The 3rd CENTRAL EUROPEAN SECTION MEETING

of the

INTERNATIONAL UNION FOR THE STUDY OF SOCIAL INSECTS

14-18 March 2013

Cluj-Napoca, Romania

organized by:

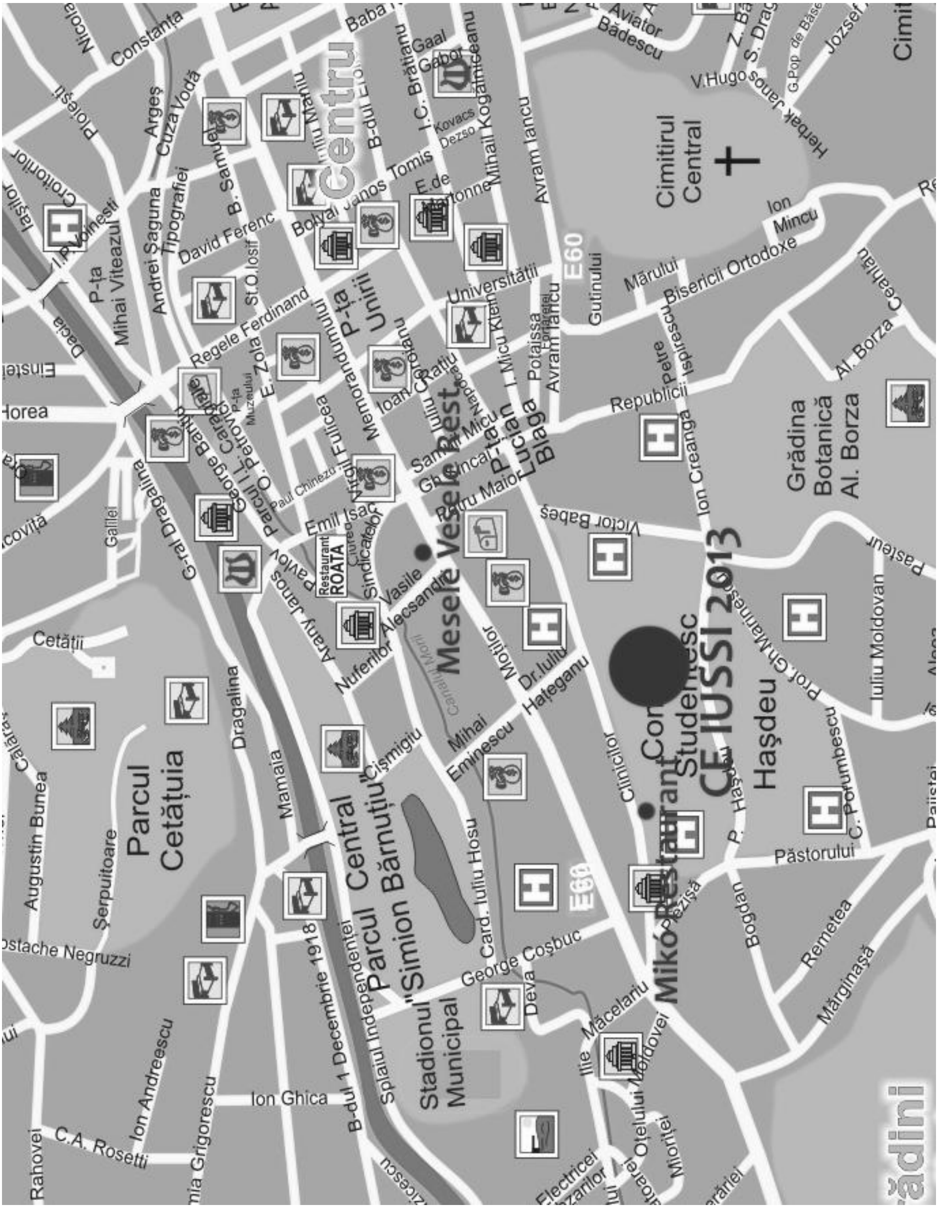
Hungarian Department of Biology and Ecology, Babeș-Bolyai University
and
Apáthy István Society
Cluj-Napoca, Romania

Organizing committee:

Bálint Markó
Anja Buttstedt
Zsolt Czekes
Silvio Erler
Ioan Tăușan
Enikő Csata
Katalin Erős
Márta Ferencz
István Elek Maák
Gyöngyvér Molnár
Enikő Német

Scientific committee:

Robin F.A. Moritz
Anja Buttstedt
Zsolt Czekes
Silvio Erler
Heike Feldhaar
Jürgen Heinze
Judith Korb
Bálint Markó


Centru
P-ța Unirii
P-ța Mihai Viteazul
P-ța Lucian Blaga
Mesele Vesele Rest
Restaurant ROATA
Conf Studențesc CE IUSSI 2013
Mikó Restaurant
Cimitirul Central
Grădina Botanică Al. Borza
Parcul Cetățuia
Parcul Central "Simion Bărnuțiu"
Stadionul Municipal
Hașdeu
E60

PROGRAM

14th March, Thursday

16:00–19:00 Arrival and registration at the Zoology Building of the Faculty of Biology and Geology (str. Clinicilor 5-7, 1st floor), Babeș-Bolyai University, Cluj-Napoca

19:00 Welcome reception at the Mikó Restaurant

15th March, Friday

Plenary talk

10:00 Nico Blüthgen: Networks of interactions among social insect species: ants, bees and their resources

11:00 **Coffee break**

Community Ecology and Chemical Communication – chair: Bálint Markó

11:15 Johan Billen, Eline Bauweleers, Rosli Hashim and Fuminori Ito: The exocrine system of *Protanilla wallacei*

11:30 Ioan Tăușan*, Jens Dauber, Maria Ramona Trică and Bálint Markó: Clear-cutting – not the end of the story for ant communities (Hymenoptera: Formicidae) – A case study from Transylvanian deciduous forests (Romania)

11:45 Zsolt Czekes, Gyöngyvér Molnár, Márta Ferencz and Bálint Markó: Ant communities of *Maculinea alcon* and *M.* '*rebeli*' populations' habitats in Transylvania, Romania

12:00 **Lunch at Mesele Vesele Restaurant**

Parasitology and Immunity – chair: Heike Feldhaar

14:00 Simon Tragust: The infection of *Lasius neglectus* with *Laboulbenia formicarum*

14:15 Katalin Erős, Bálint Markó, Zsolt Czekes, Enikő Csata and Norbert Fákó: Simple defense mechanisms that keep Pandora's box closed in a polydomous ant nest system parasitised by a lethal fungus

14:30 István Maák*, Anna Somogyi, and Judit Kovács: Response of *Formica sanguinea* Latr. 1798 and its slaves to corpses of rivals

14:45 **Coffee break**

Plenary talk

15:00 Zoltán Barta: Individual variation and social evolution

16:00 **Coffee break**

Social Evolution and Phylogeny – chair: Judith Korb

16:15 Heike Feldhaar, Mareike Wurdack, Thomas Schmitt and Carlo Polidori: Evidence for eusociality in the digger wasp *Cerceris rubida*

16:30 Tobias Pamminger, Susanne Foitzik, Dirk Metzler and Pleuni S. Pennings: Oh sister, where art thou? Indirect fitness benefit could maintain a host defense trait

16:45 Lenka Petráková* and Jiří Schlaghamerský: Phylogeography of the rare ant *Liometopum microcephalum* (Formicidae: Dolichoderinae): preliminary results of a study on populations across the entire species range.

17:00 **Coffee break**

17:15 Alexandra Schrempf, Eva Huber and Jürgen Heinze: Mating with an alien male disrupts the male's beneficial impact on longevity and fecundity of ant queens

17:30 H. Michael G. Lattorff and Sophie Helbing: Adaptive Evolution of RNAi genes in bumblebees

17:45 Mario Popp*, Silvio Erler, Sophie Helbing, Susann Parsche and H. Michael. G. Lattorff: Divergent patterns of selection on an antimicrobial peptide in two common bumblebees (*Bombus* sp.)

18:00 **City tour**

20:00 **Dinner at Mesele Vesele Restaurant**

16th March, Saturday

Plenary talk

9:30 Martin Beye: The other honeybee genome: the role of the group's genotype repertoire on behavior and gene regulation

10:30 **Coffee break**

Behaviour and Physiology – chair: Jürgen Heinze

10:45 Abel Bernadou, Giacomo Alciatore, D.C. Cardoso, M.P. Cristiano and Jürgen Heinze: Reproductive division of labor in a clonal ant, *Platythyrea punctata*

11:00 Jürgen Trettin*, Thomas Seyferth and Jürgen Heinze: Experimental manipulation of queen-worker ratio induces aggression among queens in a socially plastic ant

11:15 Steffen Pielström and Flavio Roces: Sequential task partitioning during soil transport in leaf-cutting ants

11:30 **Coffee break**

11:45 Elena Dorosheva: Competitive interactions between red wood ants and carabids: ants are good teachers but slow learners

12:00 Ivan Iakovlev and Alexei Tiunov: Trophic ecology of red wood ants: a stable isotope approach

12:15 Daniela Römer*, Martin Bollazzi and Flavio Roces: Leaf-cutting ants relocate their symbiotic fungus based on the CO_2 concentration of the nest environment

12:30 Christopher Mayack and Dhruba Naug: The role of individual energetic state in the regulation of honeybee foraging

12:45 **Lunch at Mesele Vesele Restaurant**

Parasitology and Immunity – chair: Heike Feldhaar

15:00 Qiang Huang, Christoph Kurze* and Robin F.A. Moritz: Infestation of midgut epithelium in *Nosema* tolerant and susceptible honey bee strains towards *N. ceranae* infections

15:15 Matthias Y. Müller* and Robin F.A. Moritz: Behavioural defence of honeybees against *Nosema ceranae*

15:30 Andreas Denner*, Robin Moritz and Silvio Erler: Antimicrobial activity of different honeys against bacteria which cause American and European foulbrood

15:45 **Coffee break**

Population genetics – chair: Robin Moritz

16:00 M. Benjamin Barth*, Robin F. A. Moritz, Christian W. W. Pirk and F. Bernhard Kraus: Large scale gene flow in a subterranean army ant, *Dorylus* (*Typhlopone*) *fulvus*, is promoted by male-biased dispersal

16:15 Nadège Forfert*, Ellen A. Schlüns, Orsolya R. Paniti-Teleky, Emilia M. Furdui, Daniel S. Dezmirean and Robin F. A. Moritz: Using DNA pools for genotyping colonies of the honeybee *Apis mellifera* with microsatellite DNA

16:30 Cristian O. Coroian, Irene Muñoz, Ellen A. Schlüns, Orsolya R. Paniti-Teleky, Silvio Erler, Emilia M. Furdui, Liviu A. Mărghitaş, Daniel S. Dezmirean, Eliza Căuia, Helge Schlüns, Pilar De la Rúa and Robin F. A. Moritz: Climate rather than geography separates two European honeybee subspecies

16:45 Stefanie Mattivi*, Eamonn Kehoe, Finbarr G. Horgan and Tomás E. Murray: Genetic spillover from commercial to wild populations of bumblebees

17:00 **Poster session with drinks**

Giacomo Alciatore*, J. McCaw, Abel Bernadou and Jürgen Heinze: Behavioural syndromes in a clonal ant, *Platythyrea punctata*

Andrés Arenas* and Flavio Roces: Delayed avoidance of plants in foraging leaf-

cutting ants is triggered by volatiles present in the nest refuse chamber

Klára Benedek and Zsolt Czekes: Impact of territorial *Formica* (Hymenoptera: Formicinae) species on the ant community

Julia Giehr*, Sylvia Cremer, Jürgen Heinze and Alexandra Schrempf: Adjustment of egg laying rate of ant queens to body condition?

Susanne Jacobs*, Johanna Schaubächer, Alexandra Schrempf and Jürgen Heinze: Wingless and intermorphic males in the ant *Cardiocondyla venustula*

Antonia Klein*, Jürgen Heinze and Jan Oettler: Genetic architecture in *Cardiocondyla obscurior*

Paweł J. Mazurkiewicz*, Agnieszka Wagner-Ziemka, Anna Mirecka, Katarzyna Czajkowska and Ewa J. Godzińska: Behaviour of intranidal and extranidal major workers of the African carpenter ant *Camponotus maculatus* Fabricius during dyadic nestmate reunion tests after social isolation

Dalma Molnár*, Enikő Csata and Bálint Markó: Differential reactions to *Rickia wasmannii* (Laboulbeniales) infested corpses of two ant species: the host *Myrmica scabrinodis* and non-host *M. vandeli*

Steffen Pielström and Flavio Roces: How do leaf-cutting ants (*Atta vollenweideri*) prevent water influx during the excavation of nest tunnels in flooded soils?

Janine Schyra and Judith Korb: Phylogenetic analysis of the community structure of southern African termites

Piotr Ślipiński and Michał Żmihorski: Ants by night – circadian activity of ants on clear-cut areas in managed stands

Erika Zakar*, Edit Zajácz, Tímea Rácz, János Oláh, András Jávor and Szilvia Kusza: Morpometric study of Hungarian honey bee (*Apis mellifera* L.) colonies

András Tartally, István Novák, Viktor Löki, Mónika Szűcs and Szabolcs Lengyel: Potential ant vectors of the protected myrmecochorous *Colchicum bulbocodium* plant

Natalia Timuş*, Bálint Markó and László Rákosy: Infestation of *Myrmica* host ants with fungi influences the adoption success of *Maculinea* caterpillars

18:30 **General Assembly of the Central European Section of the IUSSI**

20:00 **Dinner at Mesele Vesele Restaurant**

17th March, Sunday

8:00 **Trip to the Valley of Arieș River and to the basalt columns of Detunata**

19:00 **Farewell dinner at the Mikó Restaurant**

*student contributions – eligible for Kutter prize

INDIVIDUAL VARIATION AND SOCIAL EVOLUTION

Zoltán Barta

MTA-DE "Lendület" Behavioural Ecology Research Group,
Department of Evolutionary Zoology, University of Debrecen, Debrecen,Hungary

Life on Earth has two remarkable properties. One is variation. Apart from the vast number of extant species, considerable variation exists within species, between individuals. The other important properties of life is sociality, as Robert Trivers aptly put: "*Everybody has a social life*". It is surprising that until recently the interactions between these two properties have rarely been addressed from an evolutionary point of view. Here I overview studies on a special kind of individual variation: personality in insect. Then I present models which show how individual variation can affect the evolution of cooperation.

LARGE SCALE GENE FLOW IN A SUBTERRANEAN ARMY ANT, *DORYLUS* (*TYPHLOPONE*) *FULVUS*, IS PROMOTED BY MALE-BIASED DISPERSAL

M. Benjamin Barth*, Robin F. A. Moritz, Christian W. W. Pirk and F. Bernhard Kraus

Department of Biology, Martin-Luther-University Halle-Wittenberg, Hoher Weg 4, 06120 Halle (Saale), Germany

Sex-biased dispersal is widespread in the animal kingdom and may strongly influence gene flow and population structure. Particularly army ants, important key-stone predators in tropical ecosystems, are prone to population fragmentation and isolation due to their extraordinary mating system: Queens are permanently wingless and propagate via colony fission and only the males disperse in mating flights. Here we report on sex-biased dispersal and the genetic population structure of an African subterranean army ant, *Dorylus* (*Typhlopone*) *fulvus*. Using maternally inherited mtDNA and bi-parentally inherited microsatellites we found strong geographical structuring of mtDNA haplotypes, whereas the microsatellite genetic population structure was less pronounced. Strong mtDNA, but significantly lower microsatellite genetic differentiation translated to a more than an order of magnitude larger male migration rate compared to that of queens. This reflects the low motility of queens and strong, promiscuous dispersal by males. Thus, the well flying *D. fulvus* males appear to be the sex to promote large scale gene flow. With this study we aim to achieve a better understanding of how sex specific dispersal patterns and mating systems affect the population structure and phylogeography of species.

REPRODUCTIVE DIVISION OF LABOR IN A CLONAL ANT, *PLATYTHYREA PUNCTATA*

Abel Bernadou*, Giacomo Alciatore, D.C. Cardoso, M.P. Cristiano and Jürgen Heinze

Biologie I, University of Regensburg, Universitätsstraße 31, 93053 Regensburg, Germany

Division of labor is considered to be one of the main causes of the ecological success of ants, bees, wasps and termites. Individuals can be morphologically or functionally specialized for different tasks, e.g. the queens ensure the reproduction while workers take over all non-reproductive tasks in the nest. Several factors - genetics, morphology, age, and individual experience - have been put forward to explain division of labor in insect societies. For example,

the probability of individuals to perform a specific task may depend on their genetic background. As a consequence, the co-occurrence of workers with different genetic backgrounds in a colony could improve the efficiency with which tasks are carried out and therefore increase colony fitness. Nevertheless, a division of labor exists also among individuals that lack genetic and morphological differences, such as clonal ants. Workers of the tropical ant Platythyrea punctata are capable of producing female offspring from unfertilized eggs; thus, most colonies of this species are clones. However, data from the field suggest that colonies may fuse and form genetically heterogeneous colonies.
In this study, we investigated if different clones show different propensities to take over certain tasks, such as becoming a reproductive individual or a non-reproductive worker. Through behavioral observations, we followed the formation of hierarchies in groups of two callows with different genetic background. Preliminary results show that individuals form a hierarchy in a few days but until now we failed to document a clear clone

THE OTHER HONEYBEE GENOME: THE ROLE OF THE GROUP'S GENOTYPE REPERTOIRE ON BEHAVIOR AND GENE REGULATION

Martin Beye

Institute of Evolutionary Genetics, Heinrich Heine University Düsseldorf

The collective behaviors of workers in social insects produce group phenotypes that allow them to remain well-adapted in a changing environment. For instance, in honeybees the worker bees collectively thermoregulate their nest, defend against diseases and predators, and communicate about the location of food sources via their waggle dances. We know little about the impact of indirect genetic effects underlying the regulation of these complex traits. These indirect genetic effects arise because numerous interactions between workers produce interacting phenotypes and genotypes across individuals in the colony. I review advances in understanding these indirect genetic effects in social insects and report on our recent work in which we followed the impact of genotype variation between colony members on the individual behavioral performance, the collective group outcome and the gene regulation in the brain. Our findings suggest that the individual phenotype of a worker is affected by the genotypes that residue in the other colony members. I will discuss which impact this finding may have on the expression, regulation and evolution of individual and group phenotypes.

THE EXOCRINE SYSTEM OF PROTANILLA WALLACEI

Johan Billen*, Eline Bauweleers, Rosli Hashim and Fuminori Ito

University of Leuven

We studied the exocrine system of both workers and ergatoid queens of *Protanilla wallacei* using light, scanning and transmission electron microscopy. Our survey revealed the presence of 26 glands, of which 6 had never been found before in ants. Five of these represent novel discoveries for social insects in general. The overall novel discoveries comprise an epithelial stipes gland, a pharyngeal wall gland, a central petiole gland, a lateral postpetiole gland and a footsole gland in the hindleg pretarsi. The intramandibular epithelial gland was already reported in some bees previously, but is now for the first time also reported in ants. The exocrine system of workers and ergatoid queens is very similar, with only the spermathecal gland showing an obvious difference. This is in line with the limited anatomical as well as behavioural difference between both castes in *Protanilla* compared to the situation in *Leptanilla*.

NETWORKS OF INTERACTIONS AMONG SOCIAL INSECT SPECIES: ANTS, BEES AND THEIR RESOURCES

Nico Blüthgen

TU Darmstadt, Germany

Social insects are special, and several ecological traits differ from solitary species. Their colonies are long-lived, and they are central-place foragers. Regarding their use of ephemeral resources such as flowers, this suggests that they have to be generalised in their resource choices. Network analyses confirmed that social insects, particularly tropical species, are more generalised flower visitors than many other insects. In contrast, long-term resources such as their nest sites can be more specific: ants living in myrmecophytes are often highly specialized on certain plant species. Consequences of a higher generalization may include a higher robustness against disturbances or against losses of specific resources, while specialists may be more vulnerable. On the other hand, we currently know very little about how many different resources are required to sustain a generalist, e.g. serving as complementary diets or to stabilize the resource availability over time. Such high demands of generalists constrain the opportunities for resource partitioning, hence interspecific competition across social insects is strong. Interaction networks between social insect species (e.g. ant mosaics) help to understand which species pairs tolerate or exclude each other. In some cases, ants or stingless bees may suppress the aggression of a competitor by using chemical "tricks". Examples of ant and bee communities are shown from tropical forests and from Europe.

CLIMATE RATHER THAN GEOGRAPHY SEPARATES TWO EUROPEAN HONEYBEE SUBSPECIES

Cristian O. Coroian[1*], Irene Muñoz[2], Ellen A. Schlüns[1,3], Orsolya R. Paniti-Teleky[1], Silvio Erler[1], Emilia M. Furdui[1], Liviu A. Marghitas[1], Daniel S. Dezmirean[1], Helge Schlüns[1,3], Pilar De la Rúa[2] and Robin F. A. Moritz[1,4]

[1]*Department of Apiculture and Sericulture, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Calea Mănăştur 3-5, 400372 Cluj-Napoca, Romania*
[2]*Department of Zoology and Physical Anthropology, Faculty of Veterinary Medicine, University of Murcia, Campus de Espinardo, 30100 Espinardo, Murcia, Spain*
[3]*present address: Behavioural Biology, University of Osnabrück, Barbarastraße 11, 49076 Osnabrück, Germany*
[4]*Institut für Biologie, Molekulare Ökologie, Martin-Luther-Universität Halle-Wittenberg, Hoher Weg 4, 06099 Halle (Saale), Germany*

A vast area outside Southern Carpathians is largely known for intensive honeybee migratory practices. The dominant honeybee subspecies here is *Apis mellifera macedonica* in admixture with *A. m. carnica*. We sampled one honeybee per colony from an equal number of stationary and migratory apiaries. Mitochondrial sequence of the tRNAleu-COII intergenic region and 12 microsatellite loci have been used to analyse haplotype frequencies and population structure. The haplotype frequencies were similar in both stationary and migratory apiaries. A strong variation has showed up when structured both honeybee samples according with six temperature ranges, from 4 to 12 °C. Two distinct populations could easily be discriminated based on

temperature ranges, with a border line around 9 °C. A strong positive correlation has been found between *A. m. macedonica* distribution and temperature increase.

ANT COMMUNITIES OF *MACULINEA ALCON* AND *M.* '*REBELI*' POPULATIONS' HABITATS IN TRANSYLVANIA, ROMANIA

Zsolt Czekes*, Gyöngyvér Molnár, Márta Ferencz and Bálint Markó

Hungarian Department of Biology and Ecology, Babeș-Bolyai University, 400006 Cluj-Napoca, Clinicilor 5-7, Romania

The endangered, obligate parasitic *Maculinea* butterflies have a specific lifestyle. At first the caterpillars feed on specific host-plants and then they are adopted and fed by *Myrmica* ants, or they feed on the brood of the host ants. The two ecotypes of the Alcon Blue, *Maculinea alcon* (with *Gentiana pneumonanthe* as host plant) and *Maculinea 'rebeli'* (with *G. cruciata* as host plant) have different habitat preferences. In Transylvania there are a number of populations of both ecotypes. We studied the ant communities of several populations both in syntopic (where the two morphs co-occur) and in non-syntopic conditions. The relation between the host plant presence and the diversity of the ant community as well as the effect of the ant community structure on the presence of eggs laid by the butterflies was also tested. *Myrmica scabrinodis*, known as the most important host ant species of *Maculinea* butterflies in Central Europe, proved to be the most abundant and most characteristic host ant species present in all habitats of *Maculinea* populations. The diversity of ant species was higher in habitats of *M.* '*rebeli*' than in those of *M. alcon*. We did not found any significant differences between the ant communities of syntopic and non-syntopic *Maculinea* populations.

ANTIMICROBIAL ACTIVITY OF DIFFERENT HONEYS AGAINST BACTERIA WHICH CAUSE AMERICAN AND EUROPEAN FOULBROOD

Andreas Denner*, Robin Moritz and Silvio Erler

University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Faculty of Animal Science and Biotechnology, Department of Apiculture and Sericulture, Calea Mănăştur 3-5 400372, Cluj-Napoca, Romania

Insects such as honeybees are essential for pollination and therefore play an important factor for agricultural industry. Bee diseases like the American (AFB) and European foulbrood (EFB) lead to a reduction of honeybee individuals and thus can cause high damages in ecosystems as well as affecting the beekeeping industry, which can be measured as a reduction of fruit, vegetable and field crop plants. Honey is fed together with pollen to the bee larvae and perhaps has in addition to a function as energy resource a further one, namely the protection against bee diseases, which are caused by bacteria. We want to investigate if different honeys show specific antimicrobial effects to bacteria which cause brood diseases in bee larvae. We measured photometrically the growth of American foulbrood and European foulbrood-associated bacteria in liquid culture medium containing different concentrations of honey. Our results show, that the tested bacteria are susceptible to honeys in vitro. This indicates that honeybees might have evolved a strategy to combine selected honey feeding with the protection against AFB and EFB pathogens.

COMPETITIVE INTERACTIONS BETWEEN RED WOOD ANTS AND CARABIDS: ANTS ARE GOOD TEACHERS BUT SLOW LEARNERS

Elena Dorosheva

Institute of Animal Systematics and Ecology SB RAS

Red wood ants and carabid beetles strongly compete for territory resources. Ants affect the spatial distribution of carabids and change their behavioural patterns at the level of individual direct interactions. We studied behavioural mechanisms of adjusting the competitive relations initiating collisions between *Pterostichus magus* and *Formica aquilonia* in different conditions: in Y-shaped mazes containing an active ant leashed in one of the sections; on 30x25x10 cm plastic arenas with one, aggressive ore “peaceful”, and three ants; in the ant feeding territory in nature. In field experiments, measurements of behavioural characteristics such as running speed, duration of stops, and parameters of individual trajectories showed significant alterations in the behaviour of beetles in the ant-controlled territory. Laboratory experiments revealed that after few aggressive encounters with ants, beetles displayed a clear tendency to learn, that is, to modify their behaviour in order to avoid damages from aggressive ants. They avoided injuries manipulating a set of stereotyped behavioural patterns. Beetles successfully used patterns most suitable in current conditions. However, a great part of ants didn't display a flexible behaviour. Adult “guards” and “hunters” didn’t learn to avoid carabid, aphid milkers kept the tendency to avoid of carabids. Very likely, for ants performing the duties of guarding the territory and hunting mobile prey, learning to avoid dangers appears not to be a requirement for the colony and seems to be "forbidden".

SIMPLE DEFENSE MECHANISMS THAT KEEP PANDORA'S BOX CLOSED IN A POLYDOMOUS ANT NEST SYSTEM PARASITISED BY A LETHAL FUNGUS

Katalin Erős, Bálint Markó*, Zsolt Czekes, Enikő Csata and Norbert Fákó

Hungarian Department of Biology and Ecology, Babeş-Bolyai University, 400006 Cluj-Napoca, Clinicilor 5-7, Romania

The social system of ants is an attractive target for many parasites, and ants developed a wide variety of individual and social defense mechanisms to fight parasites. A polydomous system is made up of high number of related ant nests, which are connected through permanent worker and information exchange, that could promote the dispersal of parasites. Nonetheless, in our studied *Formica exsecta* polydomial system consisting of more than 3,000 nests the lethal endoparasitic fungi *Pandora myrmecophaga* has extremely low prevalence. The fungi manipulate workers to climb and die on grass-blades near the nest, which would ensure the efficient distribution of the parasite by covering the nest surface with the spores produced afterward. We tested a hypothesis regarding the existence of simple defense mechanism: workers would dispose of every corpse, as potential source of infestation, appearing on grass-blades, thus lowering the chances of spore dispersal. We imitated the appearance of infected ants by fixing ant corpses on grass-blades at different distances near the nest, in addition to control dummies. The results confirmed our hypothesis: ants discovered and disposed of corpses quickly and efficiently. While the discovery depended on the activity of ants, the disposal rate seemed to be independent. On the other hand, dummies also elicited intensive reaction: ants tried to remove them many times successfully. This defense mechanism can be very efficient against those parasites that rely primarily not on within-nest, but external factors during their dispersal, as thus their dispersal rate can be significantly decreased even in a supercolonial system.

EVIDENCE FOR EUSOCIALITY IN THE DIGGER WASP *CERCERIS RUBIDA*

Heike Feldhaar[1*], Mareike Wurdack[2], Thomas Schmitt[3] and Carlo Polidori[4]

[1]*Animal Ecology I, University of Bayreuth, Germany*
[2]*Biology I, University of Freiburg, Germany*
[3]*Ecological Networks group, Dep. of Biology, University of Darmstadt, Germany*
[4]*Departamento de Biodiversidad y Biología Evolutiva, Museo Nacional de Ciencias Naturales, Madrid, Spain*

Digger wasps of the genus *Cerceris* are generally solitary wasps, with few species sharing nests. The only European species where individuals share nests is *Cerceris rubida*. Behavioural observations as well as genetic data suggest that this species may be eusocial, e.g. having overlapping generations within the nest that show reproductive division of labor as well as communal brood care. Nests are founded in early summer by a single female. Later in the season nests comprise up to eleven females and show division of labour, e.g. foundresses do not participate in foraging and do not seem to leave the nest any longer. In pairwise tests, individuals were clearly able to distinguish nestmates from non-nestmates and nests are aggressively defended against intruders. We development microsatellite markers and measured relatedness of individuals collected from 12 nests comprising between 2 and 8 individuals. Relatedness within nests was 0.46 on average, with most nests seeming to comprise highly related individuals only, while a few nests contained unrelated as well as related individuals. This is to our knowledge the first potentially eusocial digger wasp of the genus *Cerceris*.

USING DNA POOLS FOR GENOTYPING COLONIES OF THE HONEYBEE *APIS MELLIFERA* WITH MICROSATELLITE DNA.

Nadège Forfert*, Ellen A. Schlüns, Orsolya R. Paniti-Teleky, Emilia M. Furdui, Daniel S. Dezmirean and Robin F. A. Moritz

Martin-Luther- Universität Halle-Wittenberg Molecular Ecology Research Group

Genotyping large sample sets with microsatellite DNA loci is both time consuming and cost intensive. We here present a new technique to screen pooled samples of workers to assess the colony genetic structure of honeybees (*Apis mellifera*) and use this data for population genetic studies. We verified the technique by comparing the actual allele frequencies derived from individual genotypes with estimates obtained from DNA pools of the same individuals. We show that this method can be used to determine allele frequencies with considerable precision, detecting rare alleles down to a threshold of 89%. The technique can be used for colony "genotypes" in population genetic studies but is also useful for colony level analyses in combination with individual genotyping to reduce the work load for detecting the presence of foreign individuals in colonies.

TROPHIC ECOLOGY OF RED WOOD ANTS: A STABLE ISOTOPE APPROACH

Ivan Iakovlev[1*] and Alexei Tiunov[2]

[1]*Institute of Systematics and Ecology of Animals of SB RAS,*
[2]*Institute of Ecology and Evolution of RAS*

We used carbon and nitrogen stable isotope analysis to reveal differences in the trophic position and energy resources of *Formica aquilonia* ants among colonies, seasons and task groups of workers and to clarify trophic relationships between ants and multispecies community of ant-tended aphids. Materials were collected at four colonies in spring, summer and autumn. Trophic position of *F. aquilonia* estimated by δ15N values of thoraxes was between that of primary and secondary predators. There were significant variations in ant trophic position among colonies, but no seasonal changes. Prey (arthropods carried to nests) - ants 15N enrichment varied with colony in the range of 1.0-2.4‰. Energy resources of ants changed significantly during season as indicated by higher δ13C values in summer than in autumn. This change could reflect a dietary transition of ants from birch sap with higher δ13C in spring to less 13C-enriched honeydew in summer and autumn. Honeydew of aphids differed in δ13C depending on the host plant: willow, aspen > birch > herbs. Carbon isotope ratio of ants significantly varied with task specialization (foragers, guards > inner-nest workers). The difference could be explained by higher metabolic costs of performing outside-nest tasks. Significant effects of season and task specialization on δ15N in ant abdomens were found. The value decreased from spring to autumn and differed between task groups (foragers > nurses). It could indicate differences in physiological status (e.g. investment in anabolic processes) and in the age of workers.

INFESTATION OF MIDGUT EPITHELIUM IN *NOSEMA* TOLERANT AND SUSCEPTIBLE HONEY BEE STRAINS TOWARDS *N. CERANAE* INFECTIONS

Qiang Huang[1,2], Christoph Kurze[1*] and Robin F.A. Moritz[1,3,4]

[1]*Institut für Biology/Zoologie, Molekulare Ökologie, Martin-Luther-Universität Halle-Wittenberg, 06099 Halle, Germany*
[2]*Honey bee Research Institute, Jiangxi Agricultural University, 330045 Nanchang, China*
[3]*RoBeeTech, Universitatea de Stiinte Agricole si Medicina Vetereinaria Cluj-Napoca, Romania*
[4]*Department of Zoology and Entomology, University of Pretoria, Pretoria 0002, South Africa*

The microsporidian *Nosema ceranae* is a natural parasite of the Asian honeybee *Apis cerana* but is now also a widespread cause of Nosemosis in the European honey bee *A. mellifera*. *N. cerana* infections can have severe effects on honey bee fitness at the individual and colony level. We found that the extensive breeding effort by Danish beekeepers against the native microsporidian parasite *N. apis* has produced a *Nosema* tolerant honey bee strain, which revealed a strongly up-regulated immune response when challenged by *N. cerana* infection compared to an unselected strain. After transmission via the fecal-oral route, spores normally germinate in the midgut, where they penetrate, replicate and destroy the cells of the gut epithelium. To understand the effect of the altered immune response on the level of infestation and destruction of the midgut epithelium, we compare sections between the selected and an unselected strain over the course of infection. We discuss these results in the context of an adaptive immune response and other underlying biological mechanisms of the selected strain against *N. ceranae* infection.

ADAPTIVE EVOLUTION OF RNAI GENES IN BUMBLEBEES

H. Michael G. Lattorff* and Sophie Helbing

Martin-Luther-Universität Halle-Wittenberg, Institut für Biologie, Molekulare Ökologie, Hoher Weg 4, 06099 Halle (Saale), Germany

Social insects are prone to parasites and pathogens. High density of closely related individuals enhances pathogen transmission. Adaptations and counter adaptations between hosts and parasites left their signatures in the genome, especially on antiviral RNAi genes indicated by the high rates of adaptive evolution. In order to quantify the impact of host-parasite conflict effects on the evolution of RNAi genes in social insects, six genes were partially sequenced and compared across different species of the genus *Bombus*. Additionally, we test for the impact of sociality on molecular evolution by a direct comparison of social species and their respective socially parasitic cuckoo bumblebees.
Hence, we could show that RNAi genes exhibit an elevated rate of adaptive evolution compared to non-immune genes, assuming a co-evolutionary interplay between RNAi genes and viruses, as the latter evade hosts defense mechanisms by production of suppressor-proteins that interfere with the RNAi- pathway. Furthermore, RNAi genes exhibit a great variance in their rates of adaptive evolution closely linked to their pathway-specific position, since proteins that directly interact with viral components evolved most rapidly. We compared the evolutionary rates of RNAi genes between cuckoo bumblebees (non-social) and their respective host lineages to infer the impact of sociality on the molecular evolution, as both, host and social parasite, experience

RESPONSE OF *FORMICA SANGUINEA* LATR. 1798 AND ITS SLAVES TO CORPSES OF ITS COMPETITORS

István E. Maák*, Anna Somogyi and Judit Kovács

Department of Ecology, University of Szeged, Közép fasor 52, 6726 Szeged, Hungary

In the case of ants and other social insects, their high density and the intensive contacts among individuals contribute to the fast spread of parasites and diseases. In order to fight parasites and pathogens, ants apply several social defensive strategies, among which the most effective one is the collective removal of corpses, as potential sources of various infections. Besides their negative influence, ant corpses can represent food sources, as well. Some new observations pointed out, that corpses can have signal properties too, at least in conflictual situations: the appearance of corpses can have inhibitory effects on the behavior of the rival species. We examined in laboratory conditions the reactions of the slave-maker *Formica sanguinea* and its slave species, to corpses of co-occurring rivals: nestmate *F sanguinea* and its *F. fusca* slave, non-nestmate *F sanguinea* and its *F. fusca* slave, submissive *F. fusca* and the territorial *F. polyctena*. The study was carried out in the case of 3 colonies, to which we presented different combinations of freeze killed corpses. We recorded separately the reaction of slave-makers and their slaves, and the time elapsed until the removal of corpses. In all cases we have found higher slavemaker activity. The majority of the corpses were carried inside the nests, and presumably were consumed. *F. sanguinea* clearly responded selectively to corpses of different origin: the corpses of the territorial *F. polyctena* were carried significantly sooner inside the nests, than other corpses. The most aggressive behavior was elicited by corpses of non-nestmate *F. sanguinea* and its slaves. The nature and intensity of *F. sanguinea*'s reactions seem to be in concordance with the nature of its interactions with the studied species. Similar selective pressures due to the shared environment. Here, we show that RNAi genes evolved significantly faster in social species due to their larger population sizes and higher mutation rates.

GENETIC SPILLOVER FROM COMMERCIAL TO WILD POPULATIONS OF BUMBLEBEES

Stefanie Mattivi[1*], Eamonn Kehoe[2], Finbarr G. Horgan[3,4] and Tomás E. Murray[1,4]

[1]*Martin-Luther University Halle-Wittenberg, Institute for Biology, Department of Zoology, D-06120 Halle (Saale), Germany.*
[2]*Teagasc, Advisory Office, Johnstown Castle Estate, Co. Wexford, Ireland.*
[3]*International Rice Research Institute, Crop and Environmental Sciences Division, DAPO Box 7777, Metro Manila, The Philippines.*
[4]*Teagasc, Oak Park Research Centre, Oak Park, Carlow, Co. Carlow, Ireland.*

Worldwide, wild bumble bees (*Bombus*) are experiencing marked declines, with up to 11% of species currently under threat of extinction. In parallel, the need to increase agricultural yields has led to the commercialisation and year-round production of bumble bee hives for pollination of over 20 different crops. At present, these commercial hives are being imported by over 50 countries across the globe with an estimated value of €55 million. In Europe, companies rear and export the native species *Bombus terrestris*, an unknown admixture of nine recognised subspecies. However, despite the widespread production and transport of these commercial bumble bee hives across the EU since the early 1980s, data on the genetic impact of commercial *B. terrestris* on wild conspecific populations is lacking. To investigate the potential for genetic spillover between commercial and wild populations, we sampled commercial hives and wild populations of *B. terrestris audax* at increasing distances from sites of prolonged bumble bee importation in Ireland. We genotyped 941 bees at 11 microsatellite loci, estimated the number of colonies adjacent to sites of importation and conducted power analyses for subsequent assignment tests on wild-caught individuals from these admixed populations. The number of native, commercial and putative hybrids was estimated with increasing distance from sites of importation and the population genetic structure compared with and without the presence of commercial bumble bees. Despite the benefits of commercial bumble bee crop pollination, the potential genetic impact on wild conspecifics should be mitigated via increased regulation and stakeholder education.

THE ROLE OF INDIVIDUAL ENERGETIC STATE IN THE REGULATION OF HONEYBEE FORAGING

Christopher Mayack* and Dhruba Naug

Institute of Biology/Zoology, Martin-Luther-Universität Halle-Wittenberg, Halle (Saale), 06120, Germany

Normally in honeybees the energetic state of the individual, which based on the amount of trehalose in the hemolymph, is coupled with the energetic state of its colony, which is based on the amount of food stores present. This has led to the predominant view that behaviors such as foraging are dictated by the colony state acting through social regulatory mechanisms. However, by feeding individuals a non-nutritious sugar, I successfully created energetic stress in foragers independent of the colony energetic state. Energetically stressed bees in a colony with full food stores do not consume this food to meet their energetic shortfall, but instead compensate by first reducing their activity level and then by increasing their foraging rate. These results demonstrate that foraging in eusocial groups is still partly under the regulatory control of the individual energetic state and supports the notion that regulatory mechanisms in solitary insects have been co-opted to drive altruistic behavior in eusocial insects. The observation that a higher proportion

of energetically stressed bees also experience higher mortality during foraging also suggests that energetic stress mediated by a variety of factors can be a common mechanism that underlies the recent observation of bees disappearing from their colonies. Using *Nosema ceranae* as a model, I will discuss how it can cause substantial energetic stress that could lead to such an uncoupling of the two energetic states. I will also discuss how nutritional imbalance in a social insect individual can alter its behavior to influence colony life history.

BEHAVIOURAL DEFENCE OF HONEYBEES AGAINST *NOSEMA CERANAE*

*Matthias Y. Mueller*** and Robin F.A. Moritz

Martin-Luther-University Halle-Wittenberg, Hoher Weg 4, D-06099 Halle, Germany

Honey bees, as eusocial organisms, possess high interaction rates. To avoid the expected increased parasite infestation honey bees evolved several behavioural and organisational defence mechanisms. One group of their diverse parasites is the Microsporidian *Nosema ceranae*. In this study we demonstrate that the interaction frequency and the behaviour towards *N. ceranae* infected honey bees are distinct to healthy nest mates. Two behavioural assays were designed in which groups of honey bee workers were recorded up to 14 days. Contact frequencies of *N. ceranae* infected honey bees and non-infected controls with their nest mates were analysed. In every experimental replicate the infected bee received more contacts than the uninfected control bee. This interaction ratio increased for the infected bee over time. A high proportion of the infected bees died as a consequence of continuous attacks by nest mates. Additionally no evidence for parasite transmission was found within in the group. Hence, behavioural modulation of healthy bees towards infected ones seems to benefit the honey bee at the group level rather than the parasite.

OH SISTER, WHERE ART THOU? INDIRECT FITNESS BENEFIT COULD MAINTAIN A HOST DEFENSE TRAIT

Tobias Pamminger[1*], Susanne Foitzik[1], Dirk Metzler[2] and Pleuni S. Pennings[3]

[1]*Institute of Zoology, Johannes Gutenberg University of Mainz, Germany*
[2]*Department of Biology II, Ludwig Maximilian University of Munich, Planegg – Martinsried, Germany*
[3]*Department of Biology, Stanford University, Stanford, CA, USA*

We examine the small scale population structure of a host species and investigate whether it could explain the evolution of a defense trait against slavemaking ants. Slavemaking ants keep workers of another ant species as slaves to rear their offspring. The slaves of the host species *Temnothorax longispinosus* exhibit an effective post-enslavement defense mechanism; instead of taking care of the slavemaker young, these slaves kill a high proportion of the parasite offspring. Because slaves are not known to reproduce, they likely do not gain any direct fitness benefit from their "rebellion" behavior. They may gain an indirect fitness benefit if neighboring colonies that benefit from the resulting reduced slavemaker threat are related to the slaves.
Using microsatellite data on a small spatial scale we demonstrate that slaves are, on average, more closely related to host colonies within the raiding range of the slavemaker nest where they live, than to host colonies outside the raiding range. Our genetic analysis indicates that polydomy can explain the elevated relatedness values between slaves and the surrounding host colonies. The observed small scale population structure is stable over at least one year and not eroded by the high raiding activity of the parasites and the unstable conditions in the habitat.
We conclude that, despite mating swarm reproduction, unstable habitat conditions and high parasite preassure, polydomy leads to small scale population structure in *Temnothorax*

longispinosus populations. Consequently slaves are related to nearby hosts colonies and the slaves' "rebellion" behavior can result in an indirect fitness benefit.

PHYLOGEOGRAPHY OF THE RARE ANT *LIOMETOPUM MICROCEPHALUM* (FORMICIDAE: DOLICHODERINAE): PRELIMINARY RESULTS OF A STUDY ON POPULATIONS ACROSS THE ENTIRE SPECIES RANGE.

Lenka Petráková* and Jiří Schlaghamerský

Department of Botany and Zoology, Faculty of Science, Masaryk University, Brno, Czech Republic

Liometopum microcephalum is an arboricolous ant ranging from Italy and eastern Czech Republic and Austria in the West to the Russian Lower Volga, western Iran and northern Israel in the East . Populations are fragmented and, in the north of its range, restricted to the floodplains of large rivers. The aim of our study was to assess the phylogenetic relationships between the more or less spatially isolated populations. We used mitochondrial DNA markers (cytochrome b, cytochrome oxidase I) and 12S ribosomal RNA. We sequenced 87 individuals collected at 25 sites across the entire species range. Bayesian analyses yielded two main clusters of samples: populations from the Middle East (Turkey and Israel) differed distinctly from those from the rest of the distribution area. We suggest that the species spread from south-eastern Europe northward and eastward. We also suggest that *Liometopum* colonized the Apenine Peninsula from southeastern Europe, the Alps presenting a barrier that prevented its colonization of western Europe. Six of the studied populations consisted of two or three haplotypes – these populations probably originated from different genetic lineages.

SEQUENTIAL TASK PARTITIONING DURING SOIL TRANSPORT IN LEAF-CUTTING ANTS

Steffen Pielström* and Flavio Roces

Department of Behavioural Physiology and Sociobiology (Zoology II), Biocenter, University of Würzburg, Am Hubland, D-97074 Würzburg, Germany.

Nests of the *Atta* leaf-cutting ants are among the largest structures built by insects. To build them, considerable amounts of soil have to be carried from the underground to the surface, often over a distance of several metres. Until now, the organisation of soil transport in the underground remained mostly hidden from the researchers' eye.

In the present study we present a detailed analysis of underground soil transport behaviour and its consequences for the organization of collective nest digging, based on experimentation under laboratory conditions. We reveal striking similarities between leaf transport during foraging and soil transport during nest excavation. Similar to leaf transport, size matching between soil pellet mass and carrier mass was observed. Soil pellets were transported sequentially over 2 m, and the transport involved up to 12 workers. Excavators deposited soil pellets about 10 cm from the digging site. Here, the loads were picked up by short-distance carriers that moved the pellets for another 9 cm at average. Finally, long-distance carriers covered the rest of the distance, walking at higher velocities than the short-distance carriers. When excavating at a location for several hours, the number of individuals involved decreased over time. As a consequence of sequential transport, the ground in the tunnel was covered with deposited soil pellets.

In a choice experiment, accumulated, freshly-excavated pellets influenced the workers' decision where to start digging. Thus, pellets temporarily accumulated as a result of task partitioning provide cues that spatially organise collective nest excavation.

DIVERGENT PATTERNS OF SELECTION ON AN ANTIMICROBIAL PEPTIDE IN TWO COMMON BUMBLEBEES (*BOMBUS* SP.)

Mario Popp*, Silvio Erler, Sophie Helbing, Susann Parsche and H.Michael G. Lattorff

Martin-Luther-University Halle-Wittenberg, Hoher Weg 4, D-06099 Halle, Germany

Exposure to a wide range of pathogens might lead to the production of antimicrobial peptides (AMPs), which is the major defense mechanism for animals lacking an adaptive immune system. Theory predicts that host-pathogen interactions between social insects and numerous pathogens lead to an evolutionary arms race. Here, we studied the evolutionary pattern of a certain AMP, hymenoptaecin, in several bumblebee species, mainly in two common species, *B. terrestris* and *B. lapidarius* along a transect of 300 km within Germany. Huge differences in polymorphism and its distribution along the gene were detected between these two species. Regarding the gene structure, hymenoptaecin is quite conserved over species in this genus. The major part of the gene is lying under neutral or strong purifying selection. Two codons in the mature peptide have been found to be under positive selection. The first codon shows a polymorphism with respect to clades as well as within a species (*B. lapidarius*), while the second codon affects the socially parasitic cuckoo bumblebees (*B. vestalis* and *B. rupestris*). Variation within the gene differs drastically between *B. terrestris* and *B. lapidarius*. *B. terrestris* shows a lack of polymorphism in the mature peptide, while *B. lapidarius* shows an increased level of polymorphism in the mature peptide. In the intron, high linkage disequilibrium and positive values for Tajima's D indicate balancing selection affecting a stretch of 150 bp with 14 SNPs segregating as distinct alleles. Furthermore, we found no association of polymorphisms to specific sampling sites or the load of pathogens.

LEAF-CUTTING ANTS RELOCATE THEIR SYMBIOTIC FUNGUS BASED ON THE CO2 CONCENTRATION OF THE NEST ENVIRONMENT

Daniela Römer[1]*, Martin Bollazzi[2] and Flavio Roces[1]

[1]*Department of Behavioral Physiology and Sociobiology, University of Würzburg, Am Hubland, 97074 Würzburg, Germany*
[2]*Facultad de Agronomía, Universidad de la República, Montevideo, Uruguay.*

Leaf-cutting ants rear a symbiotic fungus that is the basis for colony's survival. To grow optimally, the fungus needs suitable environmental conditions, one of which is the CO2 content of the air in the nest chambers, which varies across the soil profile. High concentrations are known to hinder and even preclude fungal growth. Leaf-cutting ants should therefore avoid rearing fungus in places with high CO2 concentrations. We investigated whether leaf-cutting ants relocate their fungus based on the CO2 concentration of the nest environment. In the laboratory, workers of *Acromyrmex lundi* were forced to evacuate fungus exposed to desiccation into two humid chambers connected by a y-shaped tube. In a first assay, the CO2 concentration in one of the humid chambers was high (4%), while in the other chamber a low concentration (0.1%) was offered. More fungus was relocated into the chamber with the low concentration than in the chamber with high CO2. When the high CO2 concentration was offered in both chambers, the fungus was still relocated and equally distributed inside them, indicating that workers will even accept suboptimal CO2 concentrations to avoid the risk of desiccation. Finally, when offered a choice between 1% and atmospheric CO2 values (ca. 0.06%), workers relocated the fungus into the chamber with 1%. Taken together, results show that ants relocate their fungus based on the CO2 concentration of the nest air. They avoid high CO2 concentrations

yet actually prefer low to atmospheric values, likely because low CO2 values are used as an 'inside-nest' cue.

MATING WITH AN ALIEN MALE DISRUPTS THE MALE'S BENEFICIAL IMPACT ON LONGEVITY AND FECUNDITY OF ANT QUEENS

Alexandra Schrempf*, Eva Huber and Jürgen Heinze

Biologie I, Universität Regensburg, Universitätsstraße 31, D-93040 Regensburg, Germany

In species with lifelong pair-bonding, the reproductive interests of the mating partners are aligned, and males and females are expected to jointly maximize their reproductive success. We recently showed that mating itself increases the longevity and fecundity of female reproductives (queens) of the ant *Cardiocondyla obscurior*. Here, we hypothesized that this effect might be stronger when queens mate with a male from their own than from another population, as populations are viscous and mating partners from different populations cannot co-evolve. Indeed, queens from a population in Brazil had longer lifespan and higher fecundity when mating with a male from their own population than when mating with a male collected 50 km away or from another continent, suggesting synergistic co-evolution between the sexes. This phenomenon might shape lifespan and reproductive success wherever lifelong pair-bonding is associated with local mating and adds a novel aspect to the complex interrelations between social evolution and sexual selection.

CLEAR-CUTTING – NOT THE END OF THE STORY FOR ANT COMMUNITIES (HYMENOPTERA: FORMICIDAE) – A CASE STUDY FROM TRANSYLVANIAN DECIDUOUS FORESTS (ROMANIA)

Ioan Tăușan[1,2]*, Jens Dauber[3], Maria Ramona Trică[4] and Bálint Markó[5]

[1]*Department of Taxonomy and Ecology, Babeş-Bolyai University of Cluj-Napoca*
[2]*Natural History Museum, Brukenthal National Museum, Sibiu*
[3]*Thünen-Institute of Biodiversity, Federal Research Institute for Rural Areas, Forestry and Fisheries, Braunschweig, Germany*
[4]*Department of Environmental Sciences and Physics, Lucian Blaga University of Sibiu*
[5]*Hungarian Department of Biology and Ecology, Babeş-Bolyai University of Cluj-Napoca*

Ants are important components of forest ecosystems, because they are generalist predators. Ant communities are affected by clear-cutting of forests, in particular through changes in availability of microhabitat such as dead wood, rotten logs, stumps, and empty acorns. Ant community succession of deciduous forests clear-cuts was studied in two localities: Dumbrăveni and Cluj-Napoca (Transylvania). Altogether 12 sites (Dumbrăveni: 1-year and 2-years after clear-cutting, 15-, 35-, 55-, 70- and 120-years old forests; Cluj-Napoca: 1-year and 5-years after clear-cutting, 10-, 60- and 120-years old forests) were investigated, in order to elucidate, how the composition and diversity of communities change in time and if the ant communities will recover from clear-cutting. The field setup was made by using 16 pitfall traps/site for 10 days in three periods (spring, summer and autumn) in 2011. The most abundant forest ant species was *Myrmica ruginodis* Nylander, 1846, (in Dumbrăveni) and *M. rubra* (in Cluj-Napoca), but *Temnothorax crassispinus* (Karavajev, 1926) was also present at almost every site. Thus, significant differences were recorded between forest sites both in Dumbrăveni (permANOVA, $p<0.005$, $F = 110.73$, $Df = 207$) and Cluj-Napoca (permANOVA, $p<0.005$, $F=33.77$, $Df=112$), forest species such as *Myrmica ruginodis*, *Temnothorax crassispinus* or *Stenamma debile* (Förster, 1850) were still present in clear-cuts or in young forests sites. Our preliminary results suggest that in case of deciduous forests, ant species can regenerate despite of clear-cutting.

THE INFECTION OF *LASIUS NEGLECTUS* WITH *LABOULBENIA FORMICARUM*

Simon Tragust

Tierökologie I/University of Bayreuth, Universitätsstrasse 30, 95440, Bayreuth, Germany

Socially living animals like bees, ants and termites show remarkable adaptations in the fight against parasites and pathogens. Apart from the individual immune system comprising behavioral and physiological mechanisms, they have evolved collective disease defense mechanisms, operating at the colony level, turning their colonies into fortresses. Despite these manifold defenses employed by insect societies, the ectoprasitic fungi *Laboulbeniales* (Ascomycota) manage to break all sanitary barriers and persist in ant populations. In Europe a new host-parasite system between *Laboulbenia formicarum*, a fungus hitherto only known form North America, and the invasive garden ant *Lasius neglectus*, seems to have formed. In the present study the unusual association of *Laboulbenia formicarum* and *Lasius neglectus* in one of the only four known localities in Europe was investigated in more detail, establishing the prevalence of the ectoparasite over the years and the seasons in the population and determining the amount of infection across different bodyparts. Furthermore other potential host ants were screened for the presence of *Laboulbenia formicarum* and a potential impact of the ectoparasite on the ant *Lasius neglectus* was investigated.

EXPERIMENTAL MANIPULATION OF QUEEN-WORKER RATIO INDUCES AGGRESSION AMONG QUEENS IN A SOCIALLY PLASTIC ANT

Jürgen Trettin*, Thomas Seyferth and Jürgen Heinze

Biologie I, Universität Regensburg

How reproduction is partitioned among members of animal societies varies widely among and within species. In “low-skew societies” reproduction is shared equally among group members, whereas reproduction is dominated by one or a few individuals in “high-skew societies”. In the holartic ant *Leptothorax acervorum* reproductive skew varies widely among populations. Nestmate queens from extended, homogeneous habitats tolerate each other and contribute quite equally to the offspring of the colony. In contrast, nestmate queens from patchy habitats establish social hierarchies by biting and antennal boxing, and eventually only the top-ranking queen of the colony lays eggs.

Here we investigated whether queen-queen behavior is fixed within populations or whether aggression and high skew can be elicited by manipulation of socio-environmental factors.

We show that queen antagonism associated with high skew in natural populations can be induced in colonies from low-skew populations. This indicates that queens are able to respond to environmental changes in behavioral rather than evolutionary time.

BEHAVIOURAL SYNDROMES IN A CLONAL ANT, PLATYTHYREA PUNCTATA

Giacomo Alciatore*, J. McCaw, Abel Bernadou and Jürgen Heinze

Biologie I, University of Regensburg, Universitätsstraße 31, 93053 Regensburg, Germany

Behavioural syndromes refer to the phenomenon that some individual animals consistently behave more boldly or more shyly than conspecifics across a wide range of different situations. Animal personalities are widespread throughout the animal kingdom and are important for understanding ecological and evolutionary processes. This concept has been recently introduced into social insect research where behavioural syndromes are present not only at the individual level but also at the caste and colony levels. In the latter case, this indicates that behavioural syndromes at colony level could have a genetic basis and that some behavioural traits would be heritable. An ant species in which all individuals are more or less identical, i.e., lack any genetic or morphological variations might be helpful to test this hypothesis. The ant *Platythyrea punctata* provides such a model system. Workers are capable of producing female offspring from unfertilized eggs; thus, most colonies of this species are clones.
In this study, we investigated if behavioural syndromes exist at the individual as well as clone levels, i.e., individuals / clones can be characterized as being relatively aggressive or shy. We investigated in different experimental set-up locomotory activity, aggression, novel object exploration and brood care behaviour in several *Platythyrea punctata* ant colonies. First results show that behavioural syndromes were found at the individual level, as well as the colony level.

DELAYED AVOIDANCE OF PLANTS IN FORAGING LEAF-CUTTING ANTS IS TRIGGERED BY VOLATILES PRESENT IN THE NEST REFUSE CHAMBER

Andrés Arenas* and Flavio Roces

Department of Behavioral Physiology and Sociobiology, Biocenter, University of Würzburg, Am Hubland, 97074 Würzburg, Germany

Decision making in foraging leaf-cutting ants is not simply the result of the workers´ preferences, but is also influenced by the state of their symbiotic fungus as an additional informational center. Foragers can avoid certain plant species if they have been proven to be harmful for the fungus, albeit harmless for themselves. In response to the deleterious effects on the fungus, foragers interrupt harvesting of these leaves leading to delayed rejection, a phenomenon that involves long-lasting avoidance learning and that initiates soon after the introduction of the noxious substrate into the fungus garden. We found evidence that avoidance response is mediated by the presence of the substrate-related cues at the refuse chamber of the nest, where ants deposit the waste. By exchanging the refuse chambers of subcolonies that foraged on fungicide-infiltrated leaves and non-treated subcolonies, foragers from non-treated groups were able to reject the leaves the other group experienced as noxious. Moreover, the mere presence of inert-paper disks added with neutral odors in the refuse chamber was enough to convey information about the unsuitability of the substrate: foraging ants rejected those substrates smelling to the odors that scented the refuse chamber. Interestingly, the same odors that induced rejection when offered in the refused chamber turned out to be preferred if they were initially added into the fungus garden. We suggest that leaf-cutting ants decide to accept certain plants and reject others also based on local olfactory information obtained within the nest environment.

IMPACT OF TERRITORIAL FORMICA (HYMENOPTERA: FORMICINAE) SPECIES TO THE ANT COMMUNITY

Klára Benedek[1]* and Zsolt Czekes[2]

[1]*Department of Horticulture, Sapientia University, Sighişoarei 1C, 547367 Corunca, Mureş County, Romania*
[2]*Hungarian Department of Biology and Ecology, Babeş-Bolyai University, Clinicilor 5-7, 400006 Cluj-Napoca, Romania*

An ant colony can be in competition with conspecifics and certainly with other ant species as well. The relation with other ant species also determines the functioning of colonies. Territorial species play a major role in the formation of ant communities. Their presence usually excludes the appearance of other dominant species Submissive species can live together with territorial ants, but their activity is modified or inhibited by dominants. The aim of my study was to investigate the impact of the *Formica pratensis* on the ant community living in their territory. The fieldwork was carried out from 2004 August to 2007 in two different study site: Fânaţele Clujului Nature Reserve (Cluj County, Romania) and Hoia Forest (Cluj County, Romania). The competitive behaviour of ant species was observed in the absence and in the presence of baits. The ant communities were highly dominated by *Formica pratensis*. The workers were present in almost every observation plot and no other ant species was really successful here. No other aggressive territorial ant species was detected in the studied areas. Those species that appeared on the territories dominated by the *Formica pratensis* at Fânaţele Clujului showed some kind of 'peaceful living together', thanks to the impact of the dominant species' strong superiority.

ADJUSTMENT OF EGG LAYING RATE OF ANT QUEENS TO BODY CONDITION?

Julia Giehr *, Sylvia Cremer, Juergen Heinze and Alexandra Schrempf

Biologie I, Universität Regensburg

Theories assume that it is beneficial for individuals to enhance their reproductive investment with proceeding age, especially when the expected future reproductive success is low. Hence, terminal investment before imminent death would be advantageous for individuals and could increase their fitness. Nevertheless, most species show a decline in reproduction with age and performance deteriorates with time and proceeding senescence.
Like in a few other species, – egg laying rate of queens of the ant *Cardiocondyla obscurior* increases with age.
However, it is still unclear whether queens show negative reproductive senescence, i.e. a decline of mortality and at the same time an increase in fecundity with age, or whether they are able to assess that their time left to reproduce is limited (e.g. due to available sperm numbers or their body condition) and push their fecundity at the end of their life.
To investigate whether queens are able to estimate their body condition and adjust their reproductive investment to imminent death, we will compare queens of *Cardiocondyla obscurior* that are similar of age, but differ strongly in body condition. We will artificially "sicken" and stress (cold stress, CO2) experimental queens in comparison to control queens and compare their progress in egg laying rate with age during their complete lifespan.

WINGLESS AND INTERMORPHIC MALES IN THE ANT CARDIOCONDYLA VENUSTULA

Susanne Jacobs*, Johanna Schaubächer, Alexandra Schrempf and Jürgen Heinze

Biologie I, Universität Regensburg

The ant genus *Cardiocondyla* is characterized by a pronounced male diphenism with wingless fighter males and winged disperser males. Winged males have been completely lost in *Cardiocondyla venustula*, a species in the African *C. shuckardi* group.
Nevertheless, *C. venustula* males from uThukela valley, KwaZulu Natal, South Africa, showed a high morphological variability: in addition to wingless males with widely fused thoracic sutures and without ocelli, ‘‘intermorphic’’ males were found that combined the typical morphology of wingless males with characteristics of winged males, e.g., more pronounced thoracic sutures, rudimentary ocelli, and vestigial wings.
In the Southeast Asian ‘‘*Cardiocondyla kagutsuchi*’’ complex, similar ”intermorphic“ males have been found to be limited to genetically distinct lineages (Insect. Soc. 52: 274-281, 2005). To determine whether male morphology is associated with distinct clades also in *C. venustula*, we sequenced a 631 bp fragment of mitochondrial DNA of workers from 13 colonies. The analysis revealed a large variability of mtDNA haplotypes both between and within colonies. We found six haplotypes with a sequence variation of up to 5.7 %. However, there was no correlation between male morphology and particular genetic lineages (Insect. Soc. 60, 43-48, 2013). In a future analysis, we will analyze additional mitochondrial and nuclear genes to corroborate this finding and to reconstruct the phylogeny of *C. venustula*.

GENETIC ARCHITECTURE IN CARDIOCONDYLA OBSCURIOR

Antonia Klein*, Jürgen Heinze and Jan Oettler

University of Regensburg

Easy culturing of colonies in the lab, controlled matings, a short generation time and small colony size, combined with the peculiar male diphenism of the genus makes the invasive tramp ant *Cardiocondyla obscurior* an ideal model system for studying eusociality on a behavioral and genomic level.
The genome of *C. obscurior* is sequenced and is assembled into > 10,000 scaffolds. To facilitate quantitative genetics, the resolution of the genetic architecture must improve.
A genetic linkage map based on SNPs between two highly inbred populations of *C. obscurior* will be constructed using RADseq (Restriction site Associated DNA sequencing). A cross between Japanese queens and a Brazilian male is performed, the emerging F1 hybrid queens are backcrossed to males either from Japan or Brazil and the F2 males will serve as haploid mapping population. The map will help to elucidate the relationship between eusociality, haplodiploidy and recombination frequency in hymenopterans.

BEHAVIOUR OF INTRANIDAL AND EXTRANIDAL MAJOR WORKERS OF THE AFRICAN CARPENTER ANT CAMPONOTUS MACULATUS FABRICIUS DURING DYADIC NESTMATE REUNION TESTS AFTER SOCIAL ISOLATION

Paweł J. Mazurkiewicz[1,2,3*], Agnieszka Wagner-Ziemka[1,4], Anna Mirecka[1,5], Katarzyna Czajkowska[2*] and Ewa J. Godzińska[1]

[1]*Laboratory of Ethology, Department of Neurophysiology, Nencki Institute of Experimental Biology PAS, Warsaw, Poland*
[2]*College of Inter-Faculty Individual Studies in Mathematics and Natural Sciences, The University of Warsaw, Poland*
[3]*Department of Animal Physiology, Faculty of Biology, The University of Warsaw, Poland*
[4]*International Institute of Molecular and Cell Biology, Warsaw, Poland*
[5]*Institute of Ecology and Bioethics, Cardinal Stefan Wyszyński University, Warsaw, Poland*

We compared the behaviour of intranidal and extranidal major workers of the African carpenter ant species Camponotus maculatus Fabricius during 20 min dyadic nestmate reunion tests carried out after 48 h of social isolation. During the isolation period single ants taken from a laboratory-reared colony were kept in test tubes containing carbohydrate food and water held in by a cotton plug. During the test a dyad of nestmates belonging to the same behavioural class (two intranidal workers or two extranidal ones) was allowed to interact with each other and with their physical environment in a set of two connected test tubes. Minor nurses and foragers from the same colony were investigated in the same way (data already published). Comparison of behaviour of intranidal and extranidal major workers of C. maculatus revealed both similarities and differences with behaviour of their minor nestmates. In both cases extranidal workers showed lower readiness to engage in resting activities and higher readiness to interact with elements of their physical environment (the cotton plug, the junction between the two tubes). However, striking differences in social behaviour observed between intranidal and extranidal minor workers of C. maculatus (in particular, higher readiness of minor nurses to engage in antennal contacts, trophallaxis and some forms of allogrooming) proved to be absent in major workers of that species. Our findings provide a particularly clear-cut example of behavioural differences between workers from polymorphic ant species related both to worker behavioural development (transition from intranidal to extranidal tasks) and to worker morphology.

DIFFERENTIAL REACTIONS TO *RICKIA WASMANNII* (LABOULBENIALES) INFESTED CORPSES OF TWO ANT SPECIES: THE HOST *MYRMICA SCABRINODIS* AND NON-HOST *M. VANDELI*

Dalma Molnár*, Enikő Csata and Bálint Markó

Hungarian Department of Biology and Ecology, Babeş-Bolyai University, Clinicilor 5-7, 400006 Cluj-Napoca, Romania

Ants are frequently targeted by parasites, and in some cases parasites induce changes in life-history, physiology and behavior of the hosts. The social life of ants implies high frequency of contacts among nestmates, that increases the risk of spreading any pathogen among colony members. The fungus *Rickia wasmannii*, from the entomoparasitic fungi order Laboulbeniales (Ascomycetes), obligatorily exploits ant species of the genus *Myrmica*. Little is known about the effect of *R. wasmannii* on the host or its transmission pathways. In laboratory conditions we tried to induce fungal infection in the frequent host ant *M. scabrinodis* and in the non-host ant *M. vandeli*. Two infestation sources were used: infested corpses and infested soil from infested.

nests. During the 60-days infestation experiments behavioral observation were also carried. We recorded the time elapsed to the discovery of infested corpses (non-infested corpses were used as control) and the ants' reactions to them. The number of aggressive behavioral acts (mandible gaping, biting), but also other reactions as cleaning, corpse carrying were all registered. The results show that infestation is hard to induce: there were no infested ants at the end of our study period. Nonetheless there was a differential response from the ants to infested corpses: infested corpses were discovered significantly sooner, than non-infested ones. There were no significant differences, though, between the reaction of ants to infested and non-infested corpses.

HOW DO LEAF-CUTTING ANTS (ATTA VOLLENWEIDERI) PREVENT WATER INFLUX DURING THE EXCAVATION OF NEST TUNNELS IN FLOODED SOILS?

Steffen Pielström* and Flavio Roces

Department of Behavioural Physiology and Sociobiology (Zoology II), Biocenter, University of Würzburg, Am Hubland, D-97074 Würzburg, Germany.

The Chaco leaf-cutting ant *Atta vollenweideri* constructs giant, long-lasting underground nests in grasslands regularly subjected to seasonal partial flooding. Nest openings are usually located on large nest mounds, elevated from the ground level and potential accumulations of surface water. However, when nests grow, mainly during the wet season, new openings appear on the mound. If new openings are created by tunnelling upwards, tunnels can potentially hit seasonal accumulations of surface water, with the expected risk of heavy water influx into the nest structure.

Here, we report a laboratory experiment that demonstrates the ants' ability to prevent water influx while excavating tunnels leading to the outside. Workers from a laboratory colony were offered a vertical tube filled with clay, with its surface covered with a layer of water. The water partially infiltrated the clay from above, creating a moisture gradient across the clay. The swelled, moist clay provided an effective water barrier, keeping most of the water at the surface. Workers excavated a tunnel from the bottom upwards, into the direction of the surface water. When the water layer was present, tunnel excavation stopped about 1.2 cm below the surface. Water penetration into the tunnel never occurred. In control experiments with no water at the surface, the ants extended the tunnel straight to the surface.

This experiment demonstrates that workers can deal with that kind of threat relying only on their local perception of soil moisture.

ANTS BY NIGHT – CIRCADIAN ACTIVITY OF ANTS ON CLEAR-CUT AREAS IN MANAGED STANDS

Piotr Ślipiński* and Michał Żmihorski

Museum and Institute of Zoology, Polish Academy of Sciences, Wilcza 64, 00-679 Warsaw, Poland

In Euro-Siberian forests ants from Read Wood Ants group (e.g. *Formica polyctena*, *F. rufa*, *F. aquilonia*) play an important role in shaping ants assemblages. RWA colonies act as centers of spatial organization of local ant communities influencing the abundance of subordinate species. Non-territorial species can forage within territories of RWA by avoiding direct interactions with aggressive and numerous workers of RWA. However drastic change in ecosystem like clear-cut may force some colonies of RWA to leave the disturbed area and therefore subordinate ant species (e.g. Myrmica, Serviformica) may increase in number as a consequence of the competitor release effect.

In our study we set up two sets of biocoenometric frames, first was placed on forest and clear-cut area border and second one located deeper in a clear cut area. Frames were checked twice: during day and night. Totally we counted 1044 invertebrate individuals and among them three main ants groups: Read Wood Ants (I), *Myrmica* sp. (II) and *Formica fusca* (III). Number of individuals from each group was analyzed using Generalized Linear Models (logistic regression, zero-inflated poisson regression) using distance to a forest edge (edge frames vs. clear-cut frames) and time of a day/(day vs. night) as predictors. Results clearly indicate that top dominants (RWA) were present during day time and close to a clear cut edge. *Formica fusca* was also present mostly during day hours and closer to a clear cut edge, probably because workers of Serviformica can coexist with stronger competitors by avoiding direct interactions. In contrary, *Myrmica* sp. were present mostly during night hours and further from the forests edge because of smaller temperature requirements and probably because of Wood Ants group avoiding, but this hypothesis must be further checked. The study shows that night dynamic of ant assemblage does not follow its day time distribution.

PHYLOGENETIC ANALYSIS OF THE COMMUNITY STRUCTURE OF SOUTHERN AFRICAN TERMITES

Janine Schyra* and Judith Korb

University of Osnabrueck, Department of Behavioural Biology, Barbarastraße 11, 49069 Osnabrück, Germany

Studying community assembly and structure of species allows insights into the fundamental mechanisms that dictate how species assemble and why communities are structured the way they are. In recent years there have been several improvements in this field, especially because phylogenetic data have been included into the analysis of community ecology and diversity, which has made it possible to explore theories about the influence of historical and ecological factors in structuring communities. There are two major theories of coexistence that can explain community structure. The niche theory, which states that species have to differ in their niches to coexist, and the neutral theory, which says that species are demographically equivalent and niche differences are not essential for coexistence. Here species distribution is due to random effects. We tested whether southern African termite communities are niche-assembled or if they are assembled randomly and which processes and traits are responsible for structuring communities (habitat filtering or competition). Because there are many cryptic termite species, barcoding was used for species identification. We could show that there is a regional species pool of 11 species in semiarid to arid regions of Namibia. No phylogenetic overdispersion or clustering was found, implying random species assemblages. Also including environmental variables in the analysis did not reveal a significant effect of environmental parameters. Hence, the hypothesis that termite communities in this region are random assemblages cannot be rejected.

POTENTIAL ANT VECTORS OF THE PROTECTED MYRMECOCHOROUS *COLCHICUM BULBOCODIUM* PLANT

Tartally András[1]*, Novák István[2], Löki Viktor[3], Szűcs Mónika[1] and Lengyel Szabolcs[4]

[1]*Department of Evolutionary Zoology and Human Biology, University of Debrecen, Egyetem tér 1, H-4032, Debrecen, Hungary*
[2]*Department of Zoology and Animal Ecology, Szent István University, Páter K. u. 1, H-2100, Gödöllő, Hungary*
[3]*Department of Botany, Egyetem tér 1, H-4032, Debrecen, Hungary*
[4]*Department of Tisza River Research, Danube Research Institute, Hungarian Academy of Sciences, 4026 Debrecen, Bem tér 18/c*

Colchicum bulbocodium is a highly endangered and protected myrmecochorous plant with elaiosomes on the seeds. Previous studies show that only some ant species are suitable seed dispersal vectors of myrmecochorous plants at any given site, e.g. by placing seeds into nests or trash microsites. The Hungarian *C. bulbocodium* populations are declining and there are no data about suitable vector ants of this plant anywhere. Our aim was to fill this niche.
Field observations and experiments to reveal seed carrying ants, and pitfall trappings to survey ant assemblages were done in May and June 2012 in patches with and without *C. bulbocodium* in three vegetation types (meadows, scrubs and forests) near Tura (Hungary).
Seed carrying ants were observed only once, when workers of a *Myrmica sabuleti* colony carried seeds and this ant was charateristic present only on meadow patches with *C. bulbocodium*. Other characteristic ant species of *C. bulbocodium* patches were *M. rubra* (scrubs) and *Temnothorax* sp. (forests). The ant community was more diverse in meadow patches with than without *C. bulbocodium*, was similarly diverse in scrub patches with and without *C. bulbocodium* and was less diverse in forest patches with than without *C. bulbocodium*.
Our results suggest that the presence of *Myrmica sabuleti* could be an important factor in the survival of *C. bulbocodium* populations in meadows. However, ants seem to be less important in closed habitats, maybe because of the presence of shady patches or more structured microsites (leaf litter), where the seeds can successfully survive and germinate.

INFESTATION OF *MYRMICA* HOST ANTS WITH FUNGI INFLUENCES THE ADOPTION SUCCESS OF *MACULINEA* CATERPILLARS

Natalia Timuş[1]*, Bálint Markó[2] and László Rákosy[1]

[1] *Department of Taxonomy and Ecology, Babeş-Bolyai University, 400006 Cluj-Napoca, Clinicilor 5-7, Romania, ntshk22@yahoo.com, laszlorakosy@hasdeu.ubbcluj.ro*
[2] *Hungarian Department of Biology and Ecology, Babeş-Bolyai University, 400006 Cluj-Napoca, Clinicilor 5-7, Romania, balintm@gmail.com*

Eusocial animals, like ants can be attractive targets for parasites due to the concentration of genetically similar host organisms in time and space. There is a wide range of parasitic organisms from fungi to other arthropods that exploit the social system of ants. Caterpillars of the conservation flagship butterfly genus *Maculinea* are social parasites of various *Myrmica* ant species. After a short period spent on different host plants larvae fall on the ground and are adopted by host ants due to their chemical and behavioural mimicry. On the other hand, *Myrmica* ants are also hosts for the Laboulbeniales fungus *Rickia wasmannii*, which can reach extremely high prevalence in ant nests. The presence of a parasite in a system could decisively influence the infiltration success of another parasite either negatively or positively. During our study we investigated in laboratory conditions the differences between *R. wasmannii* infested

and non-infested *Myrmica scabrinodis* colonies with regards to the adoption process of caterpillars of four different *Maculinea* forms/species: *M. alcon*, *M. a. xerophila* (sometimes also referred to as *M.* '*rebeli*'), *M. nausithous* and *M. teleius*. All four species syntopically co-occur at Luna de Jos, Romania, where *R. wasmannii* is also very frequent. All four *Maculinea* forms/species naturally parasitize *Myrmica scabrinodis*. Based on our results infested ant colonies adopted significantly faster *Maculinea* caterpillars, while, generally, the predatory *M. teleius* was adopted slower irrespective of the host ant colony's state. Based on our results fungal infestation definitely influences the adoption probability of socially parasitic *Maculinea* caterpillars.

MORPHOMETRIC STUDY OF HUNGARIAN HONEY BEE (*APIS MELLIFERA* L.) COLONIES

Erika Zakar[1]*, Edit Zajácz[2], Tímea Rácz[2], János Oláh[1], András Jávor[1] and Szilvia Kusza[1]

[1]University of Debrecen Centre for Agricultural and Applied Economic Sciences, Debrecen
[2]Institute for Small AnimaI Research and Coordination Centre for Gene Conservation, Department of Honey Bee Keeping, Gödöllő

The morphometric analisys is of special importance because this, on the one hand, shows correlation with honey bee production and on the other hand, the pure morphometric charactersitics is the basis of any potential honey bee export. From the importing countries, demand is growing for the pure pannonian honey bee that is native to Hungary. But it can only become an economically viable source of our apiary, if our bee material meets the requirements of the buyers. Honey bee workers were collected in the summer of 2010 from sixteen different locations (5-5 family/apiary). The following parameters were examined the colour of tergit (50 samples/family), the cubital index (CI) (20 samples/family) and proboscis length (20 samples/family). Our aim in this study is to differentiate between the Apis mellifera pannonica and the Apis mellifera ligustica subspecies. Our assumtion is that the samples contain other morphological features of the subspecies within the pannon subspecies. By means of Discriminant analysis, we have established that if we take two parameters, the colour of tergit and CI, then separation is 13.6% possible, if we take colour of tergit and proboscis length, its 13,4%, and finally in the case of cubital index and proboscis length, the value is 13,1%. By the application of all three parameters, the subspecies can be separated in only 16.1%. Therefore in our further studies, the intention is to include additional variables, like the study of the K19 angle measured on the wing.

List of participants

Name	Affiliation	e-mail
Alciatore, Giacomo	University of Regensburg, Germany	giacca90@hotmail.it
Atsarkina, Natalia	M.V. Lomonosov Moscow State University, Russia	azarkina@yahoo.com
Barta, Zoltán	University of Debrecen, Hungary	barta.zoltan@science.unideb.hu
Barth, Benjamin	Martin-Luther-University Halle-Wittenberg, Germany	benjamin.barth@zoologie.uni-halle.de
Benedek, Klára	Sapientia University, Romania	benedekklara@ms.sapientia.ro
Bernadou, Abel	University of Regensburg, Germany	abel.bernadou@biologie.uni-regensburg.de
Beye, Martin	Heinrich Heine University of Düsseldorf, Germany	martin.beye@uni-duesseldorf.de
Billen, Johan	Laboratory of Socioecology and Social Evolution, Leuven, Belgium	johan.billen@bio.kuleuven.be
Blüthgen, Nico	Technische Universität Darmstadt, Germany	bluethgen@bio.tu-darmstadt.de
Bruce, Andrew	University of Würzburg, Germany	andrewbruce0201@gmail.com
Buttstedt, Anja	University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca, Romania	anja.buttstedt@gmail.com
Coroian, Cristian	University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca	cristian_coroian@yahoo.com
Csata, Enikő	Babeş-Bolyai University, Romania	csataeniko@yahoo.com
Czajkowska, Katarzyna	University of Warsaw, Poland	kczajkowska@student.uw.edu.pl
Czekes, Zsolt	Babeş-Bolyai University, Romania	czekes@yahoo.com
Denner, Andreas	University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Romania	andreas.denner@student.uni-halle.de
Dorosheva, Elena	Institute of Animal Systematics and Ecology SB RAS, Russia	elena.dorosheva@mail.ru
Erler, Silvio	University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca, Romania	erler.silvio@gmail.com
Erős, Katalin	Babeş-Bolyai University, Romania	katika_eros@yahoo.com
Feldhaar, Heike	University of Bayreuth, Germany	feldhaar@uni-bayreuth.de
Ferencz, Márta	Babeş-Bolyai University, Romania	ferencz_marti@yahoo.com
Forfert, Nadège	Martin-Luther-Universität Halle-Wittenberg, Germany	nadege.forfert@gmail.com
Gallé, László	University of Szeged, Hungary	galle@bio.u-szeged.hu
Giehr, Julia	University of Regensburg, Germany	j.giehr@hotmail.de
Gyöngyvér, Molnár	Babeş-Bolyai University, Romania	gyongyos_vera@yahoo.com
Heinze, Jürgen	University of Regensburg, Germany	juergen.heinze@biologie.uni-r.de
Iakovlev, Ivan	Institute of Systematics and Ecology of Animals SB RAS, Russia	ivaniakovlev@gmail.com
Jacobs, Susanne	University of Regensburg, Germany	susanne.jacobs@biologie.uni-regensburg.de

Klein, Antonia	University of Regensburg, Germany	antonia.klein@ur.de
Korb, Judith	University of Osnabrueck, Germany	judith.korb@biologie.uni-osnabrueck.de
Kurze, Christoph	Martin-Luther-Universität Halle-Wittenberg, Germany	christoph.kurze@zoologie.uni-halle.de
Lattorff, Michael	Martin-Luther-Universität Halle-Wittenberg, Germany	lattorff@zoologie.uni-halle.de
Maák, István Elek	University of Szeged, Hungary	bikmakk@yahoo.com
Markó, Bálint	Babeş-Bolyai University, Romania	balintm@gmail.com
Mattivi, Stefanie	Martin-Luther University Halle-Wittenberg, Germany	stefanie.mattivi@student.uni-halle.de
Mayack, Christopher	Martin-Luther-Universität Halle-Wittenberg, Germany	cmayack@gmail.com
Mazurkiewicz, Paweł	University of Warsaw, Poland	pmazu666@tlen.pl
Molnár, Dalma	Babeş-Bolyai University, Romania	molnardalma@ymail.com
Moritz, Robin	Martin-Luther-Universität Halle-Wittenberg, Germany	robin.moritz@zoologie.uni-halle.de
Müller, Matthias	University of Halle, Germany	matthias.mueller@zoologie.uni-halle.de
Német, Enikő	Babeş-Bolyai University, Romania	nemeteniko@yahoo.com
Pamminger, Tobias	Johannes Gutenberg University of Mainz, Germany	pamminge@uni-mainz.de
Petráková, Lenka	Masaryk University, Czech Republic	lena23@mail.muni.cz
Pielström, Steffen	University of Würzburg, Germany	pielstroem@biozentrum.uni-wuerzburg.de
Popp, Mario	Martin-Luther-Universität Halle-Wittenberg, Germany	mario.popp@zoologie.uni-halle.de
Rákosy, László	Babeş-Bolyai University, Romania	laszlorakosy@hasdeu.ubbcluj.ro
Römer, Daniela	University of Würzburg, Germany	daniela.roemer@uni-wuerzburg.de
Schaubächer, Johanna	University of Regensburg, Germany	joschaubaecher@web.de
Schyra, Janine	University of Osnabrueck, Germany	janine.schyra@biologie.uni-osnabrueck.de
Slipinski, Piotr	Museum and Institute of Zoology PAS, Poland	pslipinski@yahoo.com
Tartally, András	University of Debrecen, Hungary	tartally.andras@science.unideb.hu
Tăuşan, Ioan	Babeş-Bolyai University, Romania	itausan@gmail.com
Timuş, Natalia	Babeş-Bolyai University, Romania	ntshk22@yahoo.com
Tóth, Beáta	University of Debrecen, Hungary	beatabarta@googlemail.com
Traugust, Simon	University of Bayreuth, Germany	simontragust@uni-bayreuth.de
Trettin, Jürgen	University of Regensburg, Germany	juergen.trettin@biologie.uni-regensburg.de
Zakar, Erika	University of Debrecen, Hungary	zakareri@gmail.com

Author index