



**European Society of Arachnology**  
**Early Career Newsletter**  
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Dear Fellow Arachnologists,

We are pleased to present the second Early Career Newsletter (EarlCNews) of the European Arachnological Society.

EarlCNews is a platform for the younger members of our Society, including Bachelor, Master and PhD students. As a collection of summaries of Bachelor, Master and Doctoral theses that have been defended in the past year, EarlCNews offers the opportunity to report on one's project and research results to a wide audience since it will be distributed via the ESA email list and on the ESA website.

We hope that ESA members who are group leaders will encourage their students to submit abstracts of their work. The students do not have to be members of the society, but it would certainly be helpful, and fees are small.

In this way, EarlCNews could develop into an information hub over the years and might help students to find a follow-up position as Master, Phd student or postdoc. That would be our goal!

Many thanks to Elena Piano for running EarlCNews!

*Gabriele Uhl  
President of the European Arachnological Society*



## #ECOLOGY & CONSERVATION

Luigi AVONDO | Master thesis

### Intraspecific variation of functional traits of two spider species in the city of Torino (Italy)

In recent decades, the uncontrolled growth of urban centers have caused numerous environmental alterations, with severe repercussions on biodiversity. However, these consequences are still little investigated at population and functional traits level. In the present study, the response of two spider species, i.e. *Asagena italica* and *Erigone autumnalis*, was investigated in the city of Torino (Italy). The population response was tested on the abundance data obtained with pitfall traps in 2017. Adult male individuals collected with pitfall traps of the two focal species study were then measured, using the length of the femur of the first leg as a proxy of their body size. The response of the abundance data and body size data of the two species to the degree of urbanization density and landscape fragmentation was then evaluated by means of statistical models. The results obtained show that there are significant patterns in the abundance of the two species, with an increase of *A. italica* with increasing urbanization and a higher number of individuals of *E. autumnalis* in the isolated sites compared to the control ones. Regarding body size, no significant changes were observed in *A. italica*, while *E. autumnalis* individuals were significantly smaller in isolated sites than in controls. It can be hypothesized that the different predatory pressure, the lower amount of biomass to prey on isolated patches and the higher intraspecific competition are some of the factors underlying these responses.

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Alessandro INFUSO | Master thesis

### Ecology and conservation of Italian endemic Nesticides spiders (Araneae, Nesticidae)

The family Nesticidae (ARACHNIDA, ARANEAE) includes 17 genera and 281 species. This family is distributed all over the planet. In Italy there are 12 species, ascribed to the genera *Domitius* (4), *Eidmannella* (1), *Kryptonesticus* (2), *Nesticella* (1), *Nesticus* (1) and *Typhlonesticus* (2). Among these, *Typhlonesticus* and *Domitius* are characterized by the presence of marked adaptations to the underground life and show very narrow distribution ranges, in some cases their distribution is dotted. Despite their ecological, biogeographical peculiarities and vulnerability, knowledge about the biology and conservation status of the spiders of this family is extremely scarce and mostly limited to taxonomic aspects. The aim of this thesis is to provide an overview of the distribution and ecology of Italian endemic species of *Typhlonesticus* and *Domitius* in order to provide an assessment of their extinction risk using the criteria of the International Union for the Nature conservation (IUCN). Initially, faunal and morphometric data have been collected and compared to evaluate the size of the ranges and the degree of adaptation to the underground environment of each species. Based on this study, all the assessed species fall into the threatened categories "Critically Endangered" or "Endangered". The assessment is mainly determined by the high degree of adaptation of these species to underground life and their limited dispersion capacity, two conditions that make them extremely vulnerable to the increase in temperature linked to global warming. Changes in land use and habitat alteration fully qualify as additional threats relevant to their survival. Launching long-term monitoring programmes, species and habitat management plans, expanding or designating new protected areas that include the locations of occurrence of these species, are considered the most effective approaches to their conservation.

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**Martin MARTINKA | Master thesis**

**The power line clearing as a barrier for soil arthropods**

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Habitat continuity can be disrupted by the presence of transmission power lines (TPL). In order for this construction to pass through the forest habitat, there is a necessity of the removal of trees leading to the permanent presence of low vegetation consisting of herbs, shrubs and young trees. The aim of this study was to determine whether herbaceous areas, mainly composed of Wood Small-reed grass, represent a dispersive barrier for forest soil arthropods and whether these animals may find refugia in shrub stands with a high proportion of brambles. During 14 weeks of pitfall trapping, 3331 arthropod individuals were collected and identified. They belonged into five groups: Oniscidea, Diplopoda, Chilopoda, Araneae and Opiliones. The community trends depended on forest and TPL clearing conditions were investigated by both, univariate and multivariate methods and also by biodiversity assessment methods. The presence of the TPL clearing significantly affected the community composition. The forest and the clearing generally differed in species composition, which indicates reduced dispersal possibilities for forest species. However, shrubs generally increased the similarity of these two sites in terms of arthropod species composition. In terms of centipedes, shrub and forest species composition was much alike and differed from the one within herbaceous stands. Environment with a dominant Wood Small-reed grass was inhabited by the lowest number of individuals and species. This was observed in all groups except millipedes, which were of least abundance in the forest. Herbaceous stands with low to medium coverage was generally preferred. On the other hand, the shrubs were inhabited by the highest number of individuals and species. Forest as well as non-forest species found refuge within this vegetation. Presence of shrubs significantly increased the number of detritophages (isopods and millipedes) in the area, but also greatly benefited arachnids and centipedes. Many species would

not occur if shrubs were absent on the TPL clearing. The trends found in the shrub stands were similar to those from forest edges and the econote effect may be playing a role in this phenomenon.

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**Andrada Denisa OPRIS | Master thesis**

**Effect of species composition and stand age on spider (Araneae) and harvestmen (Opiliones) communities in Scottish managed plantations**

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Plantation systems for commercial timber production can provide refuge for native biodiversity in fragmented and urbanised landscapes. However, species composition and stand age can result in homogenous conditions reducing plant architecture in dense stands, particularly in mature Norway (*Picea abies*) and Sitka spruce (*Picea sitchensis*), thus reducing arthropod diversity. There is a lack of consensus in literature regarding spruce plantation effects on spiders (Araneae) and harvestmen (Opiliones) and determining which environmental variables drive variation in forestry systems. Ground and litter dwelling arachnids were sampled using pitfall traps and litter sieving over five weeks between May-July in Falkland Estate Scots pine (*Pinus sylvestris*) and spruce mixture plantations of different ages, accounting for environmental variables including canopy openness, litter depth, soil pH and Collembola abundance. Results revealed a significantly higher spider richness and diversity in Scots pine and young spruce stands compared to mature spruce, possibly explained by higher vegetation structure and complexity positively impacting assemblages. Collembola abundance and soil pH represented positive and negative predictors respectively, while litter depth and canopy openness showed no effect on species richness and diversity. Regarding harvestmen, although no differences in family-level richness were found between stands, the PCA revealed stronger association with high tree cover and low understory vegetation, possibly explained by



harvestmen sensitivity to dehydration in open habitats and limited dispersal in tall grass. Overall, 10 species of high conservation importance were collected, highlighting the need to maintain a habitat mosaic during all forest cycle stages, to ensure habitat specialist conditions are achieved. These findings directly contribute to practical management of spruce plantations to maximise habitat heterogeneity and enhance natural enemy diversity at a local scale, compatible with conservation goals.

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**Jan KLÁN | Bachelor thesis**

### **Impact of Different Lawn Maintenance on Terrestrial Invertebrate Biodiversity**

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This paper focuses on differences in the composition of invertebrate communities in grasslands with different management of green space management. It was carried out on four research plots with different management types (no-till, regular treatment with a power mower, treatment with a scythe, treatment with grazing). The main objective of the work is to demonstrate, using a sample of captured spiders, centipedes, millipedes, earwigs, and leafhoppers, which form of grassland habitat management is the most appropriate in terms of biodiversity richness. Other sub-objectives were to obtain local data on the variability of soil moisture in the study plots, air humidity and temperature. These values will illustrate an idea of the habitat of the captured animals. In terms of biodiversity, the grazed habitat proved to be the richest (a total of 84 species captured). This was followed by the no-mow habitat (83 species), mowed (76) and finally mowed with a mower (74). Mowed habitat was the poorest. In all habitats, the highest number of spider species was always captured, followed by crickets, and an order of magnitude fewer millipedes, centipedes, millipedes, and starlings were captured. One species of chrysalis was captured, which is listed on the Red List of Threatened Species of the Czech Republic. This was the species *Muellerianella extrusa* (Scott, 1871), which is classified as Vulnerable (VU). The work produced results that could be implemented in urban greening

practices or greenery around family estates after thorough verification by further studies. The link between the height, frequency and type of lawn treatment and the number of species captured was clearly demonstrated. Even if the number of species intercepted is almost identical across habitats, it is undeniable that over-cutting exposes the grassland and its inhabitants to large microclimatic fluctuations that can weaken them in the long term, exposing them to higher predation and thus reducing the number of individuals of each species.

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**Kateřina KRAJÍČKOVÁ | Bachelor thesis**

### **Spider diversity research for nature conversation purposes**

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Spiders are a cosmopolitan and highly diversified group of invertebrates that play a very important role in the ecosystem. Thanks to their ubiquity in anthropogenic and economic ecosystems, we can consider them a suitable group that can be used for biological protection needs. Spider venoms and their silks also have potential uses in biotechnology in the future. Today, however, spiders face many threatening factors, including climate change, habitat loss, pesticides, acid rain, and other introduced invertebrate species. Spider conservation is currently addressed in several ways, using regional instruments such as the Bern Convention, the Habitat Directive and the IUCN Red List of Endangered Species. However, in the EU in particular, there is a lack of efforts to protect them not only in terms of evaluation but also in terms of regional and national legislation. However, the fact that they may be located in protected areas, such as national parks or protected landscape areas, also helps to protect them, which greatly helps to maintain their diversity. The biggest obstacle to spider protection is the lack of public support, which can be linked to ignorance and concern. These concerns could theoretically be addressed by pointing out that very few spider species pose a threat to humans and by educating the public about the importance of spiders in the

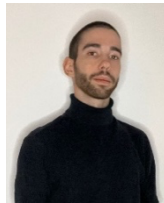


ecosystem and their potential use in biotechnology.

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**Marco TAGLIABUE** | Bachelor thesis

**Allochthonous spiders in subterranean environments: species inventory and ways of introduction**

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Alien species are a rising threat in an always more globalized world. They can be catalysts for severe environmental and economical damage. In the last 200 years, over 184 allochthonous spider species have been observed in Europe, coinciding with a strong rise in introduced species. Spiders in particular are among the main groups which happen to be invasive when it comes to subterranean habitats. With the goal of evaluating the impact allochthonous spiders have on these kind of environments, a bibliographic research was conducted, analysing scientific papers about this very topic. A database was built, providing, for 30 different species, various data, such as geographic origin and distribution, way of introduction, type of impact and how well these invasive species established themselves. Overall, allochthonous spiders have been found on each continent, with the exception of Africa and Antartctica, with the main ways of introduction being tied to commercial activities, specifically fruits shipments. The majority of the observed species seem to have established themselves quite well in their new location. Negative impacts have been attributed to a limited number of species, and it came down mainly to competition with local spiders. Spiders introduced in caves do not seem to affect the environment in any way, but this may only be due to a severe lack of data on this particular topic. Further studies should then be considered to be truly knowledgeable of the actual distribution of alien spiders in caves, and to more accurately evaluate the impact they may cause on local species.

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**Milan TŮMA** | Bachelor thesis

**Trophic ecology of velvet spiders**

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This thesis is focused on prey spectrum of velvet spiders, when in the Czech Republic occur spiders only from genus *Eresus* sp. In my bachelor thesis i researched trophic ecology of species *Eresus kollari*. To determine prey types, I used pitfall traps, laboratory observations, analysis of prey remnants from webs. These data were integrated with the analysis of published literarature and web sources. Family Eresidae includes 9 genera and more than 100 species. Center of occurence for the whole family Eresidae is Africa, where they live in warm and dry habitats. All genera use cribellate silk. Their webs are built on the ground or in vegetation. In case of ground species the web consist from web roof in upper part and from vertical underground burrow in lower part, in which spider spends most of his life. Genus *Stegodyphus* sp. build webs in vegetation where spiders hunt prey which have ability to fly. In global view velvet spiders (Eresidae) feed mainly on beetles (Coleoptera) and ants (Formicidae), but they do not despise anything what is tangled in their web long enough. They are active for the whole day and they rush for prey in the moment when prey make contact with silk.

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## #PHYLOGEOGRAPHY & SYSTEMATICS



Vladislav IVANOV | PhD thesis

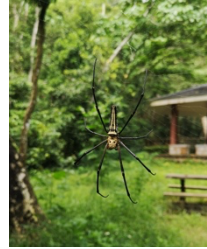
**Species delimitation in wolf spiders (Lycosidae) using DNA barcoding and double-digest restriction site associated DNA sequencing**

Species delimitation is a crucial part of biological sciences because it provides units that are used in ecology, ethology, genetics and other branches of biology. Recent advances in DNA sequencing provides a new route in the field of taxonomy as sequencing data can be consistently applied to all groups of organisms and computational frameworks for molecular data stemming directly from evolutionary theory. Currently, DNA barcoding is used as one of the major tools to aid species delimitation. Accumulation of thousands of sequences revealed conflicting patterns between established taxonomy and single gene species delimitation. In this thesis I address the issues in two genera of wolf spiders (*Alopecosa* and *Pardosa*) that are notorious for showing the same mitochondrial DNA (mtDNA) in species clearly separated by morphology, distribution and behavior. I used double-digest restriction site associated DNA sequencing (ddRADseq) to sample sequences from the nuclear genome and compare them to observed mtDNA patterns in sympatric and allopatric species and populations. The sampling covered European countries, Far East Russia, Canada and the USA. The analyses suggest that ddRADseq is able to discriminate the same entities as established taxonomy in sympatric *Alopecosa* and *Pardosa*, congruent with morphological analysis in distant populations of the same species and reliably delimits species under allopatric scenarios. Incongruence between DNA barcodes and established taxonomy confirmed by ddRADseq is likely to be explained by introgression events in recently diverged species irrespective of geographical distribution. Overall, ddRADseq can be used as reliable species delimitation tool despite conflicting mtDNA patterns in wolf spiders.

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Eva TURK | PhD thesis

**Biogeography, macro-evolutionary patterns and population genetics in golden orbweaver spiders (Nephilidae)**

Golden orbweavers (Nephilidae) are a conspicuous family of spiders, recognized for their extreme sexual size dimorphism, web gigantism and other curious features. In four chapters, we explore their historical biogeography, diversification dynamics and genetic and geographical structuring at the population level using a variety of statistical and molecular approaches. In the first chapter, we combine an original species phylogeny of golden orbweavers with data on extant species distribution and estimates of dispersal probabilities among geographical areas to reconstruct the geographical origin and subsequent dispersal routes of the clade. We develop and employ a novel method of dispersal probability attribution, adding precision to the analysis and increasing reconstruction credibility. We find support for an Indomalayan and/or Australasian geographical origin of nephilids. In the second chapter, we infer the dynamics of two main macroevolutionary processes, speciation and extinction, in the nephilid phylogeny and detect heterogeneity in both. We test two environmental and two organismal factors for correlation with diversification, but find none. In the third chapter, we further develop biogeographical reconstruction methodology on coin spiders (genus *Herennia*), whose dispersal biology is largely unknown. We test two models assuming different main dispersal methods, and find the ballooning dispersal model more parsimonious than the slow stochastic “walking” dispersal model. The analyses also reveal the wide distribution of *H. multipuncta* is not human-driven in origin, but natural. The fourth chapter compares population genetic and geographic structuring in two golden orbweaver species with markedly different life histories. Populations of both species show genetic



structure, but no geographical structure, implying strong gene flow among them.

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## #EVOLUTION & BEHAVIOUR

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**Monica SCHEFFER** | PhD thesis

**Environmental and genetic effects on fitness-relevant traits in a range-expanding spider**

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Range-expanding species provide a natural experiment to study how species can persist in novel environments, a topic that is more relevant than ever in the face of anthropogenic climate change. The wasp spider, *Argiope bruennichi*, has expanded its range from warm, oceanic and Mediterranean climate zones (populations referred to as “ancestral” or “core”) into a new thermal niche, the continental climate zone of the Baltic States and Scandinavia (referred to as “expanding” or “edge”) within the last century. Past work demonstrated that the expanding populations are European in origin, but have a signature of genetic admixture.

This discovery led to the following questions, which are investigated in this dissertation: (i) was the successful colonization of colder, continental climates due to phenotypic plasticity or genetic adaptation? (ii) If attributed to genetic adaptation, did selection act on standing genetic variation, on genetic variation introduced via admixture, on specific genomic regions, or on novel mutations? (iii) Is there a role of the microbiome in the *A. bruennichi* range expansion?

In Chapter 1, we present the first chromosome-level genome assembly for a spider and its annotation. In Chapter 2, we determine the *A. bruennichi* karyotype and identify the sex chromosomes in the genome assembly. In Chapter 3, we combine a reciprocal transplant common garden experiment on cold tolerance in core and edge spiderlings with a study of latitudinal variation in adult phenotypes, life history traits, and genotypes. This study reveals

a signature of genetic adaptation for increased cold tolerance in edge populations, and clear genetic differentiation of ancestral and expanding populations over a very short geographic distance. We conclude that the *A. bruennichi* range expansion may have been enabled by adaptive introgression but has reached a poleward range limit. Finally, in Chapter 4, we characterize the microbiome in dissected tissues of spiders from two populations, which led to the discovery of a novel vertically transmitted symbiont with astoundingly low similarity to all other sequenced bacteria. By studying the establishment and differentiation of *A. bruennichi* following range expansion, we were able to gain insight into the evolutionary and ecological processes that allowed this species to cope with novel environments. The rapid local adaptation in *A. bruennichi* suggests that evolutionary adaptation to novel environments is possible over short time periods. However, this may only be possible in species with sufficient genetic variation, or with genetic variation introduced via admixture, as in *A. bruennichi*, which has important implications for our understanding of species responses in the face of ongoing global climate change.

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**Stefan TER HAAR** | Master thesis

**Does male vibratory courtship delay female predatory behaviour in the nuptial-gift giving spider *Pisaura mirabilis*?**

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Male courtship can serve various purposes such as species recognition, indication of quality or mating status. Spiders are known for sexual cannibalism; therefore, we can expect that male traits that reduce the risk of being cannibalized are selectively advantageous. Spiders are also known for using substrate-borne vibrations to sense their environment. In orb-web spiders, male vibratory courtship can delay female predatory behaviour, presumably to protect males from female attack as they traverse the web. *Pisaura mirabilis* is a cursorial spider that does not build a web, but males produce substrate borne vibratory courtship when they



encounter female dragline silk. This raises the question of whether male vibratory courtship similarly delays female predation in *P. mirabilis* as was shown for an orb-web spider. We investigated whether male vibratory courtship signals delay female predatory response. We tested this hypothesis by playing back male vibratory courtship, white noise or a silent control while simultaneously exposing females to prey (N=52). We found no delay of female predatory response to prey, nor other differences in female predatory behaviour between treatments. Our results suggest that male vibratory courtship does not serve to reduce female aggression towards courting males in *P. mirabilis*.

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**Vladimíra ŠOLTYSOVÁ | Master thesis**

#### **Evolution of prey specialisation in thomisid spiders (Araneae: Thomisidae)**

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Phylogeny of the spider family Thomisidae has been a debated issue in the past few decades with no clear resolution, mainly due to the large number of species and their close similarity. The officially accepted subfamilies established on morphological synapomorphies were found to be paraphyletic with molecular data. I performed the most extensive molecular phylogenetic analysis of the Thomisidae family, using representatives of 73 genera. The topology is congruent with previous studies: Thomisidae are shown as monophyletic with *Borboropactus sp.* at the base, the subfamilies emerged as paraphyletic, and Aphantochilinae form one clade with Strophinae within the 'Thomisus clade'. Regarding trophic specialization, myrmecophagy (ant-eating) and araneophagy (spider-eating) is common in the Thomisidae. Using data from prey acceptance experiments (with additional 11 thomisid genera) and information on the prey of 44 genera available on the internet, I investigated evolution of trophic specialization in the family. Ancestral state reconstruction estimated both myrmecophagy and araneophagy as ancestral states, suggesting that common ancestors of Thomisidae were euryphagous predators that

included ants in their diet. Stenophagous myrmecophagy probably evolved at least three times during the evolution of the family.

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**Sandra TRANOVÁ | Master thesis**

#### **Impact of protein and lipid ratio in prey of spiders on the tendency to disperse**

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The dispersive behavior of spiders may be influenced, among other aspects, by environmental conditions or physiological conditions of the organism. In this experiment it was tested if the spider *Pardosa agrestis* can be affected by previous food experience (lipid, protein, basis) or food deprivation. Four groups of spiders of the selected species of Lycosidae were fed by *Drosophila melanogaster* in laboratory conditions. The first group of spiders were fed by rich *D. melanogaster* in proteins, the second rich in lipids, the third with a balanced ratio of these macronutrients and the last group of spiders were starving. Then the tendency of the tested spiders to disperse by wind were monitored in the laboratory microclimatic conditions. It was found out that nutrients from prey affect the dispersal behaviour of spiders. Ability to produce the fiber was found across the treatments, when ability to produce fiber was impaired in starving spiders. Additionally we tested the effect of orientation to light and wind between different levels of diet. Clearly most spiders preferred to disperse in the wind towards to light, in order to find the best conditions to start a long takeoff. These places are characterized by full lighting and for this reason the lightest possible places were probably searched.

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