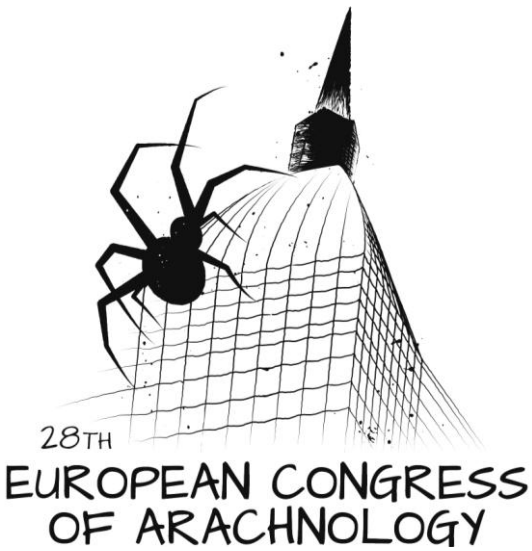
ABSTRACT BOOK



Organized by

University of Turin
Department of Life Sciences and Systems Biology

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Preface

Welcome to the 28th European Congress of Arachnology held from 24th – 29th August 2014 in Torino, Italy. The congress is hosted by the Department of Life Sciences and Systems Biology of the University of Turin and will see a total of 190 participants from 41 countries and all continents.

This book contains the abstracts of the 5 plenary, 81 oral and 81 poster presentations, with a total of 167 contributions, 73 of which given by students. The abstracts are arranged in alphabetical order by corresponding author (underlined), and an author index is included at the end for your reference. Each abstract includes information about the type of presentation (oral, poster, student-oral or student-poster), the Arachnid Order focus of the contribution, the corresponding session and author affiliation.

We wish all participants and guests a fruitful congress and a joyful stay in Torino.

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Organizing Committee

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Abstracts

Student - Oral presentation
Araneae
Biogeography and faunistics

This cave is mine – distribution and ecology of two troglophilic *Artema* (Araneae, Pholcidae) species in Israel

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3. The Hebrew University of Jerusalem, The National Natural History Collections, Edmond J. Safra Campus, Jerusalem, Israel

Israel is at a biogeographical crossroad, with a mixture of different biogeographical zones. These geographical features together with diverse climatic conditions result in a unique composition of the fauna. Pholcid spiders in this area represent a range of biogeographical origins such as African, Holarctic, Pantropical and Mediterranean. We studied the giant pholcid genus *Artema* found in Israel mainly in caves. This genus currently includes six nominal species, most of which cannot be reliably identified by the existing literature. Our research included a taxonomic revision, a survey of 40 caves in different regions in Israel, and distribution modeling. Spiders were collected by means of pitfall-traps and hand collecting. The physical attributes of each cave such as length, opening size, geology, temperature, and luminance were recorded. Our study revealed the existence of two troglophilic *Artema* species. The first, a species new to science is widely distributed mostly along the Rift Valley. The second species, *Artema doriai*, was previously known from Iran only and is rare in Israel. We found that the two species are partly along the Rift Valley of Israel. Using distribution models based on presence only data from the cave survey in combination with the physical attributes of the caves, we discuss the importance of various environmental variables for the distribution of *Artema* species in Israel in a zoogeographical context.

Keywords: biogeography, caves, pholcids

Student - Oral presentation
Araneae
Community ecology

Activity density response of ground-dwelling spider communities to habitat manipulation in agroecosystems

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The physiognomy or physical structure of the environment has an important influence on the habitat preference of spiders and ultimately, on the composition of spider communities. We conducted field studies to determine the effects of mulching and mulched surface on epigeal spiders of arable lands. We had six different locations to examine the structural relationship between spider communities and manipulated (mulched) and unmulched epigeal habitats. We had potatoes planted and arranged in plots in all locations, with half of the plots mulched and the other half left uncovered. Spiders were sampled by pitfall traps and identified at three levels (species, genera and family) with regard to individual density, species richness and species diversity. During the two years of observation, habitat manipulation generally increased the number of spiders. We captured 5752 individuals of 24 families, where 3379 individuals were found on mulched plots and 2373 on unmulched ones. The two most abundant families were Lycosidae, followed by Gnaphosidae. The number of Lycosid individuals was significantly higher on structurally more diverse surfaces. On the other hand, no significant difference was found between the species composition of the two surface types, the number of those spider species was low that we registered exclusively on mulched surface. This study draws the conclusion that enhancing the structure of soil surface by mulching increases the activity density of diurnal non-web builder spiders. We also observed that those less dominant species we captured in small number of individuals found a habitat for safe dispersal in the more protected surface of mulched areas.
The research was supported by the Research Centre of Excellence - 17586-4/2013/TUDPOL.

Keywords: epigeal spider communities, habitat structure

Student - Oral presentation
Araneae
Phylogeography

Blood is thicker than salt water: *Prochora lycosiformis* and the dispersal of Miturgidae (Arachnida, Araneae)

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Prowling spiders (Miturgidae, Simon) are medium-sized ground spiders, found in Australia, America, Africa and Eurasia. Most of the family's biodiversity is concentrated in Australia. Miturgidae *sensu stricto* (Miturginae, Diaprograptinae) lists 44 species. With only four species found in Laurasian continents and only two being Laurasian endemics, the Miturgidae *sensu stricto* are considered a Gondwanan family. The genus *Prochora* (Simon) contains one of the four miturgid species not known from a Gondwanan continent (*P. praticola*, known from China and Japan). The only other species in this genus – *P. lycosiformis*, has been reported from Israel and Sicily, on the very edge of the African and Arabian tectonic plates. These distributions, odd for miturgids, demand biogeographical explanations. Moreover, the palpal conformation *P. lycosiformis* shows a great resemblance to that of the Australian miturgid *Miturga gilva* (Koch, 1872) and this raised a question about the phylogenetic placement and supposed origin of the genus *Prochora*. Does it belong to Miturgidae *sensu stricto*? Could it have remained unchanged since the breakup of Gondwana? Or alternately - arrived recently to Asia from Australia via the Pacific Ocean? This study aimed to test the phylogenetic placement of the genus *Prochora* and its relation to Miturgidae *sensu stricto*. It has included 40 morphological characters of 17 Species of Miturgidae *sensu stricto* and 18 species from other families. All minimum-length trees found support for the placement of *Prochora* in Miturgidae *sensu stricto* as a basal genus in Miturginae. This findings hints to an early divergence in the subfamily Miturginae, rather than a recent dispersal event. We propose a scenario in which *Prochora* has spread to Eurasia from Africa or India, where its ancestors existed since before the split of Gondwana. This may be tested using evolutionary clocks to deduce the divergence of *Prochora* from other Miturginae.

Keywords: Miturgidae, *Prochora*, morphology, cladistics

Oral presentation
Araneae
Phylogeography

The Canaries revisited: resolving the *Dysdera* spiders puzzle (Araneae, Dysderidae)

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The nocturnal wandering spider genus *Dysdera* is a diverse and conspicuous component of the ground communities of Mediterranean forests. The genus has undergone a major diversification in the Canary Islands. To date 46 endemic species have been reported, providing one of the most outstanding examples of an adaptive radiation in spiders. But, is it really an adaptive radiation? After all, the multiple islands, along with the barriers created by sea level changes and lava flows, offered ample opportunities for allopatric speciation. However, several lines of evidence suggest the involvement of natural selection in the evolution of the group. Although considered as a woodlouse eater specialist, experimental evidence suggests different diet preferences among *Dysdera* species. Moreover, it has been shown that cheliceral modifications predict diet specialization and even the strategy used to capture woodlice. In the Canaries, co-occurring species show different types of chelicerae, which suggest that prey specialization played a key role in their diversification. On the other hand, was it really a rapid radiation? Little is known about the timing of colonization of the archipelago and even the actual number of colonization events remains contentious. After 20 years of research on Canarian *Dysdera*, new species are still being discovered. Some of the new findings are the results of collections in previously poorly sampled localities or habitats, such as the MSS. However, the use of DNA-based tools for species delimitation has revealed a great amount of overlooked diversity. To tackle some of the open questions about the origins and evolution of the genus and to provide a better understanding of its actual diversity, a multidisciplinary study combining experiments, morphometrics, high-throughput sequencing and state of the art phylogenetic inference methods is currently underway. In this talk we will present some preliminary results of the new research on Canarian *Dysdera*.

Keywords: adaptive radiation, phylogeny, diet specialization

Poster presentation - FM1
Opiliones
Functional morphology

Histological and histochemical study of the mesenteron of four species of opilionids (Arachnida, Opiliones)

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The midgut epithelium of four Opiliones species belonging to three families (Ischyropsalididae: *Ischyropsalis manicata*, Nemastomatidae: *Parane mastoma sillii*, Phalangiidae: *Gyas titanus* and *Mitopus morio*) has been investigated under light microscopy in periodic acid-Schiff (PAS), Alcian blue (AB) pH 2.5, Alcian blue (AB) pH 1 and bromophenol blue (BPB). The main purpose of the study was the morphological identification and histochemical characterization of the mesenteron cell types in relation to their function as distinct cell types or physiological stages of a cell type. In all species the anterior and posterior midgut epithelium revealed cells of one type. The midgut gland epithelium revealed two distinct cell types, secretory basophilic cells and digestive cells with minor and major differences between species. The digestive cells show different morphology and histochemical properties in different physiological stages: the vacuolar digestive cells, the granular digestive cells, the excretion cells. The functional significance of the morphological states has not been fully established. The resorptive cells could not be identified by the present study. The study also provides a general understanding of the gaps in the knowledge of opilionid mesenteron histology and digestion biology. Several issues of the opilionid digestion process are set forth as future directions of study: 1) is the resorptive cell a distinct cell type or just a physiological stage of the digestive cell type? 2) the real and complete course of the digestive cycle. 3) the biochemistry of the opilionid digestion; 4) the role of the intermediate tissue. 5) the regeneration of the digestive epithelium. 6) the midgut is featured as informative character in opilionid taxonomy; additional information on fine structure is valuable for this purpose.

Keywords: cells, epithelium, midgut, opilionid

Oral presentation
Post congress
Special session CaveLab

An outline of subterranean microclimate phenomenology

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Under the apparent stability of caves atmospheres, complex meteorological processes amd transient phenomena occur. As a consequence of their very long time scale, such processes play an important role on the overall cave environment.
Micrometeorological studies in caves are important in order to estimate paleo-climatic data reliability, to understand the local adiabaticity, connecting it to the occurrence of complex structures and life, to understand the speleogenetic role of condensation, to characterise caves as ecological “islands” and to protect caves, especially show-caves, against the anthropic impact.
Generally speaking, measures of temperatures in caves in the past represented a qualitative description of their atmosphere, referring mostly to epidermal layers. In general, cave temperatures were considered extremely stable everywhere. Such misconception was in reality a consequence of the low resolution of the old thermometers: a measure of the Earth’s temperature by a thermometer with a resolution of ±50 °C would leave unexplained the presence of deserts, forests and ice caps and the old subterranean measures behaved in a similar way. Nowadays, thanks to a gigantic technological advance in the field of data acquisition and storage, the development of dedicated physical models and advances in the measurement techniques and data processing, the situation is slowly changing and complex patterns emerge.
During the presentation we will outline the main microclimatic processes occurring in a cave underlining open problems, with a special interest in the complex phenomenologies of the Bossea show cave. Due to its old history (it is one of the World's oldest show cave) and thanks to the availability of long time series of microclimatic data, we will focus on temperature trends in the last century at Bossea show cave, with a special attention to the potential effects induced by global warming.

Keywords: cave temperature, hypogean, meteorology

Oral presentation
Araneae
Community ecology

Long-term monitoring of spiders in coastal dune and salt marsh habitats along the river Yzer estuary (Nieuwpoort, Belgium), final approach

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5. Instituut voor Natuur - en Bosonderzoek, Bruxelles, Belgium

Long-term monitoring of spiders has been carried since 1990 in coastal dune and salt marsh habitats of the river Yzer estuary (Nieuwpoort) along the Belgian coast. Pitfall trap sampling has been performed without interruption over a 24-year period between Spring 1990 and the present. Between 1990 and 1999, the studied area could be divided in three parts: the dune area, a naval military base and a salt marsh area. The military base was removed between 1999 and 2001 and the area was restored with dunes, dune grassland and salt marshes. This resulted in 160 year cycles spread over 41 locations scattered over the whole estuary area. The spider diversity of the whole area is very high, with a count of 246 species. A yearly high species turnover can be observed for each habitat type. Many highly specialized and stenotypic spiders occur in the dunes and salt marshes of this high diversity hot-spot. In this work we focus especially on the dynamics of the spider populations observed in the only unaltered habitat during this quarter century: the moss dune habitat. The number of species caught each sampled year varies between 36 and 62, but the cumulative number of species rises gradually each year to reach the number of 133 at the end of the study. This high variation in the yearly number of species caught has a tremendous impact on the faunal similarity between the different years. The longer the time interval between sampled years the lower the Sorensen similarity between the faunal composition. The Renkonen similarity, on the contrary, shows a slight increase in likeness of faunal composition after 16 years. The activity density of most dominant species differs consistently between years. The life cycles of the most dominant species are given.

Keywords: Araneae, dunes, monitoring

Student - Poster presentation - CE1
Araneae
Community ecology

Distribution patterns in ground dwelling-spiders along a debris-covered glacier foreland

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We studied the ground-dwelling spider assemblages along the receding Vedretta d'Amola debris-covered glacier foreland (central-eastern Italian Alps). We addressed the hypothesis that species richness, abundance, and functional guilds of spiders are associated with age since deglaciation along the glacial foreland. We also hypothesized that species distribution on the glacier and along the foreland is related to specific environmental variables. We placed 25 pitfall traps along the glacier foreland and we sampled vegetation and soil. Sampling was performed during the period July-September 2012-2013. We collected 92 individuals belonging to 13 species. Results showed that both species richness and abundance of individuals increased along the glacial foreland, with the lowest values on the glacier and the highest on sites deglaciated for almost 150 years. Specifically, a strong stepwise-increase in species richness and abundance appeared approximately 20 years after deglaciation. We observed that the number of functional guilds increased from early to late successional stage possibly in relation to higher habitat complexity and increased interspecific competition. Small spiders that spin small webs at ground level (Linyphiidae) dominate spider assemblages on the glacier. In the mid and late successional stages most of the spiders are funnel web spiders. Canonical correspondence analysis showed that the percentage of gravel and the vegetation cover are the main variables influencing the assemblages. *Meioneta rurestris* showed a higher preference for the sites on the glacier. On the other hand, *Coelotes pickardi*, *Diplocephalus helleri*, *Mughiphantes handschini* and *Pardosa nigra* were mostly related to the mid successional stages, while *Drassodex heeri*, *Sitticus longipes* and *Arctosa alpigena* to the late successional ones. According to the literature we confirmed that time since deglaciation influences spider species richness and assemblage composition; in addition the study of functional guilds offered a new opportunity to increase the ecological knowledge of the glacier foreland landform.

Keywords: Araneae, functional guilds, primary succession, species richness

Student - Poster presentation - SY1
Araneae
Systematics

New records of *Amaurobius scopolii* Thorell, 1871 and *A. pavesii* Pesarini, 1991 (Araneae, Amaurobiidae) with notes on their morphological separation

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The genus *Amaurobius* C. L. Koch is the nominal genus for the family Amaurobiidae, so far the European fauna includes 36 species, 12 of which are present in Italy. Most of these species are actually little studied and their ecology and distribution is almost unknown. In addition taxonomic problems are still present and frequent misidentification between females of closely related species occurred in the past. *Amaurobius scopolii* Thorell was originally described for South-Eastern France and lately has been reported in Italy (Alps and Apennine mountains). In his publication on Amaurobiidae of north Italy (1991), Pesarini makes the point on seven *Amaurobius* species and describes a new one, *A. pavesii* Pesarini, based only on female specimens from Apuan Alps. The new species has a similar appearance with *A. scopolii* although apparently it can be easily recognized by the shape of the epigyne. Looking for *Amaurobius* collections from Italy, we found several specimens of *A. pavesii* and *A. scopolii*. A careful examination revealed new, detailed morphological characters in palp, epigyne and vulva structures, which allow a more clear separation of these species. The new data also showed the presence of a new species (*Amaurobius* sp.) living in the Central-Southern Apennine chain, which was previously misidentified with *A. scopolii*. The three species seem to follow a general trend of intraspecific variability in genital appearance with differences in the shape of the epigynal median plate. Furthermore local populations of *A. scopolii* show minor but constant differences in palpal tegular and dorsal tibial apophysis. According to our data, *A. scopolii* is widespread from the South-Western Alps (including the French Maritime Alps) to the Northern Apennines. On the contrary, the distribution of *A. pavesii* is limited to the Apuan Alps and the new species. is widespread along all the remaining Apennine chain.

Keywords: Alps, Apennine chain, distribution, endemic species

Oral presentation
Arachnida
Biogeography and faunistics

The Arachnida collection at the Natural History Museum (NHM), London: facilitating global scientific research

Beccaloni J.

The Natural History Museum, London, United Kingdom

The key objective of this paper is to inform the arachnid community how global scientific research is facilitated through access to the world-class Arachnida collection at the NHM. The collection comprises approximately 25.850 jars of spirit, 80.000 microscope slides, 143 drawers of pinned specimens, 40 drawers of spider egg sacs and nests, and contains more than 18.000 species. The collection is worldwide in geographical range and very type-rich. The collections are both historically significant and have direct relevance to the world today, in areas such as human health. Access to the collection is both physical and virtual. Physical access is achieved through several different routes. Many specimens are sent on loan each year comprising types, non-types and both identified and unidentified specimens. Loan requests from new and existing borrowers are always welcomed. Visits to the NHM by academics are actively encouraged with access to the collection provided. The exchange of specimens held in the NHM collection with specimens from other institutions is now being established as an on-going process. Over the last few years, far greater collaboration with amateur groups has been established. Virtual access has really been developed over the last couple of years, with species-level databases available online; specimen-level databasing of type specimens being undertaken, as well as the digitization of specimens and the capture of meta-data from microscope slides. The digitization of types in alcohol will soon follow. Additionally, a database of unidentified specimens has recently been completed and made available. It is hoped that this paper will initiate a dialogue with the arachnid community: from experience, what does the arachnid community currently think about access to the NHM collections? What works and what could be improved? What type of digitization would be useful to researchers in the future?

Keywords: Arachnida, collections, facilitating, NHM, research

Oral presentation
Araneae
Symposium - Genomics

Genetic characterization of the immune system of the social spider *Stegodyphus mimosarum* (Araneae, Eresidae)

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Social spiders live in large family groups in small nests, and population genetic theory predicts that they have low heterozygosity due to their social life style. For those reasons social spiders may be especially exposed to pathogens. Evidence from natural populations suggests that average colony life span is about 5 generations, and entire populations are known to go extinct at high rates. This could be caused by pathogens. Recently, the genome of *Stegodyphus mimosarum* was sequenced, and we have characterized the genes involved in the different immune pathways.

Keywords: immunity

Student - Poster presentation - EC1
Araneae
Ecology

Cost of fear II. Predator presence directly affects leafhopper's fitness

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We studied non-consumptive interaction between the virus vector leafhopper *Psammotettix alienus*, which is a dominant sap feeding pest in cereal fields, and the hunting spider *Tibellus oblongus* which is a dominant predator of arable fields and grassy field margins. In order to have enough nutrients to lay eggs leafhoppers need to penetrate plant tissues and feed from phloem sap. We hypothesized that predator presence would negatively affect leafhopper feeding resulting in decreased fitness. We made laboratory experiments in divided micro isolators and examined how the presence of spiders affected leafhopper feeding and egg laying. The division mesh of the isolators prevented spiders to reach the prey, but leafhoppers could sense through visual and olfactory cues the spider presence. Results show that within five days those leafhoppers which were under predator stress laid significantly less eggs than control animals. Thus generalist predators, like *Tibellus oblongus*, contribute to biological control not only by direct predation effect, but also by decreasing pest fitness indirectly through stress caused by their presence.

Keywords: spider, leafhopper, fitness, predator stress

Oral presentation
Araneae
Systematics

Revision of the Australasian crab spiders currently placed in the genera *Stephanopis* O.P. - Cambridge, 1869 and *Sidymella* Strand, 1942 (Araneae, Thomisidae)

Benjamin S. P.

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The crab spider genus *Stephanopis* was established by O. P. Cambridge in 1869, the type species being *Stephanopis altifrons* O. P. Cambridge. *Sidymella* Strand was established by Simon in 1895 (generic name pre-occupied by Walker, 1856). Both genera include over a 100 described Australasian as well as neo-tropical species. All species remain unstudied since their superficial description over 100 years ago. I present preliminary results of a revision of the Australasian species of both genera using morphological and DNA sequence data. Australasian species of both genera are shown to be more closely related to each other than to neo-tropical species of the two genera. A phylogeny for the Australasian species of both genera and exemplars of other thomisid genera corroborates their monophyly and that of Thomisidae. Adult morphology is also used to describe several new species.

Keywords: crab spiders, *Sidymella, Stephanopis*

Oral presentation
Arachnida
Symposium - Genomics

Evolutionary ecology in the genomics era

Bilde T.

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The rapid development of genomic methods has revolutionized research in ecology and evolution, by facilitating insights into development, demography, and mating systems that contribute to our understanding of evolutionary processes. While genomic methods generate vast data sets to this end, they also require complex analysis and interpretation, and a major challenge is to reconcile ecological and genetic processes. I will give a brief overview over the most recent advances in ecological genomics of arachnids, and outline the approaches we take in the study of social evolution, mating systems and sexual selection.

Keywords: evolution, genomics, mating systems, sexual selection

Poster presentation – CE2
Araneae
Community ecology

Epigeic spider (Arachnida, Araneae) communities in Lithuanian peat bogs

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Spider communities in peat bogs were investigated and qualitative and quantitative analyses of the data were carried out. The composition of spider communities in seven peat bog vegetation associations (*Caricetum limosae*, *Sphagno tenelli – Rhynchosporetum albae*, *Sphagnetum magellanici*, *Eriophoro Trichophoretum caespitosi*, *Betuletum pubescentis*, *Ledo pinetum*, *Vacinio uliginosi – Pinetum*) and in three habitats adjacent to peat bogs (*Spergulo vernalis – Corynephoretum*, *Eu – Piceetum*, *Vaccinio vitis idaeae – Pinetum*) were evaluated. Peat bogs of Lithuania are characterized by a large taxonomic diversity of spiders (16 families, 123 genus, 248 species recorded). 59.9% of transpalearctic species prevail in the investigated fauna of spiders. According to the zonal distribution, the majority of species are prevalent in the temperate zone (66.5%), boreal species compose only 3%, nemoral 12.6%, polyzonal species (species that live in several areas) also make a large proportion – 14.8%. These values could be explained by the fact that peat bogs are intrazonal habitats. An investigation into seasonal dynamics showed that the maximum density of spider species was observed in the first part of the activity season (spring and the beginning of summer), which was determined by the peculiarities of the Lycosidae spider family life cycle. The influence of Linyphiidae family members in Lithuanian peat bogs is found to be weakly expressed, which is ecologically important in temperate zone.

Keywords: Araneae, Lithuania, communities, peat bog

Oral presentation
Araneae
Physiology

Differential nutrient extraction explains material investment but not architectural or property flexibility of a predatory trap

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It may be adaptive for a predator to exhibit a flexible foraging strategy as it may facilitate differentially taking prey that offer nutrients important to specific physiological needs. Because sedentary trap-building predators, such as spiders, have limited control over the prey they encounter, differential extraction of nutrients from different prey types and changes in trap architecture and function may be used interactively as means of prey selection. Here we tested, using the giant wood spider (*Nephila pilipes*), whether differential nutrient extraction might induce variations in spider web architecture and mechanical properties by feeding individuals either: live crickets, live flies, dead crickets with the web stimulated by live flies, or dead flies with the web stimulated by live crickets. We found that *N. pilipes* differentially extracted protein, lipids and carbohydrates across treatments. The most pronounced effect was a reduction in protein per gram of lipid or carbohydrate consumed when individuals were fed dead crickets with the web stimulated by live flies. Furthermore, we found that spiders in this treatment reduced their spiral thread lengths and the quantity of silk used in webs. Differential extraction of nutrients, nevertheless, was not associated with any variations in spiral stickiness or spiral glue droplet morphology. Variations in the handling and consumption behaviours of the spiders across treatments, as a result of the different tactile stimuli applied, may explain the differential extraction of nutrients across treatments. The nutritional costs associated with synthesizing spiral silks may explain why differential nutrient extraction was associated with variation in spiral silk investment.

Keywords: foraging, nutrients, silk, orb-webs, architecture

Oral presentation
Araneae
Community ecology

Analysis and remarks on the phenology of forest spiders in Hesse, Central Germany (Arachnida, Araneae)

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A large dataset concerning forest spiders in Hesse facilitated analysis of the phenology of many trapped spider species. In five Strict Forest Reserves, 314 spider species based on 75.000 adult spiders were recorded by pitfalls and trunk eclectors (at about 1.8 meters height). Determinable juveniles are also included (e.g. *Anyphaena accentuata* or *Amaurobius fenestralis*). The traps were emptied monthly over two years in each reserve, with the exception of longer winter periods (due to snow cover). In each month more than 100 spider species were trapped in total, with the maximum in May and June (231 and 228 species), the minimum in November (126 species) and 171 species in the winter periods. The percentage of the total richness trapped in single months, as well as in different trapping periods, was analysed. Also at the level of single sites the months May and June are the most important, but even here less than 50% of the all-year-richness is regularly covered. More than 50 adults from 121 of the species were caught. Regarding these species, the monthly species numbers varied between 87 (Nov) and 113 (May). Clusters were made for the months and the species. The closest pairs were Sept/Oct and Nov/Dec – but both these pairs show the largest dissimilarity. Phenological data for the species were analysed and attempts were made to categorize them into types. The “classical” phenological types cannot be confirmed. The phenology of the species cannot be classified easily into types. Conclusion: It is necessary to trap over more than one – or even over a few months – in order to generate a representative image of the spider fauna of a forest site. This can also be expected for other habitat types.

Keywords: cluster, phenology per month, pitfall traps, trunk eclectors

Oral presentation
Araneae
Symposium - Invasive species

The spider *Zoropsis spinimana* (Araneae, Zoropsidae) north of the Alps – natural spread after hitchhike?

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Zoropsis spinimana (Dufour) (Araneae, Zoropsidae) is a large, easy to recognize spider which has established stable populations northern of the Alps where it can be observed near or in houses. Due to its typical coloration pattern it can easily be recognized even by untrained observers. Consequently, it is very unlikely that its appearance in a newly colonized area will be overlooked. Therefore *Z. spinimana* may be an ideal candidate for studying recent range expansion of terrestrial invertebrates. During several years the spreading of *Z. spinimana* in Switzerland, and especially in Basel, was observed. First records since 1993 all came from locations near highways. Then a spreading in cities with warmer climate as Basel or Kriens (Lucerne) was observed, followed by a spreading in the surroundings of these cities and other cities. It is supposed that *Z. spinimana* arrived already earlier in Switzerland or Germany but that it only was able to build up populations after the climate was more appropriate.

Keywords: global warming, introduced species, range expansion

Oral presentation
Araneae
Phylogeny

Spider phylogenomics: reevaluating the history of Earth's most diverse predator lineage and the origin of the orb web

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Spiders represent an ancient predatory lineage known for their extraordinary biomaterials, including venoms and silks. These adaptations make spiders key arthropod predators in most terrestrial ecosystems. Despite ecological, biomedical, and biomaterial importance, relationships among major spider lineages remain unresolved or poorly supported. Current working hypotheses for a spider "backbone" phylogeny are largely based on morphological evidence, as most molecular markers currently employed are generally inadequate for resolving deeper level relationships. We present here the first phylogenomic analysis - based on transcriptome data comprising 327 loci - of spider relationships that include taxa representing all major spider lineages. Our robust phylogenetic hypothesis recovers some fundamental and uncontroversial spider clades, but also shows some rather surprising results that may prove controversial. These results may compel a fundamental shift in our view of spider phylogeny that will likely have broad implications for interpreting the evolution of spiders, their remarkable biomaterials, and a key extended phenotype - the spider web.

Keywords: phylogeny, systematics, evolution, orb-web monophyly

Student - Poster presentation - CE3
Araneae
Ecology

Biodiversity of stand spiders in forests of Seraidi north-east of Algeria (Edough)

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Arachnology is a poorly understood science in Algeria. In particular there are few studies on spiders. north-eastern Algeria contains myriad habitats that give opportunities to develop studies of this group of invertebrates. The objective of our study is to make an inventory of stand spiders, and to make the first species lists of occupants of the lawn of forest area (Seraidi) in north-eastern Algeria. Our working method is based on capturing individuals in the field and identifying them in the laboratory. The results show that Seraidi has a rich and diverse group of species. We recorded the presence of individuals from the families Clubionidae, Araneidae, Sparassidae, Loxoscelidae, Pisauridae, Selenopidae, Gnaphosidae, Linyphiidae, Dysderidae, Agelenidae, Salticidae, Lycosidae, Palpimanidae, Tetragnathidae, Eresidae and Zodariidae. It appears from this study that the population of spiders in our region is rich and diverse. This work reveals some of the biological diversity of the north-eastern Algeria, which has favorable habitats for invertebrate fauna in general and in particularly with regard to spiders.

Keywords: spiders, population, families, lawn, Seraidi

Student - Oral presentation
Araneae
Ecology

Trait-mediated indirect effects of spiders on plants

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The classic 'green world hypothesis' predicts strong impacts of predators on plants by killing herbivores. In addition, trait-mediated effects of predators on the prey (e.g. changes in feeding behaviour) can affect plants as well. To test for trait-mediated effects, we exposed arthropods to predator chemical cues in the lab and in the field. In the lab experiment, crickets were able to choose between a control plant and a plant bearing either spider or ant cues. We quantified plant choice, weight gain of the crickets and herbivory during the experimental period. In the field experiment, we repeatedly enclosed spiders on plants. After three days of cue deposition arthropods were allowed to colonize and feed on the experimental plants. We quantified herbivory and sampled the arthropod community on the plants. Crickets avoided plants bearing spider cues. Consequently, herbivory was reduced on plants bearing spider cues. Total herbivory (herbivory on the control and the 'spider plant'), however, did not differ from the double control (two control plants). In the field, spider cues led to complex changes of the arthropod community, namely an increased recruitment of workers of the most frequent ant species *Myrmica rubra*. Herbivory was significantly reduced on plants bearing spider cues. Our results suggest far-reaching effects of spider predation risk on arthropod communities. In contrast to density-mediated effects (i.e. if predators kill their prey), trait-mediated effects did not reduce net herbivory. Instead, they increased spatial heterogeneity of herbivory. The way predator effects cascade down (density-mediated versus trait-mediated) thus determines energy transfer from the basal to the top trophic level.

Keywords: trait-mediated effects, trophic cascades, kairomones

Poster presentation - EC2
Araneae
Ecology

Effects of Spinosad application in apple orchard on the abundance of the spider *Araneus diadematus* (Araneae, Araneidae) and the characteristics of its web

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Spinosad is an insecticide used in organic orchards and has been shown to be an effective pest control agent. However, possible effects of this insecticide on the beneficials are largerly unknown. Spiders are generalist predators and can be useful to control some pests. Our aim was to assess the possible side-effects of Spinosad on an orb-web species. These spiders can be affected on three different ways by Spinosad, 1) lethality, 2) sublethal effects that prevent them to build a web, or 3) modifications of the web that can affect the prey capture. In this study we investigated under field conditions, the response of a population of orb-web spider (*Araneus diadematus*) to the use of Spinosad in apple orchards. We surveyed the *A. diadematus* population in an apple orchard before and after the spraying of Spinosad. The spiders and their webs were counted. The webs were then photographed and analyzed in the laboratory using ImageJ. Several parameters were computed to characterize the webs: the capture area, the total length of the capture spiral, the web symmetry and the parallelism of the turns of capture spiral. The population of *A. diadematus* decreased drastically just after the Spinosad treatment. More than 30% of the spiders disappeared. The remaining individuals stopped web building during several days. When they built a web, it was without a geometrical structure and often the spider had an aberrant location on its web. After six days, the spiders spun a normal web; only the parallelism was still affected. Spinosad may affect directly and indirectly the survival and the web construction of an orb-weaving spider *A. diadematus*, but after one week there was a recovery of the web construction abilities for the surviving individuals. However the cumulative effects of repeated applications of pesticides remain to be studied.

Keywords: behaviour, insecticide, web geometry

Poster presentation – CE4
Araneae
Community ecology

Crop protection strategies influence the structural and functional diversity of epigeal spiders in apple orchards

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Apple orchards are agro-ecosystems managed with high levels of inputs and especially pesticides. Epigeal spider communities were sampled in three seasons using pitfall traps in 19 apple orchards with four different management strategies (abandoned, under organic, Integrated Pest Management or conventional protection) and thus significantly different pesticide usage. The abundance and diversity of the spider communities was the highest in abandoned orchards. Higher diversity and evenness values were the only difference in spider communities from the organic orchards compared to the other commercial orchards. The analysis of five ecological traits (proportion of aeronauts, type of diet, overwintering stages, body size and maternal care), however, clearly showed differences in the spiders from the organic orchards. The spider species in the other commercial orchards were smaller and showed higher dispersal abilities. Seven bioindicator species were identified in abandoned orchards, two species in organic ones (only Lycosidae) and one species in conventional orchards (Linyphiidae).

Keywords: pesticides, organic, bioindication, ecological traits

Oral presentation
Araneae
Biogeography and faunistics

European year of spider biodiversity research 2014 – Greece

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Accelerating taxonomic knowledge of biodiversity on a national level is one of the basic demand of current environmental policies in Europe and worldwide. The project SPIDOnetGR is addressing this need by presenting an efficient way to increase biodiversity knowledge in one of the most important biodiversity hotspots of Europe, Greece. SPIDOnetGR entangles four main institutes from Greece (University of Thrace, the Natural History Museum of Crete and the Foundation for Research and Technology) and Switzerland (University of Bern) and aims at developing a realistically complete spider inventory at a national level, to be useful for ecosystem conservation and biogeographical research. With a view to synthesize information from a multidisciplinary perspective and organise new arachnological knowledge into a European-wide electronic database in order to increase the visibility of taxonomy for a broader public, a network of scientists is recruited to contribute with their expertise to the realization of this goal. “The European year of spider biodiversity research in Greece” is an initiative undertaken by our team and embraced by the European Society of Arachnology. By this we hope to promote the idea of country-wise focus on arachnological research in Europe, and to trigger the interest of spider experts who will be willing to collaborate with us, therefore establishing a broader research network that will simultaneously focus on the same general objective. Ultimately, biodiversity on a keystone European area will be promoted, thus filling the existing gaps of knowledge. In this presentation an update on the progress of SPIDOnetGR will be presented, and the “before and after” perspective of the spiders of Greece will be discussed.

Keywords: spiders, Greece, taxonomy

Poster presentation - CE5
Araneae
Community ecology

Open, risky and sunny grasslands OR mysterious, dark and humid forests? A case study of Gnaphosidae (Arachnida, Araneae) in Pindos Mts, Greece

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Agricultural land abandonment is a major issue, concerning environmental conservation in remote areas of the Mediterranean region. While taxa such as birds, butterflies and the flora have been thoroughly studied, very little is known about spiders when it comes to land abandonment. In an attempt to explore the ways spider communities respond to agricultural land abandonment we sampled ground spiders in 20 randomly selected sites of 1km x 1km in the areas of Pindos Mts, Greece, representing an abandonment gradient in terms of forest encroachment, using pitfall traps. Analysis involved investigating the responses at the community level, as well a species-by-species approach, within Gnaphosidae and allied families. Our results showed a negative effect of agricultural land abandonment on ground spider community structure, in terms of species richness and diversity, while abundance was not significantly affected. In addition, we distinguished four species assemblages showing different responses to forest encroachment, while the species-by-species approach revealed four species with clear positive (*Zelotes balcanicus* and *Drassyllus villicus*) or negative (*Phrurolithus szilyi* and *Trachyzelotes cumensis*) response to forest encroachment. Our results support the idea that the key for protecting invertebrates in terms of community structure, as well as the species level, is to preserve landscape heterogeneity. Policies towards motivating cultivation of the former abandoned fields using traditional practices should be developed, along with the enhancement of mild grazing in abandoned agricultural land in order to maintain open spaces.

Keywords: land abandonment, spider community, Gnaphosidae, pitfall traps

Poster presentation - SY2
Araneae
Systematics

The genus *Cybaeus* (Araneae, Cybaediae) in the Alps

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The genus *Cybaeus* includes about a hundred species, mostly Holarctic, with representatives from Europe, China, Korea and, especially, Japan and western North America. In Europe, eleven species are known so far, five of which are recorded for the Alpine chain. The collection of spiders from the Maritime Alps in the framework of the first European All Taxa Biodiversity Inventory provided records of rare endemic species that are generally poorly known. On the base of the collection of several unknown males of *Cybaeus*, we discuss the validity of the previous identifications and provide the new description of the male of *C. vignai*. Furthermore, based on the examination of material stored in Museum collections (including type material) and freshly collected material, we briefly revise the western Alpine species of *Cybaeus*. Records of *C. vignai* are so far restricted to a few localities in the Italian and French Maritime Alps. According to our interpretation, previous records of males have to be referred to *C. intermedius*. However, it is likely that the species is more widespread in the South-Western Alps.

Keywords: Alpine fauna, *Cybaeus vignai, C. intermedius*, PNAM, ATBI

Plenary
Palpigradi
Systematics

Palpigradi: morphology, research history and recent advances

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Nearly 130 years of palpigrade research are reviewed in a nutshell, with the spotlight on groundbreaking scientists and their achievements in the different fields of palpigrade biology. A slide show of the external morphology of Palpigradi exhibits all characters used for species diagnoses and systematization, and also depicts the limitations of morphology-based taxonomy. The recent increase in the number of described species—accomplished with traditional methods—indicates that the current number (about 100) may be only a small fraction of the palpigrade fauna of the world. It is not guaranteed that DNA techniques such as barcoding will more efficiently capture species diversity. The highest hurdle is not the extraction of molecular information from specimens: the highest hurdle is the access to specimens.

Keywords: Palpigrades, morphology, taxonomy, biodiversity

Oral presentation
Araneae
Behavioural ecology

Revealing the selection forces behind the evolution of inaccurate Batesian mimicry in myrmecomorphic spiders

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Batesian mimicry is a defensive strategy by which a palatable species (mimic) resembles the phenotype of another dangerous or unpalatable species (model) to decrease the predation risk. In principle, it would be expected that the higher the level of mimetic accuracy, the larger the benefit from Batesian mimicry. Nevertheless, the large number of species showing inaccurate mimicry lead us to think that under particular conditions, a relatively low mimetic accuracy (i.e. inaccurate mimicry) may be the optimum strategy. Several hypotheses have been proposed to explain the evolution of inaccurate mimicry. However, these hypotheses have been rarely tested or came to contradictory conclusions. Here, we tested two hypotheses: 1) an inaccurate mimic is imitating an intermediate phenotype among several co-existing models (multimodel hypothesis); and 2) there is a trade-off between increasing the level of mimic accuracy and the ability to escape from predators (constraint hypothesis). We carried out a comparative study using 10 species of ant-mimicking spiders with different levels of mimetic accuracy (five species from the Czech Republic and five species from Australia) across broad phylogenetic context (families Gnaphosidae, Corinnidae, Zodariidae, and Salticidae). Using images of dorsal colour pattern taken under controlled light conditions, we quantify through multivariate analyses the level of resemblance between mimics and each of the potential models. Then, we measured escape speed of mimics in the lab. We found no clear evidence supporting the multimodel hypothesis. Surprisingly, we found that the relationship between visual mimicry and escape speed is U-shaped, with the species that show an intermediate level of mimic accuracy being less efficient at escaping. The fact that the most accurate mimics live in relative close association with their models, which may eventually turn into aggressive predators, may explain the high escape abilities found in these accurate mimics.

Keywords: Inaccurate Batesian Mimicry, myrmecomorphic spiders

Oral presentation
Araneae
Ecology

Assessing the conservation status of the endemic Desertas wolf spider, *Hogna ingens* (Araneae, Lycosidae)

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The Desertas Islands (Madeira, Portugal) are the sole home of one of the largest and rarest wolf spider species, *Hogna ingens* (Blackwall) (Araneae, Lycosidae). This species inhabits a single valley in the north of the Deserta Grande Island, Vale da Castanheira, currently invaded by the herb *Phalaris aquatica*. This invasive species competes with the native flora and was subject to several eradication experiments, namely through fire and chemicals. The objectives of this work were to: 1) estimate the current distribution and abundance of *H. ingens* and their respective trends; 2) evaluate the impact of the invasive plant and eradication methods on the spider population; 3) suggest future measures for the recovery of the species; and 4) evaluate its conservation status according to the IUCN criteria. The current distribution of *H. ingens* covers 23 hectares, a recent reduction from its original 83 hectares, corresponding to the entire Vale da Castanheira. A total of 4,447 and 4,086 adults and 71,832 and 24,635 juveniles were estimated to live in the valley during 2011 and 2012, respectively. We found a significant negative impact of *P. aquatica* cover on the presence and abundance of *H. ingens* and that chemical treatment specifically directed towards this species may be the only way to effectively recover the spider's habitat. We suggest 1) regular monitoring; 2) extend chemical treatments; 3) ex-situ conservation with future reintroduction of adults. Based on the current area of occupancy (AOO) of *H. ingens* and its recent decline in both AOO and number of individuals, we suggest a status of Critically Endangered for this species and its urgent inclusion in the Habitats Directive species lists.

Keywords: conservation, IUCN, Madeira, red list

Poster presentation - BF1
Araneae
Biogeography and faunistics

The genus *Orchestina* Simon (Araneae, Oonopidae) in the Mediterranean: how many species are there?

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Despite the many studies originated by the Planetary Biodiversity Inventory project on the Oonopidae, the Mediterranean fauna remained almost completely ignored until the end of the project. This work started with the discovery of one new species endemic to the Madeira archipelago, and rapidly extended to other areas of the Mediterranean. At the moment, the authors presume the existence of five new species to science, and attempt to properly redescribe two problematic species of the pavesii-group of species. Additional genetic data is also available for some species.

Keywords: Oonopidae, *Orchestina*, Mediterranean, taxonomy

Poster presentation - BF2
Araneae
Biogeography and faunistics

Unexpected species richness in small barren islands: diversification of the genus *Dysdera* Latreille, 1804 (Araneae, Dysderidae) in the Madeira archipelago

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The genus *Dysdera* is known to be highly speciose in the Canary Islands, but only five species are known from the Madeira archipelago. New samples from this area revealed a remarkable number of new species to science, which are now under study. This study aims to understand their phylogenetic relationships and to describe nine new species. The authors hypothesize that some species have highly restricted distributions and may face extinction soon, either by loss of habitat or by competitive exclusion by the invasive species *D. crocata* C. L. Koch.

Keywords: *Dysdera*, Madeira, biogeography, endemics, conservation

Oral presentation
Solifugae
Phylogeny

Phylogenetic analysis of the North American camel spider family Eremobatidae (Arachnida, Solifugae)

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In this study, we present the first phylogenetic analysis of any family in the arachnid order Solifugae. Currently the taxonomy of the family Eremobatidae is based entirely on shared morphological similarities between species. The family, which includes 187 described species, is divided into the subfamilies Therobatinae and Eremobatinae. The former includes the genera *Chanbria*, *Eremochelis*, and *Hemerotrecha*. The Eremobatinae includes the genera *Eremobates*, *Eremocosta*, *Eremorhax*, *Eremothera*, and *Horribates*. The genera *Eremobates*, *Eremochelis*, and *Hemerotrecha* are further divided into various species groups. For the molecular and morphological phylogenetic analyses, we used 81 exemplar taxa representing all genera and all but four species groups. We used a multilocus approach for the molecular phylogeny based upon two mitochondrial gene fragments (cytochrome oxidase subunit 1 and the 3' end of the 16S rRNA gene) and two nuclear gene fragments (the large subunit 28S rDNA gene and a variable fragment of the histone H3 protein coding gene). Maximum Likelihood, Bayesian, and BEAST analyses consistently recovered the monophyly of the subfamily Eremobatinae, and the genera *Eremorhax* and *Eremothera* as well as a group comprising all *Eremocosta* exemplars except *E. acuitalpanensis*. The BEAST analysis recovered a clade consisting of exemplars of the genus *Chanbria*. Among the species groups, only the scaber and pallipes species groups of *Eremobates* and the *banksi* group of *Hemerotrecha* were monophyletic; the other 15 species groups currently recognized within *Eremobates*, *Eremochelis*, and *Hemerotrecha* were para- or polyphyletic. A time-calibrated phylogeny indicated the most recent common ancestor of extant eremobatids to approximately the onset of the Miocene. This phylogenetic analysis provides the first objective assessment of the taxonomy of any family of Solifugae.

Keywords: Bayesian Inference, BEAST, solpugid, systematics

Student - Poster presentation - SY3
Amblypygi
Systematics

Taxonomic review of the Amblypygid genus *Trichodamon* Mello-Leitão, 1935 (Amblypygi, Phrynichidae)

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Amblypygi is a small order with a worldwide distribution. The family Phrynichidae is one of the most diverse of the order. The genera of this family inhabit Africa, India, Southeast Asia, and the neotropics. *Trichodamon* is the only representative of the family in the New World, and is composed by two valid species, *T. princeps* and *T. froesi*, which are found in north-east Brazil. A third species (*T. pusillus*) is currently synonymized with *T. princeps*. All works on taxonomy, systematic and biology of *Trichodamon* deal only with *T. froesi*, and *T. princeps* is restricted to its description and that of synonym of *T. pusillus*. This work proposes detect and characterize *Trichodamon* species, update the distribution of the genera, and hypothesize new characters. A geometric morphometric analysis was performed for the first time in Amblypygi in order to quantify the shape and size differences among *Trichodamon* species and different Phrynichidae genera. All characters used to identify the species of *Trichodamon* were evaluated for their viability to distinguish them. The geometric morphometric analysis was performed with the R package geomorph. The diagnostic characters of *Trichodamon* species are highly variable. A rare case of polymorphism on the gonopods of the female was detected. New sensorial structures on the distitibia and tarsus of leg IV were also found. There is geographical color variation, from the southernmost region of the distribution to the northernmost region. The southern specimens are pale and without stripes, while the northern have a brighter yellow color and marked stripes, with a gradation between the extremes. The geometric morphometric analysis showed significant differences of shape and size among specimens of different genera (*Damon*, *Euphrynichus*, *Phrynichus* e *Trichodamon*), but not among *Trichodamon* species. *Trichodamon froesi* is a synonym of *T. princeps*.

Keywords: morphology, Neotropics, taxonomy, whip spiders

Student - Poster presentation - CE6
Araneae
Community ecology

Ground-dwelling spider assemblages of lowland oak secondary succession series

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We studied the effects of reforestation on ground-dwelling spider assemblages in young (3-5 year old), middle-young (13-15 year old), middle-old (45-50 year old) stands and in old (130 year old) native oak forests as control stands by litter sifter sampling, in East-Hungary. During the study we collected 390 individuals of 61 spider species. The number of species was significantly higher in the old native oak stands than in the young reforestations. The total number of individuals was significantly higher in the old native stands and the middle-old reforested stands than in the young ones. We categorized spiders according to their habitat affinity and ecological demands, as well as disturbance sensitivity. The number of individuals and the number of species of forest spiders were significantly lower in the young reforestations than in the middle-young, middle-old stands and the old native forests. The number of disturbance-sensitive species was significantly higher in the old native forest patches than in the young stands, while the number of disturbance-sensitive individuals was significantly higher in the old native stands and the middle-old reforestations than in the young stands. The abundance and species richness of shade-preferring species were significantly higher in the old native stands, the middle-old and the middle-young reforested stands than in the young ones. Multidimensional scaling showed that the middle-young oak reforestations were separated from the middle-old and old native stands. Our results showed that large open sand surface and high air temperature in the young reforested stands affect negatively the forest species. Even in the 15-year-old reforested stands there were similar spider assemblages to that of the old native stands, demonstrating a successful recolonization of the forest spider species.

Keywords: abundance, habitat-affinity, reforestation, species-richness

Oral presentation
Araneae
Systematics

Identification of Mediterranean mygalomorph spiders (Arachnida, Araneae)

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The identification of mygalomorph spider species and genera has been a long-standing problem in arachnology. The development of a practical and adaptable key for rapid species recognition in all 14 mygalomorph spider genera occurring within the Mediterranean Basin will be presented for the first time. The key will be based on unambiguous qualitative morphological character states, diagnostic at the genus level, and biogeographically based diagnostics for species recognition. Areas where basic knowledge is still lacking will also be indicated. The key is aimed to function as a quick, state of the art and easy-to-use reference tool for planning biological investigation projects, with a special communicative value for start-up applications for nature conservation programs within the Mediterranean Basin.

Keywords: taxonomy, key, identification, conservation

Poster presentation - SY4
Araneae
Systematics

A contribution to the taxonomy of the spider genus *Troglohyphantes* Joseph, 1881 (Araneae, Linyphiidae) in the Balkan Peninsula

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The linyphiid genus *Troglohyphantes* includes 132 described species, 55 of which are known to occur in the Balkan Peninsula. Two new *Troglohyphantes* species are discovered from the eastern part of Balkan Peninsula, found in caves in Osogovo Mt. and Slavyanka Mt. (SW Bulgaria). Both sexes of the new taxa are described, illustrated and discussed within a taxonomic and phylogenetic context.

Keywords: distribution, spiders, caves, Bulgaria

Oral presentation
Post congress
Special session CaveLab

Microfungi in hypogean habitats

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The Work Package 3 of the CaveLab Project aims at studying mycobiota in different caves of Piedmont (Italy). More in detail, the main purposes are to contribute to knowledge of the mycoflora inhabiting Alpine caves and to investigate the role of microfungi in hypogean ecosystems.
The Bossea show cave was intensively studied, with the collection of 34 samples of soils and sediment in sections of the cave characterized by different level of touristic frequentation: high (HF), medium (MF) and low (LF). The samples were plated by dilution plate method, in double on two different media (MEAc and Rose Bengal); in total 164 Petri dishes were inoculated. As a whole 1726 (916 in HF, 438 in MF and 372 in LF sections) Colony Forming Units (CFUs) were counted and about 100 pure-culture strains of fungi were isolated. The strains were identified by means of both classical mycological methods and molecular tools. The most recurrent genera are *Penicillium*, *Aspergillus*, *Mucor*, *Trichoderma*, and *Bionectria*. Several species are difficult to be systematically framed and require deeper investigations. Among the most remarkable species, we identified *Acremonium nepalense* (only in HF areas), an agent of black stains on the Paleolithic parietal art; *Mortierella alpina*, a species mainly exploited for arachidonic acid production (in HF, MF and LF); *Penicillum ellipsoideosporum*, recently recorded from China for the first time and never observed elsewhere and *Aspergillus spelunceus*, a very rare species observed for the first time on the bodies of dead cave crickets.

Keywords: Bossea show cave, samples of soil, filamentous fungi, colony forming units

Poster presentation - CW1
Xiphosura
Collections & web-based resources

A collection of horseshoe crabs (Chelicerata, Xiphosura) in the National Museum, Prague (Czech Republic)

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The arachnological collection of the National Museum, Prague (NMP) contains spirit (juvenile) as well as dry (mostly adult) specimens of horseshoe crabs (Xiphosura). These marine animals are of immunological importance due to clotting agents present in their hemolymph. In total, 82 specimens (16 dry and 66 spirit) of all four currently recognised living species [*Carcinoscorpius rotundicauda* (Latreille), *Limulus polyphaemus* (Linnaeus), *Tachypleus gigas* (Müller) and *Tachypleus tridentatus* (Leach)] of horseshoe crabs are present in the collection. They were collected in Indonesia, USA and Vietnam; *L. polyphaemus* from the USA is the most numerous species in the NMP. The collection contains no type specimens. The largest part of the horseshoe crab collection is 55 spirit specimens from the collection of Václav Frič (1839–1916), whose preparations were mostly intended for educational purposes. The most remarkable item of the horseshoe crab collection is the spirit preparation of the development of *L. polyphaemus*, containing a clutch of 18 eggs and four stages of ontogeny. The preparation was donated by Prof. Alpheus Spring Packard (1839–1905) to Dr. Joachim Barrande (1799–1883) from whose inheritance it got to the NMP in 1894. This work was financially supported by the Ministry of Culture of the Czech Republic (DKRVO 2014/14, National Museum, 00023272).

Keywords: arachnological collection, Václav Frič, Xiphosurida

Student - Oral presentation
Araneae
Ecology

Prey capture in wolf spider (Araneae, Lycosidae) related taxa

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More than a half of all recent spider species have abandoned web building or never developed such an adaptation. These spiders must have found other (more economic) solutions for prey capture and retention. More than 80% of free hunting spiders feature hairy adhesive pads (scopulae), which may play a major role in prey capture. There are lots of studies about prey preferences of free hunting spiders, but little is known about the actual prey capture mechanism. In our study we investigated if the prey capture of different wolf spider related taxa (grade shaped tapetum clade) depends on behavioural traits, morphological traits and/or the spider's venom. We therefore used SEM pictures, high speed videography, LD50-toxicity tests and different types of feeding experiments. Our results show that there is a remarkably wide range of different prey capture strategies, even among closely related taxa. The scopulae are often restricted or more developed on the anterior legs and their presence is tightly linked with the use of the specific legs during prey capture. These adhesive hairs may facilitate handling oversized or dangerous prey. In addition, leg scopulae and spines may act in a complementary way. However, the pretarsal claw tufts do not play a role in prey capture; there are primarily used for locomotion. Overall the behaviour, morphology and the venom act together in prey capture of wolf spider related taxa.

Keywords: prey capture, predatory behaviour

Student - Poster presentation - BF3
Araneae
Biogeography and faunistics

First record of the spider family Palpimanidae (Thorell, 1870) (Arachnida, Araneae) in Libya

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A total of 12 adult specimens (7 males and 5 females) of *Palpimanus sogdianus* (Palpimanidae) were collected between spring 2006 and winter 2007 from the northwestern part of Libya. This is the first record of Palpimanidae in the country.

Keywords: first record, Libya, Palpimanidae

Student - Oral presentation
Araneae
Community ecology

Compositional change in a Mediterranean ground spider community over the seasons

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Community level arachnological data are scarce in the eastern Mediterranean and largely rely on studies from southeastern Europe or several Aegean islands; while Anatolia has remained untouched in this context. Aiming to gather the first comprehensive set of community level faunistic data on a Mediterranean spider assemblage from Turkey, a semi-natural olive grove and associated shrubland at Kıyıkışlacık (Muğla) was sampled monthly during a period exceeding one year. We report here the findings of a one year long pitfall trap survey (2010 & 2011), and reveal the effects of seasonality over composition and surface activity of the ground spiders in the assemblage. Among the 3,469 specimens sampled, 1,392 were adults, in which 106 species from 26 families were identified. Detrended correspondence analyses (DCA) and similarity analyses were used to explain compositional changes among samples. DCA revealed close associations between consecutive samples among seasons and explained species turnover in the course of a year, while segregating winter samples from the rest of the year. Similarity analysis also indicated activity of a distinct fauna in winter, and revealed a 'winter inactive' fauna absent in winter samples but well represented in both November and March samples. Adult percent representation and crude abundance data among samples indicate differences between winter samples and those from the rest of the year, supporting the results of previous analyses. Further studies focusing on ecological or bio-geographical gradients over spatial space in Anatolia are necessary for a better understanding on seasonality in spiders.

Keywords: Araneae, epigeal fauna, eastern Mediterranean, phenology

Plenary
Araneae
Ecology

Trophic interactions of spiders: from individuals to ecosystems

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Spiders are deeply entangled in terrestrial food webs. Given their dominance as predators, their impact on prey assemblages is surprisingly unclear, possibly due to their generalist feeding. On the other hand, the role of spiders as prey appears understudied. For example, numerous bird and wasp species feed on spiders, and ants interact with spiders in various ways. Trophic interactions affect the spatial distribution of spiders within habitats, exemplified by the placement of spider webs in prey-rich areas or by their avoidance of plants patrolled by ants. At the same time, spiders are highly mobile and spill over between different habitat types at landscape scales. Finally, the establishment and spread of non-native spiders provide opportunities to study their interactions from local to continental scales. I am going to explore examples of spider interactions at these divergent spatial scales. A special focus will be connections between spatial scales, such as the possible role of local predation pressure for the large-scale distribution of spiders. Combinations of methods from spatial ecology with diet analysis, manipulative experiments, behavioral and chemical ecology may help to disentangle the roles of spiders in the complex interaction webs they are part of.

Keywords: food webs, predation, spatial ecology

Oral presentation
Post congress
Special session CaveLab

Diatom flora in subterranean habitats: the study case of Bossea show cave (NW-Italy)

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Artificial lighting systems in show caves support the growth of autotrophic organisms (the so-called lampenflora), mainly composed of cyanobacteria, diatoms, chlorophytes, mosses and ferns. In the frame of a recent research developed inside the CaveLab Project (Work Package 4), we reviewed all the scientific papers published from 1900 up to date focusing on diatoms occurring in hypogean habitats, revealing a remarkable taxonomical richness, including a total of 363 taxa, belonging to 82 genera. The most frequent and abundant species recorded in caves are generally aerophilic and cosmopolitan and their distribution and abundance are mainly driven by air humidity and light intensity.
In order to provide a characterization of the benthic diatom flora inhabiting the show cave of Bossea (NW-Italy) and to provide a first indication on the autecology of the most abundant species, we collected 29 samples from wet walls inside the touristic section of the cave. In total, 23 diatom taxa were identified. In general, diatom assemblages were mainly composed of aerophilous taxa, mostly found in dim light conditions and resistant to strong humidity fluctuations. Four species, belonging to the genera *Achnanthidium*, *Microcostatus*, *Nupela* and *Sellaphora*, and presumably new to science, are illustrated with LM and SEM pictures.

Keywords: lampenflora, subterranean ecosystems, autecology, systematics

Oral presentation
Scorpiones
Biogeography and faunistics

The Euroscorpion revisited: not-so-cryptic diversity of *Euscorpius* (Scorpiones, Euscorpiidae)

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Euscorpius Thorell is a common genus of scorpions that inhabits various arid habitats throughout southern Europe and Anatolia. Originally, C. L. Koch recognized local Mediterranean species such as *Euscorpius tergestinus*, *E. sicanus*, and *E. naupliensis*. However, just a couple of widely ranging *Euscorpius* (*E. italicus*, *E. carpathicus*, *E. germanus*) were identified from Kraepelin to Kinzelbach, in Mediterranean Europe, the Balkans and Anatolia. Early taxonomists documented a number of subspecies in the Mediterranean *Euscorpius*, and the genus has since been demonstrated to contain a diversity of cryptic species. Since 1999, our collaborative efforts have yielded new molecular and morphological data for a number of *Euscorpius* species across the range of the genus. Particularly, analysis of DNA, in combination with diverse morphologies, has resulted in a recent major splitting of *Euscorpius*. New species have been described (or old species restored) from Greece, Italy, Turkey, Croatia, Bulgaria, Switzerland, Austria, Malta, Tunisia, etc. In our current estimate, over 20 species of *Euscorpius* inhabit Greece alone, often in sympatry. Some species appear to be ecologically dominant (such as "*E. sicanus*" complex), while others are rare, endemic, or both. We discuss several case studies from Italy, Greece, Turkey and Bulgaria, emphasizing the inadequate sampling, or broadly cryptic diversity of *Euscorpius*, as well as insufficient morphological criteria. Based on our research, scorpions in Mediterranean Europe and Anatolia are beginning to emerge as a diverse group (possibly over 50 species!), which is expected due to the region's complex, ancient biogeographic history.

Keywords: *Euscorpius*, evolution, Mediterranean, scorpions, systematics

Oral presentation
Araneae
Symposium - Mating strategies

Male mating success and locomotive performance: how important is metabolic "power"?

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The relevance of male morphological attributes, such as body size and relative limb length, for efficiently locating sexually receptive females and for prevailing in competition with other males over access to females has been the focus of much recent research, especially in species with pronounced female-biased sexual size dimorphism (SSD). Nevertheless, results have been inconsistent and a number of studies have failed to find relationships between morphology and fitness proxies, such as climbing speed. Here we focus on a so-far neglected phenotypic attribute, resting metabolic rate (RMR), and investigate its importance for males in the contexts of mating and locomotion in the orb-weaver *Argiope aurantia*, a species which exhibits extreme SSD. We performed three experiments: 1) in staged mating trials, two size-matched males competed to mate with a female. Males with higher RMR performed longer courtships, which translated into higher mating success. 2) in climbing trials, males with higher RMR achieved higher maximum running speeds on a vertically mounted rod, and RMR was more important than morphology for explaining running speed. 3) in endurance trials, RMR had no effect on the distance which males could run continuously, while average speed was negatively related to distance run. We conclude that metabolic "machinery" is important for the overall performance of males, independent of morphology, and discuss these results in the context of phenotypic evolution in highly dimorphic spider species.

Keywords: metabolic rate, sexual selection

Student - Poster presentation - GE1
Araneae
Genetics

Comparative cytogenetic study of two ctenid spiders, *Cupiennius salei* and *Viridasius fasciatus* (Araneae, Ctenidae)

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Cupiennius salei (Ctenidae) represents a traditional model to study various aspects of spider biology. It is also a candidate for genome sequencing. In order to elucidate the genome organization of *Cupiennius salei*, we established its karyotype, distribution of constitutive heterochromatin and nucleolus organizing regions (NORs) as well as size and base composition of the genome. We determined the same features also in the ctenid *Viridasius fasciatus* to compare the genome structure of these species. Notably, both species exhibit typical entelegyne karyotype. Therefore, they are suitable models of entelegyne genomes. Karyotypes of males consisted of 26 (*C. salei*) or 28 (*V. fasciatus*) acrocentric chromosomes, respectively. Both species possessed X1X20 sex chromosome system. Sex chromosomes showed a similar length ratio [1:0.78 (*C. salei*), 1:0.81 (*V. fasciatus*)]. Constitutive heterochromatin consisted of small centromeric blocks, accompanied with small distal blocks in some chromosomes. We revealed NORs at distal parts of two autosome pairs by fluorescence in situ hybridization (nos 4 and 10 (*C. salei*), nos 9 and 12 (*V. fasciatus*). Genomes of both were biased to AT pairs (59% of AT). Karyotype set found in *V. fasciatus* (28, X1X20) is supposed to be ancestral for the superfamily Lycosoidea including Ctenidae. Interestingly, *C. salei* showed both reduced 2n and increased genome size (5,948 Mbp per male diploid genome versus 5,037 Mbp in *V. fasciatus*). The higher genome size in *C. salei* could be caused by accumulation of noncoding DNA. Genome size of both ctenids is close to the average for spiders. However, it is still nearly four times higher than the lowest reports in Araneae. This indicates an appreciable fraction of noncoding DNA.
This work was financially supported by the Ministry of Culture of the Czech Republic (DKRVO 2014/14, National Museum, 00023272) and the Charles University (830413).

Keywords: Ctenidae, chromosome, genome size

Student - Poster presentation - GE2
Araneae
Genetics

Findings of unusual karyotypes in early-diverging entelegyne spiders

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Entelegyne cytogenetics is relatively well-investigated. Male 2n of these spiders ranges from 10 to 49 chromosomes. Typical entelegyne karyotypes consist of acrocentric chromosomes, contain low amounts of constitutive heterochromatin, and include low numbers of nucleolus organizing regions (NORs). Most entelegynes exhibit X1X20, X0 or X1X2X30 sex chromosome systems; sex chromosomes usually do not include NORs. During the long-term study of early-diverging entelegynes (Eresidae, Hersiliidae, Oecobiidae), we have found that their karyotypes are more diversified than those of "higher" entelegynes, which is caused by the evolutionary plasticity and persistence of some ancestral features in their karyotypes. Male 2n of the early-diverging clades vary considerably in comparison with most other entelegynes (Eresidae 24-53, Hersiliidae 28-41, Oecobiidae 19-42). Furthermore, these families contain several species with unusual karyotype: 1) *Seothyra* sp. (Eresidae) (2n♂ = 53, X1X2X30) shows the highest 2n in entelegynes. Karyotypes exceeding considerably the supposed ancestral 2n of entelegynes (42, X1X20) are exceptional. Another unusual feature of *Seothyra* sp. is the presence of three biarmed autosome pairs (all other chromosomes probably retain acrocentric morphology). Karyotypes formed by a mixture of acrocentrics and other morphological types of chromosomes are otherwise rare in Entelegynes. 2) *Dresserus* sp. I (Eresidae) (2n♂ = 46, X1X20). The karyotype of this spider contains three pairs of unusual microchromosomes, composed exclusively of constitutive heterochromatin. 3) *Dresserus* sp. II, *Paradonea striatipes* (Eresidae), *Hersilia caudata*, *Neotama* sp. nov. (Hersiliidae) exhibit a rare sex chromosome system X1X2X3X40, which has been reported only in three entelegynes so far. 4) In *Hersilia*, *Neotama* (Hersiliidae), and *Uroctea* (Oecobiidae) - one X chromosome of the multiple X chromosome system includes NOR. Sex chromosome-linked NOR is a possible symplesiomorphy of Hersiliidae and Oecobiidae. Surprisingly, NORs have spread onto all sex chromosomes in U. durandi (X1X2X30).

This work was supported by projects GAUK (nos 830413 and 1246214).

Keywords: chromosome, Eresidae, Hersiliidae, Oecobiidae

Student - Poster presentation - FM2
Araneae
Functional morphology

Chemical communication in spiders – SEM analysis of the distribution of chemosensilla on male *Argiope bruennichi* (Araneae, Araneidae)

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Olfaction is considered the prime channel of communication in spiders, irrespective of whether they are cursorial or web-building. However, we know surprisingly little about which chemical signals or cues are involved in olfaction and only a single sex pheromone responsible for long distance mate attraction is known to date. Even less is known about the receptors involved: s-shaped and blunt tipped sensilla with a subterminal pore are considered to be responsible for olfaction in spiders. So far, electrophysiological analysis demonstrated the perception of contact pheromones with these sensilla and it is generally assumed that the same structures are responsible for long distance olfaction. We investigated the structure and distribution of the supposed chemosensilla along with other sensory organs on all walking legs and pedipalps of *Argiope bruennichi* males by means of Scanning Electron Microscopy. We show that *A. bruennichi* males possess tip-pore sensilla on all legs and the palps. On the tarsi and metatarsi of the walking legs, sensilla density is high whereas on tibiae and patellae sensilla are rare. On coxae and trochanters no sensilla were found. On the adult male pedipalp, chemosensitive sensilla occur exclusively on the cymbium, a spoon shaped structure at the end of the pedipalp. Our results will help to perform targeted electrophysiological studies with the synthetic sex pheromone. We will test if the tip-pored sensilla are able to perceive the volatile sex pheromone and if sensilla of specific regions show higher sensitivity.

Keywords: SEM, chemoreceptor, olfaction, Araneidae

Student - Poster presentation - EC3
Araneae
Ecology

Selective predation in the spider *Nops* sp. (Araneae, Caponiidae), a possible araneophagous specialist

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Specialised araneophagy has been recorded in eight out of 112 spider families. Although this behaviour is rare in this group, it has received recent attention because of the particular behavioural and morphological adaptations exhibited by several araneophagous spiders during prey capture. In spite of this, most of the studies about the behaviour and biology of araneophagous spiders are restricted to few species while the mechanisms present in other species or families are unknown. The Neotropical spider family Caponiidae, is a poorly known group. It has been presumed to be araneophagous based on morphology and preliminary observations. In spite of this, the feeding behaviour and the prey preference in this family are unknown. Here we describe the prey acceptance and capture efficacy in the caponiid spider *Nops* sp. We expected a higher acceptance and capture efficiency for spiders when compared to other prey. In order to evaluate this, 30 immature individuals were obtained from eggsacs collected in a dry forest in the city of Neiva, Colombia. After hatching, individuals were starved for one week and nine potential sympatric prey types were offered in a randomized order to spiders. These included spiders of the families Oecobiidae and Lycosidae and other seven arthropod species belonging to Collembola, Coleoptera, Diptera, Hymenoptera, Isoptera, Lepidoptera and Orthoptera. Oecobiidae and Lycosidae spiders were the only prey accepted by *Nops* sp. Lycosids and oecobiids were accepted frequently, and in a similar proportion. The capture efficiency, measured as immobilization time, was similar for both spider species. These results confirm our expectation about araneophagy in *Nops*. In contrast to other araneophagous species that can catch also insects, *Nops* sp. captured only spiders, suggesting it is a strict spider-eating specialist.

Keywords: araneophagy, caponiid, feeding behaviour, spider-eating specialist

Student - Oral presentation
Araneae
Symposium - Genomics

Evaluating species boundaries in the *Aptostichus atomarius* (Araneae, Euctenizidae) sibling species complex (CA): a genotyping-by-sequencing based approach

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The trapdoor spider genus *Aptostichus* Simon is a diverse genus in the family Euctenizidae containing 40 species with distributions primarily spanning the California Floristic Province. Within this genus, the *Aptostichus atomarius* sibling species complex is a morphologically homogenous group of species – *Aptostichus angelinajolieae*, *A. atomarius, A. dantrippi*, *A. miwok*, *A. stanfordianus*, and *A. stephencolberti* – inhabiting both dune and inland ecosystems. Currently, species limits within this group are based upon a combination of geographic partitioning and mitochondrial sequence divergence. To test species boundaries and better understand diversification within this complex, a next generation genome scanning approach, genotyping by sequencing (GBS), was employed. GBS was used to generate a shallow genome scan and identify SNPs (single nucleotide polymorphisms) for 47 individuals representing the 6 currently described species within the atomarius species complex. Using UNEAK and TASSEL SNP filtering pipelines, 33934 and 107876 SNPs were recovered respectively. After filtering, 415 markers (missing sites <20%) were retained and used to cluster individuals via the program Structure (K=1-10, 1000000 MCMC reps per run, 10 replicates per K value). Population structure analyses mirror the previously analyzed mitochondrial markers, supporting 5 distinct clusters which match currently delimited species and one admixed outlier (*A. dantrippi* specimen). Interestingly, all but four of the *A. stanfordianus* inland individuals analyzed cluster with dune endemic *A. miwok*, reinforcing the paraphyly of and cryptic divergence within *A. stanfordianus*. Dune endemic species within this complex appear to be deeply diverged from each other, indicating two distinct expansions into dune habitats and parallel evolution of dune phenotypes.

Keywords: GBS, phylogenomics, SNPs, species complex

Poster presentation - CW2
Arachnida
Collections & web-based resources

From a small local collection to an active major regional collection: the National Arachnid Collection at the Hebrew University, Israel

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The arachnid fauna of Israel and its surroundings have been studied since the early 19th century by foreign specialists such as Audouin, O. P. - Cambridge and others. Prof. Aharoni, at the early 20th century, was the first local zoologist who collected spiders deliberately although he did not set up a local collection. It was only at the end of the 1920's, following the foundation of the Hebrew University of Jerusalem, that Prof. Shulov established a local arachnid collection of medical and agricultural importance. With the expansion of the collection staff in the early 1960's, the collection started growing and an effort was made to collect specimens from Israel and the neighboring areas and to identify and study all arachnid orders. Since Dr. Levy became the collection curator, in the early 1970's, it became the most comprehensive arachnid collection in the region, and a precious resource for arachnologists worldwide. He devoted his career to curate the collection and to promote arachnid research in Israel until his untimely death in 2009. The collection includes valuable literature and specimens from eight orders: Acarina (Costa; Feldman-Muhsam and Theodor), Amblypygi, Araneae, Opiliones, Palpigradi, Pseudoscorpionida, Scorpiones and Solifugae, and holds many types (mainly of Costa, Levy, Prozinsky, Shulov, Theodor). From 2009 and until recently, only routine maintenance and a few loans were made under the responsibility of Dr. Chipman and with the assistance of Prof. Lubin, Ms. Musli and the author. Since the beginning of 2014, new staff has been recruited and the collection is active again, including loans, taxonomic work and public activities. We encourage visits to the collection and scientific collaborations. In the coming years we aim to 1) complete catalogues computerization and made it available online; 2) identify material from the acarine collections and create catalogues; 3) continue the arachnological taxonomic work.

Keywords: Arachnida, collection, history, Israel, Middle-East

Student - Poster presentation - BE1
Araneae
Behaviour

Evolution of deceit by worthless donations in a nuptial gift-giving spider

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Males of the nursery web spider *Pisaura mirabilis* usually offer an insect prey wrapped in white silk as a nuptial gift to facilitate copulation. Males exploit female foraging preferences in a sexual context as females feed on the gift during copulation. It is possible for males to copulate without a gift, however strong female preference for the gift leads to dramatically higher mating success for gift-giving males. Females are polyandrous, and gift-giving males achieve higher mating success, longer copulations, and increased sperm transfer that confer advantages in sperm competition. Intriguingly, field studies show that approximately one third of males carry a worthless gift consisting of dry and empty insect exoskeletons or plant fragments wrapped in white silk. Silk wrapping disguises gift content and females are able to disclose gift content only after accepting and feeding on the gift, meanwhile males succeed in transferring sperm. The evolution of deceit by worthless gift donation may be favoured by strong intra-sexual competition and costs of gift-construction including prey capture, lost foraging opportunities and investment in silk wrapping. Females that receive empty worthless gifts terminate copulation sooner, which reduces sperm transfer and likely disadvantages males in sperm competition. The gift-giving trait may thus become a target of sexually antagonistic co-evolution, where deceit by worthless gifts leads to female resistance to the trait. We discuss factors such as female mating rate and intensity of sperm competition that may shape the evolution of male deception, and how ecological factors may influence the evolution and maintenance of worthless gifts as an evolutionarily stable alternative mating strategy by frequency dependent selection.

Keywords: sexual selection, sexual conflict, polymorphisms

Poster presentation - CE7
Araneae
Community ecology

Spider communities of open and wooded habitats in the Natural Park of Prealpi Giulie (Udine, Friuli Venezia Giulia, south-eastern Alps, Italy)

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This work presents the main results from a research conducted from 2001 to 2008 on the spider communities of the Natural Park of Prealpi Giulie (Friuli Venezia Giulia, Udine), a protected area of great naturalistic and biogeographical interest located at the edge of the south-eastern Alps. Research was conducted mainly through pitfall-traps, integrated with hand collection, in seven wooded habitats (mainly beech forest) and seven meadow and pastures sites, which also include an alpine *Carex firma* grassland and arid mountain screes. 4,846 specimens, belonging to 250 species and divided into 27 families have been identified. Results have shown that spider coenoses are diversified and closely related to the ecological differences found among the investigated habitats, although it must be considered that the method of investigation has found almost exclusively soil fauna. The difference between the communities investigated in the two typology of habitats, with reference to species dominance, ecological and faunistic aspects are analyzed and commented. As to the biogeographical aspects, a remarkable presence of endemic alpine species has been found, which confirms the biogeographical peculiarity of the area. Moreover, species with south-east European distribution are particularly represented, suggesting that this area may represent the western limit of distribution for some Balkan species. The records of some new or scarcely known species confirm our incomplete knowledge of this area and its importance from the faunistic and biogeographical point of view.

Keywords: Araneae, ecology, NE-Italy, south-eastern Alps

Oral presentation
Araneae
Symposium - Invasive species

Habitat preference and distribution of endemic and invasive spiders and other invertrebates on sub-Antartic South Georgia

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Geographical isolation of the islands of the Antarcic Ocean is thought to explain low species diversity and a high proportion of endemic species given that dispersal to these islands appears to be rare. The observed distribution of Linyphiid spiders native to these islands is one such example. A recent study of one of the sub-Antarctic islands, South Georgia, suggests, however, that human interference has played a large role in introducing a range of non-indigenous species into this region over the last few years. Comparisons between surveys made several years apart indicate, however, that the number and composition of invasive species on South Georgia fluctuates on an ecological time frame. Invasive species do not always appear to establish, possibly due to the harsh climatic conditions. Furthermore, invasive plant species are found to be a suitable host for some but not all native linyphiids, illustrating the potential for the abundance of native populations to be influenced both positively and negatively by the spread and decline of other invasive species.

Keywords: Linyphiid, invasive species, Antarctic islands

Student - Poster presentation - CE8
Araneae
Community ecology

Spiders living in the Deliblato Sand (Serbia), the largest European continental sands

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The Special Nature Reserve "Deliblato Sands", between the Danube and western Carpathian slopes, is the largest European continental sand area. It was formed during the Glacial Age from the vast layers of silica-carbon sand at Pannonian Basin. This unique mosaic of ecosystems contains particular species of flora and fauna, among which many are rare, relic, endemic and subendemic. At a national level, it represents a natural asset of special importance; falling under protection category I. On the international level it has been designated as a European Important Bird Area since 1989. From the arachnological point of view, it represents an important, but poorly known spot on the European spider map. There were only few literature references available for this area. In 2013, a comprehensive fieldwork was carried out as part of the project "Spiders and sands", which aimed to improve the knowledge on the spider diversity of the Deliblato Sand region. The spiders were collected at representative localities and habitats, using several collecting techniques. Preliminary results included a provisional inventory list of spider species for the area, new records for the Serbian fauna and recovery of previously lost data.

Keywords: Araneae, endemic, Vojvodina

Student - Oral presentation
Araneae
Symposium - Genomics

A new age for spider phylogenomics: expanding Anchored Hybrid Enrichment to resolve both deep and shallow relationships within spiders

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Anchored Enrichment (AE) is a relatively new high-throughput sequencing methodology designed to recover hundreds of unique loci for resolving both shallow and deep-scale phylogenies within non-model systems. Assembled, annotated vertebrate genomes were initially employed to build a scaffold from which probes were designed in highly conserved anchor regions that border less conserved adjacent regions in the genome. Although the efficacy of this approach has been demonstrated for vertebrate taxa using established genomic resources, the vast majority of invertebrate taxa lack reference genomes, and have considerable variation in genome size and complexity, even within families.We have expanded this powerful and highly successful approach for spiders (non-model organisms) by using 15x coverage genomic 'scans' of two mygalomorph spiders, three araneomorph 'raw' genomes, and 18 spider transcriptomes to identify homologous markers for multiple phylogenetic timescales. We targeted 585 loci averaging 600bp in length (ranging from 520-2038bp) - a dataset considered conceptually sufficient to resolve difficult nodes and allow for incomplete lineage sorting or hybridization. As proof of concept, these identified loci are used to infer a highly resolved species tree in the North American tarantula genus *Aphonopelma*. Our spider probe set should accelerate an understanding of the spider Tree of Life by providing a mechanism whereby researchers can confidently and effectively use the same loci for independent projects, while at the same time allowing for effective synthesizing of datasets to understand the macroevolutionary relationships and patterns of spiders.

Keywords: anchored enrichment, Araneae, phylogenomics, systematics

Student - Poster presentation - CE9
Araneae
Community ecology

The difference in species diversity and abundance of spiders on grape vine on terraced and conventional vineyards based on the type of management

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Impact of landscape heterogenity on different animal groups is a well-studied topic. Not only there are studies from a conservation point of view, but also studies focused on an impact of landscape heterogenity on populations of predators and crop pests. Our research was to find out whether the vine plant spider fauna on terraced vineyards is richer than the vine plant spider fauna in plain areas. We assume that terraced vineyards host richer fauna, because it is more heterogeneous and contains not only vineyards itself, but also the frontal part of a terrace. We investigated the fauna of vine plants on terraced and non-terraced areas across south Moravia region by cap-board traps. So far we only have data about overwintered and early spring spiders. We placed 10 traps on the edge of a vineyard and in the central part in each location (terraced and non-terraced) on six locations (120 traps per variant). Until now we have preliminary results only, but these are very interesting. The spectrum of spiders found is relatively poor; we found eight species only (*Synageles venator*, *Salticus zebraneus*, *Nuctenea umbratica*, *Dictyna uncinata*, *D. arundinacea*, *Micaria subopaca*, *Marpissa nivoyi*, *Agalenatea redii*), but we were not able to identify juveniles up to the specific level (710 specimens). We found that the most common spider there is the salticid *Synageles venator*, which is usually not found as a common species. The species did not overwinter on vine plants, but rather occurred there as common in the first spring month (1 ex during overwintering, 141 during March 2014). Most of the overwintering specimens were not adults (only one *Synageles venator* and *Nuctenea umbratica* was found), the spectrum was dominated by juveniles of the genus *Philodromus* and by Salticidae (mainly *Pseudicius encarpatus*, *Macaroeris nidicolens* and *Salticus* spp.). There are big differences between sites, but no significant differences between both types.

Keywords: Araneae, biodiversity, landscape heterogenity

Poster presentation - EC4
Araneae
Ecology

Inter- and intra-island introgression in a wolf spider (Araneae, Lycosidae) radiation from the Galápagos, and its implications for parallel evolution

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Parallel radiations within island systems are often assumed to follow a simple scenario in which single colonization events are followed by in-situ divergence. However, subsequent gene exchange after the initial colonization and during the divergence process might have evolutionary impacts on species radiations. First, gene exchange among ecologically similar species from different islands may lead to introgression of adaptive genetic variation and, hence, influence the parallel divergence process. Second, hybridization events among ecologically different species living on the same island may influence their genetic relationships due to the introgression of neutral genetic variation. In this study, we estimate levels of gene exchange within a wolf spider radiation of the genus *Hogna* from the Galapagos, wherein habitat specialization into 'high elevation' and 'coastal dry' species apparently evolved repeatedly on two islands. By using a multilocus approach we show that low levels of inter island and relatively higher levels of intra island introgression have most likely been prevalent within this spider radiation. Using these estimates, we demonstrate by means of a coalescence simulation that adaptive gene genealogies, expected to better reflect the adaptive divergence process, may strongly differ from gene genealogies of neutral genes. As species phylogenies within radiations are frequently used to infer the divergence pattern, interspecific gene flow should not be neglected when interpreting parallel trait evolution.

Keywords: introgression, adaptive radiation, *Hogna*, coalescence, hybridization

Plenary
Araneae
Mating strategies and genomics

Sex ratio and sexual selection games in a male dimorphic dwarf spider (Araneae, Linyphiidae)

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The expected strong directional selection for traits that increase a male's ability to fertilize females conflicts with the observation that males can show extreme variation in sexual traits. Also in spiders, males of some species show extreme intrasexual differences in the way they acquire mates. A most striking example is an extreme male dimorphism in the enigmatic dwarf spider *Oedothorax gibbosus*. Males of the *gibbosus* morph are characterized by conspicuous cephalic ornaments serving as a nuptial feeding device during copulations, while males of the *tuberosus* morph lack these structures. First, experimental data demonstrate pronounced differences in life history, mating behaviour and sperm competition between the two male morphs. Integrating these results with field observations and simulations suggest that selection for the elaborate *gibbosus* traits results in mating niche that can easily be exploited by *tuberosus* males that do not invest in such traits, which may ultimately lead to the evolution of stable dimorphism. Second, it remains unclear how such strong phenotypic differences translate on the genetic level. I will show how recent genomic tools could provide us with some insights into the genetic basis underlying such profound intraspecific phenotypic variation. Besides this male dimorphism, the species also produces a biased sex-ratio, which is generally not expected in solitary species because of Fisherian sex-ratio selection. Recent work showed that also at this level, evolutionary games are being played between spiders and endosymbiotic bacteria that distort the sex ratio of their host. Metagenomic data further show that, at least for this spider species, the endosymbiont community is restricted to bacteria known to affect host reproduction. Ultimately, I will hint how this sex-ratio game can interact with the male dimorphism. In sum, work on this spider may provide substantial insight into the evolution of secondary sexual traits and sex ratio in spiders.

Keywords: dwarf spiders, evolution, genetics, sex-ratio, sexual selection

Student - Oral presentation
Araneae
Social spiders

How to trigger your motherly instinct? Investigating the evolution of social behaviour during maternal care from a physiological and behavioural point of view

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Group-living is associated with conflicting interests among group members over who gets to reproduce, and who becomes a helper. In social spiders, individuals form permanent groups, where females can take on all tasks. Usually only a fraction of females become reproducers, whereas the remaining females care for the offspring. Allo-maternal care includes capturing prey that is given to the spiderlings but also regurgitation feeding, by which the spiderlings are fed pre-digested food. Ultimately, helpers and mothers are consumed by the spiderlings, termed matriphagy. It remains a puzzle what triggers regurgitation feeding and matriphagy in *Stegodyphus* spiders (Araneae, Eresidae). When looking at changes during maternal and allo-maternal care of social and subsocial spiders, we will be able to investigate what the transition is from being a solitary breeding to cooperatively breeding spider. In solitary species, only females that produced an egg sac perform offspring care; this implies that the transition to cooperative brood care involves a physiological transition in non-reproducing females to perform allo-maternal care. We found physiological changes in subsocial spider mothers, where we observed an elevated standard metabolic rate (SMR). Furthermore we wanted to understand in which stage during maternal care this change was triggered, and if this change was reversible. First results showed that the presence of spiderlings had the largest effect on the mother's SMR, and by removing the offspring, the mother was able to change her SMR. By comparing changes in solitary and social species we explore what triggers mothers and helpers to perform maternal care.

Keywords: maternal care, physiology, helping behaviour, sociality, evolution

Plenary
Araneae
Phylogeny

The unbearable lightness of being monophyletic: Reinterpreting the evolutionary chronicle of orb-weaving spiders with phylogenomic tools

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The orb-weaving spiders (Orbiculariae) comprise over 25% of the ca. 44,500 known living spider species and produce a remarkable diversity of webs. The wheel-shaped orb web is primitive to this clade, but most Orbiculariae spin webs that are hardly recognizable as orbs. Orb-weavers date at least to the Jurassic. With no evidence for convergence in the form of the orb web, the monophyly of the two typical orb-web taxa, the cribellate Deinopoidea and the ecribellate Araneoidea, remains problematic and the sister group of the Orbiculariae also remains elusive. Despite extensive phylogenetic scrutiny, a fully resolved cladogram of the Orbiculariae families is not yet possible. More comprehensive taxon sampling, comparative morphology and new molecular markers are required for a better understanding of orb-weaver evolution. In collaboration with Rosa Fernández and Gonzalo Giribet (Harvard University) we have applied a Next-Generation Sequencing approach to resolve deep cladogenetic events in Araneae, including testing the monophyly of Orbiculariae, accounting also for potential confounding factors in phylogenomic inference. The analyses of multiple matrices (the largest one includes 2,637 genes and 791,793 amino acids) all agree on the basic tree structure and all reject the long-accepted monophyly of Orbiculariae by placing the cribellate orb-weavers (Deinopoidea) either sister to a large clade that includes the mostly cursorial RTA clade or the Oecobiidae and not with the ecribellate orb-weavers (Araneoidea). These results are congruent with the orbicularian analyses that we have carried out in collaboration with Dimitar Dimitrov (University of Oslo) and colleagues using 362 taxa coded for the six standard genetic markers. In both studies our results imply independent origins for the cribellate and ecribellate orb-webs or a much more ancestral origin of the orb-web with subsequent loss in the RTA clade. Either alternative demands a major reevaluation of our current understanding of the spider evolutionary chronicle.

Keywords: Araneae, evolution, Orbiculariae, phylogeny

Poster presentation - CE10
Araneae
Community ecology

Do local or landscape-level factors have more important influence on the abundance and species richness of spiders in dry sandy grassland fragments in Hungary?

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Since the second half of the last century the once continuous natural and semi-natural grasslands have become fragmented and reduced their size dramatically by the increase of intensity of agricultural practices. To understand the relationship between agricultural activity and grassland biodiversity, investigations on local and landscape scale are necessary. In this study, our main aim was to study the effects of local and landscape-level factors on species richness and abundance of all spiders, grassland specialist and generalist spiders, as well as hunting and web-building spiders in nine Hungarian dry sandy grassland fragments. We also studied the effects of these factors on the abundance of the most frequent hunting species. We sampled spiders using pitfall traps between 2001 and 2009 fortnightly from the end of March to the end of October. During the study period we trapped a total of 6589 individuals of 145 species. Our results showed that only local factors (cover of plants, cover of bare ground and cover of litter) affected significantly the species richness and abundance of spiders with different habitat affinity (generalist and specialist) and guild type (hunting and web-building). The effect of plant and litter cover was significantly positive, while the impact of bare ground cover was significantly negative on the species richness and abundance. Two local factors (average height of grass and patch size) and the landscape-level factors (percentage of adjacent grasslands, inverse isolation index and habitat diversity) had no significant effects on any of the dependent variables. The species level analysis pointed out that the abundance of eight of the nine most frequent species depended only on local factors, but the abundance of *Gnaphosa mongolica* influenced exclusively by landscape-level factors. Our results suggest that the effects of local factors were more important on species richness and abundance of spiders, than landscape-level factors.

Keywords: 9-year-period, habitat-affinity, guild-types, plant-cover, bare-ground-cover

Poster presentation - CE11
Arachnida
Community ecology

Is there a correlation among species richness of three arachnid orders (Arachnida: Araneae, Opiliones, Pseudoscorpiones)? – Results of an investigation in core area forests and managed forests in the Wienerwald biosphere reserve, Austria

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The Wienerwald biosphere reserve management commissioned a biodiversity monitoring programme which aimed 1) to survey and make an inventory of the species richness for selected groups of organisms and 2) to compare the biodiversity between core area forests and managed forests. Three arachnid orders (harvestmen, pseudoscorpions and spiders) have been investigated between April 2012 and May 2013 by means of pitfall traps, soil-sifting and hand-collecting in 45 monitoring study plots for spiders/harvestmen and 50 study plots for pseudoscorpions, respectively. 39 plots were common for all three groups (25 in core areas, 14 in managed forests). In total, 171 spider species belonging to 25 families were collected, 19 species of harvestmen belonging to 4 families and 6 species of pseudoscorpions belonging to 3 families. Diversity and variation of all arachnid assemblages do not differ significantly between the core area and managed forests. We suggest two reasons for that: 1) the core area forests have been set aside only recently, and 2) the selected managed forests show an above-average level of deadwood structures. We found no correlations in species richness between pseudoscorpions and harvestmen as well as spiders; however, we found a significant positive correlation in species richness between harvestmen and spiders.

Keywords: species richness, spiders, harvestmen, pseudoscorpions

Oral presentation
Araneae
Community ecology

Can BAF index reflect biodiversity of landscape mosaics in coastal areas? A case study using spiders as indicators

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Biotope area factor (BAF) is a commonly used methodology while evaluating the ecological effectiveness of urban areas. However, this traditional method only considers the land use surface types of the landscape mosaics using aerial photos and expert questionnaire method. It is not clear whether the ecological effectiveness of areas estimated by BAF system is congruent with the actual ecological characteristics and diversity of inhabiting organisms. In this study, the practicality of the BAF systems is evaluated by comparing the BAF values of landscape mosaics located in four coastal areas in central Taiwan with the vegetation structure and spider diversity data collected in situ. We first determined the BAF values of various landscape homogenous units in these coastal areas by expert questionnaire method using aerial photos. Then sampling plots were established in these homogenous units to systematically survey vegetation structure and spider diversity. The results showed that the vegetation structure and spider diversity of sampling plots were not congruent with the designated BAF values of the homogenous unit in which the sampling plots were located. Such result indicates that a new generation of weighting system is needed to realistically and precisely designate the ecological effectiveness of landscape mosaic units.

Keywords: BAF, biodiversity, coast, spider, urbanization

Oral presentation
Araneae
Functional morphology

Spider genital asymmetry - Is it really that rare?

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While genital asymmetry is common in insects, it is supposedly extremely rare in spiders. I review the known spider cases (apparently nine independent origins) and present a newly discovered species-group of *Panjange* (Araneae, Pholcidae) from the Philippines with conspicuously asymmetric male pedipalps. The fact that six of the nine spider cases have been discovered since 2006 raises the question about the actual rarity of the phenomenon and about conceptual and methodological biases. The routine detailed examination (detachment; expansion; illustration) of only one palp and alternative interpretations for apparent asymmetries (artifacts; varying angles of view; teratologies) may bias us against discovering spider genital asymmetry.

Keywords: genitalia, asymmetry, *Panjange*, biases

Poster presentation - BF4
Araneae
Biogeography and faunistics

Some interesting jumping spiders (Araneae, Salticidae) from the Czech Republic

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In the Czech Republic is known to have at least 69 species of jumping spider (Araneae, Salticidae), but recent work indicates that more species may exist. For example, in the last few years the geographically widespread species *Sibianor aurocinctus* has been redescribed as several different species across its distributional range, and there are at least 3 species of this genus in the Czech Republic – *Sibianor aurocinctus* (Ohlert), *S. tantulus* (Simon) and *S. larae* Logunov. In addition, one female of the genus *Sibianor*, which is not similar to any known species from Central Europe, has been reported. Other notable observations include that of species from the genus *Heliophanus* given that there is uncertaintly regarding the validity of *Heliophanus pouzdranensis* Miller. The basis upon which we argue this species status should be restored will be shown (difference in coloration, size and habitats). A final species observation is one species close to genus *Icius*, which has been found in the canopy of coppiced forest in the Palava region. All species and differences will be described and discussed on our poster.

Keywords: low-land forests, tree layers, spiders

Oral presentation
Post congress
Special session CaveLab

Caves as laboratories for the study of the effects of temperature on ecosystems and biodiversity: researches of the CaveLab Project at Bossea show-cave (NW-Italy)

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Cave ecosystems offer unique opportunities for ecological studies because they are characterized by low abundance and diversity of organisms, they receive poor energy inputs and they are easily modelled. The fact that caves are stable and semi-closed systems make them ideal sites where to study the influence of temperature on ecosystems processes, functions and biodiversity, which is the core issue of this interdisciplinary project. We created a multidisciplinary research team in order to provide a deep understanding and a precise characterization of the cave ecosystem, from both an abiotic and biotic point of view, also by means of innovative technology developed within the project. Once characterized, cave ecosystems are set in a bigger frame, by considering direct and indirect factors at a local and global scale like availability of energy sources, anthropic perturbations, structure of biocoenosis, climate and past glaciations dynamics. The influence of temperature is evaluated on each ecosystem component by means of direct observations, experiments and statistical modelling. Focusing on the results, we address the role of the cave ecosystems in understanding and monitoring the effects induced by global warming. The research project is structured in seven work packages (WPs), coordinated by different member of the research team. All WPs are interconnected with each other, with concrete opportunities of transdisciplinary collaboration. Studies on cave microclimate (WP1) aim at characterizing cave climate and temperature fluctuations. A deeper understanding of such dynamics is essential for the following WPs, which focus on the influence of temperature on the different ecosystem components. The very base of the trophic interactions within cave ecosystems is studied in WP2 (bioavailability of organic matter) and WP3 (fungi and their interactions with other organisms). Cave dwelling biocoenosis and their potential as bioindicators are studied in WP4, with a special focus on direct and indirect effects of human disturbance. Species distributions and their relationships with past climatic events are the focus of WP5 and represent the basis for WP6, aimed at modelling future processes of species extinction or expansion, addressing the role of the cave ecosystem in understanding and monitoring the effects induced by global warming on biocoenosis. Focusing on the results obtained in each WP, WP7 aims at the development of the project in terms of scientific and social impact. In this interactive session we will present the researches of the CaveLab project set within the Bossea show cave, with special focus on WP1 (cave microclimate), WP3 (subterranean fungi), WP4 (lampenflora) and WP6 (cave dwelling arthropods and their potential in the study of global warming dynamics). Talks will be presented through an itinerant session inside the Bossea show cave by direct observation of the phenomena herein described.

Keywords: Alps, hypogean environment, multi-disciplinary, NW Italy, work packages

Oral presentation
Araneae
Biogeography and faunistics

An overview on the Italian spider fauna based on the new national checklist

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We provide an outline of the current knowledge on the Italian spider fauna, based on the compilation of a new updated national checklist. The checklist, that will be soon available online, provides information about the general distribution and the presence of each taxa in continental Italy, Sicily and Sardinia. Data were gathered from more than 900 papers. The number of specific or subspecific taxa currently reported for Italy is 1609, grouped in 420 genera and 53 families (nomenclature updated). More than one hundred species were excluded from the list being specie inquirendae or based on uncertain bibliographical sources. When analyzing the species distribution, a remarkable amount of endemic species (318, 19.7%) stands out, most of them (206) being recorded exclusively within the national borders. The major districts of endemism are represented by the Alpine and the Apenninic chain, the Adriatic and the Thyrrenian coast (including Corsica, Sardinia and the Western coast of the peninsula) and Sicily. Nearly half of the Italian endemic species (99) are solely cited in the original description, 125 are known for two or three localities and 67 are recorded in the type locality only. In 54 cases only one sex is described. Most of the recent arachnological researches in Italy (1995-2013) focused on the northern part of the peninsula, for which a satisfactory understanding has been achieved. On the other hand, Central and southern Italy (including the main islands) exhibit a remarkable lack of knowledge. In this respect, researches in the Mediterranean area are particularly needed. Despite the unbalance between north and south, Italy stands out for being one of the richest countries in terms of araneological diversity in Europe.

Keywords: checklist, endemics species, Italy

Student - Poster presentation - PHV1
Scorpiones
Physiology - Venom

A climatological study of scorpion sting incidence from 2007-2011 in the Dezful area of south-western Iran, using time series model

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Scorpion sting is a public health problem in south and south-west of Iran. There is little information regarding climatological effects on scorpion incidence. Therefore the present systematic survey of scorpion sting data was conducted for the first time in the Dezful area in Khuzestan, south-west Iran. This enables the local authority to predict the new outbreak of scorpion stings and making the plans to eliminate scorpion stings among the residents of the region. In total, 3,755 scorpion sting cases of the Dezful health center were monitored during April 2007-September 2011 in a time series analysis using MINITAB ver. 16 statistical software package. Results showed that temperature had significant effects on scorpion sting. The coefficient of multiple regression indicated that approximately 5 cases of scorpion stings increased per unit change in temperature. R-sq of the model was 78.6%. From the data of the present study it is concluded that the scorpion activity in Dezful County is a climate-dependent phenomenon.

Keywords: scorpion sting, time series, Dezful, climatology

Student - Oral presentation
Araneae
Social spiders

Histological examinations of the mechanisms and dynamics of maternal care in the subsocial spider *Stegodyphus lineatus* (Araenae, Eresiidae)

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The evolution of social behaviour in spiders poses some exciting questions. Particularly fascinating is the fact that in carnivorous and cannibalistic animals, like spiders, group living has evolved. The subsocial behaviour shown by several species during the period of maternal care is assumed to have been fundamental for the evolution of sociality in spiders. Investigating the mechanisms of maternal care can therefore contribute to the understanding of the fundamental aspects in the evolution of sociality. Females of the genus *Stegodyphus* feed their young via regurgitation and are consumed by them at the end of the maternal care process (matriphagy). This study aims to clarify of what triggers regurgitation feeding and matriphagy in the subsocial spider *Stegodyphus lineatus* and if these processes are strictly channeled or reversible. Females of different reproductive stages: oviposition, when the spiderlings hatched and during early and late stages of regurgitation feeding were chemically fixed for morphological studies of the midgut and the ovaries. We found that the spiderlings were not the initial trigger for regurgitation processes in *S. lineatus*. We also found that the cells of the midgut gland disintegrated during the process of accumulating the fluid material for regurgitation. But at all times part of the midgut stayed functional. If the egg sac or the spiderlings were removed from the female the process of disintegration stopped and the accumulated fluid material was reabsorbed by the intact diverticles. Matriphagy only occurred when the resources of the midgut gland were exhausted. Our results demonstrate that females of *S. lineatus* have a physiological reinsurance mechanism against brood loss. Consequently, suicidal material care is not strictly predetermined as was assumed up to now.

Keywords: histology, brood care, sociality

Student - Poster presentation - BE2
Araneae
Behaviour

RIMs in action: Courtship and copulatory behaviour of wolf spiders of the genus *Alopecosa* (Araneae, Lycosidae)

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Recently, aspects of reproductive behaviour in wolf spiders are studied with focus on the genera *Schizocosa* and *Pardosa*. The genus *Alopecosa* is slightly neglected, therefore only little is known about its reproduction. As different species of the genus *Alopecosa* live often in sympatry or parapatry and their mating periods peak at the same time, ecological and phenological isolation seems to be insignificant. Thus, courtship behaviour provides an important role in reproductive isolation mechanism (RIM). Our aims were therefore to describe courtship behaviour and the course of copulation in central European *Alopecosa* species. We have observed and recorded courtships followed by successful copulations of nine species of the genus *Alopecosa*, belonging to the following groups: *pulverulenta* (*A. pulverulenta*, *A. trabalis*, *A. taeniata*), *fabrilis* (*A. accentuata* – Czech and Italian populations, *A. inquilina*), *sulzeri* (*A. sulzeri*) and *striatipes* (*A. striatipes*, *A. schmidti*). Placement of *A. psammophila* into a specific species group is uncertain, since it possesses morphological characters of both *striatipes*- and *sulzeri*-group. We have analyzed reproductive behaviour of up to 12 pairs of each species. Courtship and copulatory behaviour of *Alopecosa* species is species specific encountering an enormous variety of courtship elements (e.g. leg waving, palpal scraping, abdominal tapping). The copulatory patterns differ in copulation duration, number of palpal insertions and hematodochal expansions – generally, every single embolus insertion is accompanied by multiple hematodochal expansions. Variation in duration of copulation and in number of hematodochal expansions among *Alopecosa* species is striking. Courtship behaviour differs significantly among the groups and there is a general pattern consistent for each group. Based on courtship behaviour, we propose placing of *A. psammophila* in the *striatipes*-group. This work was financially supported by the Grant Agency of the Charles University (GA UK 380214) and the Ministry of Culture of the Czech Republic (DKRVO 2014/14, National Museum, 00023272).

Keywords: *Alopecosa*, copulation duration, courtship, mating

Poster presentation - CW3
Araneae
Collections & web-based resources

www.arachnobaze.cz

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Arachnobaze is a web application that shows the ecological and phenological data obtained from the Database of Spiders of the Czech Republic, containing 114,000 records for 850 species. Processing of the database was realized by means selection of 8 attributes for further evaluation (Species, Altitude, Quadrate, Habitat Code, Date, Male, Female, Method of Collecting). Ecological factors of the habitat that were not a direct part of the database are derived from the features of the habitat where individual species were found. The code of the habitat is transformed into a table with the corresponding average value of ecological evluation. For this purpose, the factors were divided in 4 or 5 degrees. The data are further adjusted by frequencies of spider collections on different types of habitat, which provides more realistic information about their real occurrence. The output is a graphic representation of ecological and phenological data, modified by the frequency of collections under given conditions. In addition, the accompanying species that occur simultaneously with the given species are stated here. At the same time, the system is designed as an interactive online database, allowing the prediction of the occurrence of the species, depending on the entered environmental factors - the expected association of spiders under the given conditions. After the input of data regarding habitat, altitude, time, method of collection and region, the system generates a list of species according to the degree of probability of their occurrence. In addition, tight row format allows the input of more species followed by comparison of differences of their occurrence and environmental requirements. According to the preliminary evaluation, the results of the model are comparable with published faunistic data with specified environmental data.

Keywords: database, ecology, web application

Student - Poster presentation - BF5
Araneae
Biogeography and faunistics

A lot or not? A review of 200 years of spider research in Croatia

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Through 200 years of spider research in Croatia, 719 spider species were recorded. The first written record of spider species for Croatian territory was given by Alberto Fortis in 1774, mentioning two "dangerous spiders which can cause painful bites". First publication of spider survey was published in 1817, marking beginning of interest in Croatian spider fauna. As a part of the PhD thesis "Spiders of Croatia and analysis of the environmental determinants of their distribution", a revision of the spider checklist of Croatia and georeferencing of all known records is in progress. A review of publications as well as survey of museum collections containing spider records from Croatia is ongoing, accompanied with redetermination of questionable and unidentified material. References from the historical checklists of Croatian araneofauna and other publications known to mention spider records from Croatia were listed in the database. Secondly, arachnologists were contacted through the mailing lists of the International Society for Arachnology and European Society for Arachnology, in search of literature references for which they know to contain information about records of spiders from Croatia. Online databases were used to search and download listed literature references, but also to find new ones. Similar procedure was done for identifying museum collections containing Croatian spider material. Altogether more than 520 publications, mainly from foreign authors, mentioning spider records from Croatia have been identified. So far, 60% of the publications have been processed, resulting in 6,800 records stored in the database. 45 museums and institutions were contacted, out of which 25 were identified to have relevant spider material, counting more than 6,000 records. Based on current analysis, the number of recorded species is close to 800. Upon the collection of existing records, a georeferencing of all records without precise coordinates will be carried out using specifically designed online application.

Keywords: Croatia, georeferencing, historical data, spiders

Poster presentation - BF6
Araneae
Biogeography and faunistics

Diversity of the spider family Agelenidae (Arachnida, Araneae) in Turkey

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The family Agelenidae currently includes 1,157 species in 70 genera and has a global distribution. The family is represented by 55 species under 11 genera in Turkey now (*Agelena* 2 species, *Agelescape* 3, *Allagelena* 1, *Coelotes* 8, *Eratigena* 3, *Lycosoides* 2, *Maimuna* 2, *Pireneitega* 2, *Tegenaria* 30, *Textrix* 1, *Urocoras* 1). *Tegenaria* Latreille is the most speciose genus with 30 species of which 15 are endemic to Turkey and the total endemic species of the family is 25 (45%). This study presents the distribution of the family in Turkey based on literature data and newly collected material.

Keywords: Agelenidae, distribution, diversity, spider, Turkey

Student - Poster presentation - BF7
Araneae
Biogeography and faunistics

The burrowing spider genera *Brachythele* (Araneae, Nemesiidae) and *Lycosa* (Araneae, Lycosidae) in the Balkan Peninsula: a provisional synopsis and call for specimens.

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The burrowing genera *Brachythele* (Araneae, Nemesiidae) and *Lycosa* (Araneae, Lycosidae) have not been revised yet and the taxonomic knowledge of both genera is unsatisfactory. Many species are described by one sex only and for some of them the type material is lost. Because of their cryptic life, they are very rare in museum collections. The aim of this research is a revision of *Brachythele* and *Lycosa* from the Balkan Peninsula. To succeed in this, I need to examine more samples of these two genera.

Keywords: Araneae, taxonomy, revision

Oral presentation
Opiliones
Community ecology

The harvestmen fauna (Arachnida, Opiliones) in the core area and managed forests in the Wienerwald biosphere reserve (Austria)

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The Wienerwald biosphere reserve is currently staging the largest zoological monitoring programme for Central European forests. The aims are compiling an inventory of species richness and comparing the coenoses between the core area and managed forests. Harvestmen have been investigated, beside 11 other animal groups. In the 45 monitoring study plots in maple-lime, beech, oak, oak-hornbeam, ash and Austrian pine forests 19 harvestman species were recorded by means of pitfall traps, soil-sifting and hand-collecting. Remarkable is the adjacent presence of thermophilic, xerophilic and hygrophilic harvestman species. Diversity of harvestman assemblages does not differ significantly between the core area and managed forests. The main reason for this result is that the core area forests are, on the one hand, still quite young and, on the other hand, the selected managed forests are clearly above-average in their richness of deadwood. However a hierarchical cluster analysis showed high similarities between the harvestman-fauna of beech and hornbeam forests and oak forests respectively. The presence of *Leiobunum rupestre* is linked to the availability of rocks and is almost independent of forest types. The species diversity of the litter-inhabiting harvestman fauna shows a maximum of 4 species per site in the core area, and 1 in the managed forests. The mapped average abundance of these litter-inhabiting harvestmen was unexpectedly low: core area-sites with 2 specimens per square metre and managed forests with about half this number. Astonishing is also the high percentage of alien species inside these forests, more or less far away from the next villages and the city of Vienna: an analysis of the material yielded by specific hand-collecting reveals dominance of *Opilio canestrinii* and *O. ruzickai* making up 21 % in total. Last but not least, the nature conservation value of the core area forests is significantly higher than that of managed forests.

Keywords: Opiliones, forests, biodiversity, conservation, aliens

Poster presentation - BF8
Araneae
Biogeography and faunistics

The large house spider *Tegenaria atrica (Araneae, Agelenidae)* established in Finland

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The large house spider (*Tegenaria atrica* C.L. Koch) has established indoors in larger cities and their surroundings in Finland, especially in the southern part of the country. It was found in Finland for the first time in Helsinki in 1971. In the Finnish spider database there are about 190 records from Finland, of these the great majority in the Helsinki area (65%) and around Turku (15%). The northernmost localities lie in harbor cities along the coast of the Gulf of Bothia up to the city of Oulu (ca 65° N). In most cases *T. atrica* has been found in buildings in harbor and industrial areas. Many of these populations have lived there for years. The species has been observed also in living houses, sometimes it occurs there in great numbers. Also some permanent outdoor living populations have been found, and populations living in unheated cellars.

Keywords: invasive, spider, synanthropic, north Europe

Oral presentation
Araneae
Behavioural ecology

Web architecture alteration of the orb-weaver *Tetragnatha montana* (Araneae, Tetragnathidae) induced by a polysphinctine parasitoid (Ichneumonidae, Polysphinctini)

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The alteration of the web architecture of the orb-weaving spider *Tetragnatha montana* induced by the polysphinctine wasp larva *Acrodactyla quadrisculpta* was studied for the first time. The manipulated spider constructed a unique cocoon web that provided strong mechanical support for the parasitoid's pupal cocoon. The manipulated web consisted of one highly reinforced main thread, tensioned in 60% of the cases by a reinforced side thread. The wasp cocoon, square in cross-section, was fastened along its length to the main cocoon thread. *A. quadrisculpta* was associated exclusively with tetragnathid spiders, with a parasitism rate of 19%. High parasitoid mortality was observed during the penultimate larval stage (42%), when spiders lost their parasitoid larvae during molting or the larvae died. 4% of the parasitoid larvae died in the final instar, while an additional 27% died in the pupal stage. All spiders recovered when the larva was removed before reaching the final instar larva. One spider which was able to remove the final instar larva from its ophistosoma died because of secondary microbial attack at the site where it had been injured by the larva.

Keywords: behaviour, interaction, manipulation, wasp, spider

Student - Oral presentation
Araneae
Community ecology

Vineyard terraces as a refuge for rare and endangered spiders in a modern agriculture landscape

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Many xerothermophilic invertebrate species have become rare and endangered due to intensified agriculture and forestation during the last decades. An important question is whether human-made habitats may serve as refuges for rare xerophilous species inhabiting disappearing seminatural and natural locations. We studied spider assemblages of several vineyard terraces in the traditional wine region of the Czech Republic and investigated factors from microhabitat to landscape scale that could influence conservation usefulness of terraces. Species density, abundance, conservation value and degree of rareness were analyzed for conservation-important spider species on terraces with two succession-stage habitat types (sparse versus dense grass) in landscapes with varying proportions of surrounding potential source areas and different surrounding habitats. A total 171 species of spiders were recorded, with high proportions of rare xeric specialist (40%) and red-listed threatened species (15%) that supports the conservation potential of vineyard terraces. The conservation significance of terraces is affected by factors operating at (micro) habitat and landscape scales. Overall species density and spider abundance did not differ significantly between terraces with sparse versus dense vegetation cover. Rare and endangered epigeic species were associated with terraces having sparse vegetation while rare epiphytic species were associated with terraces having dense vegetation. Species density, conservation value, degree of rareness and abundances of red list and rare species increased with presence of adjacent steppe grasslands. Our results indicate such artificial habitats can be important refuges for a wide spectrum of xerothermophilic spiders. To prevent losses of rare and endangered xeric species, we suggest agricultural interventions and management methods that retain important diversification of microhabitats. This research was supported by grant IGA MENDELU Brno no. TP7/2014.

Keywords: agriculture, spiders, succesion stage, terraces

Student - Poster presentation - EC5
Araneae
Ecology

Effect of canopy openness on distribution of sibling species from *Pardosa lugubris*-group (Araneae, Lycosidae)

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In the Czech Republic, the *Pardosa lugubris*-group consists of three sympatric sibling species: *Pardosa alacris*, *P. lugubris* and *P. saltans*. These three species are morphologically almost identical and all three species prefer deciduous forests and forest-steppe habitats. Therefore, the question is, how can such similar species coexist? Here, we tested the hypothesis that two most abundant species from the *lugubris* group, *P. lugubris* and *P. alacris*, have differentiated their niches along a gradient of canopy openness. The study took place in eight forest stands afforested by *Quercus robur* and *Carpinus betulus* in the most northern edge of Pannonia in southern Moravia of the Czech Republic. We established 60 metres long transects reflecting the gradient of canopy openness in each forest stand. The transects consisted of 5 regularly placed pitfall traps. Spiders were collected from 12th May to 14th July 2012. We found that presence of *P. alacris* was connected to the patches with open canopy such as forest clearings. The abundance of *P. alacris* decreased with decreasing light volume toward the forest habitat. On the other hand, *P. lugubris* occurred mainly in the places with a dense, close canopy and its abundance increased with decreasing light volume. Our results confirm that the two sibling species, *P. alacris* and *P. lugubris*, can coexist in the same locations because their niches are separated along gradient of canopy openness. We also propose that the open habitat specialist *P. alacris* is able to colonize the open patches in forest even without their connection to the source habitat. This is important to consider in the context of nature conservation and forest management.

Keywords: *Pardosa lugubris*, *Pardosa alacris*, canopy, deciduous forests, Czech Republic

Oral presentation
Araneae
Symposium - Invasive species

Adaptive introgression enabled the northern range expansion of European wasp spiders *Argiope bruennichi* (Araneae, Araneidae)

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Poleward range expansions are observed for an increasing number of species and commonly attributed to global change. However, recent research indicates that range expansions might also be enabled by evolutionary adaptation. A possible example is provided by the European wasp spider *Argiope bruennichi*. Originally largely distributed in the Mediterranean region, it has greatly expanded its range in the past decades and can now be found as far north as Finland. The colonization of colder habitats in northern Europe was apparently facilitated by adaptation of expansive populations to novel climatic conditions. Northern expansive spider populations have developed an increased cold tolerance and enhanced overwintering performance compared to their southern European relatives. The functional genetic background of these contemporary adaptations is still largely unknown. We thus used whole genome and transcriptome sequencing of several native southern and expansive northern European spider populations to identify the genomic basis of their rapid evolutionary divergence. Our genome analysis shows a generally low genetic divergence between native and expansive spiders, indicating a very recent population subdivision. Despite this overall low divergence, we identify highly differentiated genomic islands, which distinguish native and expansive populations. Several candidate genes within these divergent islands can be directly associated with potentially adaptive phenotypes in northern Europe. Interestingly, the observed genomic divergence of native and expansive spider populations is primarily caused by introgression from East Asia into the expansive northern European gene pool. Based on these results, we assume that introgression of novel genetic variation enabled a rapid evolutionary divergence and triggered the wasp spider's range expansion in Europe.

Keywords: adaptation, genomics, introgression, range expansions

Poster presentation - CW4
Araneae
Collections & web-based resources

World Spider Catalog

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From 2014 on, the World Spider Catalog (WSC), so far managed by Norman I. Platnick (American Museum of Natural History, New York) will be run by the Natural History Museum Bern, Switzerland. After an internal test phase, from summer 2014 it is available on-line for the broad public. The data of the new catalog are hosted in a database. This will allow users to conveniently search for taxa (incl. old combinations, synonyms, etc.), authors, LSIDs and bibliographic information. Furthermore, we offer a simple web service through which users can retrieve modified and new taxon names for their own databases. Four editors manage the scientific content of the WSC and seven experts are available to solve critical taxonomic and nomenclatural cases. Daniel Gloor as IT specialist is responsible for the technical aspects of the new WSC.

Keywords: taxonomy, nomenclature, systematics, online database

Plenary
Araneae
Physiology

Much more complexity than necessary: the venom of a spider

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Spider venoms comprise a variety of substances which are required for venom production and processing as well as for the envenomation process of the prey. They can be categorised into five compound groups: low molecular molecules, acylpolyamines, linear cationic peptides, cysteine-rich peptides, and proteins. Mygalomorph spiders represent a basic configuration of venom composed of low molecular mass compounds, cysteine-rich peptides and enzymes, exhibiting a very well-functioning and established composition comparable to the venoms of scorpions. Dependent on the phylogenetic level of spiders, many modifications and specializations have been developed: Araneidae and Nephilidae rely mainly on amino acid containing acylpolyamines and may have reduced enzymes. Theridiidae developed large neurotoxic proteins and Sicariidae venoms predominantly contain phospholipase D beside peptides and other enzymes. Many neurotoxic and cytolytic acting peptides are considered to be family specific. Due to the increasing number of available spider venom transcriptomes, several very similar peptides have been identified in a low number of copies in several spider families. This could give an additional hint to venom evolution. The possibilities and limitations of venom composition as a phylogenetic pattern are discussed.

Keywords: enzymes, neurotoxic peptides, spider venom

Student - Oral presentation
Araneae
Symposium - Mating strategies

Mating plug efficacy in a dwarf spider (Linyphiidae, Erigoninae) – the role of size and age

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The production of mating plugs is a defensive male strategy against multiple female mating. By mechanically blocking the female genital openings a male can reduce female remating probability and thereby increase its own reproductive success. The size and persistence of mating plugs in or on the female genital openings are key traits that affect the strength of paternity protection. In the dwarf spider *Oedothorax retusus* (Linyphiidae, Erigoninae) amorphous mating plugs have been described that are significantly larger after longer copulation durations. Thus, copulation duration can be taken as a measure of plug size. Plug material in *O. retusus* is transferred in a liquid condition from the male pedipalps into/on the female genital openings. Therefore, it is unlikely that a plug is equally effective immediately after its placement compared to after curing. We investigated the influence of size and age of mating plugs on their efficacy in *O. retusus*. Even though a high proportion of subsequent males (82%) tried to mate, only one third were able to copulate. Remating probabilities were significantly higher after previous short copulations (resulting in a small plug) compared to long copulations (resulting in a large plug). With increasing age, small plugs became more effective, whereas efficacy of large plugs did not depend on their age being equally high over all remating intervals. Our study shows that mating plugs in *O. retusus* effectively impede females from further mating and that mating plug efficacy is shaped by both plug size and plug age.

Keywords: Erigoninae, mating plug, sperm competition

Student - Poster presentation - EC6
Araneae
Ecology

Effect of the glyphosate on the functional response of two Uruguayan wolf spider species (Araneae, Lycosidae)

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Recently, the use of native natural enemies has increased in order to reduce the crop production costs and mitigate the negative environmental effects caused by application of insecticides and other agrochemical products. Spiders are one of the most common and abundant natural enemies in South American crops including soybean. In spite of this, studies about the effect of insecticides and herbicides on natural South American enemies are scarce. We evaluated the effect of the herbicide glyphosate on the functional response of two wolf spiders, *Lycosa poliostoma* and *Lycosa bivittata*, which are the main dominant predators in soybean crops in Uruguay. In order to do this, we exposed adult females of both species to glyphosate residues, analyzed their functional response using different prey types namely ants (*Acromyrmex* sp.), crickets (*Gryllus assimilis*) and lepidopteran larvae. We evaluated different prey densities (1, 3, 5, 10 individuals), and compared the results with control groups which were exposed to water. We found that both species exhibited a functional response of the type II in control groups and a higher consumption of lepidopterans, followed by crickets and ants in *L. poliostoma*; while in *L. bivittata*, the consumption rate was followed by ants and crickets. Although spiders exposed to glyphosate exhibited also a functional response type II, we found significantly lower prey consumption when compared to the control groups. These results support previous evidence that some agrochemical products could have a negative effect on the feeding behavior of spiders.

Keywords: ecotoxicology, pesticides, predator-prey interactions

Student - Poster presentation - EC7
Araneae
Ecology

Effect of selective and non-selective insecticides on survival and feeding behavior of two Uruguayan wolf spider species (Araneae, Lycosidae)

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An important aspect when implementing IPM programs is focused on evaluation of the side-effect of insecticides on the biological attributes of the natural enemies used in pest control. In this study, we evaluated the effect of selective and non-selective insecticides on the survival and feeding behavior of two spider species commonly found in Uruguayan soybean crops, namely *Lycosa poliostoma* and *Lycosa bivittata*. We exposed adult females of both spider species to residues of high (0.048g/l), medium (0.024g/l), and low (0.024g/l) concentration of the non-selective insecticide Thiamethoxam and the non-selective Methoxyfenozide and recorded the survival rate daily during 120 hours. We compared the survival rate of the exposed spiders with a control group of spiders, which were exposed to distilled water. We also evaluated the prey acceptance rate of the surviving individuals for each treatment, offering *Tenebrio molitor* larvae 144 hours after exposure. We did not find significant differences in mortality between both spider species and among the concentrations of Methoxyfenozide and the control groups. Nevertheless, all the concentrations of Thiamethoxam caused a significantly higher mortality when compared to the other treatments. The highest mortality was recorded for high and medium concentrations. Although we recorded moderate mortality rates for the lowest concentration of Thiamethoxam, the exposed spiders showed a lower acceptance rate when compared to all concentrations of Methoxyfenozide and the control group; the two latter treatments were not significantly different. These results suggest that the selective insecticide Methoxyfenozide can be used at different concentrations without affecting the feeding behavior of both spider species.

Keywords: feeding behaviour, insecticides, survival rate

Student - Oral presentation
Araneae
Behavioural ecology

DNA barcoding reveals migration patterns along Swiss river systems

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The two closely related Lycosidae species *Pardosa saturatior* and *P. wagleri* occur along pebbly riverbanks in central Europe and share the same habitat types. Morphological characters are difficult to interpret, as variation in syntopic populations is high and produces intermediate forms suggesting inbreeding between those two species. Despite the unclear species status, which could not be confirmed by standard DNA barcoding approaches we could nevertheless gain some insight in migration or separation patterns along the river drainage system within Switzerland, favoring the West-East barrier hypothesis instead the north-south barrier produced by the Alps.

Keywords: barrier, DNA barcoding, migration, *Pardosa*

Poster presentation - FM3
Arachnida
Functional morphology

Comparison of zinc-based fixatives for histochemical and histomorphometric analysis of arachnid tissues

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Producing good histological preparations of arachnid tissues is often quite problematic. Studies that require high-fidelity morphological preservation for histomorphometric measurements, or spatial localization of histochemical events, inconsistent or poor histologic preparations can render samples useless for light microscopy analysis. The underlying causes of this variability are not always clear-cut. However, choice of tissue fixative is a significant factor in determining the quality outcome of an arachnid histologic preparation. Zinc–based fixatives have proven to provide exceptional morphological preservation, retention of DNA/RNA integrity and antigenic properties of vertebrate tissue and some insect tissues. However, the application of zinc-based fixatives on arachnid tissues has been quite limited. This study compares histological preparations of select tissue types such as neuronal, ocular, digestive and reproductive from several arachnid orders including: Araneae, Scorpiones, Opiliones and Solifugae. Specimen samples were fixed immediately post-sacrifice with various zinc-based fixatives or with commonly used formaldehyde-based fixatives (zinc-free). Following fixation, all tissue samples were comparably processed, embedded and sectioned. Staining was either tinctorial or with an antigenic marker identifying a particular protein expression via immunohistochemical technique. The results illustrate that zinc-based fixatives are very effective in maintaining high-quality tissue integrity for simple and complex histological investigations of a variety of arachnid tissues.

Keywords: fixation, histology, histochemistry, morphology

Student - Oral presentation
Araneae
Behavioural ecology

Effects of rearing conditions on development of learning abilities in the jumping spider *Marpissa muscosa* (Araneae, Salticidae)

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In contrast to the former assumption that animals behave in hard wired and purely instinctive manner, it is now widely appreciated that most animals possess at least some basic learning abilities. However, species differ markedly in their cognitive abilities and their investment in the underling neuronal tissue. Despite the current discussion about how genes and environment affect the development of cognition, experimental studies which address these questions are rare. Here, we test whether learning abilities of the jumping spider *Marpissa muscosa* are affected by the social or physical environment experienced during development. We used a split-brood design and reared juvenile *M. muscosa* in either a socially enriched (group living), or a physically enriched environment. As a control group, we raised representatives of each family under both physically and socially impoverished conditions. Spiders were tested with a standard learning paradigm (T-maze) in which they had to learn where a food reward was hidden. Overall, results indicate a relatively poor performance of laboratory-raised spiders in comparison to wild-caught spiders. Within the laboratory-raised spiders, group living individuals showed the highest accuracy in the learning task. In a reversal task, in which spiders had to learn the opposite reward-association than in the preceding trials, males showed a better performance than females whereas an effect of rearing conditions was not observed. Taken together, our results indicate that the development of cognitive abilities is sensitive to the environmental conditions in which animals are raised in addition to sex and maternal lines.

Keywords: Salticidae, cognition, learning, developmental-plasticity

Student - Oral presentation
Araneae
Social spiders

The effect of individual relatedness on colony performance in group-living *Cyrtophora citricola* (Araneae, Araneidae)

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Colonial spiders construct individual capture webs within a matrix of shared supporting frame threads. *Cyrtophora citricola* is a colonial orb-weaving spider with a complex three-dimensional web. Colonies may contain a few to several hundred individuals. Spiders in colonies are either related to each other, as spiderlings hatched from an egg sac could remain in their mother colony, or could be unrelated, as spiderlings can easily disperse by ballooning and settle in a distant colony. In this study we explored the influence of individual relatedness on colony performance in *C. citricola* native in Israel. We conducted laboratory experiments using two widely separated spider populations, from which we set up three different types of colonies, always with 8 spiders: the first type of colony was composed of individuals hatched from the same egg sac, the second type was composed of four individuals from one egg sac and four from a different egg sac collected within the same colony, and third type was composed of four individuals from one egg sac and four from a different egg sac collected from a distant colony. Performance of different colonies was observed for eight weeks. We found no effect of the level of relatedness among the individuals on colony performance. However, the results suggest the existence of a maternal effect on survival of the young which formed the colonies.

Keywords: colonial spiders, relatedness, colony performance

Oral presentation
Araneae
Symposium - Invasive species

Dispersal of a colonial spider undergoing range expansion

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Colonial species, by definition, are adapted to living in high population density. Philopatry and cooperation, characteristic of such species, may not favor high rates of dispersal. Yet, there are well-known cases of invasive group-living species. *Cyrtophora citricola* (Araneae, Araneidae) is a colonial orb-weaver with a wide distribution in the Old World. It is undergoing range expansion locally in Israel and has invaded many locations in the New World tropics and sub-tropics. In our research, we are focusing on dispersal behavior and gene flow in populations in Israel in an attempt to understand the behavioral mechanisms underlying range expansion on the one hand, and on the other, the connectivity between populations at local and regional scales. In wind tunnel experiments, mainly juveniles exhibited pre-dispersal behavior ("tiptoe behavior"). Mated females were released on potted acacia trees in a net house and the dispersal of young emerging from their eggsacs was observed. About half of offspring built webs within the support threads of the maternal web, and the number of young in neighboring trees decreased with distance from the maternal web. Both maternal feeding regime and the size of the maternal web influenced spiderling dispersal. Preliminary genetic analyses (mtDNA sequencing) will be used to test the hypothesis that there is extensive gene flow among *Cyrtophora citricola* colonies both within and among populations.

Keywords: spiders, biological invasions, range expansion

Poster presentation - CE12
Araneae
Community ecology

Rock, sand and loess: geomorphology for spiders

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Geomorphological features may influence assemblages of ground spiders directly, or indirectly, by means of vegetation cover and structure. The central region of the Negev Desert of Israel is dominated by three geomorphological features, all occurring in an area of similar rainfall and temperature regimes: rocky hillsides dissected by shallow wadis (dry streams), loess plains, and sand dunes. The surface area covered by these habitats in the central Negev can be ranked (from high to low) as: rocky>sand>loess>wadi. The vegetation on these substrates differs in structure, cover and species composition, with highest plant density in the wadis, followed by loess plains, rocky slopes and dunes. Are spider assemblages structured differently on these substrates? Does spider diversity reflect habitat structure or habitat area? Spiders were sampled with dry pitfall traps in four locations: one location each in sand dune and loess plateau habitats, and two in wadis and their adjacent rocky slopes. The two wadi/slopes locations differed in their underlying rock composition. The pitfall traps were opened for three days/month in three sites at each location over a period of 3 years. The greatest spider activity-density, but lowest species richness, occurred in the dunes, resulting in skewed dominance. Wadi habitats supported the highest species richness. Communities of dune and loess plain habitats were clearly separated from each other and from wadi/slopes habitats. Wadi and rocky slope communities clustered together likely due to physical proximity. Nevertheless, within this cluster, wadis were distinct from rocky habitats, and the two sites with different underlying rock composition were also distinct. We conclude that the substrate matters, with diversity reflecting vegetation characteristics, but isolation may also play an important role in determining the composition in ground-active spider assemblages.

Keywords: species diversity, pitfall trapping, Negev desert

Student - Poster presentation - SY5
Araneae
Systematics

Fecenia travancoria Pocock is recognised as a junior synonym of *F. protensa* Thorell (Araneae, Psechridae): a case of intraspecific variation

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Psechrid spiders are notable for their intraspecific variation as specimens collected from different geographic regions show some differences in their morphological characters. Both males and females of *Fecenia travancoria* Pocock (= *F. protensa* Thorell) were collected from Kumarakom Bird Sanctuary by visual searching and hand-collecting. Even though the reproductive structures of both male and female specimens showed some morphological variations in size and shape, these are fine morphological differences and recognized as intraspecific variation existing within this species. Thus *F. travancoria* (= *F. protensa*) is considered a junior synonym of *F. protensa*. All the four valid species of the genus *Fecenia* are found in South-east Asia and nearby regions but only one of these species, *F. protensa*, extends to Sri Lanka and southern peninsular India. The occurrence of *F. protensa* in southern peninsular India and Sri Lanka supports the existence of Malayan element in the fauna of peninsular India as suggested in literature. *F. protensa* may have migrated and reached southern peninsular India and Sri Lanka from the Malayan region through the Satpura highway.

Keywords: junior synonym, intraspecific variation, psechrid spiders, Satpura hypothesis

Student - Oral presentation
Post congress
Special session CaveLab

Potential of cave ecosystems as indicators for global warming

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The fact that the caves are semi-closed systems with an almost constant temperature makes them almost ideal sites where to study the effect of temperature on ecosystems. As a first approximation we may assume that a cave has a temperature almost equal to the local yearly average temperature. Increases in outside temperature (i.e. global warming) can thus easily be detected inside caves and cave dwelling organisms, showing low tolerance to temperature variations, may be affected by such variations. Altering cave microclimate, global warming may potentially cause local extinctions. One of the aims of the CaveLab Research Project (Work Package 6) is to evaluate the potentiality of the cave ecosystems as indicators for global warming. The aim of this study is to investigate the relation between cave temperature and cave dwelling arthropods, addressing their potential for the monitoring of global warming. In 2013 we allocated 72 i-button devices programmed to record temperature every 6 hours for one year in 36 caves in the Western Italian Alps. As a result, the focal caves were characterized from a microclimatic point of view that provided the baseline for the study of the relation between temperature and the occurrence of specialized cave dwelling arthropods. Later on, we extended the dataset to comprise more than 350 caves, for which we obtained a climatic profile and gathered faunistic data (presence/absence) via direct samplings and literature data. Binomial General Addictive Models (GAM) models allowed us to identify several cryophilic stenotherm hypogean species (adapted to narrow ranges of cold temperatures), that will be chosen to assess future scenarios of species distribution on a large scale according to different temperature scenarios provided by the International Panel on Climate Change (IPCC). In particular, spiders of the genus *Troglohyphantes* (Araneae, Linyphiidae), proved to be the most sensible species to thermic variations. A special focus on the regional scale (population extinctions or expansions, future scenarios of species distribution, decline of endemic species) will be given.

Keywords: Climate change, hypogean arthropods, local extinction, species distribution, temperature, i-buttons

Student - Oral presentation
Araneae
Ecology

Climatic segregation and intra-cave ecology of *Meta menardi* and *M. bourneti* (Araneae, Tetragnathidae)

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Meta menardi and *M. bourneti* (Araneae, Tetragnathidae) are well known to biospeleologists as ubiquitous members of the twilight zone of most European caves. Despite the two species being relatively common, little is known about their intra-cave ecological needs. At the same time, the question of why the two species have never been found in syntopy within the same natural cave remains. In this sense, several authors hypothesize that the two species exhibit different ecological needs in terms of temperature. In order to shed light on the ecology of the two species, we studied several populations of *M. menardi* and *M. bourneti* occurring in six caves in the Western Italian Alps (NW Italy). A series of squared plots within each cave were monitored monthly for one year. At each survey, we counted individuals occurring in each sampling squares and we collected the main environmental variables characterizing the plots. In addition, the temperature and relative humidity were continuously logged in each cave. We ran several statistical models (GLMMs) in order to relate the counts of the two species to the environmental parameters collected in the field. The distance from the cave entrance and the presence of potential prey species were the most important factors driving the relative position of both species within the cave. On the other hand, although life cycles appeared very similar, the two species seemed to exhibit different tolerance to the microclimatic variations within the cave, which emerged as the main factors determining the segregation. At least in our study area, *M. bourneti* tolerates broad microclimatic fluctuations and is potentially able to colonize a wide variety of caves. On the other hand, when the climatic conditions in a cave are suitable for *M. menardi* (narrow ranges of relatively low temperature and high humidity), *M. bourneti* is excluded.

Keywords: cave dwelling spider, ecological niche, GLMMs, phenology, Western Italian Alps

Poster presentation - CE13
Araneae
Community ecology

A survey of spider fauna in Malayatoor, an ecologically challenging part of southern western Ghats, India

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A preliminary study was conducted to document the spider fauna in Malayatoor, an ecologically challenging part of southern western Ghats located in Ernakulam district of Central Kerala, India. The study was conducted for a period of three months from the first week of November 2013 to the first week of February 2014. Spiders were collected by visual searching method along a line transect. The collected specimens were preserved in 70% ethanol. Adult male and female specimens were identified up to species level using available literature. Immature specimens were identified up to generic level. The faunistic survey yielded 77 species of spiders belonging to 61 genera and 23 families. This represents 38% of total spider families reported from India. On species level, *Pardosa sumatrana* Thorell (Araneae, Lycosidae) was the most dominant species followed by *Lycosa mackenziei* Gravely. Guild structure analysis revealed seven feeding guilds, namely orb weavers, stalkers, ground runners, foliage runners, sheet web builders, space web builders and ambushers. Stalkers and ground runners were the dominant feeding guilds representing 25% and 23% respectively of the total collection. Two species of the family Lycosidae Sundevall (*Pardosa* sp. 1 and sp. 2) are provisionally considered as new to science.

Keywords: dominant species, guild, spider fauna, visual search, Western Ghats

Oral presentation
Araneae
Functional morphology

Inconsistency in arachnological terminology: can it be standardized?

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Objective reasons for inconsistencies in terminology can be considered as follows: 1) different terms originate from different languages yet they describe the same structures (e.g. spermathecae/receptacula), some are used simultaneously as valid terms with their original (gender) endings (receptacula, palpus) and with English endings (receptacle, palp); 2) terms have different etymological backgrounds: functional (e.g. conductor); topographical (e.g. median, terminal); derivative (e.g. tegular, patellar, embolic, radial); descriptive (e.g. lamella, palea); patronymic (e.g. Fickert gland); 3) the same terms can be applied to different things (e.g. haplogynes – as a taxonomic group or as a type of copulatory organ); 4) Many terms have no proper definition (genitalia, embolus, paracymbium); 5) the same terms are applied to non-homologous structures, or vice versa homologous structures may be referred to by different terms. 1) Several editors in respected journals have their own preferences with regard to which of the alternative, valid terms should be used (e.g. epigyne or epigynum). 2) Some reviewers and editors force authors to use same terms for non-homologous structures (e.g. haematodocha and conductor in haplogynes). In our opinion, it would be more practical to use derivative terms (the median apophysis in many groups has a retrolateral position; conductor is too functional and can be applied to different parts). In addition, it is better to use shorter terms (palp but not pedipalp; carapace instead of dorsal shield of prosoma; abdomen instead of opisthosoma).

Keywords: male palp, epigyne, terminology, structure, homology

Oral presentation
Araneae
Functional morphology

Copulatory organs in spiders: can their parts be homologized?

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If not all, most arachnologists are confident that parts of the copulatory organs can be homologized at least within each suborder of spiders. In this presentation we will try to demonstrate that even most basic characters such as cymbium, paracymbium, RTA, embolus, spermatheca (=receptacle) can not be homologized with certainty within Opistothelae, Mygalomorphae or Araneomorphae.

Keywords: spider, homology, copulatory organ

Student - Poster presentation - SY6
Araneae
Systematics

Taxonomic revision of the funnel-web spider genus *Novalena* Chamberlin & Ivie 1942 (Araneae, Agelenidae), with emphasis on the Mexican taxa

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In Mexico, the family Agelenidae is represented by nine genera and 46 species, of which one genus and 31 species are exclusively found in that country. Currently, *Novalena* Chamberlin & Ivie is comprised by 19 species distributed from southwestern Canada to Costa Rica, with no new descriptions in almost 60 years. The goal of this work was to revise *Novalena* and document its high diversity in Mexico. Sixteen *Novalena* species are reported to occur in Mexico: *N. anammae*, *N. approximata*, *N. attenuata*, *N. bipartita*, *N. calavera*, *N. costata*, *N. idahoana*, *N. intermedia*, *N. laticava*, *N. lutzi*, *N. marginata*, *N. nova*, *N. orizaba*, *N. pina*, *N. tolucana*, and *N. wawona*. Two species are transferred from *Rualena* (*R. shlomitae* and *R. simplex*) and 44 new species are proposed (42 from Mexico and two from USA). Three species are placed as *nomina dubia* (*N. cuspidata*, *N. lobata*, and *N. variabilis*). *Novalena* males are characterized by having the pedipalpal tibia as long as wide; the RTA occupying more than half ectal face of tibia; the embolus short and of variable width; the conductor with one or two projections; and the tegular median process highly variable in shape. Females are characterized by having an epigynum with spermathecae longer than wide; copulatory ducts lateral and/or posterior to spermathecae, and with an anterior or lateral projection. Externally, the epigynal atrium is in posterior position of the plate and it usually lacks a division with the copulatory openings lateral and separated by more their width, if the division is present it is visible in posterior view with openings adjacent; usually with a couple of spurs in anterior margin. The distribution of *Novalena* in Mexico is mainly related to the Mexican transition zone where Neotropical and Neartic biotic elements overlap. *Rualena*, a closely related genus, is restricted to California (USA) and Baja California (Mexico).

Keywords: Ageleninae, Western hemisphere, new species

Oral presentation
Araneae
Behavioural ecology

Trait-mediated effects and intra-guild interactions: how do ant cues influence spider behaviour?

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Ants and spiders are widespread generalist predators in terrestrial habitats, whereby ants can have strong negative effects on spider populations. Intra-guild interactions consist of predation and competition, but also of changes in behaviour aimed at avoiding a harmful encounter. These behavioural outcomes, so-called "trait-mediated effects", can be stronger than direct effects and play a key role in food webs by modifying interactions between predators and herbivore prey. However, intra-guild trait-mediated effects have rarely been addressed in terrestrial ecosystems. We examined the influence of the chemical cues of workers of two ant species (*Lasius niger*, *Formica clara*) on the behaviour of small juveniles of a web-building (Phylloneta impressa) and a hunting spider (*Xysticus* sp.). We performed laboratory experiments with ant cues collected with filter papers (N=30) to test their effect on spider dispersal based on silk (rappelling). Dispersal of *Phylloneta* increased with exposure to *Lasius* but not to *Formica* cues, whereas dispersal propensity of *Xysticus* more than doubled when confronted with cues of both *Lasius* and *Formica*. In a follow-up experiment *Xysticus* individuals showed a marked increase in walking activity when exposed to *Formica* but not *Lasius* cues. Our results show that ant cues modify different behaviours in spiders and demonstrate for the first time that perceived predation risk influences spider dispersal propensity.

Keywords: intra-guild interactions, kairomone, non-consumptive effects

Oral presentation
Araneae
Symposium - Mating strategies

Numb genitalia in male spiders: fact or fiction?

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Spider males have evolved a remarkable way of transferring sperm into the female by using their modified pedipalps, the so-called palpal organs. After uptake from the sperm web, seminal fluid is stored in the spermophor of the palpal organ before being transferred into the female genital system while mating. It is assumed that the palpal bulb lacks any kind of innervation since no nerves, sense organs, or muscles haven been detected so far. We investigated the male palp of the Tasmanian cave spider *Hickmania troglodytes* (Austrochilidae) by means of X-ray micro computed tomography (μCT), light and transmission electron microscopy in order to evaluate whether sensory structures are present in the male palpal bulb. We could not observe any external cuticular structures, or muscles inside the palpal bulb. However, we identified several neurons that form a distinct cell cluster at the base of the spermophor. Moreover, we found a small nerve that runs inside the palpal bulb into furthermost distal part, the embolus, where a second cluster of neurons is present. For the first time, our data suggest that spider male genitalia might be not just numb copulatory organs.

Keywords: sexual selection, palp, Araneae

Student - Poster presentation - EC8
Araneae
Ecology

Are distinct hunting strategies of euryphagous spiders linked to their trophic functional distinction?

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Euryphagous spiders can be sorted into seven guilds and two “supraguilds” (i.e. cursorial vs. web builders) according to their hunting tactics. Nevertheless, spiders employing distinct hunting tactic do not have to occupy different trophic niches necessarily as the same task can be achieved in a different way. Contrarily, species with similar hunting tactic can occupy quite different niches, e.g. due behavioral character displacement. Several possible relationships (none, positive, negative or convex) between the functional similarity and similarity in hunting behavior can arise due to euryphagy, food limitation, partial functional redundancy and behavioral flexibility of spiders. The differences in position and width of trophic niches among sympatric spider species employing variously distinct hunting tactics were computed from the published studies. Each pair of species was ranked according to a supposed dissimilarity in their hunting strategies: 1) congeners; 2) confamiliars; 3) conguilders; 4) consupraguilders; 5) heterosupraguilders. Relative utilization of prey by the various guilds was also investigated. In terms of niche position the species pairs from the same guild differed less than the pairs from different guilds regardless to their phylogeny and supraguild membership, respectively, in nature. Similar pattern was obtained for data on prey acceptance experiments but the congeners differed less than the conguilders. In terms of niche width the congeners and heterosupraguilders were the most similar and dissimilar, respectively. The other levels differed moderately. The results indicate that four levels of dissimilarity should be distinguished when using hunting tactic as a soft functional trait (i.e. proxy for the niche occupancy) to compute the indexes of functional diversity of spiders. Euryphagous spiders from different guilds utilize similar prey types but in different proportions.

Keywords: soft functional traits, spider guilds

Student - Poster presentation - CE14
Araneae
Community ecology

Changes in coexistence mechanisms with spatial scale and management type in the spider communities from vineyard terraces

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Diverse spider communities have been suggested to be efficient biocontrol agents. To maintain high diversities of spiders in agroecosystems it is crucial to know how the spider communities are formed. There are three basic mechanisms mediating species coexistence: neutral dynamic, niche partitioning and niche filtering that can change with spatial scale, situation and system. Here we have studied which of these mechanisms maintain coexistence among epiphytic spiders in vineyard terraces. We investigated spider communities at four localities in a traditional wine region of the Czech Republic. The localities differed in the management applied in the vineyards: integrated pest management at three localities and ecological farming at one locality. Four plots were established at each locality. Spiders were sampled by sweeping once per month during three months. Spider species were characterized according to combinations of their soft and hard functional traits (hunting strategy, size, dial activity). We then investigated if the functional traits of the most abundant species overlap less, more or not distinctively than obtained by chance in the case of niche partitioning, niche filtering or neutral dynamic, respectively. The coexistence was mediated by niche partitioning at the regional scale. At the local scale niche partitioning prevailed in the community with ecological farming while neutral dynamic prevailed in the three communities with integrated pest management. The results indicate that coexistence of spiders in vineyards terraces is mediated by niche partitioning at regional as well as local spatial scales. However, the natural dynamic is disturbed by the application of pesticides and therefore other mechanisms, such as dispersion, prevail in shaping local communities in vineyard terraces with integrated pest management.

Keywords: assembly rules, integrated pest management

Student - Oral presentation
Araneae
Ecology

Implications of behavioral traits of an intra-guild predator for biological control

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Intra-guild predation is very frequent among generalist predators such as spiders, and can considerably decrease their predation pressure on pests. The frequency of intraguild predation may depend on the aggressiveness of predators. We studied how the behavioral type of generalist predators affects their biocontrol potential. We focused on symaptrically occurring *Philodromus buchari*, *Dictyna* sp., and *Cacopsylla pyri* (Homoptera, Psyllidae), which acted as a larger predator, a smaller predator, and shared prey, respectively. We studied prey preference of *Philodromus* between *Cacopsylla* and *Dictyna* and measured aggressiveness of *Philodromus* individuals. Furthermore, we investigated functional responses of *Philodromus* to *Cacopsylla* and *Dictyna*, and functional response of *Dictyna* to *Cacopsylla*. We found that on average *Philodromus* preferred *Cacopsylla* to *Dictyna*. However, aggressive *Philodromus* individuals did not show a distinct prey preference. The non-aggressive *Philodromus* individuals were choosy, preferring *Cacopsylla* to *Dictyna*. The aggressive *Philodromus* individuals had higher functional response to *Cacopsylla* than the non-aggressive individuals, while the functional response to *Dictyna* did not differ between the behavioral types. The high functional response of the aggressive individuals to *Cacopsylla* may be useful for biocontrol. However, aggressive *Philodromus* individuals may also kill more *Dictyna* spiders. The non-aggressive philodromids would not kill so many *Dictyna* nor *Cacopsylla* individuals. To evaluate the efficiency of biological control in this intra-guild predation system we performed simulations using differential models. We parameterized the models with estimated parameters and used combinations of various behavioral types in the *Philodromus* population and various *Dictyna* to *Cacopsylla* abundance ratios. We found that aggressive individuals are more efficient for biological control of *Cacopsylla* when the *Dictyna* to *Cacopsylla* abundance ratio is low while the non-aggressive individuals are more efficient when the ratio is high.

Keywords: individual specialisation, personality, pest suppression

Poster presentation - PHV5
Araneae
Physiology - Venom

Time related effects of *Latrodectus dalhi* (Araneae, Theridiidae) venom on serum biochemical changes in rabbits

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The most important toxin present in the spider genus *Latrodectus* venom that causes various symptoms is α-latrotoxin. The high molecular weight of this toxin can cause delayed/variable distribution of this toxin in the body and hence appearance of systemic signs and symptoms may vary from case to case. In the present study we try to see the time related effects of venom from *Latrodectus dahli* in rabbits. For this study six healthy rabbits with average weight of 1.5±0.3 kg were selected. The venom (0.5mg/Kg) was injected subcutaneously. Blood collection was carried out from ear vein at 0, 4, 24, 48 and 72 hrs following venom injection. Serum was analyzed for LDH, ALT, AST, CPK, CK-MB, ALP, glucose, albumin, bilirubin, urea and creatinine. The results showed that no significant changes in various biochemical parameter occurred within 4 hrs following venom injection. However at 24 hrs following venom injection the rise in AST, LDH, CPK, CK-MB, creatinine, glucose and urea were all significant. The significant elevation in serum biochemical parameters continued till 48 hrs following venom injection. However at 72 hrs after venom injection the rise in most of biochemical parameters were reduced and were non-significant when compared with the levels before venom injection. Based on the results obtained in the present study it can be concluded that the systemic signs and symptom caused by the venom from spider *Latrodectus dahli* can occur 24 hrs following bite and it is can be return to base line only after 72 hrs.

Keywords: *Latrodectus dahli*

Poster presentation - SY7
Opiliones
Systematics

An enigmatic new trogulid from the Balkans (Opiliones, Trogulidae)

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A new medium-sized trogulid species, collected in the Rhodopa Mountains (south Bulgaria) is described and illustrated. A character combination of the great thickness of the leg II femur, also with rich papilation, and its penis morphology, distinguish the new taxon from all other *Trogulus* species. Based on the glans penis stylus position, the closest relatives are probably *Trogulus nepaeformis*, *T. tingiformis*, and *T. martensi*.

Keywords: harvestmen, *Trogulus*

Poster presentation - PHV2
Scorpiones
Physiology - Venom

Preparing and characterizing chitosan nanoparticles containing *Hemiscorpius lepturus* (Scorpiones, Hemiscorpiidae) scorpion venom as an antigen delivery system

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In recent years, chitosan nanoparticles have been studied widely for protein delivery. In this study, *Hemiscorpius lepturus* (HL) venom was encapsulated in chitosan nanoparticles. The aim of the present work was to carry out a systematic study for preparing biocompatible and biodegradable nanoparticles for loading HL venom and to evaluate their potential as an antigen delivery system. In this study, HL venom loaded chitosan nanoparticles fabricated by ionic gelation of chitosan and tripolyphosphate and the factors which may be influenced in the preparation of nanoparticles were analyzed. Also, their physicochemical properties and in vitro release behavior were studied. The optimum encapsulation efficiency and capacity were observed when the chitosan concentration and HL venom were 2 mg/ml and 500 µg/ml, respectively. The HL venom loaded nanoparticles were in the size range of 130-160 nm (polydispersity index values of 0.423) and exhibited the positive zeta potential. Transmission electron microscope imaging showed spherical and smooth surface of nanoparticles. The profiles of the release exhibited a burst releases about 50% in the first 4 hrs and then slowed down at a constant rate. The obtained results suggested that the chitosan nanoparticles prepared in this work had the potential for antigen delivery.

Keywords: chitosan, nanoparticle, venom, ionic gelation

Poster presentation - PHV3
Araneae
Physiology - venom

Laboratory rearing of *Latrodectus tredecimguttatus* (Araneae, Theridiidae)

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Spiders of Theridiidae family, especially the genus *Latrodectus*, are an important source of bites to human beings, with serious side effects. Spider bites caused by widow *Latrodectus tredecimguttatus* are one of the main spider-related problems in Bojnurd city, north Khorasan province, Iran. Spider and eggsacs were collected from different parts of Bojnurd district using direct research method. After collection they were transferred to the insectariums for rearing. After identification of specimens using morphologic keys, they were released in to an insectary. The main species collected was *L. tredecimguttatus*. We collected two mature female spiders and 234 spiderlings belong to egg sacs of one of these spider. The spiderlings matured in our laboratory. Four pairs of adults were selected and established four separate terraria. Results show that the average number of egg sacs per female was 11. The average number of eggs in each egg sac was 302. The mean of length and width of the egg sacs was 17.45 and 13.64 mm, respectively. Samples were kept in two different conditions of 30 ± 3 °C and 20 ± 3 °C temperatures with 60 ± 10% and 35 ± 5% relative humidity, respectively. Spider maturation took placed after 59 days of hatching, subsequently they mated. They produced the first egg sac 12 days after mating. Average life span for female and male spiders was 216 and 110 days, respectively. The favourite food for them was flies, bee, and grasshoppers. As widow spiders are widely spread in different parts of the world and in Iran and their bites can be deadly for old people and children, it is essential to study the life cycle and habits of these species for further control and probable use of their products for antivenom development.

Key words: development, Black widow spider, Bojnurd, Iran

Student - Oral presentation
Araneae
Physiology

Spider venom hyaluronidases and their substrates

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The occurrence of venom hyaluronidases seem to be widely spread among the phylogeny of spiders. These enzymes are considered to act as spreading factors by degrading the connective tissue of the prey and thereby facilitating the distribution of other venom components. However, the spreading properties of hyaluronidases in typical spider prey species have never been demonstrated so far. Also the target substrate of spider venom hyaluronidases remains hitherto unknown. We examined the substrate specificity of venom hyaluronidases from thirty spider species out of eighteen different families. Further, we tested a possible tissue degrading effect of hyaluronidases by using a bioassay with *Drosophila melanogaster*. Glycosaminoglycans of crickets, spiders and flies were isolated to evaluate a potential substrate for spider venom hyaluronidases in typical spider prey species. We observed a wide distribution of venom hyaluronidase activity over the phylogenetic tree of spiders. However, differences in the degradation efficiency indicate for structural differences of the enzyme in some of the tested spider families.

Keywords: spider venom, hyaluronidases, glycosaminoglycans

Poster presentation - BF9
Araneae
Biogeography and faunistics

A collection of Sardinian spiders (Arachnida, Araneae)

Mulas A., Ruiu D., Fois F. & Deiana A. M.

Private

A total of 122 adult spiders, representing 65 species, were collected in fifteen different localities in Sardinia, using both pitfall traps and direct capture. Among the male spiders, we found *Trachyzelotes huberti* (Platnick & Murphy), which is reported for the first time in the island, the interesting species *Haplodrassus severus* (C.L. Koch) and *Dysdera shardana* (Opatova & Arnedo,), a rare Sardinian endemism. Among the females, *Palpimanus gibbulus* (Dufour) was found in the Island of Mal di Ventre. This study suggests the presence of a high spider diversity in Sardinia and hints to the necessity of further studies.

Keywords: Araneae, *Trachyzelotes huberti*

Student - Poster presentation - EC9
Acarina
Ecology

Mite infection of *Carabus violaceus* (Coleoptera, Carabidae) in lowland oak forest fragments

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We investigated the mite (Arachnida, Acari) infection of *Carabus violaceus* (Coleoptera, Carabidae) in rural and urban habitats in and around Debrecen city, Hungary. We collected *C. violaceus* by live-capture pitfall traps and preserved them frozen. We sorted mites from the host beetle and preserved them in alcohol. We trapped altogether 137 *C. violaceus* individuals: there were 62 individuals from the rural area and 75 individuals from the urban one. Total mite sample consisted of 7,185 individuals representing three species (*Poecilochirus carabi*, *Macrohales glaber* and *Photia hejniana*). We found 2,052 mite individuals on *C. violaceus* in the rural habitat, and 5,133 mite individuals on *C. violaceus* in the urban habitat. We hypothesized that the prevalence of *P.hejiana* (Astigmata) should be higher in the urban habitat, because the host carabid species was less resistant to parasitic mite species due to the urbanization. *P. carabi* and *M. glaber* (Mesostigmata) feed on Diptera eggs and larvae, and use the carabids for transfer. Thus, the prevalence of these species depends on the number of Diptera individuals rather than the viability of *C. violaceus.* Our result showed that prevalence of *P. hejniana* was significantly lower in the rural habitat than in the urban one, while the prevalence of *M. glaber* and *P. carabi* was higher in the rural habitat. Our results showed that the disturbance (urbanization) increased the prevalence of parasitic mites, while the prevalence of phoretic mites decreased in the urban forest patches.

Keywords: Acarina, disturbance, parasite, phoresis, urbanization

Poster presentation - SY8
Scorpiones
Systematics

Two new species of the genus *Odontobuthus* (Scorpiones, Buthidae) from southern and eastern Iran

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Two new species of scorpions in the genus *Odontobuthus* (Scorpiones, Buthidae) are described from Khorasan Province in the east and Hormozgan Province in the south of Iran. Currently, *Odontobuthus* includes two species in Iran, *O. doriae* Thorell, which is restricted to high elevations of the central Iranian Plateau and *O. bidentatus* Lourenço & Pezier from the Zagros Mountains. The results of morphological comparisons, univariate and multivariate statistical analysis and phylogenetic analysis of COI sequence data clearly confirm a deep split between populations from the eastern Iranian Plateau and *O. bidentatus* Lourenço & Pezier and *O. doriae* Thorell. According to comparative morphological and molecular analysis, two new species, *O. tirgari* Mirshamsi and *O. tavighiae* Navidpour, Soleglad, Fet & Kovařík were described from Iran.

Keywords: scorpion, fauna, new species, COI

Student - Poster presentation - BF10
Araneae
Biogeography and faunistics

Spiders (Arachnida, Araneae) of Khibiny Mountains, Kola Peninsula, Russia: a preliminary analysis

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Khibiny is a small mountain range with altitudes up to 1,200 m a.s.l. situated in the center of the Kola Peninsula within the northern taiga zone. Although its south-eastern part is strongly damaged by intensive mining operations performed there since 1930s, a national park is recently being organized on this territory. Available data on the spider fauna of Khibiny is sporadic and dispersed within a number of papers. In total only 77 species have been recorded there previously. Our studies have been conducted during four seasons (summer-autumn 2008–2011) mainly in the southern and central parts of the mountains. Spiders were collected in both natural (on the altitudinal gradient from forest belt to alpine tundra) and anthropogenic habitats by sifting of moss and litter, pitfall traps, sweeping, hand collection, and soil sampling. Dice's index (PAST 1.97) was used to evaluate faunistic similarities between the spider faunas of various biotopes. In total, 3,810 adult specimens belonging to 111 species from 13 families were caught in the area under study which is lesser than, for instance, in adjacent mountainous areas of Sweden (Torneträsk area), where as many as 170 species from 14 families have been recorded. The families Linyphiidae and Lycosidae are the richest in terms of species diversity (76 species, 68% and 13, 12% respectively) that is generally typical of the high altitudes in Europe. The highest number of species (60) was observed in the alpine tundra belt with 21 species found exclusively in this biotopic type. High species diversities were also discovered in mountain birch forests (56), spruce forests (29) and on river or lake banks (23). During cluster analysis studied coenotic faunas were split into two main groups, one of which includes spider assemblages of main types of mountain communities (various forests and alpine tundras), another – habitats which not depend on altitude (meadows, riparian and anthropogenic habitats).

Keywords: Kola Peninsula, mountains, spider assemblages

Poster presentation - CW5
Araneae
Collections & web-based resources

World Spider Catalog Association

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While the World Spider Catalog (WSC) lists the taxonomically relevant information like a typical catalog (but does not contain the PDFs for the references), the related Association (WSCA) collects all taxonomic spider literature and makes it accessible to its members. Usually free access to literature is not easy, among others due to copyright protection. For the WSCA this means that all the references which are given in the WSC will be made available as PDFs. So, the WSCA has two main activities, to collect the mentioned literature and to make it accessible for its members within a password protected access. The Swiss Civil Law allows associations to make the collected PDFs available for its members, if there is no commercial purpose, thus to bypass the mentioned copyright restrictions. Of course, WSCA has no commercial purpose, there are no membership fees and becoming a member takes only two mouse clicks. We present the current taxonomic literature status and show the ease of up- and downloading articles.

Keywords: arachnological literature, taxonomy, open access

Oral presentation
Araneae
Symposium - Invasive species

Invasive spiders in Europe?

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The terms “alien” and “invasive” are defined in a global biogeographical context and the difference to “natural spread” is explained. On the basis of database and literature analyses a list of spider species alien to Europe is given. This list comprises more than 100 species and it is explained why it grows permanently. On the other side, probably none of these alien species can be considered to be invasive and the reasons for this are also explained. Prognoses indicate that we will have more alien species in the future and some of them could become invasive.

Keywords: alien, biogeography, invasive, natural spread

Student - Poster presentation - EC10
Araneae
Ecology

Comparative assessment of adaptive developmental plasticity in African golden-silk spiders (Araneae, Nephilidae): males in *Nephila senegalensis* (but not in *N. fenestrata*) accelerate sexual maturation in response to female silk cues

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Phenotypic plasticity allows individuals to adapt to variable environmental conditions and changing selection pressures, such as demographic changes in a population that may determine the availability of potential mates. Plastic responses are triggered by reliable cues, and female silk cues have been proposed to induce plastic adjustment of development and growth in male spiders. In the genus *Nephila*, pronounced seasonality and a male-biased sex ratio frequently lead to competition of several males for the same female. If costs of competition can be reduced by outrunning potential rivals, males that perceive female cues should accelerate development and mature earlier. We chose two African species, *Nephila fenestrata* and *N. senegalensis*, to investigate adaptive developmental plasticity in response to female silk cues. Using a split-brood design, we reared spiders under standardized conditions in climate-control chambers. Spiders in the experimental treatment were regularly presented with virgin females´ silk, while spiders in the baseline treatment were reared without female silk cues. We recorded the duration of male development until reaching maturity and male adult-weight. Males in *N. senegalensis* matured 2-4 days earlier when presented with female silk cues, which could entail significant benefits in natural populations, but there was no difference in male weight. In *N. fenestrata*, our treatment had no effect at all, which is difficult to explain. Within its genus, *N. fenestrata* is a relatively small species with a shorter time interval between male and female maturation; thus males may not benefit from developmental plasticity in this context.

Keywords: developmental plasticity, male competition, *Nephila*

Poster presentation - CE15
Araneae
Community ecology

Vertical structure of lowland deciduous forest spider community

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Vertical structure of spiders was studied several times. There are published data about spiders of tree canopies, bushes and vegetation undergrowth, litter or forest soil. But there was no published work dealing with vertical structure of spider community on trees in forests. We investigated invertebrate fauna by flight intercept traps which were placed in oak – horn beam forests in South Moravia (Czech Republic). We placed altogether nine lines of three flight intercept traps – these traps were placed in three levels of tree layer above the surface – 2 m, 5 m and 10 m. Traps were placed so that they do not touch tree branches or tree trunks. The research was carried on 16th May until 3rd October 2011, and traps were emptied monthly. We have collected 80 specimens of adult spiders belonging to 38 species, and together with juveniles we collected 588 spiders. Nearly all recorded species belong to arboricolous species except to two species of *Araeoncus* (which prefer more wet habitats, and usually are found in moss) and invasive *Mermessus trilobatus*. All spiders were distributed equally throughout the vertical structure, while only few species prefer a particular layer. There were some species exclusively in the canopy (*Gibbaranea gibbosa*, *Cicurina cicur*) or in the middle layer (*Philodromus dispar*), but most of species prefer the middle layer and canopy together (most of Philodromidae and Salticidae) or lowest and central layer together (most of Theridiidae). Data were evaluated by using the program CANOCO.

Keywords: flight intercept trap, forest, spiders

Student - Oral presentation
Araneae
Phylogeography

Loosening the belt: How the Hercynian Belt breakup shaped the distribution of the trap-door spider genus *Ummidia* (Araneae, Ctenizidae) in the Western Mediterranean

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The present day amphi-Atlantic distribution of the trap-door spider genus *Ummidia* has been suggested to be a result of continental drifting. Here, we use a multi-locus approach that combines one mitochondrial and four nuclear genes to reconstruct the phylogenetic relationships within the Mediterranean *Ummidia* species based on a thorough sampling across the known distribution of the genus. Additionally, Bayesian relaxed clock methods and specific substitution rates are used to infer the temporal framework for its diversification. Species distribution modelling tools were further used to assess the ecological preferences of the three *Ummidia* species inhabiting the Iberian Peninsula and to evaluate their ecological interchangeability. Our results indicate that the present day distribution and diversity of the Mediterranean *Ummidia* was mostly shaped by the Hercynian Belt breakup and the subsequent drifting of the resulting microplates, which dates back to the Miocene. In spite of the reported ability of *Ummidia* for airborne dispersal the observed phylogeographic patterns and the isolation of ecologically interchangeable and geographically proximate species indicate that long distance dispersal events are rare and that the present day distribution may be mostly attributed to vicariant events driven by microplates split. Two inferred events of backward colonization of the Iberian Peninsula from northern Africa were presumably facilitated by land bridges formed during the Messinian Salinity Crisis. Finally, several additional evolutionary independent lineages that may correspond to new species were detected.

Keywords: biogeography, Mediterranean, molecular dating, *Ummidia*

Poster presentation - BF11
Araneae
Biogeography and faunistics

Spiders (Arachnida, Araneae) of the site of community importance and special area of conservation "Alpi Marittime" (NW Italy)

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We present a checklist of the spiders (Arachnida, Araneae) of the Site of Community Importance and Special Area of Conservation IT1160056 “Alpi Marittime” (NW Italy). The checklist is based on literature records and unpublished material collected from 2007 to 2013 within the first European All Taxa Biodiversity Inventory coordinated by the European Distributed Institute of Taxonomy (EDIT). The examination of the literature provided a list of 113 species recorded for the study area between 1890 and 2013, scattered in 35 publications. During the fieldwork, we collected 4390 specimens at 79 different localities through 264 sampling events. The original data provided here raise the total number of species known for the study area to 295, grouped in 147 genera and 31 families. We recorded a remarkable percentage (9%) of endemic species, including rare endemic elements poorly known in literature, such as *Vesubia jugorum*,*Troglohyphantes konradi*, *Nesticus morisii* and *Turinyphia clairi*. Thirty-eight species are new records for the regional fauna and four species are recorded for the first time in Italy.

Keywords: SW-Alps, Piedmont, faunistics, All Taxa Biodiversity Inventory (ATBI), endemic species

Oral presentation
Araneae
Behavioural ecology

Comparative analysis of passive defences in spiders (Arachnida, Araneae)

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Being frequent prey of many predators, including especially wasps and birds, spiders have evolved a variety of defence mechanisms. Here I studied patterns of passive defences, namely anachoresis, crypsis, masquerade, aposematism and Batesian mimicry, in spiders. Using published information pertaining more than 1000 spider species, the phylogenetic pattern of different passive defences (i.e. defences that decrease the risk of an encounter with the predator) was investigated. Furthermore, I studied the effect of foraging guild, geographical distribution and dial activity on the frequency of defences as these determine the predators diversity, presence and perception. I found that crypsis (background matching) combined with anachoresis (hiding) was the most frequent defence confined mainly to families/genera at the base of the tree. Aposematism (warning coloration) and Batesian mimicry (imitation of noxious/dangerous model) were found in taxa that branched later in the tree, and masquerade (imitation of inedible objects) was confined to families at intermediate positions of the tree. Aposematism and Batesian mimicry were restricted to a few lineages. Masquerade was used particularly by web-building species with nocturnal activity. Aposematism was rare but mainly used by web-building diurnal species. Batesian mimicry was frequently observed in cursorial species with diurnal activity. Cryptic species were more common in temperate zones, whereas aposematic and mimetic species were more common in the tropics. Here I show that the evolution of passive defences in spiders was influenced by the ecology of species.

Keywords: aposematism, crypsis, evolution, masquerade, mimicry

Oral presentation
Post congress
Special session CaveLab

Environmental drivers of lampenflora growth in the Bossea showcave (NW-Italy)

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Lampenflora is a German term widely used to indicate photosynthetic organisms which are able to grow in subterranean environments by exploiting artificial lights. The main components of lampenflora are microalgae, which can proliferate creating extended biofilms on cave walls. The implementation of management procedures to reduce the growth of lampenflora in showcaves is fundamental, considering that its proliferation may cause physical, chemical and aesthetic damage to the cave speleothems (i.e. stalactites, stalagmites, columns, flowstones and stonewalls). The aim of this work is to investigate which environmental variables are the main drivers of lampenflora growth in Bossea showcave in order to provide general suggestions for management activities. We focused on the three main photosynthetic groups composing lampenflora: diatoms, green algae and cyanobacteria. We identified 28 illuminated walls in which 3 sampling plots at different distances from the light were defined. With the aid of the Benthotorch® fluorometer, in each sampling plot we measured the chlorophyll a concentrations of cyanobacteria, diatoms and green algae, which were related to the environmental factors possibly favouring their growth or dispersion via Generalized Linear Mixed Models. Results obtained from statistical models revealed different responses of the three photosynthetic groups to environmental variables, with the light intensity as the common driver, influencing positively their abundances. Cyanobacteria and diatoms are also favoured by the presence of seeping water on rock surface and high windspeed next to the rock plays a role in containing diatom growth. In view of our results, management should be addressed towards a reduction of light intensity, and particular attention should be paid in cleaning those walls where seeping water is present.

Keywords: GLMM, lampenflora, cave management

Student - Poster presentation - CE16
Araneae
Community ecology

Comparison between spider assemblages inhabiting the cave and the associated MSS in the Pugnetto hypogean complex (NW Italy)

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The so-called MSS (=*Milieu souterrain superficiel*) is composed of a network of small voids in screes covered by a soil layer. According to several authors, by providing an insulation layer from the outside, MSS microclimatic conditions are strictly comparable with that of other hypogean environments, such as caves. Spiders living in MSS have been poorly investigated. We designed an subterranean pitfall-trap survey in order to: i) characterize spider assemblage living in MSS; ii) explore the occurrence of the different species in relation to depth; iii) compare the species inhabiting the MSS with species inhabiting the cave compartment. The study was conducted in two caves belonging to the Pugnetto hypogean area (Graian Alps, NW Italy). Several pitfall traps were placed in the Pugnetto caves, ranging from the cave entrance to the interior (approximately 500 m inside). The MSS habitat occurring around the caves was sampled with subterranean traps, capable of collecting fauna at a deepness of 0.40, 0.60 and 0.80 m. Moreover, in order to characterize the underground microclimate, we placed temperature and humidity dataloggers in correspondence of each trap. Traps were replaced once a month for one year. Over the year, we collected 17 spider species in the MSS and 8 in the caves. Troglophile (e.g. *Nesticus eremita*) and subterranean specialized species (e.g. *Troglohyphantes bornensis*) were collected in both environments. The higher diversity of species in the MSS was mainly related to the presence of trogloxene (occasional) species. Several individuals belonging to a possible new species of Troglohyphantes (Linyphiids), apparently exclusive of the MSS domain, were also collected. Regarding microclimate, the thermal variability at the surface seemed to moderately affect the microclimatic conditions of MSS, resulting in smoothed, but still present, daily and seasonal variations in temperature and humidity.

Keywords: hypogean spider, *Milieu souterrain superficiel*, pitfall traps, subterranean sampling device, *Troglohyphantes* n. sp.

Student - Poster presentation - CE17
Araneae
Community ecology

Ground-dwelling spiders in forest and adjoining olive groves: spillover as usual?

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Olive is a perennial crop typical of Mediterranean areas, and it has always been considered a complex agro-ecosystem. The key pest is the olive fruit fly *Bactrocera oleae* (Rossi). Spiders may contribute to the natural control of this pest. In numerous studies from annual crops, spillover of natural enemies from nearby seminatural habitats was found important for pest suppression. We studied the potential of nearby seminatural forest to enhance spiders in olive groves as part of a larger study on the natural suppression of the olive fruit fly. The study was part of the EU FP7 project QuESSA (www.quessa.eu) that aims to better understand the ecosystem services provided by semi-natural habitats to increase sustainability of agricultural systems. The study was carried out in the Monte Pisano area (NW Tuscany, Italy) during the summer of 2013. Twelve olive groves (6 organic and 6 conventional) bordering mixed forest were examined and ground-dwelling spiders were sampled using pitfall traps along 30 m transects in the olive groves, the border of the forest and the interior of the forest. We collected a total of 809 spiders belonging to 23 families and a total of 68 species, including 14 new records for regional fauna. In contrast to many other agroecosystems, spider densities were higher in olive groves than in the seminatural forest. Higher spider densities at forest edges compared to forest interior suggest spillover of spiders from the olive groves into the forest rather than vice- versa. In addition, species composition differed between olive groves and the edge and the interior of the forests. Our results indicate that the direction of spillover may depend on the degree of disturbance of the agroecosystem, with perennial crops depending less on surrounding undisturbed areas than annual crops.

Keywords: edge, olive, seminatural habitat, spillover

Student - Oral presentation
Araneae
Physiology

Optimizing material plasticity across ontogeny: does orb-web spiders' silk tailoring potential change with increases in body size?

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Orb-webs built by spiders are designed to entrap large, rare prey where radial threads, composed of major ampullate silk (MAS), serve as the primary stopping component. MAS can be tailored to fit specific mechanical needs as it is drawn from the gland through the application of differential reeling forces. Many orb-web spiders exhibit dramatic changes in web architecture through ontogeny accompanied by probable changes in prey size and type, however, how material properties of MAS change is not fully resolved. We hypothesize that shifts in the ecological niche through maturation are coupled with an alteration in silk tailoring potential that reduce effects of fiber-elongation on cross-sectional area during silk spinning. Here, we examine post-secretion plasticity of MAS across various levels of maturity in the giant wood spider, *Nephila pilipes* (Araneae, Nephilidae). We measure tensile properties of forcibly drawn MAS pulled at four separate reeling speeds and at supercontracted 'ground' state of juvenile and adult spiders. We also examine both amino acid composition to identify potential shifts in molecular profiles of MAS and orb-web structural parameters. Silk samples and web parameters were collected only from field-caught spiders whose diets were standardized and had built at least two complete webs while in captivity. As the tailoring process of MAS changes thread cross-sectional area, we speculate our results to illustrate larger spiders' silk to become stiffer than that of smaller spiders. As a trade-off to a broader range of tensile properties, this would conserve large diameters in bigger spiders to allow very large forces of very rare, but highly profitable prey to be absorbed.

Keywords: silk, orb-web, ontogeny, plasticity

Poster presentation - EC11
Opiliones
Ecology

Higher levels of fluctuating asymmetry in harvestmen cave (Arachnida, Opiliones) populations compared to surface populations

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Fluctuating asymmetry (FA) is a subtle random deviation from a perfect symmetry in bilateral traits. Environmental fluctuations can impose selection on individuals with low FA by simply removing asymmetric individuals from the population. Symmetric individuals are likely to better bear the environmental fluctuations, having simultaneously higher survival probabilities. Less variable subterranean environment may eliminate or weaken selection that is important for maintenance of a particular trait. Such environment without many attributes characteristic to surface habitats may exert what is termed "relaxed selection". We hypothesized that cave populations under relaxed selection against FA express higher degree of FA than surface populations experiencing a more stringent selection. We compared the levels of FA in pedipalps and two segments of chelicerae among surface and cave populations of a troglophile harvestmen species (*Paranemastoma silli*). The levels of FA in cave populations in pedipalps were markedly and consistently higher compared with surface population. While we cannot fully disentangle the mechanisms of natural selection affecting the FA of cave populations our study supports the idea that FA responds to differences in the strength of selection.

Keywords: fluctuating asymmetry, relaxed selection, harvestmen

Student - Poster presentation - SY9
Araneae
Systematics

A new species of jumping spider from the Western Ghats of India with comments on mating plug in the family Salticidae (Arachnida, Araneae)

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A new species of jumping spider *Stenaelurillus* n.sp., is described and illustrated from the Western Ghats in the Kerala region of India. Both male and female spiders of *Stenaelurillus* n. sp. were collected from Kurisumudi in Malayatoor, in Ernakulam District of Kerala, India. The specimens were collected from a rocky area covered with litter in a deciduous forest by visual searching and hand collecting method. Specimens were preserved in 70% ethanol and identified as new species after comparing it with the descriptions and illustrations of congeneric representatives. Males of *Stenaelurillus* n. sp. are characterised by uniformly dark dorsal opisthosoma without any pattern, paired creamy white areas at the anterior part of the bulbus, and palpal femur with a single disto-dorsal spine; females by the presence of small and 'vase'- shaped spermathecae, wide copulatory openings and copulatory ducts with weakly sclerotized anterior part. The specific epithet is an adjective in apposition and is derived from the whitish part of the tegulum. A mating plug, which is unusual in the family Salticidae was observed in the copulatory opening of this new species. The left copulatory opening of *Stenaelurillus* n. sp. was found to be sealed with amorphous secretions (whether male or female origin is unclear). The mating plug covers nearly the whole area of the left copulatory opening and the surrounding epigynal region.

Keywords: jumping spider, mating plug, new species, Western Ghats

Student - Oral presentation
Araneae
Behavioural ecology

Reactions of jumping spiders towards aposematic prey (Araneae, Salticidae)

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We studied the reactions of a jumping spider *Evarcha arcuata* (Araneae, Salticidae) towards heteropteran prey. True bugs (Heteroptera) are often distasteful, as indicated by their optical and/or chemical signals, and we tested how these signals affect predatory behaviour of spiders. Using larvae of colour mutants of *Pyrrhocoris apterus* (Pyrrhocoridae), we found out that the red, natural colour is a more effective signal than yellow and white. The effect was most marked by asymmetrical generalisation: spiders that learned to avoid white or yellow forms decreased their attack rate when subsequently presented with the red form. When we re-tested the same spiders next day, the white colour form was also less memorable. Nevertheless, the spiders learned to avoid all the colour forms at the same rate. We also compared the reaction of spiders towards red larvae of *P. apterus* and of a similar aposematic species, *Scantius aegyptius* (Pyrrhocoridae). Mortality of *S. aegyptius* was significantly higher, suggesting that its defence is less effective. Despite that, we observed similar avoidance-learning rate, memorability, and generalisation between the two species. We have studied the reaction of spiders towards adults of a reddish, aposematic species, *Oxycarenus lavaterae*, its non-aposematic relative, *O. hyalinipennis* (Oxycarenidae), and dark red, aposematic larvae of both species. While the adults of both species were well-protected and the spiders learned to avoid them, the predation on larvae was constantly high. Moreover, the experience of spiders with larvae increased the predation risk of subsequently encountered adults. Although warning signalling didn't affect avoidance learning, it affected other aspects of predatory behaviour, which can be just as important for evolutionary ecology of aposematism and mimicry. These results do not only show complex cognitive abilities of jumping spiders, but they provide an insight into seldom explored, "invertebrate" point of view on the function of warning signals. The study was supported by CSF grant P505/11/1459.

Keywords: aposematism, avoidance, Heteroptera, mimicry, Salticidae

Poster presentation - PHS1
Araneae
Physiology - Spider silk

Morphology, function and evolution of spider silk glands – a review

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All spiders possess silk glands which open through modified setae, called spigots, on their spinnerets. The spinnerets are special appendages on ventral abdomen that are present only in spiders. Spiders are unique in maintaining an amazing battery of up to nine gland types. Each type of gland produces silk with unique material properties that have adapted for different functions. Spiders use silk in almost all aspects of their life, including locomotion, creating shelter, ballooning, obtaining prey and reproducing. Current research has been focused predominantly on the silk glands of two model genera *Araneus* (Araneae, Araneidae) and *Nephila* (Araneae, Nephilidae), and on their major ampullate glands in particular. Our current knowledge about other spider silk glands and about silk glands of non-orb weaving spiders is fragmented. The collective knowledge about spider silk glands was reviewed and summarized in 1972 and 1977 by Jacqueline Kovoor. Since then, many published papers have contained sparse information about silk gland histology, the morphology of the external spinning apparatus, spider spinning behavior and the properties of different silks. We present a synthesis of this newly accumulated information. We describe the morphology of spider silk gland and the process of silk spinning. Other topics covered include the ontogeny of silk glands, an overview of spider silk gland types in the major spider groups and evolution of the spider silk glands.

Keywords: spider, silk, spinning, glands

Student - Poster presentation - SY10
Araneae
Systematics

The genus *Ischnothyreus* (Araneae, Oonopidae) from Java and Sumatra

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As part of the ongoing goblin spider PBI project (Planetary Biodiversity Inventory), the main author revises the genus *Ischnothyreus* Simon from Java and Sumatra with description of seven new species from Java and eight from Sumatra. This is the first record of this genus from the island of Java. Furthermore the male of *I. serpentinum* Saaristo is described for the first time. Most of the males of the newly described species possess conspicuous apophyses on the cheliceral fang base, assumed to be used during courtship. Probably they interact with grooves on the female post-epigastric scutum connected to apodemes underneath. Special morphological features of *Ischnothyreus* males are described and discussed, such as peculiar trochanter apophyses and partially fused pedipalp segments.

Keywords: *Ischnothyreus*, Java, Oonopidae, Sumatra

Student - Poster presentation - SY11
Scorpiones
Systematics

On the type locality of *Pandinus ulderigoi* Rossi, 2014 (Scorpiones, Scorpionidae) and its vulnerable status

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The genus *Pandinus* Thorell includes some of the largest scorpion species in the world (over 14 cm of total length), such as *Pandinus imperator* (C.L. Koch), *P. dictator* Pocock, *P. gambiensis* Pocock and *P. ulderigoi* Rossi. The first three species are included in the CITES list, Appendix II, while the latter was recently discovered and described from Central African Republic from an unknown type locality. The analysis of additional specimens, representative of both sexes, confirms that the more closely related species is *P. imperator*, which can be distinguished by the characters summarized in literature and also by a different trichobothrial pattern, hereby presented. New material collected in the environment of Bangui together with a recent ecological and geographical study about major vegetation zones, suggest that the correct type locality of *P. ulderigoi* should be regarded as Bangui. Since *Pandinus* species are not easy to identify by the custom officers and considering that the since 2012 the European Union has a current import suspension of *P. imperator* from Ghana, it is possible that also *P. ulderigoi* could be imported from Central African Republic to avoid CITES regulation. For this reason, I suggest to add *P. ulderigoi* to the *Pandinus* species protected by the Washington Convention.

Keywords: Central Africa, Bangui, CITES convention

Student - Oral presentation
Araneae
Social spiders

Multiple origins of social behaviour in crab spiders (Araneae, Thomisidae)

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Most spiders live solitarily and are very aggressive even towards conspecifics. Sociality in spiders is rare, with less than 25 of the roughly 44,500 species being social. Nevertheless, sociality has evolved multiple times across several families and nearly all studied social lineages have originated from a periodically social (subsocial) ancestor. Group-living crab spiders (Thomisidae) can be exclusively found in Australia and differ from most other social spiders since they lack a communal capture web. In crab spiders, three subsocial and a single permanently social species are described to date. Three of the group-living species were placed in the genus *Diaea* and another in the genus *Xysticus*. Most Australian thomisids are, however, difficult to identify because descriptions are old and often of insufficient quality. We clarify the phylogenetic relationship of the four group-living Australian thomisids and conclude that amongst these, subsociality has evolved at least twice independently. Our results help to understand the evolution of sociality in thomisids and support the hypothesis that permanent sociality in spiders has evolved multiple times relatively recently from subsocial ancestors. Furthermore, our results suggest the need for revision of the Australian Thomisidae.

Keywords: *Diaea*, Thomisid phylogeny, social evolution

Student - Oral presentation
Araneae
Functional morphology

3D functional morphology of the femur-patella joint in the spider *Cupiennius salei* (Araneae, Ctenidae)

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It is a well-known fact that walking legs in spiders lack extensor muscles in some joints. This concerns the femur-patella joint and the tibia-metatarsus joint. It is assumed that the extension in these joints is achieved by an increased hydraulic pressure within the hemolymph system. The femur-patella joint has specially been the object of scientific interest as the main walking propulsion is realized in this joint. But despite several studies, knowledge on morphological details during extension and flexion of this joint remains uncertain until today. Here we present the first functional morphological 3D-analysis of the femur-patella joint of *Cupiennius salei* using micro-CT scans. Our investigations reveal a complex structural arrangement of this joint. The arcuate sclerite represents the most prominent structure in the membrane. Beside this sclerite, we furthermore found three radial, but less sclerotized regions that affect the overall shape of the arthrodial membrane but also influence the folding regions during the flexion of the walking leg. Based on 3D-models of extended and flexed joints, finite element analyses were carried out to test functional interactions between hydraulic pressure in the lacunar hemolymph system and the exoskeleton.

Keywords: hydraulic leg extension

Oral presentation
Araneae
Ecology

Cost of fear: effect of spider presence on leafhopper feeding behaviour

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Prey behaviour may dramatically change in response to the presence of predators (predator stress, PS) including reduced plant consumption in herbivores. Our goal was to understand how PS influences prey feeding behaviour in virus vector sap feeding insects, where such changes may have multitrophic implications. The model system included the spider *Tibellus oblongus*, and the leafhopper *Psammotettix alienus*, only vector of wheat dwarf virus (WDV). These leafhoppers cannot survive long without feeding, and during feeding first they need time to penetrate to the phloem, and when feeding from the phloem (virus transmission may occur at this stage) they are practically anchored to the plant. We made short term (30 min) and longer (3 h) laboratory observations in microcosms and examined how the presence of spiders affected leafhopper movement and feeding. Initial results show that leafhopper behaviour is definitely influenced by spider presence. In PS treatments leafhoppers moved more frequently, but movement bouts were shorter. Jumping, typical escape behaviour, was also more frequent in PS treatments. Actual feeding was detected by the occurrence of honeydew droplets. Feeding occurred significantly less frequently when spider was present, and there was an indication that feeding events were also shorter. We propose that such changes in leafhopper behaviour warrant further investigations to better understand how spiders may indirectly affect the spreading of economically important plant viruses.

Keywords: nonconsumptive, cascade, vector, spider, avoidance

Oral presentation
Araneae
Phylogeny

Molecular phylogeny of the orb weaver spider family Araneidae (Arachnida, Araneae)

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Spiders of the family Araneidae are among the best known groups of spiders and they figure prominently in popular works, general textbooks and natural history books. They are also among the largest spider families, with more than 3,000 described species in 169 genera. The family has been the target of much phylogenetic and evolutionary research and speculation through times, but the first phylogenetic analysis based on a character matrix is only 17 years old. It was based on morphology and included 57 araneid genera, mainly from the northern hemisphere. We here present a new phylogenetic analysis of the family based on the mitochondrial genes CO1 and 16S and the nuclear genes 18S, 28S and Histone H3 and including 85 araneid and 25 outgroup genera. We present the different results obtained based on various data partitions as well as analytical methods and discuss the results in light of the previous suggested phylogeny for the family as well as the implication for classification and circumscription of the family.

Keywords: evolution, phylogeny, Orbiculariae

Oral presentation
Araneae
Symposium - Mating strategies

Sequential mate choice of male and female *Argiope* (Araneae, Araneidae)

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Males of all studied species of *Argiope* are adapted to mate with a single (monogyny) or maximally two (bigyny) females. Hence, male reproductive success is to a large extent determined by the quality of the mating partner. Partner quality depends on fecundity but also on genetic quality and compatibility. Females are considered polyandrous with maximal mating rates that depend on the efficiency of mating plugs that the males apply. Female reproductive success will be less determined by partner phenotypic quality, but by gaining high quality and compatible sperm. However, for both sexes mate encounter rates as well as the probability of finding a better or another mate at all may be difficult to predict. I report how *Argiope* males and females incorporate these variables in their mate choice strategies.

Keywords: sexual selection, mating, behaviour, choice

Poster presentation - GE3
Opiliones
Genetics

Karyotype evolution of the harvestmen suborder Laniatores (Arachnida, Opiliones)

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Harvestmen (Opiliones) are the third most numerous order of arachnids, with more than 6,500 described species. There are four main phylogenetic suborders: Cyphophthalmi, Eupnoi, Dyspnoi and Laniatores. In spite of this massive species diversity, only 80 harvestmen species have been karyotyped so far. According to the current knowledge, the harvestmen represent a considerably diverse group when it comes to their karyotypes, with the diploid chromosome number for these arachnids ranging from 10 to 109. To date, most cytogenetic attention has been paid to suborder Eupnoi. On the other hand, only 11 species of Laniatores from three families have been karyotyped so far, despite this being the most diverse group of Opiliones, with more than 4,000 described species divided into 30 families. Results so far for Laniatores show the highest diploid chromosome numbers known amongst harvestmen (2n = 40 – 109). One possible explanation of this significant distinction from the other suborders is the polyploidy of the Laniatores genome. Currently, only results from Brazilian Gonyleptidae are known. The question raised was whether it is possible to relate those results to the whole Laniatores group. To resolve this, we have been analyzing karyotypes of other phylogenetic lineages of Laniatores. We managed to generate chromosomal information from representatives of another eight families (20 species) and we found diploid chromosome numbers ranging from 36 to 86. A comparison of our results with known phylogenetic relationships shows that lower chromosome numbers are more ancestral in the karyotype evolution of Laniatores. Higher diploid chromosome numbers (more than 70) have only been discovered in Cosmetidae and Gonyleptidae, which belong to the superfamily Gonyleptoidea.

Keywords: chromosome, harvestman, karyotype, Laniatores

Student - Oral presentation
Araneae
Behavioural ecology

Indication of postmating isolation between two sibling species of spiders

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Pardosa wagleri and *P. saturatior* are two sibling vagrant species which differ in ecology, phenology, and size. Overall they have sympatric distribution but occur at different altitudes. Nevertheless, contact areas can be found and there is some genetic evidence that hybrids occur in the wild. They are considered to be reproductively isolated because of the differences in courtship behaviour and size of genitalia. We investigated premating and postmating reproductive isolation mechanisms. Specifically, we studied whether males of these species are able to discriminate between chemical and visual cues of conspecific females and females of the sibling species. Further, we paired males of both species with heterospecific females to reveal whether females accept heterospecific males. We found that males of both species perform courtship when exposed to contact cues deposited on silk and visual cues of females regardless of the species. Moreover, despite considerable differences in courtship behaviour, *P. wagleri* females accepted and copulated with heterospecific males with similar frequency as with conspecific males. Males of *P. wagleri* were most frequently ignored or even cannibalised by *P. saturatior* females. In both species, cocoons were produced only by females which mated with conspecific males. Our results suggest that *P. wagleri* and *P. saturatior* are isolated by a postmating barrier; however, since there is an indication that hybrids can be found in nature, this isolation seems to be incomplete.

Keywords: courtship, heterospecific mating, sibling species

Student - Poster presentation - PHV4
Scorpiones
Physiology - Venom

Male and female venom glands in a sexually stinging scorpion (Arachnida, Scorpiones)

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Males of many scorpion species repeatedly sting females during mating. Based on anecdotal evidence, this behaviour ("sexual stinging") seems to be correlated with a sexual dimorphism in telson and venom gland size, i.e. males should show bigger telsons and venom glands than females. As natural selection theory predicts bigger female venom glands (females need more nutrients for their offspring), we hypothesise that this sexual venom gland dimorphism evolved under sexual selection in relation to the male's sexual stinging behaviour. In an ongoing project, we investigate morphometrics and morphology of male and female telsons and venom glands by means of light microscopy, scanning and transmission electron microscopy in the sexually stinging scorpion *Euscorpius alpha* (Scorpiones, Euscorpiidae). Male telsons are significantly wider and higher than female ones. In the compound light microscope, no clear sexual dimorphism in gland morphology is recognisable, except that the male gland is more voluminous. Female venom glands are covered at the periphery by smooth ring musculature which is exceptional for arthropods. The female gland itself is composed of five types of secretory cells. An elaborate system of supportive cells surrounds the gland cells all over their surface. These supportive cells branch into multiple processes (termed "microtubuli" in the literature) that penetrate into the reservoir. As the reservoir's volume varies extremely due to variable filling status, these processes must be very flexible. We hypothesise that the supportive cells avoid gland cell damage when the reservoir is emptied and assist during release of the gland cell's secretions. The ultrastructure of the male venom gland is compared with that of the female and differences are discussed with respect to their role in sexual stinging behaviour.

Keywords: dimorphism, sexual stinging, venom gland

Student - Oral presentation
Araneae
Symposium - Genomics

The effect of mating system on genome-wide genetic diversity: a comparative study of sister species with inbred and outbred mating systems

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Theory predicts that inbreeding results in reduced effective population size, which reinforces genetic drift and accelerates loss of genetic diversity, ultimately impairing the potential of populations to respond to environmental challenges. The cost of inbreeding is therefore considered to act as a major selective force shaping mating strategies towards a preference for unrelated mates. However there are species for which inbreeding is the rule rather than the exception. Social spiders live in communal nests containing up to several thousand individuals, in which they feed communally and cooperate in prey capture, web maintenance and brood care. This social life style includes obligate mating among close relatives. Social spider species belong to genera containing subsocial outcrossing sister species i.e., closely related species in which individuals, after a cooperative juvenile stage, but before maturation and mating, disperse out of the maternal nest and live their adult life solitarily. Specifically, in the genus *Stegodyphus* (Araneae, Eresidae) three species have independently evolved permanent sociality, whereas the remaining 20 species are subsocial. In our study we use a RAD-sequencing approach to compare the inbreeding social species *S. sarasinorum*, *S. dumicola* and *S. mimosarum* and the outcrossing congeners *S. pacificus*, *S. africanus*, *S. tentoriicola* and *S. lineatus* in order to examine consequences of social life style on genome-wide genetic diversity, structure, and genome evolution. Population genetic theory predicts that social species will have depleted genetic diversity within populations, but elevated population differentiation. These predictions will be tested by comparing genetic diversity and structuring between social species and the subsocial sister species.

Keywords: population genetics, population structure, genetic diversity, mating system

Student - Poster presentation - CE18
Araneae
Community ecology

Spider species richness comparison within protected and unprotected area in Eastern Slovenia

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Protected areas of nature have a great importance as biodiversity hotspots in degraded landscapes, and play a significant role in endangered species conservation. In order to assess the ecological state and confirm the importance of protected areas, we compared the spider species richness of two forests in eastern Slovenia, both with very similar vegetation and soil composition: one in the protected area of Natura 2000, and another in an unprotected area. Over a period of ten days, several selective and non-selective sampling methods were used (litter sifting, aerial hand collecting, ground hand collecting, sweep netting, pitfall traps and inverted leaf blower), both at night and in daytime, in the same quantity at both sites. One sampling unit was defined as one hour of intensive sampling by one person, using one metod of sampling. In overall, we collected over 64 sampling units. Statistic analysis was ran in Estimate S v9, using six estimators (ACE, ICE, Chao 1, Chao 2, Jack 1 and Jack 2). During this study, a total of 1,103 spiders were captured. Compared with the forest in an unprotected area, there was a greater number of species recorded in the Natura 2000 protected forest, where we also collected a slightly higher number of specimens. Results, presented as an estimation of species richness based on accumulation curves, show significant difference in species diversity in favour of the protected area, therefore justifying the conservation policy of natural habitats in environments degraded by agricultural activity.

Keywords: Araneae, biodiversity assessment, short-term sampling

Student - Oral presentation
Scorpiones
Phylogeography

Improved phylogeography of the scorpion genus *Buthus* (Scorpiones, Buthidae) and novel insights regarding Maghreb diversity through a cox1 barcoding approach.

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The scorpion genus *Buthus* Leach has a wide distribution, extending from the Mediterranean region to the Arabian Peninsula and southward to the Sahel and the Horn of Africa. Nevertheless, 80% of its 45 accepted species are endemic to the Palearctic, making it one of the most diverse scorpion genera present in this Ecozone. The knowledge on the genus species diversity has increased extraordinarily in recent years, from a mere five valid species known in 2000. Several studies have examined the genus diversity using molecular tools and have revealed a complex genetic history. Here we applied a twofold approach to improve our understanding of the origins and patterns of *Buthus* diversity. First, we took advantage of an increased coverage of the genus distribution, adding specimens from its eastern range, to test the hypothesis of Morocco as the centre of its diversity and the use of the Mediterranean North Africa corridor for the eastward expansion of the genus by means of a multi-locus molecular approach. Although sub-Saharan samples were missing, our initial hypotheses were confirmed. Second, we used all available cox1 gene sequences to apply a barcoding approach to the Maghrebian *Buthus* diversity. This area holds 50% of the genus species, but morphological identification is hampered by the similarity of several species. We included new morphological identifications, sampled at type localities and used quantitative species-delimitation methodologies to untangle the challenging taxonomy of the genus, while improving our understanding of the geographical distribution of its diversity in the Maghreb.

Keywords: *Buthus*, Scorpiones, phylogeography, Palearctic, species-delimitation

Student - Oral presentation
Araneae
Systematics

Barcoding of European spiders: closely related species in the genus *Araniella* (Araneae, Araneidae)

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One of the main ideas of barcoding is to use the sequence of the mitochondrial COI gene for species identification. This approach showed to be successful in a number of cases where it was possible to assign taxa to their phylogenetic place. However, some difficulties remained, especially in cases of closely related species. This study is a part of the ongoing Barcoding of European spider project where we put special emphasis on the genus *Araniella*. Two of eight species that occur in Europe (*A. opistographa* and *A. cucurbitina*) are considered closely related and it can be difficult to distinguish them on the basis of their morphological parameters. For each specimen the first subunit of COI gene was amplified and sequenced. Sequence editing, alignment and building of a neighbor-joining tree were done using software Geneious 7. Our results showed a clear barcoding gap between the inter- and intraspecific divergence of COI sequences in these two closely related species. This indicates the possibility to use barcoding for distinguishing these two species but it also showed that they might not be as closely related as it was expected.

Keywords: barcoding, COI, *Araniella*, spiders, identification

Student - Oral presentation
Araneae
Behavioural ecology

Foraging benefits of visual specialization in the strictly nocturnal, ogre-faced spider, *Deinopis spinosa* (Araneae, Deinopidae)

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Sensory systems are both important and metabolically expensive. A trade-off thus exists between the benefits gained from having a sensory system and the metabolic costs associated with its possession. Though several studies have documented the costs of maintaining certain sensory systems, few have investigated the functional benefits gained from possessing specialized sensory structures. We investigated the presumed foraging benefits gained from the enlarged eyes of the ogre-faced spider, *Deinopis spinosa*. These strictly nocturnal spiders have the largest camera-lens eyes of any arthropod relative to body size and they are presumed to function in increased foraging efficiency at night. To directly test this hypothesis, we conducted repeated-measures, visual occlusion trials in both natural and laboratory settings. Our results indicate that *D. spinosa* relies heavily on vision to capture cursorial prey items, but remains able to capture aerial prey items whilst visually occluded. In the field, cursorial prey captured were larger than aerial prey, indicating the potential for higher quality prey from the ground. Our study documents specific benefits gained from sensory system enhancement and we propose that access to higher quality prey items has selected for an enhanced visual system within the genus of *Deinopis*.

Keywords: foraging strategy, sensory specialization, web-building

Poster presentation - BF12
Araneae
Biogeography and faunistics

Why is the number of spider species in Central Europe still increasing?

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Since the 1920s, when political borders changed significantly in Central-Europe, one could only have guessed how many spider species existed in Hungary. The most obvious reason for the uncertainty was that the milestone papers (i.e. Herman's and Chyzer & Kulczynski's contributions) used previously defined political borders. The last of these authors are highly cited to the present day, thus the Hungarian species occurence often need revision. Samu & Szinetár have published a bibliographic checklist, which was the first species list for the current borders of Hungary, summing up all literature until 1999. They listed 725 species, but this number is known to have increased since that time. There are several reasons why additions have been made: for instance the new additions might have been rare, or poorly known or alternatively improved methods of collection or identification may have yielded new data. There are still likely to be undiscovered species in Central-Europe that new collecting methods may discover. An important but significant alternative explanation for newly occuring species is that they have been newly introduced from other continents or that they have spontaneously expanded their ranges (mainly from southern Europe); some of the new faunal elements establish in natural habitats, whereas others settle in buildings or other human related habitats. The following examples are used to depict the different reasons for the finding of new faunal elements: *Baryphyma pratense* (Blackwall); *Theonia kratochvili* Miller & Weiss; *Mermessus trilobatus* (Emerton), *Zodarion zorba* Bosmans and *Zoropsis spinimana* (Dufour). This research was supported by the European Union and the State of Hungary, co-financed by the European Social Fund in the framework of TÁMOP 4. 2.1/b, LIFE08 NAT/H/000289 and TÁMOP 4.2.4. A2-MZPD-12-0327 National Excellence Program.

Keywords: special sampling methods, range expansion, immigrant

Student - Poster presentation - CE19
Araneae
Community ecology

The effects of non-native plantations on ground-dwelling spider assemblages

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We investigated the impacts of non-native plantations (black locust, Scots pine, and red oak) on ground-dwelling spider assemblages near Debrecen city, Hungary. We compared the spider assemblages of the non-native plantations with native oak forests, typical in the region. We sampled spiders using litter sifting in 2011 every third week from the middle of April to the end of October. During the study we collected altogether 546 individuals representing 50 species. The overall species richness was the lowest in the red oak plantations, while the overall abundance was the highest in the black locust plantations. The species richness and abundance of forest specialist species was significantly higher in the native oak forests than in the red oak plantations. The number of open-habitat, xerophilous and light-preferring species did not differ significantly in the plantations and in the native oak forests, while the abundance of these species were the highest in the black locust plantations. These findings could be explained by the fact that the black locust plantations were the most open and warmest. Multidimensional scaling showed that the spider assemblages of the non-native plantations were separated from that of the native oak forests. Our result showed that the establishment of non-native plantations had a significant effect on the diversity and composition of spider assemblages. Primarily the forest specialist species are threatened, because they are sensitive to disturbances and changes of the environmental conditions.

Keywords: abundance, black-locust, control-oak-forest, habitat-affinity, species-richness

Student - Poster presentation - BE3
Araneae
Behaviour

Plasticity and intersexual disparities in extended phenotypes: testing the effects of airflow on a sheet-weaving spider (Arachnida, Araneae)

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Behavioural traits are products of life-history and real-time trade-offs which may result in overall optimization of fitness under local conditions. Cross-contextual behavioural correlations and behavioural consistencies across situations have recently been explored as, and suggested to be indicative of, behavioural syndromes. Behavioural syndromes have been studied in a variety of taxa, and spiders have shown to be model organisms for such research. From an adaptive perspective, a behavioural syndrome can be both consistent across temporally heterogeneous environments and phenotypically plastic. Intersexual disparity is a recurrent feature of spider mating systems, and recent publications suggest distinctions in life histories could drive divergence within behavioural syndromes, manifesting as important sex-specific variance within populations. Dispersal is a costly life-history trait, for which costs can be incurred prior/during dispersal, and throughout subsequent life-history stages. During breeding dispersal, mature male spiders of many web-building species assume a female-seeking role. Bridging is a mode of silk-assisted horizontal locomotion applied by species of the family Linyphiidae for a variety of state-dependant purposes, and habitually used by male spiders as an effective function for locating suitable conspecifics at relatively short distances. By measuring extended phenotypic outcomes of bridging behaviour across contrasting environmental situations (still and airflow) in wind tunnels under laboratory conditions, intersexual disparity was identified in the form of male-biased bridging propensity in the sheet-weaving spider *Tenuiphantes tenuis*. Additionally, when subjected to airflow (0.6 ± 0.1 ms-1) males demonstrated plasticity in bridging behaviour, and thus persisted to bridge more than females under equivalent conditions. Speculatively, consistent intersexual disparity in bridging propensity across contrasting environmental gradients might be symptomatic of a male-specific dispersal syndrome.

Keywords: dispersal, locomotion, behaviour, syndrome, plasticity

Oral presentation
Araneae
Behavioural ecology

Prey-luring and female-courting functions of conspicuous clypeus of the brown huntsman spider *Heteropoda venatoria* (Araneae, Heteropodidae)

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Both male and female of the brown huntsman spiders (*Heteropoda venatoria*) of the family Heteropodidae have a conspicuous white stripe on the clypeus region. These spiders are strictly nocturnal and do not build webs to catch prey. The conspicuous markings of nocturnal spiders have received little attention but previous studies on orb-web spiders showed that bright body coloration of nocturnal species functions as lures to lepidopterans. So far, the function of conspicuous body colorations of nocturnal wandering spiders is not clear. In this study we investigated the function of the conspicuous markings on clypeus of the brown huntsman spider *H. venatoria* by field manipulations and laboratory mating trials. We constructed dummies resembling *H. venatoria* in appearance and color and recorded insects' response to dummies with or without white clypeus by infrared video cameras. The results showed that dummies with white clypeus attracted significantly more moths than those without. In another field experiment we manipulated the color signals of the living spiders and monitored insects' responses to them. Compared with spiders with color of white clypeus altered, those with intact conspicuous clypeus attracted significantly more moths. In laboratory mating trials males with intact white clypeus were significantly more likely to be accepted and less likely to be attacked by females than those with this trait manipulated. Here we provide evidence that wandering spiders use visual luring to catch flying prey. We also show that color signals are involved in the courtship of nocturnal spiders. Therefore, the conspicuous white clypeus seems to exhibit dual functions of visually attracting flying prey and courting females.

Keywords: foraging, courtship behaviour, moth, Heteropodidae, color signal

Oral presentation
Araneae
Symposium - Mating strategies

Post-copulatory sexual selection research on spiders

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Spiders have stimulated a vast number of studies on reproductive strategies. Nevertheless there is a striking discrepancy between the magnitude of knowledge achieved on pre-copulatory compared to post-copulatory processes of sexual selection. Sperm competition and cryptic female choice - ubiquitous among non-monogamous species- are key components of reproduction. Yet, our understanding of fertilization outcome is incomplete, and has for long relied mostly on simplistic models of sperm priority patterns based on reproductive morphology. What emerges from reviewing the available literature on paternity studies is an extreme variation in paternity outcome. I here report the current state of the field with the aim of highlighting the complexity of factors underlying fertilization success and point to novel directions for future research.

Keywords: sexual selection, sperm competition, reproduction

Oral presentation
Araneae
Symposium - Mating strategies

Female genital mutilation: a novel male strategy to secure paternity?

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The risk of sperm competition poses high selective pressure on males to evolve counter-adaptations. Generally known male strategies to prevent sperm competition are amorphous secretions or body parts that males leave behind after mating. Mating plugs were shown to reduce female re-mating probability in a number of spiders. However, a strategy that seems to entail less costs for the male is the mutilation of the female genital area after mating. A literature search revealed that female genital mutilation seems particularly common in Araneidae, in 60 species of which females were found without scape on the epigynum. Since the scape is crucial for genital coupling, its loss inevitably renders the female unable to re-mate. We present data from field observations and laboratory experiments on the araneid *Larinia jeskovi*, in which female genital mutilation is common.

Keywords: mating behaviour, sperm competition, genitalia

Oral presentation
Araneae
Community ecology

Spider diversity in high altitude landscape: Askot Wildlife Sanctuary, Uttarakhand, India

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Effective biodiversity conservation actions in altitudinal landscapes are often impeded by paucity of relevant taxonomic and ecological information. Attempt to document the spider diversity was conducted in one of the fragile protected areas of western Himalayan landscape i.e. Askot Wildlife Sanctuary (AWLS), which is rich in biodiversity and located in the eastern Kumaon region of Uttarakhand state of India. The study aimed to document the spider diversity and investigate the role of altitude in structuring community to validate and observe distribution patterns with contending theories for spider conservation in western Himalaya. Greater taxonomic knowledge of the high altitude spiders will enable more scientifically informed bio-monitoring that requires increased accuracy and species level identification to detect the more subtle environmental changes associated with human impact, consumption and climate change. A preliminary survey of spider diversity was conducted in different areas of the Askot landscape between 1,500m to 3,300m altitude with western Himalaya and Trans-Himalayan (Tibetan-Pale arctic) transitions zone. The range and habitat and community representation yielded rich species diversity. These areas were sampled both for spiders and vegetation types. The sampling plots were selected based on these altitudinal belts from all possible microhabitats; random square sampling plots (10 m x 10 m) were laid in the different habitats and identified 18 families so far. The family Araneidae (Orb web spiders) was most predominantly present in lower altitudes (1,800m – 2,500m) followed by Lycosidae (wolf spiders) and Linyphiidae (Hammock web spiders). However, at mid altitude (2,500m – 3,300m) the families Lycosidae and Linyphiidae were more dominantly present and at higher altitudes (above 3,300m) Linyphiidae was predominantly present. This study is expected to provide an inventory of the spiders found in the landscape highlighting rare and endemic species including their diversity and distribution patterns.

Keywords: Askot Wildlife Sanctuary, Western Himalaya

Oral presentation
Araneae
Phylogeny

Phylogeny of the spider genus *Ixchela* Huber, 2000 (Araneae, Pholcidae) based on morphological and molecular evidence (CO1 and 16S), with a hypothesized diversification in the Neogene

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The genus *Ixchela* is composed of 20 species distributed from northeastern Mexico to Central America, including the five new species described here from Mexico: *Ixchela azteca*, *I. jalisco*, *I. mendozai*, *I. purepecha*, and *I. tlayuda*. We test the monophyly and investigate the phylogenetic relationships in *Ixchela* using morphological and molecular data. Parsimony analysis (PA) of 40 morphological characters with equal and implied weightings supported the monophyly of *Ixchela* with eight synapomorphies of the male genitalia: 1) bulb a with prolateroventral apophysis; 2) cone-shaped femur, long and slender; 3) embolus with an apical ventral projection; 4) embolus with an apical dorsal projection, spine-shaped; 5) procursus distally with a small, curved, sclerotized spine; 6) procursus with a long seta on ventral protuberance; 7) procursus conical and long, basally wide; and 8) embolus with a small, sub-distal sclerotized ventral spine. The PA analyses with equal and implied weightings, and Bayesian inference (BI) analyses for the separate CO1 gene (506 characters), concatenated gene fragments CO1+16S (885 characters), morphology+CO1 (546 characters), and the combined evidence data set (morphology+CO1+16S) (925 characters) support the monophyly of *Ixchela*. Our preferred topology found two large clades: clade 1 has a natural distribution in the Mesoamerican biotic component, whereas clade 2 predominates in the Mexican Mountain biotic component. *Ixchela* diverged around 60 Ma ago in the Cenozoic; the divergence of the two clades that compose *Ixchela* was at the end of the Paleogene (26 Ma), whereas the diversification of the species seems to have been primarily in the Neogene period (23-1.8 Ma).

Keywords: taxonomy, phylogeny, morphology, molecular-clocks, biogeography

Oral presentation
Araneae
Symposium - Genomics

Bacterial communities of spiders

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It is becoming increasingly clear that the bacterial community of an organism is a key player in its ecology and evolution. However, in spiders, community wide knowledge on bacterial diversity is currently lacking. We fill this gap by determining the bacterial community of spiders from the genera *Oedothorax* and *Stegodyphus* of which the latter consists of both social and solitary species. These analyses reveal that between genera, bacterial community composition can differ dramatically with only few bacterial species dominating in *Oedothorax* and a high diversity in *Stegodyphus*. Within the *Stegodyphus* genus, bacterial species are found infecting both social and solitary spiders as well as bacterial species that are seemingly more population specific. This indicates that, although differing in general ecology, both single and group living spiders face similar challenges regarding their local bacterial community.

Keywords: bacteria, group living, sex ratio

Student - Poster presentation - BE4
Araneae
Behaviour

Does prey availability affect deception in a nuptial-feeding spider?

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The spider *Pisaura mirabilis* (Araneae, Pisauridae), is known for its peculiar nuptial-feeding behavior: males court females by donating an insect prey wrapped in white silk and mate while the female is consuming it. The gift is under sexual selection imposed by strong female preference for gift-giving males and it functions as a mating effort by increasing male mating success and assuring sperm transfer. Males may however donate gifts with no nutritional value consisting of empty arthropods exoskeletons and plant parts. This deceptive tactic allows males to gain matings by exploiting the female preference for the gift without paying the full costs of gift construction as deceptive males may avoid energy expenditure and risks associated with hunting and increase their mating success when food is scarce. Food scarcity and poor male condition (i.e. poor hunting abilities) should therefore enhance deception. We conducted a field study on a natural population in Germany to assess the frequency of male gift-giving tactics (honest or deceptive). Males found carrying a nuptial gift in the field were captured, weighted and measured, and the gift content was assessed. Prey abundance was monitored through sticky and pitfall traps during the entire mating season. We discuss how prey availability and male body condition affect the occurrence and frequency of such strategy.

Keywords: mating strategies, deception, worthless donations

Student - Poster presentation - EC12
Araneae
Ecology

The effect of colony density on fitness and dispersal of the colonial spider *Cyrtophora citricola* (Araneae, Araneidae)

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Group living animals are expected to exhibit different dispersal strategies than solitary animals. While density-dependent dispersal is common in solitary organisms, group living animals may experience strong Allee effects (positive effect of density on the per capita growth rate, due to the benefits of group living) and negative density dependent dispersal. *Cyrtophora citricola* is a colonial, web-building spider that is undergoing a range expansion in Israel and was found to be invasive in the New World. Allee effects and negatively density- dependent dispersal may be an important factor in determining invasion success and range expansion rate. Previous studies showed that dispersal of *C. citricola* juveniles is reduced when webs of conspecifics and prey remains are present, but the main mechanism of colony formation in this species remains unknown. In order to study the effect of colony density on fitness and dispersal in *C. citricola* I am conducting experiments using lab-raised colonies in different densities, to examine the effect of density on feeding, body condition and survival, as well as on dispersal propensity ("tiptoe behaviour") and site tenacity. In addition, a census of natural colonies is being carried out bimonthly over the last two years, in 11 sites throughout the southern region of Israel (Arava, Western Negev and Beer Sheva). The field data allow us to calculate colony growth and survival in relation to colony size, geographic location and habitat productivity.

Keywords: coloniality, density dependency, dispersal

Oral presentation
Araneae
Systematics

Lucid identification key to Theridiidae spiders (Arachnida, Araneae) of biosecurity importance

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The family Theridiidae is the fifth most diverse family of spiders worldwide and accounts for 5.3% of known spider diversity; however, in New Zealand and Europe, theridiids account for 14.3% and 14.9%, respectively, of the invasive spider fauna. In New Zealand, theridiids are considered of high biosecurity importance as they are some of the most commonly intercepted invertebrates and 27% of all spider interceptions are theridiids. The identification of theridiids in New Zealand is problematic as only 41 of the estimated 200 species have been described. Most of the 41 described New Zealand species have not been revised for over 100 years and are not recognisable based on their original descriptions. Most of the New Zealand Theridiidae fauna is native (some endemic to genus level), but the majority of species found around human modified environments are introduced species from Australia and other parts of the world. A Lucid Key to Theridiidae Spiders of Biosecurity Importance to New Zealand has been produced and features will be shown and discussed (http://keys.lucidcentral.org/keys/v3/theridiidae/). The selection of the 64 species included the key will also be discussed. This key is also of relevance to Europe and other parts of the world as it includes introduced and native theridiid species commonly associated with human environments, species that have been intercepted at the New Zealand border, widely-distributed foreign species and species found overseas that are a likely biosecurity threat. We have tried to avoid specialist morphological terms in order to make the key accessible to many users.

Keywords: invasive species, New Zealand, Theridiidae

Student - Poster presentation - BE5
Araneae
Behaviour

Display behaviour of male *Saitis barbipes* (Araneae, Salticidae), an attractive system for studying sexual signalling

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We set out to characterize in detail the display behaviour of male *Saitis barbipes* towards male and female conspecifics. *S. barbipes* is a Mediterranean Euophryine salticid that employs legs III in elaborate visual displays that have, until now, been described in little detail.
We collected 10 male individuals from southern France and placed them in visual contact with either a male or female conspecific that we collected from the same location. Display behaviour was categorized into ten distinct gestures and recorded in sequence in an ethogram. Males that saw the male were then shown the female (and vice versa), and behaviours recorded once again. All males saw the same male and the same female. Eight of ten gestures were used towards the female only, the other two displayed to males and females. We defined the courtship dance of males based on the common use of certain gestures. Six gestures were used during the courtship dance exclusively. The three modes of display we observed were male-male, male-female non-courtship and male-female courtship. During courtship, males exhibited displays with significantly greater gesture frequency compared to the other two modes of display ($p < 0.01$). There was no difference in gesture frequency between the non-courtship displays. Our work has shown that male *S. barbipes* perform different repertoires of gestures using legs III depending on both the sex of the encountered conspecific and whether he is courting. We have also shown that courtship involves a much greater frequency of gestures, which may suggest that it is the most energetically expensive mode of display. This makes sense in light of current sexual signalling theory. Finally, we have provided definitions of the three display modes through detailed classification of individual gestures. These offer a guide for future research involving sexual signalling in this species.

Keywords: display, courtship, *Saitis barbipes*, Euophryinae

Student - Oral presentation
Opiliones
Functional morphology

Functional morphology of the genitalia of Laniatorean harvestmen (Gonyleptidae, Opiliones)

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Genitalia are often more complex than necessary for sperm transfer and sperm storage which is attributed to sexual selection and/or conflicts between the sexes. To understand the driving forces of this complexity, studies are required that unravel not only the morphology of the structures involved but also their interplay. To this aim, we investigated mating behaviour, genital morphology as well as interactions of male and female genitalia of Laniatorean harvestmen. In *Pachyloides thorelli* (Laniatores: Gonyleptidae) we analyzed mating behavior and investigated functional genital morphology of both sexes using histology and X-Ray microtomography of cryo-fixed pairs. Based on 3D reconstructions of pairs in copula, we evaluated the potential interplay between male and female structures. For *Triaenonychoides cekalovici* (Laniatores: Triaenonychidae) we reanalyzed the genital morphology and identified inaccuracies in former descriptions of the ovipositor morphology as well as of the male genitalia. Our preliminary results will serve as a basis for in-depth investigations on genital coupling, potential male manipulations and cryptic female choice in Opiliones.

Keywords: genital morphology, genital coupling, Opiliones

Student - Oral presentation
Araneae
Community ecology

Diversity of spider assemblages on the mountainous mires in Sudety mountains

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The main goal of this study was to find out how the spider assemblages of mountainous mires differ according to particular habitat characteristics. This research both supplements data collected by previous researchers and also gives much insight in spiders' diversity and population dynamics. The spiders were collected in Sudety Mountains (SW Poland) with pitfall traps and a sweep net during two succeeding seasons, in 2010 and 2011. The traps were checked regularly every 18-20 days, the same applies to the collecting with a sweep net. The >30 study plots that were chosen were grouped depending on: the mire type (raised bog, poor fen), vegetation (undergrowth) type, their being open or overgrown by a forest, surrounding habitats, altitude and total size. Species composition, relative abundance (activity), dominant species number, proportions of 'indicator' species and annual dynamics were compared in the relation to the above mentioned characteristics. The data were also analyzed with different diversity indices and estimators, the utility of which is subsequently discussed. The studied spiders' assemblages differed both in their family and species composition and activity depending especially on the mire type. Although a considerable within-group unity (e.g. for raised bogs or transitional mires in spruce forest) was observed as regards the general activity and proportions of different family members, there were also differences within one group of mires in species composition and proportions of species. The studied assemblages differed also in a number of species that are characteristic for mires. The assemblages of spiders on mountainous mires were generally stable over this short lasting period of research. However, they might still undergo some changes, as shown by comparison with older data. Furthermore, a few new localities of a couple of rare species were found.

Keywords: assemblages, Araneae, mire, mountains

Student - Poster presentation - PHS2
Araneae
Physiology - Spider silk

How spiders avoid getting stuck in gluey capture threads: evidence for a protective surface coating in Theridiidae and Pholcidae (Arachnida, Araneae)

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More than a hundred years ago, the French naturalist Jean-Henry Fabre suggested a fatty body surface coating that should protect araneoid spiders from getting stuck in their webs. Up till now this has been tested only for Araneidae and Nephilidae but not for other Araneoidea or web invaders like the cellar spider *Pholcus phalangioides*. We measured the adhesion of differentially treated legs of spiders of different families and of an insect in the web of the bridge spider, *Larinioides sclopetarius* (Arachnida, Araneidae). One experimental group of legs was washed with an organic solvent (CS2), the second one with distilled water, and the third group was left untreated. CS2-washed legs stuck significantly stronger than legs of the other two groups in Theridiidae and Pholcidae. In the Linyphiidae there is only a significant difference between CS2-washed and untreated legs. In Lycosidae and locusts (*Locusta migratoria*) there is no significant difference between the three treatments. These data give evidence for an independent origin of an organic protective body surface coating in Araneoidea and in the haplogyne web invader *Pholcus phalangioides*.

Keywords: adhesion, organic body surface cover

Student - Poster presentation – FM4
Arachnida
Functional morphology

Smooth adhesive foot pads in arachnids

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Adhesive foot pads are wide spread among arthropods and some lizards. During the last decades those were subjects of intense research aiming to provide functional explanations for possible biomimetic transfer. Although the adhesive pads are well-studied in various insects, spiders and geckoes, very little is known on their structural diversity and function in non-spider arachnids. Here we present novel data for the smooth adhesive pads (arolia, pulvilli) of whip spiders (Amplypygi), pseudoscorpions (Pseudoscorpiones) and prenymphs of whip scorpions (Thelyphonida). All those enable the animal to cling upside down to a smooth glass slide. In most cases fluid secretions were found, that did not evaporate over time. Whereas the surface of pseudoscorpion arolia is smooth, it is microstructured in whip spiders (excluding prenymphs). Pull-off tests revealed significantly higher adhesive forces in the latter, which supports the hypothesis of adhesive strength enhancement through contact splitting. Prenymphs of Amblypygi and Thelyphonida bear well developed arolia that are used to cling to the back of their mother. In whip spiders of the suborder Apulvillata, as well as in Thelyphonida, those are lost after the first mold. Future studies shall reveal morphological and functional correlates in adhesive pads of harvestmen (Opiliones), camel spiders (Solifugae), and ticks (Acari).

Keywords: adhesion, Amblypygi, Pseudoscorpiones, Scorpiones, Thelyphonida

Student - Oral presentation
Opiliones
Functional morphology

Unique harvestmen (Arachnida, Opiliones) use viscoelastic fluids to capture springtails

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A high number of harvestmen (Arachnida, Opiliones) belonging to the suborder Palpatores bear glandular hairs (setae) at their pedipalps, which are especially prominent in some dyspnoid genera. The setae have a drumstick-like appearance (formerly described as 'Kugelhaare', clavate setae) as they bear a spherical lipidous secretion droplet at their tip. These were previously hypothesized to be sticky and used in prey capture. However, clear evidence for this was lacking to date. We investigated the prey capture of the harvestman *Mitostoma chrysomelas* (Nemastomatidae) using a high speed video camera and measured adhesion of single clavate setae in contact to a glass sphere at different pull-off velocities. Adhesion highly increased with an increased pull-off speed, ranging from 1 µN at 1 µm/s up to 7 µN at 1 mm/s. This corresponds to the weight of small springtails (Collembola) and soil mites (Oribatei) belonging to the prey spectrum of this species. The investigation of the fluid dynamics of stretched glue droplets showed that the glue exhibits typical characteristics of a viscoelastic fluid forming typical beads-on-a-string morphology (BOAS) over time, which is well known for spider capture threads as well as for sticky tentacles of carnivorous plants. These analogies depict that viscoelasticity is a highly efficient mechanism for prey capture, as it holds the stronger, the faster, the struggling prey moves. Cryo-scanning electron microscopy of snap frozen harvestmen with glued springtails revealed that the gluey secretions have a high affinity to wet the highly microstructured cuticle of collembolans, which was previously reported to be highly repellent by both polar and non-polar liquids. Further observations show that glue droplets can be contaminated with the detached scaly setae of collembolans. This may represent a counter-adaptation against entrapment by viscoelastic glue, similar to the surfaces of Lepidoptera and Trichoptera (Insecta) that use a similar mechanism to escape from spider webs.

Keywords: adhesion, clavate seta, Collembola, microstructure, Opiliones

Student - Oral presentation
Araneae
Physiology

The structure and function of the silken attachment discs of spiders

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Araneomorph spiders are well-known to apply a distinct pattern of pyriform secretions to glue silk threads to substrates or with each other. These were formerly hypothesized being a two compound material including spidroins (silk proteins) and an amorphous cement-like portion. Although being essential for both dragline securing and web building, these so-called attachment discs are scarcely studied regarding their structure, composition, mechanical properties, spinning behaviour and evolution. We investigated morphology and ultrastructure of attachment disks in selected spider species with the means of light, scanning electron, transmission electron and atomic force microscopy. We found that the attachment disk is basically divided in four functional parts, which exhibit structural differences between members of web building and free hunting spiders. These differences are assumed to have a great influence on their mechanical performance. In order to reveal whether structure of the disk is determined by spinneret movements during disk deposition, we high-speed-videorecorded the dynamics of silk application during attachment disk spinning using an inverted microscope operating in a reflection interference contrast mode. We found a great difference in spinneret movements between web-building *Uloborus plumipes* (Araneae, Uloboridae) and free hunting *Marpissa muscosa* (Araneae, Salticidae). Furthermore, we performed tensile tests of attachment disks of *Nephila senegalensis* (Araneae, Nephilidae) spun on three different substrates (glass, Teflon and Acer leaf). We found that the attachment ability is highly substrate dependent, which in turn leads to the hypothesis that thread anchoring sites have to be well chosen by spiders.

Keywords: biomechanics, silk adhesion, biomimicry

Oral presentation
Scorpiones
Biogeography and faunistics

Zoogeography of scorpions (Arachnida, Scorpiones) in Turkey

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The present review summarizes the studies in systematics and zoogeography of Turkish scorpions. Because of the geographic position of Turkey, it acted as a bridge and transitional area between Asia and Europe. Such a barrier and bridge caused formation of the different zoogeographical regions and faunal elements. To understand the faunal elements and scorpion fauna of Turkey, the geographic and paleogeographic barriers which affect the distribution of species are important. The specimens were collected from under the stones in daytime and using UV lamp at night from all regions of Turkey. The literature records were also used. Among the known species in Turkey, *Androctonus crassicauda*, *Buthacus macrocentrus*, *Compsobuthus matthiesseni*, *Hottentotta saulcyi*, *Leiurus abdullahbayrami*, *Mesobuthus phillipsii*, *Scorpio maurus*, *Calchas birulai*, and *C. kosswigi* are distributed in south-eastern Anatolia. *Leiurus abdullahbayrami*, *C. birulai* and *C. kosswigi* are endemic or subendemic in Anatolia, and the other species originate from Iran and Middle East. *C. schmiedeknechti* and *M. nigrocinctus* are distributed in the Eastern Mediterranean region and originate from Levant. *M. eupeus*, *M. caucasicus*, *Orthochirus zagrosensis*, and *C. anlasi* are distributed in Eastern Anatolia. *C. anlasi* originate from Anatolia, *O. zagrosensis* and *M. eupeus* from Iran, and *M. caucasicus* from Central Asia. *C. nordmanni*, *Euscorpius italicus* and *E. mingrelicus* are distributed in the Black Sea region. While *C. nordmanni* is endemic in Anatolia, *E. italicus* and *E. mingrelicus* originate from the Balkans. *E. rahsenae* is endemic to the Marmara region. *Iurus kinzelbachi*, *Protoiurus asiaticus*, *P. kadleci*, *P. kraepelini*, *Neocalchas gruberi*, *E. avcii*, *E. lycius*, and *E. gocmeni* are distributed in the Aegean and Mediterranean regions. Although *M. gibbosus* is distributed in the Balkan Peninsula, it originated from Anatolia. The other species are endemic or subendemic in Anatolia. The present study is important to evaluate the distribution and endemism of the Turkish scorpions.

Keywords: scorpiones, scorpion, zoogeography, endemism, Turkey

Oral presentation
Araneae
Functional morphology

The covering setae of ground spiders (Araneae, Gnaphosidae)

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The previous study of the setae covering the ground spiders' opisthosoma shows that the setae are genus specific. It points out that setae deserve serious study. However, covering setae still are universally neglected and setae morphology is little known. The study pursues the description of covering setae across the whole family Gnaphosidae to establish the setae characteristics relevant to ground spiders' systematics and phylogeny reconstruction. Scanning electron microscope imaging provides useful diagnostic characters for setae description and a further understanding of the relationships among gnaphosids. Study shows that setae are genus specific and provide valuable characteristics to genera and subfamily delineation. There are six major types of covering setae among gnaphosid spiders: squamose, plumose, lanceolate, pinnate, arborate, and sabre-shaped. Squamose setae are characteristic to *Anzacia*, *Micaria*, *Hypodrassodes*, *Herpyllus*, and *Nauhea*. Plumose setae occur in *Berlandina*, *Nomisia*, *Minosiella*, and *Pterotricha*. *Apopyllus*, *Drassodes*, *Leptodrassus*, *Litopyllus*, *Parasyrisca*, *Sosticus*, and *Zimiromus* have lanceolate setae. Gnaphosa species have pinnate setae. *Fedotovia uzbekistanica* has arborate setae. *Aphantaulax* and *Poecilochroa* have sabre-shaped setae. The study reveals the existence of different types of covering setae and provides a set of characteristics important for classification and phylogenetic analysis of Gnaphosidae.

Keywords: lanceolate, setae, squamose, pinnate, plumose

Student - Poster presentation - BF13
Araneae
Biogeography and faunistics

About Hersiliidae Thorell, 1870 (Arachnida, Araneae) in Iran

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Hersiliidae (Arachnida, Araneae) is a small family consisting of 176 species and 15 genera, which due to their prominently long posterior lateral spinnerets are commonly known as two-tailed spiders. Most species are found in tropical/subtropical regions of the world, and their range rarely extends 40°N. The study of Hersiliidae in Iran is very recent: the first documentation of them was made by Marusik and Fet in 2009, when they described two new species from Iran, *Hersiliola foordi* and *Duninia rheimsae*, which the latter was based on the basis of the female sex only. Later in 2013, Mirshamsi et al. reported *H. sternbergsi* Marusik & Fet and *D. baehrae* Marusik & Fet, 2009 from Iran for the first time and provided the description of a new species, *D. darvishi* Mirshamsi & Marusik. In our current study, we provide data on the discovery of a new genus and its new species from southeastern Iran, and two other new species of *Hersiliola* and *Hersilia*, from Islands of Persian Gulf. As a result, the number of Iranian genera and species are increased to four and eight, respectively, which is the highest species diversity of this taxon in the Palaearctic.

Keywords: fauna, Hersiliidae, Iran

Poster presentation - PHS3
Araneae
Physiology - Spider silk

Mass survey of antimicrobial function of spider and egg sac silks

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Spider silks are fascinating biopolymers, which are made from proteins. The physical properties, such as elasticity and strength have been intensively studied. Other properties, such as chemical components and antimicrobial capacities have been largely overlooked. Spiders build webs in a variety of environments, such as on the ground, in caves, on bushes and tree trunks and even under water, where all kinds of microbes are active. As protein-rich fibers, spider silks should be easily attacked and colonized by metatrophic bacteria or fungi. However, it is rarely observed that spider silk is decomposed or covered by fungi. Thus, it is highly possible that spider silks contain antimicrobial substances. Actually, spiders can be invaded by many araneopathogenic fungi in groups such as *Akanthomyces*, *Clathroconium* and *Gibellula*, which have been observed to germinate from bodies of spiders. Similarly, spiders deposit eggs in different situations, where a wide spectrum of pathogenic microbes may cause lethal infections to the eggs. This is especially true for those spider species which produce eggs without a cocoon, or without maternal care. Nevertheless, how spider eggs are protected from the invasion of microbes is almost unknown. Recently, it has been reported that the web silk of agelenid spider *Tegenaria domestica* (Araneae, Agelenidae) can inhibit the growth of the Gram positive bacterium, *Bacillus subtilis*. But whether antimicrobial function also exists in other groups of spiders, such as orb-weavers, is still unknown. Meanwhile, the antimicrobial mechanism has not been examined. To address these issues, I will subject the silks and egg sac silks collected from 15 families of Araneae to both fungi and bacteria. This study would strengthen current understanding in the antimicrobial property of spider silks.

Keywords: antimicrobial, spider silks, egg sac silks

Poster presentation - PHV6
Scorpiones
Physiology - Venom

Effect of *Hemiscorpius lepturus* (Hemiscorpiidae, Scorpiones) venom on biochemical parameters in rabbits

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Several studies have been published about the clinical and biochemical manifestations produced by the venom of scorpions of the Buthidae family, but very few reports have indicated the manifestations induced by the venom of the Hemiscorpiidae family. *Hemiscorpius lepturus* is an important scorpion species present in the south and southwestern of Iran, which causes morbidity and mortality in children and adults. In the present study, *Hemiscorpius lepturus* venom was injected (6.3mg/kg) into a group of six rabbits. A blood sample was collected before and three hours after venom injection for determination of blood sugar level, SGOT, SGPT, LDH, CPK and ALP. Our results showed that the venom injection caused a significant ($p > 0.001$) increase in SGOT, SGPT, LDH and blood sugar levels. There was also an increase in CPK, and ALP levels after venom injection (not significant). All animals died four hours after being treated with venom. It is suggested that further studies are needed to provide a clearer view of the real mechanism of *Hemiscorpius lepturus* venom.

Keywords: *Hemiscorpius lepturus*, scorpions, Iran, biochemical

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(*Bold numbers indicate corresponding author contributions*)