and SD. The species carries maternally acquired endosymbionts known to influence reproduction in spiders. Our initial studies suggest that size variation is explained to a large extent by direct genetic effects on females but by maternal effects on males. The sex chromosome system of the species represents most spiders but differs from the systems of well-studied model species. To gain insights into the mechanisms for SD against this genomic background, we currently aim to establish the following: i) determine the extent to which male size is determined by maternal environmental and genetic effects; ii) identify female traits underlying maternal effects; iii) describe sex-specific genomes and sex-determining loci; and iv) sex- and age-specific transcriptional profiles; and v) test the role of maternally transmitted endosymbionts in determining size variation. Combining traditional and cutting edge methods, i.e. pedigree-based breeding, quantitative genetics, genomics, and transcriptomics, we aim to characterise the sex-specific differences that underpin SD. These will provide a critical foundation for in-depth investigation of the mechanisms of sexual differentiation and the role of sex-specific maternal effects in shaping phenotypes.

Transgenerational effects of maternal feeding in *Nephilingis cruentata*

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Maternal effects—non-genetic influences of the maternal phenotype on the offspring phenotype—can vary with maternal environment or genetics. These effects account for about 10% of phenotypic variation, with maternal environments, such as food availability, significantly shaping offspring traits. Under food-scarce conditions, females adapt their reproductive strategies to optimize offspring survival and fitness by adjusting offspring number, size, and sex ratio to manage reproductive costs and enhance future reproductive potential. Despite extensive research, significant gaps remain in understanding these effects across multiple generations. Most studies focus narrowly on specific juvenile fitness traits without comprehensively analyzing how these effects are distributed among genetic, maternal, and environmental components. This study addresses these gaps by examining the impact of maternal feeding (low vs. high feeding regime) over three generations on reproductive outcomes and offspring traits in the African hermit spider, *Nephilingis cruentata*, which exhibits extreme sexual-size dimorphism. This species provides a unique model for studying maternal effects, as recent research suggests a sex-specific architecture underlying adult body size. However, maternal food amount did not affect the body size of offspring of either sex. We present findings on how maternal feeding affects the likelihood of having descendants, the timing of first oviposition, and the number and mass of egg sacs as well as offspring traits such as developmental time and survival. For each trait, we evaluate how its variation is partitioned among genetic, maternal, and environmental components.

Equipped for Sexual Stings? The Male-Specific Venom Profile of *Euscorpius italicus*

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Some scorpion species abound with a fascinating behavior during their mating dance: Male individuals perform a sexual sting and inject venom into their mating partners. Previous studies suggested, that males thereby increase their chances of a successful mating procedure. However, the specific venom components at play and the venom's effect in context of sexual stings has never been investigated thus far. Here, we aim to shed light on the chemical and functional basis of this conundrum by using the sexually-stinging scorpion *Euscoprius italicus* as a model system. We demonstrate that *E. italicus* exhibits a sexually dimorphic venom with male-specific venom components. This was first determined by analyzing the presence/absence patterns of ion signals in MALDI-TOF mass spectra of venom samples from both sexes and juveniles. Based on a comprehensive proteo-transcriptomic analysis, we present a first venom profile for the genus *Euscorpius* and identify an array of sex specific venom components. Through analysis of mRNA expression patterns, we further show that several potential toxin precursors are downregulated in male venom glands, possibly to reduce toxic effects to females during the sexual sting. Finally, we have identified the precursor of one of the most prominent male-specific venom peptides, which is an ideal candidate for activity tests in future studies.

Nephila spider male aggregation: Preference for optimal female size and web clustering

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Sexual size dimorphism theory predicts male-biased operational sex ratios in species where females are significantly larger than males. We revisited this assumption through a field study of the giant wood spider *Nephila pilipes* (Fabricius, 1793) (family Nephilidae) in Singapore, a species where females are on average 6.9 times larger than males. Additionally, we tested two hypotheses concerning male distribution, given their tendency to aggregate in certain female webs. The *optimal female size hypothesis* predicts that males would predominantly occupy webs of intermediate-sized females. The *web clustering hypothesis* posits that more males would be found in webs closer together compared to those farther apart. Our census did not support the assumption of a male-biased operational sex ratio, but did reveal an uneven distribution of males in female webs allowing testing of the two hypotheses. Males were more commonly found in webs of intermediate-sized females rather than the largest ones, aligning with the *optimal female size hypothesis*. Proximity among female webs was predictive of male presence, supporting the *web clustering hypothesis*. We conclude that in *N. pilipes*, male occupation of female webs is facilitated by clustering of webs and a preference for cohabiting with optimally sized, receptive females. Our findings, however, challenge the theoretical association between operational sex ratios and extreme sexual size dimorphism.

Key words: Sexual size dimorphism, eSSD, operational sex ratios, sexual selection, *Nephila pilipes*, Nephilidae.

Human poisoning by spiders have been known since ancient times in Europe. However, no revision exists on the spiders involved and the incidence of bites per country. Here, I present a literature search of spider bites for Europe, from 1900 onwards. Although more than 30 spider species have been mentioned in the medical literature as causing poisoning of humans in Europe, the two main species involved are *Latrodectus mactans* and *Loxosceles rufescens*, mainly in Mediterranean countries. The number of accidents is in general low, even in Mediterranean countries. Some deaths have been reported, but the number of confirmed deaths is less than 10 in the last 30 years. Spiders cannot be currently considered as a serious medical threat in Europe, especially in Central and Northern Europe.

Title: Venom composition of two prey-specialised spiders

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Abstract: Predatory venoms are usually effective against certain prey resulting from evolutionary arms races. Nevertheless, many venomous animals remain understudied, including spiders, one of the most diverse groups of venomous predators. Most spiders are generalists who prey on a wide range of prey. However, a small proportion of spiders are prey specialists that preferentially hunt only one prey type, often represented by dangerous prey, such as termites, ants, or other spiders. They utilise morphological, behavioural and venomic adaptations to subdue such prey. Despite evidence suggesting that prey-specialised spiders immobilise prey with their potent venom, they have not been thoroughly investigated. Our research focused on the venom of two prey-specialised spiders: the araneophagous white-tailed spider (genus *Lampona*) and the termitophagous sand-diving spider (*Ammoxenus amphalodes*). To elucidate the venom proteomes in these spiders, we used a proteo-transcriptomic approach. Our analysis revealed 208 putative toxins in the *Lampona* proteome. Most abundant lampotoxins belonged to two families characterised by unique scaffolds containing eight or ten cysteine residues. We also showed that *Lampona* venom is more potent against spider prey than alternative cricket prey. Similarly, we identified 116 putative toxins in the venom proteome of *A. amphalodes*. The most abundant venom components were six cysteine-rich ammoxotoxins belonging to family 1, comprising over one-third of the venom proteome transcripts. These findings are congruent with the hypothesis that a few structurally similar toxins dominate the venoms of predators with narrow diets. In the future, prey-specific toxins could help develop bioinsecticides targeting only a focal pest.

Key words: adaptation; araneophagy; prey; specialisation; toxins; termitophagy; venom composition; venom potency

34th ECA Poster Abstract

Title: Ultrastructure of large leg spines in *Tetragnatha*: evidence for mechanosensory function

Authors:
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Carsten Müller, Universität Greifswald
Gabriele Uhl, Universität Greifswald
Rosemary Gillespie, University of California Berkeley

Abstract:

Every organism relies on sensory input to navigate complex environments, and spiders in particular use webs as an extension of their neurosensory structures. Hawaiian long-jawed orb weaver spiders (genus *Tetragnatha*) have repeatedly abandoned web-building behavior, and the question remains as to how these species adapt to this sensory loss. Multiple cursorial *Tetragnatha* species independently developed long leg spines, but the purpose of these spines - whether sensory or mechanical - is unknown. I hypothesize that leg spines serve a dual physical and sensory purpose, and combine high-speed video observation of prey capture events with scanning and transmission microscopy imaging to identify and characterize the external and internal ultrastructure of these spines. During prey capture, cursorial *Tetragnatha* species use leg spines to surround and secure flying prey prior to subduing the prey item with venom. SEM images show the external structure of the leg spine follicle and shaft closely resemble other mechanosensory hairs present on the legs. TEM cross sections of spine socket confirm the characteristic structures of a large mechanoreceptive sensillum, with the presence of two to three tubular bodies visible. The results of the video, SEM, and TEM all suggest that the leg spines in cursorial Hawaiian long-jawed orb weavers function as mechanosensory sensilla in addition to aiding in the physical capture of prey.

Session: Ecophysiology and Behavior

Abstract

When winters get warmer - effects on body condition in overwintering *A. bruennichi* spiderlings (Arachnida, Araneae)

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Climate change and global warming affect the distribution, phenology, and survival of species. The orb-weaver *Argiope bruennichi* has undergone rapid latitudinal range expansion from southern Europe to Scandinavia in the last century. Previous studies have investigated adaptation and plasticity to colder climatic conditions in the northern regions. However, it remains unclear how spiders of the core populations in the Mediterranean will react to warmer temperatures. We therefore explored whether warmer winters affect the body condition of *A. bruennichi* spiderlings overwintering in the egg sac. Adult females were collected after mating and before oviposition at three locations in southern France. They produced egg sacs under a simulated local temperature regime in the laboratory. Three winter temperature treatments were simulated: warmer (+3.7°C), and even warmer (+4.8°C), as predicted by the IPCC, and a control treatment. Spiderlings hatch from the eggs within a few weeks after oviposition and stay in the egg sac over winter. Egg sacs were randomly assigned the treatments. In spring, we investigated the body condition of the living spiderlings using light microscopy and µ-CT. Spiders that underwent one of the warmer winter treatments had a lower body condition index compared to those in the control group. We therefore surmise that spiderlings which experience warmer winter conditions emerge in spring with a lower amount of resources. Indeed, reduced survival in warmer winters was found in a companion study. We anticipate a shift in the range of this abundant species.

Surviving at the edge: Physiological mechanisms and gene expression patterns in a latitudinally range-expanding spider

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The European wasp spider *Argiope bruennichi* has exhibited an unusually rapid latitudinal expansion from the Mediterranean to the Baltic states and Scandinavia over the past century. This expansion outpaces regional warming trends due to climate change, suggesting an adaptive response to novel environments, rather than the simple tracking of optimal climate conditions. In particular, populations at the expanding edge in northern Europe face greater seasonality and colder winters, presenting a unique opportunity to study genetic and phenotypic adaptations to cold stress. This study aims to elucidate the molecular and metabolic mechanisms underlying the successful colonization of colder habitats by edge populations compared to the native core populations. We used a reciprocal transplant common garden design with spiderlings from core and edge locations. We quantified the degree of local adaptation and phenotypic plasticity at the edge relative to the core populations by assessing their differential gene expression and metabolic profiles. Our results strongly support the hypothesis that edge populations are locally adapted to colder winter conditions. Edge populations showed an increased expression of genes associated with cold tolerance. Fatty acid profiles further support these findings. Moreover, spiderlings from the edge showed higher survival probability and phenotypic plasticity in both winter conditions. These insights into the adaptive strategies of *Argiope bruennichi* contribute to our understanding of rapid ecological expansions under climate change.

Pekár S. 2024. Defences in arachnids: what do we know and where should we go

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Arachnids fall prey to many predators, namely other arachnids, birds, insects, lizards, mammals, and amphibians. Defences in arachnids have not been sufficiently studied. Empirical evidence is rare but has slowly been accumulating over the last decade. Almost all types of defences known have evolved in arachnids, but countershading and elusiveness await to be discovered. Anachoresis is used most frequently across all orders; only in Acari, Araneae, Opiliones, and Solifugae is it rivalled by background matching, and Batesian mimicry. The latter has been studied most intensively, focusing particularly on hypotheses that explain prevalence of inaccurate Batesian mimics. I will identify the major gaps, overview current methods used to study defences, and propose future avenues for investigation.

Comparison of venom efficacy of euryphagous and ant-eating spiders against different prey

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Abstract

Predatory venom is an adaptive trait that has evolved independently in many different taxa. It is a mixture of various compounds, such as small molecules, peptides and proteins that allow predator to immobilise different prey species. Recently it was found that venom composition of spiders is adapted to their prey. We tested a hypothesis that the venom of ant-eating spiders is more potent against ants than the venom of euryphagous species and against alternative prey. We used the following species of spiders: *Ariadna* sp., *Eusparassus* sp., *Gnaphosa* sp., and *Hogna* sp. We extracted crude venom from these spider species by milking. We injected the crude venoms of various concentrations into ants and flies. We recorded the paralysis latency and mortality and compared them among spider species and prey types using logistic regression. Then we performed proteomic profiling using MALDI-TOF and gel electrophoresis. We found that the venom of different species if distinctly effective for different prey species.

Key words:

Spider venom; venom efficacy; ant-eating spiders; euryphagous spiders; LD_{50} ; predator-prey interactions;

The biggest role of spiders in ecosystems is predation of other invertebrates; however, spiders are important hosts for many parasitoids as well. A large group of these parasitoids represent the Darwin wasps from the tribe Polysphincta (Hymenoptera; Ichneumonidae; Pimpilinae) the larval development of which is dependent on spiders. This cosmopolitan group parasitizes mainly arboreal spiders from the families Dictynidae, Tetragnathidae, Theridiidae, Araneidae and Linyphidae. While the views on the phylogeny of spiders has been more or less complete, the evolution of Darwin wasps is still not clear. Another question is why some species prefer only one host while the others have multiple hosts even across genera. In this poster, we summarize the current knowledge of the way of parasitation of spiders by European wasp genera. We present our current research with its main aim to find out food preferences of these parasitoids, their host specificity, as well as when and under what conditions speciation of parasitoids occurs. Finally, we also introduce the first phylogenetic three of European Darwin wasps in relation to spider phylogeny based on the results of our research.

The key to agrobiont adaptation is a unique response to daylight changes in the cohort splitting wolf spider, Pardosa agrestis

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One of the most successful adaptations to temperate arable habitats among spiders is exhibited by the wolf spider Pardosa agrestis. Previous research discovered that the agrobiont nature of P. agrestis is underlined by cohort splitting, a special life history pattern, in which spring hatching spiderlings diverge in their developmental routes. Slow developers reach maturity only next spring, whereas a considerable portion, rapid developers, reach adulthood the same year late summer, mate and their offspring catch up next spring with the slow developers. Other Pardosa species seem to follow only the slow developmental route. We hypothesised that the key for this unique adaptation is that P. agrestis responds differently to daylight changes than other Pardosa species. This was tested by rearing in parallel spring spiderlings of P. agrestis and of another abundant species, P. hortensis, under natural and four experimental light regimes. Development of both species was critically affected by light schedule, but in characteristically different ways. Importantly, under persistently increasing daylight P. hortensis could be “tricked” into producing a second, late-summer generation. In P. agrestis cohort splitting occurred within the same clutch under natural and increasing light regimes and was contingent on body mass condition. Comparison of maturation events and body mass changes in the treatments suggests that not absolute daylight length but the pattern of change triggers different growth patterns that are potentially present in both species. Thus, a critical difference between cohort splitting and annual life cycles is flexible developmental response given to changing daylight length. Funding: OTKA-K134811.

The function of self-sacrificial behaviour in the brown widow spider

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Abstract:

Male self-sacrifice during mating is one of the most extreme forms of male reproductive investment. In two apparently self-sacrificial widow spiders (*Latrodectus hasselti* and *L. geometricus*), males can mate with both adult and subadult females ('immature mating') but only with adults do they actively invite cannibalism via a copulatory 'somersault' into the fangs of the female. In *L. hasselti*, self-sacrifice prolongs copulation and decreases the remating probability of the female, thereby increasing male reproductive success. Here we investigate the causes and consequences of copulatory cannibalism in *L. geometricus.* Although it has been described as self-sacrifice, we observed that the somersault can be facilitated or even triggered by the female via abdominal movements and/or pulling the male toward her mouthparts. Further, we investigated the effect of somersaulting and cannibalism on mating and remating outcomes for adult and subadult females. Our behavioural experiments show that males in better condition are more likely to somersault and to be cannibalized by their mates, suggesting that this behavior may affect male paternity through female choice. However, contrary to the hypothesis that somersaulting improves male fitness, neither male somersault nor female cannibalism reduce female remating rates. Moreover, males that do not somersault copulate for nearly twice

as long as males that do somersault. Further investigation (i.e. paternity analysis) is needed to elucidate the effect of this behavior on male reproductive success and postcopulatory female mate choice.

When winters get warmer - effects on metabolism and fatty acids in overwintering *Argiope bruennichi* spiderlings (Arachnida, Araneae)

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Climate change has ecological effects ranging from the individual level to the entire ecosystem. Little is known about the specific effects of climate change on overwintering spiders although higher temperatures can influence metabolism and energy balance of individuals. We investigated the effect of increased winter temperatures on the warm-adapted populations of the spider species *Argiope bruennichi* in Southern France. In *A. bruennichi,* spiderlings hatch from eggs and overwinter in the egg sacs with a limited amount of yolk. We hypothesize that increased overwintering temperatures influence the spiderlings´ metabolic rate, which in turn affects fatty acid consumption and survival probability. To this aim, we exposed egg sacs with spiderlings to two warmer winter regimes (+3.7 and +4.8 °C above the "usual" ambient temperatures) as projected by the IPPC and compared them to a control treatment simulating the ambient temperature regime. We demonstrate that mortality increased with higher ambient temperatures, with no difference between the two warmer treatments. The metabolic rate was higher in the warmer treatments and was correlated with a significant reduction in energy-storing fatty acids such as saturated and monounsaturated fatty acids. We suggest that the reduction in energy stores lead to higher mortality. Consequently, even small increases in winter temperatures, as chosen here, are likely to impact *A. bruennichi* on both individual and population levels, possibly leading to a shift in the range of this abundant species.

Exploring mating system and sexual cannibalism in a raft spider

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Dolomedes spiders are central to studies investigating evolutionary phenomena like extreme mating behaviours and the diversification of mating systems. Within this genus, there's considerable variation in mating strategies between species. At one extreme, *D. tenebrosus* males are strictly monogynous, while at the other, *D. scriptus* and *D. triton* males mate with multiple females. To deepen our understanding of mating system evolution, more data on closely related species are essential. To that end, we studied mating system and sexual cannibalism in *D. plantarius* spider. We hypothesized that in a polygamous mating system, males mate more frequently than females, larger individuals have greater reproductive success, and mated females are more likely to cannibalize males, especially when the size ratio between them is smaller. We documented the interactions of females and males repeatingly exposing them to new mating partners. Our findings show that both sexes can engage in multiple matings, with males mating with an average of 3.8 females and females with 1.9 males. A positive correlation between the number of matings and offspring in females suggests that polyandry offers reproductive benefits. Additionally, our data confirm that mated females are more likely to cannibalize males during courtship. However, we found no significant relationship between body size and either reproductive output or sexual cannibalism. This study contributes new insights to the ongoing comparative analysis of mating strategies in *Dolomedes* spiders, highlighting that male mating rates generally surpass those of females, a pattern commonly observed in sexually reproducing species.

Same-Same but different: common garden experiments in the range-expanding spider *Zodarion rubidum* (Araneae, Zodariidae)

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ABSTRACT

Species are adapted to the environment in which they occur, being constrained in space by abiotic and biotic factors that shape their distribution over time. Yet, some species can show dramatic geographic range-expansions, colonizing and surviving in new places far from their native area. To overcome environmental constraints at range margins, selection may result in two evolutionary responses: phenotypic plasticity and/or local adaptation. In this study, we investigated the case of *Zodarion rubidum* Simon, 1914, an ant-specialist spider that colonized north-eastern Europe from the Mediterranean in recent decades. To determine whether thermal tolerance, diet widening and/or exploratory behavior contributed to the expansion and establishment of *Z. rubidum* across Europe, we compared three distinct populations in a common garden experiment design. Specifically, we measured (i) the temperature preference, using a thermal gradient set-up, (ii) the developmental time at two contrasted temperatures, using climatic chambers, (iii) the venom efficiency, as a proxy for diet range, running feeding trials with three ant-species representing three subfamilies as prey items, and (iv) the locomotory activity, recording specimens in a new environment. Preliminary results indicate that *Z. rubidum* shows a clear temperature preference and a specialized venom for Formicinae ants, but with no significant differences between the three studied populations. Developmental time and exploratory behavior may also bring additional elements to identify whether and how much core and margin populations of *Z. rubidum* differ, a crucial information to better understand the range-expansion dynamics of this species as well as its current and future distribution.

KEYWORDS: phenotypic plasticity, adaptation, temperature preference, development, diet range, exploratory behavior

Targeted capture of weaver ants with a unique power-amplified silk trap in a tropical cobweb spider (Theridiidae: *Propostira* sp.)

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Abstract:
Due to their high abundance, ants are a rich food source for predatory animals, but their capture is risky as they are highly defended. Tropical cobweb spiders (Theridiidae: *Propostira* sp.) live in association with green weaver ants (*Oecophylla smaragdina*) on which they seem to feed exclusively. Here we document how these spiders overcome the challenge of isolating and immobilizing single major workers from foraging trails of these aggressive ants by constructing a unique snare that lures ants and propels them into its core web at extreme speed. The snare consists of a dense, regularly shaped cone-like foot structure (the lure) that specifically attracts nearby *O. smaragdina* ants, and a fan-shaped array of tension lines acting as spring actuators. Due to the high number of aligned tension lines, small pre-strain of the silk is sufficient to overcome the strong attachment forces of the ant and accelerate its body at up to 130 G. The mechanical properties of the silk produced by this spider are comparable with those of other species of cobweb spiders. However, the instantaneous power output per actuator mass (power density over 1 MW/kg) exceeds that of other ballistic spider webs, and the snare releases 200 times the kinetic energy of a typical theridiid gumfoot thread, underlining the remarkable feat of this spider's snare architecture.

Biogeography and Conservation

Diversification of Spiders in the Remote Islands of Oceania

Rosemary Gillespie

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Adaptive radiation is one of the key drivers of species diversity, yet the mechanism through which it is achieved, and the outcome of the process, are largely unknown. In many lineages, initial divergence results from environmental or sexual selection leading to divergence of species between environments and subsequent secondary contact. In other lineages, initial reproductive isolation may be achieved without divergent selection; here, ecological niche divergence can develop as a result of interactions between close relatives during secondary contact. The Hawaiian archipelago – in which each island provides a snapshot in time of the evolutionary process – is one system that can offer insights into the processes of adaptive radiation, allowing the early stages of radiation to be studied in real time. In this seminar I identified lineages in which the abiotic environment appears to play the dominant role in adaptive diversification, with repeated and convergent evolution of sets of taxa adapted to similar sets of environmental conditions. In contrast, divergence in other lineages appears to be the result of character displacement associated with direct interaction between close relatives, leading to convergent evolution of niche-specialized ecomorphs within a given environment. I discussed the importance of differentiating between patterns to understand the processes that underpin adaptive radiation. I concluded the talk with a short discussion of the conservation status of Hawaiian spiders and the urgent need for action.

Investigating indirect effects of stream pollution on the diet of *Tetragnatha montana* using DNA metabarcoding

Maike Huszarik, Alexis P. Roodt, Teagan Wernicke, David Åhlén, Ralf Schulz, Peter Hambäck, Martin H. Entling

Riparian spiders transfer nutrients from aquatic to terrestrial ecosystems through their consumption of emergent aquatic insects. However, spiders and the riparian food web may be affected when chemical pollution in the aquatic ecosystem alters the timing, composition or abundance of emerging insects. We aimed to investigate how chemical pollution indirectly affects the diet of *Tetragnatha montana* in forested riparian areas of 10 freshwater streams in southwestern Germany. We used DNA metabarcoding to examine the gut content of *T. montana* collected from stream sites along a gradient of agricultural and urban pollution. In addition, we sampled flying insects at each site using Malaise traps. While we did not find a difference in the overall proportion of aquatic insects in the Malaise traps nor spider diet, *T. montana* consumed more Chironomidae and fewer other aquatic Diptera at more polluted sites. This not only suggests that spiders continued to rely on aquatic prey at polluted streams, but also that the composition of the spider diet shifted towards more pollution-tolerant aquatic insects, which has not been detected in previous studies. Their continued reliance on aquatic prey at polluted sites may increase spiders' dietary uptake of pollutants, potentially exposing the greater riparian food web.

Road to cave: speciation hypothesis of Spelaeochthonius

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Spelaeochthonius Morikawa, 1954, which comprises 11 species, is a genus in the family Pseudotyrannochthoniidae Beier, 1932. Members of this group can be represented by troglobitic characteristics and narrow-range endemism. Three species are documented on the Korean Peninsula: *Spelaeochthonius cheonsooi* You, Yoo, Harms and Harvey, 2022; *S. dentifer* Morikawa, 1970; *S. seungsookae* You, Yoo, Harms & Harvey, 2022. In this study we utilize ten species, including three recorded Korean species, two Japanese species, and five new species, for molecular analysis. We employ four genes (COI, H3, 18S, 28S) commonly used in pseudoscorpions studies. This study aims to (i) demonstrate the narrow-range endemism of *Spelaeochthonius*, (ii) explore the speciation pathway of this genus, and (iii) compare the phylogenetic analyses with another genus which are presented in Korea, *Allochthonius*. Consequently, our understanding of biodiversity and necessity of species conservation.

Spider Community Composition in Different Forests in Ghana

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Forest conversion in Ghana is acute due to anthropogenic activities such as agriculture, mining, logging, and infrastructure development. These activities lead to deforestation, threatening the biodiversity of these forests with extinction in a region where many arthropod groups are understudied and most species undescribed. Spiders and their relatives are extremely sensitive to habitat change because of their role as generalist predators of insects and other spiders. They are adapted to hunt in a variety of ecosystems, including the different forest strata, making them sensitive to small changes in ecosystem and overall arthropod composition. Spiders are therefore potential indicators of habitat change and organisms that may support the monitoring of forest restoration in West Africa. Spiders were sampled with standardized protocols from a primary forest, an agroforestry plantation, and two actively restored forests through seedling and tree planting after mining and logging. The family composition and diversity of spiders in these forests varied considerably due to their land use. A total of 35 families of spiders were sampled in these forests using pitfall traps, beating, and visual searching. 26 families from the primary forest, 22 from agroforestry, 23 from the post-mining forest, and 14 from the post-logging forest. Spider activity density decreased in the order primary forest, agroforestry, post-logged forest and post-mined forest. Lycosidae, Zodariidae, and Ctenidae were the families with the highest activity density across sampling sites. These included 12 species of Lycosidae in the genera *Pardosa*, *Hogna*, *Trochosa*, *Hippasa*, and *Hippasoso*, 10 species of Zodariidae in the genus *Mallinella* and *Dusmadiores*, and 8 species of Ctenidae in the genera *Africactenus*, *Anahita*, *Amicactenus*, *Petaloctenus*, and *Piloctenus*. The high occurrence of Lycosidae in the primary forest is associated with habitat disturbances due to the loss of woody vegetation, and the occurrence of certain species of Ctenidae in pitfall traps indicates the rate of degradation of natural forest ecosystems. The presence of Zodariidae species is primarily associated with the occurrence of particular ant species. Some spider families are therefore potential indicators of habitat change and organisms that may support the monitoring of forest restoration in West Africa.

Keywords: Spider, arthropod, Forest, degradation, restoration, monitoring,

Title: Effect of floods on spider community in a floodplain mesocosm

Authors: Stephane Mutel, Martin Entling, Mirco Bundschuh, Ralf Schulz, Alessandro Manfrin

Floods play a vital role in rivers contributing to the morphological shaping of river and riparian areas and affecting composition of arthropod and plant communities, as well as the productivity of ecosystems. Intensity and duration of natural floods are impacted by anthropization of river systems (e.g., diking, damming) and climate change and, in turn translate on cascading effects on aquatic-terrestrial communities. While it is known that natural flood regimes can shape spider communities in riparian area, there is a lack of knowledge on the impact of flood events on altered floodplains.

We conducted a study on a field mesocosm, the Riparian Stream Mesocosm (RSM), in South-West Germany. The experiment was conducted implementing a full-block design using 16 independent mesocosm units, each one including a 1m wide stream and an adjacent 4m grassland riparian area. RSM units were exposed to varying flood intensity (3, 7, and 14 days) or used as controls (i.e., no flood). The flooding design was repeated 4 times between May and September 2024 to consider seasonal variability. Spiders were collected before and after each flooding cycle using pitfall traps. We hypothesized that the flooding of the riparian areas would reduce abundance and species richness of spiders, and the effect to be positively related with the flood intensity. We also expected treatment-specific community shifts with riparian specialists favored compared to generalist species.

From May to July, after 14 days of floods spider species richness was reduced compared to before the flood. With shorter flood, richness wasn’t affected. The number of spiders was not affected by any flood treatment. Spider community composition responded to seasonality while there was no difference related to the flood treatment. Species-specific analysis confirmed our hypothesis with higher number of spiders with high moisture preference (e.g., *Piratula latitans*, *Prinerigone vagans*) in flooded units than in the control.

Spiders as integrators of brown and green food webs in a changing world

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Understanding how environmental and anthropogenic disturbances impact arthropod communities is essential in the current state of climate change and biodiversity crisis. Recent studies have revealed high local extinction and a sharp decrease in arthropod biomass, compromising essential ecosystem services. Despite their key role in the functioning of ecosystems, spiders have traditionally been excluded from monitoring programs and conservation plans, due to their great diversity but poor taxonomic knowledge. The main motivation behind this research is to shed light on the impact of environmental and anthropogenic disturbances on spider assemblages, and how, in turn, changes in those assemblages relate to ecosystem functioning. Specifically, we will examine the effects of global warming, fragmentation, openness and management practices on spider communities in cork oak forests, which are among the habitats of greatest cultural and natural value in the Iberian Peninsula. We will overcome previous limitations by using novel DNA sequencing strategies that allow large numbers of samples to be efficiently processed. Furthermore, genetic data will allow us to infer phylogenetic relationships to estimate the phylogenetic diversity of local communities; reveal geographic and environmental patterns of genetic diversity and investigate predator-prey interactions. We will examine changes in prey composition and assess spider species' genetic variability under various environmental and anthropogenic conditions. We will also contribute to completing a catalog of Iberian spider DNA barcodes, which will facilitate their identification for future studies.

Overwintering of spiders in leaf litter of the non-production elements of woody vegetation in the agricultural landscape

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Keywords: overwintering; spiders; leaf litter; agricultural landscape; solitary trees; woody vegetation; land use

The long-term survival of arthropod populations in a landscape relies on successful hibernation. Leaf litter of non-production elements of woody vegetation, such as solitary trees, groups of trees in line formation and non-linear groups of trees can provide suitable overwintering habitats for arthropods. In South Moravia, we can find in general three types of agricultural landscapes which differ in the ratio of arable land to orchards and vineyards and in the size of the landscape grain: the landscape with 1) the prevalence of arable land (AL); 2) the prevalence of orchards/vineyards (OV); and 3) the same proportion of arable land and orchards/vineyards (AL-OV). We investigated the importance of leaf litter in these three agricultural landscapes and woody vegetation formation types as overwintering habitats for spiders. Leaf litter was sampled from an area of 1 m^2 in three types of woody vegetation formation in each agricultural landscape (20 samples per woody vegetation formation type in each landscape, in late autumn and early spring; altogether 360 samples). Leaf litter was sifted in a laboratory and spiders were placed in the ethanol and determined. Significant differences in spider assemblages were found between landscape types, specifically between OV and AL-OV ($p = 0.02$) and OV and AL ($p = 0.04$), woody vegetation formation types, namely between the non-linear group of trees and solitary type ($p < 0.001$) and between the linear and solitary type ($p < 0.001$), and sampling seasons ($p < 0.001$).

This research was supported by the Grant agency of Gregor Johann Mendel C-MNG-2021-002.

Biogeography and species delimitation of the Western Mediterranean trap-door spider genus *Amblyocarenum* (Araneae, Nemesiidae).

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Mygalomorph spiders are an ancient and relatively morphologically homogeneous lineage. Due to their sedentary lifestyle, mygalomorph spiders often display tendencies to micro-endemism. However, their genetic differentiation is usually not matched by changes in external morphology. The lack of apparent external differences among closely related taxa thus often hinders the traditional morphology-based taxonomic research and leads to underestimation of species diversity. The present-day disjunct distribution of the trap-door spider genus *Amblyocarenum* spans across the Western Mediterranean region, including the Iberian and Appenine peninsulas, the islands of Sardinia and Sicily and parts of Northern Africa. The genus currently comprises four nominal species, one of which (*A. walckenaeri*) displays a wide distribution spanning across both Iberian Peninsula and Northern Africa. Here we use genomic data to reconstruct phylogeny of the genus *Amblyocarenum*, infer its biogeographic origins and provide a temporal framework of its diversification. Our results suggest that the dynamic geological past of the region played an important role in the diversification of the genus and its present-day distribution is mostly owed to vicariant events. Additionally, the results suggest an existence of cryptic diversity within the genus.

Effect of grazing by large wild herbivores in a Central European oak forest on the epigeic spider community

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Forest grazing has a significant impact on vegetation and soil through biting, trampling and feces. Through these impacts, it shapes animal communities. It can be assumed that grazing leads to a loosening of vegetation, thereby supporting heliophilic, thermophilic and xerotolerant species. To test this hypothesis, we used a long-term experiment in the Červený kříž reserve in the Křivoklátsko protected landscape area, where part of the stand of the thermophilous oak *Melico pictae-Quercetum roboris* is fenced off for a long time and part is accessible to wild herbivores such as deer and wild boar. We installed pitfall traps on the grazed area and on the area excluding large herbivores, which were exposed for spring and summer seasons. The poster presented here reports the changes in species composition and abundance of epigeic spiders that were observed between the two treatments. Conservation aspects related to the effect of grazing on forest biodiversity are discussed.

Monitoring functional trait variation in *Vesubia jugorum* (Simon, 1881) (Araneae: Lycosidae) assessed as Endangered in the IUCN Red List

Tolve M., Milano F., Piano E., Isaia M.

According to the International Union for Conservation of Nature (IUCN), monitoring is one of the sources of information on the status of threatened populations. Considering its limited geographic range, and the projected decline of its habitat due to climate change, *Vesubia jugorum* (Simon, 1881) has been classified as Endangered on the IUCN Red List. Studies demonstrated a relationship between the species and climate. Specifically, specimens with largest femur and cocoon occur in localities with the highest habitat suitability. In 2019, the University of Turin with Mercantour and Alpi Marittime Natural Parks, started a monitoring programme, aiming at detecting potential population declines and changes in functional traits over time. The monitoring programme focuses on 17 populations spread across the species range and is repeated every five years. In each population, femurs IV and cocoons from five females were collected and measured. The data showed femur length ranging from 5.590 to 7.510 mm. The shortest femurs (mean = 5.778 mm) were collected where habitat suitability value is 17.0%, while the longest femurs (mean = 7.288 mm) were collected where value is 73.7%. The cocoon size ranged from 6.915 to 12.545 mm. The regression analyses highlighted a significant relationship between femur length and habitat suitability. The next monitoring campaign will be conducted in 2024 in the frame of the CRYPTERS project financed by the TETTRIs 3PP programme and data are not available as of this writing. Despite that, for the sites monitored so far, we will include a first comparison with 2019 data.

Title: Assessment of spider assemblages and their responses to grazing regulation in the Great Indian Bustard habitat of Desert National Park, Rajasthan

Abstract: The Thar Desert in Rajasthan and Gujarat, spanning 10% of India's land area, hosts unique biodiversity adapted to its extreme aridity. Conservation efforts, focused on protecting the critically endangered Great Indian Bustard (GIB), involve chain-link-fence exclosures in GIB breeding sites to regenerate grassland vegetation and safeguard nesting areas by excluding grazing and other human activities. This study aims to assess the impact of these exclosures on spider assemblages, which are vital prey for GIBs. Currently, there is limited knowledge about spider communities in the Thar Desert and their response to grazing exclusion. Research findings will provide crucial insights into the conservation benefits of livestock grazing regulation for non-target taxa like spiders, contributing essential baseline data for the Thar Desert ecosystem and informing more effective conservation strategies for this unique and fragile landscape.

Getting rid of unwanted Australians – Developing a pheromone tool for the eradication of *Latrodectus hasseltii* in New Zealand

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Latrodectus hasseltii, the Australian redback, is an invasive spider that has been established in New Zealand since 1980. It is a threat to the endangered Cromwell chafer beetle as well as another threatened chafer beetle, skinks and the New Zealand endemic widow spider, *Latrodectus katipo*. The Australian redback has also established in Osaka, Japan and has the capability to spread further in New Zealand and to other parts of the world, including Europe. Since I talked about this spider at the 29th European Congress of Arachnology, some preliminary work has been done on the possibility of using pheromones to control it and now we have a three-year project, led by an analytical chemist, to develop a pheromone tool to eradicate *L. hasseltii* Central Otago. Preliminary findings will be presented as well as details of our proposed research.

Infrequent oceanic long-range dispersal and evolution of a top terrestrial arthropod predator in the sub-Antarctic

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Keywords: sub Antarctic, island biogeography, Toxopidae, marronoid clade, littoral, long, distance dispersal, phylogenetics

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