31st ECA

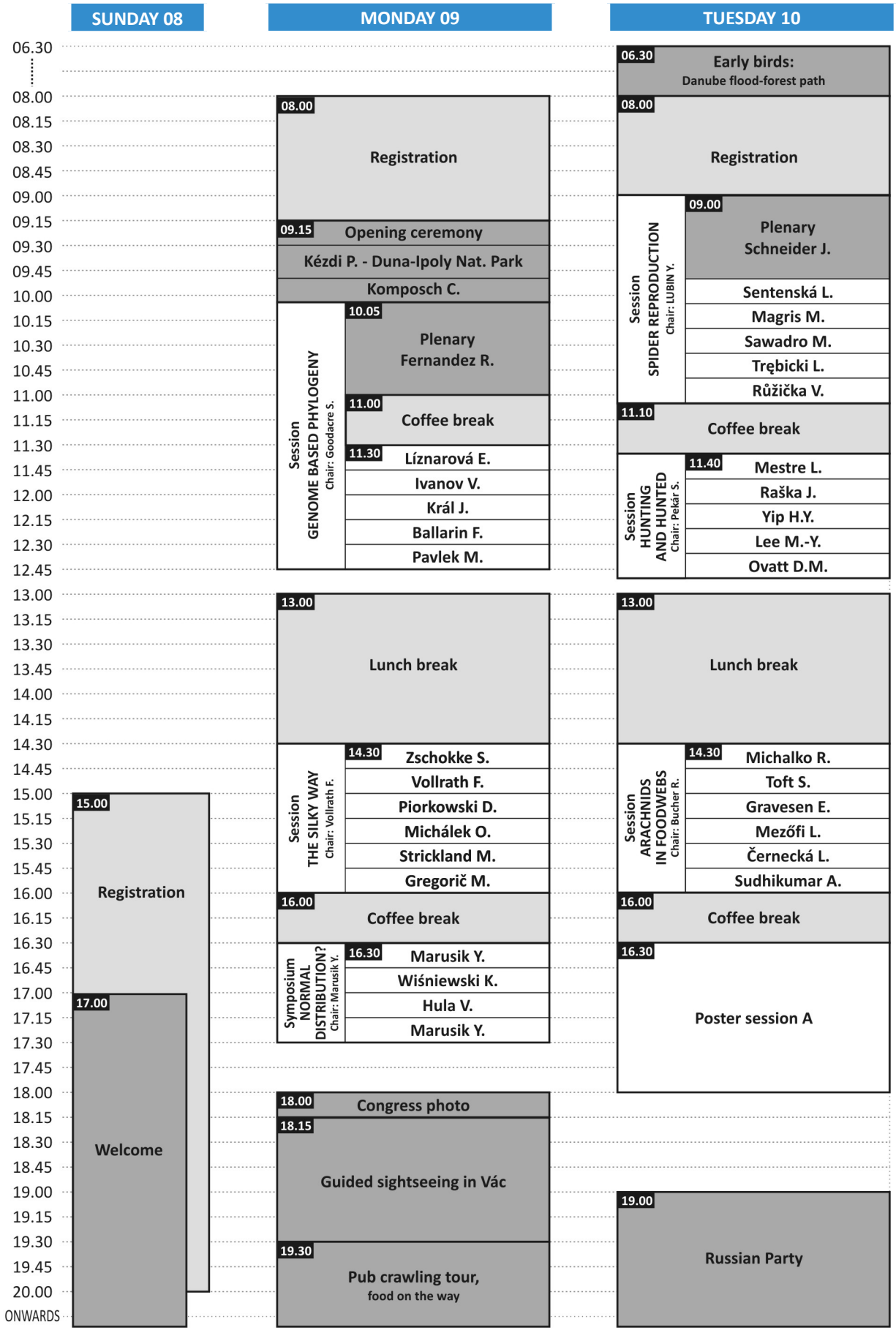
2018 VÁC, HUNGARY

8-13 July

www.eca2018.hu

FINAL PROGRAM & ABSTRACTS

PROGRAM OVERVIEW (click the day)



PROGRAM OVERVIEW (click the day)

WEDNESDAY 11

09.00 MID-CONGRESS TOUR

17.00 Gulash in the forest

THURSDAY 12

06.30 Early birds: Dragon boating

09.00 Plenary Selden P.

Session ALL HISTORY Chair: Wunderlich J.
- Harms D.
- Simmons Z.
- Koomen P.

10.45 Coffee break

Session ENVIRONMENTAL ISSUES Chair: Nentwig W.
- 11.15 Komposch C.
- Armiach Steinpress I.
- Mahadeo V.
- Samu F.
- Milano F.
- Sudhin P.P.

13.00 Lunch break

Session EVOLUTIONARY TRICKS Chair: Toft S.
- 14.30 Pekár S.
- Hundertmark A.
- Gibbons A.T.
- Levy T.
- Schaider M.

15.45 Coffee break

16.15 General Assembly of ESA

17.15 Poster session B

19.00 Congress dinner

21.30. Csürrentő Folk Band dance and concert

FRIDAY 13

06.30 Early birds: Market place

09.00 Plenary Wirkner C.S.

Session SPIDER LOOKS: INSIDE AND OUTSIDE Chair: Foellmer M.
- Runge J.
- Kariko S.
- Kirchmair G.

10.45 Coffee break

Session COMMUNITY AND LANDSCAPE ECOLOGY Chair: Michalko R.
- 11.20 Gallé R.
- Szabó Á.
- Bucher R.
- Štokmane M.
- Tóthmérész B.
- Neisseril K.

12.50 Lunch break

Session UNDERGROUND ARACHNOLOGY Chair: Isaia M.
- 14.00 Gavish-Regev E.
- Komnenov M.
- Plaiasu R.
- Yağmur E.A.

15.00 Coffee break

15.30 Closing ceremony

06.30 ... 08.00 08.15 08.30 08.45 09.00 09.15 09.30 09.45 10.00 10.15 10.30 10.45 11.00 11.15 11.30 11.45 12.00 12.15 12.30 12.45 13.00 13.15 13.30 13.45 14.00 14.15 14.30 14.45 15.00 15.15 15.30 15.45 16.00 16.15 16.30 16.45 17.00 17.15 17.30 17.45 18.00 18.15 18.30 18.45 19.00 19.15 19.30 19.45 20.00 ONWARD

31st European Congress of Arachnology

Organisers:

Hungarian Ecological Society and the **Centre for Agricultural Research, Hungarian Academy of Sciences** in co-operation with the community of **Hungarian arachnologists**

Co-organising partners:

Apor Vilmos Catholic College & **European Society of Arachnology**

8–13 July, 2018
Vác, Hungary

Budapest, 2018 (version 24/VII)
Edited by László Mezőfi and Éva Szita

Organising Committee

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The logo

The 31st ECA logo, designed by Éva Szita, depicts the uloborid spider *Hyptiotes paradoxus* perching on the signal thread of its reduced orb-web. The typical triangular orb is framed by the Danube with its bend; all threads are meeting at the congress town Vác.

Content

Preface

Welcome to the 31th European Congress of Arachnology!

This congress is jointly organised by **Hungarian Ecological Society** and the **Centre for Agricultural Research of the Hungarian Academy of Sciences** in co-operation with the **Hungarian arachnologists**. Altogether 133 participants from all over the world (from 27 countries) registered.

This book contains the programme and the abstracts of four plenary talks, 58 oral presentations, and 53 poster presentations, of which 52 are given by students.

The abstracts are arranged in alphabetical order by first author. Each abstract includes information about the type of presentation (oral, poster) and whether it is a student presentation.

We wish all participants a joyful stay in Vác.

On behalf of the Organising Committee

Ferenc Samu

General Information

Information for speakers

Each speaker will have **15 minutes** available (including questions and discussion). Please, prepare your presentation in **MS Office PowerPoint for Windows or as PDF or as executable Prezi**. Bring the file on a USB memory stick, using your last name as the file name, or if you have more files, create a folder with that name. Users of Macintosh should export their presentation to a Windows compatible platform. We suggest to create a backup PDF version for the case of unforeseen incompatibility. Embedded video files are also advisable to have in a couple of standard video formats (avi, wmv, mp4) in your folder. We also advise to have a downloadable backup copy of all files, e.g. in Dropbox.

Poster presentations

Poster stands are suitable for standard **A0 (0.841 m × 1.189 m)** portrait format posters, which is the recommended size (although they can accommodate a maximum size of 0.97 m × 2.3 m posters, which is clearly not recommended). There will be two poster sessions: **session A** on Tuesday covering behaviour, ecology and molecular studies, **session B** on Thursday covering morphology, physiology, taxonomy, biogeography and faunistics. Poster stands will be numbered the same way as posters, presenters should attach their poster to the corresponding stand preferably until Monday midday and leave them on display irrespective of poster session. Presenters should be at their posters during the relevant sessions.

Proceedings

Congress participants are welcome to submit their oral or poster contribution to the Congress Proceedings. These will be published as an issue or a section of an issue of A**rachnologische Mitteilungen** during the following year (2019) and will be available online. When preparing the manuscript, please, follow the Guidelines for Authors of this journal (https://arages.de/en/journal/instructions-to-authors.html).
Please, submit the manuscript to proceedings.eca2018@gmail.com.
Deadline for submission is November 30, 2018.

Student awards

Best student talks and poster presentations will be awarded during the closing ceremony. Number and kinds of awards to be announced later.

The Venue (see maps in the next pages)

The congress venue is the Apor Vilmos Catholic College, a teacher training college, located centrally in the old town. Registration, scientific program, on-venue dorm accommodation and canteen are all in the main building of the College (see floor plans).

Address: Konstantin Sqr. 1-5, Vác, H-2600

Scientific sessions: Pope John Paul II Hall

Registration, social area, coffee breaks: Apor Vilmos Hall

Poster session: Sports Hall (Gym)

Social and relaxation area, welcome party, Russian Party: Inner yard

Off-venue dorm: Honvéd Str. 13., Vác, H-2600

Congress dinner: Rubra Art Lounge, Dr. Csányi László Körút 52. Vác, H-2600

Internet access

WiFi access will be available on the Venue and in the dorms (most, if not all, accommodations also provide wifi service). For those from the European Union mobile internet access is possible according to their home mobile data plan.

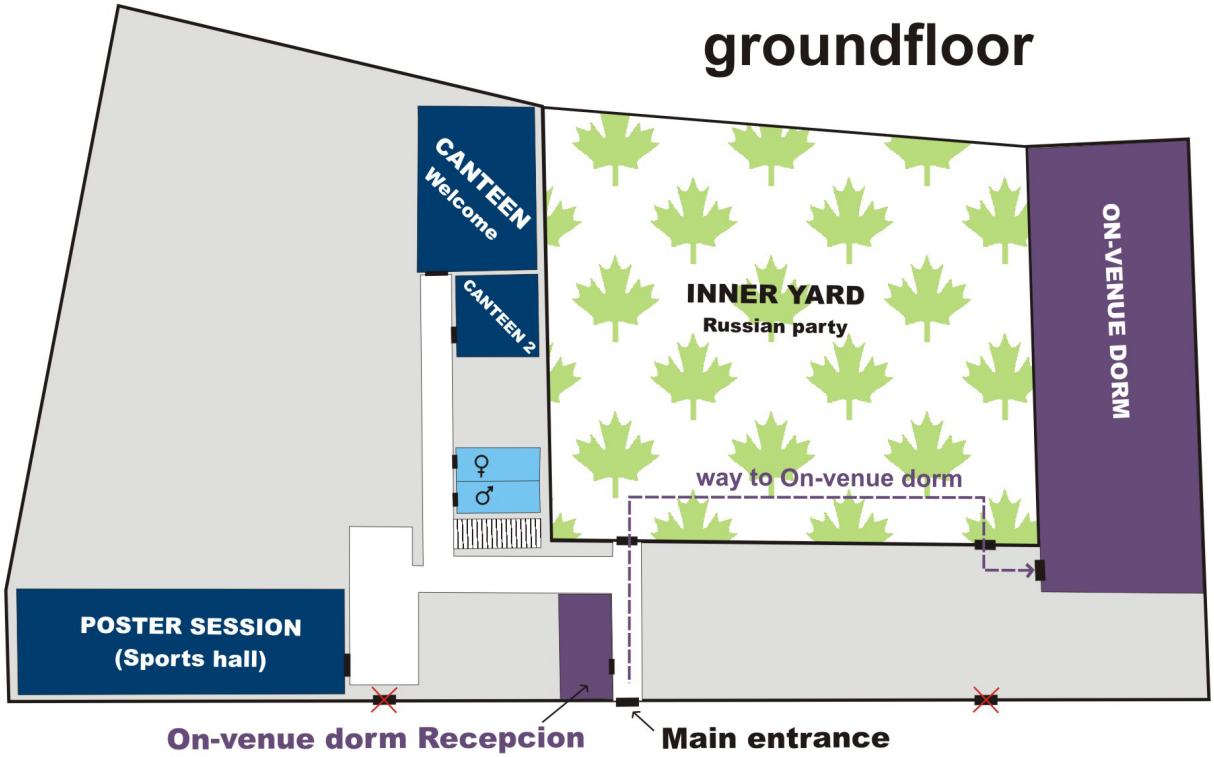
Arrival information

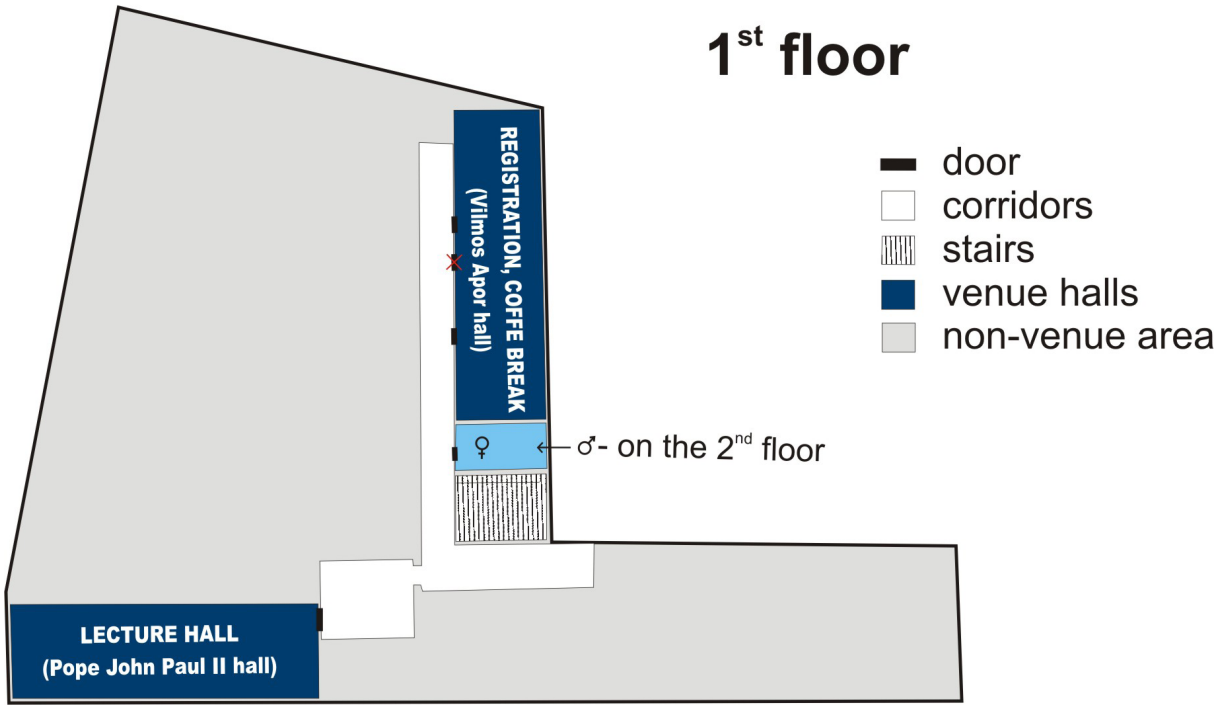
You can either first arrive to your accommodation or to the registration at the College (the Venue). Registration will be open from 15:00 Sunday and from 8:00 Monday. Dorm accommodation can be occupied from 15:00 Sunday. Welcome party starts at 17:00 Sunday.

Travel

For those with smart phone we suggest the use of map and navigation apllications. Waze is excellent for drivers with up-to-date traffic info. Google Maps is useful for any transportation mode, including walking and public transport. Public transport timetables and route planning is absolutely reliable in Hungary. For those without mobile data, for instance, the HERE WeGo application is a good alternative (Android and iOS), which also contains public transport info.

VENUE MAPS


groundfloor
CANTEEN
Welcome
CANTEEN 2
INNER YARD
Russian party
ON-VENUE DORM
♀
♂
way to On-venue dorm
POSTER SESSION
(Sports hall)
On-venue dorm Recepcion
Main entrance


1st floor
REGISTRATION, COFFE BREAK
(Vilmos Apor hall)
♀
♂- on the 2nd floor
LECTURE HALL
(Pope John Paul II hall)
door
corridors
stairs
venue halls
non-venue area

Congress locations

1 - Venue; 2 - On-venue dorm; 3 - Off-venue dorm; 4 - Railway station; 5 - Congress Dinner (Rubra Art Lounge); **6 - Way to the Floodplain educational trail; 7 - Dragon boat meeting point; 8 - Vác Market; 9 - Exchange khiosk**

Getting to Vác

From Budapest we suggest to take a train from the station "Nyugati pályaudvar" or "Nyugati pu." Trains leave from outside platforms, if you enter the main hall, then they will be on your left, further away. Take the next train with destination of Vác or Szob (S70 and Z70), but avoid international trains or "Veresegyház-Vác" trains, which may require seat reservation or take a longer route. Trains leave at least every 30 minutes (www.elvira.hu is a searchable timetable). Tickets can be bought from machines in the main hall or at the head of the outside platforms, which take cards or Forint notes; English can be chosen as menu language.

Arrival by air: From Budapest Airport either take public transportation or get a taxi to "Nyugati pályaudvar" train station (see above). The airport is served by "Főtaxi" (yellow cabs); first go to their kiosk found just outside when you leave the main airport building, they will put you in the cab queue, which advances rapidly. Pay your cab with card as the simplest option, you can also ask for a bill. Cost to Nyugat pu. will be c. 22-25 EUR.

Arrival by train: If you arrive to Budapest, then guide yourself to Nyugati pu. station (see above) by public transport or taxi. Some international trains may stop in Vác, check out this possibility when you choose a train.

Arrival by car: Use navigation as the best option. Beware that the M2 highway from Budapest to Vác is under construction (being widened), 60 km/h speed restriction all way long, but manageable. You can choose the old Route 2. When driving in Hungary beware of speed traps and radar-hunting police. Paying parking is not marked by coloured markings, safest if you ask. Parking tickets are issued from coin operated machines.

Getting around in Vác

From the railway station (especially with luggage) taking a taxi is the best option. Taxis take you within town between any two places for 1000 Forints (less than 3 EUR). In the town most places are reached the easiest on foot. The biggest Vác taxi company accepts cards, but according to our enquiry all accept Euro besides Forints (best if you ask beforehand).

Parking

If you are by car, parking zones (see map) and restrictions must be observed. Do not park in opposite direction (in a two-way street on the left side), you can get a ticket or wheel clamp for it. Parking tickets can be bought from coin operated machines. Parking is free on week-ends (form Saturday 12:00 till Monday 8:00). There are free parking areas quite close to the venue and the city centre. If you stay in private accommodation ask your host about parking options. For a limited number of cars, if it is not to be used on a daily basis, we can offer closed parking space in the St. Joseph Student Hall (off-venue dorm). Contact the organizers to secure this option for your car.

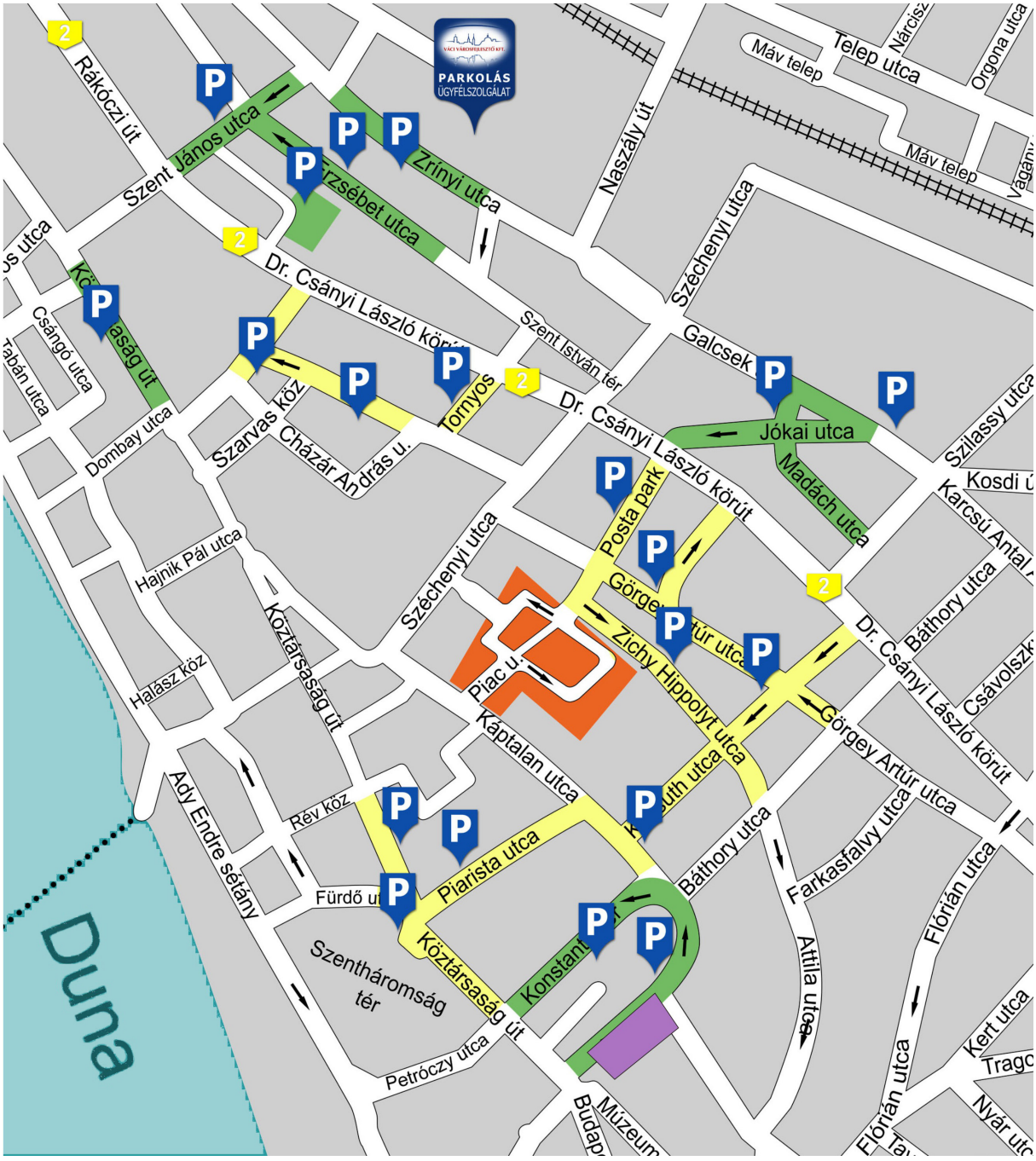
Parking zones in Vác

tariff zone 1

tariff zone 2

underground garage

venue



Card use and currency change

Major bank cards (Visa, Master, Maestro including electronic versions, but American Express less widely, others virtually not) are widely but still not everywhere accepted. No real distinction is made between “credit card” and “debit card” (your business how you pay it afterwards). Touchless paying (PayPass) is widely available, including many machines, which gives you the safety that your card is not swallowed :).
The official currency is Forint (Hungarian Forints, HUF or Ft). Euro might be accepted at some larger supermarkets or tourist-related businesses, but usually not at a favourable rate. Usually you can get the best rate if you buy things directly with your card. Still, you will need some cash in Forints. I suggest not to exchange money at the airport or within the railway station. Banks give rather bad rates. ATMs are mid-way, and at least a quick solution. If you need the best option, look for small exchange shops, kiosks. You can find at least one in Vác (see map), or you can step outside Nyugati station and there will be many (http://valutavaltok.hu gives you addresses and rates).

Meals

For those who booked lunch and “on-venue breakfast” these meals will be (self-)served in the canteen of the College on the ground floor. Snacks and refreshments will be in the registration hall (Apor Vilmos Hall) during coffee breaks. The congress dinner will be in the Rubra restaurant (see map).

Morning programs

Meet for all early bird programs in front of College at 6:30 a.m.

July 10 – Early morning guided walk on Danube riverbank forest trail (2 EUR/person, min 10, max 30 persons, register and pay until Monday 16:00).

July 12 – Dragon boating on the Danube. Pre-register and pay for this program until Tuesday 16:00 at registration desk (2 EUR/person, max 40 persons).

July 13 – Early morning visit to the market.

Evening programs

July 8 – 17:00 - 22:00: Welcome party (College, canteen)

July 9 – 18:00: Guided evening walk in Vác, eventually ending up in pubs, meet in front of College

July 10 – 19:00: Russian party (College, inner yard)

July 11 – 17:00 - 22:00: Evening gulash („pörkölt") cooked on fire from Hungarian grey cattle, accompanied with some red wine. Close to Diósjenő in the Börzsöny Mts.

July 12 – 19:00: Congress dinner in Restaurant Rubra, afterwards live music and dancing with a Hungarian folk band

July 13 – 18:00: For those staying for the night evening ralaxation and talking in pubs, restaurants

Mid-Congress tours

A) Börzsöny Mountains excursion.

We reach "Magas Tax" parking lot (c. 700 m a.s.l.) by bus, from which the highest peak in Börzsöny, Csóványos (939) is a good climb. From there we descend to Diósjenő (308 m), crossing during the walk a variety of different habitats (rock grasslands, meadows, pristine forests). On the tour we will be accompanied by an expert ranger, who will provide details about the flora and fauna of the area. We will also stop at viewpoints with nice panoramas, and there will be plenty opportunity to observe spiders. We work on getting group permits for collecting specimens, under way at the time program goes to press. The tour takes c. 10 km, covers 600 m elevation difference, but that is mostly descent. The tour ends at Diósjenő Forest Recreational Park, where the other groups join us and we will be all treated to a Hungarian "gulash" cooked on open fire and to some nice local wine. Buses take us back to Vác in the evening.

B) Szentendre Island tour.

We reach Szentendre Island in the Danube by a ferry cross directly from Vác. Taking the larger leaps by bus, in the morning we reach the Northern tip of the island. There we visit riverbank and flood forest habitats, and will have an opportunity to either have a short swim or just walk to the knee in the river. Later we reach the Southern part of the island with sand dunes and their typical grassland vegetation, much like large areas on the Great Hungarian Plain. You will be accompanied by Csaba Szinetár who will most certainly point out every possible spider habitat. We work on getting group permits for collecting specimens, but cannot make a definite promise until we got that. Reaching the other bank of the Danube we stop over at the small town of Szentendre, a real tourist attraction for a short stroll in the centre and if one feels like sit in a café. Late afternoon the bus will take us Diósjenő Forest Recreational Park, where we joint the other groups to spend the evening and to treated to a Hungarian "gulyás" cooked on open fire and to some nice local wine. Buses take us back to Vác in the evening.

C) Visegrád historic sites.

From Vác a bus will take the group to Nagymaros, from where we take a ferry to cross the Danube to Visegrád on the opposite side. Visegrád was a medieval residence town for Hungarian kings (http://www.visegrad.hu/muemlekek-muzeumok-1), King Mathias being the most famous. First we visit Mathias' renaissance Royal Palace and the Salamon Tower. Then by a short, but rather steep walk (covers 200 m altitude difference) we reach the Citadel, which is a museum, but also gives a breathtaking view of the Danube Bend. Both at the Palace and in the Citadel we will have guided visits. On the way back we take a longer route through the forest to reach the ferry again. After taking the ferry back to Nagymaros the bus will take us to Diósjenő Forest Recreational Park, where we joint the other groups to spend the evening and to treated to a Hungarian "gulyás" cooked on open fire and to some nice local wine. Buses take us back to Vác in the evening. Please note that **MUSEUM ENTRANCE FEES ARE NOT COVERED** in this tour. They cost 12 EUR/person payable at registration.

PROGRAM

(click presentation title for abstract)

MONDAY, JULY 9

8:00	**Registration desk open**
9:15	**Opening ceremony**
9:35	*Pál Kézdy* **Nature conservation in the Danube-Ipoly NP**
9:50	*Christian Komposch* **Arachnologists in their natural habitats**

Session - Genome based phylogeny

Chair: Sara Goodacre

10:05	**Plenary lecture:** *Rosa Fernández* **Phylogenomics, diversification dynamics and comparative transcriptomics across the Spider Tree of Life**
11:00	**Coffee break**
11:30	*Eva Líznarová, Stano Pekár & Petr Bureš* **Comparative analysis of spider genome sizes**
11:45	*Vladislav Ivanov, Yuri Marusik, Kyung Min Lee & Marko Mutanen* **Applications of ddRAD sequencing in taxonomy and systematics of wolf spiders (Lycosidae)**
12:00	*Jiří Král, Alexandr Sember, Tereza Kořínková, K. Divišová, Azucena C. Reyes Lerma, Ivalú M. Ávila Herrera, Martin Forman, José G. Palacios Vargas, Magda Zrzavá, Petr Nguyen, Paula Cushing, Alexander V. Gromov & Tharina L. Bird* **Karyotype evolution of tetrapulmonate arachnids (Arachnida: Tetrapulmonata)**
12:15	*Francesco Ballarin & Shuqiang Li* **Molecular-based analysis shed new light on phylogeny and evolution of the family Nesticidae (Arachnida, Araneae)**
12:30	*Martina Pavlek, Silvia Adrian, Fulvio Gasparo & Miquel A. Arnedo* **Tales from the crypt: origins and evolutionary history of the cave-dwelling Dysderidae spiders in the Dinaric karst**
13:00	**Lunch break**

MONDAY, JULY 9

Session - The Silky Way

Chair: Fritz Vollrath

14:30 *Samuel Zschokke, Stefanie Countryman & Paula E. Cushing*

Spiders in space – orb web related behaviour in a zero-gravity environment

14:45 *Fritz Vollrath*

Spiders, webs and soft robotics

15:00 *Dakota Piorkowski, Niall Doran, Chen-Pan Liao, Chung-Lin Wu, Sean Blamires & I-Min Tso*

Just add water and age! Cribellate silk stickiness increases at high humidity across ontogeny in the Tasmanian cave spider, *Hickmania troglodytes*

15:15 *Ondřej Michálek, Yael Lubin & Stano Pekár*

Spraying silk: Araneophagous hunting strategy used by the ground spider *Poecilochroa senilis* (Gnaphosidae)

15:30 *Michelle Strickland, Victor Tudorica, Milan Řezáč, Neil R. Thomas & Sara L. Goodacre*

Conservation of a pH-sensitive structure in the C-terminal region of spider silk extends across the entire silk gene family

15:45 *Matjaž Gregorič, Matjaž Kuntner, Maja Ravnikar & Denis Kutnjak*

Spider webs as a source of environmental DNA: A preliminary report

16:00 **Coffee break**

Session - Normal distribution? Symposium

Chair: Yuri Marusik

16:30 *Yuri Marusik*

The World Spider Catalog and distribution of spiders

16:45 *Konrad Wiśniewski*

Phenology of spider populations in Central European mountains

17:00 *Vladimír Hula & Vojtěch Pešan*

Spiders of tropical pavilions of the zoological gardens in the Czech Republic

17:15 *Yuri Marusik & Zoë Simmons*

The splendid confusion about terra typica of spiders described by O. Pickard-Cambridge from the Himalaya and Xinjiang

18:00 **Congress photo**

18:15 **Guided sightseeing in Vác**

19:30 **Pub crawling tour, food on the way**

TUESDAY, JULY 10

6:30 **Early birds: Walk the Danube river bank flood -forest path**

Session - Spider reproduction

Chair: Yael Lubin

9:00 **Plenary lecture:**

Jutta Schneider

Sex specific plasticity in life-history and the mating system of *Nephila senegalensis*

9:50 *Lenka Sentenská, Lucie Hoffschläger, Stano Pekár, Ally Harari, Gabriele Uhl & Yael Lubin*

Costs and benefits of immature mating in the cannibalistic brown widow spider *Latrodectus geometricus*

10:05 *Martina Magris & Cristina Tuni*

Enough for everyone: *Pisaura mirabilis* males do not reduce their mating effort with increasing mating opportunities

10:20 *Marta Sawadro, Agata Bednarek, Agnieszka Molenda & Agnieszka Babczyńska*

Allatoregulatory neuropeptides role in vitellogenesis process of *Parasteatoda tepidariorum* (Araneae, Theridiidae) spider females

10:35 *Łukasz Trębicki, Barbara Patoleta, Katarzyna Janiszewska, Jarosław Stolarski, Maciej Bartos, Yuri Marusik, Mirosława Dabert & Marek Żabka*

Securing paternity in jumping spiders, with description of a novel form of mating plug in *Cytaea* Keyserling, 1882 (Araneae: Salticidae)

10:50 *Vlastimil Růžička & Adam Růžička*

Three-dimensional modelling in arachnology on example of *Porrhomma*-species (Araneae: Linyphiidae)

11:10 **Coffee break**

Session - Hunting and hunted

Chair: Stano Pekár

11:40 *Laia Mestre, Florian Menzel & Martin H. Entling*

Hunting mode of spiders influences their fear of ants

11:55 *Jan Raška & Stano Pekár*

Reactions of mantises towards anti-predatory defence of *Eresus kollari* and its potential models

12:10 *Ho Yin Yip & I-Min Tso*

Can I borrow a light? Do web building spiders sense and use bioluminescent cues to lure prey?

12:25 *Ming-Yu Lee*

Do nocturnal spiders use visual signal as species recognition cues?

TUESDAY, JULY 10

12:40	*Drisya Mohan Ovatt, Kashmeera Neisseril & Ambalaparambil Sudhikumar* **Is cooperation in prey capture flexible in Indian social spider *Stegodyphus sarasinorum*?**
13:00	**Lunch break**

Session - Arachnids in foodwebs

Chair: Roman Bucher

14:30	*Radek Michalko, Stano Pekár, Martin Dul'a & Martin H. Entling* **Biocontrol efficiency of spiders across the globe: a meta-analysis**
14:45	*Søren Toft* **Do harvestmen obtain a nutritionally balanced diet in the field?**
15:00	*Ejgil Gravesen, Lenka Petráková, Jiayi Qin & Paul Henning Krogh* **Greenland glacier retreat: DNA gut content analysis shows strong intraguild predation (IGP) and confirm bottom-up effect for spiders and harvestmen**
15:15	*László Mezőfi, Csaba Nagy, Dávid Korányi & Viktor Markó* **Preliminary data on the natural prey of arboreal hunting spiders (Araneae) in apple orchards**
15:30	*Ľudmila Černecká, Anton Krištín & Radek Michalko* **Abiotic factors and biotic interactions jointly drive spider assemblages in nest-boxes in mixed forests**
15:45	*Ambalaparambil Sudhikumar & Kashmeera Neisseril* **Changes in per capita interaction strength between spider and grasshopper during anomalous temperature rise in summer season**
16:00	**Coffee break**

Poster session A

16:30	
19:00	**Russian party**

WEDNESDAY, JULY 11

9:00	**Whole day excursion**
17:00	**Post-excursion gulash in the forest**

THURSDAY, JULY 12

6:30	**Early birds: Dragon boating on the Danube**

Session - All history

Chair: Jörg Wunderlich

9:00	**Plenary lecture:**
	Paul Selden
	Spiders with tales to tell: fossil evidence of the stem group of the Araneae
9:50	*Danilo Harms, Ulrich Kotthoff, Jörg U. Hammel & Jason Dunlop*
	Arachnids in European succinite ambers: What's the big picture?
10:05	*Zoë Simmons*
	The exotic araneae collection of Octavius Pickard-Cambridge; access denied but we are in great spirits
10:20	*Peter Koomen*
	New techniques for spider photography
10:45	**Coffee break**

Session - Environmental issues

Chair: Wolfgang Nentwig

11:15	*Christian Komposch*
	"Game of Death" – The spider and harvestman fauna at a controversial hydropower construction site
11:30	*Igor Armiach Steinpress, Ibrahim Salman, Tanya Levy, Assaf Uzan, Nitzan Segev, Yael Lubin & Efrat Gavish-Regev*
	Arachnids at an oil spill – the 'Avrona case
11:45	*Vashtidevi Mahadeo & Matthias Foellmer*
	Sub-lethal effects of pesticides on the wolf spider *Pardosa littoralis*, a key predator in North American salt marshes
12:00	*Ferenc Samu, Zoltán Elek, Bence Kovács, Flóra Tinya, Réka Aszalós, András Bidló & Péter Ódor*
	Shifts in the community structure of spiders over four years after forestry treatments
12:15	*Filippo Milano, Stefano Mammola & Marco Isaia*
	The assessment of the global extinction risk of an Alpine spider species threatened by climate change
12:30	*Puthoor Pattammal Sudhin, Karunnappilli S. Nafin & Ambalaparambil Sudhikumar*
	Effect of forest fire on diversity of spiders - a case study from Western Ghats, Kerala, India

THURSDAY, JULY 12

13:00 **Lunch break**

Session - Evolutionary tricks

Chair: Soeren Toft

14:30 *Stano Pekár, Ondřej Bočánek, Ondřej Michálek, Lenka Petráková, Charles R. Haddad, Ondrej Šedo & Zbyněk Zdráhal*

Venom gland size and venom complexity – essential trophic adaptations of venomous predators: a case study using spiders

14:45 *Antje Hundertmark & Sara L. Goodacre*

It's what's inside that matters: endosymbiont infections in *Linyphia* spiders

15:00 *Alastair T. Gibbons*

Endosymbionts in the field: spiders don't walk alone

15:15 *Tanya Levy, Meshi Hood, Gila Kahila Bar-Gal, Yael Lubin & Efrat Gavish-Regev*

Home alone: The fine line between kleptoparasite and predator

15:30 *Miriam Schaider & Günther Raspotnig*

Methyl ketones in *Nemastoma triste* – a chemical link between Cyphophthalmi and Dyspnoi

15:45 **Coffee break**

16:15 **General Assembly of ESA**

Poster session B

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19:00 **Congres dinner**

FRIDAY, JULY 13

6:30 **Early birds: Visit the market place**

Session - Spider looks - inside and outside

Chair: Matthias Foellmer

9:00 **Plenary lecture:**

Christian S. Wirkner

Evolutionary morphology of chelicerates

9:50 *Jens Runge & Christian S. Wirkner*

A morpho-functional comparison of antenniform legs in Pedipalpi

10:05 *Sarah Kariko, Jaakko V. I. Timonen, James C. Weaver, Dvir Gur, Carolyn Marks, Leslie Leiserowitz, Mathias Kolle & Ling Li*

Tiny spider, big color: structural origins of coloration in the spider *Phoroncidia rubroargentea* Berland, 1913 (Araneae: Theridiidae) from Madagascar

10:20 *Gabriel Kirchmair & Günther Raspotnig*

Cuticular hydrocarbons of selected Pseudoscorpion species

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Session - Community & landscape ecology

Chair: Radek Michalko

11:20 *Róbert Gallé, Nikolett Gallé-Szpisjak & Péter Császár*

Landscape structure is a major driver of spider diversity in natural Central European forest-steppes

11:35 *Ágota Szabó, Péter Császár, Attila Torma & Róbert Gallé*

Spider assemblage structure and functional diversity patterns of natural forest steppes and exotic forest plantations

11:50 *Roman Bucher, Herbert Nickel, Stefanie Kaib, Melanie Will, Juan Carchi, Nina Farwig & Dana Schabo*

Do we need to monitor spiders or are popular biodiversity indicators sufficient?

12:05 *Maija Štokmane*

The spatial distribution of epigeic spiders and other ground-dwelling arthropods within the Apšuciems calcareous fen: a response to vegetation heterogeneity

12:20 *Béla Tóthmérész, Tibor Magura, Roland Horváth, Csaba Szinetár, János Eichardt & Éva Kovács*

Local factors are more important than landscape-level factors to control spider assemblages in un-managed grasslands

12:35 *Kashmeera Neisseril, Drisya Mohan Ovatt, Karunnappilli Nafin & Ambalaparambil Sudhikumar*

Diversity of sand dune spiders in Great Indian Thar desert

FRIDAY, JULY 13

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Session - Underground arachnology

Chair: Marco Isaia

14:00 *Efrat Gavish-Regev, Igor Armiach, Tanya Levy, Assaf Uzan, Marija Majer, Ibrahim Salman, Nitzan Segev & Yael Lubin*

Burrow placement of *Sahastata nigra* (Simon, 1897), and their potential as indicators of habitat recovery in a hyper-arid desert

14:15 *Marjan Komnenov & Roman Ozimec*

Subterranean spider fauna (Arachnida, Araneae) of the Dinarides

14:30 *Rodica Plaiasu & Raluca I. Bancila*

Temporary emigration of a cave-dwelling harvestman species

14:45 *Ersen Aydın Yağmur & Rahşen S. Kaya*

Preliminary results on the subterranean spider (Araneae) fauna collected by MSS traps in western and central Anatolia

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ABSTRACTS

Poster presentation

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Habitat manipulation: the effect of mulching on dominant and non-dominant spider species

Gergely Ambrus, Péter Dudás, Márk Szalai & Ferenc Tóth

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Habitat structure has a potential to influence spider fauna. The factors of habitat manipulation are well analysed in ecological studies, and it has been shown that enhancing the structure results in higher number of individuals and sometimes in higher number of species as well. Mulching soil surface is one of the methods to diversify habitat structure. According to our hypothesis the advantages of mulching affect the dominant species of an area. We supposed that since mulched surfaces increase the number of microhabitats, there will be a more diverse assemblage of spiders in mulched areas. We addressed the following questions: (i) What impact, if any, does habitat manipulation have on the diversity values? (ii) If the activity density is higher on the manipulated surface, what is the reason most accountable for this finding? It is because of an elevated number of dominant species, or the non-dominant ones instead or both? Between 2012 and 2014 the effect of changes in habitat structure was studied at species and assemblages level in potato plots at six locations in Hungary. Half of the plots were covered with decaying plant material, and the other half left unmulched. Pitfall traps were placed in the same number and pattern in each plot. Species diversity was calculated with Rényi entropy function. A total of 7205 individuals were captured: 4196 of them from mulched plots and 3009 from the unmulched ones. The most abundant families were Lycosidae (56 %), Gnaphosidae (15%) and Linyphiidae (13%). There were 53 species found only in mulched plots and 44 species only in the unmulched plots. None of the cumulative proportion of individuals of these species reached 2% compared to the total number. There were 78 species captured in both habitats being 97 % of the total capture. Although, no correlation between the habitat structure and species diversity was confirmed, the activity density values of females of the mulched plots were significantly higher than that of the males, but this difference was mainly due to non-dominant species. Mulching did, in general, increase the number of individuals, but this increase did not turn rare species into dominant ones.

ORAL PRESENTATION - STUDENT

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Arachnids at an oil spill – the 'Avrona case

Igor Armiach Steinpress (1), Ibrahim Salman (2), Tanya Levy (1), Assaf Uzan (1), Nitzan Segev (2), Yael Lubin (2) & Efrat Gavish-Regev (1)

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The 'Avrona nature reserve, situated in the 'Arava hyper-arid desert (Israel), has experienced two major ecological disasters (oil spills), in 1975 and 2014, originating from the trans-Israel pipeline, which runs through the reserve. While the 1975 spill site was left untreated, at the 2014 site the surface was tilled to expose the oil-soaked soil to aerobic microbial activity. In the aftermath of the recent spill, a five-year multidisciplinary monitoring scheme was established to assess the effects of the spill on the ecosystem. As a part of this program, we are monitoring spiders and scorpions in 'Avrona using pitfall traps, trunk refugia and visual search in defined plots. Acacias are keynote species in the reserve; therefore we placed traps both under and near selected trees, to evaluate their influence on the abundance and composition of arachnid communities. We hypothesized that the abundance of arachnid taxa closely associated with the soil substrate will be negatively influenced by the oil-soaked soil. Our objectives are to compare the 2014 and 1975 oil spills to each other and to adjacent control plots. After two years of monitoring (2016, 2017), our results indicate a significantly lower abundance of scorpions at the untreated 1975 spill site. A similar pattern was also observed for the distribution of the burrowing filistatid spider, *Sahastata nigra* (Simon, 1897), which did not construct burrows in contaminated soil. In the spill sites where the oil cemented the soil into a hard surface, it may be difficult for burrowing arachnids to dig through the substrate. These results suggest long-lasting effects of a surface spill that can cause far-reaching changes in the structure of the delicate desert ecosystem.

Poster presentation - Student

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Versatile web use by a klepto-araneophagic spider, *Neospintharus syriacus*

Nirit Assaf (1), Tanya Levy (2, 3), Meshi Hood (2), Yael Lubin (4) & Efrat Gavish-Regev (2)

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The spiders of the sub-family Argyrodinae (Theridiidae) are known to have specialized feeding behaviors including stealing prey from other spiders (kleptoparasitism) and predation of other spiders (araneophagy). In a former study we conducted, the klepto-araneophagic species, *Neospintharus syriacus* (O.P.-Cambridge, 1872), was found on webs of various host species, as well as on self-built webs. Moreover, we observed *N. syriacus* occupying host-absent webs, and different web-complexes (sheet-webs, dome-shaped-webs, orb-webs and irregular-webs) inhabited by another argyrodine kleptoparasite, *Argyrodes argyrodes* (Walckenaer, 1841). In order to study the factors that might affect the choice of webs used by *N. syriacus*, we established a monitoring scheme in Ma'agan-Mikha'el, the only locality in Israel where we observed *N. syriacus* and *A. argyrodes* together. We asked whether web use by *N. syriacus* changes over the seasons, and whether patterns of web use correlate with developmental stage of the argyrodines, the relative abundance of the two species, and the availability of potential host webs and prey. The on-going monitoring is performed in five sites once a month since September 2017. A total of twelve plots, with webs chosen haphazardly are surveyed each month in all sites. For each plot, we documented plant species, web types and sizes, host-web species identities and prey presence, in addition to the presence of argyrodines and their egg sacs. Here we present first results from this argyrodine monitoring, including abundance of webs, prey and spiders throughout the year, and discuss the factors affecting web-use by *N. syriacus*.

Poster presentation - Student

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Comparing pitfall trapping and suction sampling data collecting for ground-dwelling spiders in relation of artificial gaps

László Bali (1), Dániel Andrési (1, 2), Katalin Tuba (1) & Csaba Szinetár (3)

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Gap formation is part of the natural regeneration processes in temperate forests. Artificial gaps created by modelling these processes can be essential in close-to-natural forest management techniques and achieving continuous forest cover. In order to assess the short-term effects of such artificial disturbances on the forest floor arthropod communities, spiders are ideal study subjects. In our current study, we are focusing on the comparison of two frequent ground-dwelling spider collecting methods, pitfall trapping and D-Vac suction sampling, in relation of artificial gap openings. Our data collection was carried out in West Hungary, in the Vép 32/D turkey oak forest sub-compartment. For pitfall trapping, two of the sub-compartment's artificial gaps (15 x 30 m) and the surrounding stand were surveyed with Barber-type pitfall traps (diameter 90 mm, filled with 10% acetic acid solution). In both gaps, the traps were arranged in 70 m long transects along the gaps' longitudinal axis, with 15 traps in each transect, 5 m from each other. Emptying of these traps took place after 2 weeks of field use, at 24.06.2014. The D-Vac suction sampling was carried out at 24.06.2015. We surveyed 6 additional gaps. At each gap, we sampled five, 1 square meter areas, beginning from the centers of the gaps, 5 m apart, with double repetition. To compare the data of the two surveys, we compared specimen and species numbers of the sampling points and calculated the Shannon (H') and Simpson (D) diversity indices. With pitfall traps, we collected 928 specimens, representing 34 species; which means an average of 2 specimens/day/trap. With suction sampling, we collected 1254 specimens, belonging to 41 species, which means an average of 21 specimens/sampling. Examining the distribution of the communities, we found that with both sampling method, the specimen numbers showed a growing tendency towards the centers of the gaps. The values of the species numbers were also higher in the middle parts of the transects with pitfall traps, but the suction sampling did not show any clear trends in this regard. Comparing the individual indices for each sampling showed clear differences between the two methods. In case of pitfall trapping, both H' and D indices were higher in the middle parts of the transects, while the indices of the suction samplings did not show any clear trends.

ORAL PRESENTATION - STUDENT

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Molecular-based analysis shed new light on phylogeny and evolution of the family Nesticidae (Arachnida, Araneae)

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Nesticidae is a relatively small family of troglophilic spiders widely distributed along temperate, subtropical and tropical areas of the world and currently including 15 genera and 278 species (World Spider Catalog, 2018). Traditionally the family has been considered rather uniform since its establishment by Simon in 1894, with the wide majority of the North American, European and Asian species previously included in the genus *Nesticus*. Only recently, new studies carried out using both morphological characters and molecular analysis have revealed a much wider diversity of genera and species, allowing a consistent revision of the family. Here we illustrate the current phylogenetic status of Nesticidae inferred on the base of new molecular studies and we discuss the primary role of ancient climatic events in shaping the evolutionary history of these spiders. To accomplish this goal we analyzed the sequences of more than 120 nesticid species, mostly from Europe and Asia. We selected two mitochondrial (COI & 16S) and four nuclear gene fragments (18S, 28S, H3 & Actin5c) for a total of more than 6000bp to reconstruct, and subsequently time-calibrate, a robust phylogenetic tree of nesticid spiders. Our preliminary results show that the family Nesticidae, as intended so far, could be polyphyletic with the genera *Gaucelmus*, *Hamus* and *Nescina* possibly belonging to different spider families. We confirm the ancient age of the family dating its origin in Upper Cretaceous and we identify three main evolutionary lineages within the Nesticidae sensu stricto. Accordingly to our preliminary analysis, the climatic and geological events occurred in Eurasia along the second half of the Eocene Epoch (~41–34 Ma) deeply shaped the phylogeny and distribution of Nesticidae, causing extinctions and promoting allopatric speciation between the close-related European and Asian clades. More recently, during the last 15 Ma, a faster diversification rate can be recorded involving a possibly explosive radiation in the taxa distributed in the Carpathian Mountains and in Japan.

Poster presentation

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The arachnological collections of the Museo Civico di Storia Naturale of Verona, a poorly-known taxonomic treasure for arachnologists

Francesco Ballarin, Roberta Salmaso & Leonardo Latella

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The Museo Civico di Storia Naturale of Verona (Italy) houses unique zoological collections of invertebrates. Among them the arachnological collections represent an excellence, boasting thousands of specimens and hundreds of species of arachnids (mostly spiders) from all over the world. Within the stored samples, types represents a conspicuous and crucial fraction which considerably increase the scientific value of the preserved material. Nevertheless, despite the undeniable taxonomic and systematic importance of such collections, their typology, and even their existence, are currently poorly-known among international arachnologists. In this poster we summarize the main features the collections, giving information about the number and composition of the taxa collected, their geographical provenience, the amount of types, and so on. The bulk of the stored material is represented by the collection "Paolo Marcello Brignoli", realized by the homonymous Italian arachnologists in the years '60–'70 of the last century, and consisting of approximately 7000 samples, ~ 1300 species and more than 300 types. In addition, the Museum stores the collection "Di Caporiacco" (~340 species, ~80 types) including samples from Kenya collected by the author in the years '40, and the "General Collection" (~3500 samples, ~780 species, ~70 types), comprising the material collected over the years by different authors and being still integrated nowadays with new species. Making such information available we aim to disclose to other arachnologists the presence and composition of the collections, making easier for them to locate species and types and therefore to facilitate future taxonomic studies of the preserved material.

POSTER PRESENTATION - STUDENT

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Ecology of spiders in the south-eastern Algerian Sahara

Wahiba Berretima (1), Imene Radjai (1), Ourida Kherbouche-Abrous (2) & Salaheddine Doumandji (1)

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A study about spiders is realized in four palm groves of both regions, those of Biskra and Touggourt, who belong to the Saharian bioclimatic stage. It is the first taxonomic inventory of the stand of spiders in these two regions. The environment studied is an agro-ecosystem composed of different varieties of date palms. Spiders were trapped in the pitfall and caught by hand. During one year, the collect of 1.621 individuals is made, including 656 males, 513 females and 452 juveniles divided between 22 families and 123 species. The results show the abundance of the family Gnaphosidae with 29 species, the Lyniphiidae and the Salticidae with 11 species each one. The dominant species is *Zodarion* sp. (Zodariidae). The study of various indexes shows that climatic conditions such as temperature are the main factors that influence in the distribution of spiders in the different palm plantations studied. The phenology of species studied showed that each species has a different phenology of others. The abundance of males is higher than that of females, while females are more present than males during the year.

Poster presentation - Student

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Gnaphosid spiders (Arachnida, Araneae) of Nakhchivan Autonomous Republic of Azerbaijan

Narmin Beydizade

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Here I would like to give some information of our materials about gnaphosid spiders, which were collected in Nakhchivan in 2012 (by other colleagues) and in 2017 years. Nakhchivan Autonomous Republic (AR) is an administrative unit of Azerbaijan separated from the rest of the country. It has joint borders with Armenia, Iran and Turkey. Very little is known about araneofauna of this territory compared to some other regions of Azerbaijan. For fauna of Azerbaijan is known more than 700 species, (~270 genera, 44 families) and more than 180 species known from Nakhchivan AR. The first gnaphosid spider *Micaria lenzi* Bösenberg, 1899 was reported by Eskov [1987] in Nakhchivan. 30 further gnaphosid spiders from Nakhchivan were recorded by Marusik, Guseinov, Aliyev. This study provides information about some frequently occurring gnaphosid spider species from Nakhchivan. During the expedition we were found for example (1♀) *Poecilochroa variana* C.L. Koch, 1839; (2♂♂) *Paecilochroa* cf. *furcata* Simon, 1914; (2♂♂) *Gnaphosa steppica* Ovtsharenko, Platnick et Song, 1992; (3♀♀) *Leptopilus* cf. *levantinus* Levy, 2009; *Nomisia ripariensis* O. P.-Cambridge, 1872; (1♂) *Nomisia* cf. *celerrima* Simon, 1914; (2♀♀1♂) *Drassodes lapidosus* Walckenaer, 1802; (2♀♀) *Haplodrassus dalmotensis* L. Koch, 1866; (1♀) *Zelotes latreillei* Simon, 1878. On the grounds of our material *Gnaphosa steppica* Ovtsharenko et al., 1992 as a separate species to the fauna of the Azerbaijan as is showed Ovtsharenko, Platnick et Song, 1992. *Poecilochroa* cf. *furcata* Simon, 1914, *P. variana* C. L. Koch, 1839 and *Leptopilos levantinus* Levy, 2009 and highly probable *Nomisia* cf. *celerrima* Simon, 1914 are new spider species to the fauna of Azerbaijan. The high number of new and rare species recorded in the present study emphasizes, that further faunistical studies and careful assessment of the arachnofauna of the region are needed to gain a more complete species list of Azerbaijan.

Oral presentation

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Do we need to monitor spiders or are popular biodiversity indicators sufficient?

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In the last decades, agricultural intensification has led to severe declines in biodiversity. Arthropods in particular suffered from agricultural intensification but are rarely incorporated in large scale biodiversity monitoring's. Instead, a few established indicator taxa such as breeding birds or vascular plants are often used as a cost effective measure of overall biodiversity. However, recent studies revealed only weak correlations between indicators and other taxa. Trophic relationships can contribute to explain such contrasting results: For example, positive relationships between adjacent trophic levels should be stronger compared to trophically unrelated taxa. In addition, the strength of relationships should increase with increasing specialization. Here, we compare the species richness of five taxa belonging to four trophic levels (plants, butterflies and leafhoppers, spiders, birds). We selected 21 agricultural landscapes in Hesse (Germany), which are part of the national monitoring program of common breeding birds in Germany. We sampled arthropods and conducted vegetation surveys in three predominant habitat types per landscape. We applied non-linear regression models to compare relationships between arthropod taxa and the species richness of birds and plants. Positive relationships between the studied taxa were relatively scarce and depended on the spatial scale of the analysis. Spiders were the only taxon, which was positively related to the species richness of birds at the landscape scale. At the field scale across different habitat types, the species richness of plants was positively related to all studied arthropod taxa. Thereby, relationships between adjacent trophic levels and with increasing specialization were indeed stronger, but there were also exceptions. Given the inconsistency of positive cross-taxa correlations, we suggest that the short-cut via indicator taxa provides only limited information about the species richness of arthropods with a high degree of uncertainty. We therefore encourage conservationists to incorporate multiple arthropod taxa in large scale monitoring's in order to achieve a reliable measurement of biodiversity.

Poster presentation - Student

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Effects of crab spider distributions on an early flowering legumes' component communities, in a scrubland habitat

Tristan Canterbury & Jay Pugsly

Hosted by CERES International, The University of Sussex, East Sussex, UK

The importance of flower crab spiders as predators of pollinators has often been noted; however, their potential effects during the early growing season seem too often overlooked. During the early growing season crab spiders (Thomisidae) may be at higher densities and feed on a variety of non-pollinating flower visiting taxa. We investigated the effect of crab spider abundance on herbivore insect densities on *Erophaca boetica* in the early spring of a Mediterranean scrubland ecosystem in Aljezur, Portugal. Our prediction was that spider density would negatively correlate to herbivore densities, potentially benefitting the plants. To test this, we conducted a field experiment comparing the effects of 3 different spider densities on herbivore abundance on individual plants. The treatments were 0 (control), 1 (natural) or 3 spiders (extreme), and were replicated 8 times (N= 24 patches). The abundances of different herbivore taxa in the patches were sampled over 5 days along with net migrations of spiders in or out of the patches. We considered social interactions between the crab spiders, cannibalism and intraguild predation and other factors that often limit natural spider densities. We also addressed the effects of migration on herbivore and spider distributions and densities per plant. There is an abundance of *Synema globosum* in the community we studied, which seemed too small to predate on larger pollinator species. Our data shows that the presence of Thomisidae reduces the abundance of thrips. The effect of this we suggest may be a net profit to *E. boetica* in herbivory reduction. No significant difference was found between the extreme and the normal patch types in thrip abundance. We discuss the likelihoods of 4 possible explanations for this, with the use of migration data and our observations, however further study into the intraspecific behaviour of *Synema globosum* is necessary to rule any of them out. Our results suggest that there is a mutualistic instead of a parasitic relationship between Thomisidae and *E. boetica*. A mutualism between *S. globosum* and *E. boetica* fits nicely with our observations of both the morphological features of *E. boetica*'s inflorescences and the behaviour of the spiders. We conclude that taking all factors into account (Migration and predation of spiders, herbivores and pollinators), is important to understand spider-plant interactions.

Oral presentation - Student

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Abiotic factors and biotic interactions jointly drive spider assemblages in nest-boxes in mixed forests

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Spiders are common inhabitants of tree cavities, factors that drive their community structure in these microhabitats are little known. Here we investigated whether bark type, season, intraguild predation (IGP) among spiders, and presence of vertebrate predators can influence the spider community structure in tree cavities. We examined spider abundance and the taxonomic and functional composition of spiders in nest-boxes within two mixed forest stands in central Slovakia in 2012–2013. In total, 1211 spiders belonging to 31 species were sampled from 60 nest-boxes at two sites over three seasons. Spider abundance peaked in autumn as spiders sought wintering sites. Guilds and taxonomic composition changed seasonally with spring and autumn communities dominated by ''Other hunters'' (Anyphaenidae, Clubionidae, Philodromidae) while during summer the community was dominated by ''Sheet web weavers'' (Linyphiidae). The guild and taxonomic turnover may be partly explained by the interaction between spiders' phenology and Intraguild Predation (IGP) exerted by winter-active spiders on smaller spiders from autumn until spring. Bark type influenced the guild composition as dominance of ''Space web weavers'' was higher in trees with rough bark than in trees with smooth bark. The rough bark also reduced the intensity of IGP intensity by *Anyphaena accentuata* (Sundevall, 1833) on philodromids. The presence of insectivorous birds reduced the abundance of spiders by 67%. The presence of bird predators altered the guild composition as they affected mostly the web spiders. The results show that the biotic interactions and abiotic factors interactively determined the spider community structure in the nest-boxes depending on spiders' functional traits.

The study was financially supported by the Science Grant Agency of the Ministry of Education of the Slovak Republic and the Slovak Academy of Sciences, grant VEGA No. 2/0012/17.

Poster presentation - Student

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New characterisation of cave species *Neobisium* (*Blothrus*) *slovacum* Gulička, 1977 (Pseudoscorpiones: Neobisiidae): cytogenetic and morphological approach

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Pseudoscorpions from the subgenera *Blothrus* Schiödte, 1847 are the most abundant in European caves and majority of the species are distributed in southern Europe. In Slovakia, the only known *Blothrus* species is *Neobisium slovacum* Gulička, 1977. It represents the first finding of troglomorphic pseudoscorpion in Western Carpathians and the first troglomorphic pseudoscorpion for Slovakia. Summarizing the previously data, there has not been published complete description of adults and nymphal stages of this species. The newly found material of *N. slovacum* was collected at three localities in Slovak Karst – Šingliarova chasm, Hačavská cave and Zvonivá chasm. Description and karyotype analysis of newly available specimens, that comprised 14 adults and one deutonymph, have been provided. Intrapopulation variability in some morphometric and morphological characters has been examined, and could be caused by isolations of individual populations at different localities. The karyotype and distribution of 18S rDNA clusters using fluorescence in situ hybridization (FISH) of *N. slovacum* were described. The male karyotype comprised of 69 chromosomes with the predominance of biarmed chromosomes and X0 sex chromosome system. Two pairs of the signals for 18S rDNA on biarmed chromosomes (submetacentric and metacentric) of different sizes were identified. Our study represents the first known data about the distribution of 18S rDNA clusters in the arachnid order Pseudoscorpiones. The geographic distribution of the species was summarized as well. *Neobisium slovacum* is currently known from 15 localities in Slovak karst in Slovakia and one locality in Hungary. Hačavská cave in Slovak Karst represents the new northernmost locality of distribution for the subgenus *Blothrus* in Europe.

Poster presentation - Student

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Variability of *Pardosa lugubris* (Walckenaer, 1802) life cycle between years, different populations in the field and in the laboratory

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Many aspects of spider life cycles are poorly known, because studying them requires breeding the animals or carrying out a time-consuming analysis in the field. This type of research may however considerably contribute to our knowledge on basic (and often crucial for further analysis) characteristics of spiders biology. The main aim of my study was to analyze variability of *Pardosa lugubris* life cycle between different seasons, populations in the field and studying their growth and development in the laboratory. In the field I collected data on occurrence of different life stages every 7-10 days by direct search. I have been studying three different subpopulations of this species in one area. In the second part of the research I reared spiders in laboratory, analyzing their development in the cocoon and the successive growth of spiderlings. By combining the data I could accurately trace the *P. lugubris* life cycle in its natural environment. Data collected in three successive years show that the life cycle of *P. lugubris* is variable and most probably depends on environmental conditions in a given year. A population of *P. lugubris* adjusts its life in subsequent years. The spiders moult to subadult stage about two months after hatching, but do not reach adulthood just before the breeding season, i.e. the autumn of the same year, or the successive spring. This may affect their life expectancy (especially in case of males that die shortly after the breeding season) and the stage, in which spiders overwinter. Most individuals stay as subadults in the winter, some younger stages are also present during the cold part of the year. The results obtained by me are important in the context of known data on life cycle of Lycosidae and document plasticity of their life-cycle. I also give numerous data on their growth rate and size of subsequent stages. Moreover, I discuss some problems concerning breeding the species in captivity. In course of my research I have observed some interesting behaviours, such as nursery web building or matriphagy.

Poster presentation

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Pseudoscorpions (Arachnida: Pseudoscorpiones) in Miller's collection in the National Museum in Prague (Czechia)

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Professor František Miller (1902–1983) was a famous Czech arachnologist. After graduating at the Faculty of Science of the Charles University in Prague, he started to teach at the secondary schools in Štubnianske (today Turčianske) Teplice, Žilina (towns in Slovakia), and Jindřichův Hradec (a town in southern Bohemia). In 1947, he habilitated at the University of Agriculture in Brno and worked there until his death. During his fruitful life (65 published papers), František Miller studied primarily spiders, namely linyphiids. As formalin pitfall traps and sieving belong to the most important collecting methods in arachnology, Miller's material contains also other soil or epigeic invertebrates, including pseudoscorpions. The major part of his large private collection was purchased by the National Museum in Prague in 1983 and deposited into the zoological collection of the Natural History Museum under accessory numbers 100/83 and 103/83. The pseudoscorpions were sorted out of mixed samples, identified according to current arachnological knowledge and databased. The pseudoscorpion collection contains 211 specimens preserved in 80% ethanol, representing 18 species from five families. The material was collected in 1940–1976 at 37 localities in Czechia and Slovakia. The collection is valuable because it contains historical records of particular value for faunistic purposes, important especially in rare species such as *Mesochelifer ressli* (Cheliferidae), *Rhacochelifer disjunctus* (Cheliferidae), *Neobisium brevidigitatum* (Neobisiidae) and *Neobisium jugorum* (Neobisiidae).

This work was financially supported by Ministry of Culture of the Czech Republic (DKRVO 2018/14, National Museum, 00023272).

Poster presentation - Student

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Individual differences in behaviour of the nursery web spider (*Pisaura mirabilis*)

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Although a growing body of studies investigates personality in invertebrates, the experiments comparing more ecological contexts and situations are still lacking. To fill in some of the existing knowledge gaps, we studied personality in nursery web spider (*Pisaura mirabilis*) in the foraging and anti-predator context. The main aim of this study was to investigate individual differences in behaviour of subadults of *P. mirabilis* (25 females and 24 males), identify repeatable behavioural traits and describe how they are interrelated. In addition, we asked to what extent is personality in *P. mirabilis* related to its morphology and physiology. We carried out a series of experiments to quantify following behavioural traits: thanatosis display, exploration latency, response to touching by a small brush, attack rate, attack from a distance and overkilling of prey. The results suggest that although we observed behaviour in foraging and anti-predator contexts, repeatable traits created only a single continuum from bold and more aggressive to shy and less aggressive individuals. Specifically, individuals which did not display thanatosis also responded more aggressively to touching by a brush and attacked prey more frequently and from a larger distance. Interestingly, the most repeatable trait was thanatosis display, which was significantly repeatable in both males and females. In other traits, we identified differences in repeatability between sexes, depending on the ecological context. While response to the brush was repeatable only in males, attack rate was repeatable only in females. In summary, we found that subadults of *P. mirabilis* displayed individual-level differences in several behavioural traits along the bold/aggressive – shy/non-aggressive continuum, while the degree of repeatability varied among traits and between sexes.

Plenary talk

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Phylogenomics, diversification dynamics and comparative transcriptomics across the Spider Tree of Life

Rosa Fernández

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Museum of Comparative Zoology, Harvard University, MA, USA

Dating back to almost 400 My, spiders are amongst the most diverse terrestrial predators but their phylogeny and diversification dynamics remain poorly understood. Here, we use a synergistic approach to study spider evolution through phylogenomics, comparative transcriptomics and lineage diversification analyses. We assembled a transcriptome-based dataset of 159 spider species to scrutinize family-level interrelationships. Moreover, we used our phylotranscriptomic backbone to constrain the analysis of a Sanger dataset for nearly 1,000 species to explore lineage diversification. Lastly, we leveraged our transcriptomic data to investigate functional novelties that putatively drove spider diversification. Our analyses, based on ca. 2,500 genes, reject a single origin of the orb-web (the "ancient orb-web hypothesis"), and suggest that orb-webs evolved multiple times since the late Triassic-Jurassic. We found no strong association between the loss of foraging webs and increases in diversification rates, suggesting that other factors (e.g., habitat heterogeneity or biotic interactions) potentially played a key role in spider diversification. Finally, we report notable genomic differences in the main spider lineages: while araneoids (ecribellate orb-weavers and their allies) revealed an enrichment in genes related to behavior and sensory reception, the Retrolateral Tibial Apophysis (RTA) clade—the most diverse araneomorph spider lineage—showed enrichment in genes related to immune responses and polyphenic determination. This study, one of the largest invertebrate phylogenomic analyses to date, highlights the usefulness of transcriptomic data not only to build a robust backbone for the Spider Tree of Life, but also to address the genetic basis of diversification in the spider evolutionary chronicle.

Poster presentation

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Optimal duration of hard copulation in *Argiope aurantia*

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The duration of copulation is one of the most variable reproductive traits across spiders, ranging from seconds to hours. Some species, for example in the araneid genus *Argiope*, exhibit very short copulations of a few seconds per insertion. This has been hypothesized to be result of cannibalistic females imposing selection on males to escape the attack by reducing insertion duration. However, copulation duration is positively correlated with the number of sperm transferred and fertilization success in many species. Thus, given the tradeoff between sperm transfer and the risk of being cannibalized, males may optimize the duration of copulation to maximize lifetime reproductive success. Here we test whether male *Argiope aurantia*, which face a female attack in 80% of insertions, are optimizing the duration of the insertion of the first pedipalp to maximize the number of sperm transferred during all achieved insertions with potentially cannibalistic, post-molt females. As covariates in our analysis we include male and female somatic and genitalic traits, which had previously been shown to be important for sperm transfer. Indeed, we found an optimal insertion duration of 4s, which was close to the average of 3.3s. Further, male size was positively and conductor length negatively related to sperm transfer, confirming the importance of male body size and genital trait dimensions. Thus, we found evidence for the adaptive significance of very short copulations during “hard copulations” (with post-molt females), but the relevance of copulation duration remains to be tested in the context of “soft copulations” (with females while molting).

Poster presentation

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Detection of molecular markers in spiders by cytogenetic methods

Martin Forman (1), Filip Pajpach (1), Lenka Prokopcová (1), Michaela Pappová (1), Barbora Hrubá (2), Matěj Kotz (1) & Jiří Král (1)

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Spiders display a considerable diversity of karyotype features. Diploid numbers of spiders vary from 7 to 128. These arachnids also exhibit an outstanding diversity of sex chromosome systems and chromosome morphology. An essential step to make a detailed analysis of spider karyotype evolution is identification of syntenic chromosome regions. It is usually impossible to use banding techniques for this purpose. A promising tool for identifying chromosome regions in spiders is fluorescence in situ hybridization (FISH). We have focused on FISH detection of highly transcribed genes organized in tandem repeats (e.g. genes for rRNA, snRNA, and histones). Here we report the progress in detection of 18S rRNA genes and the first detection of 5S rRNA, histone H3, and U2 snRNA genes by FISH. Data from more than twenty spider families revealed from one to more than ten 18S rRNA loci. H3 probes have been tested in selected mygalomorph and araneomorph spiders. Genomes of studied species contained from one to three H3 loci. 5S rDNA and U2snDNA probes have been successfully tested in *Araneus diadematus* (Araneidae), which exhibits one interstitial 5S rDNA and two terminal U2 snDNA loci. Except for 18S rDNA clusters, which displayed sex chromosome location in a few families, all examined markers were autosomal. Interestingly, compared to araneomorphs, H3 signals of mygalomorphs were more robust, indicating higher number of gene copies in clusters. Thus, H3 gene seems to be a suitable marker for studying highly diversified karyotypes of mygalomorphs. On the other side, target sequences of H3 probes were less conserved, which requires construction of specific probes for particular genera or even species of mygalomorphs.

The research was supported by the project of Charles University (no. 92218), Czech Science Foundation (no. 16-10298S) and Ministry of Education, Youth and Sports (no. SVV 260314).

Poster presentation - Student

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Web-invading cellar spiders (*Pholcus phalangioides*, Pholcidae) protect themselves from adhering to capture threads of alien webs by an anti-adhesive surface coating

Miriam Frutiger, Simon Wittmer & Christian Kropf

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The cellar spider, *Pholcus phalangioides*, is known to occasionally invade alien capture webs (both cribellate and gluey ones) to prey on the resident spider or steal ensnared insects. So, the question arises how *P. phalangioides* protects itself from adhering to the capture threads of the invaded web. We tested experimentally for the presence of an organic anti-adhesive surface coating on the legs of cellar spiders and calculated an index of adhesion (IOA) for the gluey orb web of *Larinioides sclopetarius* (Araneidae) and the cribellate orb web of *Uloborus plumipes* (Uloboridae). We defined three experimental groups of cellar spider legs, i.e. untreated legs ("u"), legs washed with distilled water ("w") and legs washed with the organic solvent carbon disulphide ("cd"). In both types of orb web, u- and w-legs stuck significantly weaker than cd-legs, indicating the presence of an organic surface coating on the cellar spider's legs. There was no significant difference in IOA between u- and w-legs. The significance of these results is discussed with respect to prey capture strategies of *P. phalangioides*.

Poster presentation

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Present knowledge on spiders (Araneae) in Pannonian salt habitats (Slovakia)

Peter Gajdoš

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Inland salt marshes, steppes and meadows belong to Slovakia, as well as to Europe, among the most endangered types of habitats. They are listed in Annex 1 of the EU Habitats Directive as the EU's priority habitats. These types habitats have an range centre in the Pannonian area and throughout Slovakia, the northern boundary of their ranges extend. Their areas have been drastically reduced in Slovakia over the last half century due to collectivisation and changes in land-use. The last remains of the salt marshes a steppes are islet-like distributed and they are currently only located on the Danube lowlands. Totally they occupy an area of only 500 hectares and although they are legally protected by listing in the Natura 2000 network, they are endangered by extinction. From the arachnological point of view salty habitats of Slovakia, except of the salt marsh in Šúr Nature Reserve, are unknown. For widening of knowledge on spider fauna of salt habitats in Slovakia, we have summarized unpublished data, material from museums from these type of habitat and also results from our present researches which we have realised from end of 2016 to present time (2018) in 9 plots located in five Natura 2000 sites (SKÚV), namely Bokrošské slanisko (SKUEV 0076), Kamenínske slaniská (SKUEV 0066), Panské lúky (SKUEV 0095), Šurianské slaniská (SKUEV 0096) and Pavelské slanisko (SKUEV 0099). The study plots represent Panonnic salt steppes and salt marshes (1530) and inland salt meadows (1340) with different vegetation covers near the Hungarian border in Danubian lowland belonging to the Pannonian region (Southwestern Slovakia). Overall, we evaluated the material more than 6 thousands spider specimens. Presently 246 species belonging to 21 families are documented from salt habitats in Slovakia and the list of these species with degree of relationship to salty habitats is presented. The importance of these types of habitat is also emphasized by the recording of many very rare and threatened spider species as well as the findings of eight new species for Slovak fauna.

Project VEGA 2/0171/16

Poster presentation

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Spiders (Araneae) inside of the buildings in Central Europe (Slovakia)

Peter Gajdoš (1), Mariia Fedoriak (2), Anna Šestáková (3), Veronika Himpáová (4), Csaba Szinetár (4) & Ľudmila Černecká (5)

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There is no integral study of the synanthropic spiders inside of buildings in Slovakia. From beginning of 2016 to end of May of 2018 we carried out the study of spiders inhabiting the buildings in different part of Slovakia. The material was collected by authors and many other colleagues exclusively inside of the buildings: dwellings, university, touristic and institute facilities, pubs, green houses of botanical garden and a poultry farm. During this period we have obtained spiders from 180 localities situated in all Slovakia. Our study was added by our older data (from 1978-2015) and literature data from other 46 localities. During our study we collected 957 spider specimens representing 54 species, 12 families. The majority of spider material is from dwellings, where was eudominant *Pholcus phalangioides* is shown to be the most abundant synanthropic spider in Slovakia making 45% of all the collected specimens. The second most abundant species was *Steatoda triangulosa* (13%). The representatives of both mentioned species were collected in all the inventoried towns and majority of studied villages. Species composition in buildings for non dwelling facilities is similar as in dwellings. In the long-term horizon species composition in dwellings is radically changed during last forty years (e.g. previous eudominant *Pholcus opilionoides* is replaced by *Pholcus phalangioides*, occurrence of new alien species, etc.). From the Greenhouse of Botanical Gardens in the Slovakia 70 species is documented with dominance of *Parasteatoda tepidariorum* (18.9%) and *Pholcus opilionoides* (7.5%). Several alien species were collected only these types habitat. Authors documented considerable differences in spider composition among individual botanical gardens located in different part of Slovakia (Bratislava, Nitra and Košice). Also several alien species we documented in shop centres with selling of exotic plants where *Uloborus plumipes* occurs as eudominant species. The building for animal breeding also create specific conditions for occupying this place by spiders. During our study we realised also one-shot research in the poultry farm where we collected 73 specimens belonging to 10 species. The most abundant species was *Steatoda bipunctata* (38.4%). Totally 136 species is documented from building in Slovakia and list of these species with degree of synanthropy is presented. Several from these species is new for Slovak fauna or some of them also were considered as extinct.

ORAL PRESENTATION

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Landscape structure is a major driver of spider diversity in natural Central European forest-steppes

Róbert Gallé, Nikolett Gallé-Szpisjak & Péter Császár

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Disentangling the effects of habitat size, landscape composition and configuration on biodiversity is among the main challenges of landscape-scale conservation biology. In human-modified landscapes the degree of habitat loss and quantitative configuration metrics are usually intercorrelated as habitat fragmentation is usually induced by habitat loss. In this study our aim was to give a comprehensive analysis of spiders of naturally mosaic forest-steppe ecosystems. The Pannonian ecoregion situated in central Europe, covers the westernmost forest-steppes that comprise of relatively small forest patches embedded in a grassland matrix resulting in structurally and microclimatically fine-scale mosaic ecosystems. We studied the effect of the following local and landscape parameters: (1) focal forest patch size (local variable); (2) the proportion of forest patches in 500 m radius buffer (habitat amount, landscape composition); (3) cumulative edge length of the forest patches in the local landscape (landscape configuration). We selected 40 sampling sites, 20 forest patches in extensive, dry, sandy forest-steppe areas of the Kiskunság Sandy Ridge and 20 forest patches in the mesic forest-steppe mosaic of the Turjánvidék region. We collected 11323 adult spiders belonging to 131 species; 3105 individuals of 73 species in dry forests and 8218 spiders of 92 species in mesic forests. Spiders showed a clear response to landscape scale parameters, which was mediated by the habitat preferences of the species. Habitat amount had a negative effect on the abundance of open habitat spiders collected in forest patches. Edge length had an effect on the abundance of both open habitat and forest spiders, the interaction of habitat amount and patch size had a negative effect on forest specialist spider abundance. Our findings revealed that patch size, landscape compositional and configurational heterogeneity play a major role in shaping the diversity of spiders in the Centre-European forest-steppes, thus an effective conservation strategy also take into account the landscape heterogeneity besides local habitat parameters and patch size.

Poster presentation

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Comparative study of predatory behavior and feed efficiency of generalist and specialist araneophagous spiders

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Spiders include a wide variety of species which specialize on the consumption of particular prey types, including spiders, ants, termites among others. In spite of this, studies of comparisons of trophic adaptations for the consumption in generalist and specialist spiders are still scarce. In this work we make a comparison between the predatory behavior and feeding efficiency of a generalist and specialist spiders. We used as a generalist the spider *Harpactea rubicunda* and as specialist the araneophagous *Nops* cf. *variabilis*. In both spiders we compared the predatory versatility, prey size and nutrient extraction when using other spiders (*Pardosa* sp.) as a prey. We found that when feeding on spiders, the generalist have higher versatility on prey capture, feed on smaller prey but extract nutrients similarly when compared to the specialists. These results suggest that although specialists and generalist differ on the prey capture and size, achieve nutrients in a similar way.

Oral presentation

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Burrow placement of *Sahastata nigra* (Simon, 1897), and their potential as indicators of habitat recovery in a hyper-arid desert

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'Avrona nature reserve is situated in the 'Arava hyper-arid desert (Israel), where two major ecological disasters (oil spills) occurred, in 1975 and 2014. Consequently, a long-term monitoring scheme for arachnids was launched in May 2016. During the first year of the monitoring (2016) we found a burrowing filistatid species, not recorded previously from Israel, *Sahastata nigra* (Simon, 1897). As the oil cemented the soil into a hard surface, it may be difficult for burrowing arachnids to dig through the substrate. In order to understand the effect of the oil spill on *S. nigra*, we studied its habitat preference and its potential to be indicator of habitat recovery. During 2017-2018, we monitored 60 active burrows of *S. nigra*. Although some burrows where close to the oil spill, none of them were situated directly on oil contaminated soil. Additionally, we studied in detail the habitat and burrow characteristics of 18 *Sahastata nigra* burrows (burrow-centered plots) and 20 control plots. The plots (burrow and control) were 45*45 cm^2 each. The burrow-centered plots were chosen from the previously monitored burrows, while the control plots, near each burrow, were chosen haphazardly. All plots were photographed, and their soil characteristics and the distances to other objects in their surroundings (shrubs, trees, and other burrows) were measured. For the *Sahastata nigra* burrows, size of the burrow opening and its height above the soil surface were measured, and we noted the presence of the spider. Here we present the habitat preference of *S. nigra* in 'Avrona nature reserve, and discuss the effects of the oil spill and the potential of this species to be an indicator of habitat recovery in a hyper-arid desert.

ORAL PRESENTATION - STUDENT

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Endosymbionts in the field: spiders don't walk alone

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It is well established that spiders are infected with a wide range of vertically transmitted intracellular bacteria, collectively termed endosymbionts. The significance of these relationships are largely unknown and most studies on spider-endosymbiont interactions focus on their distribution, and not their consequences. It has been hypothesised that endosymbionts are able to drive sex ratio bias in populations as well as cause behavioural differences in functional traits such as aerial dispersal (ballooning) and mating. Typically spider research has fallen short, as in insects this can be extended to nutrient acquisition, heat tolerance, insecticide resistance, and even protection from predators. This talk will focus on beneficial spider communities collected from European agricultural systems. The extended project aims to characterise spider and endosymbiont diversity and abundance, identify the key local and landscape factors that drive spider populations, and then hone in on specific interactions that can be tested in the laboratory. In recent years the microbiome of many animals has received increasing attention and it is clear that endosymbionts alter the spider's life cycle. The question is whether these altered physiological/ behavioural traits are beneficial or detrimental to the spider, and then ultimately if this affects the overall efficacy of biological pest control and ecosystem services.

Oral presentation

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Greenland glacier retreat: DNA gut content analysis shows strong intraguild predation (IGP) and confirm bottom-up effect for spiders and harvestmen

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Arthropod food webs were explored in a glacier foreland area in West Greenland using a combination of structural equation modelling (SEM) and DNA gut content analysis. Arthropod predators and their (arthropod) prey animals were sampled with traditional "wet" pitfall traps and their numbers were analyzed using structural equation modelling (SEM) in relation to a set of environmental variables. The result of the SEM analysis was compared with DNA gut content analysis, where arthropod predators were caught alive in "dry" pifall traps before the gut content analysis as we would like to know how bottum-up or top-down mechanisms influence predator and prey animal numbers. The structural equation modelling (SEM) suggests that the spider populations in the foreland area may be involved in bottom-up regulated food chains in relation to the numbers of available flies as well as to the abundance of the collembolan Isotoma anglicana. DNA gut content analysis support that the spiders may be subject to bottom-up regulation by collembolans and flies, as we found the same pattern of prey species composition in the environmental surroundings as in the gut content of the spiders. DNA gut content analysis shows that the spider, *Collensia holmgreni*, feed on a broad spectrum of available prey animals (18 arthropod species and families), including collembolans, dipterans, harvestmen, mites and maybe larvae of the ground beetle *Nebria rufescens*. *C. holmgreni* also feed (extensively) on other available linyphiid spiders like *Oreoneta frigida* and *Improphantes complicates* as well as the lycosid *Arctosa insignita*. The SEM analysis revealed a very significant (positive) relationship between the number of spiders and the number of the parasitic wasp (*Aclastus borealis*) that prey on spider eggs. *A. borealis* is supposed to attack the cocoons of linyphiid spiders. The SEM analysis may also suggest that the harvestman, *Mitopus morio*, is involved in bottom-up food chains feeding on flies and ground beetle (*Nebria rufescens*) larvaes. The DNA gut content analysis confirms this suggestion as Chironomidae, Muscidae and Simuliidae flies, linyphiid spiders, Isotomidae collembolans as well as *N. rufescens* ground beetle (larvae) are important prey animals for *M. morio* which also has a broad food spectrum involving 24 different species and families.

Oral presentation

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Spider webs as a source of environmental DNA: A preliminary report

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Sampling of environmental DNA (eDNA) coupled with state-of-the-art molecular detection approaches can potentially overcome many limitations of traditional biodiversity monitoring. Several tissues from live organisms represent potential sources of eDNA, e.g. urine and other excretions, feces, integument, seeds and spores, but eDNA from dead organisms can also be available in form of whole cells or extracellular genetic fragments. Spider webs as aerial traps/filters represent an interesting new eDNA source. Only two studies to date have investigated spider web eDNA, and have successfully obtained both spider and prey DNA directly from webs. However, these studies were conducted in controlled laboratory conditions, and thus DNA degrading factors, such as heat, humidity, and light, have likely been reduced compared to field conditions. We here outline a research agenda that aims to assess the utility of spider webs as sources of eDNA. Here, we report how we investigate the detection efficiency of prey genetic material on two different web types in nature, the orb and sheet webs. In controlled laboratory conditions, we test how DNA degrading factors, specifically light, heat and humidity affect the detection efficiency of eDNA from webs.

Poster presentation - Student

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The bearer of bad news: comparative morphology of metasomata in scorpions

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Scorpions are among the most popular research objects within Arachnida and there is an impressive body of knowledge about their biology, distribution, morphology etc. The venom sting, in particular, has gained a lot of attention due to its fatal effects. Therefore, it is especially remarkable, that up to now there is basically no comparative morphological study on the metasoma, the body part, which enables the venomous injection. The metasoma can be characterized as variation on a theme, not only between species but also between sexes: it always consists of five body segments and a venom sting. Nevertheless its form ranges from long and thin, short and rather reduces to thick and very dominant. Due to its high morphological variability, it also plays a key role in taxonomy. In this study, we therefore aim to investigate species representing major scorpion clades and covering most of the morphological variation. Using high resolution micro-computed tomography and 3D-reconstruction we present first visualizations of metasomal external skeletal elements in combination with their musculature. Results will be discussed along recent hypotheses on phylogeny and the metasomal segments will be compared in terms of their serial homology. Based on these findings, further questions may be clarified, for example: is there a connection between the carina and the muscle attachment sites in the metasoma? Or are there hints of a hydraulic system in scorpions?

Poster presentation - Student

▲ Back to the Program

Short-term effect of conservation management methods on epigeic spiders in steppe habitat – preliminary results

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Until the second half of the 20th century, the Czech landscape was traditionally maintained by grazing and prescribed burning, which caused it to be inhabited by a heterogeneous mosaic of microhabitats. However, abandonment of traditional farming methods caused that area with early stages of succession to become overgrown and homogenized, and thus resulted to the loss of arthropod biodiversity. The aim of this research is to contribute to the current knowledge in the areas of restored conservation management methods and their effects on spider diversity. Since there are only a few studies on the aforementioned topic, which are mostly focused on mowing and grazing, the method of prescribed burning would help bridge that knowledge gap. The study took place in the Nature Monument Pláně with habitat type acidophilus grasslands on shallow soils in southern Moravia of the Czech Republic. The study area was traditionally maintained by goat and sheep grazing and there has been no management from 2009 to 2016. The spiders were collected using pitfall traps, which were placed in rectangles (4 × 5 m) with four treatments: ground disturbing, mowing, prescribed burning, and no management (control plot). Three plots were chosen for this research wherein the treatment was repeated four times in each plot, hence sixteen pitfall traps were placed in one plot. Spiders were collected from 12th May to 17th October 2017, but only the results from the first two months of this experiment will be presented. Overall, 4,624 specimens belonging to 62 species were collected. In general, valuable arachnofauna composition including 15 rare and endangered species belonging to Red List of Czech spiders was discovered. The preliminary findings show that the treatment had no significant effect on spider diversity, which may have been caused by short-term treatment effect. However, habitat specialists focus more on the disturbing plots (e.g. burning and ground disturbing) than those with no management. For overall results, data will be collected in a two-year timeframe.

The study was financially supported by the Specific University Research Fund of the Faculty of Forestry and Wood Technology, Mendel University in Brno (LDF_PSV_2017004).

ORAL PRESENTATION

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Arachnids in European succinite ambers: What's the big picture?

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The study of fossils in European ambers has a long tradition and to date over one thousand arachnids have been described from three major deposits: Baltic amber from the Gulf of Gdańsk, Bitterfeld amber from Germany, and Rovno amber from the Ukraine. Together, these ambers are often called succinite depending on their content of succinic acid. Amongst the fossils recorded in succinites are taxa of immense biogeographical importance, or those that are highly suitable for reconstructing paleo-biota during past times of warmer temperatures. General discussions relate to the uncertainties with dating succinites, but also whether these ambers are synonymous or rather reflect different depositional histories; in the latter case preserving distinct assemblages of species. Other discussions pertain the taxonomic uncertainties for many of the spider taxa and the lack of a taxonomic framework for some other arachnid lineages. Whilst plants, fungi, lichens and insects are commonly used for reconstructing European biota during the Paleogene, such integrated studies have yet to be undertaken from an arachnid perspective. In this presentation, I propose a more integrated approach of novel techniques, ecological syntheses, biogeographical reconstructions, and modern databases to generate a "big picture" of European palaeobiota from an arachnid perspective.

POSTER PRESENTATION - STUDENT

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The hemolymph vascular system in *Parasteatoda tepidariorum* (Araneae; Theridiidae)

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Evolution and development of major organ systems is one of the key fields in evolutionary biology. In this field, the common house spider *Parasteatoda tepidariorum* has become an emerging model organism for new genetical and explorative tools in EvoDevo. Despite this growing body of research, little is known about morphological features, in particular internal organs. To this end and in the course of a comparative survey on the circulatory system in spiders, we investigated several specimens of *Parasteatoda tepidariorum*. Using modern micro-computed tomography in combination with histological sectioning we visualized circulatory organ features three dimensionally for the first time. Results are discussed with what we know about the circulatory systems in spiders so far.

Poster presentation - Student

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Same same, but different! Karyotype variability of suborder Cyphophthalmi on Balkan Peninsula (Arachnida: Opiliones)

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Suborder of Cyphophtalmi is a basal group of harvestmen (Opiliones) with several specific morphological signs and is spread across all continents except Antarctica. Currently, there is described only about 200 species. Molecular phylogenetic analyses which were carried out in recent years have discovered hidden species diversity of this rather morphologically uniform group. The hidden species diversity of the Cyphophtalmi is very likely caused by its low ability to spread and long-term isolation of its populations. That is why we focused on the study of karyotype variability, which could also reflect isolations of single lines. Suborder is divided into six families occurring mostly in different biogeographical areas. The most convenient family for our study is Sironidae (ca. 50 species) that inhabits the area of Laurasia with representatives in Europe, North America and Japan. We have chosen the region of Balkan Peninsula. Furthermore, during the Pleistocene era the area was glaciated, which caused a creation of many refugia thus a high degree of genetic isolation. Our results demonstrate that in this area occurred a karyotypic differentiation of the Cyphtophalmi and that the karyotypes of the Cyphtophalmi are not as uniform as recent published data indicated. Today we have data about karyotypes from more than 25 species from 4 specific lineages (Dinaric, Aegean, Gjorgjevici, Volos). We discovered diploid chromosome number ranges from 24 to 30. We also found high diversity of NORs after application fluorescent in situ hybridization (FISH) with specific chromosome probes. Combination of the results from our cytogenetics and phylogenetics analysis with morphological analysis from past shows that on the Balkan Peninsula, there is much higher diversity through these lineages, than we expected. Also we can recognize some possible areas with refugia from last glaciation and predict evolution of genus *Cyphophtalmus* on the Balkan Peninsula.

Poster presentation

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Ground-dwelling spider assemblages in floodplain forests along an urbanization gradient

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Urbanization is one of the most important threats to arthropod biodiversity and abundance due to alteration, reduction, fragmentation and loss of original natural habitats. These processes often lead to localized extinctions and to the change of species composition, since invasive and exotic species outcompete native species. Despite this, urbanized habitats may contribute to the maintenance of biodiversity to varying degrees. Spiders are generalist predators, often considered to be sensitive to habitat alteration, but several species can adapt to urban environments. We investigated the influence of urbanization on ground-dwelling spider assemblages along an urbanization gradient in South-Hungarian floodplain forests. We collected spiders by litter sifting from spring to autumn fortnightly in 2014. We tested three commonly used hypotheses (intermediate disturbance hypothesis, habitat specialist hypothesis and hygrophilous species hypothesis) and two novel hypotheses (shade-preferring species hypothesis and disturbance sensitive species hypothesis) regarding to the response of spider species to urbanization. Our results supported (i) the intermediate disturbance hypothesis, as the overall species richness was the highest in the moderately disturbed suburban habitat. The number of forest specialist and shade-preferring species decreased along the urbanization gradient verifying (ii) habitat specialist hypothesis and (iii) shade-preferring species hypothesis. We found that the number of hygrophilous and disturbance sensitive species was the lowest in the urban habitat, as the (iv) hygrophilous species hypothesis and (v) the disturbance sensitive species hypothesis predicted. Based on species composition, spider assemblages of the rural and suburban habitats were clearly separated from the assemblages of urban habitats. Our research supported that spiders are reliable indicators of urbanization, because species with different habitat affinity and ecological demands showed a remarkable differences along the urbanization gradient. Based on our findings we emphasize that low and moderate intensity of forest management contribute to the preservation of the local species richness in floodplain forests.

Oral presentation

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Spiders of tropical pavilions of the zoological gardens in the Czech Republic

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Tropical pavilions host a lot of different organisms even the non-target species. Together with soil and plants there are plenty species invading whole world, including some vertebrates (e.g. *Ramphotyphlops braminus* or frogs of genus *Eleutherodactylus*). There were also species described only on specimens from glasshouses (e.g. species of Zygentoma or Palpigradi). Spiders were studied systematically in several such places around the world and have never been studied in the Czech Republic. We have studied fauna of tropical pavilions in nearly all ZOOs in the Czech Republic (12) extensively by hand collecting (2016) and two ZOOs were studied intensively afterwards by pitfall traps and sifting (Brno, Prague – 2017). We aimed on different heated pavilions during first part of the study (together with glasshouses also pavilions of elephants, hippopotamuses, giraffes etc. were observed) and on tropical glasshouses in Prague and Brno ZOOs in the second part of the study. During the first part of the study, there were recorded altogether 32 species from 19 families of spiders including very common native species (e.g. *Enoplognatha ovata*, *Araneus diadematus*) or rather rare native species (*Textrix denticulata*, *Scytodes thoracica*, *Ero aphana*). We also recorded some typical species for such habitats, like *Hasarius adansoni*, very common occurrence of *Pholcus phalangioides* or different syntropic Therdiidae and Agelenidae. From the point of view of new species, there were recorded *Loxosceles rufescens* and *Tegenaria parietina* for the first time in the Czech Republic and new data about the presence of recently discovered *Coelosoma floridanum* and *Trieaeris stenaspis* were given. In the second part, there were recorded 23 species from 13 families. The most widespread species were *Hasarius adansoni*, *Triaeris stenaspis* and *P. phalangioides*. There were also recorded new species for the fauna of Czech Republic: *Heteroonops spinimanus* (Oonopidae) and *Theotima minutissima* (Ochyroceratidae), both are second records for that species from Europe. There were also recorded one juvenile specimen of family Prodidomidae, probably *Zimiris doriai*. This family was never recorded from the Czech Republic too. We found also some other rarely collected synatropic species (*Dysdera crocota*, *Coleosoma floridanum*, *Nesticodes rufipes*, *Modisimus culicinus* and *Triaeris stenaspis*).

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ORAL PRESENTATION - STUDENT

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It's what's inside that matters: endosymbiont infections in *Linyphia* spiders

Antje Hundertmark & Sara L. Goodacre

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Endosymbiotic bacteria that live inside arthropod hosts have been the subject of intensive study over past decades. Their impact and effects on hosts are in some cases well understood, but there are many instances where little is yet known. Various studies have proposed that endosymbionts might play a role in the speciation process because they can prevent successful mating between unequally infected individuals. Different strains of the same endosymbiont are known potentially to occur in different populations of the same species. These different strains can lead to cytoplasmic incompatibility (CI) between males and females. Hence, geographically distant populations infected with different CI-inducing endosymbiont strains can also potentially become reproductively isolated from one another. The sheet-web spider species *Linyphia hortensis* and *L. triangularis* were chosen to study the composition of endosymbiont strains in populations from distant location and the impact on the host genome. Wild caught spiders from four locations (United Kingdom, Germany, Denmark and Sweden) were brought to the lab and screened for endosymbionts. The screenings showed infections with *Wolbachia*, *Rickettsia* and *Spiroplasma*, with *Wolbachia* being the most common found endosymbiont. The populations were compared using the mitochondrial gene COI. Low genetic diversity in a highly conserved region of the COI gene are consistent with selective sweeps induced by endosymbionts.

Poster presentation - Student

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The effect of habitat type and overwintering on spider body condition and locomotion: case of *Pardosa alacris*

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The majority of Central European forests were converted to tree plantations and are under intensive forestry management. Overwintering in temperate regions of Europe is a prominent mortality risk for invertebrates and may affect their behaviour and body condition. *Pardosa alacris* C.L. Koch, 1833 is a common ground dwelling spider in central European native and plantation forests, and habitat type and prey availability may play important roles in their overwintering. Here we assess the effects of winter on spiders from native poplar and exotic pine plantations. We collected 180 specimens in native and exotic tree plantations before overwintering and after winter, when the activity of *P. alacris* increases. The locomotory behaviour of *P. alacris* (distance covered and speed) was assessed by tracking their movement in a white circular plastic arena for three minutes. We also assessed body condition, body size, and total fat content by extacting body fat content. Forest type and sex had significant effects on body length. Fat content was significantly higher in the spring than in autumn, and spiders covered larger distances and were faster in autumn than in spring. Fat content had a significant negative effect on average speed. Spiders in native forests were smaller but grew more during the winter than in exotic plantations, possibly due to higher prey availability in native forests. Visually-hunting predators may significantly affect spiders. Fat spiders with better body condition moved less, and were thus less detectable by predators. However the low movement rate may result in a low rate of encountering prey items, thus lowering feeding efficiency.

ORAL PRESENTATION - STUDENT

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Applications of ddRAD sequencing in taxonomy and systematics of wolf spiders (Lycosidae)

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Molecular methods in taxonomy and systematics are becoming a routine rather than novel approach. The logic of molecular methods application is uniform which makes them an extremely efficient tool for studying all kinds of basic and applied biological questions including taxonomy and systematics. Here we discuss double-digest restriction site associated DNA sequencing (ddRADseq) and its applications for wolf spiders' taxonomy and systematics, genus *Pardosa* in particular. The ddRADseq belongs to reduced representation genome sequencing methods meaning that it samples thousands of loci from the whole genome (roughly up to 2% of it). One of our target group is *Pardosa pullata*-group. We started with sequencing DNA barcodes (COI) and found that they are in conflict with established taxonomy of these wolf spiders, i.e. COI could not discriminate morphological species. Thus, we proceeded with ddRADseq and consecutive analysis of the genome scale data showed that the target species represent separate lineages and that current species hypothesis proposed by Kronestedt holds true. Simultaneously, we sequenced quite many other *Pardosa* species as well as some representatives of different subfamilies of Lycosidae. Concerning *Pardosa* there are two interesting findings. First, we analyzed *P. atrata* and *P. palustris* specimens from Finland and Northeast Siberia and ddRADseq data suggests that these distant populations might represent different species. Further morphological scrutiny showed differences in copulatory organs in *P. atrata* from Finland and Eastern Siberia. *Pardosa palustris* was not studied in detail yet but we believe that the situation is quite similar. Second, ddRADseq shows that different *Pardosa* species groups actually represent independent evolutionary lineages which was suggested earlier based on morphology. Moreover, *Acantholycosa* is always clustered "within" *Pardosa* (both based on ddRADseq and COI) with the closest neighbor being *P. eiseni* from *P. nigra* group. The latter suggests whether all up-to-date studied species groups represent separate genera or that *Acantholycosa* could be synonymized with *Pardosa*. It is clear though that ddRADseq can be a very efficient tool to study such kind of questions.

Poster presentation - Student

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Species complexes in the genus *Roncus* (Pseudoscorpiones: Neobisiidae) in the Alps

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Despite being the fourth largest order of arachnids, pseudoscorpions are still largely understudied. Consequently, only morphological and morphometric characters are traditionally used for their species delimitation, which, without proper knowledge of variability of these characters, often lead to underestimation of the real diversity of pseudoscorpions. Recently, however, the emergence of more advanced methods (such as DNA analysis, cytogenetics, geometric morphometry) and their combination into an integrative approach, allows us to estimate the species' boundaries and their relationships more precisely. In our study, we focused on two species complexes in the genus *Roncus* in the Alps, which is a region long known for its high degree of endemism, caused by altitudinal zonation and climatic oscillations in the plio-pleistocene. For that reason, we encounter complex biogeographical patterns in groups such as pseudoscorpions, that have low dispersal abilities and specific ecological preferences. According to our results, which are based on a combination of DNA analysis and geometric morphometry, we argue that *R. alpinus* is in fact a complex of four species. Similarly, DNA analysis and karyological analysis indicate that *R. tenuis* is also a complex of four species differing for example in the morphology of sex chromosomes.

This work was supported by Grant Agency of the Charles University (GAUK 727916).

Poster presentation

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Love on the rocks: mating behavior and ecology of the mound building spider *Castianeira* sp. (Araneae: Corinnidae)

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In this study we provide the first description to our knowledge of the mating behavior of the mason spider *Castianeira* sp. (Araneae: Corinnidae), a mound-building species from the Greater Yellowstone Ecosystem in Wyoming, USA. Female mason spiders are the only eight-legged architects known to build a mound on top of their egg sacs, with females building mounds beginning in early July and continuing through the beginning of September. Experimental data suggests mounds are especially important during the first 24 hours after her egg sac has been made to prevent spiderling mortality. Female spiders construct egg sacs in a nook on a rock, then cover them with materials they gather during hundreds of collecting trips. They select pebbles, flower blossoms, small sticks, seeds, and invertebrate body parts like ant exoskeletons, snail shells and cricket legs to be part of the mound and attach them with silk. Prior to 2017, neither males nor courtship had been observed in the field, but in July 2017, we observed both: we observed slight sexual dimorphism (with females appearing somewhat larger), and we recorded several instances of mating behavior during the day. We analyzed this behavior using Behavioral Observation Research Interactive Software (BORIS), and our observations suggest a simple mating behavior pattern with the male approaching the female while she is building her mound followed by inserting his palps (with palpal insertion ranging approx. 5-76+ seconds) with little pre- or post-copulatory interaction. These observations expand the understanding of the mason spider's life cycle and mating system including reconsidering how and when mating occurs, whether or not females mate multiple times, and its impact on the number of egg sacs produced during the season. Further study is needed to understand the cues (chemical, visual, vibrational/seismic) males and females use during courtship and mating and what role (if any) female silk or the mound plays in finding mates.

Oral presentation

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Tiny spider, big color: structural origins of coloration in the spider *Phoroncidia rubroargentea* Berland, 1913 (Araneae: Theridiidae) from Madagascar

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This study investigates the structural basis for the red, silver and black coloration of the theridiid spider, *Phoroncidia rubroargentea* (Berland, 1913) from Madagascar. Specimens of this species can retain their colour after storage in ethanol for decades, whereas most other brightly pigmented spider specimens fade under identical preservation conditions. Using correlative optical, structural and chemical analysis, we identify the colour-generating structural elements and characterize their optical properties. The prominent silvery appearance of the spider's abdomen results from regularly arranged guanine microplatelets, similar to those found in other spiders and fish. The microplatelets are composed of a doublet structure twinned about the [021] axis, as suggested by electron diffraction. The red coloration originates from chambered microspheres (approx. 1 µm in diameter), which contain structured fluorescent material. Co-localization of the red microparticles on top of the reflective guanine microplatelets appears to enhance the red coloration. The spider's thick cuticular layer, which encases its abdomen, varies in its optical properties, being transparent in regions where only guanine reflectors are present, and tanned, exhibiting light absorption where the red microspheres are found. Moreover, colour degradation in some preserved spider specimens that had suffered damage to the cuticular layer suggests that this region of the exoskeleton may play an important role in the stabilization of the red coloration.

Poster presentation - Student

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Road verges, functionally important or not?

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In recent decades, the majority of natural forests and forest-steppes of Central Europe have been destroyed and transformed into planted forests to meet the needs of the growing population. Habitat loss has detrimental effects on species richness and diversity of biota worldwide. In this research, we explored the potential role of road verges in forest plantations of non-native tree species in maintaining spider fauna. We hypothesized that linear grassy stripes along road verges maintain the spider species of forest steppes. We established 10 sites in each of the following types of habitats: grassland component of forest steppes, grassland and road verges between pine plantations in the southern part of Hungary. At every site, 4 pitfall traps were placed to collect ground-dwelling spiders; the sampling of vegetation-dwelling spiders was done by sweep net technique. We pooled data and performed a pairwise comparison of species richness and abundance. Furthermore, functional diversity (RaoQ entropy and community-weighted mean values) was calculated with five different traits, namely stratum, moisture preference, shading tolerance, feeding, and dispersal. We found higher functional diversity in road verges between the pine forests than the two other habitats. Forest generalist species constitute a large part of the road verge fauna; these species have a larger variance in trait values. However, several forest steppe spiders are not able to colonize this habitat. Nonmetric multidimensional scaling (NMDS) suggested that road verges were more similar to forest steppes in terms of spider composition than to grasslands. We concluded that road verges act as a secondary linear habitat in pine forests for spiders, and play an important role in maintaining their richness and abundance; hence, they have important conservational value.

ORAL PRESENTATION - STUDENT

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Cuticular hydrocarbons of selected Pseudoscorpion species

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Many biological aspects of the arachnid order Pseudoscorpiones are still poorly understood and not well documented by scientific evidence. In this study, a first analysis of the chemical composition of cuticular hydrocarbons in selected species of pseudoscorpions is given. Therefore, representatives belonging to five families, namely Cheliferidae, Chernetidae, Cheiridiidae, Neobisiidae and Chthoniidae were whole-body-extracted in hexane and extracts were analyzed by gas chromatography-mass spectrometry (GC-MS). A total number of 53 hydrocarbons was detected. These compounds belong to alkanes, methyl-branched alkanes and alkenes with chain lengths between 21 and 33 carbon atoms. Generally, conspicuous hydrocarbon patterns were limited to adults with some taxa showing no hydrocarbons at all. An integrated taxonomic approach, adding specific chemical characters for pseudoscorpion taxonomy, as well as the ecological benefits of presence or absence of cuticular hydrocarbons are discussed and differences between the species are described.

Oral presentation

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Subterranean spider fauna (Arachnida, Araneae) of the Dinarides

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The Dinarides are known as European biggest karst region, with the world's highest diversity of subterranean fauna. Many relict forms occurs, also caves with highest subterranean biodiversity, as Postojna and Vjetrenica. Beside amazing biodiversity, subterranean fauna is highly endemic, with over 90% strictly endemic taxa to the Dinarides. This study is based on the critical analysis of all literature records and represent the first attempt to summarize the fauna of the subterranean spiders in the Dinarides. So far, a total of 103 subterranean taxa from 7 families are known from the Dinarides: Agelenidae (9), Dysderidae (22), Leptonetidae (12), Linyphiidae (45), Nesticidae (7), Pholcidae (3), Tetragnathidae (3), Sicariidae (1) and Theridiidae (1). There are 7 genera endemic to the Dinarides: *Folkia*, *Mesostalita*, *Parastalita*, *Stalita*, *Stalitella*, *Fageiella* and *Typhlonyphia*. Highest number of species has the genus *Troglohyphantes* (33). The largest fraction of troglobitic species are encountered in the families: Dysderidae (21), Linyphiidae (14), Leptonetidae (6) and Nesticidae (5). Our recent findings of several new subterranean taxa (genus, species) from different families, demonstrate that the subterranean spider fauna of Dinarides is only partially known and still largely unexplored.

Oral presentation

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"Game of Death" – The spider and harvestman fauna at a controversial hydropower construction site

Christian Komposch

ÖKOTEAM – Institute for Animal Ecology and Landscape Planning

The Kelag GmbH constructed a pump-storage hydropower station in the Hohe Tauern mountains in the Central Alps of Austria. The project's original description and environmental impact statement had to include expected negative environmental effects and appropriate mitigative measures. The governmental demand is the documentation that after the project's completion there will be no significant harm to the fauna and flora. In addition to other taxonomic groups, harvestmen and spiders served as bioindicators to evaluate a possible negative impact on the local biodiversity. The stakeholders included the hydropower corporation and their external consultant team, the nature conservation department from the provincial government of Carinthia and their external expert team and the federal environmental agency (UBA) as the inspection authority. The hydropower-team presented a report based on 10 harvestman and 37 spider species, mapped by means of pitfall traps and hand-collecting. Surprisingly no negative impacts on any of these species was indicated. However the federal environmental agency located severe errors and gross deficiencies in this report. Consequently, the Carinthian nature conservation department contracted the ÖKOTEAM to make comparable investigations on the arachnid fauna of this area and to evaluate the project solicitor's report. Our field work resulted in the documentation of 15 harvestman and 44 spider species. The big difference in these two evaluations (hydropower-team versus ÖKOTEAM) is the number of red-data-list species. The ÖKOTEAM study found 10 species of Opiliones and 9 species of Araneae, compared to 5 and 4, respectively for the power company study. Moreover, the most sensitive species were missing from the report of the project solicitor. Based in part on the incomplete and erroneous environmental appraisal the hydropower station was built. A post-construction monitoring demonstrates a significant red-list species reduction with only 22 % (18>>4) of the overall species and only 7 % (162>>12) of the individuals. This case study shows impressively how economic and political targets are met via development-friendly environmental reports selected and paid by project solicitors. The impotence of nature conservation agencies enables this game of death, which ends in a camouflaged loss of biodiversity.

ORAL PRESENTATION

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New techniques for spider photography

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Reliable field guides with nice, colourful, recognizable photographs of spiders are rare. Usually the spiders were photographed in nature with various backgrounds and different aspects, making it difficult to compare a collected spider with the pictures presented. In 2015 the first steps were taken to prepare a field guide with photographs of live spiders of Xishuangbanna prefecture, in the very south of China, close to Laos. All spiders were anaesthetized and photographed in a standard way, against a white background. In 2017 this work was continued using new techniques like automatic focus bracketing and stacking, and very high resolution photography with a moving sensor. These techniques will be explained and their usefulness for spider photography will be discussed. Of course, a few nice results will be shown.

Poster presentation

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Latitudinal diversity of spiders in Finland

Seppo Koponen

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Circa 650 species of spiders are known in Finland. The country (land area of 300 000 sq. km) lies between 60 and 70 degrees of northern latitude and belongs to five vegetation zones: Hemiboreal, South Boreal, Middle Boreal, North Boreal and Subarctic zones. The spider diversity declines to the North, from 550 known species in the Hemiboreal zone to 270 species in the Subarctic zone. The species number at the best-studied locality in the Hemiboreal zone (around the Tvärminne Zoological Station, 60°N) is 430, and in the Subarctic zone (Kilpisjärvi Biological Station, 69°N) only 185 species. On the other hand, the proportion of Linyphiidae, the dominant spider family in northern areas, has an opposite trend: 40 % of the known spider species in the Hemiboreal zone are linyphiids, but in the Subarctic zone 60 %.

Poster presentation

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Species-specific behaviour manipulation of orb-web building spiders (Araneae, Araneidae) in the genus *Sinarachna* (Ichneumonidae, Ephialtini, Polysphincta genus-group)

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Ichneumonid wasps from Polysphincta genus-group are koinobiont ecto-parasitoids of spiders. The larva, attached to the dorsal side of the ophisthosoma/prosoma, develops while the spider continues foraging. Shortly before pupation, the parasitoid final instar larva manipulates the web-building behaviour of the host in order to construct safe shelter against natural elements and predators during the parasitoid pupation. It is expected that, the architecture of the modified web (cocoon web) is providing more durable support for the wasp's pupa. Genus *Sinarachna* comprises only five described species. Two of them, Palaearctic *S. nigricornis* (Holmgren, 1860) and Holarctic *S. pallipes* (Holmgren, 1860) widely occur in Europe. Their biology and interaction with orb-web building spider hosts are poorly known. We found species specific host manipulation in wasps of genus *Sinarachna* in Europe. Final instar larva of *S. pallipes* forced the spider host to build the 3D symmetric cocoon web, whereas cocoon web induced by larva of *S. nigricornis* was the sparse 2D structure. Our study supported hypothesis that host-parasitoid interactions in Polysphincta genus-group are species specific and co-evolved in narrow association with biology of their spider hosts.

Poster presentation

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Effect of neonicotinoid insecticides on predatory activity of wolf spider *Pardosa agrestis* (Westring) (Araneae, Lycosidae)

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Neonicotinoids are one of the most widely used insecticides nowadays. They are a class of neuro-active insecticides chemically similar to nicotine. Neonicotinoids bind to nicotinic acetylcholine receptors that are limited to the cells of the central nervous system in insects. Normally, they are activated by the neurotransmitter acetylcholine that is broken down by acetylcholinesterase to terminate signals from these receptors. However, acetylcholinesterase can not break down neonicotinoids, the cells are overstimulated, which can cause paralysis and death. The receptors of mammals and insects differ in the structure; most neonicotinoids bind stronger to the insect ones. Because of high toxicity to insects and almost no toxicity to mammals they have became popular insecticides. However, we know very little about their toxicity to other animal groups so far, including spiders. We tested the effect of prey treatment by four different neonicotinoid insecticides (Actara, Biscaya, Confidor and Mospilan) on predatory activity of agrobiont spider *Pardosa agrestis* (Westring) (Lycosidae). Control group was treated by distilled water. The number of captured/consumed/killed preys (*Drosophila* flies) was recorded in six period after 30 min. Dead flies were replaced with live ones so that to maintain a constant density of prey in the arena. The body size of each spider was recorded and the relationship between predatory activity (capturing, feeding, overkilling) and spider size/capturing time was tested. Total feeding of *Pardosa* spiders differed statistically significant between control group (untreated prey) and groups fed on prey treated by Confidor and Biscaya ($p = 0.008$, $p = 0.002$). Feeding decreased significantly when prey was treated by Confidor and Biscaya in females ($p = 0.02$ and 0.0008), but not in males. The all four neonicotinoid treatments (Actara, Biscaya, Confidor and Mospilan) significantly increased the overkilling of prey ($p = 0.004$). Spiders from control group overkilled at average 0.25 fly, whereas spiders fed on flies treated by neonicotinoids killed between 1.1 – 1.4 fly per experiment. We found the negative effect of neonicotinoids on spider feeding and the positive effect on overkilling in short-lasting laboratory experiments. The long-lasting effect of neonicotinoids or their effect on nature population were not documented in this study, but they could be expected to be harmful.

POSTER PRESENTATION - STUDENT

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Study on karyotypes of African theraphosids

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Most data on spider chromosomes concern the most diversified spider clade, the entelegyne araneomorphs. Mygalomorph cytogenetics is not satisfactorily understood. The ancestral karyotype of the mygalomorph superfamily Avicularioidea consisted probably of a high number of biarmed (i. e. metacentric and submetacentric) chromosomes and four different X chromosomes. Our study is focused on African members of Theraphosidae, which is the most diversified mygalomorph family. In addition to standard karyotype features (diploid number, chromosome morphology, sex chromosome system), we also determined the pattern of constitutive heterochromatin (C-banding) and nucleolus organizer regions (further NOR) (fluorescence in situ hybridization). African theraphosid fauna is composed of members of five subfamilies, namely Eumenophorinae, Harpactirinae, Ischnocolinae, Selenogyrinae, and Stromatopelminae. Although these subfamilies do not constitute a monophylum, they show remarkable cytogenetic features. Karyotypes of ischnocolines are closest to the supposed ancestral theraphosid karyotype. They usually exhibit a high diploid number and three X chromosomes. Eumenophorines differ from ischnocolines by slightly lower diploid numbers and predomination of acrocentric chromosomes, which probably arose from ancestral biarmed chromosomes by pericentric inversions during an ancient evolutionary period. The most derived karyotypes were found in stromatopelmines and harpactirines, which show a considerable reduction of diploid numbers and sex chromosome numbers. Karyotypes of stromatopelmines consist approximately of forty chromosomes. Diploid number of harpactirine *Idiothele mira* ($2n♂ = 25$) is the lowest found in theraphosids so far. In harpactirines and stromatopelmines, the X chromosomes fused into a single element. We failed to obtain any selenogyrine for this study. Karyotypes of the analyzed African theraphosids contain low numbers of NORs. Some NORs exhibit an enormous size. Karyotype data of African theraphosids will be useful to reconstruct the karyotype evolution of theraphosids and sex chromosome evolution of spiders.

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Poster presentation

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New data on the Moroccan spiders

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There are only few known data on the Moroccan spiders in the last decades. The ongoing examinations on the area were performed by Denis et al. (1956, 1961). Wunderlich (1987) and Schmidt (1973) reported the arachnofauna of the islands near Morocco. From the most recent papers the comprehensive Salticidae studies of Moscaliuc (2014) must be mentioned, while Deltshev (2015) examined the arachnofauna of the Atlas Mountains in Morocco. Gál et al. (2016) reported new data of Moroccan orb-weaver spiders (Araneidae), and Gál et al. (2017) also added to description of a new velvet spider (*Loureedia maroccana* Gál, Kovács, Bagyó, Vári & Prazsák, 2017) from Morocco. The authors presents to results of their examinations which were June 2012 to November 2013 from the Atlas Mountain to the Atlantic Ocean, between Rabat and Agadir. Specimens were either collected by sweep netting and individually or by using pitfall traps. The spiders were kept deep frozen till the determination. Our faunistic results were interpreted according to the World Spider Catalog (2018) respectively. During the almost 18 months of fieldwork the authors identified 115 species from 27 spider families. On the examinations remarkable number of species were identified in Morocco which were previously known from only Europe. The appearance of several Holarctic (12) and Palearctic (26) species ranged spiders were confirmed from the area. According to our results it can be assumed that the most southern occurrence of these species is in Morocco. Some of the species were already known from the surrounding countries (e.g. Spain, Portugal, Algeria), and the World Spider Catalog (2018) did not refer Moroccan occurrence. The question rises: some spiders were introduced to Morocco with the globalized trade. The results of this faunistical revision presented, to 93 spider species in total, which were known from the surrounding countries, but are new occurrence in Morocco.

Poster presentation

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New morphological group of lady bird spiders in Hungary (Araneae, Eresidae)

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According to the most recent taxonomic literature (Řezáč et al. 2008, Kovács et al. 2010, Kovács et al. 2015) three species of the genus *Eresus* are known in Hungary: *E. kollari* Rossi, 1846, *E. moravicus* Řezáč, 2008 and *E. hermani* Kovács, Prazsák, Eichardt, Vári & Gyurkovics, 2015. We recognized a fourth distinctive form in Hungary, which is differs from the nominate form of *E. moravicus* in the female genital morphology, in colour pattern of prosoma on females and males, in habitat preference, phenology and in genetic characters of mitochondrial marker. The nominate form of *E. moravicus* seems to occur in Hungary exclusively on calcareous and siliceous open or closed rocky grasslands, and absent from open or closed sand steppes, steppes on loess, slope steppes on stony soils, and from calcareous rocky steppes in contrast to the distinguished form of *E. moravicus*. The results of genetic analysis show low sequence diversity within the *E. moravicus* group sensu lato compared with other *Eresus* populations, however slight but strongly consequent genetic differences were found in mitochondrial marker between the nominate form of *E. moravicus* and its new form, suggesting a putative reproductive isolation and therefore different morphological characters between them.

Oral presentation

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Karyotype evolution of tetrapulmonate arachnids (Arachnida: Tetrapulmonata)

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Arachnids are a highly diverse arthropod group, yet the organization and evolution of their genomes remain poorly understood. We aimed to reconstruct the karyotype evolution of tetrapulmonate arachnids, a major clade comprising Araneae (spiders), Amblypygi, Thelyphonida, and Schizomida. We performed a detailed cytogenetic analysis of the non-spider tetrapulmonate orders, plus two additional orders with putative close phylogenetic affinities to tetrapulmonates, namely the Ricinulei and Solifugae. Cytogenetics of these five orders is virtually unknown. Our study in combination with existing information indicates that ancestral arachnids had a low to average 2n, one pair of nucleolar organizer regions (NORs), low levels of heterochromatin and recombinations, and no heteromorphic gonosomes. Our results further indicate that the karyotypes of amblypygids, thelyphonids, schizomids, and solifuges diversified via centric fusions, pericentric inversions, and changes of NOR pattern and, in solifuges, also via tandem fusions. Although amblypygids and thelyphonids have a much lower species diversity than spiders, they possess a considerable karyotype differentiation. Some solifuges display an enormous expansion of heterochromatin and NOR number. Most non-spider tetrapulmonates differ from spiders by the absence of morphologically differentiated sex chromosomes. We hypothesize that the ancestor of amblypygids, thelyphonids, and spiders exhibited a homomorphic XY system, and that telomere heterochromatin and NORs were involved in the origin and evolution of amblypygid sex chromosomes. Our results do not support relationship of pseudoscorpions and solifuges. On the contrary, they support the Cephalosomata clade (comprising acariforms, palpigrades, and solifuges) and a genome duplication in the spider ancestors.

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ORAL PRESENTATION - STUDENT

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Do nocturnal spiders use visual signal as species recognition cues?

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In nature, visual signals have various functions such as attracting prey, courting mate, warning predators and species recognition. Relevant studies on nocturnal spiders show that their body color may function to court females and attract prey. However, little is known about the role visual signal played in heterospecific interactions in nocturnal spiders. Since spiders use multiple sensory modes to recognize their mating partners, I wonder whether nocturnal spiders could use visual signals in species recognition. *Heteropoda venatoria* and *Heteropoda simplex* are commonly seen nocturnal wandering spiders in low elevation areas in Taiwan. These two sympatric spider species have similar external appearance except that *H. venatoria* have a white stripe on their face. I tested whether *H. venatoria*'s white stripe function as one of the species recognition signals for these two species of Heteropoda. I set up interaction arena in the laboratory and manipulated the visual signal of spiders by removing white stripes and monitor the interactions of spiders in various treatment groups. I predict that male *H. simplex* will perform courtship behavior to female *H. venatoria* with white stripe experimentally removed, and the latter will warn the former by performing warning behaviors. I also predict that when a female *H. simplex* encounters a male *H. venatoria* with white stripe experimentally removed, and male will court the female with caution, and the female will initially accept but eventually reject the courting male.

ORAL PRESENTATION - STUDENT

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Home alone: The fine line between kleptoparasite and predator

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Argyrodinae (Theridiidae) is known for its specialized feeding behaviors including stealing prey from other spiders (kleptoparasitism) and predation of other spiders (araneophagy). Initially, all argyrodine species were considered to be kleptoparasitic. Currently, the genera *Neospintharus*, *Ariamnes* and *Rhomphaea* are regarded as primarily araneophagic, while the genus *Argyrodes* may include mainly kleptoparasitic species. In Israel, it is unclear if the local argyrodine species are kleptoparasitic or araneophagic. *Neospintharus syriacus* (O.P.-Cambridge, 1872) is the most widespread and common argyrodine species in Israel, and can be found on various host species. I found *N. syriacus* commonly on webs of *Holocnemus pluchei* (Scopoli, 1763) and *Frontinellina frutetorum* (C. L. Koch, 1834), as well as on host-absent webs. These field observations led me to question the placement of *N. syriacus* on the predatory behavior scale between araneophagy and kleptoparasitism. Furthermore, it was not clear to what extent the host species affects its predatory behavior. In order to test this, I performed laboratory experiments using adult females collected from the field. First, I tested for araneophagy by introducing *H. pluchei* hatchlings into a small container occupied by *N. syriacus* and checked for predation on the hatchlings after 4 days (n=37). Hatchlings were consumed by *N. syriacus* in 35 % of the cases. Then I tested for kleptoparasitism by introducing *N. syriacus* onto an established host web either in the presence or absence of the host, using two hosts species, *H. pluchei* and *F. frutetorum*. I observed the behavior of *N. syriacus* for four hours after introducing prey onto the web (n=17, n=12, respectively). I defined and categorized *N. syriacus* behaviors, producing an ethogram for each treatment. Results show greater prey capture rates in host-absent treatment. *N. syriacus* demonstrated a range of kleptoparasitic behaviors, and was able to attack and feed on prey, regardless of host presence. My observations suggest that host presence is not obligatory, and that the behavior of *N. syriacus* is highly plastic. The observations of predatory behaviors in *N. syriacus* will help to map the evolution of these behaviors in relation to the phylogeny of this interesting subfamily.

ORAL PRESENTATION

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Comparative analysis of spider genome sizes

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The genome size is one of the most fundamental genetic properties of living organisms. Genome size is defined as the total amount of DNA contained within haploid chromosome set. Important findings from the study of genome sizes are that the sizes vary dramatically among species and that this variation has no relationship to organismal complexity. It was found that haploid genome size is positively correlated with cell size, and negatively with cell division rate in a variety of taxa. The genome sizes of animal species vary more than 5000-fold, but both the evolutionary implications and the mechanisms responsible for the origin of this diversity remain unclear. Arthropods represent, by far, the dominant forms of multicellular life on the planet, yet the genome sizes of several groups (e.g. arachnids, myriapods) remain almost entirely unknown. Nevertheless, studies of genome size variation and its phenotypic impacts are not entirely lacking for invertebrates. In copepod crustaceans, for example, significant negative relationships have been reported between genome size and developmental rate. Positive associations between genome size and body size have been reported in flatworms, molluscs, copepod crustaceans, aphids and flies. Spiders represent a diverse group of animals, but to date there is just one study, where the genome sizes of about one hundred species out of more than 47 thousands described species were measured. We followed up in this research and we used flow cytometry to measure genome sizes of another 106 spider species from 26 families occurring in Europe. We found quite high variability in genome sizes among different spider families, the smallest genomes were found in the families Palpimanidae and Pholcidae, while the biggest genomes were found in the Oecobiidae and Segestriidae. Also within several families quite high variability in genome sizes was found. Within species, females always have bigger genome, which is given by unusual type of sex determination system X1X20 occurring in the majority of spider species.

Poster presentation

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Diversity and assemblage filtering in ground-dwelling spiders (Araneae) along an urbanisation gradient in Denmark

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We studied the effects on spiders of a three-step rural-urban urbanisation gradient near a Danish town embedded in a historically forested landscape. Using pitfall traps set in forested habitat patches, we collected a total of 3075 adult spiders of 80 species; the habitats under different degrees of urbanisation had 45-47 species. We found support for Gray's Increasing Disturbance Hypothesis: the species richness/trap was significantly higher in the rural habitat than any other one, and decreased from the rural forest to forest fragments dominated by non-native trees in the urban park. The number of forest specialist species also decreased along the urbanisation gradient. Neither the presence of generalist nor light-preferring species increased under more urbanised conditions but web builders and hygrophilous species were more species-rich in the rural habitat than elsewhere. Using indicator values, we identified *Coelotes atropos*, *Walckenaeria corniculans*, *Walckenaeria cucullata*, and *Pachygnatha listeri* as species linked to the rural and suburban habitats, *Trochosa terricola*, *Saaristoa abnormis*, *Robertus lividus* as characteristic of the rural habitat, and *Gongylidium rufipes*, *Diplocephalus latifrons* as urban habitat specialist.

ORAL PRESENTATION - STUDENT

▲ Back to the Program

Enough for everyone: *Pisaura mirabilis* males do not reduce their mating effort with increasing mating opportunities

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Male traits and processes associated with reproduction are costly, and as males possess a finite energetic budget, investment in one mating event limits potential investment in further matings. Males should hence be prudent in their reproductive effort in order to partition their resources among multiple partners and ensure that these are not depleted before mating opportunities have ceased. Consequently, males have evolved to plastically adjust their reproductive investment in response to elements of the social environment, such as female availability, reducing their courtship effort or their sperm allocation as the number of mating partners increases. We tested this hypothesis using the nursery web spider *Pisaura mirabilis*, a species characterised by nuptial gift-giving mating behaviour, which entails conspicuous costs for males. We manipulated male perception of mate availability by modifying the number of females they were exposed to and then recorded their behaviour during courtship and copulation with a female. Contrary to expectations, males exposed to higher numbers of mating opportunities did not reduce their investment in the current partner, in terms of nuptial gift production, courtship and sperm allocation, estimated as total copulation duration. Our results may be explained if *P. mirabilis* males were able to increase their reproductive budget by drawing resources from non-reproductive traits and functions, such as growth or body maintenance, or by increasing their food intake (i.e. consuming part of the gift). Interestingly, we found that males silk-wrapped nuptial gifts for longer when mating with smaller females. Further studies would be required to test the effect of multiple matings on male growth and lifespan and to measure male food intake under different conditions of female availability. Moreover, a specifically designed experiment should explore the effect of female size on male preferences and resource allocation, and investigate potential benefits of male mate choice.

Oral presentation

▲ Back to the Program

Sub-lethal effects of pesticides on the wolf spider *Pardosa littoralis*, a key predator in North American salt marshes

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The pesticide Scourge and the larvicide Altosid are used on salt marshes of Long Island, New York, to control mosquito populations. Pesticides often impact non-target species by increasing mortality or by altering behavior or physiology through sub-lethal fitness-decreasing effects. The wolf spider *Pardosa littoralis* is a key predator in this ecosystem and changes in their behavior have the potential to affect ecosystem function. This study investigates the behavioral effects of Scourge's active ingredient resmethrin on adults, and the active ingredient of Altosid, methoprene, on juvenile individuals. Locomotive performance was tested for both pesticides. Resmethrin was tested at 5µg /L in combination with two levels of salinity (0.01 % and 0.05% NaCl) since pyrethroids have been shown to effect voltage regulated sodium channels. Juvenile spiders were tested at 10 mg/L of methoprene, which has been shown to affect development as a juvenile growth hormone mimic. We found that at low salinity, exposure to resmethrin resulted in reduced burst distances. Low salinity was associated with decreased burst speed. Therefore, lower salt concentrations may be stressful, leading *P. littoralis* to be more susceptible to the effects of resmethrin. However, exposure to methoprene did not cause any significant differences in speed or endurance. Body size and condition were consistently positively related to performance measures. Methoprene and resmethrin may not directly affect *P. littoralis*' speed and endurance; however, presence of other stressors in the environment can alter these outcomes and lead to other immediate fitness consequences.

Poster presentation

▲ Back to the Program

Climatic cabinet tests prove reduced thermal tolerance in *Troglohyphantes* spiders

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According to direct field observations and theoretical models, anthropogenic global warming may significantly influence and modify the underground cave climate in different ways compared to what happens outside. Despite empirical evidence supports the existence of a reduced physiological tolerance to temperature fluctuations in subterranean species, direct experiments have been rarely performed. In this work, we experimentally tested the thermal tolerance of *Troglohyphantes* spiders (Araneae, Linyphiidae) inhabiting caves and other subterranean habitats across the Western Italian Alps. Alive specimens of 11 species of *Troglohyphantes* spiders were collected in the field and carried to the laboratory. We used standard climatic test cabinets to evaluate their physiological thermal tolerance. We set up the climatic test cabinet to warm up progressively, from the natural temperature (i.e. the one recorded in the cave) with increasing ramping temperature set at 1°C/day. Experiments included replicates of 10 specimens each, including a control. As a result of their adaptation to a thermally-constant environment, we observed that *Troglohyphantes* spiders display a general stenothermal profile and that the specific response of the individual species to increasing temperatures varies significantly according to the degree of subterranean adaptation. This results corroborates our previous results based on species distribution modelling, pointing out a significant decline in habitat suitability in respect to climatic alterations due to climate change.

Poster presentation

▲ Back to the Program

Spider World Records: record-breaking achievements by spiders

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Spiders have a bad reputation among the general public: they are considered ugly, hairy, brown, and deadly poisonous creatures. There are tales describing how they lay eggs in human skin, frequent toilet seats in airports, and crawl into your mouth when you are sleeping. Misinformation about spiders in the popular media and on the World Wide Web is often rampant, leading to distorted perceptions and often negative feelings about spiders. However, despite their negative connotation, arachnids offer intrigue and mystery and can be used to effectively engage even arachnophobic people into scientific discussions and activities. In order to provide an entryway for teachers and students — as well as scientists themselves — into the biology and diversity of spiders, we compiled a list of 99 record-breaking achievements by spiders (the "Spider World Records"). We chose a world record style format, as this is known to be an effective way to intrigue readers of all ages. We group our records into different macro-categories ranging from Taxonomy and Morphology to Ecology and Diversity. We also report on curiosities and clarify fake news about these underappreciated animals. By making these achievements accessible to non arachnologists and arachnologists alike, we suggest that this list could be used: (i) by educators to draw in students for science education, (ii) to highlight gaps in current organismal knowledge, and (iii) to suggest novel avenues for future research efforts. Our contribution is thus specifically aimed to raise public awareness and attractiveness of spiders, meanwhile providing the first official knowledge base for world spider records.

ORAL PRESENTATION

▲ Back to the Program

The World Spider Catalog and distribution of spiders

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It is impossible to imagine Arachnology of the modern time without using WSC almost every day, whether it is by taxonomists and faunists or by those who work on ecology, ethology, or physiology of spiders. The WSC is powerful tool lacking in other species diverse orders of arthropods. Although the Catalog was originally designed to provide references to taxonomic literature, WSC also lists as supplementary data the distribution of species. Many arachnologists rely on this supplementary data uncritically. In my presentation I will give examples of distribution misinterpretations in the Catalog, and will demonstrate an algorithm that extracts correct data about the known distribution of certain species, at least in the Holarctic.

Oral presentation

▲ Back to the Program

The splendid confusion about terra typica of spiders described by O. Pickard-Cambridge from the Himalaya and Xinjiang

Yuri M. Marusik (1, 2) & Zoë Simmons (3)

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O. Pickard-Cambridge described 109 new species based on the material collected during the Second Yarkand Mission. The expedition led by Ferdinand Stoličzka started in Murree, northern Punjab, British India (now Pakistan) and reached Yarkand, southwestern Xinjiang, China. Stoličzka collected a lot of natural history specimens including birds, mammals, reptiles, molluscs and arthropods. On the return journey to Murree, Stoličzka passed away. The type materials from this expedition are hard to identify, having no proper labels, such as species name and localities, though a few are numbered. For this reason, most of the types remain unrecognised in the collection. Up to now, only a few groups were the subject of studies. These groups are represented by the few species that were easy to recognize, like Dysderidae or Filistatidae. Only two species rich families, Salticidae and Thomisidae have been revised. Whilst trying to revise two other species rich families, the Lycosidae and Gnaphosidae, we recognized that the World Spider Catalog, as well as catalogues of Bonnet, Rower, regional catalogs and revisions often provide incorrect data about type localities of the majority of species, many being located in other countries, and separated from the actual type locality by over 500 kms. At least one species is considered as described from Kyrgyzstan, althought the Second Yarkand Mission did not pass through this country. Most of localities mention in the text of O. Pickard-Cambridge are easy to recognize, although some remain uncertain. In this presentation we will provide accurate data about type localities of each species.

Oral presentation

▲ Back to the Program

Hunting mode of spiders influences their fear of ants

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Predator non-consumptive effects (NCE) are a suite of phenotypical and behavioural responses of prey to avoid predation that can cascade down food webs (i.e. the ecology of fear). An understanding of the role of fear in ecosystems remains limited because intraguild interactions are neglected and the role or prey traits is poorly known, therefore experimental multi-species approaches are necessary. Some spider species avoid negative interactions with ants by dispersing when detecting ant cues. We set out to test NCE of ants on 8 cursorial and 9 sedentary spider species to test the influence of spider hunting mode on the strength of NCE. We used filter papers to collect cues (cuticular hydrocarbons) of the black garden ant (*Lasius niger*). We placed spiders individually on filter papers and filmed each spider once on each treatment (cue, blank). Individuals could not escape the filming arenas, so increases in activity indicated avoidance behaviour. Cursorial spiders spent a longer time moving and being mobile, and had a higher overall mean mobility when exposed to ant cues compared to blank filter papers, whereas sedentary spider species did not react to ant cues at all. These results match theoretical models that predict that fast-moving organisms have higher encounter rates with predators than slow ones, since we show that the intensity of fear in spiders corresponds to their risk of encountering ants. Still, cuticular hydrocarbons are long-lasting ant cues and therefore signal a relatively low risk of an imminent encounter with ants, which can explain why these cues did not trigger any NCE on sedentary spiders. Our findings show that ant cues induce fear in spider assemblages and that the strength of NCE depends on spider traits. Our multi-species approach shows NCE as an important driver of intraguild interactions in a community context.

Poster presentation - Student

▲ Back to the Program

A strange zodariid (Araneae: Zodariidae) specimen from Hungary: *Zodarion* or *Acanthinozodium*?

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Until now three zodariid species were known from Hungary: *Zodarion germanicum* (C. L. Koch, 1837), *Z. rubidum* Simon, 1914 and *Z. zorba* Bosmans, 2009. In 2013 the occurrence of *Z. zorba* was a great surprise, because the species previously was known only from Greece. However, two years later, in December 2015, another interesting zodariid specimen (1♂) was collected by litter sampling from an apple orchard in Hungary. After examining the specimen it was clear that the spider belongs to the *Zodarion aculeatum* species group. This group comprises three sibling species (*Z. aculeatum* Chyzer, 1897, *Z. sardum* Bosmans, 1997 and *Z. scutatum* Wunderlich, 1980), all of which are rarely collected and have a narrow distribution range in Europe. Our specimen showed the most similarity with *Z. sardum* (although the match is not perfect), which is quite surprising, because the mentioned species is known only from Sardinia. But there is another interesting aspect of this story: examining the specimen more closely it had features (e.g. all femora with a double row of long ventral setae, deep dorsal pit at the base of the male's cymbium) that are characteristic of a recently revalidated genus *Acanthinozodium*. *Acanthinozodium* species are known only from Africa and our specimen could not be identified as either of them. This probably means that the taxonomic classification of the *Z. aculeatum* group needs to be revised and the whole group should be transferred to the genus *Acanthinozodium*. In this case, species belonging to the *Z. aculeatum* group would be the first representatives of the genus *Acanthinozodium* from outside Africa and our record would indicate the northernmost presence (and also the first Central European record) of the genus. To proper identification of our specimen and to clarify the taxonomic position of the *Z. aculeatum* group, it will be necessary to examine the type specimens and to collect further individuals from the mentioned strange zodariid species.

The study was financially supported by the National Research, Development and Innovation Office of Hungary (K112743).

ORAL PRESENTATION - STUDENT

▲ Back to the Program

Preliminary data on the natural prey of arboreal hunting spiders (Araneae) in apple orchards

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According to a realistic estimate the global spider (Araneae) community kills 400–800 million tons of prey (mainly insects) annually. Thus, spiders as natural enemies have one of the greatest potential in biocontrol of certain groups of arthropods. They form abundant and diverse assemblages in agro-ecosystems such as fruit orchards, therefore, spiders might have an important role as natural predators of orchard pests. According to literature data, hunter spiders might control pest populations more effectively than web-builder spiders. The species composition of canopy dwelling hunting spider assemblages in various fruit orchards is already well known, however, limited data exist on their ability to control pests. Thus, among others, the aims of our study were to determine the spider species with potential pest control ability and to provide data on the natural prey spectrum of the arboreal hunting spiders in apple orchards. The natural prey spectrum of the canopy dwelling hunting spider assemblages was examined in various organic apple orchards in Szabolcs-Szatmár-Bereg County, Hungary. Apple trees were visually inspected regularly in several apple orchards and hunting spiders with prey in their chelicerae were collected during the growing season between 2014 and 2018. The prey was taken from the spiders, and both the spider and the prey were identified. Some morphological, dimensional data of the spider-prey pairs were also analyzed. During the four-year study, 740 evaluable arboreal hunting spider individuals with prey were collected comprising seven families and 28 species. *Philodromus cespitum* and *Carrhotus xanthogramma* were found to be by far the most abundant hunting species. In examining the natural prey of the spider assemblages, it was found that hunting spiders mostly feed on arthropods irrelevant to pest management (indifferent prey), but they also consume significant amount of pests especially different Sternorrhyncha species. We also found that, depending on the hunting strategy and spider species, there might be significant differences in the taxonomic and size composition of the natural prey.

The study was financially supported by the National Research, Development and Innovation Office of Hungary (K112743).

Oral presentation - Student

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Spraying silk: Araneophagous hunting strategy used by the ground spider *Poecilochroa senilis* (Gnaphosidae)

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Many spiders use silk not only to build prey-catching webs but also retreats (nests). However, even these seemingly defended fortresses can be invaded by specialized predators. For example, some araneophagous spiders use aggressive mimicry and by imitating the vibrations of the caught prey or a potential mate they deceive and hunt the web-building spiders. The ground spider *Poecilochroa senilis* (Araneae: Gnaphosidae) has been found occasionally in the retreats or webs of other spiders in the Negev desert (Israel). Our aim was to investigate the preference of *P. senilis* for spider prey and to test the hypothesis of aggressive mimicry, i.e. abuse of signals when invading shelters of other spiders. First, we investigated the fundamental trophic niche of *P. senilis* by performing acceptance experiments in the lab. We revealed *P. senilis* accepted only some prey types, mainly spiders. *Poecilochroa senilis* was able to subdue even spiders bigger than itself. Then we investigated the hunting strategies of *P. senilis* in a series of behavioural experiments. We used the jumping spider, *Mogrus logunovi* (Araneae: Salticidae) as a prey, which is commonly preyed upon in the field. *Poecilochroa senilis* immobilised prey by spraying piriform silk on its face. This strategy is commonly used by gnaphosid spiders to hunt dangerous prey. When invading the shelter of the jumping spider, *P. senilis* did not utilize stealth or deceiving approach, but directly invaded the shelter through its entrance. The jumping spider frequently abandoned the shelter, but *P. senilis* remained inside and waited for its eventual return. In other cases, the jumping spider defended the shelter, but *P. senilis* was sometimes able to penetrate this defence by force. Our observations show *P. senilis* is an araneophagous predator immobilising its prey by gluey silk. We did not observe use of aggressive mimicry, but *P. senilis* used conditional hunting strategies to hunt salticids both outside and inside their retreats.

Oral presentation

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Biocontrol efficiency of spiders across the globe: a meta-analysis

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The role of generalist predators, such as spiders, in biocontrol remains controversial as they can either suppress or enhance pest populations. The biocontrol function of spiders seems to be, therefore, context-dependent. Here we performed a meta-analysis of the published data on the effect of spiders on pest densities and crop performance. We investigated (i) the overall effect of spiders on pest density and crop performance; (ii) whether the biocontrol efficiency of spiders depends on taxonomy of pests; the hunting strategy of spiders (hunters and web-weavers), the crop type (vine, cabbage, wheat, and rice), and climate and geography. We found that spiders, in general, supressed pests significantly. The pest suppression efficiency of spiders was enhanced not only by increased spider density but also by increased spider taxonomic diversity. The effects of spiders cascade down and they improve the crops' performances. In addition, the effects of spiders escalate rather than attenuate down through the food-chains. We also found that the biocontrol efficiency of spiders differed among crops. The highest efficiencies were in rice and vine. In addition, the biocontrol efficiency of spiders increases with mean annual temperature and consequently decreases with higher latitudes. The hunting strategy or pest taxon did not influence the biocontrol efficiency of spiders significantly. Our results provide strong evidence that generalist spiders are effective biocontrol agents, especially in crops with higher structural heterogeneity and under warmer climate. Our study also provides a unique support for the hypothesis that the predation pressure in terrestrial ecosystems intensifies towards tropics as previous studies showed only increase of attack rate by predators rather than of predation pressure itself.

ORAL PRESENTATION - STUDENT

▲ Back to the Program

The assessment of the global extinction risk of an Alpine spider species threatened by climate change

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There is a great deal of evidence that climate change causes severe reductions in the range of distribution of mountaintop species. *Vesubia jugorum* (Araneae, Lycosidae) is a large-sized wolf spider, occurring in alpine rocky areas above 2,300 m asl in a restricted district of the Western Alpine chain, on the border between Italy and France. By means of Ecological Niche Modelling (ENM), previous studies have demonstrated that due to climate change, the current observed distribution of this species is declining. This work provides the first assessment of the extinction risk of an Alpine spider species threatened by global warming, according to the IUCN Red List Categories and Criteria. Moreover, we present the results obtained by the analysis of the functional traits, based on morphological characters of 80 specimens collected in the field. The analyses aim at corroborating the results obtained by ENM in relation to the identification of the most important areas for the conservation of this species. According to the IUCN assessment, *Vesubia jugorum* is classified as Endangered. This evaluation is related to criterion B, focusing on the geographic range and the estimated reduction of the suitable areas in the near future. Accordingly, the current observed extent of occurrence (EEO) is 4,412 km^2 and the area of occupancy (AOO) is 835 km^2, falling within the threshold values required for the inclusion in this category. On the basis of the inferred extension in the distribution range and the low number of locations (criteria A and D), the species falls into the category Vulnerable. Similarly to most invertebrate species, criteria C and E are not applicable due to inadequacy of thresholds and for the unavailability of information required for their application. The analysis of functional traits identifies the area of the Argentera-Mercantour massif as the most important area of conservation, hosting the populations characterized by higher performance in terms of body size, and thus representing the key area for future conservation policies. Moreover, according to ENM results, this area was inferred as the region with the highest climatic suitability within the current species range.

Poster presentation - Student

▲ Back to the Program

Spider conservation in Italy

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Despite their ecological importance and their diversity, spiders are still under-represented in conservation policies and conservation biology, especially compared to other invertebrate groups. Considering the international legislation, only one species (*Macrothele calpeiana*) is listed in the Bern Convention and in the Habitats Directive and only 20 species are reported in the Convention on International Trade in Endangered Species (CITES), none of which is naturally occurring in Europe. In addition, the risk of extinction of 199 species have been assessed by the International Union of Conservation of Nature (IUCN), 10 of which occurs in Europe. We provide a focus on the conservation of spiders in Italy, with reference to the species cited by the international legislation (*Macrothele calpeiana*), the Italian regional legislation (*Dolomedes plantarius* and *Argyroneta aquatica*) and the IUCN Red List (*D. plantarius*, *Hasarius adansoni*, *Vesubia jugorum* and *Pimoa delphinica*). In view of the remarkable diversity of the Italian fauna, we conclude that the current conservation of spiders in Italy is largely inadequate.

Poster presentation - Student

▲ Back to the Program

Detection of antibacterial proteins in embryos of different spiders species

Agnieszka Molenda, Marta Sawadro, Izabela Zogata & Agnieszka Babczynska

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Adult spiders have an innate immune system, connected mainly with the hemocytes – cells capable of an immune response based on phagocytosis or microbial encapsulation, as well as on the production of antibacterial proteins. Egg sac protects embryos from unfavorable environmental conditions. There are many reports on the role of cocoons, however there is a lack of knowledge about its role in the immune system of spider embryos. Therefore, in this study it was investigated whether embryos rely solely on the protective role of the cocoon, or whether they are also capable of producing peptides against pathogens by themselves. Three species of spiders were selected for the research: *Parasteatoda tepidariorum*, *Xerolycosa nemoralis* and *Agelena labyrinthica*. Each spider has a different type of parental care over the cocoon. Cocoons with embryos of the tested species were collected daily for 6 days beginning with the 24 h after laying the eggs. Nymph samples were collected 24 hours after hatching. In addition, two subgroups were designated in each age group: embryos left in the cocoon and eggs extracted from the cocoon, incubated in a Petri dish for 24 hours. To check the presence of one of the most common antibacterial proteins – lysozyme (14,4 kDa) and defensins (3-5 kDa), two complementary tests were performed. An electrophoretic protein profile was made using the ultra-low range marker (1,06-26,6 kDa). An enzyme-linked immunosorbent assay (ELISA) was performed, using anti-lysozyme and anti-defensin antibodies, to identify and confirm the presence of studied antibacterial substances and reveal possible age-connected quantitative differences. The final results indicate that the embryos of the tested spider species produce both types of proteins, as well as presumably other antibacterial molecules. Age groups in which lysozyme and defensins are significantly higher than in the reference group (24h) is 96-144 hour of embryos life. Lysozyme in all species is produced at a higher level than defensins. Deprivation of cocoon protection for 24 hours results in increased production of lysozyme only in *X. nemoralis* species. Presumably, this is related to the specific type of cocoon care that is heavily exposed to mechanical damage. This is the first study on the immune system of spider embryos - it has been proven that embryos may produce their own defense system – antibacterial enzymes – lysozyme and defensins.

Poster presentation - Student

▲ Back to the Program

Effect of fringe/surrounding vegetation on the abundance and diversity of paddy field spiders (Arachnida: Araneae) of Kol wetlands, Kerala, India

Karunnappilli S. Nafin & Ambalaparambil V. Sudhikumar

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Spiders are among the most common predators in the agricultural landscapes of rice paddy fields. A high degree of heterogeneity in the surrounding landscape have been demonstrated to have a positive effect on spider abundance and species richness on arable land. The non-rice habitats in the vicinity and periphery of rice fields sustain a reservoir of natural enemies during successive cultivation cycles and therefore command special attention. The present study was designed to evaluate the effects of fringe/surrounding vegetation on the abundance and diversity of spiders in the paddy field ecosystem. For this purpose, five paddy fields with varying degree of vegetation structure surrounding the plots were selected in the Muriyad Kol wetlands, which is part of the Vembanad-Kol Ramsar site. Each of these paddy fields consisted of two sampling plots: Plot 1 with < 5 m and plot 2 with > 25 m from the edge of the field. Based on bordering vegetation, plots were categorised into: type A with thick vegetation and average tree height of > 5 m, and type B with tall grass and small shrubs. The mean abundance, richness and diversity of spiders among the plots were compared. A total of 2,027 individuals belonging to 92 species were collected, of which 1255 individuals were collected from plot 1 and 772 individuals were collected from plot 2. From the pooled samples, plot 1 with type A vegetation had the highest estimated Species Richness (Chao 1) of 109.40 ± 16.06 (± SE), whereas the least estimated Species Richness of 43 ± 7.74 species was recorded at plot 2 with type A vegetation. The mean abundance of spiders varied significantly among the areas with plot 1 recording 77 ± 10.78 and plot 2 with 48.83 ± 3.92 individuals and, 88.11 ± 9.72 and 53.22 ± 5.38 individuals in vegetation types A and B respectively. Similarly, the average estimated Shannon diversity in plot 1 was 33.45 ± 7.55 and plot 2 was 18.78 ± 4.008 in vegetation type A, and 29.85 ± 5.28 and 18.89 ± 3.83 species in area 1 and 2 respectively with vegetation type B; they showed significant difference among the plots in both vegetation types. The study corroborates the positive effects of fringe or surrounding vegetation on the abundance and diversity of paddy field spiders.

ORAL PRESENTATION - STUDENT

▲ Back to the Program

Diversity of sand dune spiders in Great Indian Thar desert

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The Great Indian desert or Thar desert lies in northwestern region of India and adjoining area of Pakisthan. About 85% of the Thar desert is part of Rajasthan state. Much of the Thar desert is covered by sanddunes. These sanddunes are totally unexplored in arachnological point of view. So, this study was to find the diversity of spiders in sanddunes of Thar desert for the first time. Spiders were collected using methods like beating, aspiration, handpicking and inverted umbrella method for six months. Most diverse family collected was Salticidae followed by Thomisidae. Guild structure analysis of collected spiders revealed feeding guilds viz., stalkers, ground runners, foliage runners and ambushers. A preliminary inventory list of sanddune spiders is presented here. This is a pioneering attempt to record the spider diversity of the sanddunes of India.

Poster presentation

▲ Back to the Program

The spiders (Arachnida, Araneae) of the Arctic Islands

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Arctic fauna is relatively poor and consists mainly of the species with wide distributional ranges. This caused by the relatively small age of Arctic landscapes and harsh environmental conditions (Danks, 1981; Brochmann et al. 2003). Invertebrate faunas of the Arctic islands are specific because the processes of their formation differ from those on the mainland (Gislason 2005; Alsos et al. 2009). However, species composition of only few Arctic Islands and archipelagos, as Greenland, Dolgiy Island, Wrangel Island, Ellesmere Island, Svalbard have been described carefully. Available faunistic data from other Arctic archipelagos (e.g. Franz Jozef Land, Novaya Zemlya, Severnaya Zemlya, Novisibirskie Islands) and especially from small islands is fragmentary. A preliminary overview of the spider fauna of the Arctic Islands based on literature data and the original material is presented. The fauna includes at least 160 species. *Erigone psychrophila* and *Halorates spetsbergensis* inhabit almost every island; *Agyneta nigripes*, *H. holmgreni*, *Diplocephalus barbiger*, *E. arctica palaearctica*, *Hilaira glacialis* and *Masikia indistincta* are numerous also. The fauna of the adjacent Islands is most similar.

Poster presentation

▲ Back to the Program

A preliminary study on spider fauna of sacred groves in India

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Sacred groves are valuable gene pools and the first major effort of the society to recognize and conserve biodiversity. Besides preserving rich biodiversity, they help in soil and water conservation. Sacred groves are maintained intact for generations to support relic vegetation and are often among the best places to study endemism. At present most of the sacred groves are on a path of gradual decline owing to various socio economic factors. Like other groves of Kerala sacred groves of North Malabar region is also facing the threat of extinction from increasing anthropogenic activities. The study intends to carry out sampling of sacred groves of Northern Kerala having rich and diverse flora which can support a diverse array of spider fauna and to reveal the diversity and species richness of selected sacred groves. The sampling methods such as ground hand picking, areal hand picking and vegetation beating were used to collect specimens. The collected specimens were preserved and identified up to species level using available literature such as Tikader (1987), Sebastian & Peter (2009) and World Spider Catalog 2018. The diversity, richness and evenness were calculated using SPSS Program. A total number of 124 species of spiders belonging to 76 genera and 23 families were identified from above mentioned sacred groves. Family Araneidae were found as the most dominant followed by Salticidae, Theridiidae and Thomisidae. Nine families were observed as least dominant in the study area. This study was the first attempt to report the spider assemblage from these sites and serves as a base line for future study of spiders in sacred groves.

ORAL PRESENTATION - STUDENT

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Is cooperation in prey capture flexible in Indian social spider *Stegodyphus sarasinorum*?

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Among social spiders cooperation is considered as a key characteristic behaviour. The permanent social and cooperative spiders live their entire lives in communal web and nest. We assessed the spider cooperation under natural conditions in relation to the number of spiders in the colony and the nature of the prey captured by social spider *Stegodyphus sarasinorum* Karsch 1892 (Araneae: Eresidae). The study was conducted in Christ college campus (N 10°21' E 76°12'), located in Irinjalakuda town of Thrissur district, Kerala, India. We recorded the period of activity, nature of the prey, recruitment time, number of individuals recruited and time taken for immobilization. The period of activity was seen at 8 am and the period of inactivity was at 11 am. The prey remnants and live preys were collected and identified up to the order level. Five different orders viz. Coleoptera, Orthoptera, Hymenoptera, Hemiptera and Isoptera were identified. Beetles (Coleoptera) and grasshoppers (Orthoptera) were used to study the cooperative behaviour in this spider based on their abundance. Out of the 144 tests, 72 tests were carried out in the active period and the remaining tests were conducted in the inactive period. This study reveals that the immobilization time and recruitment time were limited in beetles i.e., the beetles were attracted faster than the grasshopper. But large numbers of spiders were recruited for ingesting the grasshopper when compared to beetles. The study concluded that the cooperative behaviour in *S. sarasinorum* is flexible and it depends upon the type of prey present.

ORAL PRESENTATION

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Tales from the crypt: origins and evolutionary history of the cave-dwelling Dysderidae spiders in the Dinaric karst

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Because of their large size, active predatory lifestyle and abundance, spiders of the family Dysderidae are among the most conspicuous creatures in European caves. In the Dinaric karst, cave-dwelling representatives belong to two out of three subfamilies, namely Rhodinae and Harpacteinae. The Rhodinae genera *Stalita*, *Parastalita*, *Mesostalita* and *Stalitella*, are exclusively formed by troglobiont species endemic to the Dinarides, while *Rhode* includes both epigean and subterranean species distributed in the central and western Mediterranean basin. The Harpacteinae are represented in the region by two subterranean genera, *Stalagtia* and *Folkia*, both Balkan endemics. Interestingly, Harpacteinae troglobiont species dwell in the southern Dinarides, while Rhodinae are mostly restricted to the northern part. The taxonomy of these groups, including their generic status, is a matter of debate and there has been no explicit, quantitative phylogenetic hypothesis about the relationships within or between the subfamilies so far. Here, we present the results of a multi-locus phylogenetic analysis using mitochondrial and nuclear genes of a thorough taxonomic sample both within Dysderidae and across most Synspermiata families. Our results support the monophyly of two subfamilies (Rhodinae and Dysderinae), but suggest that, as currently defined, Harpacteinae is not. All nominal genera within Rhodinae are indeed monophyletic. Conversely, within Harpacteinae the recovered clades are in conflict with current taxonomy, confirming previous suggestions that diagnostic traits at the genus level need to be re-evaluated. We further conducted a time estimation analyses using a combination of fossil and biogeographic node calibrations. Our time-stamped phylogenetic hypothesis allow us to further interrogate about the number and timing of the colonization events of the Dinaric underground environment.

Oral presentation

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Venom gland size and venom complexity – essential trophic adaptations of venomous predators: a case study using spiders

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Specialised predators possess variety of adaptations. In the venomous predators this may include size of the venom gland and venom composition. It is expected that due to different foraging strategies predators with a wide trophic niche (generalists) should possess larger venom glands that contain more diversified components than species with a narrow niche (specialists). We focused on spiders, as the most diversified group of venomous predators, in which a wide variety of trophic strategies has evolved. We conducted a comparative analysis using 40 spider species, in which we measured the size of their venom gland and its complexity using proteome profiling methods. The species were classified into three trophic groups: generalists, facultative specialists, and obligatory specialists. We found that the venom glands of generalists are larger than those of obligatory specialists, which is presumably due to more frequent prey capture by the former. The complexity of venom, of peptides (2-15 kDa) and proteins (15-250 kDa), was more diverse in generalists than in specialists. Multivariate analysis of venom revealed significant differences among the three trophic categories only in the complexity of peptides. Our study thus shows that venom gland size and its content have taken different pathways during the evolution of trophic strategies in spiders. Generalists evolved larger venom glands with more complex composition, whereas obligatory specialists possess smaller glands with less diverse chemical structures, presumably containing prey-specific toxins.

ORAL PRESENTATION - STUDENT

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Just add water and age! Cribellate silk stickiness increases at high humidity across ontogeny in the Tasmanian cave spider, *Hickmania troglodytes*

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Cribellate silk is a composite of puffy cribellar nano-fibrils that surround strong axial fiber generates van der Waals and hygroscopic forces that adhere and entangle captured prey in webs. Maintaining attachment of prey to the web is of high importance to the spider, as it needs to locate and subdue struggling prey within seconds. Therefore, understanding how biotic and abiotic factors, such as ontogeny and humidity, influence the adhesive performance of these threads can provide insights into the preferred foraging habitats and capture abilities, particularly for spiders living in harsh environments. We tested the adhesive performance of cribellate silk from the Tasmanian cave spider, *H. troglodytes* (Family: Austrochilidae); an ancient spider with a long lifespan that lives in caves of near complete atmospheric water saturation. We found that silks tested at high humidity (>90% RH) generated more force at detachment and performed more work of adhesion than silks tested at lower humidity (~45% RH). Interestingly, we also found adhesive properties to increase with ontogeny, which we speculate is due to increased number of cribellar fibrils as shown in other species, but only when tested at high humidity. Our results demonstrate a unique case where the extreme conditions of the cave environment enhance the performance of a phenotypic feature in a spider. Furthermore, our findings highlight the importance of the incorporation and use of water in a capture silk system typically seen as a “dry” adhesive.

Oral presentation

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Temporary emigration of a cave-dwelling harvestman species

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Cave systems are less transparent than surface habitats and significantly less is known about movement patterns and intrinsic behavioural processes of cave-dwelling animals. Because these animals are difficult to study with traditional tracking techniques, we resort to the capture-recapture modelling framework to assess temporary emigration. We investigated the influence of cave, surface weather variables, season, individual heterogeneity and sex on the temporary emigration of the *Paranemastoma silli silli* (Herman, 1871). We used multistate capture-recapture models on individually marked adults of two populations inhabiting two caves, Closani and Lazului Caves, located in the Mehedinti Mountains in southwestern Romania. Adult harvestmen demonstrated clear seasonality and heterogeneity in temporary emigration. We found that temporary emigration of harvestmen exhibited between caves variation and there was little support for surface weather variables in controlling temporary emigration. Our results highlight that the study of temporary emigration patterns is useful to gain valuable insights into movement and intrinsic behavioural processes of cave-dwelling species.

POSTER PRESENTATION - STUDENT

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Gravity hypothesis cannot explain the maintenance of extreme sexual size dimorphism in *Nephilingis cruentata*

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Selection pressures leading to extreme, female biased sexual size dimorphism (SSD) in spiders are still debated. For example, the gravity hypothesis predicts that adult male sizes are constrained by body mass, which limits adult dispersal ability over a certain size threshold (carapace width = 4.17 mm; mass = 42.5 mg). We tested whether male size affects climbing and bridging ability in *Nephilingis cruentata*, an orbweaver with extreme SSD and high variation in male size (carapace width = 1.16 – 1.77; mass = 3.0 – 14 mg). Males of different sizes were placed in a vertical platform and video recorded to calculate climbing speed. For testing bridging ability, we measured the duration of the crossing of the bridging thread, as well as its sagging distance. Against the predictions, smaller size did not confer males with an advantage in climbing or bridging speed. In fact, larger males were faster in the climbing ($P < 0.001$), but not in the bridging trial ($P = 0.746$). We therefore find no support for gravity affecting the dispersal ability in *N. cruentata* males. We conclude that the gravity hypothesis has only a limited overall explanatory power for the maintenance of extreme SSD.

Oral presentation - Student

▲ Back to the Program

Reactions of mantises towards anti-predatory defence of *Eresus kollari* and its potential models

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Aposematism and mimicry are among extensively studied topics especially in the context of evolutionary ecology and cognitive ethology. However, our knowledge on these phenomena may be biased due to the fact that the used spectrum of predators is usually limited to model species of birds. This may be the case of antipredatory defence and mimetic relationships of the ladybird spider *Eresus kollari*. Aposematic males of this species are considered to be Batesian, unprotected mimics of some other, protected species. This assumption is based on their vulnerability to airborne bird attacks, but the situation may be more complicated with other predators. In our study, we used the *Mantis religiosa* as a predator. The preying mantis is quite common at localities of *E. kollari*, so a potential predator-prey relationship can be expected in these two species. In addition to the ladybird spiders, we presented three similar prey species to the mantises: the seven-spot ladybird (*Coccinella septempunctata*), a stink bug species *Graphosoma lineatum* and the firebug (*Pyrrhocoris apterus*). These three species are known to possess defence mechanisms that are effective against other predators, especially birds, and may therefore serve as models of *E. kollari*. Reactions of the mantises towards the presented prey are discussed in context of previous experiments focusing on antipredatory defence of the studied species.

Poster presentation

▲ Back to the Program

Consequences of early sexual interactions in the Uruguayan subsocial spider *Anelosimus vierae* (Theridiidae)

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In many spiders, it is common that the adult male detects subadult♀ and guards them until they reach adulthood. The attractiveness of subadult♀ can vary during the penultimate stage, becoming more attractive just before the final molt. The subadult females of the subsocial spider *A. vierae* are very attractive to males. The subadult females could court, adopting a receptive posture and perform "pseudo-copulation": males do insertion attempts by drumming to the epigynum. We want to know the consequences and possible benefits of the pseudo-copulation in both sexes of *A. vierae*. The specific objectives are: 1) can the penultimate female be able to modulate their development rate until adulthood, according to the occurrence of pseudocopulation? 2) Are differences in mating latency between couples with previous sexual experience and sexually naive partners? 3) Have males any preference of mating when exposed to females that had sexual experience during their penultimate stage and sexually naive females? In the laboratory, we made 4 groups of 30 penultimate females with different age and were faced to virgin adult males, performing couples. The sexual interactions were registered and analyzed by J-Watch. Only the aged penultimate females accepted the courtship and pseudocopulate. We found that the latency towards the last molt in subadult females with and without sexual experience was similar. Couples of individuals who have previous sexual experience copulated more quickly than couples formed by at least one individual without sexual experience. Finally, individuals who had prior sexual experience prefer to copulate with other individuals who also had it. Pseudocopulation may be disconcerting at first glance, because it is presumed to have energy costs without the benefits associated with. However, these results indicate that this behavior has positive effects on future sexual encounters. In future studies we would evaluate if the pseudocopulation occurs in other species of *Anelosimus* with different degree of sociality. This information added to other behaviors could allow us to understand better the evolution of sociality.

ORAL PRESENTATION - STUDENT

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A morpho-functional comparison of antenniform legs in Pedipalpi

Jens Runge & Christian S. Wirkner

Allgemeine und Spezielle Zoologie, Universität Rostock, Rostock, Germany

Arthropodia are seen as key inventions having facilitated the evolutionary success of Arthropoda. The subdivisions in podomeres in combination with the segmental arrangement along the arthropod body are crucial aspects of their versatility. In association with tagmatization, arthropodia underwent large evolutionary changes thus enabling a variety of biological roles like swimming, prey capture or carrying sensory organs etc. With regard to the latter, antennae are the most specialized forms of appendages, which are only found in mandibulates, i.e. myriapods, crustaceans and hexapods. In chelicerates such specialized appendages are primarily missing. Nevertheless, within Arachnida several taxa evolved antenniform legs by transformation of the anterior-most walking leg. Most prominent example for well developed antenniform legs are the Pedipalpi (Amblypygi + Uropygi). Their antenniform legs are especially elongated, reduced in diameter and highly subdivided compared to walking legs. From a functional point of view, antenniform legs are characterized by a high motility. However, the reasons for this high motility remain uncertain as morphology of antenniform legs is sparsely studied. In our morpho-functional approach, we highlight joint morphology and the muscular arrangement of antenniform legs in representatives of Amblypygi and Uropygi. Using high-resolution micro-computed tomography and 3D-reconstruction we give detailed visualizations of leg morphology. Subsequently, we compare these patterns to the ground pattern of walking legs thus trying to reveal the evolutionary changes towards antenniform legs. Moreover, the antenniform legs are compared between the two groups. The comparison reveals distinct morphological differences despite the monophyly and the supposed homology of antenniform legs within Pedipalpi. Therefore, morphological differences will be discussed in the light of the two alternative evolutionary scenarios: (1) homologous evolution with later differentiation at least within one taxon or (2) convergent evolution of antenniform legs within Pedipalpi.

Poster presentation - Student

▲ Back to the Program

The prosomal endoskeleton and musculature in *Galeodes granti* (Solifugae)

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Solifugae are fast predators with a peculiar morphology of the locomotor system. With respect to the prosoma, this means that all coxae are immobilized and an endosternite is missing. In other arachnids, the endosternite generally serves as attachment site for the extrinsic musculature, which connects to the coxae of the walking legs. Both muscles groups are missing within the prosoma of Solifugae. Due to the immobilized coxae, the movement of the leg against the body is realized within the coxa-trochanter joint. The corresponding musculature therefore serves as (secondary) extrinsic musculature. Instead of the missing endosternite, Solifugae have a central endoskeleton, which is composed of dorsally elongated coxal apodemes. This endoskeletal system serves as attachment sites for muscles attaching to podomeres within the leg. We reinvestigated the complex prosomal morphology in *Galeodes granti* by conducting high-resolution micro-computed tomography. The 3-dimensional analysis aims at facilitating a better understanding of the complex morpho-functional interrelations of skeletal and muscular elements in the prosoma of Solifugae.

ORAL PRESENTATION

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Three-dimensional modelling in arachnology on example of *Porrhomma*-species (Araneae: Linyphiidae)

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Three-dimensional modelling has shown its importance in many fields, zoological systematics included. For the first time, 3D models of vulvae were used in distinguishing of similar species. Distinguishing of females of *Porrhomma egeria* and *P. campbelli* according to only dorsal and ventral views is very difficult. The same is true for the pair *P. microps* and *P. profundum*. Caudal view is necessary for distinguishing of vulva of these pairs of species. To visualize important morphological characters, 3D models were reconstructed in Blender 3D. 3D model combines all important views of female genitalia – ventral, dorsal, lateral and caudal views – in one object.

Oral presentation

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Shifts in the community structure of spiders over four years after forestry treatments

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There is a paradigm shift in Central Europe from the traditional forestry systems towards continuous cover forestry resulting in a diversification of management practices. We followed the effects of four forestry treatments over four years in a mature temperate sessile oak - hornbeam forest on the community structure of ground living spiders in Northern Hungary. Management types belonged either to rotation system (preparation cutting, clear-cutting, retention tree group) or to selection forestry (gap creation) and were studied together with unmanaged control blocks. We intended to follow changes in a Before-After-Control-Impact (BACI) design in a complete block setup with six replicates for each treatment. Spiders were collected by 4 pitfalls in each 30x30 m block. Before treatment samples were collected in 2014 in all plots. Here we summarize the responses of the spider community between 2014-2017. There was a considerable yearly variation in spider species richness and abundance, but controlling for this by the yearly changes in the control plots we could observe a continuous increase of both spider abundance and species richness in all treatments as compared to the control. The treatments resulted in significant changes in biotic and abiotic environmental variables, out of which spider community structure was mostly influenced by the increase in herb cover and temperature and the deficiency in canopy closure defining two distinct species groups that reacted in an opposite way to these variables, while spring litter mass was also an important variable, favoured by a third species group. The Principal Response Curve analysis revealed that spider communities in all forestry treatments in a rather similar way departed gradually from communities in the control plots in the first two years after treatment implementation, which change seemed to halt or even turn back in the third year. Ongoing experiments are likely to uncover the longer term dynamics of changes in forthcoming years.

The study was supported by Hungarian Research Found (OTKA 111887) and by the National Research Development and Innovation Office (GINOP-2.3.2-15-2016-00019).

Oral presentation

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Allatoregulatory neuropeptides role in vitellogenesis process of *Parasteatoda tepidariorum* (Araneae, Theridiidae) spider females

Marta Sawadro, Agata Bednarek, Agnieszka Molenda & Agnieszka Babczyńska

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Functions of the nervous and neuroendocrine system of spiders are still not fully understood. Recent reports confirmed the synthesis of allatoregulatory neuropeptides in *Parasteatoda tepidariorum* (Araneae, Theridiidae). It indicates that neurohormonal regulation of physiological processes in this spider species is present. The main goal of this study was to check whether allatostatin A, allatostatin C and allatotropin play a role in the vitellogenesis process in females of *P. tepidariorum*. Functions of allotoregulatory neuropeptides were recognized by analyzing the concentration of vitellogenins and expression of genes encoding vitellogenins (PtVgs) after injection of synthetic allatoregulatory neuropeptides. Injections of 10-3 M, 10-5 M and 10-7 M neuropeptides solutions in females in the penultimate stage of the nymph (35th day of development) were performed. The expression of PtVgs genes in the midgut glands and ovaries were measured by the real-time polymerase chain reaction (qPCR), whereas the concentration of vitellogenins in the in the midgut glands, ovaries and hemolymph were analyzed by enzyme-linked immunosorbent assay (ELISA). The obtained results confirmed that the process of vitellogenesis in *P. tepidariorum* was controlled by allatoregulatory neuropeptides. Allatostatins were recognized as inhibitors of the vitelogenesis process, resulting in decreased expression gene encoding the vitellogenins and inhibition of vitellogenin synthesis, while synthetic allatotropin acted as a stimulator of vitelogenesis, resulting in induction of expression gene encoding the vitellogenins and caused an increased synthesis of vitellogenin.

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Oral presentation

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Methyl ketones in *Nemastoma triste* – a chemical link between Cyphophthalmi and Dyspnoi

Miriam Schaider & Günther Raspotnig

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A pair of large prosomal exocrine glands, so-called scent glands, are present in all harvestmen species and thus, they represent an ideal model system for reconstructing the evolutionary history of exocrine secretion chemistry. However, while the secretions of Laniatores (phenols, benzoquinones, vinyl ketones), Cyphophthalmi (naphthoquinones, methyl ketones) and some Eupnoi (naphthoquinones, benzoquinones, ethyl ketones) are fairly well studied, the scent gland chemistry of the Dyspnoi and its relation to the remaining suborders is still unclear. Until recently, only four species of the dyspnoan family Nemastomatidae were studied revealing naphthoquinones, anthraquinones, methyl and ethyl ketones. The latest report on dyspnoan secretion chemistry refers to the nemastomatid *Nemastoma triste* that produces straight-chain methyl-ketones (heptan-2-one, nonan-2-one, 6-tridecen-2-one, 8-tridecen-2-one), methyl-branched methyl-ketones (5-methyl-heptan-2-one, 6-methyl-nonan-2-one), naphthoquinones (1,4-naphthoquinone, 6-methyl-1,4-naphthoquinone) and chloro-naphthoquinones (4-chloro-1,2-naphthoquinone, 4-chloro-6-methyl-1,2-naphthoquinone). Chemically, the secretions of *N. triste* are remarkably reminiscent of those found in Cyphophthalmi. While naphthoquinones are widely distributed across the scent gland secretions of harvestmen (all suborders except Laniatores), methyl-ketones and chloro-naphthoquinones arise as linking elements between cyphophthalmid and dyspnoan scent gland chemistry.

Plenary talk

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Sex specific plasticity in life-history and the mating system of *Nephila senegalensis*

Jutta Schneider

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The genus *Nephila* is well known for its extremes, such as the extreme size differences between the sexes, their extremely large golden orb-webs and their curious adaptions to an unusual mating system such as regular sexual cannibalism, mate plugging, male emasculation, one-shot genitalia and spermatogenesis that terminates at maturation. However, species differ in presence-absence and the combination of the above traits. I will present data from several experiments on *Nephila senegalensis* from Southern Africa, a species with a pronounced reversed sexual dimorphism and a very large variation within each sexes. Using controlled feeding studies in a split-brood design we explore the causes and fitness consequences of this variation and shed some light on sex-specific selection pressures. Staged mating competition between two males from different size classes revealed balanced paternity gains of large, medium and small males although achieved by different means. Genital damage does not occur in *N. senegalensis* and males can mate repeatedly although they can only charge their pedipalps once. Hence, while males have a potentially unlimited mating rate, the limitation in sperm supplies opens the scene for curious sperm investment strategies explained to some degree by interactions between male and female body sizes. The recent discovery of endosymbiotic bacteria that seem to influence crucial selection parameters such as sex ratio but also growth, adds another level of complexity to this fascinating study system.

Plenary talk

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Spiders with tales to tell: fossil evidence of the stem group of the Araneae

Paul Selden

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Ten years ago, a new order of arachnids was described, based on some fossils from the Devonian (c. 385 Ma ago) and Permian (c. 275 Ma ago): the Uraraneida. These were defined as spider-like animals which displayed silk-producing spigots but which were not borne on spinnerets, and a flagelliform telson. Uraraneids demonstrated that silk glands evolved in the stem lineage heading towards true spiders, but before the genetic mechanism for opisthosomal appendages had been reactivated. This year, a new protospider was discovered in Burmese amber, merely 100 Ma in age. This animal, *Chimerarachne yingi*, appears to be a missing link between the uraraneids and true spiders in that it possesses not only a flagelliform telson but also fully formed spinnerets bearing spigots. In this talk, these animals are described, their contribution to our knowledge of spider evolution, especially of the silk-producing mechanism, is discussed, and the possibility of new animals which occupy the resulting gaps in the record is postulated.

Oral presentation

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Costs and benefits of immature mating in the cannibalistic brown widow spider *Latrodectus geometricus*

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Males of many species of spiders cohabit with immature females; mating, however, occurs only after maturation of the female. Generally, maturation is connected to a suite of changes in morphology, physiology and behaviour and only after the final moult to maturity the genital organs are considered to be fully developed. In the brown widow spider *Latrodectus geometricus*, however, mating with immature females is common and even results in the successful production of offspring. These females moult to adult stage and then produce viable eggs fertilized by sperm from mating as immature. From the male perspective, immature mating is beneficial in this species, because males that mate with immature females are not cannibalized and can achieve more than one mating. Mature females, on the other hand, generally cannibalise males and thereby limit them to a single copulation. We conducted choice experiments in order to elucidate whether males are able to distinguish immature from mature females and whether they prefer to mate with the immature, non-cannibalistic females. In contrast to our expectations, males showed no clear preference for immature females. One of possible explanations is that there are costs arising from immature mating. These costs can vary from loss of sperm in the moulting process to disadvantages in sperm storage due to unfavourable storage conditions. Therefore, we investigated mechanistic aspects of the two mating types. Specifically, we inspected morphology of the female copulatory organs in immature and mature females by means of non-invasive micro-computed tomography (Micro-CT) as well as classical histology. We discuss our results in the light of male mate choice and potential costs and benefits of the immature mating.

Oral presentation

▲ Back to the Program

The exotic araneae collection of Octavius Pickard-Cambridge; access denied but we are in great spirits

Zoë Simmons

Life Collections, Oxford University Museum of Natural History, Oxford, UK

The Oxford University Museum of Natural History (OUMNH) has held the O. Pickard-Cambridge collection of Arachnids since its donation in 1917. O. Pickard-Cambridge was the single most productive British researcher of arachnids, describing over 1600 species, of which 1402 are spiders. More than 900 of these are still valid species. The vast majority of the type specimens are thought to be in the OUMNH collection but only a small percentage have been specifically located and documented. There are a number of other challenges associated with accessing the material that has led to this collection being vastly understudied by researchers. April 1st 2018 saw the launch of the 'In Great Spirits' project that seeks to alleviate some of the immediate obstacles associated with this collection through both a robust documentation project and refurbishment of the store. Implementation of a new museum-wide database system means that this information will be accessible to researchers globally. This freshly available data is already impacting collections strategy and future plans for development will be outlined, along with the growing opportunities for researchers to work with this historically important collection.

Poster presentation - Student

▲ Back to the Program

The environmental conditions and the selection of the wintering site for spiders overwintering in terrestrial shells of gastropods

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Empty shells of gastropods represent, in nature, a significant, multipurpose refugium for various species of invertebrates. The most numerous inhabitants are spiders, which use them most often for over wintering in the steppe areas. Shells are inhabited by non-abundant and rare species, demanding on the conditions of the steppe and its management, as well as on the specific characteristics of the shells. Significant in this case are also various types of post-industrial sites or military spaces. Due to blocked succession, these secondary locations provide similar environmental conditions for steppe species. The research was based on the collection of empty shells of two species of gastropods - *Caucasotachea vindobonensis* and *Xerolenta obvia* and variously large bullet shells with the presence of a cobweb on the steppe areas of southern Moravia. In the case of shell collection, environmental conditions (exposure and slope of the area, management, presence of moss, grass, herbs, presence of bare soil and stones) and characteristics of shells (soiling, damage, age of the shell or sinking in the soil) were investigated. These conditions could significantly affect the abundant use of shells. A total of 889 shells and 57 bullet shells were obtained, of which 175 spider (17 species with two indefinite individuals from families Theridiidae and Linyphiidae) were obtained. In both cases, the most abundant species was *Pellenes nigrociliatus*. A strong affinity of this species to the shell *X. obvia* was confirmed from previous studies. Interesting is its high occupancy of bullet shells (48%). Thus, *P. nigrociliatus* uses so many different, often atypical forms of hiding place that the environment provides. Other important species include *P. tripunctatus*, *Sitticus penicillatus*, *Euryopis quinqueguttata*, *Steatoda albomaculata* and *Cheiracanthium pennyi*. Positive results within the environmental characteristics were resulted in the presence of low and sparse vegetation, the presence of bare soil and a stone substrate. The sinking of the shell was negative.

Oral presentation - Student

▲ Back to the Program

The spatial distribution of epigeic spiders and other ground-dwelling arthropods within the Apšuciems calcareous fen: a response to vegetation heterogeneity

Maija Štokmane

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Calcareous fens belong to the most species-rich ecosystems of the temperate zone of the Northern Hemisphere. At the same time, however, calcareous fens are very rare in most of the countries in the European Union, including Latvia, and therefore it is necessary to evaluate the quality of this rare habitat type. As good bioindicators, spiders are potentially useful tools for assessing the conservation value of rare and threatened habitats, thereby it would be really worthwhile to study spider ecology in calcareous fens. The aim of the present study was to assess the spatial distribution patterns of spiders within the chosen calcareous fen and to discover the factors which could potentially influence this distribution. The research was carried out in the calcareous fen Apšuciems in 2012. The sample plots were located in a regular pattern throughout the whole fen, and the pitfall trapping was used as the spider sampling method. Other ground-dwelling invertebrates (non-Araneae arthropods) were also collected with pitfall traps. The data on the vascular plant species composition, richness, and diversity were also obtained. In order to detect the spatial diversity patterns of spiders, non-Araneae arthropods and plants within the Apšuciems fen, the hotspot maps of their distribution were created. In addition, the data were also interpreted using the ecological ordination techniques. A total number of 1,831 spider individuals, belonging to 61 species from 17 families were registered during the investigation. The largest taxonomic groups of non-Araneae invertebrates recorded in the studied fen were ants (Formicidae; 4,999 individuals), woodlice (Isopoda; 507), ground beetles (Carabidae; 405), rove beetles (Staphylinidae; 269), harvestmen (Opiliones; 224) and millipedes (Diplopoda; 181). The results showed that most spider species were not evenly distributed within the fen, but had a patchy or aggregated distribution and showed a rather high habitat specialization. Overall, spider diversity hotspots visually overlapped with those fen places where the plant diversity was higher. Similarly, the highest densities of non-Araneae arthropods also occurred in the fen spots with higher plant diversity. The main conclusion from the present study is that both spiders and non-Araneae arthropods respond to similar habitat features and that the type of the vegetation has a great influence on the composition of spider and other arthropod assemblages.

ORAL PRESENTATION - STUDENT

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Conservation of a pH-sensitive structure in the C-terminal region of spider silk extends across the entire silk gene family

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Spiders produce multiple silks with different physical properties that allow them to occupy a diverse range of ecological niches, including the underwater environment. Despite this functional diversity, past molecular analyses show a high degree of amino acid sequence similarity between C-terminal regions of silk genes that appear to be independent of the physical properties of the resulting silks; instead, this domain is crucial to the formation of silk fibres. Here, we present an analysis of the C-terminal domain of all known types of spider silk and include silk sequences from the spider *Argyroneta aquatica*, which spins the majority of its silk underwater. Our work indicates that spiders have retained a highly conserved mechanism of silk assembly, despite the extraordinary diversification of species, silk types and applications of silk over 350 million years. Sequence analysis of the silk C-terminal domain across the entire gene family shows the conservation of two uncommon amino acids that are implicated in the formation of a salt bridge, a functional bond essential to protein assembly. This conservation extends to the novel sequences isolated from *A. aquatica*. This finding is relevant to research regarding the artificial synthesis of spider silk, suggesting that synthesis of all silk types will be possible using a single process.

POSTER PRESENTATION - STUDENT

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Let's rearrange! Structural dynamics of holokinetic chromosomes in small buthid scorpions (Buthidae: *Gint*)

Jana Štundlová, Pavel Just, František Kovařík & František Šťáhlavský

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Buthids represent deeply diverged and most diverse lineage within the order Scorpiones. In comparison with other scorpion families, they uniquely possess holokinetic chromosomes that are characteristic of the ability to attach spindle microtubules along their entire length. In the case of chromosomal aberrations (e.g. fission, fusion), such a property may ensure accurate meiotic segregation of the resulting chromosomal fragments. Buthid scorpions are distinguished by the frequent occurrence of heterozygous chromosomal rearrangements which points to dynamic structural changes of their genome organization. Although Buthidae represents the most commonly investigated group of scorpions from the cytogenetic point of view, the comprehensive information about cytogenetic aspects still lacks in 93% of species. In the present study, we investigate the species of *Gint*, small buthid scorpions endemic to the Horn of Africa, using standard and molecular cytogenetic techniques to deepen the knowledge of karyotype dynamics of the genus. We performed comparative analyses of four species tracking karyotype differences at various structural levels: chromosome complement, rDNA distribution, and heterozygous interchromosomal associations. Our results show that, unlike other African scorpion genera with stable karyotypes (e.g. *Androctonus*, *Buthus*), *Gint* displays striking interspecific variability in all cytogenetic aspects investigated. Notably, various types of heterozygous chromosomal rearrangements occurred frequently resulting in intraspecific polymorphism in some species. This indicates a high incidence and an accumulation of independent chromosomal translocations or fusion/fission events in karyotypes of species studied.

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Oral presentation

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Changes in per capita interaction strength between spider and grasshopper during anomalous temperature rise in summer season

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Over the 20th century, prodigious changes are taking place in the climate patterns of the world, including changes in temperature, precipitation and wind patterns. Projected ramifications of climate change shows that, the global average temperature is likely to increase twofold in the upcoming years compared to last hundred years. This change has the potential to aggravate the water scarcity in some areas, but mitigate them in others. According to previous eco-physiological studies, animals respond to water scarcity by increasing consumption of moist food or by decreasing water losses. Understanding and predicting the impacts of climate change on species interactions and ecosystem processes is critical for planning future mitigation efforts. Experiments reported here are focused on wolf spider *Pardosa sumatrana* Thorell, 1890 (Araneae: Lycosidae). Changes in interaction strength between spider and grasshopper were studied under water supplemented and drought conditions. Experimental setup in the field consisted of four pairs of water supplemented and drought plots. Independent sample t-test was conducted to compare the interaction strength in two conditions. The interaction strength was found to be strong in both water supplemented and drought plots. This may be due to the anomalous increase in temperature that occurred during the experiment. This study shows that climate change induced alterations in availability of water can significantly affect the interaction strength between spiders and its prey. Although interaction strength was slightly higher in drought plot than in water supplemented plot, both showed strong and negative interaction. This may be due to record temperature rise that occurred during the study period. This supports the fact that when temperature rises to bring drought condition, animals respond by increasing consumption rate as indicated by most physiological models of animal water balance. Temperature was so high so that even in water supplemented plots spiders became water stressed and had to increase consumption rate to compensate the water loss. This unprecedented rise in temperature during the experimental period also resulted in massive death of experimental animals in drought plots. This study shows that issues raised by climate change can seriously affect the ecosystem processes that plays critical role in maintaining the persistence and stability of ecosystem.

ORAL PRESENTATION - STUDENT

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Effect of forest fire on diversity of spiders - a case study from Western Ghats, Kerala, India

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Western Ghats is a mountain range that runs along the western side of India and is one of the hot spots of biological diversity in the world. Wayanad Wildlife Sanctuary is the part of the Western Ghats and also the second wildlife sanctuary in Kerala. It is bestowed with lush green forests and rich animal life and houses some of the rare and endangered species of both flora and fauna. However, the forest fires continuously ravage this protected area during the summer season and poses great threat to the forest vegetation and wildlife. The present study compares the diversity, richness and abundance of spiders in the burned and unburned habitats of Wayanad Wildlife Sanctuary. The study was conducted in the three selected habitats of the sanctuary, mainly teak plantation, grassland and moist deciduous forest. The nine months survey after the fire resulted in the documentation of a total of 6806 individuals of spiders belonging to 237 species, 109 genera and 25 families. The overall species richness of spiders was significantly higher (229 species) in the unburned habitats than in the burned habitats (76 species). In the burned habitats, the maximum species richness (50 species) was recorded from moist deciduous forest, followed by teak plantation (48 species) and grassland (23 species). The species richness of unburned moist deciduous forest, teak plantation and grassland were 151, 120 and 58 species respectively. When all burned habitats were compared to unburned habitats, the one-way ANOVA showed significant differences between the species richness, abundance and diversity among teak plantation, grassland and moist deciduous forest. Our results demonstrate that the overall species richness, abundance and diversity were higher at the unburned habitats than the burned habitats. Furthermore proves that, fire has a significant impact affecting the diversity, richness and abundance of spiders.

Poster presentation

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Using large-scale, non-destructive comparative morphology to study visual and sensory evolution in spiders

Lauren Sumner-Rooney & Zoë Simmons

Oxford University Museum of Natural History, Oxford, UK

Vision has been one of the most important evolutionary innovations in animal history. The ability to navigate, forage and seek mates using complex light cues revolutionised the way animals interacted with each other and their environment and had a dramatic direct impact on the evolution of animal life. The evolution of sensory structures and brains is believed to be interlinked, with the brain evolving in parallel with sensory systems as they become more complex. These systems offer an exquisite framework for studying an enormous variety of broader evolutionary processes. Both are complex, diverse and 'advanced' biological innovations, but comprise fundamental units, are conserved across high-level taxonomic groups, and are subject to stringent selective pressures, making them excellent evolutionary model systems. Our aim is to generate high-throughput non-destructive soft tissue imaging data using synchrotron technology to study the evolution of eye and brain structure in spiders. Although few species are visual hunters, spiders display an enormous range of visual abilities and structures, and behaviours including courtship, navigation and prey capture can rely heavily on light cues. Most species are equipped with four pairs of eyes in two distinct groups that differ in their retinal structure, innervation, photoreceptor composition and development, and usually fulfil different roles. In the largest comparative study of eye and brain architecture to date, we will use morphological data, contextualised phylogenetically, to study fundamental evolutionary patterns linking eyes, central nervous systems and ecological shifts. These include the elaboration, adaptation and loss of eyes, the parallel changes evident in brain structure, identification of new neurocladistic characters, the neural consequences of eye loss and sensory reinvestment in other modes such as mechanoreception, and potentially markers for the impacts of anthropogenic changes including light pollution. Comprehensive, high resolution datasets will provide extraordinary resolving power previously unseen in evolutionary neurobiology, and this approach could herald a new framework for studying macroevolutionary processes, with a particularly important role for natural history collections. We are currently appealing for suggested study groups and the loan or donation of material, particularly from Deinopidae and Caponiidae, as well as lycosids and salticids with unusual visual habits or habitats.

Oral presentation - Student

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Spider assemblage structure and functional diversity patterns of natural forest steppes and exotic forest plantations

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The majority of natural forest steppes in Central-Europe were converted to forest plantations, a significant part of plantations are composed of exotic pine trees. This brings dramatic changes in habitat structure. The formerly open-canopy forest patches and grasslands became closed-canopy forests and key habitat factors were altered, such as microhabitat diversity, plant species composition, microclimate, and amount of dead organic matter. Here we studied the difference in spider species richness, assemblage composition, and functional diversity of native forest steppes, exotic pine plantations, their edges, and adjacent grasslands. We selected 10 native forest patches and 10 pine plantations in commercial maturity, all plantations had direct interface with extensive forest steppe areas. We sampled spiders in forests, forest edges, and adjacent steppe grasslands, resulting in 60 sampling plots. We found different species composition in natural forest patches and pine plantations; however forest edges and grasslands near forest edges did not differ significantly. Spiders with preferences for shaded and humid habitats were associated with forests. Web builders were associated with pine plantations and their edges, large vegetation dwelling spiders had preferences for grasslands and native forest edge, and ballooning spiders were associated with grasslands and edges. Pine forest belts around natural forest steppe patches, besides being low quality secondary habitats for forest steppe spiders, also hamper effective dispersal; the high density of trees and the lower wind speed may act as barriers for effective ballooning. Contrary to our expectations, we found lower functional diversity at natural sites than at pine plantations. The hot and dry microclimate of natural forest steppes favours some trait states (e.g., drought-tolerant, preferences for open habitats), and this may lead to convergence in trait values and a lower functional diversity of forest steppe spider assemblages than the that of assemblages in pine plantations.

Poster presentation

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"Join the army": a Mediterranean area expansion from Hungary, the case of *Zodarion zorba*

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Up until the end of the XXth century, *Zodarion germanicum* was represented in Hungary as the only species of the family Zodariidae. Since 1990 more and more data have been gathered of *Zodarion rubidum*, which probably occurs here due to its northern area expansion. The third species *Zodarion zorba* belongs to the *spinibarbe* group, which has a remarkable diversity in the Eastern Mediterranean. It has been described recently and its first record from an army target practice area in Hungary five years ago was a great surprise. Males have been collected via pitfall traps in a calcareous sandy steppe habitat in high numbers. Based on the high abundance of males in May, targeted collections in June 2014 were successful in getting the hitherto unknown female of the species. In the past 5 years, we have collected hundreds of specimens. We illustrate the male and the female with original drawings and images. The ant species *Lasius psammophilus* was the dominant ant species on the collecting sites, and it is very likely to serve as a specific prey of *Z. zorba*. The disjunct occurrence of *Z. zorba* (in Peloponnese, Greece and in Kisalföld, Hungary) suggests human-associated introduction as the explanation. Moreover, the practice area was used by a troop that had previously participated in a Greek military exercise in early 2000's. *Mermessus trilobatus* has a similar case, as it has been brought in to Europe with North-American military vehicles (Nentwig et al. 2015). We have an extensive sampling protocol since 2009, so we suspect *Z. zorba* was present in a very low number in the area. In 2017 it was the dominant species of the whole area in May. We conclude that the mesoclimate of the calcareous sandy steppe habitat was adequate to propagate the species, and it has found its adequate prey, *Lasius psammophilus* as well. We expect the further expansion of this species in Central-Europe.

The study was supported by projects LIFE08NAT/H/000289.

Poster presentation

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East side story: review of the *Loureedia* species (Eresidae)

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Loureedia is one of the most extravagant colored velvet spider genus, described 6 years ago, to accommodate a single species *Loureedia annulipes*. Despite the type locality is not precisely known, many specimens have been reported from Israel and many South Mediterranean country, like Lybia, Egypt and Tunisia. Last year a new species *L. maroccana* has been described as the westernmost species of the genus. Here we describe two more species, *Loureedia pooyani* from Tehran expanding the genus' range by 2000 km eastward, and *Loureedia europaea*, which is the first confirmed record from Europe. This diversity of species allows us to refine the diagnosis of the genus and see the morphological variation enabling further taxonomic inquiries. With fresh, living specimens available, we were able to make some observation of the habitat selection, lifestyle, web structure which may aid further discoveries. Preliminary DNA data suggest closer relationship between the western two species although not with strong support.

Oral presentation

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Do harvestmen obtain a nutritionally balanced diet in the field?

Søren Toft

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In the laboratory, predators like spiders and carabid beetles can select a nutritionally balanced diet from complementary food sources. It is unknown to what extent such complementary foods are available in the field in amounts that allow predators to obtain a balanced diet there. I tested two species of harvestmen, both recent invasive immigrants in Denmark: *Opilio canestrinii* and *Dicranopalpus ramosus*. Firstly, 24 hour consumption of two extreme semi-artificial diets (lipid:protein (L:P) ratio 1.58 and 0.10) was measured from animals immediately after they were collected in the field. Then they were fed ad libitum with both diets for one week, allowing the animals to satiate and reach a nutritionally balanced condition, after which a second measurement of 24 hour consumption was made. The results showed that the harvestmen consumed more food in the first than in the second measurement, indicating a level of hunger in the field. However, the total L:P ratio consumed from both diets did not change from the first to the second measurement in any of the species. This shows that the diet obtained in the field has a nutritionally balanced L:P ratio. Interestingly, the two species selected very different L:P ratios: *O. canestrinii* selected a diet of high lipid content (L:P 0.66), *D. ramosus* a diet of high protein content (L:P 0.37). This indicates different prey niches that may allow coexistence between the two species.

Oral presentation

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Local factors are more important than landscape-level factors to control spider assemblages in un-managed grasslands

Béla Tóthmérész (1), Tibor Magura (2), Roland Horváth (2), Csaba Szinetár (3), János Eichardt (3) & Éva Kovács (4)

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The importance of landscape-level factors is reported to support diversity of spiders in arable lands and strongly disturbed habitats. Cropland management and agricultural practices destroy and/or modify strongly the spider assemblages. Thus, continuous recolonization from the surrounding landscape sustains the species composition of these assemblages. We hypothesized that in unmanaged grasslands, the spider assemblages are stable, and the local factors become more important drivers in shaping spider assemblages than landscape-level factors. We tested the importance of local and landscape-level factors on the abundance and species richness of spiders in unmanaged grasslands (Kiskunság National Park, Hungary). At the local scale we found that species richness and abundance increased by plant cover, litter cover, and patch size, while decreased by bare ground cover. These factors also influenced significantly the abundance of two frequent species (*Alopecosa psammophila*, *Berlandia cinerea*). At the landscape-level we found that only the isolation had significant effect on the total abundance, on the abundance of hunting and habitat specialist species, and on the abundance of a frequent species (*Gnaphosa mongolica*). In summary, we found that in unmanaged grasslands the local factors had vital role controlling the species richness. This is the opposite conclusion that was earlier reported for agricultural ecosystems, where landscape-level effects had important role supporting the species assemblage by continuous recolonization.

ORAL PRESENTATION - STUDENT

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Securing paternity in jumping spiders, with description of a novel form of mating plug in *Cytaea* Keyserling, 1882 (Araneae: Salticidae)

Łukasz Trębicki (1, 5), Barbara Patoleta (1), Katarzyna Janiszewska (4), Jarosław Stolarski (4), Maciej Bartos (5), Yuri Marusik (3), Mirosława Dabert (2) & Marek Żabka (1)

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Salticidae is the most diverse spider family (over 6050 sp.) with members being capable of unique jumping behaviour and characterized by distinct eye pattern (and good vision). Like in many other spider taxa with polyandrous mating systems, males of salticid species have evolved various adaptations to monopolize the female and to protect sperm investment and avoid sperm competition. A physical blocking with variety of mating plugs represents one such adaptation. To date only in small fraction of salticid species (19 species of 12 genera) the presence of mating plugs were documented. Although in some species the male origin is obvious as the plugs are made of broken parts of embolus or specialized cymbial setae, in most cases the plugs are made of amorphous secretion of different (male, female, combined or unknown) origin. Herein, we have documented with light emission microscopy (LEM), scanning electron microscopy (SEM) and X-ray microtomography (micro-CT) mating plugs of species of *Cytaea* and some representatives of closely related genera. The mating plugs in *Cytaea* were made of amorphous substance and were tightly placed in the copulatory ducts. In order to clarify the plug origin, we analysed the structure of the bulb and discovered a special gland connected with spermophore. The gland seems to secrete the plug substance. Analysis of the epigynes revealed that the tube-like spermathecae were completely filled with sperm (pale substance) with well visible, coiled spermatozoa. Similar spermatozoa were found in the structure of mating plugs. Phylogenetic reconstruction using COI, 16S rRNA and 28S rRNA sequence data suggests that both genitalic complexity and mating plug presence could evolved independently in different *Cytaea* groups as the result of sexual selection.

Poster presentation - Student

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Trophic niche and conditional foraging strategy in the cribellate-web spider *Titanoeca quadriguttata* (Araneae: Titanoecidae)

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Spiders are the main predators of insects in many ecosystems. However, the trophic niche was studied only in few spiders, and the foraging behaviour was studied mainly in non-web-building or orb-web spiders. Here, we investigated the trophic niche and the predatory behaviour of a cribellate-web spider, *Titanoeca quadriguttata* (Hahn, 1833). Juvenile spiders were collected under stones in a quarry in Brno, Czech Republic in October. We offered every individual nine prey types (spider, springtail, termite, cricket, cockroach, beetle, fly, moth, and ant) and observed the frequencies of capture and consumption, and foraging behaviour. We found that *T. quadriguttata* accepted many prey types so its fundamental trophic niche was wide. The hunting behaviour was different among prey types, depending on the size and dangerousness of the prey. There were two capture behaviours used. For dangerous and some large prey, such as spider and cricket, spider bit and immediately retreated, whereas for the innocuous and small prey, such as springtail and fly, spider bit and held the prey in chelicera. The attack was administered to different body parts of prey. For example, ants were always bitten on the head, and crickets were bitten on legs. We conclude that *T. quadriguttata* is an euryphagous generalist predator which uses conditional prey capture strategies to catch the variety of prey types.

Poster presentation

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Arachnofaunistical value of the Eastern-Transylvanian peat bogs

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Peat bogs are in serious decline throughout the western Palaearctic. They were once typical landscape elements, but today, especially as a result of human influences, the degradation of these habitats is pronounced. The characteristic climate, hydrology, food scarcity and high acidity are limiting factors, which determine the unique, specialized flora and fauna of the bogs. Because of the rare and threatened species, the peat bogs are listed in Annex I of the European Habitats Directive as one of the priority habitat types, and protected under the Natura 2000 Network. The spider fauna of the Northern and Western European peat bogs is relatively well known, but only sporadic information exists for Central and Southern European peat bogs. In Romania, there are several peat bogs located in the Eastern Carpathians. These are known as glacial refuges for rare, relict plant species, therefore they have high conservational value. The results of some recent studies have shown that these bogs also have a unique spider fauna with many rare species. As a result of arachnological researches conducted in peat bogs located in the Harghita, Nemira and Giurgeului Mts., eight new species for the Romanian fauna were indicated, many of them rare, bog specialist species, these are: (i) *Agyneta similis* (Kulczyński, 1926): Lacul Dracului (Ördögtó) wooden bog (Harghita Mts.); (ii) *Centromerus laevitarsis* (Simon, 1884): Mlaştina După Luncă peat bog (Vaslábi Fenék-rétláp) (Giurgeului Mts.); (iii) *Cnephalocotes obscurus* (Blackwall, 1834): Mohoș, Beneș and Luci (Lucs) peat bogs (Harghita Mts.); (iv) *Gnaphosa nigerrima* L. Koch, 1877: Mlaştina După Luncă, Mohoș and Apa Lină (Lassúág) peat bogs (Nemira Mts.), Borsáros raised-bog (Borsáros-borvízláp); (v) *Haplodrassus moderatus* (Kulczyński, 1897): Fagul Rotund (Kerekbikk) peat bog (Nemira Mts.); (vi) *Maro minutus* O. P.-Cambridge, 1907: Mohoș peat bog; (vii) *Notioscopus sarcinatus* (O. P.-Cambridge, 1872): Apa Lină, Fagul Rotund and Mohoș peat bogs; (viii) *Taranucnus setosus* (O. P.-Cambridge, 1863): Mohoș peat bog. The above rare, bog specialist species also add a high conservational value to these peat bogs. The presence of such faunistical value should demand a more extensive protection of these habitats from behalf of the national authorities, not only regarding the botanical values, as it is currently, but also concerning the fauna.

POSTER PRESENTATION - STUDENT

▲ Back to the Program

The influence of CO1 barcoding on spider taxonomy (Arachnida, Araneae)

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CO1 barcoding is a promising approach for species recognition and partly also delimitation in various animal taxa. Especially in spiders (Araneae) it offers novel possibilities for identification of juveniles (that are mostly indistinguishable by morphology) and in several species also for identification of females. Here, we address the problems with CO1 barcoding in the widespread species *Synema globosum* (Thomisidae), which rarely or never balloons, in this way showing a severely limited dispersal potential. We expected a molecular geographic polymorphism. Two clearly separated CO1 clusters of *S. globosum* could be identified in Central Europe with a few individuals even belonging to a third, mostly Mediterranean clade. A subsequent inspection of male and female genitalia of our *S. globosum* specimens revealed high intraspecific variation in both sexes. Work about the taxonomic significance of this variation, i.e. a match between molecular and morphological clusters is in progress.

ORAL PRESENTATION

▲ Back to the Program

Spiders, webs and soft robotics

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The spider's complement of vibration sensors have evolved to filter input, with the lyriform organs on its legs perhaps the most interesting example. A spider's web (best understood in the orb geometry) incorporates a range of silk threads woven into an intricate structure where, together, filament properties and fabric structure affect vibration transmission. Both spider and web can, separately and together, be interpreted to act as matched filters i.e. morphological computing devices. In this sense the combination of spider and web is a highly evolved, and consequently complex, signal processing mechanism. This suggests that spider and web could provide interesting lessons for the emergent field of soft robotics.

Plenary talk

▲ Back to the Program

Evolutionary morphology of chelicerates

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Among many fields in biology, the study of animal form has gone through a major renaissance in the last decade. The reasons for this revival of morphological research are manifold, including the astonishing technical revolutions allowing e.g. virtual three-dimensional analyses of the internal anatomy of animals, but also major advances in the conceptual framework on which morphological description are founded. How do we describe features of animals? Is function a describable aspect of form? What is a morpheme? What is a character? These questions only give a small insight into the complexity of the theoretical context. In my talk, I would like to address the revolution of morphology in the light of recent advances in Arachnology. I will especially focus on three major organ systems and their interrelatedness: the respiratory system in non-pulmonate arachnids, its functional evolutionary interconnections to the circulatory system, which in turn has strong influences on the locomotory system in arachnids. Finally, I will synthesize our findings to propose a unified morphological scenario for the evolution of hemolymph pressure generation in spiders.

ORAL PRESENTATION

▲ Back to the Program

Phenology of spider populations in Central European mountains

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This study is based on data collected in the course of different research projects in 2010-2012, which focused on spiders inhabiting montane mires. The large number of specimens collected by pitfall traps and sweep netting enables broad analysis of dissimilarities in annual species activity. Spiders were collected throughout the growing season (i.e. from late April to mid-October) in the Western Sudetes. More than 32 000 adult specimens are included in the study, solely the species with total number of more than 30 recorded specimens were examined. The analysed spider populations inhabit mountains, thus their phenology might be other than in the same species living in lowlands. I compare my results with published data and the Internet data bases for some European regions (Czechia, Germany, Great Britain). I recorded the well known sequence of occurrence of different taxa (e.g. within the lycosids, the adult *Pirata* occur earlier than adult *Pardosa*). For the liniphiids I construct the annual calendars of dominant species, separately for the two sexes. In the second step of the analysis the period of highest activity is compared for my data and the published results. As in some previous works I divide the species into those of fairly constant phenological pattern regardless from their origin from different geographical areas and those, which are variable. Moreover, I evaluate the level of variety in phenological pattern for selected species. Some additional analysis show also the high female bias in a few linyphiid species, inconsistency of phenological patterns between the sampling methods and document prolonged life cycle of some mountainous species (e.g. *Arctosa alpigena lamperti*). Basing on my results I will discuss several problems concerning interpretation of phenological data: what do the results on phenology really mean, especially when acquired with different methods, why are there different levels of consistency of annual activity among the species, how does male versus female yearly activity differ and what may influence some sex bias in phenological studies? More data is needed to accomplish meaningful results on patterns and intraspecies similarity of annual activity patterns from different regions. The special regard should be taken to obtain the data for various methods and the areas of distinct characteristics.

Poster presentation - Student

▲ Back to the Program

Indirect effects of Sika deer browsing on spider assemblages in southern Taiwan

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In areas with high densities of herbivores, the local ecology can be negatively impacted due to browsing and trampling. In southern Taiwan, the Kenting National Park Management Office began to release sika deer into the wild in 1994 and it has now become evident that these deer have begun to have significant effects on the structure and composition of vegetation around Kenting National Park. However, it is still unclear on how these changes may influence other local species. Spiders have been found to be useful bioindicators of environmental disturbance due to the fact that they are important predators of invertebrates and are sensitive to micro-habitat requirements. Therefore, the objective of this study was to determine how the presence of sika deer have indirectly impacted the composition of spider assemblages within Kenting National Park. Fifteen sampling areas were selected, with each site consisting of two 7x7 m quadrats. Sika deer exclusion quadrats were surrounded by 1.8 m high fences and control quadrats with no fences were placed adjacent to fenced off areas. From March 2017 to December 2017 data was collected for vegetation density, canopy coverage and cursorial spider assemblages (diversity and body size). We predict that the presence of sika deer will have a negative impact on the vegetation structure in control plots and that this will result in a decrease in the diversity and body size of cursorial spiders.

Oral presentation

▲ Back to the Program

Preliminary results on the subterranean spider (Araneae) fauna collected by MSS traps in western and central Anatolia

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MSS (Mesovoid Shallow Substratum) traps are a method that serves to understand of the invertebrate species from subterranean habitats. The composition of the subterranean spider fauna of Turkey is poorly known. In this study, we investigated the spider fauna inhabiting the deep soil stratum by MSS trap method for the first time in Turkey. The plastic tubes with 78 cm length and 70 mm width, including holes between the seventh and thirtieth centimeters in the bottom were used to collect the specimens. The tubes were placed completely under the surface in vertical position, and a cup containing ethylene glycol was put deep inside of the tubes. Humid soil or stone accumulated areas were preferred. A total of 24 MSS traps were set up in 9 localities in western Anatolia and 50 MSS traps were set up in 27 localities in central Anatolian region. The traps have been checked from November 2014 to April 2017 in western Anatolia and from April 2016 to November 2017 in central Anatolia. As a result, the following spider families were identified from the collected MSS traps: Sicariidae, Scytodidae, Pholcidae, Dysderidae, Palpimanidae, Mimetidae, Theridiidae, Anapidae, Linyphiidae, Araneidae, Agelenidae, Amaurobiidae, Liocranidae, Zodariidae, Gnaphosidae, Thomisidae and Salticidae. More detailed informations are given on Anapidae and the species *Zangherella apuliae* (Caporiacco, 1949). Some spiders were collected from the leaf litters with berlese funnel and obtained specimens were compared with MSS samples in some localities. Some species were collected both two methods and this shows some species movable inside soil and live surface until 70 cm deep of soil.

ORAL PRESENTATION - STUDENT

▲ Back to the Program

Can I borrow a light? Do web building spiders sense and use bioluminescent cues to lure prey?

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Many types of predators use visual signals to lure prey. For example, spiders may use their own body color as a visual cue to attract nocturnal prey or, potentially, that of other species. Previous observations have shown that certain web-building spiders catch male fireflies at night during firefly reproductive season, and build webs near the bioluminescent species. These phenomena suggest that some spiders may use a bioluminescent signal from a captured firefly to lure prey into their webs. In this study, we investigate whether a web-building spider uses bioluminescent cues from captured fireflies to lure nocturnal prey, and whether the firefly's bioluminescent signal can be manipulated and used by spiders to enhance luring. This study is divided into four parts: 1) Selection test: examining whether spiders prefer to build webs near bioluminescent cues, 2) Luring test: determining whether prey can be lured by a firefly's bioluminescent cue, 3) Spider eye-cover test: determining if spiders can sense and change the bioluminescent signal of the captures fireflies, 4) LED test: examining how the differences in prey luring abilities of the visual cues of male, female and captured male fireflies. Preliminary results show that web-building spiders prefer to build webs near the bioluminescent cues and that these cues increase prey attraction and interception rates of the spider webs.

Oral presentation

▲ Back to the Program

Spiders in space – orb web related behaviour in a zero-gravity environment

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Gravity affects all organisms that do not spend their entire life on a horizontal plane. Since understanding the relevance of gravity for organisms requires studying them in a zero-gravity environment, NASA (among others) have brought different organisms into their space laboratories for observations and experiments. In my presentation, I describe the results of such an experiment where two juvenile *Nephila clavipes* spiders were brought to the International Space Station and observed over a period of two months. During that time, a camera took pictures of the spiders and the webs they built every five minutes. Spiders were kept in a cubic habitat with an artificial day-night cycle (12:12) and fed with a continuous supply of fruit flies. Under natural conditions, *Nephila* spiders build webs with the hub near the upper edge of the web and always orient themselves downwards when sitting on the hub whilst waiting for prey. As these asymmetries are considered to be linked to gravity, we expected the spiders experiencing no gravity to either build webs with the hub in the centre (as 1st instar *Nephila* do) or to place the hub at a random edge of the web. Similarly, we expected the spiders to orient themselves either towards the larger part of the web when sitting on the hub, or to show an inconsistent or random orientation. The results of our study only partially matched our expectations. While most webs built without gravity were indeed much more symmetric than the control webs built under normal gravity, some webs still had a rather pronounced vertical asymmetry. In addition, spiders showed a random orientation only during the time when the lights were turned off, whereas the spiders quite consistently faced away from the lights, which were all placed along one side of the habitat, when the lights were on. Closer analysis furthermore revealed, that the webs, whose building had started after the lights had been turned on were more asymmetric (with the hub being nearer the lights) than those whose building had started before the lights had been turned on. However, there was no relationship between web asymmetry and the orientation of the spider. We conclude that the behaviour of *Nephila* spiders is greatly influenced by gravity. We also conclude that in the absence of gravity, the direction of light can serve as an orientation guide during web building and when sitting on the hub in a similar way that gravity serves as an orientation guide in the absence of light.

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Student Awards

Best oral presentations

1st Jens Runge

A morpho-functional comparison of antenniform legs in Pedipalpi

2nd Ondřej Michálek

Spraying silk: Araneophagous hunting strategy used by the ground spider *Poecilochroa senilis* (Gnaphosidae)

3rd Filippo Milano

The assessment of the global extinction risk of an Alpine spider species threatened by climate change

Best poster presentations

1st Pavla Dudová

Individual differences in behaviour of the nursery web spider (*Pisaura mirabilis*)

2nd Yun-Yun Tsai

Trophic niche and conditional foraging strategy in the cribellate-web spider *Titanoeca quadriguttata* (Araneae: Titanoecidae)

3rd Rebecca Heidbrink

The hemolymph vascular system in *Parasteatoda tepidariorum* (Araneae; Theridiidae)

Special prize of the National Geographic Hungary

Ágota Réka Szabó

Spider assemblage structure and functional diversity patterns of natural forest steppes and exotic forest plantations

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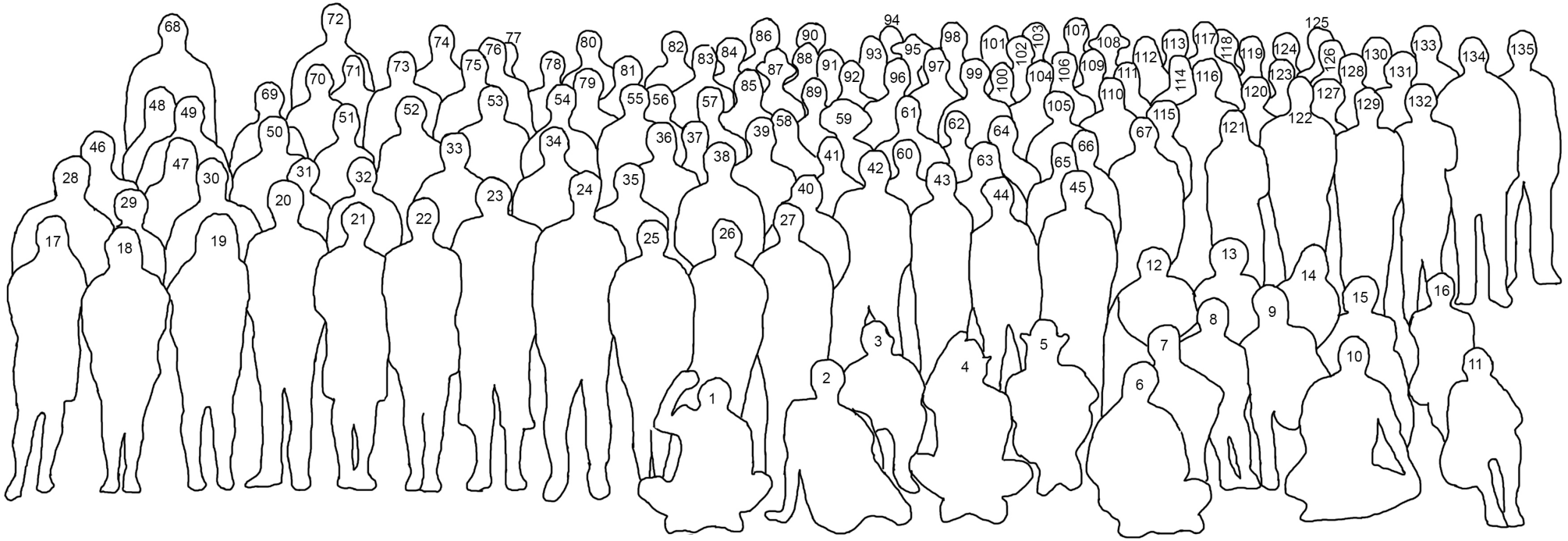

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