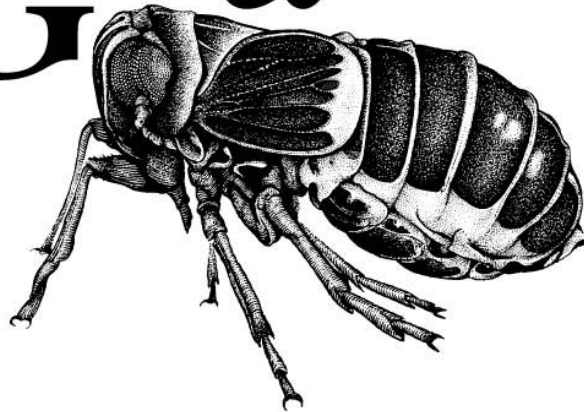


Abstracts

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GaaE



**Entomologentagung
vom 21.–24. März 2011 in Berlin**

Tagungsleitung und Organisation

Hannelore Hoch
Roland Mühlethaler
Stephan Blank
Holger Dathe

museum für naturkunde 
SENCKENBERG
world of biodiversity



Veranstalter : Deutsche Gesellschaft für allgemeine und angewandte Entomologie

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Plenary talk

Plenary talk, public lectures

Plenary talk

Quo Vadis Entomology?

D. Grimaldi

The most compelling issue of our time is the loss of nature, through population pressure, deforestation, climate change, pollution, pesticide- and herbicide overuse, and invasive species. How much will we know before we lose it? The best estimates are that 3 to 5 million species of insects exist, 1.1 million of which have been described in the past 253 years since Linnaeus's 10th edition of *Systema Naturae*. Since insects are the flagship taxon of biodiversity, it is important to assess the present state of studies and research on insect diversity, specifically systematics, behavior, ecology, morphology, biogeography, and natural history. The scope of truly understanding insect natural history is profoundly daunting, particularly considering the tiny fraction of groups whose life histories are known, and that we know of less than 10⁻⁸-percent of the estimated 100 million species that have ever existed. Is it reasonable to strive for knowing all or even most living insect species? At what level will our knowledge be sufficient? While digital technology offers great promise for imaging, sequencing, and the storage, analysis, and sharing of data, it is also a double-edged sword that imposes serious social, institutional, and scientific constraints on classical objectives of entomology. Unorthodox approaches are required, and some major topics and promising aspects are discussed.

David Grimaldi, American Museum of Natural History, USA, grimaldi@amnh.org (Presenting author)

Public lecture - Film

**Faszination Insekten-Mikrokosmos
Highlights aus verborgenen Insekten-Welten**

U. Wyss

Der Film (Laufzeit 62 Minuten) setzt sich aus verschiedenen Aufnahmen zusammen, welche mit Hilfe eines Stereomikroskops das Verhalten von Insekten dokumentieren. Sein Ziel ist es, dem Betrachter einen faszinierenden Einblick in eine Welt zu eröffnen, die mit bloßem Auge kaum wahrnehmbar ist.

Zuerst werden unter dem Thema ‚Vom Monster zur Diva‘ Larven von Schwebfliegen und Florfliegen vorgestellt, die sich nach ihrer schaurig-gefräßigen Blattlaus vertilgenden Jugend in hübsche erwachsene Insekten verwandeln. Dazu gehört auch der zum Insekt des Jahres 2010 gekürte Ameisenlöwe, der in einem Sandtrichter überwiegend Ameisen fängt und verzehrt. Es folgt ein kurzer Abschnitt über den Beuteerwerb einer im Süden Afrikas heimischen Gladiatorschrecke, welche vor erst acht Jahren in eine neue Insektenordnung gestellt wurde und damit großes Aufsehen erregte. Sie wird anschließend mit der allgemein bekannten Gottesanbeterin verglichen.

Besonders eindrucksvoll sind die von Schlupfwespen im Verlauf ihrer Evolution entwickelten Parasitierungsstrategien. Es wird gezeigt, wie Blattlaus-Schlupfwespen ihre Wirte attackieren, wie ein Hyperparasitoid auf der Suche nach einer Wirtslarve die Blattlaus besteigen muss, wie eine winzige Eier parasitierende Art (*Trichogramma brassicae*) begattete Kohlweißling-Weibchen wahrnimmt und dann besteigt, um auf diese Weise per hitch-hiking direkt zum Ort der Eiablage zu gelangen. In Getreidekörnern lebende Kornkäferlarven werden von einer Schlupfwespe erkannt, welche wahrhaft erstaunliche Mechanismen entwickelt hat, um diese Schmarotzer erfolgreich zu parasitieren.

Es folgen Aufnahmen, die sich auf die Lebensweise von zwei pflanzenschädlichen Motten konzentrieren, welche am Ende ihrer larvalen Entwicklung architektonische Meisterwerke konstruieren, in denen sie sich dann verpuppen.

Allgemein bekannt ist das Loch in der Haselnuss, doch nur wenige wissen, wie es entsteht. Um diese Lücke zu schließen, wird die Lebensweise des Urhebers, des Haselnussbohrers, in allen Einzelheiten vorgestellt. Der Film endet mit einer amüsanten Geschichte über das Sexualverhalten von zwei Brüdern, die um die Gunst eines Schlupfwespen-Weibchens buhlen, wobei der Verlierer zum Gewinner wird.

Urs Wyss, C.A. Universität Kiel, Deutschland, uwyss@phytomed.uni-kiel.de (Presenting Author)

Weiss/Wiehe Award - Lecture

**Revision und kladistische Analyse der indo-australischen Buntkäfergattung
Xenorthrius Gorham, 1892 (Coleoptera: Cleridae: Clerinae)**

J. Eberle

Im Rahmen einer Diplomarbeit an der Technischen Universität München wurde die Buntkäfergattung *Xenorthrius* Gorham, 1892 unter Betreuung von Prof. Dr. Roland Gerstmeier taxonomisch revidiert. Aus 26 Museen und privaten Sammlungen standen 586 Tiere zur Verfügung. 22 Arten wurden neu beschrieben, elf Arten von *Orthrius* Gorham, 1876 zu *Xenorthrius* Gorham, 1892 transferiert. Für fünf Arten wurden neue Synonyme vorgeschlagen. Es resultieren 50 Arten die mit einem Bestimmungsschlüssel determiniert werden können. Zudem wurde pro Art eine Punktverbreitungskarte angefertigt und, falls vorhanden, wurden männliche Genitalien gezeichnet. Habitusfotos zu jeder Art sind auf neun Farbtafeln zusammengefasst. Die Analyse der verwandtschaftlichen Verhältnisse anhand morphologischer Merkmale ergab leider keine gesicherten Ergebnisse.

Roland Gerstmeier & Jonas Eberle (2010). Revision of the Indo-Australian checkered beetle genus *Xenorthrius* Gorham, 1892 (Coleoptera: Cleridae, Clerinae). *Zootaxa* 2584: 1–121.

Jonas Eberle, Staatliches Museum für Naturkunde Karlsruhe, Deutschland,
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Section 01 -Talks

Biodiversity, trophic interactions and global change

Section 01 - Keynote

Individual interactions in a community context: plant quality and neighbouring plants as drivers of multitrophic interactions and insect diversity on individual plants

T. M. Bezemer

One of the long-standing aims in ecology has been to examine what determines how many and which insects can be found on a particular plant. Within this theme, various hypotheses have been formulated that can be categorized into two broad groups: hypotheses related to the host plant, and ones related to the surrounding plant community or habitat. Both plant quality and neighbourhood identity can affect the insects on a plant, but until now these aspects have rarely been considered in tandem. Moreover, individual plants of a particular species can vary greatly in nutritional quality, but the role of host plant quality for insect plant-interactions in the field is often ignored. I will use examples from the literature and from our own work in semi-natural grasslands, to show how, and to what extent plant nutritional quality and the identity of the neighboring plant community can affect the multitrophic interactions and insect communities on individual plants. I will show how much natural variation there is in nutritional quality of plants, and how root feeding insects and other soil organisms can affect the aboveground nutritional quality of the plant, and thereby influence the aboveground insect community and multitrophic interactions. Finally, I will discuss how plant quality and the identity of the surrounding plants can affect the behaviour of insects in the field, and show how the diversity and complexity of the plant community can affect the behaviour of parasitoids that are searching for hosts on those plants.

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Section 01 - Talk

Short term effects of simulated climate change on grassland arthropods – a small-scale approach

S. Buchholz, D. Rolfsmeyer & J. Schirmel

Climate change is currently a very controversial and much-discussed topic. But the most important question is always the same: What will be the ecological consequences if the global mean temperature keeps on rising, changes in weather conditions occur and unusual weather phenomena arise? Spiders and carabid beetles are known to be sensitive towards changing environmental conditions of their habitats. In the present study spiders, carabid beetles and two other taxa (Opiliones, Orthoptera) were captured in grassland for a total of 42 days from the beginning of May till the end of August. In order to simulate small-scaled climate changes three different treatments were created: a drought, a control and an irrigation treatment. For each treatment five plots each with a size of 16 m² were installed. Drought plots were protected from precipitation by a transparent roof-like construction and irrigation plots were irrigated once every week starting in July, whereas no changes were made to the control plots. Those different treatments had a significant influence on soil moisture, which was therefore used as the main predictor variable in the relevant statistical tests. These statistical analyses (ANOVA, Kruskal-Wallis test, GLM) then detected significant species and family responses for both indicator groups, but ordination analyses (NMDS) and multivariate analysis of variance (MANOVA) did not indicate the same for species composition or ecological traits such as body size or moisture preferences. This suggests that a connection between changing microhabitat conditions - especially soil moisture - and the increase or decrease of species and family numbers does exist.

Sascha Buchholz, Technische Universität Berlin, Institut für Ökologie, FG Biodiversitätsdynamik, Deutschland, sascha.buchholz@tu-berlin.de

Section 01 - Talk

The influence of landscape structure on the prey choice of a trap-nesting wasp

V. Coudrain, F. Herzog, C. Schüepp & M.H. Entling

Landscape fragmentation can strongly affect species distribution and abundance. Fragmentation effects can be due to (1) altered migration of a species in fragmented habitats, or (2) altered species interactions in fragmented habitats, such as reduced food availability. So far, only few studies have distinguished these potential underlying causal factors. We censused trap-nesting Hymenoptera in 30 sites in agricultural landscapes of the Swiss Plateau. The sites varied in local isolation from forest, and in the cover of woody habitats in the surrounding landscapes ($r = 500$ m). We regularly collected the nests of the most abundant trap-nesting wasp *Trypoxylon figulus* and determined the spiders that the wasps had deposited as larval food. Our results confirmed the negative effect of fragmentation, mainly patch isolation, on the abundance of *Trypoxylon figulus*. Theridiidae and Araneidae were the most hunted families. They accounted for 82 % and 14 % of all captured prey, respectively. Within each family, *Theridion impressum* and *Mangora acalypha* were the dominant prey species. Preliminary analyses revealed no significant effects of landscape variables on prey composition or numbers, suggesting that the reduction of *T. figulus* abundance at isolated sites could be due to reduced colonization rather than due to food shortage. Interestingly the high predominance of Theridiidae contradicts the hypothesis that 3D spider webs evolved as a defensive structure against predatory wasps.

Valérie Coudrain, Institute of Ecology and Evolution IEE, University Berne, Switzerland,
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Section 01 - Talk

Set-aside land and EU agro-policy - quo vadis biodiversity?

T. Frank, T. Drapela, C. Haschek, B. Knittl, B. Lukasch, D. Moser, P. Querner, C. Schulze & J.G. Zaller

Intensive agricultural practice is among the major threats to biodiversity worldwide. Due to the current EU agro-policy, we observe an ongoing simplification of modern agricultural land by the tremendous decline of semi-natural fallow land, leading to a significant decrease of farmland biodiversity in European agroecosystems. In a recent study in Eastern Austria, we investigated the impact of landscape and site factors on the biodiversity and abundance of several arthropod groups and birds in twenty-nine landscape sectors ranging from structurally poor to complex. Species richness of Collembola responded positively to landscape diversity. Similarly, richness of dung beetles (Scarabaeidae) and birds increased with the amount of set-aside fallow land. Within predatory arthropods potentially reducing pest populations, species richness of agrobiont spiders was positively related to percent fallow land at large scale (radius 1250 m), and activity-density was positively related to length of road-side strips with maximum effects at large scale (radius 1750 m) and non-crop area at small scale (radius 750 m). Reproduction of the common carabid *Amara similata* decreased significantly with distance to fallows. When the species richness of four arthropod groups with several nutritional traits including three predatory beneficial groups was analysed jointly (Araneae, Collembola, Carabidae, Staphylinidae), landscape diversity was shown to be the only significant parameter explaining between 10-16% of the variance, respectively (radii from 250 m to 1500 m), and the abundance of predators (Araneae, Carabidae, Staphylinidae) was negatively correlated with pest insect numbers, which suggests a positive pest control effect. While several beneficial arthropods were shown to be promoted by arable set-aside land, pests were not furthered by such semi-natural land, as was shown for oilseed rape infested by pest insects and damage on rape caused by these pests. Our results clearly reveal that semi-natural set-aside habitats are urgently required to promote both overall animal biodiversity and beneficial arthropods, but not pests. Thus, it is necessary to counteract the current EU agro-policy that ceased subsidising the establishment of set-aside habitats.

Thomas Frank, University of Natural Resources and Life Sciences Vienna, Austria,
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Section 01 - Talk

Biodiversity Inventories: Insects as challenge – the ATBI+M approach

C.L. Häuser, A. Hoffmann, A.S. Kroupa & J.C Monje

The All Taxa Biodiversity Inventories + Monitoring (ATBI+M) concept has been successfully implemented in seven protected areas in four European countries (France, Italy, Slovakia, Germany) as part of the EDIT project (www.atbi.eu). More than 350 experts have recorded occurrences of 10,384 species of animals, plants, and fungi within 3 years. With a total of 111 participants, entomologists have been largely involved in the ATBI+M programme spending more than 1,500 days for field work between 2007 and 2010. Through their participation 6,705 insect species were recorded for the ATBI+M sites so far, representing 90% of all recorded animals and 65% of all recorded species. More importantly, 31,452 fully geo-referenced datasets on the distribution of insect species within the surveyed area were obtained. New species records for the individual protected areas or countries are of particular value for any biodiversity assessment, and 52 new species records resulted from the ATBI+M Mercantour / Alpi Marittime (France/Italy).

For all ATBI+M sites experts for 17 insect orders conducted field surveys, with Lepidoptera and Coleoptera being best represented (40 and 27 experts for each order, respectively). Nevertheless several insect groups are still underrepresented in the inventories due to shortage of available experts. Overall the ATBI+M approach has greatly contributed to increase the biodiversity knowledge of the surveyed areas, thus providing a solid baseline for nature conservation management.

Christoph L. Häuser, Museum für Naturkunde - Leibniz Institute for Research on Evolution and Biodiversity at the Humboldt University Berlin, Germany, christoph.haeuser@mfn-berlin.de (presenting author)

Section 01 - Talk

Vergleichendes Klimakammerexperiment zum Einfluss unterschiedlicher Tagestemperaturverläufe auf Entwicklung, Fraß, Gewicht und Fettkörper von *Coccinella septempunctata* und *Harmonia axyridis*

S. Krengel, B. Freier, C. Brandsch, & G. Stangl

Im Rahmen einer Reihe von Untersuchungen zum Einfluss erhöhter Temperaturen auf verschiedene ökologische Parameter von *Coccinella septempunctata* und *Harmonia axyridis* und ihr Potential zur natürlichen Regulation von Getreideblattläusen erfolgte im Jahr 2010 ein Experiment in drei Klimakammern mit jeweils exakt definierten, verschiedenen Tagestemperaturverläufen.

Die dabei verwendeten, mit dem Potsdam-Institut für Klimafolgenforschung (PIK) gemeinsam abgestimmten, drei Tagestemperaturverläufe T0 (normal mit $\bar{\theta} = 17,8$ °C), T3 (erhöht mit $\bar{\theta} = 20,8$ °C) und T6 (stark erhöht mit $\bar{\theta} = 23,8$ °C) wurden in 24-stufigen Tagestemperaturverläufen in vollautomatischen, begehbaren Klimakammern realisiert. Im Mittelpunkt dieser Untersuchung stand der Einfluss der drei Temperaturverläufe auf das geschlechtsspezifische Gewicht, die Fraßleistung und den Fettkörpergehalt der beiden Coccinellidenarten. Eier der beiden Coccinellidenarten wurden dafür einzeln in speziell entwickelten Versuchsgefäßen angesetzt und über die gesamte präimaginale Phase sowie 10 d nach dem Schlupf der Imagines den entsprechenden Temperaturverläufen ausgesetzt.

Es konnten deutliche Unterschiede zwischen den beiden Arten und Temperaturstufen festgestellt werden. Besonderes Interesse verdienten dabei die Unterschiede im Fettkörpergehalt der ad libitum mit *Sitobion avenae* gefütterten Imagines, besonders im Zusammenhang mit den bei höheren Temperaturen eher sinkenden Körpergewichten und steigenden Fraßmengen.

Sandra Krengel, Julius Kühn-Institut, Institut für Strategien und Folgenabschätzung im Pflanzenschutz, Kleinmachnow, Deutschland, sandra.krengel@jki.bund.de (Presenting Author)

Section 01 - Talk

Top-down control of the apple blossom weevil by parasitic wasps: local-scale factors affect parasitism, parasitoid sex ratio and parasitoid size

K. Mody, C. Spoerndli & S. Dorn

Sustainable agriculture benefits from insect-mediated ecosystem services such as biological pest control. Local-scale factors may have a strong influence on the trophic interactions underlying conservation biological control. We studied the tritrophic relationship between apple trees, the apple blossom weevil *Anthonomus pomorum*, and associated parasitic wasps in fruit orchards, to quantify the effects of the following potential local-scale determinants of the ecosystem service 'parasitism', as well as of the population parameters 'sex ratio' and 'body size' of the ichneumonid *Scambus pomorum* as the key parasitoid of *A. pomorum*: (1) apple cultivar, (2) presence of ants, and (3) distance between apple trees and forest. Effects of (4) changing environmental conditions on parasitism were considered by studying five years varying in temperature and precipitation, and by incorporating orchard clearcut as fundamental agro-ecosystem alteration. Apple cultivar affected parasitism of *A. pomorum* by hymenopteran parasitoids as well as the sex ratio (proportion female *S. pomorum*) and size of *S. pomorum*. Ant exclusion from apple trees significantly increased parasitism in one apple cultivar and decreased sex ratio in another cultivar. Distance of apple trees to forest affected parasitism of *A. pomorum* and sex ratio of *S. pomorum*. Parasitism differed significantly among study years. Across-year parasitism levels were more similar for overall parasitism than for parasitism by *S. pomorum* alone, indicating a stabilizing effect of parasitoid diversity on parasitism. This study shows that local-scale factors including crop cultivar, presence of ants as parasitoid-antagonists, within-field position of crop plants and antagonist diversity may affect the ecosystem service parasitism and important parasitoid population characteristics.

Karsten Mody, ETH Zürich, Applied Entomology, Switzerland, karsten.mody@ipw.agrl.ethz.ch
(Presenting Author)

Section 01 - Talk

Effects of grassland intensification on functional insect diversity on different trophic levels

C. Rothenwöhler, C. Scherber, & T. Tschardtke

Species richness and abundance patterns of interacting insect groups are important factors influencing ecosystem processes. Agricultural intensification often reduces biodiversity and associated ecosystem functions, while trophic guilds can be differentially affected and contradictory effects have been found in different regions. The aim of this study was to measure the effects of land-use intensification on the community of insect functional groups (predators and herbivores) and therefore on the biological control potential of differently managed grasslands in three regions, which are located along a north-south gradient in Germany. Additionally we investigated whether short-term and small-scale experimental grassland abandonment (allowing short-term succession) can compensate for the surrounding agricultural intensification, affecting insect diversity and abundance. True bugs (Heteroptera) and beetles (Coleoptera) were chosen as indicator groups because they both include phytophagous and zoophagous species. We found a consistent negative effect of grassland intensification on species richness and abundance of the herbivore and predatory insect community in the three study regions; hence, local land-use intensification appeared to be a key driver of insect community degradation in Germany's agricultural grasslands. Grassland abandonment enhanced herbivore abundance and predator species richness, which indicates the importance of even small succession plots as habitat islands in the agricultural landscape.

Christoph Rothenwöhler, Agroecology, Georg-August-Universität, Göttingen, Germany, crothen@gwdg.de (presenting author)

Section 01 - Talk

How plant identity and diversity affect food choices in soil insects

N. Schallhart, M.J. Tusch, C. Wallinger, K. Staudacher & M. Traugott

A significant proportion of plant tissue is located in roots and tubers. However, due to the difficulties in examining below-ground trophic interactions, little is known on the dietary choices of root-feeding insects. Consequently, it is not known how plant identity and diversity affect the feeding behaviour of soil herbivores. In the present study we examined how (i) root availability, (ii) plant identity and (iii) plant diversity affect the dietary choices of click beetle larvae within the genus *Agriotes*. These insect larvae are generalist herbivores and serious pests in arable land.

We established a mesocosm experiment including four plant species: *Zea mays*, *Lolium perenne*, *Trifolium pratense* and *Galinsoga ciliata*. These plants were offered to the *Agriotes* larvae in varying combinations and at four diversity levels (1–4 plant species). The proportion of the different plant species in the animals' diet was determined via stable isotope analysis.

Taking into account the proportion of each plant in the diet, the root biomass and its relative changes in individual plant species among diversity levels, we found no effect of root availability on dietary choices. However, *Z. mays* was preferred and *G. ciliata* avoided by the larvae, while we found no such effects for *T. pratense* and *L. perenne*. Both, the preference and avoidance increased markedly in higher diversity levels.

These results suggest that the mechanisms governing food choices in soil insect herbivores are complex and affected by both, plant diversity and identity.

Nikolaus Schallhart, Mountain Agriculture Research Unit, Institute of Ecology, University of Innsbruck, Austria, Klaus.Schallhart@uibk.ac.at (Presenting Author)

Section 01 - Talk

Impact of the invasive moss *Campylopus introflexus* on carabid beetles and spiders in grey dunes

J. Schirmel, L. Timler & S. Buchholz

Campylopus introflexus is an invasive moss in Europe that is adapted to acidic and nutrient-poor sandy soils with sparse vegetation. In habitats grey dunes it can build dense carpets and modify habitat conditions. While the impact of the moss invasion on the vegetation is well analysed, there is a lack of knowledge regarding possible effects on arthropods. In this study we analysed the impact of *C. introflexus* on carabid beetles and spiders, as both taxa are known to be useful indicator taxa even on a small-scale level. In 2009 we compared species composition in a) invaded, moss-rich (*C. introflexus*) and b) native, lichen-rich (*Cladonia* spp.) grey dunes by using pitfall traps. A total of 1,846 carabid beetles (39 species) and 2,682 spiders (66 species) were caught. Species richness of both taxa and activity densities of spiders were lower in invaded sites. Species assemblages of carabids and spiders differed clearly between the two habitat types and single species were displaced by the moss encroachment. Phytophagous carabid beetles, web-building spiders and wolf spiders were more abundant in native, lichen-rich sites. Shifts in species composition can be explained by differences in the vegetation structure, microclimate conditions and most likely a reduced food supply in invaded sites. By forming dense carpets and covering large areas, the moss invasion strongly alters typical arthropod assemblages of endangered and protected (EU-directive) grey dunes.

Jens Schirmel, Biologische Station Hiddensee, Deutschland, jens_schirmel@web.de

Section 01 - Talk

The effect of inter- and intraspecific diversity of drosophilids on decomposition processes

H. Schmitz, T.S. Hoffmeister

In a world of increasingly fragmented landscapes where species diversity is additionally threatened by climate change, the effects of diversity on ecosystem processes become more and more relevant. Previous work has mainly focussed on the effects of species richness on ecosystem processes. However, fragmentation also impacts population sizes and thus intraspecific genetic variability. To date, the effects of biodiversity provided by genetic variability have rarely been studied on ecosystem processes. Here we study the effects of intraspecific and interspecific variability on decomposition processes, using a simple experimental system of drosophilid flies and an artificial medium, consisting of a carbohydrate source and live yeast. Drosophilids are an intriguing subject of study, since they coexist without resource partitioning. We thus ask whether complete redundancy prevails or whether variability affects decomposition processes. Isofemale-lines with a defined developmental time representing different genotypes of three different *Drosophila* species (*Drosophila melanogaster*, *D. subobscura* and *D. immigrans*) were used to elucidate the possible effects of diversity. In different treatments decomposition rates of resources were measured through combining larvae of different genotypes of those three species. The observed parameters are metabolic rates, C/N-ratios, and fitness parameter of the flies (length and weight of pupae, survival probability).

Heike Schmitz, Population & Evolutionary Ecology Group, University of Bremen, Germany,
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Section 01 - Talk

What's on the menu? – Food-web interactions in a high alpine predator community

D. Sint, L. Raso, S. Plangg, T. Recheis, R. Kaufmann & M. Traugott

Retreating glaciers free large areas of bare ground which is then (re)colonised by organisms. Although it is acknowledged that predatory arthropods are one of the first animals found on these sites, little is known about what prey sustains these early colonizers. Three main food sources are considered: (1) intraguild predation is often thought to be the most important factor but without additional energy input such a system cannot be stable. This supplementary prey can either be (2) an autochthonous food source (e.g. collembolans which are also among the first colonizers) and/or (3) so-called aeolian input – allochthonous arthropods that fly or are wind-blown into the glacier foreland.

In the present study molecular methods have been used to determine the importance of the different food sources for an arthropod predator community on recently deglaciated areas in a glacier foreland in the Tyrolean Alps. A multiplex PCR system was developed and ~1400 predators - mainly carabid beetles and lycosid spiders - were screened for DNA of collembolans and the predators present in this glacier foreland. The results indicate that intraguild predation does occur, but it seems to be less important than it has been previously assumed. On the other hand, about 60 % of all predators contained collembolan DNA, indicating that these detritivores are a key food source, sustaining predator communities close to the glacier front. Whether flying insects can be a significant food source strongly depends on their availability. Thus Malaise traps together with grey and yellow bowls were placed in the vicinity to the glacier to estimate the amount of flying insects coming into this area. About 40 taxa, including 31 families of Diptera, were recorded, but often in low numbers. Therefore, their actual contribution in sustaining the predators is still unclear but we hope to shed more light on this within our ongoing work.

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Section 01 - Talk

Zur Artenvielfalt der Schnellkäfer (Elateridae) in der Agrarlandschaft Sachsen-Anhalts - Ergebnisse eines Pheromonfallen-Monitorings

M. Tackenberg, C. Wolff, C. Volkmar & M. Lübke-Al Hussein

Drahtwürmer stellen bei der Kultivierung verschiedenster Nutzpflanzen tierische Schaderreger dar, deren adultes Vorkommen hinsichtlich ihrer Diversität in den Jahren 2009/2010 durch ein Elateriden-Monitoring in Sachsen-Anhalt untersucht wurde. Hierzu standen Pheromonfallen, für die Arten *Agriotes lineatus*, *A. obscurus*, *A. sputator*, *A. sordidus* und *A. ustulatus*, von der Firma Syngenta, zur Verfügung. Für die Untersuchungen wurden 5 Standorte, sowohl bewirtschaftete als auch unbewirtschaftete Flächen in der Agrarlandschaft Sachsen-Anhalts, ausgewählt. Das Monitoring wurde im Zeitraum von Anfang April bis Ende Juli, in Zusammenarbeit mit der Landesanstalt für Landwirtschaft, Forsten und Gartenbau Dezernat Pflanzenschutz durchgeführt. Das Fangmaterial wurde konserviert und mittels Binokular im Labor determiniert. In beiden Versuchsjahren konnte das Vorkommen von *Agriotes sordidus* nicht nachgewiesen werden. Jedoch wurden die anderen *Agriotes*-Arten an den einzelnen Standorten mit unterschiedlichen Aktivitätsdichten gefangen. Die verschiedenen Aktivitätsniveaus stehen in Zusammenhang mit den jeweils vorherrschenden Witterungsbedingungen in den Testjahren. Neben diesen Monitoring- Arten fanden wir in den Fallen auch andere Arten der Ordnung Coleoptera. Häufiger vertreten war *Agrypnus murinus*. Zusätzlich zu dieser Art fanden wir *Agriotes gallicus* (Verbreitung: Südeuropa). Außer den benannten Arten kamen *Selatosomus aeneus* und *Ampedus sanguineus* in unterschiedlichen Aktivitäten vor. Mit 83% artspezifischer Fänge in 2009 und 74% artspezifischer Fänge in 2010 ist die Lockwirkung der einzelnen Pheromonfallen als gut und damit aussagekräftig einzuschätzen. Zu den nicht artspezifischen Fängen gehörten vor allem Laufkäfer verschiedener Gattungen, Curculionidae, Scarabaeidae sowie Ohrwürmer und Wanzen. Die Beifänge erklären unterschiedliche ökologische Nischen, sowie abiotische Faktoren, insbesondere Witterungsbedingungen.

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Section 01 - Talk

Die Biodiversität einer zentralalpinen Landschaft am Beispiel der Zweiflügler (Diptera)

J. Ziegler

Hochgebirge weisen eigenständige Lebensgemeinschaften auf, die einer natürlichen mosaikartigen Differenzierung unterliegen. Hinzu kommt oft eine enge Verflechtung mit Kulturlandschaften. Untersuchungen zur historischen und rezenten Biodiversität sind deshalb in den Alpen besonders interessant und aufschlussreich. Deshalb wurden im Parco Nazionale dello Stelvio die Zweiflügler, die artenreichste Ordnung der Tierwelt in Mitteleuropa, hinsichtlich ihrer Diversität untersucht. Im ersten Projektabschnitt wurden in Kooperation mit 31 internationalen Wissenschaftlern 1.094 Arten determiniert, die 46 Dipteren-Familien mit 25.280 Individuen repräsentieren. Bisher wurde erst die Hälfte des vorliegenden Materials abschließend bearbeitet. Trotzdem konnten bereits 248 Arten erstmals für Italien nachgewiesen werden, von denen zehn Arten sogar als neu für die Wissenschaft beschrieben wurden. 771 Arten waren bisher nicht aus der Provinz Bozen - Südtirol bekannt. In diesem Beitrag werden darüber hinaus erstmals Ergebnisse zur Artendiversität in unterschiedlichen Lebensräumen und Höhenstufen vorgestellt und Hinweise zur besonderen Gefährdung bestimmter Lebensräume abgeleitet. Zu den dominanten Familien im Untersuchungsgebiet gehören u.a. die Cecidomyiidae, Mycetophilidae, Sciaridae und Phoridae, deren Arten überwiegend phytosaprophag, mykophag und phytophag leben.

Ziegler, J. (2008) (ed.): Diptera Stelviana. A dipterological perspective on a changing alpine landscape. Results from a survey of the biodiversity of Diptera (Insecta) in the Stilfserjoch National Park (Italy). Volume 1 - Studia dipterologica. Suppl. 16: 395 pp. and 4 maps; Halle (Saale), Ampyx-Verlag.

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Section 02 -Talks

Morphology, systematics, evolution

Section 02 - Keynote

Die Phylogenie der Holometabola und die Rolle der Morphologie im Zeitalter der Phylogenomik

R.G. Beutel & F. Hünefeld

Im Rahmen eines DFG Projektes wurde der umfangreichste bisher für die Holometabola verfügbare morphologische Datensatz zusammengestellt und analysiert. Die Datenaufnahme wurde optimiert. Micro-Computer Tomographie kombiniert mit anderen Techniken hat sich als äußerst effizient erwiesen. Die phylogenetischen Resultate weichen stark von Ergebnissen ab die auf rRNA Sequenzen basieren, bestätigen aber fast alle Gruppierungen die sich in einer Analyse von Sequenzen von Kerngenen ergeben haben: Holometabola, Holometabola exkl. Hymenoptera, Coleoptera (=Strepsiptera + Coleoptera), Neuropterida, Neuropterida exkl. Neuroptera, und Mecoptera inkl. Boreidae und Nannochoristidae. Die Flöhe wurden als Schwestergruppe der Diptera plaziert. Die Mecoptera (=Antliophora + Amphiesmenoptera) wurden nur in den Bayes'schen Analysen als Monophylum bestätigt. Probleme wurden vor allem von Taxa mit vielen Autapomorphien verursacht, und durch nicht anwendbare Merkmale die sich aus der Reduktion von wichtigen Strukturen ergeben. Zur beispiellosen Entfaltung der Holometabola haben verschiedene Faktoren in einzelnen Linien beigetragen: gutes Flugvermögen (v.a. Hymenoptera und Diptera), die Fähigkeit in verschiedenen Lebensstadien unterschiedliche Habitate und Nahrungsressourcen zu nutzen (reduzierte innerartliche Konkurrenz), Ernährung von flüssigen Substraten (z.B. Dipterenlarven), und die Ko-Evolution mit den Angiospermen (u.a. Hymenoptera, Lepidoptera). Die Morphologie kann und wird auch im "Zeitalter der Phylogenomik" eine sehr wichtige Rolle spielen. Sie liefert von molekularen Datensätzen unabhängige phylogenetische Resultate, die eine kritische wechselseitige Überprüfung ermöglichen. Sie ist außerdem essentiell für die Rekonstruktion der evolutiven Transformationen auf dem phänotypischen Niveau, für das Testen von evolutiven Szenarien, und für die phylogenetische Einordnung von fossilen Taxa.

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Section 02 - Keynote

The evolution of eusociality in insects: insight from the sweat bees

R.J. Paxton, A. Soro & J. Field

Eusociality has evolved just a few times in the ant, bees, termites and wasps, yet those lineages that have evolved eusociality have become ecologically dominant in many terrestrial ecosystems. Modern phylogenies give a robust handle on how often and when eusociality has evolved in insects, but we still lack a good understanding of how; what were the selective pressures that favoured altruism and helping rather than selfishly reproducing as a solitary individual – Darwin's 'one special difficulty'. I shall review current ideas, in which relatedness and inclusive fitness are placed central to our interpretation of reproductive altruism. Interestingly, some sweat bee (Halictidae) species straddle this major evolutionary transition; they are socially polymorphic, exhibiting both solitary and social behaviour, allowing unparalleled opportunities to investigate how and why eusociality has evolved in this group of bees, and potentially in other lineages, too. Previous studies of socially polymorphic sweat bees have suggested a genetic basis to the social transition. We have tested whether there is a genetic underpinning to this transition in the socially polymorphic sweat bee *Halictus rubicundus*, which exhibits solitary behaviour in the cooler north of its European range and sociality in the warmer south. Our population genetic data reveal subtle genetic differentiation between populations, though the level of differentiation between social and solitary populations is no greater than expected by geography alone (isolation by distance). These data suggest little or no reproductive isolation between solitary and social populations of *H. rubicundus*. Our common garden experiments, in which we cross-foster social *H. rubicundus* into a solitary environment and *vice versa*, indicate plasticity in social behaviour. If there is a genetic underpinning to the social transition, our results suggest that it has a simple genetic architecture, possibly controlled by one or a few key, regulatory genes.

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Section 02 - Talk

Resilin in dragonfly wings

E. Appel & S. Gorb

Resilin is well known for its rubber-like properties, including long-range (visco-) elasticity, ability to store kinetic energy, absorb shocks, and enhance flexibility of cuticular structures. In insect flight systems it has already been described in vein joints, veins, folding lines, transitions between veins and wing membrane, as well as in wing hinges and elastic muscle tendons in various species, including Coleoptera and Dermaptera. In contrast to wings of neopteran insects, where resilin plays a crucial role in wing folding, examinations on the distribution of resilin in wings of Odonata is especially important for understanding wing mechanics during flight, because the rather stiff corrugated wings of representatives of this order cannot be folded. Previously, only wings of the damselfly *Enallagma cyathigerum* Charp. (Coenagrionidae) have been studied (Gorb, 1999). In the present study we combined (1) fluorescence microscopy, (2) scanning electron microscopy, and (3) simple mechanical tests to elucidate the distribution of resilin patches in wings of the basal anisozygopteran species, *Epiophlebia superstes* Selys (Epiophlebiidae). Resilin patches are mainly located in wing vein joints situated in pleat valleys, thus their distribution distinctly differs between the dorsal and ventral wing sides. Our morphological results complement data from previous experimental studies (Wootton & Newman, 1986; Kim et al., 2009) to suggest that resilin is involved in either compression or tension, depending on the location in either narrow pleats at the leading edge (*compression*) or shallower pleats at the trailing area (*allowing the angle widening*). This morphological basis enables rather stiff, ultralight, and corrugated wings to bear deformations, e.g. during camber formation, without material damage or fatigue, thus enabling the strong lift production Odonata are known for.

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Kim W-K, Ko JH, Park HC, Byun D, 2009. Effects of corrugation of the dragonfly wing on gliding performance. J. Theor. Biol, 260: 523-530.

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Section 02 - Talk

Amazing strategy: sequestration in lygaeid bugs as a retained ancestral character.

C. Bramer, G. Petschenka, J. Deckert & S. Dobler

Some plants produce a wide spectrum of secondary metabolites that act as feeding deterrents against herbivores. One important group of plant toxins are cardiac glycosides (cardenolides, CGs) which are specific inhibitors of the ubiquitous animal enzyme Na, K-ATPase.

However in many cases, insects have found ways to take up these deterrent chemicals and use sequestered cardenolides for their own defense.

Several species of the hemipteran subfamily Lygaeinae are known to store cardenolides, the most famous example being the large milkweed bug (*Oncopeltus fasciatus*). In this study we investigate whether further species of Lygaeinae are able to sequester cardenolides and determine the phylogenetic origin of this ability. By feeding assays with radiolabelled polar (ouabain) and nonpolar (digoxin) cardenolides we analyzed in seven lygaeine species and three outgroup species their ability to sequester cardenolides and the efficiency of the uptake.

To interpret the observed differences we established a phylogeny of this group based on 3.1 kb of their nuclear and mitochondrial DNA.

The necessary adaptation for cardenolide sequestration must have arisen at the basis of the Lygaeinae, yet the physiological processes must have been refined during the evolution of the subfamily. Current analyses aim at elucidating the metabolic processes in different Lygaeid species and testing the effectiveness of different defenses.

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Section 02 - Talk

Comparative studies on the occurrence and distribution of brochosomes and wax on *Graphocephala fennahi* and *Cicadella viridis*

J. Gaestel

Brochosomes are 0.2- 4 μm large particles, which are only produced by leafhoppers (Cicadellidae). They were discovered in 1952 and have often been confused with pollen. Brochosomes are produced in the golghi-complex of the middle part of the malpighian tubules and consist of proteins and lipids. They are secreted and distributed over the surface of the body. Various functions have been proposed for brochosomes: protection against water, sugary secretes, UV-light, desiccation or even against infection by microbes and fungi. The behaviour of distribution is called anointing and can vary among species as well as nymphs and adults of the same species. After distribution the animals brush the body and appendages with specialized setae on the tibiae of the hindlegs. Morphologically, brochosomes are hollow spheres. Their surface consists of hexagonal and pentagonal units and is highly hydrophobic. The air is held between the particles, in the openings of the units and the central cavity of the brochosomes so that a brochosome coating in fact forms a plastron. Size and structure of brochosomes can vary between species, life stages, parts of the body and sexes .

In former studies it was assumed that brochosomes could have evolved convergently to wax which is common in other Hemiptera, such as in Fulgoromorpha and Sternorrhyncha. Wax particles apparently have the similar functions as brochosomes. The majority of leafhoppers (Cicadellidae) do not produce wax except for nymphs of the suborders Typhlocybinae, Idiocerinae and Macropsinae which do not produce any brochosomes but have been observed to display thin wax coatings of the body. Some leafhoppers, however, produce brochosomes as well as wax. Among them are two well-known species *Cicadella viridis* and *Graphocephala fennahi*, the latter being a neozoon in Europe, causing damage on ornamental Rhododendron.

In my master thesis I plan to study characteristics of brochosome and wax coating of these two species. The main objective of my research project is to compare the occurrence and distribution of wax and brochosomes between *Cicadella viridis* and *Graphocephala fennahi*. For this, I will observe coatings of wax and brochosomes on select parts of the body, e.g. wings, thorax and abdomen with SEM methodology. Here I have chosen different regions of wings for observation. On abdomen I will study sternites and tergites. It is hoped that the results of these studies will form the basis for further investigations on the possible correlation of wax and brochosome coating with habitat preferences.

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Section 02 - Talk

Evolution of Corixidian mouth-parts

C.W. Hädicke

Among the Nepomorpha (Water bugs) Popov, 1968 the Corixoidea (water boatmen) *Stys* and Jansson, 1988 are the most diverse taxon, with nearly 602 species. The Corixoidea show many unique modifications (concerning the head and mouth parts), therefore Börner (1904) once created the suborder Sandaliorrhyncha, to separate the Corixoidea from other Heteroptera. Their feeding habits are another unique feature. In contrast to all other Nepomorpha the Corixoidea presents different nutrition (e.g. carnivory, herbivory and omnivory) (Savage, 1989). Since carnivory is characteristically for the Nepomorpha, omnivory is a potential autapomorphy of the Corixoidea. Moreover it is not clear whether the common ancestor was herbivorous, omnivorous or carnivorous. Therefore, morphological features, which serve alimentation, were reinvestigated. By mapping the characters on the recent cladogram (Zimmermann, 1986), evolutionary pathways were detected. Done to insufficient knowledge of the Corixidian feeding habits, no reliable statements about the original feeding habits can be made. Nonetheless, the results allow new insights into character evolution of the Corixoidea.

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Savage, A. A. (1989): Adults of the British aquatic Hemiptera Heteroptera a key with ecological notes.- Freshwater Biological Association Scientific Publication No. 50, Ambleside.

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Section 02 - Talk

Diversity and evolution of the planthopper taxon Bennini in Southeast Asia (Hemiptera: Fulgoromorpha: Cixiidae)

H. Hoch

The cixiid tribe Bennini is a taxon widely distributed in Southeast Asia. Bennini species are characterized by a structure unique in insects: adults of both sexes display a conspicuous rod-like process arising (bi-)laterally from the base of the abdomen. Distally, the tip of the rod is slightly enlarged and apically concave, bearing at least two types of sensillae. Wax-glands situated on the margin of the „cup“ produce a hollow hood which provides a cover for the sensillae. Prior to the current study 22 Bennini species were known mainly from the Philippines, Borneo, New Guinea, the Sunda Archipelago, New Guinea, Caroline Islands and the Solomon Islands. So far 98 taxa have been recognized (in addition to the known species, which – with the exception of one species – could be re-examined) which on the basis of morphological characters must be interpreted as new species. This is an increase of 500 %.

The lateral sense organ as described above is homologous in all Bennini species, providing a strong argument for the monophyly of the taxon and thus rendering it a potentially well-suited model to help clarify the complex geologic history of the area. Centers of species density are the Philippines, Borneo, Sulawesi, New Guinea and the Solomon Islands. Patterns of geographic distribution of the Bennini are determined by high levels of local endemism, which may or may not reflect insufficient geographic coverage of sampling. Preliminary results of a phylogenetic analysis based on morphological characters revealed vicariance as well as radiations underlying local diversity. Interestingly, Bennini are rather uniform in external characters (head carination, wing venation, even wing coloration) but display a wide range of disparity in male and female genital configurations, suggesting that sexual selection may play a significant role in driving diversification. It appears logic to assume that the abdominolateral sense organ has some function in mate location and – recognition. In 2010, the first ever known nymphs of Bennini could be collected in a cave on the Island of Bohol, Philippines. They do not display the fully developed organ, but autoluminescence microscopy revealed that the abdominolateral organ is visible at least in the IV. and V. instar. It can thus be assumed that they are indeed functional only in adults. Little is known about intraspecific communication in the Bennini, however, in one species from Sulawesi, we could observe that males and females produce low-frequency substrate-borne vibrations, not strikingly different from those of other planthoppers. Consequently, alternative hypotheses on the function of the abdominolateral organ are conceivable.

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Section 02 - Talk

Function and evolution of setal tracheal gills in small adepagan water beetles (Hydradeephaga)

S. Kehl & K. Dettner

Adult adepagan water beetles (Coleoptera: Dytiscidae, Noteridae, Haliplidae and Gyrinidae) rely on a subelytral air store for respiration, which has to be renewed at the water surface in regular intervals. The dive duration varies from a few minutes to 24 h depending on species, activity and temperature. However some species remain submerged for several weeks. In this species, fine structure analyses of the beetles surface showed specialised setae, mainly distributed on the elytra, which acts as tracheal gills. Screening a wide variety of adepagan water beetles showed that many of them are equipped with setal tracheal gills and gives an insight into the function and evolution of this new respiration technique.

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Section 02 - Talk

Chemical communication as a genetically barrier – When sex pheromones do not attract mating partners from other populations.

C. König, J. L.M. Steidle, T. Tolasch

Sex pheromones play an important role in mate finding and recognition of many animals, especially in insects. Concerning the species specificity of pheromones a speciation process, triggered by a modification in the composition is deemed to be one potential factor in speciation.

The Identification of sex pheromones from different click-beetles (Coleoptera, Elateridae) revealed for one species, *Idolus picipennis* (BACH, 1852) the existence of at least three different forms, separated by completely different sex pheromones. In field tests, conducted with synthetic pheromone mixtures the different forms were caught in high numbers exclusively in traps baited with their respective own pheromones, even in sympatric populations of two forms. This indicates that *I. picipennis* is a mixture of at least three distinct species. Before this study, the species was thought to be the only member of its genus in Europe.

Extensive morphometrical studies of preserved museum specimens from numerous localities show a wide distribution of two of the forms over Central Europe, while the third form is only known from one locality so far. First results of molecular biological studies showed minor but constant differences (0.3-0.8%) in the COXII region and no differences between the populations in a partial region of the gene COI. This points to a very recent separation of the different forms.

It is discussed that changes in the pheromone composition might have played an important role in this separation event.

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Section 02 - Talk

Die antennalen Sensillen von Grabwespen – Vergleichende Morphologie und phylogenetische Signifikanz (Hymenoptera: Apoidea)

S. Krause & M. Ohl

Die Antennen aculeater Hymenopteren sind mit zahlreichen Sinnesorganen, Sensillen, ausgestattet, die als Chemo-, Mechano-, Thermo- und Hygrorezeptoren dienen und eine wichtige Funktion beim Reproduktionsverhalten (einschließlich Nestbau- und Beutefangverhalten) sowie bei der inter- und intraspezifischen Kommunikation haben. Ihre kutikularen Anteile sind komplexe Strukturen, auf denen die morphologische Unterscheidung verschiedener Sensillentypen basiert. Die Mehrheit der bisher veröffentlichten Studien widmet sich jeweils nur einer oder sehr wenigen Arten, und die Homologisierung von Sensillen innerhalb der Aculeata ist oft problematisch. Eine einheitliche Sensillen-Klassifikation konnte bisher nicht etabliert werden. Das Vorkommen von bestimmten Sensillentypen, ihre Dichte, Verteilung und spezifische Morphologie sind Merkmale, die potentiell für phylogenetische Analysen verwendet werden können. Da die Antenne und ihre Sensillen in enger Assoziation mit ihren spezifischen biologischen Funktionen evolvierten, kann ihre Ausprägung nicht allein in einem phylogenetischen Kontext verstanden werden. Die Hauptziele des laufenden Projekts sind daher die vergleichende morphologische Untersuchung und Beschreibung der Antennen und antennalen Sensillen der Aculeaten sowie die Untersuchung ihrer phylogenetischen Signifikanz. Der Schwerpunkt liegt dabei auf den Grabwespen (*Sphecidae sensu lato*), eine morphologisch diverse Gruppe mit fast 10.000 beschriebenen Arten und einer Vielfalt an Reproduktionsstrategien.

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Section 02 - Talk

Fossil rhopalosomatid wasps revisited (Hymenoptera)

V. Lohrmann

The family Rhopalosomatidae is still one of the least known hymenopteran groups. As far as is known, members of the family, whose recent fauna is largely limited to the subtropics and tropics, are ectoparasitoids of crickets. Four fossil taxa are currently assigned to the family, the oldest dating back to the early Cretaceous. Whereas the family assignment of the three known compression fossils tentatively placed in Rhopalosomatidae is rather controversial, the affinities of *Eorhopalosoma* (with two known fossils) from Burmese amber and an additional undescribed species from Dominican amber are fairly clear. The amber specimens share most diagnostic features of the modern macropterous genera, such as the characteristic wing venation, the large ocelli or the apical bristles on the first flagellomeres. Nevertheless, the presence of only one apical bristle on each basal flagellomere and a quadridentate mandible in *Eorhopalosoma* suggests that the burmite fossils are intermediate between the enigmatic, brachypterous genus *Olixon* and the modern macropterous forms.

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Section 02 - Talk

Die männlichen Genitalorgane von *Suocerathrips linguis* (Phlaeothripidae) und *Frankliniella occidentalis* (Thripidae) (Thysanoptera)

J. Joel, J. Teuber & G. Moritz

Die Genitoanalsegmente der Thysanoptera sind entsprechend der Differenzierung der Geschlechtsorgane sowohl zwischen Weibchen und Männchen sowie auch zwischen den beiden Unterordnungen Terebrantia und Tubulifera sehr unterschiedlich gestaltet. Ziel der Untersuchungen ist es insbesondere die morphologischen Besonderheiten der inneren und vor allem äußeren Gestaltung des männlichen Reproduktionssystems bei *Frankliniella occidentalis* (Terebrantia) und *Suocerathrips linguis* (Tubulifera) herauszustellen. Übereinstimmend besteht die innere Ausstattung aus mesodermalen, paarigen Testes sowie den Vasa deferentia, die caudal zu einer Vesicula seminalis erweitert sind. Beide Vesiculae münden in den unpaaren, mit einer Intima ausgekleideten Ductus ejaculatorius ein. Ebenfalls befinden sich hier die Ausführungsgänge der einfach (Terebrantia) bzw. doppelt (Tubulifera) paarigen akzessorischen Anhangsdrüsen. Die äußeren ektodermalen Strukturen zeigen eine mediane Phallobasis, die lateral von paarigen Parameren gestützt wird. Der zentral durch die Phallotheca gebildete Hohlraum dient der Aufnahme der ausstülpbaren Endotheca inklusive Aedeagus. Während bei den Tubulifera Phallo- und Endotheca stärker sklerotisiert sind, stabilisieren bei den Terebrantia längere, unterschiedlich mit Sensillen ausgestattete Paramere und bislang unbeschriebene endothecale Skleritstrukturen die distale Genitalarmatur während der Kopulation. Bei kopulierenden Tieren wird der Ovipositor weit dorsocaudal abgeklappt, wodurch ein umfassendes Eindringen der gesamten Genitalsklerite zu beobachten ist. Dabei dienen Paramere und endothecale Strukturen der optimalen Ausrichtung der Gonopore zum Ductus spermathecae.

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Section 02 - Talk

Transfer und postkopulatorisches Schicksal der Spermiozeugmen bei *Pterostichus nigrita* PAYKULL 1790 (Coleoptera: Carabidae)

S. Schneider & H.-J. Ferenz

Neben vielgestaltigen Spermien, können verschiedene Insektenarten Spermienkonjugate herstellen. Bildung und Bedeutung dieser Strukturen sind bisher unzureichend verstanden. Auch der Laufkäfer *Pterostichus nigrita* bildet solche Konjugate. Diese sogenannten Spermiozeugmen bestehen aus 2-4 mm langen hyalinen Trägerfäden, an denen beidseitig 30-40 Spermatozoenbündel über ihre gesamte Länge angeknüpft sind. Um Rückschlüsse auf die Bedeutung dieser besonderen Spermienkonjugate ziehen zu können, wurde die Übertragung der Trägerfäden während der Kopulation, sowie ihr postkopulatorisches Schicksal analysiert. Mit histologischen und elektronenmikroskopischen Methoden konnten in verschiedenen Phasen der Kopulation beteiligte Strukturen und Prozesse erkannt werden. Im weiblichen Genitaltrakt von *Pt. nigrita* fand sich in der Spermathek eine ungewöhnliche, bisher unbeschriebene Dornenstruktur. Wir schließen aufgrund unserer Beobachtungen auf folgenden Verlauf der Begattung: Während der Kopulation werden die Spermiozeugmen, eingepackt in Anhangsdrüsensekret in einer Spermatophore, in der Bursa copulatrix des Weibchens deponiert. Sofort nach der Kopulation lösen sich bereits hier die ca. 380 µm langen Spermien vom Trägerstab und gelangen in die Spermathek, wobei der Dorn für den Transport und die korrekte Lagerung der Spermien notwendig ist. Die Trägerfäden verbleiben im Spermathekenausführgang. Dort sind sie auch 8 Wochen nach erfolgter Kopulation noch anzutreffen.

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Section 02 - Talk

A preliminary molecular cladistic analysis of the dipteran family Sciaridae (Insecta, Nematocera)

J. Seeber, K. Heller, W. Arthofer, A. Rief & M. Traugott

Sciaridae are a dipteran family distributed worldwide and containing about 1700 named extant species. Until now, their classification in genera has been conducted solely based on morphological characteristics (in earlier times only wing venation, nowadays mainly genitalic characters). Sciaridae are extremely uniform in general aspect and the few distinguishing characters used for generic classification appear to be very variable throughout the family. We attempt to verify the existing classification by analysing DNA sequences of a mitochondrial (cytochrome c oxidase subunit 1) and a nuclear gene (18S). Aligned sequences will be analysed by Bayesian inference, and species specific sites will be identified.

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Section 02 - Talk

Functional integument surface of easy bleeder sawfly larva, *Rhadinoceraea micans* (Hymenoptera, Tenthredinidae)

D. Voigt, S. Gorb & J.-L. Boevé

The integument surface of some sawfly larvae is covered with wax crystals. These species are able to easily bleed haemolymph. Non-wettability has been recently suggested to be the main function of these waxes. We investigated intact, peeled and replicated states of cuticle surfaces of sawfly larvae by using cryo-scanning electron microscopy and contact angle measurements with Aqua Millipore water. The easy bleeder *Rhadinoceraea micans* (Klug) (Tenthredinidae, Blennocampinae) showed rather complex surface structures, hierarchically arranged at three different levels (annulets, hill-shaped sculptures, and wax crystals), whereas the cuticle surface of the non-easy bleeder *Nematus pavidus* Serville (Tenthredinidae, Nematinae) appeared less complex, being smoother and wavier. Contact angles of water on the intact cuticle were 172° dorsally and 120° ventrally (median values) in *R. micans*, whereas only 67° dorsally and 47° ventrally in *N. pavidus*. After peeling off the waxes, the wettability of *R. micans* decreased significantly. Resin replicas of the intact cuticle surface were hardly wettable in both species. We suppose that epicuticular crystalline waxes significantly contribute to the surface superhydrophobicity and probably self-cleaning mechanisms in the easy bleeding larvae of *R. micans*, because the combination of waxes with two further structural levels (annulets, sculptures) results in a distinct roughness and air pocket inclusions, decreasing the effective contact area between the solid and liquid. It is likely that, generally, the integument surface of easy bleeders is adapted to their particular defence strategy, contributing to both the maintenance of released haemolymph droplets and the avoidance of self-contamination with this fluid. Additionally, the superhydrophobicity of *R. micans*' body surface may have another important ecological function, such as preventing drowning, since this species lives in a semi-aquatic environment.

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Section 02 - Talk

Reconstructing the phylogeny of Cixiidae (Hemiptera: Fulgoromorpha) - female genitalia as a new character complex

M. Zilch

Cixiidae are regarded a plesiomorphic group of Fulgoromorpha. Neither the monophyly of the Cixiidae nor the phylogenetic relationships within the Cixiidae have been satisfactorily clarified (COETTO & BOURGOIN 2008; COETTO et al. 2008).

While also the high variability in male genitalia among species is widely used for identification within the taxon, especially female genitalia have been little studied and have hardly been used for classification. The external and internal structures of this complex have hitherto been described only in some fulgoromorph taxa. Here complex structures with highly differentiated characteristics between different genera and species can be found, e.g., reduction and (secondary?) enlargement of the ovipositor, size and shape of the wax-producing plate on tergite IX, distribution and shape of wax-secreting pores on tergite IX and anal tube. Even cryptic internal structures such as the sclerotized plates on the wall of the copulatory chamber might not only be of high diagnostic value (REMANE & ASCHE 1979), but may carry phylogenetic signal.

In my study I will investigate the internal and external female genital complex by classical methods such as light microscopy and scanning electron microscopy (SEM) as well as by non-invasive high-resolution Micro-Computed Tomography (Micro-CT). This technique uses x-rays to create cross sections of an object allowing to create virtual three-dimensional reconstructions of the structures to be analyzed. By this it is hoped that a better understanding of the functional morphology and the evolutionary transformation of the female cixiid genitalia can be achieved.

In the end the following questions should be answered: Which morphologically (and ethologically) configurations of the female genitalia can be found within the Cixiidae? What is the ground pattern (set of characters in the hypothesized ancestral species)? Which evolutionary transformations are likely to have taken place within the taxon?

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Coetto P., Kergoat G.J., Rasplus J., Bourgoïn T. (2008): Molecular phylogenetics of cixiid planthoppers (Hemiptera: Fulgoromorpha): New insights from combined analyses of mitochondrial and nuclear genes. - *Molecular Phylogenetics and Evolution* **48**: 667–678.

Remane R. & M. Asche (1979): Evolution und Speziation der Gattung *Cixius* LATREILLE 1804 (Homoptera Auchenorrhyncha Fulgoromorpha Cixiidae) auf den Azorischen Inseln. – *Marburger Ent. Publ.* **1**(2): 1-126.

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Section 03 - Talks

Biogeography and faunistics

Section 03 - Keynote

Faunistics - Quo vadis?

P. Schnitter

Faunistics as a subsection of zoogeography is dealing with data collection of wild living animals on a scientific basis. As a neglected topic it requires purposeful rediscovery and constant promotion in the coming years.

Specialists in faunistics need both, excellent expertise and a long experience in identification of species. Recently, the number of such specialists has much decreased, and many of them are getting on in years. Urgently needed successors are not in sight – not least because of inadequate training at the universities. The time available to complete bachelor or master thesis is short, and practical training periods are extremely limited. Lack of experts in some fields is an obvious result.

However, zoology and botany are classical biological disciplines, and communication of knowledge at academic level is an essential requirement for faunistic research. In this context, scientific collections in museums and institutes play a vital role. Unfortunately, they do not receive the attention and support they really deserve.

A look at the “Biodiversity Strategy” of the German government shows that species expertise is indispensable for the scientific research and protection of fauna and flora. This applies also to the practical implementation of international nature protection directives, such as the European Flora-Fauna-Habitat Directive.

The overall situation – with all its chances and challenges - shall be addressed from the perspective of a federal state conservation authority.

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Section 03 - Talk

The influence of succession on Carabid - biocenosis of a former military training area in Upper-Lusatia

C.M. Heidger, F. Menzel & S. Moll

The natural succession on a former military training area was monitored from 1999 to 2010. It is situated in an area of dunes and after the end of utilisation in the year 1990 the open sand areas created through tank driving are colonized by vegetation. Botanical investigations of different seral stages were performed with the method of BRAUN-BLANQUET each year. It was found that the following stages were present at the investigation site at the same time: open sand areas, dry grassland with *Corynephorus canescens*, areas dominated by mosses and lichens (*Cladonia* sp.) with young pines (*Pinus sylvestris*), patchy birch (*Betula pendula*) forests. The succession area is surrounded by monotonous pine plantations of different age.

At each seral stage 10 pitfall traps were placed and the Carabid species were analysed. In the years 2000 and 2008 the traps were active during the whole vegetation period and in the other years only for one week at the end of July.

The results showed a strong dependence of specialized species on certain stages of succession. The psammophil species only occurred in early stages of succession. Silvicol species were already present in a natural birch forest and in a pine plantation nearby. But the biodiversity in the pine plantation was much lower than in the birch forest.

A first record of the Red List species *Miscodera arctica*, which is critically endangered in Saxony, was made for this area at a border between a young pine forest and a succession stage with mosses dominating the herb layer and a few pines which have colonized in a low density forming the shrub layer. Open sand was still present at the border between the two habitats. Further German Red List species like *Harpalus flavescens*, *Harpalus neglectus*, *Harpalus autumnalis*, *Harpalus servus*, *Masoreus wetterhallii*, *Amara quenseli silvicola* were predominantly psammophil and or xerophil and mainly occurred at the first stages of succession with low plant coverage.

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Section 03 - Talk

Phylogeography of grasshoppers on the Canary Islands

A. Hochkirch, Y. Görzig, K. Gölsdorf, M. Husemann & J. Deppermann

Volcanic archipelagos represent excellent areas to study colonization and speciation processes. The Canary Islands are known as an ideal study system as the volcanic history of these oceanic islands is well known. We studied the phylogeography of two grasshopper genera, the flightless endemic genus *Arminda* and the fully winged genus *Sphingonotus*, which is widespread throughout the old world. We sequenced mitochondrial and nuclear gene fragments to infer the phylogeny of both genera and reconstruct their colonization pattern. While the phylogenetic relationships in the genus *Arminda* strongly support a stepping stone colonization model from East to West (corresponding to the prevailing ocean currents), the phylogeny of *Sphingonotus* suggests a multiple colonization history with origin of seven endemic species and recent colonization of two widespread species. Within-island speciation events occurred at least twice in *Arminda* (on Tenerife and on Gran Canaria), while the genus *Sphingonotus* colonized the Canary Islands at least eight times independently. Wind-dispersal might explain this pattern. While strong storms are known to transport insects from the African continent to the Canary Islands, this mode of dispersal might not occur between the islands. Thus, ancestral lineages might have colonized single islands without inter-island exchange. Although *Sphingonotus* species are generally good flyers, most endemics are rather small and thus might actively not reach other islands.

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Section 03 - Keynote

Autökologische und molekularbiologische Untersuchungen zur Charakterisierung der Kleidermotte *Tineola bisselliella* (Lepidoptera: Tineidae) als Referenzorganismus

B. Krueger-Carstensen & R. Plarre

Um eine Vergleichbarkeit von Schutzverfahren gegen Material schädigende Insekten gewährleisten zu können sind Referenzorganismen erforderlich, die für ihre Funktion als Modellorganismus eindeutig ökologisch und genetisch charakterisiert sind. Dies spiegelt sich in den Konzepten der Öko- und der Genospezies wider.

Dieser Vortrag präsentiert autökologische, faunistische und molekularbiologische Untersuchungen an der Kleidermotte *Tineola bisselliella*, einem weltweit wirtschaftlich bedeutsamen Materialschädling. Fragen zum natürlichen Habitat, zur Ausbreitung und zur Befallswahrscheinlichkeit werden diskutiert und Möglichkeiten einer eindeutigen genetischen Identifizierung aufgezeigt.

In Klimakammern wurde das Schlupfverhalten der Kleidermotte in Bezug auf Anzahl und Zeit unter verschiedenen Kombinationen der beiden abiotischen Faktoren Temperatur und Luftfeuchtigkeit (RF) getestet. Unter Berücksichtigung des mitteleuropäischen gemäßigten Klimas widersprechen die ersten Ergebnisse zunächst nicht dem möglichen Vorkommen in natürlichen Habitaten Deutschlands. Freilandfänge in und um Berlin deuten auf lediglich eine Generation pro Jahr mit saisonaler Abundanz hin und lassen eine komplexe Korrelation der Anzahl gefangener Kleidermotten mit der Umwelt des Fundortes vermuten. Molekularbiologische Untersuchungen sowohl auf der Ebene der Spezies als auch von Subspezies sollen nun zu einer zusätzlichen Artcharakterisierung und einer möglichen Populationsdifferenzierung herangezogen werden. Damit können Erkenntnisse über den Genfluss verbunden mit Hinweisen zur Schädlingsverbreitung von *Tineola bisselliella* gewonnen werden.

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Section 03 - Talk

Towards a checklist of the western Palaearctic bees – first results and the role of amateurs

M. Kuhlmann

Bees are the major pollinators of flowering plants and of more than half of all crop species and thus are ecological and economic keystone species. Despite this, knowledge of bees is still fragmentary in many parts of the world including large parts of the western Palaearctic region. To tackle this problem an attempt has been made to compile a checklist of the bees (Hymenoptera, Apoidea, Anthophila) of the western Palaearctic region with the help of fellow taxonomists. The checklist is planned to be published online using Scratchpads (www.scratchpads.eu) and will include synonyms and species records at a country level. Currently about 3340 bee species in 101 genera are known from this region. The ten most speciose genera comprise 67% of all bee species with one fifth of the total fauna in *Andrena* alone. The Mediterranean Basin and Asia Minor are the centres of species diversity.

In the past two decades the taxonomic knowledge base for bees has been eroded dramatically in Europe, especially for many taxonomically challenging and speciose genera. In Europe we currently have 15 expert bee taxonomists with eight professionals (two close to or past retirement age) covering 21 genera (21%) and 1298 species (38.9%) and seven amateurs (two close to or past retirement age) covering 62 genera (62%) and 2366 species (70.9%). For 316 species (9.5%) in 18 genera (18%) no expert taxonomists are available. There is almost no overlap of expertise between amateurs and professionals or between the older and younger generations respectively. Thus, each expert has a unique and irreplaceable taxonomic knowledge. Due to lack of interest in taxonomy vital expertise is likely to be lost on a large scale within the next few years as knowledge is not passed on to the younger generation.

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Section 04 - Talks

Landscape ecology and nature conservation

Section 04 - Keynote

Future landscapes for insect conservation

M. Samways

Insects are the most speciose component of terrestrial compositional biodiversity. Their biomass is also substantial, and they are also highly connected in many food webs, and so insects inevitably feature strongly in many aspects of functional biodiversity. This means that if we are serious about conserving biodiversity at the landscape level, we must consider insects, and other invertebrates. These animals would span the spectrum from rare and threatened ecological specialists through to widespread and common generalists. Inclusion of all these ecotypes, from specialist pollinators to soil generating detritivores, means that insects must be mainstreamed into all aspects of conservation of functional biodiversity and ecosystem processes.

The field of insect conservation is coming of an age where some general principles are emerging, starting with a foundation of five design principles and a golden thread. The principles are 1) maintain reserves, 2) maintain as much quality landscape as possible, 3) reduce contrast between landscape elements, 4) outside reserves, bring in land sparing, and, 5) link areas of quality habitat. All these are aimed at maintaining the triple golden thread of large patch size, improved patch quality, and reduced patch isolation. This trio maximizes opportunities for optimal conservation metapopulation dynamics, and increases opportunities for survival in the face of climatic adversity, short and long term. Instigation of these principles can be done through development of large-scale ecological networks, which are part of the ongoing process of designing landscapes for the future.

Upon this design base are several overlays, all of which are interrelated and interactive. The first overlay hinges on the appreciation that landscapes are dynamic and their conservation requires the integrated management principle of simulating natural disturbance. This management overlay ties in closely with all the five design principles. A further overlay includes incorporating the mesofilter, which includes features such as topographic heterogeneity, resources for particular life activities, and resources as habitats e.g. dead wood. Another overlay is the fine-filter, species approach, where certain focal species are given particular attention, with Red Listed species coming to mind. Then there is the socio-economic overlay, where the needs of humans are also considered across the integrated landscape matrix. The aim here is to optimize agricultural production while maximizing biodiversity conservation. All these overlays together are an integrated approach which mainstreams insect conservation into the current and future overall global conservation goals of maintaining biodiversity at current levels and sustaining ecosystem processes.

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Section 04 - Talk

Use of Northern Marsh Harrier raptor nests as shelter for arthropods

M. Gercken, M. Stubbe, M. Egas & R. Simmons

During the summer 2010 particularly one eyrie of a Northern Marsh Harrier (*Circus aeruginosus*) has been manifold controlled for the purpose of sampling specimen of insects and spiders, which use the raptor nest either as shelter, i.e. nest inhabitants, or merely as a source of diet, i.e. nest visiting arthropods. Collected specimen chiefly revealed diverse representatives of beetles, dragonflies, flies, hymenoptera and spiders. Moreover also many leeches have been discovered in the imminently surrounding of the harrier's nest and, as a peculiarity, in the interior nest as well. In the latter case it turned out that these leeches have used the eyrie as a source for reproduction, which the observed cocoons clearly show. Likewise together with these leeches inside the nest some larvae and pupae of diving beetles (*Dytiscidae*) have also been found. The harrier's offspring was three juveniles, from which one has later died at the nest. However, only two of these birds could be captured for scientific purpose and thus, when inspecting the juveniles, blood-sucking louse flies (*Hippoboscidae*) have been sampled. Our findings contribute to specific nest ecology studies of birds of prey and give some impressions on possible interactions between and among arthropods in means of particular food webs taking place at raptor nests. Eventually, concerning the observed leeches with focus on breeding birds and their offspring, we argue what role these tiny organisms may play and if they may have any effects on the health of these birds. Similarly we also question our findings, if there is any co-existence between these leeches and the detected larvae and pupae of diving beetles (*Dytiscidae*).

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Section 04 - Talk

Agricultural intensification differentially affects syrphid communities in northern and central Europe

S. Haenke, C. Winqvist, C. Thies, J. Bengtsson & T. Tschamtké

Species richness and abundance of natural enemy taxa may vary largely across regions owing to climate, landscape, and land use and have implications for ecosystem services such as biological pest control and pollination, but such changes are poorly explored. Syrphid flies are among the largest groups of dipteran flies involving over 700 species in Europe. Adult syrphids predominantly feed on pollen and nectar, while their larvae exhibit various trophic guilds such as zoophagous, phytophagous and saprophagous feeding types. We analysed syrphid fly abundance and species richness in cereal fields in Sweden and Germany. In each of these two regions, four fields were managed at low levels of agricultural intensification (with no or only little applications of mineral fertilizer and chemical pesticides), and located in structurally complex landscapes, and four fields were managed at high levels of agricultural intensification (highly fertilized, but insecticide-free) and located in simple landscapes with high proportions of arable land (>90%). Thus, agricultural intensification was simultaneously varied at the local and the landscape scale in our experiment, and this variation represented typical conditions for each region. Total syrphid abundance and species richness was higher in Germany compared to Sweden, while agricultural intensification affects the trophic guild differentially in the two study regions. Aphidophagous species such as *Episyrphus*, *Sphaerophoria* or *Eupeodes* were more abundant in intensively managed landscapes with high proportions of crop fields, while other trophic guilds were more abundant in landscapes with low levels of agricultural intensification, especially in Germany. Facilitation initiatives should therefore take into account the regional changes of community composition, and region-specific response to agricultural intensification rather than focus on indirect indicators such as landscape and/or local field diversification.

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Section 04 - Talk

The influence of succession on Carabid - biocenosis of a former military training area in Upper-Lusatia

C.M. Heidger, F. Menzel & S. Moll

The natural succession on a former military training area was monitored from 1999 to 2010. It is situated in an area of dunes and after the end of utilisation in the year 1990 the open sand areas created through tank driving are colonized by vegetation. Botanical investigations of different seral stages were performed with the method of BRAUN-BLANQUET each year. It was found that the following stages were present at the investigation site at the same time: open sand areas, dry grassland with *Corynephorus canescens*, areas dominated by mosses and lichens (*Cladonia sp.*) with young pines (*Pinus sylvestris*), patchy birch (*Betula pendula*) forests. The succession area is surrounded by monotonous pine plantations of different age.

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Section 04 - Talk

Restoration of a Danube floodplain forest: Initial state of ground dwelling Carabid and Staphilinid communities

M. Kilg, R. Schopf & A. Gruppe

Due to river embankment and straightening started up in the early 19th century 75% of floodplain forest areas in Bavaria got lost (MARGRAF, 2004). On the Upper Danube between Neuburg and Ingolstadt a restoration project was raised to bring back hydrological dynamics to a former hardwood floodplain forest. A new established permanent watercourse should revitalise groundwater level fluctuation and assure morphological dynamics in a small scale. Additionally, artificial ecological flooding (0-4 times a year, depending on Danube water level) should provide flooding of lower level areas and subsequently restore habitat types adapted to frequent undulation (STAMMEL et al, 2010 subm.). In an interdisciplinary monitoring project an assessment of results of the measurements will be compiled. Hence a detailed analysis of the initial state prior to ecological flooding is essential. From the faunal point of view arthropods and particularly beetles are suitable taxa to show effects of environmental factors and here ground dwelling Carabidae and Staphilinidae are taken exemplarily. Carabid and Staphilinid communities of four habitat classes (three defined by surface relief and a fourth by a geological exception) are compared in order to recognize actual differences between them. With special emphasis on hygrophilous and typical floodplain dwelling species we hypothesise shifts in species assemblages due to ecological flooding.

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Section 04 - Talk

The impact of spatial and temporal variables on functional groups of carabid beetles at set-asides in the agrarian landscape

R. Platen, G. Berger & S. Malt

The effects of abiotic and biotic environmental variables at set-asides as well as of the surrounding landscape matrix on functional groups of carabid beetles, such as ecological group, preferred habitat type, wing morph, and hibernation type were investigated. The plots were located within or on the edges of cereal fields. The animals were caught by pitfall traps on 18 plots in the northeastern lowland of Brandenburg, Germany during the years 2000-2002. The composition of the coenosis was analysed by Principal Component Analysis (PCA). The PCA-diagram showed that the distribution of the species was arranged in accordance to the habitat conditions at the set-asides, so that clusters of dry sandy plots, thermophilic summits and wet spots were clearly separated. Multiple Linear Regressions were performed to test the impact of spatial and temporal variables on the functional groups, using three different models: i) Soil-microclimate, ii) Vegetation structure, iii) Spatial-temporal. The target variables were i) the number of species ii) the number of individuals iii) the bodymass. The results revealed that the soil texture does not affect the number of species and the bodymass to a great extend. The number of individuals of xerophilic species are positively correlated with coarse soil fractions and negatively correlated with soil moisture. The number of hygrophilic species and the bodymass are positively correlated with cover values of different vegetation layers, whereas the number of individuals of xerophilic species was negatively correlated with cover and height of the vegetation. Besides the distance to waters, which diminished the numbers of xerophilic species, individuals as well as the bodymass, the landscape matrix had only little impact on the target variables of the coenosis. The age of the set-asides benefits the number of individuals and the body mass of brachypterous species whereas the corresponding numbers of dimorphic and macropterous species are negatively correlated. Set-asides with no or only few management activities have an increasing effect on the numbers of all the target variables with significant results. The spatial and temporal variables tested on a local and on a landscape scale had a differentiated influence on functional groups of the coenosis of set-asides in the agrarian landscape. From this study, we conclude that variables at a local scale, such as soil texture, microclimate and vegetation structure have a greater impact on the functional groups of ground beetles than the landscape matrix.

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Section 04 - Talk

Density, diversity and community structure of gamasid mites in grassy arable fallows of different age

J. Wissuwa, J.-A. Salamon & T. Frank

The density and diversity of gamasid mites (Gamasina and Uropodina) were investigated in nine grassy arable fallows according to a factorial design with age (young: 2-3, middle-aged: 6-8, old: 12-15 years) and plant (legume: *Medicago sativa*, herb: *Taraxacum officinale*, grass: *Bromus sterilis*) as fixed factors. 4 plots were randomly chosen at each fallow in May 2008. At each plot plant roots and the adjacent soil of 5 stochastically selected plant individuals were dug out with steel cylinders for heat extraction of soil fauna and measurement of environmental parameters.

GLM analysis using SAS revealed a significant effect of the plant species with higher mite density in *B. sterilis* than in *T. officinale* samples. Intermediate density occurred in *M. sativa* samples. The density of uropodine mites which comprised 2.3 % of all individuals was significantly higher in young than in old fallows with middle-aged fallows having intermediate mite numbers. No effect of age or plant was shown for mite diversity.

In total 83 mite species were identified. The most abundant and frequent species were *Asca bicornis*, *Hypoaspis aculeifer*, *Rhodacarellus silesiacus*, *Leiioseius bicolor*, *Hypoaspis kargi* and *Alliphis siculus*. Altogether the communities of the fallows were dominated by roughly 25% of all encountered species.

A canonical analysis of principal coordinates shows that mite communities were different between age classes. In a leave-one-out cross validation 78% of all samples were correctly classified into their respective age class. Appropriate mite species that discriminate well between age classes were e.g. *H. aculeifer*, *Amblyseius bidens* and *Arctoseius cetratus* according to the results of GLM analysis, SIMPER procedure in the statistic program PRIMER and dominance classification.

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Section 05 - Talks

Invasive insects

Section 05 - Talk

Invasive Longicorns in Bavaria – Anything else than Asian Longhorned Beetle (ALB)?

U. Benker

Since 2004 the plant protection service of Bavaria has to deal with the Asian Longhorned Beetle *Anoplophora glabripennis* (Motschulsky, 1853), ALB as abbreviated designation. This Cerambycid beetle was very probably introduced from China with wood packaging material used for transporting granite. Adult beetles emerged from the wooden pallets and were successfully building up an open land population in the village Neukirchen/Inn – rural district Passau. Over the last seven years the following deciduous trees have been detected as host plants of *A. glabripennis* in Bavaria: Maple (*Acer* spp.), birch (*Betula* spp.), white chestnut (*Aesculus hippocastanum*), willow (*Salix* spp.) and poplar (*Populus* spp.). By means of eradication like constantly monitoring, cutting the trees, chipping and burning the wood the population of ALB in Neukirchen/Inn could be depressed to a present low level. The infested area is still around the graveyard within a radius of about 500 metres. Into the forestal area the population of *A. glabripennis* couldn't yet extend.

The near related longicorn species *Anoplophora chinensis* (Forster, 1771), abbreviated as CLB for Citrus Longhorned Beetle, was for the first time found in June 2007 in Bavaria. In the rural district Neu-Ulm a single female beetle was sitting near to a wooden pallet with an exit hole. The country of origin was again China. In 2008 some specimen of CLB were spread within Germany in *Acer palmatum* ornamental trees offered by two big discounters. But no case of reproduction could be confirmed in Bavaria.

The third invasive species worth mentioning is the Japanese Pine Sawyer *Monochamus alternatus* Hope, 1842. In 2009 this species used two different ways of travelling from China to Bavaria. Firstly inside the well-known wooden pallet, furthermore in a toy table.

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Section 05 - Talk

East Asian pest of elms spreads in Europe: The zigzag sawfly *Aproceros leucopoda* (Hymenoptera: Argidae)

S. M. Blank, G. Csóka, Y. Gninenko, T. Huflejt & G. Véték

The “zigzag sawfly” *Aproceros leucopoda* Takeuchi, 1939 originates from East Asia. At least since 2003 the invasive species has spread over a vast area in south-eastern Europe. The larvae can completely defoliate native and non-native elms (*Ulmus spec.*) and may cause at least partial dieback. Field observations indicate that elms are infested independent of their age and site characteristics. Parthenogenetic reproduction, short life cycle of summer generations and the ability to produce four generations per year result in the production of numerous progeny. The evolution of a seasonal dimorphism in head morphology, a simple cocoon that is attached directly to the host plant and a short period spent in the cocoon in summer generations, are putative apomorphies shared by *Aproceros* and *Aprosthemina*. These traits reduce developmental costs and contribute to the proliferation of *A. leucopoda*. No specialized parasitoid is known that can effectively reduce outbreaks of this species. Meanwhile *A. leucopoda* has been recorded for Austria, Hungary, Poland, Romania, Slovakia, the Ukraine (Blank et al. 2010), Moldova (Timuş et al. 2008, “*Arge sp.*”) and Serbia (Hirka 2010). An occurrence in the Krasnodar region of Russia requires taxonomic confirmation. It is likely that this pest will spread into central and south-western Europe. Further monitoring of *A. leucopoda* is required to assess future range extensions in Europe, its exacerbating effect on Dutch elm disease and to find a suitable biocontrol agent.

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Section 05 - Talk

Auftreten und Ausbreitung des Buchsbaumzünslers *Cydalima (Diaphania) perspectalis* (Walker, 1859) in Nordrhein-Westfalen

M. Klug

Seit dem Jahr 2008 werden vom Buchsbaumzünsler verursachte Fraßschäden an *Buxus sp.* in Nordrhein-Westfalen beobachtet. Die bis 5 cm langen Raupen dieses Falters aus der Familie der Pyralidae fressen zunächst meist unbemerkt im Inneren der Pflanzen. Sie skelettieren die Blätter und fressen die Rinde an den Zweigen ab. Die befallenen Triebe und ganze Pflanzen können absterben. In jedem Jahr entwickeln sich mindestens zwei teilweise überlappende Generationen. Die L3- bis L4-Larven überwintern an ihren Wirtspflanzen.

Der Buchsbaumzünsler stammt aus Ostasien (China, Japan, Korea, fernöstliches Russland). Mit importierten Pflanzen wurde er vermutlich in der ersten Hälfte des vergangenen Jahrzehnts nach Mitteleuropa eingeschleppt. In den bekannt gewordenen Befallsgebieten hat er sich in wenigen Jahren etabliert. Er verursacht dort erhebliche Schäden an Buchs in Gärten, auf Friedhöfen und im öffentlichen Grün. Im Herbst 2010 wurden erstmals Raupen in einer Buxusvermehrung festgestellt. Aufgrund seiner versteckten Lebensweise ist eine Bekämpfung schwierig.

Bestrebungen, den Buchsbaumzünsler zum Quarantäneschädling zu erklären und damit Möglichkeiten zur phytosanitären Kontrolle des internationalen Handels mit Buchspflanzen zu schaffen, wurden 2010 von der Europäischen Union eingestellt. Pflanzentransporte und internationaler Handel bergen allerdings auch in Zukunft die Gefahr der großräumigen Verbreitung des Schädling. In den bereits vorhandenen Befallsgebieten ist mit der natürlichen Ausbreitung des Buchsbaumzünslers zu rechnen.

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Section 05 - Talk

Influence of Methoxypyrazines released by *Harmonia axyridis* and *Coccinella septempunctata* on the sensory properties of wine

S. Kögel, J. Gross & C. Hoffmann

Introduced as a biological control agent in North America and middle Europe the Harlequin Ladybird *Harmonia axyridis* has spread all over these countries capable to become an increasing problem for winegrowers. During harvest the beetles feed on grapes and may get crushed with them during processing causing release of hemolymph (containing mainly pyrazines) into the must. These chemical compounds are responsible for a specific alteration of the smell and taste of wine called “ladybird taint”.

Sensory trials on Riesling and Pinot Noir wines produced in 2009 with added live beetles of *H. axyridis* showed that the ladybird taint is detectable at a threshold of 4 beetles per kilogram of grapes. But the sensory detection depends on the winemaking practices and the cultivar. In red wine the sensory threshold of pyrazines is lower (1 ng/l) than in white wine (2 ng/l). In addition, crushed must fermentation also increased the detection limit of the ladybird taint compared to must heating.

In the nineteen seventies and eighties the wine quality in German wine growing region suffered from a contamination with chemical compounds of *Coccinella septempunctata* (7-point-ladybeetle). Cudjoe *et al.* (2005) found that *H. axyridis* has a hundred-fold higher quantity of pyrazines in their hemolymph than *C. septempunctata*. Up to now it is unknown whether there is a difference in the quantity of beetles of the two species necessary to deteriorate wine quality.

In order to answer this question Riesling wines from 2008 were compounded with the hemolymph of both species in triplicate. 8 beetles and 16 beetles were crushed in 6 ml bidest. water and centrifugated. The hemolymph was added to the wine at 8 or 16 beetles per liter. A sensory panel of 10 persons characterized the intensity of the ladybird taint. Interestingly, the wines with 7-point showed a significant higher intensity of ladybird taint than the vials with *H. axyridis*.

The hemolymph of the beetles will be now analyzed with HS-SPME-GC-MS for different pyrazine contents under different conditions (stressed and non-stressed insects) and under different feeding conditions.

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Section 05 - Talk

Interaktive Effekte von Temperatur und dem pyrethroiden Insektizid λ -Cyhalothrin auf die Stechmücken *Aedes albopictus* und *Culex pipiens f. molestus*

A. Kreß, R. Müller, U. Kuch & J. Oehlmann

Einleitung: Die Asiatische Tigermücke *Aedes albopictus* wird durch den weltweiten Handel verbreitet, kommt jedoch noch nicht in Deutschland vor. Unter Berücksichtigung des Klimawandels werden permanente Populationen durch Verbreitungsmodelle für weite Teile Deutschlands vorausgesagt. Als Vektor für mindestens 19 Arboviren stellt *A. albopictus* in Zukunft ein Risiko für die menschliche Gesundheit dar. Bekämpfungsmaßnahmen werden häufig mit dem Vernebeln von Pyrethroiden durchgeführt. Solche Maßnahmen betreffen ebenso die einheimische Fauna, wie z.B. die Stechmücke *Culex pipiens*. Das Ziel dieser Arbeit ist es, die interspezifische Sensitivität der beiden Vektoren an einem exemplarischen Pyrethroid (Karate von Syngenta auf λ -Cyhalothrinbasis) bei 3 Temperaturen zu testen.

Material und Methoden: Es wurde ein *Full-Lifecycle*-Test entwickelt, mit dem die Larvalentwicklung, Emergenz, Paarung und Eiablage von Stechmücken unter Quarantänebedingungen untersucht werden kann. In einer ersten Versuchsreihe wurden 6 bis 9 Konzentrationen von λ -Cyhalothrin mit je 30 L1-Larven beider Stechmücken-Arten bei 20°C getestet, um die letalen Konzentrationen LC₁₀, LC₅₀ und LC₉₀ zu berechnen. In einer zweiten Versuchsreihe wurden diese 3 Konzentrationen bei 20°C, 25°C und 30°C getestet, um eine Veränderung der Ökotoxizität durch die Temperatur aufzuklären.

Ergebnisse: Die LC₅₀ von λ -Cyhalothrin liegt bei beiden Vektoren bei ca. 95 ng/l a.i., jedoch ist *A. albopictus* bei niedrigeren Konzentrationen unempfindlicher und bei höheren Konzentrationen sensitiver als *C. pipiens*. Das Pyrethroid hat eine geringere Toxizität bei höheren Temperaturen. Insgesamt liegen die letalen Konzentrationen, welche zu einer Bekämpfung von *A. albopictus* benötigt würden, so hoch, dass die aquatische Biozönose massiv geschädigt werden würde.

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Section 05 - Talk

Exploring mechanisms behind the invasive success of the ladybird *Harmonia axyridis*

A. Vilcinskas, T. Degenkolb, H. Schmidtberg, R. Röhrich, J. Wiesner & H. Vogel

An increasing number of invasive species characterized by rapid growth and spread of populations after their establishment in new habitats impact negatively both biodiversity and economy. Their invasive success is promoted by several factors among which the lack of specialized natural enemies in colonized habitats is prominent. Theory predicts that strong humoral defenses should also facilitate invasive success because invasive species have to cope with pathogens which they face in their new environments. To test this hypothesis, we analysed the immune system of the ladybird *Harmonia axyridis* because after being introduced in many countries as a biological control agent, it has become an invasive species threatening biodiversity of native ladybirds. Our study elucidates striking differences between the antimicrobial defense of invasive and non-invasive ladybird species. In order to stimulate immune responses we injected bacteria into *H. axyridis* and analyzed its immunity-related transcriptome by next generation sequencing. The discovered diversity of its antimicrobial peptides was higher than in all insect species (including the model beetle *Tribolium castaneum*) for which a fully sequenced genome is available. Our presentation will provide new insight into the mechanisms explaining the invasive success of *H. axyridis*.

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Section 05 -Talk

Climate change impact on Western Corn Rootworm (*Diabrotica virgifera virgifera* LeConte) hatching and larval development in Northern Germany

A. Wilstermann & S. Vidal

Despite considerably quarantine and eradication strategies, Western Corn Rootworm will establish and become a permanent corn pest in Germany. Models based on North American development data indicate a possible spread up to Scandinavia under present-days climate conditions. To date experimental data on Western Corn Rootworm development under North German climate conditions and impact of climate change are missing. In this presentation the results of laboratory experiments of larval development at present-day (weekly mean temperature data collected 1971-2000 from an important corn producing region in Lower Saxony) and moderate predicted climate change conditions (2° C increase till the year 2030) will be presented. The impact of increased temperatures on hatching date, mortality and development rate from egg to third instars were examined. The experiments started with the developmental threshold (11° C) for Western Corn Rootworm eggs (at the beginning of May at present-day conditions and at the middle of April at climate change conditions). Hatching of eggs was simultaneously documented by burying Petri dishes in the soil. Corn was sown either on 1st or 15th of May to examine the impact of plant growth on larval development. The experiments were set up in climatic exposure cabinets, and temperature regimes were adjusted weekly. Each experimental cycle required three month. Corn growth was monitored to correct for biomass effects. The experiments ended by extracting the larvae from the soil via a Kempson device. Larvae were counted, instars were determined and their mortality, nutritional conditions and development stages were assessed. As expected, a shift in hatching time was detected from the end of June (present-day condition) to the beginning of June (climate change condition). Plant biomass and plant age impacted mortality and development. The results of these experiments will be discussed with regard to future climatic scenarios in Northern Germany.

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Section 06 - Talks

Chemical ecology and behavior

Section 06 - Keynote

Early Herbivore Alert: Plant Responses to Insect Eggs

M. Hilker & T. Meiners

Attack of plants by herbivorous insects is often initiated by insect egg deposition. Several plants have been shown to notice insect egg deposition and to respond to this very first step of attack by a wide range of defensive strategies. The defensive plant responses to insect eggs are elicited by compounds associated with the eggs or the egg-laying insects. The chemical structures of these elicitors range from carboxylic acid esters, benzyl cyanide to proteins. The egg-induced plant's response can act directly against the eggs and egg-laying females by production of oviposition deterrents, ovicidal substances, growth of neoplasms and formation of necrotic tissue (hypersensitive-like response); the two latter types of responses loosen the attachment of eggs to the plant, and eggs easily fall off the plant. In addition, egg-induced plant responses can act indirectly against the eggs by a change of the plant's odour which leads to attraction of egg parasitoids. The parasitoids have been shown to respond specifically only to plant odour induced by eggs of their major host species. The lecture will provide an overview of our current knowledge on defensive plant responses to insect eggs and, in turn, parasitoid responses to plant volatiles induced by insect egg deposition.

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Monika Hilker, Freie Universität Berlin, Institute of Biology, hilker@zedat.fu-berlin.de

Section 06 - Talk

Differing patterns of sequestration of iridoid glycosides in the Cionini (Coleoptera, Curculionidae)

C. U. Baden, S. Franke & S. Dobler

Weevils of the genera *Cionus* and *Cleopus* exclusively feed on plants containing iridoid glycosides (IGs). These IGs are secondary metabolites that are frequently used by insects as plant derived defences. All *Cionus* species tested so far are able to sequester two of these IGs: aucubin and catalpol. The beetles' sequestration patterns differ depending on the host plant. In general, all species living on *Scrophularia* sequester more aucubin than catalpol whereas in species feeding on *Verbascum* the opposite pattern can be observed, although catalpol does not dominate in their host plant. While most *Cionus* species feed either on *Scrophularia* or on *Verbascum* (Scrophulariaceae), *C. hortulanus* as the only exception feeds on both plants. In this species it depends on the local host plant, which IG is preferentially sequestered. We tested whether the differences in sequestered IGs are genetically fixed between populations or purely influenced by the host plant. For this, we reared half of the beetles' offspring collected from *S. nodosa* on this plant and the other half on *V. nigrum*. Over their complete life cycle, the IG concentrations of the offspring and their host plants was monitored and compared to the parental generation. As it turned out, the IG content in the beetles confirmed completely the mentioned general pattern of more sequestered aucubin on *S. nodosa* and more sequestered catalpol on *V. nigrum*. Thus the sequestered IGs are exclusively determined by the host plants and not by genetic differences between beetle populations. However, the IG content pattern of the beetles on *Verbascum* does not mirror the plants' concentration but must have been modified by degradation upon feeding or by the beetles' metabolism.

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Section 06 - Talk

Sociality and Fungiculture in Ambrosia Beetles

P.H.W. Biedermann & M. Taborsky

Fungiculture in insects is known from attine ants, macrotermite termites and ambrosia beetles. The first two groups are eusocial and exhibit some of the most highly developed social organizations known among all organisms. In contrast, the social organization of ambrosia beetles is largely unknown. Adult female offspring in xyleborine ambrosia beetles delay dispersal from their natal nest, during which period they often engage in various brood care and fungus maintenance tasks. Most remarkably even larval offspring engage in helping, which is unique among holometabolous social insects.

Dispersing females transmit spores of mutualistic ambrosia fungi (Ascomycetes) in special organs from the natal gallery to their new nest. These transmitted fungi usually dominate the microbial complex within the galleries. Our experiments show that adult females induce growth of the mutualistic fungus that is characterized by massive fruiting structures (sporodochia). These fruiting bodies seem to be an essential component of beetle nutrition. Our data suggest that an important function of delayed dispersal of adult females from their natal nest might be improved growth conditions of their ambrosia fungus creating potential for indirect fitness gains of philopatric females by an increase in sibling production. Sociality in ambrosia beetles probably evolved in close association with the beetle-fungus symbiosis.

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Section 06 - Talk

How *Nasonia vitripennis* females care for the sex life of their sons

B. Blaul & J. Ruther

Sexual selection theory predicts that phenotypic traits used by the choosing sex to find a mate should reflect honestly the quality of the sender and thus, have to be costly. Physiological costs arise, for instance, if a signal depends on limited nutritional resources. Hence, the nutritional status of an organism should not only determine its quality as a potential mate but also its ability to advertise this quality to the choosing sex. In many insects, the availability and quality of food is controlled by the oviposition behavior of the female and thus, the performance of the offspring. A causal connection, however, between the oviposition decisions of insect females and the mating chances of her offspring has hardly ever been shown. Here we demonstrate a link between host quality, oviposition preference, and offspring mating success in the parasitic wasp *Nasonia vitripennis*. We find that females lay more eggs in hosts whose diet had been supplemented with a fat rich in linoleic acid (LA+) than in hosts reared on a diet of comparable energetic value but poor in LA (LA-). Males developing in LA+ hosts possess a threefold number of spermatozoa and attract more virgin females by releasing higher amounts of the attractive chemicals than males from LA- hosts. We close our line of evidence by showing in ¹³C labeling experiments that LA functions as a precursor of the male sex pheromone. Hence, females making the right oviposition decisions may increase their indirect fitness by enhancing not only the fertility of their sons but also the attractiveness to potential mates.

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Section 06 - Talk

Host-plant recognition by the oligolectic bee *Hoplitis adunca*

H. Burger, S. Dötterl, C.M. Häberlein, S. Schulz, M. Ayasse

Solitary bees are important pollinators of angiosperms. They visit flowers mainly to collect pollen and nectar to provide their larvae with food. Oligolectic bees are specialized on few closely related plant species for pollen foraging. At the beginning of the flight season newly emerged, naïve females have to find and recognize their specific host-plants to reproduce successfully.

To investigate the importance of floral cues for host-plant finding and recognition in oligolectic bees, we chose *Hoplitis adunca* (Megachilidae), a solitary bee species which is highly specialized on the flowers of *Echium* spp. (Boraginaceae). We hypothesized *H. adunca* to use *Echium*-specific signals to recognize their host-plants. To test the hypothesis we used a combination of chemical (GC-MS) and electrophysiological (GC-EAD) analyses, spectral reflection measurements and bioassays.

Our investigations showed that the interplay between visual and olfactory cues of *Echium* flowers is essential for host-plant finding and recognition by *H. adunca* females. The visual cues of the flowers attract the bees, while the olfactory cues, which are *Echium*-specific uncommon floral scent compounds only known from the host-plants of *H. adunca*, are used by the bees to recognise their host plant and discriminate it from non-host plants. They are therefore ideally suited to be used as a plant specific recognition cue.

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Hannah Burger, Institute of Experimental Ecology, University of Ulm, Germany, hannah.burger@uni-ulm.de (presenting author)

Section 06 - Talk

How to pickle a mouse: a lesson on carcass preservation by secondary metabolites of the burying beetle, *Nicrophorus vespilloides* (Coleoptera: Silphidae)

T. Degenkolb, R.-A. Düring & A. Vilcinskas

Burying beetles of the genus *Nicrophorus* are unique models in evolutionary ecology because they localise small vertebrate carcasses by the volatiles emitted, reproduce on these carcasses and bury them in the soil. The remarkable bi-parental care for their offspring includes both preservation of the carrion and its preparation as diet and nursery. It is known that buried carcasses show no signs of microbial decay and those experimentally treated with *Nicrophorus* secretions grow less bacteria and fungi. Here we report identification of primary and secondary metabolites released by *Nicrophorus vespilloides*. Using headspace-SPME coupled to GC/MS and direct infusion GC/MS approaches, we identified 35 organic metabolites in headspace, anal, and oral secretions. We discuss the potential ecological relevance of these compounds with respect to their antimicrobial activity and their repellent activity towards insect competitors. Interestingly, we found a number of fatty acids that plausibly could assist solubilisation and skin penetration of the secreted antimicrobials and repellents.

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Section 06 - Talk

Adult feeding preference and larval performance of cabbage stem flea beetle (*Psylliodes chrysocephala* L.) on brassicaceous host plants

A. Döring & B. Ulber

The cabbage stem flea beetle (*Psylliodes chrysocephala* L.) is a major pest of winter oilseed rape in Europe. Its host range comprises several plant species of the family Brassicaceae, such as turnip rape (*Brassica rapa* L. *silvestris* Briggs), oil radish (*Raphanus sativa* L. var. *oleiformes* Pers.) and white cabbage (*Brassica olerifera* L. var. *capitata* f. *alba*). There is little information on the differential host suitability of these plant species for both adults and larvae. The objective of this project was to identify potential feeding preferences of adult cabbage stem flea beetles on different brassicaceous plant species and cultivars of oilseed rape. Furthermore, to analyse the host plant quality for the larvae of cabbage stem flea beetle, larval performance was investigated on this set of test plant species and varieties.

In dual choice feeding tests adult cabbage stem flea beetles were supplied with one leaf of a standard oilseed rape cultivar ("Robust") and one leaf of different test plants on intact plants. The consumed leaf area was measured by using an image processing software. While adult beetles showed a significant feeding preference for turnip rape and oil radish, there was no significant difference between oilseed rape and white mustard or between different cultivars of oilseed rape.

To investigate the host plant quality of different oilseed rape varieties and other brassicaceous plant species for the larvae of cabbage stem flea beetle, newly hatched L1 larvae were released on petioles of potted test and standard plants, respectively. Larvae were allowed to feed for fourteen days. Plants were harvested and various larval growth parameters were measured. Highest larval weight was found on turnip rape, while lightest larvae were found on white mustard. The weight of larvae from cultivars of oilseed rape was in between.

Alexander Döring, Georg-August-University Göttingen, Germany, adoerin1@gwdg.de (Presenting Author)

Section 06 - Talk

Living in a mushroom world – Chemical defence of *Tritoma bipustulata* (Coleoptera; Erotylidae)

K. Drilling, K. Dettner & K. D. Klass

The present study provides first insights in the chemical defensive system of the erotylid beetle *Tritoma bipustulata* and reports the previously unknown ability of abdominal reflex bleeding in this coleopteran family. Furthermore, structural details of the glands of the pronotum of *Tritoma bipustulata* are provided for the first time.

The glands, which open in the pronotal corners, bear, upon a long, usually unbranched excretory duct, numerous identical gland units, each comprising a central cuticular canal surrounded by a proximal canal cell and a distal secretory cell. The canal cell forms a lateral appendix filled with a filamentous mass probably consisting of cuticle, and the cuticle inside the secretory cell is strongly spongiose – both structural features were previously not known for compound glands of beetles.

The defensive chemistry of the secretion of pronotal glands, of the abdominal reflex blood as well as of the hemolymph was analysed by GC-MS. The different secretions include aromatic compounds, alkenes, ketones, organic acids as well as a single sesquiterpene. The majority of these detected compounds had strong antimicrobial properties in microbiological assays with entomopathogenic micro-organisms. In feeding bioassays with ants mainly compounds, detected in the abdominal reflex blood, were significantly deterrent. These results were discussed with regard to the mycophagous way of live of these beetles.

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Drilling, K., Dettner, K. 2010. First insights in the chemical defensive system of the erotylid beetle, *Tritoma bipustulata*. *Chemoecology* 20(4), 243-253.

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Section 06 - Talk

Age-related nest topology in Giant honeybees (*Apis dorsata*)

J. Lerchbacher, F. Weihmann, T. Hötzl, M.M. Singh & G. Kastberger

Division of labour is an important factor for the success of eusocial insects and age-related in honeybees (Lindauer 1952). In Giant honeybees (*Apis dorsata*) the nest architecture reflects division of labour by topological specifications regarding the functions of colony members. In particular, the “bee curtain” displays such functional regions distinguishing “mouth zone”, “quiescent zone”, attachment and rim zones, as well as surface and subsurface layers.

We investigated the nest topology regarding the age distribution of surface bees in two *A. dorsata* colonies in Nepal. The abdominal colouration of *A. dorsata* worker bees changes in their life (Otis et al. 1990, Woyke et al. 2000). In young worker bees the dorsal side of the abdomen is bright, whereas older bees have one to four dark tergites. This enables age determination according to abdominal colouration. We labelled freshly hatched bees with day-specific colour tags and observed them in a small foster colony for 16 days, until the colony had absconded. Thus, we obtained the abdominal colouration of worker bees with identified age distinguished in four age classes. The labelled bees did not turn dark within the observation time. Therefore, we sampled older worker bees with dark colour patterns, extending the number of age classes to eight.

With self-developed software tools, utilizing the established age index, we determined the age of surface bees by image analysis. The findings show, that surface bees are arranged in an age gradient from old to young with increasing distance from the “mouth zone” to the peripheral rims of the nest. Bees in the “mouth zone” were of the age classes 6-8. Beyond the mouth zone, mainly younger bees of the age classes 1-4, with an age between 5-16 days, as well as older bees of the age class 5 occurred. Nest defence by “shimmering” is performed in the quiescent zone (Kastberger et al. 2008) and therefore primarily carried out by younger bees.

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Section 06 - Talk

Sensorial implications of pollen collection and pollen feeding in bumblebees.

A. Goertz, V. Piorek & K. Lunau

Bees collect pollen on flowers and add nectar to the pollen before they transport it into the nest. The foragers of pollen storing species like *Bombus terrestris* store the pollen in empty nest cells and leave the nest for the next foraging bout. Nest workers eat the stored pollen and feed the larvae with regurgitated pollen. In the present study we investigate the sensory cues that bumblebee workers and larvae use to identify pollen. Here we report on experiments, in which we monitored the use of pollen surrogates by bumblebees. As a chemically inert pollen surrogate without any nutritional value, we used pure glass powder in which the glass spherules measured 50µm in diameter, which is similar to the diameter of the pollen grains in many flowers. Flower-naïve bumblebee workers did not collect glass powder from odourless artificial flowers made of foam rubber, but readily buzzed and collected glass powder from emasculated natural flowers, in which the glass powder was offered in a pipette tip. Microscopic inspection of the foragers' gut showed, that they had eaten small amounts of glass powder. Foragers deposited the collected glass powder in the nest and continued collecting glass powder. Bumblebees did not collect glass powder to which bitter-tasting substances were added. Nest workers fed larvae with glass powder and the larvae ate it as revealed from microscopic gut inspection of larvae, which died following the consumption of large amounts of glass powder. Our results suggest that bumblebees do not respond to chemical cues of pollen and collect all powdery substances of flowers. It is discussed whether visual cues of pollen, particularly the yellow, UV-absorbing colour, play a role for pollen detection in bees. Also, we cannot yet exclude the importance of tactile cues for pollen collection and pollen eating in bumblebees.

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Section 06 - Talk

Functional response with a twist: searching efficiency of an egg parasitoid attacking the invasive Mango fly

T. S. Hoffmeister, S. Ekesi & K. Merkel

The invasive Mango fly *Bactrocera invadens* is rapidly spreading throughout central and eastern Africa, outcompeting native fruit fly species and encapsulating native natural enemies. It is thus of tremendous importance to identify potential biocontrol agents that might help suppressing fly populations of *B. invadens*. We investigated the searching efficiency and patch time allocation of a candidate species, the egg-prepupal parasitoid *Fopius arisanus* on egg batches of the invasive Mango fly *Bactrocera invadens* on Mango domes. Since host eggs are laid in an aggregated fashion, we expected host encounters to increase the search motivation of the parasitoid and thus the patch residence time of *F. arisanus*, possibly leading to density independent or positively density dependent parasitism. On the other hand, we considered the fact that eggs laid in larger batches might not all be accessible to the ovipositor of the searching parasitoid and thus might be benefitting from a partial refuge.

Using statistical models we will demonstrate how successful ovipositions influence the search motivation and thus patch time allocation in this parasitoid. Elaborating on Royama's functional response model, we demonstrate a functional response with a density dependent refuge for *F. arisanus*.

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Section 06 - Talk

Floral odour composition loses ability to repel ants after inhibition of terpene-synthesis.

R. R. Junker, J. Gershenzon & S. Unsicker

In their natural environment, plants are synchronously confronted with mutualistic and antagonistic interaction partners. In contrast to animals, plants are not able to flexibly and directly modify their behaviour or the signals they display to adequately respond to the current requirements. Thus, plants would benefit from signals that contain messages for mutualists and antagonists. For floral scents it has been hypothesized that benzenoids are evolved as pollinator attracting signals, while monoterpenes may serve as defensive compounds against antagonists [1, 2]. In order to test this hypothesis, we inhibited the terpene-synthesis in flowers of *Phlox paniculata* and compared the responses of *Lasius niger* ants to the natural and the modified floral scent bouquets. While the natural odours were strongly repellent against, the bouquets with a reduced proportion of terpenoids were not. The proportion of linalool within the scent bouquets predicted the ants' responses: the more linalool was emitted the more repelled were the ants. Flying flower visitors, mainly hoverflies, did not differently visit the two types of flowers. These results support the hypothesis that monoterpenoids play a significant role in flower defence. Likewise, the attraction of pollinators often is elicited by individual compounds – and not bouquets – which suggests that the chemical complexity of floral scent bouquets is evolved to adequately respond to both mutualists and antagonists and therefore maximise the plants' fitness.

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[2] Junker, R.R. & Blüthgen, N. 2010. Floral scents repel facultative flower visitors, but attract obligate ones. *Annals of Botany* 105: 777-782

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Section 06 - Talk

Host species influence the cuticle chemistry of *Lariophagus distinguendus*

S. Kühbandner, K. Hacker, J.L.M. Steidle & J. Ruther

The pteromalid wasp *Lariophagus distinguendus* is an ectoparasitoid of several grain investing beetles. It is known that hydrocarbons (CHC's) function as mating pheromones in *L. distinguendus*. In this study we analyzed CHC-profiles of *L. distinguendus* strains reared on different host species. We prepared whole body extracts of the wasps and analyzed them by gas chromatography coupled mass-spectrometry (GC-MS). CHC-profiles were compared between strains by Permanova analysis. We found significant differences in the CHC-profiles between strains from different hosts. These differences were found in males as well as females and might contribute to a reproductive isolation between *L. distinguendus* strains which are specialised on different hosts, i.e. *Stegobium paniceum* (Anobiidae) and *Sitophilus granarius* (Curculionidae) (Hacker et al., unpublished results).

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Section 06 - Talk

**All wasp is not the same wasp: Habitat preference indicates host races in
Nasonia**

P. Malec & J. L. M. Steidle

Host races can be regarded as an intermediate stage in the process of speciation and have been reported from various insect taxa. In this study, several criteria of host race definition were examined for a population of the parasitoid wasp *Nasonia vitripennis* (Walker) (Hymenoptera: Pteromalidae). Wasps were collected from birds' nests and carrion using fly puparia as baits. Field-collected individuals were used to establish laboratory strains. Biotests, sequence analysis and crossing experiments were conducted to test for differences between strains originating from different habitats. The data meet some criteria for host race definition and thus, in part, support the hypothesis of host race formation in the studied population of *N. vitripennis*.

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Section 06 - Talk

Tritrophic interactions in complex odorous environments: Do land use, plant species and odor diversity affect orientation of insects?

T. Meiners, N. Wäschke, K. Hardge, C. Herbst, M. Hilker & E. Obermaier

We tested the hypotheses that (a) complexity of vegetation odors is dependent on plant species diversity (and land use) and (b) olfactory orientation by arthropods is negatively affected by increasing plant species diversity. Our tritrophic model system was the monophagous weevil *Mecinus pascuorum*, its ubiquitous host plant plantain (*Plantago lanceolata*), and its larval parasitoid *Mesopolobus incultus*.

Odor blends of 27 plots in the study areas Schorfheide-Chorin, Hainich and Schwäbische Alb with different land use gradients and plant species diversity were analyzed by GC-MS. The number of volatile compounds detected and their quantities per plot were subjected to a diversity analysis by Shannon-Wiener, which resulted in a complex pattern of relationships between plant species diversity and odor diversity in the field. Incidence of the weevil *M. pascuorum* and the parasitoid *M. incultus* in the field correlated positively with plant species diversity.

Further laboratory olfactometer studies revealed that host finding by the parasitoid and host plant finding by the weevil were not impaired by odor complexity. However, when given a choice between different odor diversities, the parasitoid preferred a simpler odor bouquet. The beetle's searching activity was enhanced with increasing complexity of odor blends. Hence, analyses of relationships between plant species diversity, odor diversity, and olfactory orientation by insects can help to elucidate the outcome of multitrophic interactions and to improve knowledge important for successful biological control.

Randlkofer, B., Obermaier, E., Hilker, M. & Meiners, T. 2010. *Basic & Appl. Ecol.* 11: 383–395.

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Section 06 - Talk

Enantioselective attraction is associated with high antennal sensitivity for (-)ipsdienol in male orchid bees, *Euglossa cyanura*

L. Mitko, D.L. Schorkopf & T. Eitz

Male neotropical orchid bees (Euglossini) collect volatile chemicals from orchid flowers and other non-floral sources like decaying wood and feces. Species-specific blends of volatiles (fragrances) accumulate in hind tibial pouches, to be later exposed during courtship display. Species-specific volatile preferences have given rise to highly specialised floral scents in euglossophilous plants (euglossine pollination syndrome). Previous studies have shown that the monoterpene alcohol ipsdienol is a major component of the floral scents of several species of neotropical orchids, which are pollinated by volatile-collecting male orchid bees (Whitten et al. 1988). Ipsdienol is also known as a pheromone of various species of bark beetles (Scolytidae), which are able to distinguish between optical isomers of ipsdienol. This leads to enantioselective behaviours. Synthetic, racemic ipsdienol is a known attractant of males of the orchid bee *Euglossa cyanura* (Whitten et al. 1988). In the present study choice tests in the field (Los Tuxtlas, Mexico) with (+) and (-) ipsdienol showed exclusive attraction of *E. cyanura* to (-)ipsdienol. We hypothesized that the behavioral preference for (-)ipsdienol is associated with enantioselective, olfactory adaptations. We used electroantennography (EAG) to measure antennal sensitivity to both (+) and (-) enantiomers in male *Euglossa cyanura* and compared the results with responses of males of the sympatric *Euglossa mixta*, which is not attracted to any ipsdienol isomer. *E. cyanura* showed significantly stronger antennal responses to (-)ipsdienol than to (+) ipsdienol, in contrast to *E. mixta*, which showed no difference. In an inter-specific comparison *E. cyanura* showed a significantly stronger responses to (-)ipsdienol than *E. mixta*, confirming the hypothesis of enantioselective, chemosensory specialisations in male orchid bees.

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Section 06 - Talk

Polyphage Thysanopteren induzieren Alkaloid-Produktion als Abwehrreaktion in *Eschscholzia californica* (Papaveraceae)

I. Schütz, G. Moritz & W. Roos

Der Kalifornische Blüenthrips *Frankliniella occidentalis* (Pergande 1895) durchläuft nach dem Schlupf aus dem Ei innerhalb von mindestens 5 bis 6 Tagen zwei Larvalstadien, die durch intensive Nahrungsaufnahme gekennzeichnet sind, danach zwei Ruhestadien ohne Nahrungsaufnahme (Vorpuppe und Puppe), bevor nach frühestens acht Tagen adulte Tiere schlüpfen. *F. occidentalis* ernährt sich vom Zellsaft der Blatt- und Blütenepidermis von Vertretern zahlreicher Pflanzenfamilien (Moritz 2006).

Die Haltung und Vermehrung erfolgt auf Blättern von *Phaseolus vulgaris* mit zeitweiligem Angebot von *Chrysanthemum*-Blüten und Kiefernpollen bei ca. 23°C. *Eschscholzia californica* und *Chelidonium majus* gehören zur Familie der Mohngewächse, die alkaloidhaltigen Milchsaft bilden und sich durch diesen gegen Fraßfeinde verteidigen können.

Larven von *F. occidentalis* bevorzugen im Wahlexperiment Blätter der Bohne gegenüber Blättern von *C. majus*. Bei ausschließlichem Angebot von Papaveraceen-Blättern (*C. majus* oder *E. californica*) sind sie aber in der Lage, diese als Nahrungsquelle zu nutzen. Die Blätter der Papaveraceae enthalten cytotoxische Alkaloide vom Benzophenanthridin-Typ. Diese spielen bei der Interaktion zwischen Thrips und Pflanze eine wesentliche Rolle:

a) Blätter von *E. californica* reagieren auf den Kontakt mit dem Thrips mit der Überproduktion dieser Alkaloide, d.h. mit einer ähnlichen Reaktion wie auf phytopathogene Pilze. Es ist noch unklar, ob dabei ein volatiles chemisches Signal oder der Verwundungsreiz ausschlaggebend ist.

b) In *F. occidentalis* wurden von der Pflanze gebildete Alkaloide und mindestens eines ihrer Abbauprodukte nachgewiesen. Dies spricht dafür, dass die Thripse zur Aufnahme und vermutlich auch zur Entgiftung von Benzophenanthridinen in der Lage sind.

Die Ergebnisse eröffnen neue Fragestellungen zur evolutionären Anpassung von Thripsen und Nahrungspflanzen.

G. Moritz 2006. Thripse. Westarp Wissenschaften, Hohenwarsleben

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Section 06 - Talk

Evolution of premating isolation: Do host plants shape mating preferences of herbivorous leaf beetles by altering their contact pheromones?

T. Otte, S. Geiselhardt, & M. Hilker

Sympatric speciation of herbivorous insects may be promoted by plasticity in plant preferences if plant species affect the insect mating signals and thus, lead to assortative mating. We investigated the effects of host plant species on sex pheromones in the leaf beetle *Phaedon cochleariae* which is feeding upon brassicaceous plants and uses cuticular hydrocarbons (CHCs) as contact pheromones for mate recognition. Two beetle lines were derived from a common ancestral line reared on Chinese cabbage: a new line on Chinese cabbage and a line kept on watercress. Laboratory bioassays showed that males significantly preferred females reared on the same host plant as males. The CHC profiles of the two lines showed no qualitative, but significant quantitative differences. A canonical discriminant analysis of the beetles' CHC profiles separated them according to sex and host plant. Furthermore, we could show that the beetle's CHC pattern specific for the ingested host plant species is detectable after only a 14-day-feeding period of the adult on the respective plant. A chemical analysis of the fatty acid composition of Chinese cabbage and watercress revealed significantly quantitative differences of some unsaturated fatty acids; these differences might have caused the differences in the CHC pattern of the beetles ingesting the plant fatty acids. Our results show that a host plant shift can induce a rapid change of sex pheromones of an herbivorous insect and thus, lead to assortative mating. These phenotypic changes in mate recognition cues of an herbivorous insect may promote genetic divergence and thus, drive speciation.

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(presenting author)

Section 06 - Talk

Die Bedeutung von Pheromonen bei der Paarung der Roten Mauerbiene, *Osmia bicornis* (= *rufa* syn.)

D. Rolke, K. Seidelmann

Die Rote Mauerbiene, *Osmia bicornis* (Synonym: *O. rufa*), ist eine in Mitteleuropa weit verbreitete Solitärbiene mit dem Paarungssystem einer opportunistischen Polygynie: Die Weibchen sind monandrisch und unmittelbar nach dem Schlupf rezeptiv. Die protandrischen Männchen betreiben eine "Wettsuche" nach frisch aus dem mütterlichen Nest geschlüpften Weibchen (scramble competition). Dabei durchstreifen die Männchen individuelle Suchgebiete bei Nahrungspflanzen oder Nistorten und fliegen sowohl sich bewegende als auch ruhende Objekte mit bienenähnlichem Habitus an. Die Identifizierung artgleicher rezeptiver Weibchen erfolgt dabei erst im Nahbereich anhand eines spezifischen Bouquets kutikularer Substanzen. Rezeptive Weibchen werden nach kurzem Antennenkontakt unmittelbar bebalzt, brutaktive Weibchen aber ignoriert.

Einmal begattete Weibchen wehren weitere Kopulationsversuche ab. Die Induktion der Irrezeptivität erfolgt im Verlauf der Paarung in der Phase der Postkopulation, wenn das Männchen nach Abschluss der Intromission weiter auf dem Weibchen verbleibt und ein auffälliges, rhythmisches Verhalten zeigt. In dieser Phase überträgt das Männchen einen ungesättigten Ester aus der Sternitdrüse auf das Weibchen. Diese männchenspezifische Substanz wirkt als Antiaphrodisiakum und ist mehrere Tage auf der Weibchenkutikula nachweisbar. In dieser Zeit stellt das Weibchen sein Duftbouquet um. Wie Verhaltenstests zeigten, nimmt die Attraktivität der Weibchen auch ohne Kopulation innerhalb einiger Tage nach dem Schlupf ab. Eine Kopulation beschleunigt diesen Prozess jedoch.

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Section 06 - Talk

An uncommon volatile as potential mediator in an oil-bee oil-plant pollination system

I. Schäffler & S. Dötterl

Floral fatty oils are an alternative reward to pollen and nectar. It is only used by specialized bees, i.e. oil-collecting bees, as food for their offspring and to line their cells. The interaction between oil-flowers and oil-bees is highly specialized as the plants are only pollinated by these bees, and the oil-bees are dependent on the oils of these plants.

The Central European oil-bees, *Macropis fulvipes* and *M. europaea*, are associated with three species of oil-producing *Lysimachia*. Until now it is not clear how the bees find their oil hosts, but we could show that pentane solvent extracts of *L. punctata* flowers are highly attractive to *Macropis* bees indicating that bees are attracted to the plants by means of olfactory floral cues. We analyzed these solvent extracts by GC-MS (Gas chromatography - Mass spectrometry) and tested it on antennae of *M. fulvipes* by using GC-EAD (GC-Electro-Antennographic Detection). Among the EAD-active compounds we found glycerols esterified with one, two or three acetic acid molecules (monoacetin, diacetin, and triacetin). These compounds could be by-products in the biosynthesis of the fatty floral oil (glycerols esterified with long-chain β -acetoxy fatty acids), and were not described as natural compounds before. Diacetin elicited the highest response in antennae of *M. fulvipes*. A mixture of five EAD-active compounds (including diacetin) was highly attractive to *M. fulvipes* bees and diacetin seems to be the key attractant. As we found diacetin also in other Holarctic and non-Holarctic oil-plants we suggest that this compound could be a mediator for oil-bees to identify their oil-plants around the world.

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Section 06 - Talk

Polyphage Thysanopteren induzieren Alkaloid-Produktion als Abwehrreaktion in *Eschscholzia californica* (Papaveraceae)

I. Schütz, G. Moritz & W. Roos

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Section 06 - Talk

Pheromonphysiologie und Phasenpolyphänismus - Das Beispiel *Schistocerca*

C. Stahr

Die Gattung *Schistocerca* enthält ökophysiologisch sehr heterogene Arten, deren Hauptverbreitungsgebiet die Neue Welt ist. Einzige Ausnahme ist die afrikanische Wüstenheuschrecke *Sch. gregaria*, die einen ausgeprägten Phasenpolymorphismus zeigt und riesige, destruktive Schwärme bilden kann. Ihre amerikanische Schwesterart, *Sch. americana* hat nur einen reduzierten Phasenpolymorphismus und prägt selten Schwarmverhalten aus. Beide Arten besitzen charakteristische Männchen-Pheromone, die im reproduktiven Kontext eingesetzt werden. Geschlechtsreife, gregäre *Sch. gregaria*-Männchen emittieren verschiedene aromatische Substanzen. Die Hauptkomponente, Phenylacetonitril (PAN), wird exklusiv in der gregären Phase bei Anwesenheit von anderen Männchen als Rivalen zur postkopulatorischen Partnerbewachung und zur Eigenmarkierung als Abstinon eingesetzt. Im Gegensatz dazu wurden bei *Sch. americana*-Männchen zwei ungesättigte Alkohole und ein kurzkettiges Aldehyd detektiert. Die Emission von cis-3-Nonen-1-ol wird auch hier durch die Populationsdichte beeinflusst. Allerdings ist die Präsenz von Männchen gegenüber geschlechtsreifen Weibchen von untergeordneter Bedeutung. Ebenso wurden Unterschiede in der Substanzabgabe der einzelnen Körperregionen im Vergleich zu *Sch. gregaria* beobachtet. Bei *Sch. americana* muss daher von einer anderen Rolle der Männchen-Pheromone ausgegangen werden. Verhaltenstests legen bei der amerikanischen Art eine Funktion der Pheromone als Weibchenaphrodisiaka im Kontext einer Wahl durch Weibchen (cryptic female choice) nahe.

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Section 06 - Talk

Enantioselective pheromone communication in the genus *Leptopilina*

J. Stökl, J. Hofferberth, B. Schöllhorn, & J. Ruther

Wasps of the genus *Leptopilina* are solitary parasitoids of *Drosophila* larvae. Very little is known about the mate finding and courtship behaviour of these wasps, but literature data suggest the presence of a female sex-pheromone.

Chemical analyses of cuticle washes of males and females of *L. heterotoma* showed sex specific differences in the profile of cuticular hydrocarbons as well as the presence of a female specific iridoid compound, which could be identified as iridomyrmecin. In behavioural experiments we demonstrate, that males of *L. heterotoma* are specifically attracted by a single enantiomer of iridomyrmecin. The same compound also initiates courtship behaviour in the males. Cuticular hydrocarbons do not attract the males but may be important for species recognition and courtship.

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(Presenting Author)

Section 06 - Talk

Blatt, Knospe, Blüte oder Hülse – wann kommt der Erbsenwickler zur Erbse?

G. Thöming & H. Saucke

Der Erbsenwickler *Cydia nigricana* (Lepidoptera: Tortricidae) hat sich mit zunehmendem Erbsenanbau zu einem bedeutenden Problemschädling entwickelt. Die Larven des Erbsenwicklers können sich auf verschiedenen Leguminosenarten entwickeln, die Hauptwirtspflanze ist allerdings die Erbse (*Pisum* spp.). Freilandstudien in Nordhessen (2006-2008) haben eine starke Korrelation zwischen der Phänologie der Erbsenpflanzen und den Flugperioden des Erbsenwicklers gezeigt.

Diese Kopplung der Phänologie von Erbsenpflanze und Erbsenwickler wird zur Zeit in Verhaltensstudien untersucht. Ziel ist es, das vom Erbsenwickler am meisten präferierte Entwicklungsstadium der Erbsenpflanze zu bestimmen. Darüber hinaus sollen Duftstoffanalysen der Erbsenpflanzen durchgeführt werden, um die Beziehung zwischen Wirtspflanze und Schädling genauer zu charakterisieren und verhaltensaktive Duftstoffe zu identifizieren.

Diese phänologischen Beziehungen und Präferenzen des Erbsenwicklers (♂♂/♀♀, verpaart/unverpaart) werden in Wahl-Versuchen im Pflanzenkäfig („2-choice“) und im Windtunnel („no-choice“) unter kontrollierten Bedingungen untersucht. Verschiedene Entwicklungsstadien der Erbse (Blatt-, Blütenknospen-, Blüten-, Hülsenentwicklung) sowie eine Nichtwirtspflanze werden getestet.

Erste Ergebnisse bestätigen die Freilandstudien und deuten darauf hin, dass die späte Blütenknospe und Blüte die am stärksten präferierten Entwicklungsstadien sind, insbesondere von den verpaarten Weibchen.

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Section 06 - Talk

The importance of carcass volatiles as attractants for the hide beetle *Dermestes maculatus* (De Geer)

C. von Hoermann, J. Ruther, S. Reibe, B. Madea & M. Ayasse

A decaying cadaver emits volatile organic compounds that are used by carcass associated insects in order to find their brood substrate. Although volatile organic compounds (VOCs) that are released by carcasses have been identified, little is known about the specific compounds that are used by these insects while searching for a cadaver. Therefore, we have investigated the chemical ecology involved in the attraction of the hide beetle *Dermestes maculatus*, which feeds as an adult and larva upon decomposing carcasses. Our aims have been to identify the responsible compounds in the odours of the carcass that are important for the attraction of the beetles. Furthermore, we have studied sex- and age-related differences in beetle attraction and tested whether the hide beetle can distinguish between various stages of decomposition by means of the emitted odours. Headspace collection of volatiles released from piglet carcasses (bloated stage, post-bloating stage, advanced decay and dry remains), coupled gas chromatography-mass spectrometry (GC-MS), gas chromatography with electroantennographic detection (GC-EAD) and bioassays were conducted to identify the volatiles responsible for the attraction of the beetles. Freshly emerged male beetles were attracted by the odour of piglets in the post-bloating stage and the EAD-active compound benzyl butyrate. Statistical analysis revealed a higher relative proportion of benzyl butyrate in the odour bouquet of the post-bloating stage in comparison with the other stages. We therefore conclude that this compound plays an important role in the attraction of hide beetles to carcass odour. This underlines the potential use of *D. maculatus* for the estimation of the post mortem interval. The decomposition stage at which the female beetles are attracted to the odour of a cadaver remains unknown, as well as the volatiles involved in this attraction. Pheromones of male beetles might play an essential role attracting females to the carrion substrate for mating and ovipositioning.

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Section 06 - Talk

Training for defence: the transition from stochasticity to synchronisation of collective behaviours in Giant honeybees (*Apis dorsata*)

F. Weihmann, T. Hötzl & G. Kastberger

The Southeast Asian Giant honeybee (*Apis dorsata*) occurs in nests whose central comb is covered by multiple layers of bees (termed as bee curtain, Ruttner 1988). In case of threat Giant honeybees are capable of producing collective defence as Mexican-wave-like shimmering waves (Kastberger et al. 2008), during which single bees flip the abdomen in highly synchronised and cascaded patterns. Another instance for abdomen flipping behaviour is flickering, where surface bees act seemingly stochastically. Its goal is still unknown but seen in context of the release of the social Nasonov pheromone (Kastberger et al. 1998).

In this work, we investigated the flickering-shimmering transition hypothesis which proposes that flickering is a preliminary stage to shimmering. Shimmering waves are initiated by trigger bees (Schmelzer et al. 2008). We provide evidence that the trigger bees show a higher arousal level in the flickering phases prior to shimmering than their neighbours. A higher arousal level is expressed by increased flickering rate and intensity.

We have proved this flickering-shimmering transition hypothesis in three Giant honeybee colonies in Chitwan (Nepal). Therefore, we evoked shimmering waves by a dummy wasp and compared the flickering activities before and after the stimulation. The rate and intensity of flickering of the bees were assessed on the whole nest surface and the flickering activities of trigger bees were compared with those of non-trigger bees. We detected nuclei of increased flickering activity just at these positions where the trigger bees had been identified in subsequent shimmering. After continued stimulation the differences between trigger bees and their “non-trigger” neighbours diminish which implies ongoing recruitment of bees for triggering of shimmering activities.

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Section 07 - Talks

Insect-microorganism interactions

Section 07 - Keynote

***Wolbachia* and other microbial manipulators of insect reproduction**

R. Stouthamer

Much of the early ground-breaking work on insect symbiosis was done by Paul Buchner who studied the presence of mainly nutritive symbionts in many different invertebrates in the first half of the twentieth century. This field has witnessed a revival over the last 20 years, and with the advent of molecular DNA techniques large strides have been made in our understanding of the intimate relationships of such symbionts with their hosts. A whole new type of symbionts has also become prominent over this period: bacteria that manipulate their host's reproduction in order to gain an increased representation in the host's offspring, without necessarily contributing much to the host in terms of nutrients. Such bacterial symbionts are called reproductive parasites. Examples include bacteria belonging to the genus *Wolbachia*, *Rickettsia*, *Cardinium* and *Arsenophonus*. These bacteria have evolved several strategies allowing their spread within their host populations. Commonly evolved strategies are the killing of male offspring, the rendering of genetic males into functional females, and one of the most extreme strategies is getting rid of males all together by inducing complete parthenogenetic reproduction in infected females. Generally these reproductive parasites bias the sex ratios in populations towards females, because females are the sex that transmits them to the next generation. Eggs are much better at transporting the bacteria from one generation to the next than sperm cells. Consequences of these infections on their host populations will be discussed with emphasis on the *Wolbachia* bacteria that induce parthenogenesis.

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Section 07 - Talk

Wolbachia in feminoiden Zikaden (*Eupteryx* spp.)

C. Henke & H. Nickel

Zikaden der Gattung *Eupteryx* (Cicadellidae, Typhlocybinae) sind bedeutende Schädlinge an Arznei- und Gewürzpflanzen, u.a. auch an Salbei (*Salvia* L., Lamiaceae). In zwei geographisch voneinander getrennten Populationen (Bonn/Nordrhein-Westfalen und Göttingen/Niedersachsen) wurden Weibchen von *Eupteryx decemnotata* Rey, 1891 und *Eu. melissae* Curtis, 1837 mit veränderter Genitalmorphologie gefunden. Bei einer verwandten Blattzikadenart aus Norditalien wird eine ähnliche Missbildung von maternal vererbten Bakterien der Gattung *Wolbachia* hervorgerufen. Daher haben wir *Eupteryx decemnotata* und *Eu. melissae* beider Populationen mittels einer molekularen Screeningmethode (PCR) auf eine Infektion mit den Reproduktionsparasiten *Wolbachia* sowie *Candidatus Cardinium* untersucht. Dabei wurden für *Wolbachia*-Endobakterien drei Gene (16S rDNA, *wsp*, *ftsZ*) und für *Cardinium* ein Gen (*CLO*) untersucht, die das Vorhandensein der zwei Reproduktionsparasiten spezifisch nachweisen können. Des Weiteren wurden die Verwandtschaftsbeziehungen der Wirtspopulationen der beiden Standorte mittels des Gens Cytochrome-Oxidase I (COI) untersucht. Das Screening unterstützt die Annahme, dass die Populationen von *Eu. decemnotata* und *Eu. melissae* mit *Wolbachia* infiziert sind. Phylogenetische Analysen (Neighbor Joining) weisen darauf hin, dass zunächst eine der beiden Arten in der Vergangenheit infiziert wurde und dass ein horizontaler Transfer zwischen den Arten stattgefunden hat. Diese Studie ist der erste Nachweis von *Wolbachia* in *Eupteryx*-Arten, auch wenn der Nachweis des kausalen Zusammenhangs zwischen der Missbildung des Ovipositors und *Wolbachia* noch aussteht. Reproduktionsparasiten könnten die Populationsdynamik durch Veränderung der Geschlechterverhältnisse verschieben, wodurch sie zu einer treibenden Kraft in der ökologischen Differenzierung und Evolution von Arten werden könnten.

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Section 07 - Talk

Effect of arbuscular mycorrhizal fungi (*Glomus intraradices* Smith & Schenck) on the oviposition of rice water weevil (*Lissorhoptrus oryzophilus* Kuschel)

M. Cosme, M. J. Stout & S. Wurst

Root-feeding insects are important drivers in ecosystems, and links between aboveground oviposition preference and belowground larval performance have been suggested. The root-colonizing arbuscular mycorrhizal fungi (AMF) play a pivotal role in plant nutrition and are known to change host quality for root-feeding insects. However, it is not known if and how AMF affect the aboveground oviposition of insects whose offspring feed on roots. According to the preference-performance hypothesis insect herbivores oviposit on plants that will maximize offspring performance.

In a greenhouse experiment with rice (*Oryza sativa*) we investigated the effects of AMF (*Glomus intraradices*) on aboveground oviposition of rice water weevil (*Lissorhoptrus oryzophilus*) whose larvae feed belowground on the roots. The oviposition (i.e. the numbers of eggs laid by weevil females in leaf sheaths) was enhanced when the plants were colonized by AMF. However, the consumed leaf area by adult weevil feeding was not affected. Although AMF reduced plant biomass, it increased nitrogen (N) and phosphorus concentrations in leaves and N in roots.

The results suggest that rice water weevil females are able to discriminate plants for oviposition depending on their mycorrhizal status. Probably the discrimination is related to AMF-mediated changes in plant quality, i.e. the females choose to oviposit more on plants with higher nutrient contents to potentially optimize offspring performance. AMF-mediated change in plant host choice for chewing insect oviposition is a novel aspect of below- and aboveground interactions.

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Section 07 - Talk

Die antimikrobielle Verteidigung von *Harmonia axyridis*: Der Schlüssel zum Erfolg?

A. Eben & J. Gross

Der Asiatische Marienkäfer, *Harmonia axyridis*, ist ein polyphager Räuber, der seit 2007 in ganz Europa verbreitet ist. Auffällig für diese Art ist eine hohe Resistenz gegenüber Krankheiten. Um eine mögliche Ursache für dieses Merkmal zu finden, wurde die mikrobielle Aktivität der Hämolymphe von adulten exotischen *H. axyridis* mit der von heimischen *Coccinella septempunctata* verglichen. In Agardiffusionstests war die antimikrobielle Aktivität der Hämolymphe von *H. axyridis* signifikant höher als die der Hämolymphe heimischer Marienkäfer. Im Gegensatz zu *C. septempunctata* war die antimikrobielle Aktivität in der Hämolymphe von *H. axyridis* auch ohne vorherige Induktion durch Bakterien vorhanden. Die minimale Hemmkonzentration (MIC) der Hämolymphe von *H. axyridis* wurde gegen Gram-positive und Gram-negative Bakterien und gegen Hefe getestet. Die MIC-Tests zeigten, dass die minimale Hemmkonzentration gegen das Gram-negative Bakterium *Escherichia coli* und gegen die Hefe *Saccharomyces cerevisiae* deutlich niedriger war, als die zur Hemmung des Gram-positiven *Bacillus subtilis* nötige Hämolymphekonzentration. Die höchste Konzentration an Hämolymphe wurde zur Hemmung von *B. thuringiensis tenebrionidae* benötigt. Weiterhin fanden wir, dass die von lebenden Käfern frisch entnommene Hämolymphe signifikant höhere antimikrobielle Wirkung zeigte, als die Hämolymphe von länger gelagerten, toten Käfern. Außerdem wurden Unterschiede zwischen Männchen und Weibchen, sowie der Einfluss der Elytrenfärbung von *H. axyridis* und der Effekt unterschiedlicher Nahrung der Käfer auf die antimikrobielle Aktivität ihrer Hämolymphe untersucht. Die Bedeutung der Ergebnisse wird im Rahmen aktueller Daten diskutiert.

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Section 07 - Talk

Combining entomology & nematology

M. Herrmann, V. Susoy, W. E. Mayer & R. J. Sommer

Associations and interactions between insects and nematodes are probably as numerous as the diversity of taxa and relatedness of habitats would suggest. And yet, the interface of nematology and entomology remains notoriously under-studied with the main focus being on entomopathogenic nematodes of the families Steinernematidae and Heterorhabditidae.

We study beetle-associated nematodes of the family Diplogastridae, concentrating mainly on scarab beetles and wood inhabiting weevils. Collections of beetles on five continents and six islands yielded more than 26 new nematode species and two novel genera. These are now cultured in the lab, some with their cognate insect hosts, for more detailed studies on the exact nature of their interactions.

Whilst the scarab beetle-nematode interaction is mostly of necromenic nature, i.e. nematode larvae dwell on the beetle, waiting for its natural death, to then continue their development and feed on the carcass, we see in the weevil-nematode system some beneficial effects of Diplogastrid presence for the beetle. Combining traditional methods with modern techniques we were able to reveal interesting cases of co-evolution and novel modes of dispersal and host-finding behaviour.

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Section 07 - Talk

Wolbachia in arrhenotokous thrips species

S. Kumm & G. Moritz

Wolbachia is known to induce thelytokous reproduction in *Franklinothrips vespiformis* (Arakaki et. al. 2001) and *Hercinothrips femoralis* (Kumm & Moritz 2008). In Thysanoptera, Wolbachia was also found in some arrhenotokous species. In *Echinothrips americanus* (Thripidae) all tested individuals were positive for Wolbachia, whereas in *Suocerathrips linguis* (Phlaeothripidae) some individuals were positive whereas others were negative.

Different mating tests were arranged with adults of *E. americanus* and these showed that Wolbachia might cause cytoplasmic incompatibility (CI) in this species which would be the first proof of this reproductive manipulation in the order Thysanoptera. We performed experiments with different crosses between infected and uninfected individuals. Uninfected males and females were gained by antibiotic-treatment. As expected for CI in haplodiploids, the number of progeny in the cross of uninfected females and infected males was reduced and showed a strong male bias.

S. linguis is a subsocial phlaeothripid species. Individuals with different wing morphs exist in one population. Whereas individuals with long and cut wings are always females, short winged individuals are males. Within one population we found always Wolbachia-infected and non-infected individuals. We tested different wing morphs for the presence of Wolbachia and found the bacterium only present in some long and cut winged individuals, no short winged specimen was infected.

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Kumm, S., Moritz, G. 2008. First detection of Wolbachia in arrhenotokous thrips species (Thysanoptera: Thripidae and Phlaeothripidae) and its role in reproduction. *Environ. Entomol.* 37 (6): 1422-1428.

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Section 07 - Talk

Is there an intimate association between the grape phylloxera and *Pantoea* spp.?

N.C. Lawo & A. Forneck

Previous studies could show that even if the grape phylloxera (*Daktulosphaira vitifoliae* Fitch) lacks any intracellular symbionts such as *Buchnera* spp., leaf-galling forms are associated with the bacterium *Pantoea agglomerans*. As different studies report the involvement of the bacterium in varying metabolomic pathways of several insects we assume some relevance for phylloxera. Thus we aimed to clarify whether *P. agglomerans* is obligatory associated with leaf-galling phylloxera sucking on leaf-forming rootstocks and furthermore, if there is a linkage between leaf- and root-galling phylloxera feeding on the same rootstock. Applying a nested Polymerase Chain Reaction (PCR), we randomly screened nine leaf-galling populations from Europe and one population of leaf- and root-galling phylloxera feeding on the same rootstock for any infection with *P. agglomerans*.

In addition, we aimed in a culturing bioassay to verify whether *Pantoea* spp. appears inside leaf-galling phylloxera or on their integument's surface. Therefore, five leaf-galling phylloxera populations were additionally examined for *Pantoea* spp. growth on tryptic soy agar (TSA) plates. Our results reveal that the bacterium is not always associated with leaf-galling phylloxera feeding on leaves and/or roots of leaf-forming rootstocks and that it does not occur inside the aphid.

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Section 07 - Talk

Borrelia afzelii* influences olfactory orientation and vertical movement of *Ixodes ricinus

T. Meiners, A. Werkhausen, L. Nierhaus & H. Dautel

Nymphs of the blood-feeding tick *Ixodes ricinus* are known to walk short distances towards host odour, although their main mode of host finding is ambushing passing vertebrates. Several chemicals have been identified that can mediate the olfactory orientation of the eyeless ticks which are vectors of *Borrelia burgdorferi sensu lato* (Bb s.l.). While tick nymphs can parasitize both small and large vertebrates, large vertebrates like deer are not reservoir competent for Bb s.l.. Leaving possible co-feeding transmission apart, a large mammal thus often means a dead end for Bb s.l. Here we investigate whether *Borrelia afzelii* infected and uninfected ticks behave differently towards host (dogs, men, mice, mice litter) odours or certain host volatiles (CO₂; hexanoic acid) and we compared the questing heights of both tick groups. Uninfested ticks responded on a locomotion-compensator (servosphere) to all offered kairomones (except mice litter odour) and chose a high ambushing position. Infested ticks, although showing the same walking activity as uninfected ones, in contrast did not orientate to dog and human (but to mice litter) odours and chose a low ambushing position in stalk-arenas. Taking into account that mice and other small mammals are considered as main reservoir hosts of *B. afzelii*, our results support the idea that the bacterium might be able to influence the behavior of its vector for its own benefit.

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Section 07 - Talk

A multitag 454 pyrosequencing approach to detect endosymbiotic bacteria in weevils of the genus *Otiorhynchus* spp. (Coleoptera: Curculionidae)

A. Reineke & J. Hirsch

The application of next generation sequencing technologies hold great potential for the analysis of microbial communities (metagenomics), such as an assessment of the diversity of endosymbiotic communities in insects. Here, we report on a pilot study using a multitag 454 pyrosequencing approach of a bacterial 16S rDNA fragment to characterise bacterial communities associated with four different weevil species of the genus *Otiorhynchus* (Coleoptera: Curculionidae). Members of this genus are extremely polyphagous and are regarded as pests of a variety of ornamental and nursery plants worldwide. Adults cause damage by feeding on the foliage of the plants, while soil-borne larvae feed on the host plant's roots. By sequencing a total of ~48.000 bacterial PCR amplicons, we identified 50 different operational taxonomic units (OTUs), representing the total endosymbiotic bacterial diversity in the four studied *Otiorhynchus* species. The vast majority of sequences belonged either to the genus *Rickettsia* or were similar to "*Candidatus* Blochmannia" like bacteria. Beside these dominant groups several other bacteria were found in low sequence frequencies, with the four studied weevil species differing in the composition of their bacterial communities. Identifying endosymbionts in this genus represents a first step towards an understanding of both the evolution of different reproductive strategies in these weevils (parthenogenesis versus sexual reproduction) as well as of endosymbiont-host insect interactions and may provide a future basis for the design of novel pest management strategies.

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Section 07 - Talk

Mechanisms and effects of horizontal and vertical transmission of secondary endosymbionts in aphids and parasitoids

H. Alkhedir, P. Karlovsky & S. Vidal

Aphids harbour primary endosymbionts, which are involved in the metabolism of amino acids, and facultative secondary endosymbionts, which contribute to several life history traits in clones harbouring them. These secondary bacterial endosymbionts of aphids are known to be transmitted vertically from the mother to the offspring; horizontal transmission can be experimentally achieved by mating between aphid clones or by using microinjection techniques. However, we show that additional routes of bacterial transmission, either horizontally or vertically, prevail under natural conditions. The former route of transmission takes place via a form of “cannibalism” among aphid clones, where young nymphs feed on the haemolymph of other aphids (mostly older instars). The latter route of transmission depends on aphid parasitoids. During host feeding or during development of the parasitoid larvae secondary endosymbionts are taken up and are maintained in the haemolymph of these organisms. We were able to demonstrate that these secondary bacterial endosymbionts do not only affect life history traits of aphid specimens harbouring them, but also life history traits in the parasitoids, too. The implications of these findings will be discussed with regard to the background of aphid clone maintenance and aphid-parasitoid interactions.

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Section 08 - Talks

Physiology, biochemistry, developmental biology

Section 08 - Keynote

Studying cave adaptation in beetles

M. Friedrich

Strongly cave-adapted animals are characterized a suite of stereotypic morphological changes compared to surface species, which includes regressive traits such as the loss of body pigmentation and visual organs but also constructive modifications such as the increase in appendage length and touch receptors. Mechanistic insights into the genetic and developmental causes of these transformations are largely restricted to vertebrate models of cave adaptation at present. We have therefore begun to study the molecular causes and consequences of cave adaptation in the small carrion beetle genus *Ptomaphagus* (Coleoptera, Polyphaga, Leiodidae), which includes ancestral surface dwellers as well as highly adapted cave inhabitants in the Southeast of the United States. One of the best-known representatives is *Ptomaphagus hirtus*, which is characterized by the loss of hind wings and the reduction of the compound eye to a small lens patch. Deep sequencing analysis of gene expression in the adult head of lab-cultured animals revealed the preservation of phototransduction and circadian rhythm gene activities. While the same data also indicate the loss of select vision-related genes, the behavioral response of *P. hirtus* in light-dark choice assays is consistent with the presence of functional visual organs raising interesting ecological, physiological and evolutionary developmental questions.

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Section 08 - Talk

Caste specific development in larvae of eusocial *Melipona* stingless bees (Apidae, Meliponini) is determined by nutrition and genetic predisposition

S. Jarau

Reproductive division of labor in highly eusocial bees is based on the fact that female larvae may alternatively develop into adult workers or queens. In almost all species, queens are reared in larger cells than workers and receive more, or even different, food. In honey bees, for example, only larvae in large cells that receive “royal jelly” throughout their development can develop into queens. However, in stingless bees of the genus *Melipona*, queen and worker cells are indistinguishable, and all larvae feed on similar amounts of food. The mechanism that triggers queen development in these bees is still unresolved despite more than half a century of research and debate. We recently found that an enrichment of the larval food of *M. beecheii* with geraniol, which is the main compound in the labial gland secretions of nurse workers of this species, significantly increases the number of larvae that develop into queens. Interestingly, the proportion of larvae that developed into queens in treated brood cells matched the value (25%) predicted by a two-loci, two-allele model of genetic queen determination, in which only females that are heterozygous at both loci are capable of developing into queens. Due to the haplo-diploid system of sex determination in bees, this criterion is met by one quarter of a queen’s daughters. We, therefore, conclude that labial gland secretions, added to the food of some cells by nurse bees, trigger queen development, provided that the larvae are genetically predisposed towards this developmental pathway. Furthermore, geraniol is the first “caste determination substance” to be chemically identified in the larval food of social bees, including the honey bee, up to now.

Jarau, S., van Veen, J.W., Twele, R., Reichle, C., Herrera Gonzales, E., Aguilar, I., Francke, W. & Ayasse, M. 2010. Workers make the queens in *Melipona* bees: Identification of geraniol as a caste determining compound from labial glands of nurse bees. *J. Chem. Ecol.* 36: 565-569.

Stefan Jarau, Institut für Experimentelle Ökologie, Universität Ulm, Deutschland, stefan.jarau@uni-ulm.de (Presenting Author)

Section 08 - Talk

Resting metabolism of vespine wasps (*Vespula* sp.) in comparison with other arthropods

H. Käfer, H. Kovac & A. Stabentheiner

Vespine wasps (*Vespula* sp.) are capable of impressive thermoregulatory performance. However, the knowledge on their respiration is sparse and almost nothing is known about their resting metabolism. To investigate the wasp foragers' respiration they were placed in a flow through respirometer chamber where their CO₂ production was recorded overnight. Endothermic and behavioural activity was observed by infrared thermography to ensure that the individuals were "at rest". Most resting wasps were ectothermic or only slightly endothermic (thoracic temperature excess against abdomen <0.6°C). At high temperatures (>30°C) many wasps regurgitated liquid to cool their head by evaporation.

In the investigated temperature range ($T_a = 2.8$ to 42.4°C) mean CO₂ production rate of resting wasps increased according to an exponential function until the upper lethal temperature at ~ 46 - 47°C ($32.6 \text{ nl mg}^{-1} \text{ s}^{-1}$ at 2.8°C , $437.4 \text{ nl mg}^{-1} \text{ s}^{-1}$ at 25.0°C , $2312.5 \text{ nl mg}^{-1} \text{ s}^{-1}$ at 42.3°C).

Comparison with other arthropods shows that vespine wasps are among those with the highest mass specific resting metabolism. At 20°C their CO₂ production is 60% higher than that of honeybees ($300.9 \text{ nl mg}^{-1} \text{ s}^{-1}$ vs. $186 \text{ nl mg}^{-1} \text{ s}^{-1}$). *Nowickia* sp., a tachinid fly of comparable body mass, has an even lower resting metabolism. It produces only $38.4 \text{ nl mg}^{-1} \text{ s}^{-1}$ or 13% of the wasps' CO₂ output.

A comparison with 10 species from the literature showed that the basal turnover obviously does not correlate with body mass if surveyed among taxa – even in relatively closely related species like bees and wasps the basal metabolism may vary significantly.

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Section 08 - Talk

Thermoregulation of foraging honeybees on flowering plants

H. Kovac, A. Stabentheiner

During nectar and pollen foraging in the temperate climate, honeybees are exposed to a broad range of ambient temperatures, challenging their thermoregulatory ability. The body temperature that the bees exhibit results from endothermic heat production, exogenous heat gain from solar radiation and heat loss. We investigated the thermoregulatory behavior of foragers on 33 flowering plants in dependence on season and environmental factors.

The bees were always endothermic. On average, the thorax surface temperature (T_{th}) of *Apis mellifera carnica* was regulated at a high and rather constant level over a broad range of ambient temperatures ($T_{th}=33.7-35.7^{\circ}\text{C}$, $T_a=10-27^{\circ}\text{C}$). However, at a certain T_a , T_{th} showed a strong variation, depending on the plants from which the bees were foraging. At warmer conditions ($T_a=27-32^{\circ}\text{C}$) the T_{th} increased nearly linearly with T_a to a maximal average level of 42.6°C . The thorax temperature excess decreased strongly with increasing T_a ($T_{th}-T_a=21.6-3.6^{\circ}\text{C}$). The mean temperature of the head ($24.3-37.2^{\circ}\text{C}$) was more strongly elevated above T_a in the cold than in the warmth. The abdomen was the coolest body part ($16.0-37.5^{\circ}\text{C}$). Its temperature increased linearly with T_a (about 5°C above T_a). The bees used the heat gain from solar radiation to elevate the temperature excess of thorax, head and abdomen. Seasonal variations could be detected. The mean T_{th} of bees foraging in spring was 4.2°C higher than in summer. We presume the foragers' motivational status to be responsible for the variation of T_{th} between different plants and seasons.

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Section 08 - Talk

Cardenolide Resistance in Milkweed Butterflies (Lepidoptera, Danaidae): Evolutionary and Biochemical Aspects

G. Petschenka, S. Fandrich, S. Schröder & S. Dobler

Cardenolides are highly toxic secondary plant compounds which specifically inhibit the ubiquitous animal enzyme Na^+K^+ -ATPase. Larvae of the monarch butterfly (*Danaus plexippus*) feed on apocynaceous plants which produce high amounts of cardenolides for their defence. The caterpillars, however, can not only tolerate the toxins but also sequester them and use them for their own protection against predators.

The monarch Na^+K^+ -ATPase was shown to possess a reduced *in vitro* sensitivity to the cardenolide ouabain (Vaughan & Jungreis 1977). This *target site insensitivity* is regarded to render this species resistant to cardenolides. Since usage of apocynaceous plants is a general feature of danuids we screened the Na^+K^+ -ATPases of species of different genera (*Danaus*, *Tirumala*, *Amauris*, *Idea*, *Ideopsis*, *Euploea*) for their ouabain sensitivity. Our study revealed the existence of three forms showing different sensitivities. Most genera possess very sensitive enzymes. A highly ouabain insensitive form of the enzyme is restricted to *D. plexippus*. Additional *Danaus* species and members of the sister taxon *Tirumala*, however, were shown to possess a form with an intermediate sensitivity suggesting a stepwise evolution of *target site insensitivity* in milkweed butterflies.

Apocynaceous plants usually produce a wide array of structurally different cardenolides. For this reason it might be insufficient to determine Na^+K^+ -ATPase sensitivity with ouabain only. We therefore applied various cardenolides to the *D. plexippus* - Na^+K^+ -ATPase to elucidate structure-activity relationships. Our data demonstrate that there are striking differences. Certain cardenolides inhibit the Na^+K^+ -ATPase to an extent similar to the inhibition by ouabain observed for sensitive Na^+K^+ -ATPases. Hence, the famous *target site insensitivity* in *D. plexippus* is a relative phenomenon that deserves a more differentiated consideration.

Vaughan, G.L., Jungreis, A. M. (1977): Insensitivity of lepidopteran tissues to ouabain: physiological mechanisms for protection from cardiac glycosides. *Journal of Insect Physiology*, 23: 585-589.

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Section 08 - Talk

The role of polydnaviruses in modulating host immunity and development

C. Schafellner & A. Schopf

Polydnaviruses (PDVs) associated with their respective parasitic wasp species represent a remarkable obligatory association between a virus and an insect. The PDV-carrying endoparasitic wasp *Glyptapanteles liparidis* (Hym., Braconidae) parasitizes early larval stages of the gypsy moth, *Lymantria dispar* (Lep., Lymantriidae). Protected by venom and PDV, the wasp larvae develop without provoking a cellular defense reaction of the host. Parasitized larvae exhibit a significantly lower number and viability of hemocytes. Additionally, parasitization reduces the ability of hemocytes to spread. The wasps regulate host development by targeting the hormones that trigger metamorphosis and the hemolymph nutrient content. Growth and food consumption of the parasitized hosts are reduced and they never show any signs of metamorphosis. After parasitoid emergence from the host, the host remains developmentally arrested and dies. In the absence of PDV/venom, however, parasitoid eggs or larvae fail to develop; they are readily encapsulated by host hemocytes and killed.

Gamma-sterilized wasps that inject infertile eggs at oviposition, but viable PDV particles allowed us to study the effect of wasp-associated factors on host growth and metabolism without the interference of a developing parasitoid. Such PDV/venom-injected hosts reach the final instar, but exhibit severe malformations or die as larval-pupal intermediates. The few insects that were able to molt into adult moths needed longer to develop and attained higher body masses.

Additionally, we tested PDV efficiency in a species closely related to the gypsy moth, but non-permissive. *G. liparidis* wasps oviposit into young nun moth (*Lymantria monacha*) larvae, but the eggs are eliminated by encapsulation. The effects of parasitism on host growth (mortality, malformations), however, were similar to virus-injected *L. dispar* larvae. Preliminary results of PDV gene activity in the parasitized hosts show that several virus genes enter the host hemocytes of the permissive host *L. dispar*. However, some of these genes are not able to infect the blood cells of the non-permissive host *L. monacha*, thereby obviously keeping the immune responses intact.

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Section 08 - Talk

Energetic and thermal optimization of foraging honeybees in a variable environment

A. Stabentheiner, H. Kovac

In foraging honeybees, which are nearly always endothermic, compensation of heat loss is a great challenge because of their small body size. This calls for energetic optimization. A high body temperature, on the other hand, may speed up foraging despite the necessity of a higher energy turnover, because muscle function is temperature dependent. We investigated the balancing of thermoregulation (measured by infrared thermography) with reward, energetic investment (measured *via* CO₂ production, V_{CO_2}) and solar heat gain in bees foraging sucrose from within a 12 ml flow-through respirometer chamber.

Bees foraging 0.5 M sucrose with unlimited flow in shade (<100 W/m²) regulated the thorax surface temperature (T_{th}) at 39.5 and 37.4 °C at ambient temperatures (T_a) of 34 and 15 °C, and displayed a V_{CO_2} of 109 and 164 μ l/min, respectively.

Solar radiation (>500 W/m²) was invested to do both increase T_{th} and decrease V_{CO_2} . However, this was done differently at different T_a s. T_{th} increased by only 0.9 °C at $T_a = 34$ °C (to 40.4 °C) but by 3.8 °C at $T_a = 15$ °C (to 41.2 °C). This caused V_{CO_2} to decrease to 67 μ l/min at $T_a = 34$ °C but to increase to 181 μ l/min at $T_a = 15$ °C. The increase of T_{th} in sunshine increased suction speed considerably.

With less profitable reward (0.5 M sucrose at a limited flow of 0.9 ml/h) bees in shade decreased both T_{th} and V_{CO_2} (to 37.6 and 36.9 °C at a V_{CO_2} of 46 and 165 μ l/min, at $T_a = 34$ and 15 °C, respectively). Solar radiation increased T_{th} to 38.7 and 37.4 °C, and decreased V_{CO_2} to 33 and 129 μ l/min at these T_a s, respectively.

Foraging in sunshine reduced energetic costs per stay at all T_a s and reward rates (~30-64%). Our investigation shows that foraging honeybees exhibit differential thermal and energetic strategies at different environmental conditions and rewards to optimize foraging efficiency.

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Section 08 - Talk

The burying beetle *Nicrophorus vespilloides* - Immune effector molecules and enzymes for carcass utilization

H. Vogel, C. Badapanda & A. Vilcinskas

Beetles of the genus *Nicrophorus* are among the largest and most conspicuous of the staphylinoid superfamily. While some species feed on both dung and certain fungi, most are carrion-associated and will breed at carrion on which the larvae will feed.

The burying beetle *Nicrophorus vespilloides* (Silphidae) is able to locate a deceased animal within a very short time after its death, and up to a distance of several km. Male and female cooperate in burying the carcass, and defend it against infestation by dipteran larvae and other intruders, showing biparental care of their offspring. Hairs or feathers of carrion are removed, and a „brood ball“ is formed and impregnated with oral and anal secretions. These secretions not only efficiently prevent bacterial and fungal growth as the carcass shows hardly any sign of microbial decay but also pre-digests the food source for their larvae. Thus, *Nicrophorus* not only has a highly complex and unusual ecology and behavior, but also contains effective antimicrobial defenses and enzymatic tools for the shedding and pre-digestion of the carcass.

We generated a deep transcriptome of adult *Nicrophorus* (both control and immune-stimulated) using NextGen (Roche 454 and Illumina) sequencing technologies and have identified a larger number of immune-related effector genes and transcripts coding for enzymes related to digestion and carcass pre-processing. Here we will discuss these findings in the light of the highly adapted and specialized carcass conservation and utilization ecology of *Nicrophorus*.

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Section 09 - Talks

Biotechnology of insects

Section 09 - Keynote

Nano Photonic structures of Morphidae : An hotchpotch of singularities

S. Berthier

The Morphidae are known for their very impressive and vivid blue iridescent coloration, even if it concerns only a great half of the 36 species actually identified. As a physicist working on photonic structures, I will also focus this presentation on these iridescent species, more precisely on the nano structure of their wing scales, considered no more as a biological cell but as a natural photonic crystal. A butterfly wing – and this is particularly true for that of the Morpho - is a multifunctional device: Aside the flight which is its main function, it delivers an intra specific message, it participates to the thermodynamic balance of the butterfly, the structure ensures the hydrophobia and the self cleaning of the wing...As all these constraints are characterized by different typical size scales, the structure has to be itself multiscaled. As all of these functions are equally vital for the insect, none of them has to be privileged, which requires a global optimization. This requires a non perfect structure at each scale: the structural disorder then appears as a fundamental and vital parameter.

The mean structure of the wings of the Morphos is well known and will be very briefly recalled to focus on the exceptions, the singularities and the great diversity of structures that characterize this extraordinary family. We will show for example that, while most of the iridescent species practice a coherent optic, two species neglect the phase of the wave and have chosen the incoherent one, with strange consequences. The non coloured properties – the polarization state of the reflected light - also reserve many surprises. At least, we will conclude by the presentation of a work in progress: the dynamic aspect of the coloured properties, i.e. the evolution of the aspect of the Morpho during the flight

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Section 09 - Talk

RNA interference based approaches in insect biotechnology

E. Knorr & A. Vilcinskas

RNA interference (RNAi) caused by exogenous double-stranded RNA (dsRNA) has emerged as a powerful technique for down-regulating gene expression in insects and other organisms. Injection of dsRNA to suppress expression of the corresponding gene has become a widely used tool in analyzing gene functions. We used this method to explore the functions of proteins, such as metalloproteinases, metalloproteinase inhibitors and heat shock proteins, in development and immunity of the model beetle *Tribolium castaneum* which is amenable to systemic and persistent RNAi. Injection of dsRNAs results in a variety of phenotypes among which some are lethal when they interfere with essential developmental processes or metabolism. The discovery that also feeding of dsRNA produces RNAi effects in insects has opened the door for novel approaches in insect biotechnology. RNAi mediated silencing of specific gene(s) in pest insects through plant delivered RNA, offers the possibility to target genes necessary for their development, reproduction, or feeding success. Recent literature provides evidence that expression of dsRNAs directed against insect genes in transgenic plants causes RNAi effects which can confer protection against insect herbivores. Principally, this technology enables engineering of a new generation of pest-resistant GM crops. However, efficacy of protection and the range of species affected are dependent on the RNAi targets selected. Hormone receptors present in insects, but absent from vertebrates, represent favourite target genes since analogues of insect growth regulators such as ecdyson or juvenile hormone have been introduced as environmental save insecticides in plant protection.

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Section 09 - Talk

A novel technology for protein expression in insects

G. R. Makert, S. Chabierski, N. Delaroque, M. Giese, M. Szardenings & S. Ulbert

This study describes an efficient and simple method to express foreign proteins in insects via feeding of plasmid DNA. For the proof of principle, the mealworm *Tenebrio molitor*, the fly *Musca domestica*, and the honey bee *Apis mellifera* were fed with a plasmid encoding the Enhanced Green Fluorescence Protein (EGFP). The DNA was mixed with the food specific for the species tested (sugar water or dry meal) and exposed to the animals up to several days. EGFP expression was detected over a period of several days by fluorescence microscopy and western blot. The protein was found in a variety of tissues in all insects analyzed, and no toxic side effects were observed. Furthermore, feeding of a plasmid coding for the arthropod-specific neurotoxin ω -atracotoxin Hv1a led to statistically significant mortality in insects, in comparison to control DNA. These results demonstrate that it is possible to transiently transfect insects via orally applying plasmid DNA and are applicable in several fields of biotechnology, including recombinant protein expression and insect pest control strategies.

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Section 09 - Talk

Circular polarization handedness switching in chiral beetle's cuticles

P. Simonis, A. di Martino, M. Foldgna & S. Berthier

Beetle's cuticles are known to have been able to evolve a large variety of structures with the consequence that they produce a great variety of visual effects. These range from metallic sheen and iridescence to interferential production of very dull colors [1]. Even if the human eye is only very weakly sensitive to it [2], the production of well-defined polarized light can be considered an important visual effect in biology. Many animals, including insects (i. e. bees), octopus, squids and cuttlefishes do perceive polarization. Some beetles, particularly in the family of Cetonidae, produce circular polarized light after reflection from their cuticle [3], maybe for intra or extra species recognition. We present here the first complete experimental account of the abrupt change of handedness of the circular polarization produced on these insects under a change of incident wavelength. Several beetles such as *Cetonia aurata* and *Chrisina chrysargyrea* have been studied. A simple theoretical model has been developed to explain the transition from left to right at a rather well defined wavelength.

[1] Jean-Pol Vigneron et Priscilla Simonis, 2010, "Structural Colours", pp. 181-218, in Jérôme Casas and Stephen J. Simpson, editors: *Advances in Insect Physiology*, Academic Press (Burlington) Vol. 38,

[2] A. Le Floch, G. Ropars, J. Enoch, V. Lakshminarayanan, (2010) "The polarization sense in human vision", *Vision Res.* 50(20):2048-2054

[3] A. A. Michelson, *Philosophical Magazine* 21, 554-567 (1911)

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Section 09 - Talk

Insect Biotechnology in Germany

A. Vilcinskas

Insect biotechnology can be defined as the use of insects as well as insect-derived cells or molecules in medical (red biotechnology), agricultural (green biotechnology), industrial (white) biotechnology or other technological applications such as bionics which focuses on the systematic transfer of solutions from nature to the technical world. Biotechnology comprises a very broad spectrum of applications which are differentiated by established color-codes, for example, the blue biotechnology refers to technological application of marine organisms to produce food, cosmetics, medication or new materials. By analogy, I propose the alternative term yellow biotechnology when insects or insect-derived cells or molecules are used in medical, pharmaceutical, agricultural or industrial applications because yellow is yet not occupied in the color-code and insect hemolymph has often a yellow color. The remarkable advances in insect biotechnology are essentially driven by scientific breakthroughs in molecular biology, particularly by the development of tools and techniques that allow genetic characterization and engineering of organisms and cells. The presentation provides an overview about knowledge-based, targeted discovery of novel insect-derived molecules and their role in the development of second generation antibiotics or enzymes for industrial applications. The enormous economical and innovate potential which has been attributed to this emerging research field, convinced the government of Hesse to invest 4.5 million € in a collaborative research center and 4 million € in a Fraunhofer project group (both located at the university of Giessen) to establish for the first time a competitive research unit focusing on insect biotechnology in Germany. The presentation provides an overview about its goals and research program, and introduces the first graduate school in insect biotechnology.

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Section 10 - Talks

Transgenic plants and insects

Section 10 - Keynote

GM crops and environmental risks associated with biological diversity: Three themes and consequent challenges

D. A. Andow

For many reasons, great controversy surrounds the scientific issues related to environmental risk assessment (ERA) of GM crops. Some of this hinges on different assumptions about what environmental effects are important to consider: direct and/or indirect; agricultural and/or non-agricultural; human-mediated and/or not mediated by humans. In reviewing this literature, I found three significant themes about the unintended effects of GM crops on biological organisms. The first theme is that the ERA methodology needs to be improved so that it can assess sustainability in meaningful ways. Using natural and biological control as an example, a meta-analysis of the laboratory studies examining toxicity of Bt crops to natural enemies revealed that there were many undetected and unreported direct effects of Bt crops on arthropod predators and parasitoids; hence the methods are not sufficiently sensitive to reliably reveal the effects. Pest management and biological control theory need to be incorporated into ERA to assess sustainability. The second theme is that culture is important for ERA. Unfortunately, nearly all ERA endpoints are narrowly utilitarian. The scientific response to reports that monarch butterflies may be harmed by Bt maize in the USA addressed the scientific dimensions of risk assessment, but what value do monarchs have for US citizens? The attention revealed the depth of cultural concern for a biological species; such cultural concerns are by necessity local and need to be incorporated into ERA. The third theme is that economic entomology will still thrive with Bt crops. New pests are arising on many Bt crops, including mirid bugs on Bt cotton in China and stink bugs on Bt cotton in SE USA. Our investigations are suggesting that in SE USA, stink bugs have become a pest in part because of the reduction in insecticides targeted at pest Lepidoptera, but also because of release from competition from these same Lepidoptera. The reasons that these new pests arise is a challenge for risk assessment and insect ecology.

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Section 10 - Talk

Assessing potential effects of multi-insect resistant maize on *in vitro* reared honey bee larvae

S. Härtel, H. P. Hendriksma & I. Steffan-Dewenter

The honey bee (*Apis mellifera*) is a key non-target arthropod in environmental risk assessment of genetically modified (GM) insect resistant crops. Transgenic insecticidal proteins primarily affect the larval phases of target organisms and older honey bee larvae are directly exposed to GM pollen during their development. Therefore robust and highly standardized testing methods for *in vitro* rearing of honey bee larvae are required to minimize potential risks for this important pollinator. Here we test effects of pollen of a single and a stacked *Bt*-maize variety on the survival and prepupae weight of bee larvae. In the laboratory, we used and adopted a new GM plant risk assessment method by adding transgenic pollen directly to the larval diet. We tested pollen of two transgenic and three conventional maize varieties, by feeding three days old larvae a semi-artificial diet containing a realistic exposure dose of 2 mg pollen. As positive control we fed toxic pollen to the larvae. In a second experiment, we tested the effects of single as well as a mix of purified Cry-proteins in our bioassay. The concentration of the Cry-proteins ranged from 0 to 1000x of the estimated environmental concentration. Assessment endpoints were survival and pre-pupae weights of the tested individuals. We will discuss the results of our pollen and Cry-protein feeding studies on honey bee larvae in detail. The controlled direct exposure to the plant produced insecticidal proteins improves the strength of GM plant risk assessments for bees. We conclude that our novel method has the potential to become a standard method in honey bee environmental risk assessments.

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Section 10 - Talk

Einfluss der Seitenkettenlänge aliphatischer Glucosinolate auf die Resistenz von *Arabidopsis thaliana* gegenüber verschiedenen spezialisierten Lepidoptera-Arten

I. Mewis, F. Rohr, J.GH. Tokuhsa, M. Schreiner, & Ch. Ulrichs

Die in der Pflanzenordnung Brassicales vorkommenden Glucosinolate (GS) besitzen eine gemeinsame Grundstruktur, allerdings ist der Seitenkettenrest dieser Sekundärmetabolite variabel und kann aliphatisch, aromatisch bzw. indolisch sein. Insbesondere die aliphatischen GS-Profile von *Arabidopsis thaliana* L.-Ökotypen und anderen Vertretern der Brassicales variieren sehr. Bisherige Studien zu intra-spezifischen GS-Variabilität geben wenig Einblicke über die Wirkung einer unterschiedlichen Seitenkettenstruktur auf phytophage Insekten. Aufgrund dessen wurden innerhalb dieser Studie die biologische Wirkung aliphatischer Glucosinolate mit einer unterschiedlichen Kettenlänge auf verschiedene Lepidoptera, den Generalisten *Spodoptera exigua* (Hübner) und den Spezialisten *Pieris brassicae* (L.), untersucht. Als Modellpflanze fungierte *A. thaliana* Columbia Wildtyp (WT), welche innerhalb der Expression von MAM3 (*mam3+*) genetisch modifiziert wurde. Das MAM3-Protein katalysiert die Kondensation von Acetyl-CoA mit α -Ketosäuren innerhalb der Seitenkettenverlängerung von C3- bis C8-Glucosinolaten ausgehend von Methionin.

Entsprechend dem chemischen Methylsulfinyl-GS-Profil wurden die unterschiedlichen *mam3+*-Linien eingeteilt in C3 (fünf Linien) oder C7/C8 (sieben Linien) produzierend. Die Bioassays mit den Insekten erfolgten im Vergleich zum WT, wobei der aliphatische GS-Gehalt generell niedriger in den *mam3+*-Linien war, bei gleichbleibenden Gehalten an Indolyl-GS. Die prozentuale Gewichtszunahme der Larven des Generalisten *S. exigua* war nach drei Tagen signifikant höher an den *mam3+*-Linien im Vergleich zum WT. Im Gegensatz dazu war die Gewichtszunahme des Spezialisten *P. brassicae* geringer an dem C3-GS-produzierenden *mam3+*-Phänotyp im Vergleich zum C7/C8-GS-akkumulierenden *mam3+*-Phänotyp und dem WT (C4). Die Ergebnisse lassen auf eine unterschiedliche biologische Funktion von GS verschiedener Kettenlänge schließen.

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Section 11 - Talks

Tropical entomology

Section 11 - Talk

Odour preferences and perfume composition of male orchid bees (*Euglossa* spp.) along an ecological gradient

M. Hannibal & T. Eltz

Male orchid bees collect volatile substances from natural sources and store them in specialized hind leg pockets. Over time they acquire complex and species specific blends of perfumes which are thought to function as attractants for females during courtship display. How do males succeed in composing species-specific blends of perfumes from a variable and unpredictable volatile “market”? It has been proposed that both innate odour preferences as well as learning are involved. Cage experiments revealed that males avoided odor compounds that they had collected on previous occasions. To test whether such experience-dependent choices, in combination with a variable market, are responsible for the observed geographic variation in volatile preferences, we measured bait compound preference and perfume composition of *Euglossa aff. viridissima* males at 16 different locations on the Yucatán peninsula, Mexico. The chemical composition of the male hind leg perfume was measured as the best proxy of local volatile availability. As expected, significant geographic variation in bait preferences as well as perfume composition was found. A preliminary analysis showed a negative relationship between the relative attractiveness of some compounds and their incidence in male perfumes, i.e. males avoided collecting certain compounds at locations where these compounds are abundant. Some of the geographic variability of bait preferences and perfume composition was related to habitat type. The compound benzyl benzoate was collected significantly more frequently at inland versus coastal localities. This preference was associated with a significantly lower incidence of benzyl benzoate in the hind leg perfumes of males captured at inland localities. Our data corroborate the idea that male orchid bees use learned avoidance of locally abundant odors to compose species specific “bouquets” of perfume.

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Section 11 - Talk

Attraction of *Euglossa igniventris* females to odorous substances.

K. Lunau, S. Dötterl & T. Eltz

Male euglossine bees (Euglossini) collect volatile substances from flowers, tree saps, faeces and other sources. Combining the volatiles collected from various sources the males build up and store in tibial pouches of their hind legs species-specific perfumes. At perching sites individual males release their perfumes which probably act as pheromone analogues that are emitted to attract females (Eltz et al. 2008). Males can be easily observed in neotropical rainforests when components of their perfumes are exposed for baiting, and – far less often – at perching sites, at natural sources of volatiles and on nectar-rewarding flowers. Females have been only rarely observed at nesting sites and on flowers from which they collect pollen, nectar and resin. Here we report observational data of *Euglossa igniventris* ♀♀, which were attracted towards the fruits of the tree *Tabernaemontana arborea* (Apocynaceae) and to human odour during our study on Barro Colorado Island (Panama) in 2010. Four approaches of *E. igniventris* ♀♀ per hour to the body of the first author were registered. In order to exclude that the females were attracted to volatiles emitting from the clothes, particularly those made of natural rubber such as shoe soles, a baiting experiment was set up, in which the naked body and some clothes were offered as baits; the females were attracted mostly towards the body. It was also observed that *E. igniventris* ♀♀ collected the white pulp of opened fruits of *T. arborea* with their hind legs. Preliminary GC-MS-studies of head space collected odours indicate that body and *T. arborea* fruits do not share prominent volatile components; further and more fine-tuned studies are necessary. The possible relationships between the responses of male and female euglossine bees towards odour sources are discussed.

Eltz T, Zimmermann Y, Pfeiffer C, Ramírez Pech J, Twele R, Francke W, Quezada-Euan JJG, Lunau K 2008. Current Biology, 18: 1844-1848.

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Section 11 - Talk

Diversity and latitudinal distribution of hymenoptera parasitoids associated to Agromyzidae in the Peruvian coast.

N. Mujica & J. Kroschel

Field surveys to study the latitudinal distribution of parasitoids associated to Agromyzidae flies were conducted in the winter and autumn season in ten agricultural production regions along the Peruvian coast from Tumbes (0°01'11" S) in the north of Peru to Tacna (18°21'05" S) in the south, in a total of 29 provinces. Sampling of leafminer-infested leaves from 29 vegetable crops yielded 63 species of hymenopteran parasitoids. The endoparasitoids *Halticoptera arduine* (Walter) (48.2%), *Chrysocharis flacilla* Walker (19.5%), and *C. caribea* Boucek (8.0 %) as well as the ectoparasitoid *Diglyphus websteri* (Crawford) (8.7%) were the most abundant parasitoids. Parasitoid diversity was affected by the particular climatic conditions along the Peruvian coast and this was supported by alpha and beta diversity analysis. *H. arduine*, *D. websteri* and *Ganaspidium* sp. showed a wide distribution along the Peruvian coast from north to south, which clearly indicates their adaptation to different climates. *C. flacilla* was more abundant in the southern part of Peru and *C. caribea* in the north and central coast, which indicates that both species have probably more specific climatic requirements. Further, our results indicate that ectoparasitoids are more abundant at higher temperatures in the tropical region of northern Peru or during warmer vegetation periods. In Tumbes, ectoparasitoids represented 80% of the parasitoid population in autumn but only 41% during the winter season. Likewise, it was the only region where *H. arduine* did not occur in the autumn season. The wide host plant and leafminer fly adaptation of the parasitoids *H. arduine*, *C. flacilla*, *C. caribea*, *D. websteri*, *D. begini* and *Ganaspidium* sp. shows great potential of those parasitoids for classical biological control programs, allowing its use in a number of different crops and leafminer fly associations.

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Section 11 - Talk

Interactions between neotropical bees, flowering plants and hummingbirds: sensory exclusion of bees as nectar robbers of neotropical plants.

S. Papiorek, K. Lunau, T. Eltz & M. Sazima

Neotropical bees often act as nectar robbers or nectar thieves to exploit the nectar of flowers pollinated by hummingbirds. As these bees do not pollinate the flowers, costs arise for flowers that do not exclude nectar-robbing bees. Flowering plants pollinated by hummingbirds show typical morphological characters summarized as the “ornithophily-syndrome”. Some of these morphological characters are thought to (1) act as adaptations for the interaction with the pollinators of the flowers, (2) exclude non-pollinating visitors, or (3) both. For example, the mechanisms for the exclusion of bees are a long tubular morphology of the corolla, dilute nectar located at its base, the absence of a landing platform, and the absence of odour. In this study we tested sensory exclusion of bees and show that both white and red hummingbird-pollinated flowers differ from bee-pollinated flowers in their reflection properties of UV-light. On average, hummingbird-pollinated red flowers are less UV-reflective and white flowers are more UV-reflective than the same-coloured bee-pollinated ones. In preference tests with artificial flowers, neotropical orchid bees prefer red UV-reflecting artificial flowers and white UV-nonreflecting flowers over red and white flowers with opposite UV-properties. Plotting floral colours and test stimuli into the honeybees’ perceptual colour space suggests that the less attractive colours are achromatic for bees and therefore not detectable against the background. The results of our preference tests and spectral reflection recordings suggest that, beside the morphological characters given above, the floral colour can act as an exclusion mechanism for non-pollinating visitors like bees. The underlying colour preference in bees might provide hummingbirds with an ecological private channel consisting of colours which are non-attractive for bees.

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Section 11 - Talk

Cuticular hydrocarbons distinguish cryptic sibling species in *Euglossa*

T. Pokorny & T. Eltz

Different species of orchid bees, often brilliantly coloured bees from tropical America, can be told apart by their colouring and morphological differences, as well as by the composition of their males' acquired perfume blends (Zimmermann et al. 2009). In the course of the recent discovery of *Euglossa* aff. *viridissima*, a yet undescribed cryptic sibling species of *Euglossa viridissima* (Eltz et al. 2008), we have conducted an analysis of their respective cuticular hydrocarbons. The samples comprised individuals of two localities in southern Mexico situated 265 km apart, and were collected in both dry and wet season. The composition of cuticular hydrocarbons was species specific irrespective of locality and time of year, and allowed a clear distinction of the two lineages, including the correct attribution of a rare morph of *E. viridissima* with aberrant morphological characteristics.

Our current research now aims to determine if *Euglossa* species can generally be distinguished by their cuticular hydrocarbon profiles and whether they might reflect the phylogenetic relationships, thus providing another clue for genealogic analyses in this genus.

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Section 12 - Talks

Medical entomology

Section 12 - Keynote

Recent developments in bluetongue disease epidemiology and in research on the *Culicoides* vectors (Diptera: Ceratopogonidae) of the bluetongue virus

H. Kampen

After three years of bluetongue virus serotype 8 (BTV-8) circulating and spreading, the most dramatic vector-borne epidemic of veterinary relevance in contemporary Europe, bluetongue disease (BTD), appears to have come to a standstill in 2010, probably as a result of the mass vaccination programmes implemented in 2008. Many questions, however, remain to be answered, particularly concerning the epidemiological role of the biting midge vectors of the virus. For example, it is still not definitively known which indigenous *Culicoides* species are vector-competent for the virus, although several studies suggest that certain members of the *Obsoletus* and the *Pulicaris* complexes are the vectors. In addition to that, the identification of culicoid specimens belonging to species complexes is still an obstacle in European BTD research as they cannot be distinguished morphologically. Newly developed identification assays, predominantly DNA sequence-based approaches, have been shown to differ in specificity and sensitivity. Moreover, it is not clear whether a viral wildlife reservoir exists. If present, it could be the source of resurgent virus activity once the immunization prevalence among domesticated ruminants has sufficiently decreased with the continuing replacement of immunized by non-immunized animals. In some European countries heavily affected in 2007 and 2008, including Germany, compulsory vaccination has already been suspended because of the limited number of outbreaks during 2009. One way to identify possible reservoir hosts of the virus is to test putative vector species for the origin of their blood meals, in order to determine their host preferences before screening the respective host species for BTV in a second step. Several blood meal identification studies have been conducted only recently but have so far been mainly focussed on evaluating methodologies. The presentation will provide an overview on BTD and BTD vector research and discuss recent findings and developments.

Helge Kampen, Friedrich-Loeffler-Institut, Bundesforschungsinstitut für Tiergesundheit, Germany, helge.kampen@fli.bund.de (Presenting Author)

Section 12 - Talk

Characterisation of aspartate and cysteine proteases in the digestive tract of *Triatoma infestans* (Hemiptera)

C. Balczun, C. K. Meiser, J. Siemanowski, S. Helling, K. Marcus, C. Stephan, H. E. Meyer, A. Kollien, T. Schneider & G. A. Schaub

The reduviid bug *Triatoma infestans* is the main vector of *Trypanosoma cruzi*, the aetiological agent of Chagas disease in Latin America. All postembryonic stages are exclusively blood feeders and ingested 6-12 times their original body weight. The distensible anterior midgut, the stomach, stores the essentially undigested blood and small portions are passed into the digestive and absorptive posterior midgut. In contrast to other haematophagous insects, the lumen of the midgut is acidic and the blood proteins are digested by cathepsins, i.e. aspartate and/or cysteine proteases. In order to understand the participation of the different cathepsins in blood digestion, cDNAs encoding four cysteine proteases and two aspartate proteases have been amplified and sequenced. In addition, the two isoforms of cathepsin D have been identified in the luminal content of the posterior midgut by mass spectrometry. The expression levels of the proteases at different time points after blood feeding have been quantified by means of quantitative PCR as well as the activities of aspartate and cysteine proteases. These data point out that cathepsin B is the main digestive protease of *T. infestans*.

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Section 12 - Talk

Entwicklung eines Wahlversuchs für die Wirksamkeitsprüfung von Kontaktinsektiziden gegen die Bettwanze *Cimex lectularius*

A. Boyer, E. Schmolz & C. Kuhn

Der Befall mit Bettwanzen ist nicht nur ein sehr lästiges, sondern auch gesundheitsgefährdendes Problem für die Betroffenen. Seit Ende der 1990er Jahre nimmt die Befallsrate in Privathaushalten, Reiseunterkünften, Transportmitteln und öffentlichen Einrichtungen wieder dramatisch zu. Die Bekämpfung ist aufgrund der kryptischen Lebensweise der Tiere oft langwierig und teuer. Bettwanzen werden mit Kontaktinsektiziden bekämpft, gegen die es mittlerweile Resistenzen gibt. Es ist daher von großer Bedeutung, Testverfahren zu entwickeln, mit denen insektizide Produkte gegen *Cimex lectularius* auf ihre Wirksamkeit unter simulierten Praxisbedingungen geprüft werden können. In den bislang zur Wirksamkeitsbewertung eingesetzten Versuchen wurden die Bettwanzen direkt auf eine mit Kontaktinsektizid behandelte Oberfläche gesetzt und für eine definierte Zeit dort gelassen. Dieses Vorgehen entspricht einem Zwangsversuch. Im Gegensatz hierzu liefen die Prüftiere im Wahlversuch, angelockt durch einen spezifischen Reiz (CO₂ in Kombination mit einer Wärmequelle), über eine mit Insektizid behandelte Oberfläche. Der Lockreiz sollte für die Bettwanzen die Anwesenheit eines Wirtes vortäuschen. Dabei richtete sich die Einwirkzeit der verwendeten Insektizide nach dem natürlichen Laufverhalten der Tiere. Zur Entwicklung des Wahlversuchs wurden vergleichende Versuche mit zwei Insektiziden unterschiedlicher Wirkstoffe und Eigenschaften durchgeführt. Zusätzlich kamen Prüfoberflächen mit unterschiedlichen Oberflächeneigenschaften zum Einsatz. Die Wirksamkeit von Mittel A (Pyrethroid) und Mittel B (Bendiocarb) gegen *C. lectularius* konnte mit Hilfe des Wahlversuchs praxisnah getestet werden. In den Wahlversuchen konnte nachgewiesen werden, dass die Weibchen sensibler als Männchen auf die eingesetzten Insektizide reagierten. Vermutet wird ein Zusammenhang mit der traumatischen Insemination als Paarungsverhalten bei *C. lectularius*.

Arlette Boyer, Umweltbundesamt Berlin, Deutschland, arlette.boyer@uba.de (Presenting Author)

Section 12 - Talk

Wie lange kann die Zecke *Ixodes ricinus* in Wohnungen überleben? - Untersuchungen zur Überlebensdauer bei verschiedenen relativen Luftfeuchten

H. Dautel, D. Kämmer & A. Gharbi

Der Gemeine Holzbock, *Ixodes ricinus*, ist die mit Abstand häufigste Zeckenart in Mitteleuropa und als Überträger verschiedenster Pathogene, darunter insbesondere das FSME-Virus und Spirochaeten der Gattung *Borrelia* von Bedeutung. Die Spezies ist bekannt dafür, dass sie nur an Standorten vorkommt, an denen die relative Luftfeuchte (r.F.) mikroklimatisch nicht für längere Zeit unter 80% fällt und dass sie bei anhaltender Trockenheit infolge Dehydrierung relativ schnell abstirbt. Nicht selten werden Zecken aber nach Aufenthalt im Wald z.B. auf der Kleidung mit nach Hause verschleppt. Hier stellt sich die Frage, wie lange solche Zecken in der Wohnung eine potentielle Gefahr darstellen. Zecken, die mit Haustieren (Hunde, Katzen) eingeschleppt werden, fallen häufig als vollgesogene Exemplare vom Tier ab und stellen zunächst kein direktes Risiko dar, da sie erst nach erfolgter Häutung bereit sind, Blut zu saugen. Ziel der Untersuchung war es, herauszufinden, wie lange hungrige Zecken in der Wohnung überleben können und ob vollgesogene *I. ricinus* in der Lage sind, sich bei typischer Wohnraumluftfeuchte weiter zu entwickeln.

Zu diesem Zweck wurden ungesogene Larven, Nymphen und Adulti sowie gesogene Larven und Nymphen von *I. ricinus* individuell bei verschiedenen r.F. gehalten und der Mortalitätsverlauf über die Zeit ermittelt. Erwartungsgemäß stieg die Überlebensdauer mit steigender r.F. an. Bei 90% r.F. trat im Versuchsverlauf sogar kaum eine Mortalität auf, da die Zecke bei dieser Feuchte ihre Wasserbilanz durch Aufnahme atmosphärischen Wasserdampfs ausgleichen kann. Bei 33 bis 76% r.F. überlebten die Zecken je nach Entwicklungsstadium zwischen wenigen Tagen (Larven) und einigen Wochen (Adulti; gesogene Nymphen). Die gesogenen Nymphen erwiesen sich hierbei als besonders trockenheitsresistent. Sie wurden daraufhin mittels Wägungen gesondert untersucht, um herauszufinden, inwiefern metabolisch produziertes Wasser zu ihrem Überleben beiträgt.

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Section 12 - Talk

Vektorassoziierte Tierseuchen in der staatlichen Tierseuchenbekämpfung in Niedersachsen

J. F. Freise, O. Brüning & J. Diekmann

In der „Richtlinie des Bundesministeriums für Ernährung, Landwirtschaft und Verbraucherschutz über Mittel und Verfahren für die Durchführung der Desinfektion bei anzeigepflichtigen Tierseuchen“ (Stand Februar 2007, aktualisiert im Mai 2009 und im November 2009) sind Mittel und Verfahren zur Desinfektion und Entwesung bei anzeigepflichtigen Tierseuchen zusammengefasst.

In der Richtlinie sind 44 anzeigepflichtige Tierseuchen aufgenommen worden, von denen neun als vektorassoziiert im engeren Sinne zu bezeichnen sind, weil die Pathogene durch hämophage Dipteren bzw. Zecken übertragen werden.

Eine dieser vektorassoziierten Krankheiten ist die Blauzungenkrankheit, die im August 2006 das erste Mal in Deutschland auftrat. Da die Blauzungenkrankheit in der EU eine anzeigepflichtige Tierseuche ist, ist bei einem Ausbruch die Durchführung bestimmter, im Tierseuchengesetz festgelegter Maßnahmen vorgeschrieben. Dabei soll auch mittels Vektorkontrolle die Tierseuche bekämpft werden.

Die rechtlichen Gegebenheiten in Deutschland erschweren den Einsatz von Bioziden, die gegen Vektoren angewendet werden sollen, deren Biologie und Ökologie noch nicht abgeklärt ist.

Für eine ausreichende Vorbereitung auf das Auftreten von vektorassoziierten Tierseuchen sind wissenschaftliche Untersuchungen zu den Vektoren notwendig. Nach dem in 2007 durchgeführten „Gnizenmonitoring“ im Rahmen der Bekämpfung der Blauzungenkrankheit findet derzeit ein Monitoring zum Auftreten von *Aedes albopictus* in Niedersachsen statt.

Des Weiteren werden im Rahmen des gemeinsamen Tierseuchenbekämpfungshandbuchs von Niedersachsen und Nordrhein-Westfalen bereits erste Notfallpläne entwickelt. Diese stehen bundesweit den kommunalen Veterinärbehörden zur Unterstützung bei der Bekämpfung zur Verfügung.

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Section 12 - Talk

Der Einfluss von Kälteepisoden auf die Entwicklung der forensisch relevanten Schmeißfliege *Lucilia sericata*

S. Henze & J. Amendt

Das Hauptanwendungsgebiet der Forensischen Entomologie ist die Eingrenzung der minimalen Leichenliegezeit. Dazu wird eine Altersbestimmung der ältesten, sich am Leichengewebe entwickelnden nekrophagen Insekten, in der Regel Schmeißfliegen, durchgeführt. Die für diese Untersuchungen verwendeten Methoden berücksichtigen die Tatsache, dass die Entwicklung der Tiere temperaturabhängig und artspezifisch ist, ein Einfluss von natürlichen Schwankungen und biologischen Parametern wurde bisher jedoch nicht ausgiebig untersucht. In der vorliegenden Arbeit wurden deshalb die Auswirkungen von plötzlichen Temperatureinbrüchen, wie sie in der forensischen Routine im Vorfeld von Obduktionen madenbefallener Leichen durchaus üblich sind, auf die Entwicklung der forensisch relevanten Schmeißfliege *Lucilia sericata* untersucht. Ziel der vorliegenden Arbeit war es zu überprüfen, inwieweit eine Kälteepisode von 8 °C über drei Tage einen Entwicklungsstopp in den juvenilen Entwicklungsstadien von *L. sericata* bedingt. Außerdem wurde untersucht, ob die Kälteepisode einen Einfluss auf die Entwicklungszeit nach der Abkühlung hat. Es zeigte sich, dass niedrige Temperaturepisoden bei fast allen juvenilen Entwicklungsstadien zu einem Entwicklungsstopp während der Kälteepisode führten. Weiterhin beeinflusste die erfahrene Kälteepisode die Entwicklungszeit der Tiere nach Rückführung in höhere Temperaturen, die Art dieser Auswirkung war allerdings von dem Entwicklungsstadium abhängig, in dem die Abkühlung stattfand: Je jünger die Tiere zu diesem Zeitpunkt waren, desto länger dauerte ihre Gesamtentwicklung. Kühlte man Fliegenpuppen ab, benötigten diese insgesamt weniger Zeit um ihre Entwicklung abzuschließen. Die Bedeutung dieser Studie für die forensische Praxis wird diskutiert.

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Section 12 - Talk

Tick-borne pathogen identification in the taiga tick *Ixodes persulcatus* collected from East-Kazakhstan

M. Kronefeld, F. Stürzl, J. Amendt, Z. Shapiyeva, U. Kuch, P. Kraicy & R. Zehner

Lyme Borreliosis is the most common vector-borne disease in Europe as well as in the Far East. Its geographical distribution is closely related to the occurrence of the hard ticks *Ixodes persulcatus* and *Ixodes ricinus* which are also the main vectors of tick-borne encephalitis virus. Almost everywhere, the rates of infection by TBE virus of adult *I. persulcatus* are relatively low and mostly do not exceed 3%. Only in small regions in the Far East these rates can attain 10-15%. The prevalence of *Borrelia* spp. varies widely between different tick species and even from site to site. It appears that the taiga tick *I. persulcatus* is a much more efficient vector than *I. ricinus*, because there is a significant difference between the levels of infection in areas where both species shows a sympatric occurrence. In the case of *I. persulcatus* the prevalence of *Borrelia* spp. may reach 60% in some places. The most common spirochete species in the Far East are *Borrelia afzelii* and *B. garinii*.

Our study was conducted in the east part of Kazakhstan in four different districts. So far we investigated over 600 *Ixodes persulcatus* ticks from Kazakhstan for harboring *Borrelia* sp. and TBE. First results show that *Borrelia garinii* is more prevalent than *B. afzelii*. TBE virus was found in approx. 5% which indicates that residents take a significant risk of contracting TBE virus in East Kazakhstan.

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Section 12 - Talk

Habitat selection by larvae and pupae of *Ochlerotatus detritus* (Diptera: Culicidae)

R. Lühken & E. Kiel

Breeding site selection of mosquitoes significantly affects the distribution of immature stages within the colonised water bodies. However, very little is known about active habitat selection of larvae and pupae.

Our study deals with the mosquito species *Ochlerotatus detritus*, which is a common pest species from coastal areas in Europe. We experimentally analysed habitat selection of larvae and pupae in response to the factors complexity and experiment duration. Furthermore, we tested whether the choice is adapted according to the presence of a predator or their chemical cues.

Our studies demonstrated an increasing detection probability of larvae and pupae with increasing complexity of the habitat and duration of the choice experiments. Neither predators nor chemical cues influenced larvae. Pupae, on the other hand, showed a higher preference for higher complexities in the chemical cue treatment, but not in the presence of predators. These results are especially discussed in connection to the predation-refuge hypothesis.

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Section 12 - Talk

Phlebotomen und Leishmanien in Süddeutschland

K. Pfister & B. Beran

Sporadische Mitteilungen über das Auftreten von autochthonen Leishmaniosefällen sowie Berichte von Sandmücken (*Phlebotomus mascittii* und *P. perniciosus*) in Deutschland gaben Anlass zur Frage, ob bereits endemische Populationen von Sandmücken vorhanden sind und ein Infektionsrisiko für Leishmaniose in Süd-Deutschland gegeben ist. Zur Untersuchung der Sandmücken in Deutschland wurden an 44 Standorten in ökologisch, bevorzugten Sandmücken-Habitaten und Orten mit bereits berichteten Vorkommen entomologische Feldstudien durchgeführt. Mehr als 105.018 Insekten wurden mit Hilfe von Lichtfallen (CDC miniature light traps) und Klebefallen (sticky traps) gefangen. Über 40.933 Exemplare der Insekten wurden der Familie der Psychodidae zugeordnet. Spezielle Aufmerksamkeit galt den Unterfamilien der Phlebotominae (Vektoren von Leishmaniose), Psychodinae sowie Trichomyiinae. Während der Untersuchung wurden keine Phlebotominae (Sandmücken) in Deutschland gefangen. In der durchgeführten Vergleichsstudie in Italien wurden Sandmücken sowohl in der endemischen Region (*P. perniciosus* n = 55, *S. minuta* n = 98) als auch in dem bis dato nicht endemischen Gebiet (*P. perniciosus* n = 5, *S. minuta* n = 25) gefangen.

Die während der entomologischen Untersuchungen in Deutschland gewonnenen Daten bestätigen nicht die bisherigen Berichte über das Vorkommen von Sandmücken in Süd-Deutschland. Derzeit scheint das Risiko einer Leishmanieninfektion wegen des Fehlens des Vektors in Süd-Deutschland nicht gegeben, obgleich Leishmanien-infizierte Hunde jedes Jahr nach Deutschland importiert werden.

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Section 12 - Talk

The Stable Fly *Stomoxys calcitrans* - biology and impact on livestock

R. Pospischil

Fly infestation is a major hygienic and economical problem causing considerable production loss. The blood sucking species *Stomoxys calcitrans* is known to build up large populations in cattle farms and horse stables. During the last 20 years infestation of pig stables by *S. calcitrans* started to be a growing problem in many places worldwide.

Besides disease transmission the stable fly *S. calcitrans* causes considerable irritations by its frequent biting activity. The species is often found in high population densities due to its short lifecycle and a high reproduction rate. Studies in American in cattle operations have shown that infestation with stable flies has an adverse effect on physiological parameters such as body temperature, respiration/heart rate and restlessness, leading to reduced productivity. For pig rearing and fattening facilities adverse effects caused by stable flies were not studied until now, but have to be expected.

The larger house fly *Musca domestica* which is always found together with *S. calcitrans* in livestock develops in manure. The stable fly maggots need manure plus hay or other fibre rich plant materials. Therefore both fly species develop in different areas in the stables, and the animal food has a strong impact on the occurrence of both species.

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Section 12 - Talk

Interaktionen von *Trypanosoma cruzi* und Triatominen

G. A. Schaub

Triatominen übertragen *Trypanosoma cruzi*, den Erreger der Chagas Krankheit, einer der großen Tropenparasitosen. Die mit infektiösem Blut aufgenommenen Blut-Trypomastigoten wandeln sich im Magen zu Epimastigoten um, die sich im Dünndarm und v.a. im Rektum intensiv vermehren. Der Flagellat beeinflusst den Vektor nur subpathogen, v.a. bei der Hungerresistenz und der intestinalen Immun-Homeostase. Auswirkungen des Vektors auf den Einzeller zeigen sich bei etablierten Infektionen in der Präferenz für das Rektum, in dem sich dreimal so viele Flagellaten entwickeln wie im Dünndarm. Außerdem wirken sich Blutaufnahmen und Hunger direkt auf die Stadien-Zusammensetzung der Populationen aus: Die Blutaufnahme induziert die rasche Umwandlung von Epimastigoten, die für Säugetiere nicht infektiös sind, zu den infektiösen metazyklischen Trypomastigoten. Bei Hunger werden verstärkt Sphäromastigote gebildet und daraus nach einer Blutaufnahme für kurze Zeit Riesenzellen. Die *T. cruzi*-Stämme unterscheiden sich in ihrer Potenz zur Etablierung. Im Magen aggregieren und lysieren v.a. Hämolysine und Lektine je nach Stamm die Flagellaten. Ebenfalls zur Lyse führen Ko-Infektionen mit *Serratia marcescens*, während die anderen intestinalen Bakterien *T. cruzi* kaum beeinträchtigen. Das intestinale Immunsystem reagiert auf den Flagellaten, die bei den für die antimikrobiellen Lysozyme und Defensine kodierenden Genen die Expression induzieren, ebenso wie beim Cathepsin D. Beim Stickstoffoxid erfolgt die Induktion im Rektum sogar, bevor der Parasit diese Region erreicht.

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Section 12 - Talk

Altersbestimmung an Puppen forensisch relevanter Fliegenarten

B. Zajac & J. Amendt

Die Altersbestimmung larvaler Stadien forensisch relevanter Fliegenarten wird mit empirisch gestützten Methoden, z.B. dem Vergleich mit den das Wachstum der Maden widerspiegelnden Diagrammen, erfolgreich zur Eingrenzung der minimalen Leichenliegezeit eingesetzt. Befinden sich die Tiere aber bereits im Puppenstadium, können diese Methoden nicht zum Einsatz kommen und lediglich eine vage Aussage über das mögliche Alter der Puppe getroffen werden. Das Puppenstadium bzw. die Metamorphose nimmt aber ca. 50% der gesamten juvenilen Entwicklung ein und kann zurzeit nur retrograd nach erfolgreicher Weiterzucht zum adulten Tier bestimmt werden, was nicht immer gelingt oder bei totem Material nicht möglich ist. Werkzeuge zur Eingrenzung dieses wichtigen Stadiums sind deshalb wünschenswert. Wir haben aus diesem Grund Puppen der zwei forensisch bedeutsamsten Fliegenarten *Lucilia sericata* und *Calliphora vicina* hinsichtlich der Bestimmbarkeit ihres Alters untersucht. Die Identifizierung morphologischer Landmarken wie bestimmter Borsten oder die Ausfärbung der Augen ermöglichte eine teilweise auf den Tag genaue Eingrenzung des Puppenalters bei beiden Arten. Additiv wurden Daten zum Gewicht der Fliegenpuppen erhoben, welche eine lineare Gewichtsabnahme mit zunehmenden Puppenalter belegen. Von der Verpuppung bis zum Tag vor dem Schlüpfen der adulten Fliege verloren die Tiere im Mittel 25,8% (*Calliphora vicina*) bzw. 17,6% (*Lucilia sericata*) ihres Gewichtes.

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Section 13 - Talks

Soil entomology

Section 13 - Keynote

Tools to open the black box – biochemical markers unravel soil food webs

L. Rueß

Soils harbour an enormous diversity of organisms connected by multitrophic interactions that are central to nutrient cycling. Microarthropods, in particular microbial grazers such as Collembola, are important determinants for the energy and carbon flow through belowground food webs. Regardless of their significance, trophic relationships in soil are still poorly understood. Due to the cryptic habitat and the small size of the fauna, feeding strategies are difficult to address, either experimentally or by direct observation.

Over the last decade, stable isotopes have increasingly been used as biomarkers. The isotopic ratios of $^{15}\text{N}/^{14}\text{N}$ and $^{13}\text{C}/^{12}\text{C}$ in animal tissues were employed to reconstruct food webs, with nitrogen assigning relative trophic levels and carbon food resources. Recently, lipid patterns were applied to unravel trophic interactions. Food derived fatty acids are conserved and transferred in the food chain, a fact called “dietary routing”. Several marker fatty acids have been defined for Collembola feeding strategies hitherto. To increase resolution, lipid and stable isotope techniques were combined, and, by comparison of the $\delta^{13}\text{C}$ in fatty acids of consumer and diet, specific trophic links were determined.

In conclusion, biochemical markers offer new insight into feeding habits of soil animals in situ. The relative simplicity of chemical analysis, which uses widely available equipment, provides a high potential for food web studies. A prospect for the future is the combination of stable isotope probing (SIP) in nucleic acids (DNA-SIP) and fatty acids (FA-SIP) to link identity and function in soil key biota.

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Section 13 - Talk

Using easily identified macrofaunal taxa for soil zoological site assessments

C. Kantner, A. Bruckner

During the last 100 years, limnologists have established an indicator system which evaluates water quality by analyzing the occurrence of aquatic organisms using representative taxa from nearly all animal and plant groups. In soil zoology, single taxa like Collembola or Carabidae are established as indicators, however, evaluations are based on only on a very limited fraction of animals present in the soil (taxocoenoses). A more comprehensive use of the diversity of soil organisms is hampered by tremendous identification problems in many of the groups.

The aim of this diploma thesis was to test whether single taxa - when identified to a level which can be achieved without expertise and with reasonable time effort - are indicative for soil analyses. The most important requirement for a taxon to qualify as an indicator was that it had to be identified unambiguously, rapidly, and without preparation. To test this, the macrofauna of 20 sites belonging to four forest types (beech, acidic beech, oak and pine stands) and 5 non wooded sites as a contrast to the forest types (2 grasslands and 3 forest clearing sites) were sampled, all of them situated in the biosphere reserve Wienerwald in Lower Austria. Three different sampling methods were applied: (i) pitfall traps (ii) a manual search on the ground and (iii) soil samples. Taxa sampled on the sites that did not meet the requirements above were not counted. To test the indicativeness of the selected taxa, various parameters were surveyed at the sites (density of canopy, stand density, deadwood density, Ellenberg indicator values of vegetation). The results showed that the factor sitetype (this factor included the 4 forest types and the non-forest type) had a significant influence on the similarity of the indicator assemblages, however, contributed little to total variability (approximately 12%). It was not possible to analyze the influence of individual taxa on this result, due to the low explained variability. Of the three methods, the pitfall traps best represented the site assemblages, regardless of the data transformation used. In further analyses the method could be improved by more sampling dates or a overworked taxa set.

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Section 13 - Talk

Überlebensstrategien und Kosten-Nutzen-Bilanzen einer räuberischen Insektenlarve (*Euroleon nostras* FOURCROY, Myrmeleontidae)

K. Meißner, M. Feike, C. Pires & J. Stetzkowski

Bei 200 Arten, deren Larven im Boden Trichterfallen bauen, ist der Entwicklungszyklus evolutionsbiologisch stabil. Aber nach der Eiablage entwickeln sich drei Larvenstadien in etwa 24 Monaten unter schwierigsten Konditionen. Die Larven leben in Extremwerthabitaten: Die Trichter sind stabil als auch instabil, sie sind rieselfähig, werden verweht und erneuert oder beim Beutefang beschädigt. Die Bodentemperatur erreicht Werte über 50° C, die Bodenfeuchtigkeit geht gegen Null, aber nach Regenfällen sind die Trichterhorizonte durchnässt. Und Beute gibt es für die sit-and-wait-Predatoren selten und unregelmäßig. Obwohl sie z. B. erst nach 3 oder 25 Tagen und seltener wieder Beute machen, nimmt ihre Biomasse von der geschlüpften Larve (L1: 0.5mg) bis zum Bau des Kokon (L3: 140mg) auf das 280-fache zu. Wir untersuchen die Überlebensstrategien im Freiland wie im Labor und kontrollieren dabei die Populationsökologie, Bodentexturen, Beutespektrum und Wachstum, Bau und Parameter der Trichterfallen, die Ausnutzung der Beute, den Wasserhaushalt und Stoffwechselraten. Mit Optimalitätsmodellen zu Kosten und Nutzen des Trichterbaues werden quantitative Voraussagen geprüft. Alle Larvenstadien bauen den Trichter in ca. 0:25 h (n= 257, Textur 0.2-0.5 mm), in 23:35 h des 24 h-Tages sind sie i. w. inaktiv. Larven von 20 bis 30 mg haben in dieser Aktivitätszeit eine Stoffwechselrate, die 8-fach über dem Niveau des Ruhestoffwechsels liegt. Aus einer Ameise von 9,45 mg (*F. rufa*, *F. polyctena*) kann ein Löwe 3,45 mg Nahrung extrahieren und 0.37 mg Kohlenstoff gewinnen. Bei einem mittleren Niveau des Grundstoffwechsels von 0,62 µg C h⁻¹ könnte er damit 25 d auskommen. Die Ameisenlöwen optimieren außerdem die Fangleistung ihres Trichters, indem sie ihn obligatorisch und periodisch erweitern (n=96, Periodenlänge 23.20±02.11 h). Für einen erweiterten Trichter von 70 mm Durchmesser, der aus kleineren Dimensionen entwickelt wird, werden z. B. nur 33 g statt 53 g Sand transportiert. Damit sind 38 % der Transportkosten für den Stoffwechsel eingespart worden.

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Section 13 - Talk

Dipteran larvae as main decomposers in high alpine soils

A. Rief, M. Steinwandter, E. Meyer & J. Seeber

In alpine regions soil dwelling larvae of Diptera, which are important decomposer species, take over the role as keystone species of decomposition from earthworms, as the latter recede in number and biomass. This is not only due to temperature conditions and the short growing season, but also because of the reduction of habitat structure. Dipterans are, however, a taxon which is among the least-studied groups of soil animals, mostly because soil-dwelling larvae are challenging to be identified to species level. Thus, only few studies have dealt with soil dwelling Dipteran larvae in alpine regions.

In a first step the soil-macro fauna of alpine grassland sites in the Stubai Alps (Central Alps, Austria, 2.200 – 2.500 m a.s.l.) was detected and identified to family level. Results from emergence trap sampling on the study site have shown that two Dipteran families are predominant: the Sciaridae and the Chironomidae.

The second step is to identify the key decomposer species using stable isotopes. The $^{15}\text{N}/^{14}\text{N}$ ratios will be used to clarify the relative trophic positions of the soil animals: primary decomposer, secondary decomposer, and predator. As biochemical reactions discriminate against the heavier isotope, ^{15}N accumulates in the animals' tissues the more the higher the trophic level. Primary decomposers will have the lowest $\delta^{15}\text{N}$ value, followed by secondary decomposers, predatory species will be on top of the range. Combined with molecular barcoding methods the identification to species level and/or the assignment to taxonomical units (TUs) is allowed.

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Section 13 - Talk

Plant species effects on soil macrofauna density in grassy arable fallows of different age

J.-A. Salamona, J. Wissuwa, S. Jagos, M. Koblmüller, O. Ozinger, C. Winkler & T. Frank

The density of soil macrofauna groups in nine grassy arable fallows of different age were investigated in a factorial design with the factors 'plant species' (legume: *Medicago sativa*, herb: *Taraxacum officinale*, grass: *Bromus sterilis*) and 'age class' (2-3/3-4, 6-8/7-9, 12-15/13-16 years). Four plots were selected randomly at each fallow. In May 2008 and May 2009, within each plot five *M. sativa*, *T. officinale* and *B. sterilis* plants were extracted with their associated soil using steel cylinders. The material from each plant species was used for extraction of soil macrofauna and for determination of environmental parameters.

The main results were (May 2009) (i) the density of the saprophagous macrofauna was significantly higher in *B. sterilis* than in *M. sativa* and *T. officinale* samples indicating that this group benefited from the particularly high amount of fine roots in the *B. sterilis* samples; (ii) the density of Gastropoda increased significantly with the age of the fallows due to the increasing amount of fungal biomass; (iii) densities of saprophagous macrofauna and predatory beetles were highest in the 7-9 yr old fallows indicating that predators may have benefited from the increased availability of their prey in the medium stage of grassland succession.

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Section 14 - Talks

Forest entomology

Section 14 - Talk

Are dispersal and infestation distances in *Ips typographus* limited by energy reserves?

K. Dworschak, M. Kautz & R. Schopf

Spatial dispersal of pest species is not only important for understanding their population ecology, but also for assessing outbreak risks and applying appropriate management strategies. Lipid reserves are supposed to determine the distance bark beetles are able to cover. Several previous studies showed depletion of lipids with a decline of conditions during development, whether through competition, enhanced host defense or lack of nutrients, among others.

Our study confirmed this decline in size, weight and lipid content for seven *I. typographus* L. (Coleoptera, Scolytinae) metapopulations which developed under different conditions. However, lipid content showed no correlation with individual flight capability of beetles. In laboratory experiments, beetles with more lipid reserves were not necessarily able to fly farther. Nevertheless, distributions of flight distances within these populations were comparable among each other. They all followed an inverse power law function with a cumulation of beetles flying only short distances. They varied in the maximum flight distances which were only achieved by a small fraction of the populations.

The obtained distributions of flight distances matched the distribution of new infestations observed over a time span of 22 years in the National Park Bavarian Forest (Germany), which also followed an inverse power law function. Independent from potential dispersal capability of beetles or local site conditions, 65 % of new infestations occurred within 100 m of previous infestations and 95 % within 500 m.

These results show that differences in morphology or physiology caused by conditions during development seem to influence dispersal potential and infestation patterns only marginally. Thus, to increase efficiency, management strategies in forests with only few infestation sources should rather concentrate on the close vicinity of previous infestation spots instead of being applied area-wide.

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Section 14 - Talk

Untersuchungen zum höhenabhängigen Auftreten von Borkenkäfern und den Pathogenen in *Ips typographus* (Coleoptera, Curculionidae) im Bereich des Nationalpark Gesäuse (Steiermark)

H. Gasperl & R. Wegensteiner

Auf sechs verschiedenen Standorten wurde das Auftreten von Borkenkäfern an Fangbäumen im Frühjahr 2000 untersucht; die Standorte lagen auf verschiedenen Höhenstufen und wiesen unterschiedliche Exposition auf: Standort 1 auf 850m und S-SW Exposition, Standort 2 auf 980m und S-SW Exposition, Standort 3 auf 1200m und S-SW Exposition, Standort 4 auf 1100m und NW Exposition, Standort 5 auf 1250m und W-NW Exposition und Standort 6 auf 650m Seehöhe und N-Exposition. Insgesamt konnten acht Borkenkäferarten festgestellt werden, *Ips typographus* und *Pityogenes chalcographus* als die zahlenmäßig dominanten Arten, daneben noch *Hylurgops glabratus*, *Polygraphus poligraphus*, *Dryocoetes autographus*, *Pityophthorus pityographus*, *Ips amitinus* und *Trypodendron lineatum*. *I. typographus* und *P. chalcographus* konnten an allen sechs Standorten nachgewiesen werden, *D. autographus* an fünf Standorten (1, 2, 4, 5 und 6), *H. glabratus* (2, 4 und 5) und *I. amitinus* (3, 4 und 5) an drei Standorten, *P. poligraphus* an zwei Standorten (2 und 5) und *P. pityographus* (6) und *T. lineatum* (6) an einem Standort. Das Pathogen-Artenspektrum bei *I. typographus* variierte in den Käfern von den einzelnen Standorten. Insgesamt konnten sechs verschiedene Pathogenarten gefunden werden, das *Ips typographus* Entomopoxvirus, *Gregarina typographi*, *Mattesia* sp., *Chytridiopsis typographi*, *Nosema typographi* und *Unikaryon montanum*. Die Pathogen Artendiversität war in den Käfern von Standort 3 am größten (5 Arten) und am Standort 5 am niedrigsten (2 Arten).

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Section 14 - Talk

**Monitoring and risk assessment of the Pine Processionary Moth,
Thaumetopoea pityocampa (Den. & Schiff.) (Lep., Notodontidae), for the Upper
Rhine Valley**

P. Halbig, H. Delb, L. Henke, E. Wagenhoff & D. Klimetzek

In 2007 the Pine Processionary Moth (PPM) was observed in the Upper Rhine Valley for the first time. Initially it was accidentally introduced with planting material to Obernai, Alsace, France. Consequently damages to pine trees and human health problems due to urticating caterpillar hairs are expected. In order to monitor whether PPM has already spread to Germany, where no records had been confirmed until then, delta traps with commercial lures were placed along the adjacent border in 2010 and regularly checked during the flight period from June to August. Not a single PPM was caught, although flight was registered in Obernai at the same time. Hence it can be assumed, that PPM has not crossed the border yet. To assess the potential risk of an establishment in Germany, climatic and stand data were analysed in context of the so far known habitat requirements of PPM. According to current climatic conditions, especially winter temperatures and the amount of insolation do not seem to allow a constant settlement of PPM at the Upper Rhine-Valley. However a temporary spread of PPM into this area can not be excluded. Considering the predicted scenarios of an upcoming climate change, a future permanent establishment of PPM is becoming more likely to occur.

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Section 14 - Talk

Falterflugüberwachung der Nonne (*Lymantria monacha* L., Lepidoptera, Lymantriidae) im Land Brandenburg – Gibt es Rationalisierungsmöglichkeiten?

K. Hielscher

Die Nonne (*Lymantria monacha* L., Lepidoptera, Lymantriidae) zählt zu den bedeutendsten forstschädlichen Insekten in den Kiefernbeständen Brandenburgs. Der Übergang der Nonne von der Latenz zu erhöhten Dichten am Beginn einer Massenvermehrung (Progradation) wird in Brandenburg mit Hilfe von Falterfängen in Pheromonfallen (erste Stufe der Nonnenüberwachung) bestimmt. In der Hauptstelle für Waldschutz wurden die Daten der Nonnenfalterfänge aus den letzten 10 Jahren für das gesamte Land Brandenburg einer statistischen Analyse unterzogen. Die Daten von 2000 bis 2009 schließen eine vollständige Nonnenmassenvermehrung mit den Phasen Progradation, Gradationsmaximum sowie Retrogradation und mehrere Jahre der Latenz ein. Insgesamt wurden die Fangergebnisse von über 11000 Fallen analysiert. Als Ergebnis der Datenauswertung werden Vorschläge zur Rationalisierung der Falterflugüberwachung mittels Pheromonfallen vorgestellt.

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Section 14 - Talk

Die Ausbreitung des Eichenprozessionsspinners *Thaumetopoea processionea* (L.) (Lepidoptera, Thaumetopoeidae) in Nordrhein-Westfalen, sein Gefahrenpotential und die Bekämpfungsmöglichkeiten

M. Klug

Seit Beginn des letzten Jahrzehnts wurde zuerst am Niederrhein ein jährlich wiederkehrendes und sich verstärkendes Auftreten des Eichenprozessionsspinners beobachtet. Inzwischen reicht das Befallsgebiet bis weit in die Köln-Aachener Bucht, in das westliche Ruhrgebiet und in das Münsterland hinein. Im Forst hat der Eichenprozessionsspinner in Nordrhein-Westfalen bisher keine wesentlichen Schäden verursacht. Kahlfraß blieb meist auf einzelne Eichen in den am stärksten befallenen Gebieten am Niederrhein und im westlichen Münsterland beschränkt.

Die Raupen dieses Nachtfalters aus der Familie der Prozessionsspinner sind jedoch in den betroffenen Städten und Gemeinden vor allem Schädlinge, die die menschliche Gesundheit beeinträchtigen können. Ihre ab dem dritten Larvenstadium in winzigen, haarähnlichen Gebilden (sogenannten Brennhaaren) produzierten Drüsensekrete verursachen eine pseudoallergische Reaktion, die sich in Entzündungen der Haut, der Augen und der Atemwege manifestieren kann. Neben der akuten Gefährdung während der Raupenentwicklung ist dabei auch die lange anhaltende Wirksamkeit des Nesselgiftes Thaumetopoein in alten, bereits verlassenen Raupennestern problematisch. Die „Brennhaare“ aus diesen Nestern können durch den Wind weiter verbreitet werden.

Zur Bekämpfung der jungen Raupen (L1 und L2) sind *Bacillus thuringiensis*-Präparate geeignet. Da sich die jungen Raupen im oberen Kronenbereich aufhalten, muss vor allem der Mantelbereich der Krone sorgfältig behandelt werden. Dazu ist bei größeren Bäumen die Ausbringung der Spritzflüssigkeit von einem Hubsteiger aus notwendig. Auch gebläseunterstützte Spritzen werden verwendet. Bei Alleen und Straßenbepflanzungen ist es in bestimmten Fällen sinnvoll, die Behandlung vom Hubschrauber aus vorzunehmen.

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Section 14 - Talk

Is tracheally released pheromone involved in *Ips typographus* aggregation?

L. Lehmborg, A. Gruppe & R. Schopf

Pheromone mediated mass attack causes enormous damages of the European spruce bark beetle, *Ips typographus* (Coleoptera: Scolytinae) in Norway spruce. The common understanding states that males ingest orally the spruce-born precursor (-)- α -pinene and release its oxidation product cis-verbenol via frass, as a constituent of their aggregation pheromone. Precursor uptake by feeding implies high risks for pioneers, when boring in vigorous trees. They are endangered to stick in the resin and if not, may be killed in their bore holes by high concentrations of volatile terpenes. But a high attack density within a short time period will minimize these risks.

We hypothesized that aggregation outside the host could enhance the survival probability of pioneers and the chance to overcome host defense. Therefore, one possibility could be a tracheal uptake of (-)- α -pinene and release of cis-verbenol.

A tracheal uptake of (-)- α -pinene followed by an oxidation to cis-verbenol was recently shown. The present study demonstrates that *I. typographus* has also the ability to exhale cis-verbenol. In lab, starved beetles were incubated in an artificial (-)- α -pinene atmosphere and their released volatiles were analyzed via GCMS.

(-)- α -pinene treated beetles exhaled significant higher amounts of cis-verbenol compared to untreated controls. Furthermore, olfactory tests showed that exhaled cis-verbenol released by (-)- α -pinene treated beetles attracted conspecifics. We assume that tracheally emitted cis-verbenol has the potential for a precolonisation aggregation.

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Section 14 - Talk

**Populationsdynamik der Fichtengespinstblattwespe (*Cephalcia abietis* L.,
Hymenoptera) in den nord- und ostbayerischen Mittelgebirgen**

H. Lemme

Die Fichtengespinstblattwespe wird in den bayerischen Mittelgebirgen seit Jahrzehnten durch Grabungen im Herbst überwacht. Für diese Analyse wurden die Daten dieser Grabungen von 1980 bis 1990 für Teile des Frankenwaldes und Teile des Bayerischen Waldes sowie für den Zeitraum von 1991 bis 2009 aller Suchen im Frankenwald, Fichtelgebirge, Oberpfälzer Wald und Bayerischen Wald ausgewertet. In dem über etwa 250 km langen Mittelgebirgszug vom Frankenwald bis zum Bayerischen Wald verlief die Dynamik der Blattwespe weitestgehend synchron, zum Teil jedoch auf einem unterschiedlichen Dichteniveau. Im Zeitraum von 1980 bis 1994 durchlief die Fichtengespinstblattwespe mehrere Massenvermehrungen in den genannten Mittelgebirgen.

Die Nymphen (Ruhelarven) der Blattwespe liegen in Mitteleuropa zwischen 1 und 5 Jahren im Boden bevor diese im Frühjahr als Imago erscheinen. Im Zeitraum von 1980 bis Mitte der 90iger Jahre lagen die Nymphen in der Regel 3 Jahre im Waldboden. Mit dem Dichterückgang seit Mitte der 90iger bis zum erneuten Dichteanstieg 2006 lag die Dauer der Diapause bei 5 Jahren.

Die Konsequenzen für die Überwachung der Art werden beschrieben.

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Section 14 - Talk

Die Wirkung von Neem-Extrakten auf die Reproduktion und Brutentwicklung des Buchdruckers, *Ips typographus* (Coleopt., Scolytinae): Welche Entwicklungsstadien sind empfindlich?

I. Weber & A. Schopf

Ziel der Untersuchungen war es, die Wirksamkeit von Neem-Extrakten auf die Entwicklung und Brutleistung des Buchdruckers vor und nach bereits erfolgter Brutetablierung an liegenden Fichtenstämmen zu testen sowie die Empfindlichkeit der verschiedenen Entwicklungsstadien des Borkenkäfers gegenüber der Behandlung zu bestimmen. Das Mittel wurde durch das Aufsprühverfahren appliziert. Nach erfolgter Brutanlage wurden die Parentalkäfer abgefangen und die Mutterkäfer auf den Zustand des Eireifungsprozesses in ihren Gonaden untersucht. Dabei zeigte sich kein Unterschied zwischen den Käferweibchen aus den unterschiedlich behandelten Stammvarianten. Nach dem Ausschluß der Jungkäfer, wurden die Brutsysteme geöffnet und anhand verschiedener Parameter ausgewertet. Mit Hilfe dieser Daten konnten die Eimortalität, die Larven- und Puppenmortalität sowie die Ausschlußrate der Jungkäfer bestimmt werden. Die Analyse der Brutbilder ergab, dass bei den mit Neem-Extrakten behandelten Stämmen sowohl die Ei- (63%) als auch die Larvenmortalität (100%) signifikant höher war als bei den nur mit reinem Lösungsmittel (22% bzw. 46%) behandelten bzw. unbehandelten Stämmen (41% bzw. 9%), wenn die Applikation zwei Wochen vor dem Einbohrtermin stattfand. Wurde die Behandlung zwei Wochen nach dem Käferansatz durchgeführt, war mit 87% lediglich die Larvenmortalität an den Neem-Stämmen deutlich höher als bei den Kontrollstämmen (Blank: 56%; unbehandelt: 48%).

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Section 14 - Talk

Bark-beetle-associated nematodes of the family Diplogastridae

V. Susoy, M. Herrmann & R. J. Sommer

Nematodes of the family Diplogastridae often show a close association with bark beetles. Although numerous species of bark-beetle-associated diplogastrids were described more than 40 years ago, much remains to be studied on the biology, ecology, and life histories of these nematodes. We combine field studies and experimental approaches to investigate this. We collect bark beetles from different countries, screen them for presence of diplogastrid nematodes and then study beetle-nematode associations under controlled laboratory conditions. To date we examined more than 2000 beetles from 34 species. Of those, 14 beetle species yielded 365 isolates of diplogastrids belonging to 19 putative species. Isolated nematodes show very high level of host specificity. Cophylogenetic analysis shows that certain nematode clades tend to be associated with particular bark beetle clades. This suggests that coevolution between nematodes and some host lineages could have taken place. We also show that chemical substances from host trees and host beetles affect dauer recovery of diplogastrids. Thus, nematodes may use them to link their life histories to the life cycles of their host bark beetles.

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Section 15 - Talks

Entomology of plant and stored product protection

Section 15 - Keynote

Kampf dem Kartoffelkäfer – ein Alien und seine Erfolgsgeschichte in Deutschland von 1936 bis in die Gegenwart

S. Kühne

Die Geschichte des Kartoffelkäfers (*Leptinotarsa decemlineata* Say) in Deutschland ist ein Lehrbeispiel für die unkontrollierte Ausbreitung eines Schaderregers, der ohne regelmäßige Gegenmaßnahmen schwere Ertragsminderungen an einer unserer wichtigsten Nahrungspflanzen verursachen würde. Das Fehlen natürlicher Feinde und seine enorme Anpassungsfähigkeit an Pflanzenschutzmittel machen ihn zu einem starken Gegner, der auch die zukünftigen Generationen immer wieder herausfordern wird. Von seinem Auftreten im Jahr 1936 bis in die Gegenwart wird die historische Bekämpfung des Kartoffelkäfers vorgestellt. Neueste Ergebnisse zur Regulierung des Käfers im Ökologischen Landbau zeigen die Vorteile biologischer Pflanzenschutzmittel auf, die artspezifisch wirken und dabei gleichzeitig Nutzorganismen schonen bzw. sogar fördern können. Ein moderner und nachhaltiger Pflanzenschutz setzt auf komplexe Regulierungsstrategien unter Verwendung vorbeugender und direkter Maßnahmen, die am Beispiel des Kartoffelkäfers vorgestellt werden. Dazu gehören z. B. die Vermeidung von Durchwuchskartoffeln und Nachbarschaftsflächen mit Kartoffeln im Vorjahr sowie ein Resistenzmanagement der angewendeten Pflanzenschutzmittel. Die Verwendung neuer Prognosemodelle ermöglicht dabei die Bestimmung des optimalen Bekämpfungszeitraumes.

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Section 15 - Keynote

New ways to deliver insect pest management for sustainable intensification of agriculture and product protection

J. A. Pickett

For sustainable intensification of agriculture and the production of agricultural products, delivery of tools for insect control needs to move further towards plant breeding and genetic modification of crops, and related but appropriate approaches for animal husbandry. Considerable success has been achieved by use of directly insecticidal gene products, but only for a limited range of crops and associated pests. However, the prospect of manipulating plant secondary metabolites acting as semiochemicals, and even insect pheromones, is now being realised. Thus, by a combination of enhancing direct secondary metabolite based defence and indirect defence by the induction of parasite and predator recruitment, using breeding and heterologous gene expression, a new generation of insect management approaches will be delivered either by sustainable external production or by direct generation by crops and livestock.

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Section 15 - Talk

A laboratory test for structural treatments with diatomaceous earths (DE) against stored product insects

C. Adler

Diatomaceous earths (DE) are used in Germany for the control of stored product insects in grain and in empty storage structures. An advantage of utilizing amorphous skeletal remnants of diatoms rather than crystalline fine sand is that the human lung can clean out fine amorphous dust particles while long crystalline structures can cause silicosis. Various diatomaceous earths locally available in Southeastern Europe were tested regarding their efficacy against stored product insects. For this purpose they were dried, ground and sieved to a certain particle size. In order to test structural treatments in the laboratory the dosage authorized in Germany (10g/m²), half and double this dose was applied in glass Petri dishes. Testing larval *Tribolium confusum* did not give clear results due to premature pupation. Thus the relative tolerance of adult stages of *T. confusum*, *Sitophilus oryzae* and *Rhyzopertha dominica* were compared. It was difficult to obtain an even distribution of DE on the glass surface. Ten adult insects were added into each Petri dish. *T. confusum* proved most tolerant among the three species.

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Section 15 - Talk

Zum Problem der räumlichen Verteilung vorratsschädlicher Insekten bei der Auswertung von Monitoringdaten

D. Bartels

Das Monitoring von Schadinsekten in Vorratslagern soll eine möglichst frühzeitige Detektion von Befall ermöglichen, Befallsherde lokalisieren helfen oder Auskunft über die zeitliche Entwicklung der Befallsstärke geben. Sowohl für die Auswertung der Monitoringdaten, als auch für die Bewertung der Monitoringverfahren selbst bezüglich ihrer Effizienz werden Kennzahlen benötigt.

Diese müssen möglichst praxisnah im Lager gewonnen werden, da sich das komplexe System aus Schadinsekten, Vorratsgut und Lagerraum nicht im Labormaßstab nachbilden lässt. Für die Auswertung bzw. Modellierung der Daten beschränkte man sich in der Vergangenheit meist auf eine Betrachtung des Systems als eine „black box“, d.h. die nicht beobachtbaren Prozesse innerhalb des Systems blieben unberücksichtigt. So wurde oft versucht, die räumliche Verteilung von Proben- und Fangergebnissen („output“) mit einer passenden mathematischen Funktion der tatsächlichen Verteilung der Schadinsekten („input“) gleichzusetzen.

Viele der zu Grunde liegenden Wirkmechanismen bei der aktiven Verbreitung von vorratsschädlichen Insekten sind jedoch aus Laborexperimenten bekannt. Sie erfordern eine differenzierte Modellbildung in Abhängigkeit von der verwendeten Monitoringmethode und der Verhaltensbiologie der beobachteten Schädlingsart.

Im Vortrag soll die Bedeutung der räumlichen Datenanalyse für die Interpretation von Monitoringergebnissen anhand von Beispielen verdeutlicht werden.

Daniela Bartels, Deutschland, danielabartels@arcor.de (Presenting Author)

Section 15 - Talk

***Drosophila suzukii* eine phytosanitäre Gefahr für den Obst- und Weinbau Europas?**

P. Baufeld

Drosophila suzukii, die Kirschessigfliege, ist ein polyphager Schädling, der alle weichschaligen Obstsorten und Weinsorten (soft fruits) befällt. Ursprünglich in weiten Teilen Asiens endemisch, wurde diese Species nach Nordamerika eingeschleppt, wo sie sich sehr schnell ausbreitete und bereits beträchtliche Schäden verursacht. Seit 2009 wurde *D. suzukii* auch lokal in Italien (Südtirol, Toskana, Kalabrien), Spanien (Katalonien) und Frankreich (Languedoc-Roussillon, Provence-Alpes-Côte-d'Azur, Korsika) festgestellt, wo bereits lokal schwere Schäden von bis zu 90 % registriert worden sind. Verschleppt wird diese *Drosophila*-Art mit befallenen Früchten. Die klimatischen Bedingungen und das Angebot an Wirtspflanzen sind in den meisten Ländern Europas vorhanden und damit die Möglichkeit der Ansiedlung. Die phytosanitäre Gefahr geht insbesondere von der enormen Vermehrungsrate von bis zu 15 Generationen pro Jahr aus. Unüblich für *Drosophila*-Species, die Weibchen penetrieren mit einem Raspelapparat die Fruchthaut und legen die Eier in die gesunde Frucht hinein. Die Maden zerstören durch ihren Fraß das Fruchtfleisch. Darüberhinaus können Sekundärinfektionen auftreten. Die Kirschessigfliege würde bei der Einschleppung nach Deutschland mit großer Wahrscheinlichkeit ein sehr bedeutender neuer Schädling im Obst- und Weinbau sein. Erhebliche Schäden bzw. ein Bedarf an einem intensiven Insektizideinsatz wären die Folge.

Aufgrund ihrer großen Relevanz für den Obst- und Weinbau wurde diese invasive Art von der Europäischen und Mittelmeeran Pflanzenschutzorganisation (EPPO) auf die Warnliste (Alert list) gesetzt. Eine internationale Expertenarbeitsgruppe hat zu *D. suzukii* im Jahr 2010 eine Risikobewertung (pest risk assessment) erarbeitet.

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Section 15 - Talk

Zur Wirksamkeit des Insektizids Spinosad als Vorratsschutzmittel in Getreide gegen den Kornkäfer *Sitophilus granarius* (L.) und die Mehlmotte *Ephestia kuehniella* ZELLER

S.L. Bliedung, M. Stähler & Ch. Reichmuth

Um gut lagerfähige Vorratsgüter wie Weizen und anderes Getreide ohne synthetische Insektizide gegen Schadinsekten zu schützen, ist die Entwicklung wirksamer und dennoch gut abbaubarer natürlicher Mittel, die sich durch hohe Umweltverträglichkeit auszeichnen, erwünscht. Das aus Metaboliten eines Bakteriums bestehende Insektizid Spinosad gehört zu einer neuen Insektizidklasse mit weitem Wirkungsspektrum gegen Arthropoden und sehr geringer Toxizität gegenüber Säugetieren.

Anhand von Tierversuchen mit allen Entwicklungsstadien der beiden bedeutenden vorratsschädigenden Insekten Mehlmotte *Ephestia kuehniella* und Kornkäfer *Sitophilus granarius* mit Dosierungen im Bereich von 0,1 bis 4 mg Spinosad/kg des Weizensubstrats wurden Spinosadgehalte der behandelten Proben sowie die Mortalitätsraten der Tiere bestimmt.

Aus den Ergebnissen ging hervor, dass die Wirkung des Mittels stark vom entsprechenden Entwicklungsstadium abhängt. Im Gegensatz zu den empfindlicheren Larven von *Ephestia kuehniella* starben Puppen und Falter auch bei Anwendung der höheren Dosen nicht ab. Bei Mehlmottenlarven, welche relativ hohen subletalen Dosen ausgesetzt waren, zeigte sich eine Verdreifachung der Entwicklungszeiten zur Imago. Trotz relativ konstanter Entwicklungszeiten der subletal behandelten Kornkäferlarven und -brut ergab sich bei dieser untersuchten Art eine stark abtötende Wirkung auf die Käfer, wohingegen die Präimaginalstadien deutlich widerstandsfähiger waren.

Über die Wirkung und Stabilität des Spinosads im behandelten Getreide wird detailliert berichtet.

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Section 15 - Talk

Development of bait sprays for cherry fruit fly species (Diptera: Tephritidae) – achievements and restrictions in bait stability and acceptance

E. Böckmann, K. Köppler, H. Kleeberg, P. Baumjohann, E. Hummel, B. Ruch, I. Schäfer & H. Vogt

The European cherry fruit fly *Rhagoletis cerasi* (Diptera: Tephritidae) is the major pest species in cherry orchards with the larvae feeding causing the main damage of the fruit. Bait sprays based on phagostimulants combined with small amounts of insecticides may markedly reduce insecticide use, especially because of their spatial restricted type of application. We investigated the possibilities of this technique in cherry fruit fly control using formulations of natural insecticides (i.e. NeemAzal-T/S, NeemAzal-T and Spruzit Neu) with azadirachtin (a secondary metabolite of the neem tree seed) and pyrethrum (derived from *Chrysanthemum* flower heads), respectively, as active ingredients. The baits contained sugar and protein to improve feeding. Acceptance, effectiveness, rainfastness and UV stability of baits was studied under laboratory-, semi-field- and field conditions. The results show that baits were effective in laboratory bioassays and semi-field conditions. Results under field conditions were satisfactory at moderate infestation rates. Repellent effects of insecticides were found in different extent, with acceptance of NeemAzal-T being predominant. UV-stability was satisfying and rainfastness was enhanced but remains insufficient for areas with summer rain like in middle Europe. Our results should be conferrable to the eastern cherry fruit fly, *Rhagoletis cingulata*, originating from North America, and occurring as cherry pest in Germany and other European countries since some years. Future investigation is needed to improve long distance attraction of flies to the bait.

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Section 15 - Talk

***Plioreocepta poeciloptera* als möglicher Verbreiter von *Fusarium* spp. an Spargel (*Asparagus officinalis* L.)**

T. Koch, H.-M. Poehling, & K. Wydra

Die Spargelfliege (*Plioreocepta poeciloptera*) gehört zu den wichtigsten Schadinsekten im Spargel. Neben der durch den Larvenfraß herabgesetzten Assimilationsleistung der Spargeltriebe verursachen die Weibchen bei der Eiablage und durch Host-feeding Verletzungen am Trieb. Neben auftretenden Ertragsverlusten können die Verletzungen zur Verbreitung parasitärer Pilze der Gattung *Fusarium* Link beitragen. Deren Infektion an Spargel zu Fäulen an Wurzel, Rhizom und Trieb führen und somit irreversible Welken sowie reduzierte Ertragsleistungen verursachen. In unseren Untersuchungen wurde unter kontrollierten Bedingungen an Spargeljungpflanzen getestet, ob die Verwundung durch den Legebohrer der Weibchen eine Eintrittspforte für den Pilz darstellt und die Kontaminierung der Fliegen die Verbreitung von *Fusarium*-Sporen fördert. Mittels qPCR-Analyse war es möglich die *Fusarium* DNA (*F. proliferatum*) in den Trieben und Wurzeln der Versuchspflanzen zu quantifizieren und eine Bewertung der Infektionsrate vorzunehmen. Anhand dieser Analysen kann geschlossen werden, dass vom Ort der Eiablage und/oder Host-feeding der Fliege eine starke Infektion des Triebes mit *Fusarium* stattgefunden hat. Durch den Larvenfraß wurde die insbesondere basipetale Verbreitung von *F. proliferatum* begünstigt. Der Infektionsweg über die Wurzel erwies sich innerhalb der vierwöchigen Versuchsdauer als weniger aggressiv. Um die Infektionsquellen für die Wurzel-, Kronen- und Stängelfäule gerade bei Jungpflanzen zu reduzieren, ist es nach unseren Beobachtungen erforderlich eine Kontrolle des Insektenbesatzes durchzuführen.

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Section 15 - Talk

Effect of weather conditions on frit fly activity and its infestation levels in spring wheat

N. El-Wakeil, I. Bormann & C. Volkmar

The study of weather effects in insect ecology should focus on how behavioural characteristics of individual organisms translate into population and community dynamics. Weather affects on host-plant quality which affect naturally on insect population. Effect of weather condition; temperature, rainfall and global solar radiation on frit fly catches by water traps as well infestation percents was evaluated in spring wheat in central Germany during 2007 to 2010. Three colour water traps (blue, white and yellow) were used to survey frit fly population to determine the suitable date to control. The infestation percents were calculated by counting the infested plants before and after treatment of 3, 7, 10 and 15 days in two spring varieties (Sakha 93 and Triso). Generally, infestation percents were higher in Sakha 93 than Triso variety. The correlation among different weather conditions and trap catches and infestation percents were assessed.

The weather conditions in 2008 and 2009 were drier, warmer and also solar radiation was higher than 2010, which affect on catches of water traps as well infestation percents of frit fly. There was a positive correlation between blue trap catches and solar radiation and negative correlation with white and yellow trap catches. Infestation percents were higher in 2008 & 2009 than 2010; although trap catches were higher in 2010 than 2008 & 2009, because weather conditions affected negatively oviposition and newly larvae in 2010. The results emphasize that weather conditions can play a precise role in insect population: that of a limiting factor that determines the relative importance of various biotic determinants of population dynamics. Changing the focus of inquiry from mechanisms of population regulation to the interplay of biotic and abiotic factors re-establishes the conceptual importance of weather for insect-population ecology.

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Section 15 - Talk

Zur Diversität von Zikadenpopulationen im Getreide und deren Vektorfunktion (WDV) in der mitteldeutschen Agrarlandschaft

L. J. Finger, T. Block, W. Witsack, N. Drechsler & C. Volkmar

Um über die Diversität und das Dispersionsverhalten von Zikadenpopulationen in der Agrarlandschaft Aussagen treffen zu können, wurde 2010 eine Feldstudie an zwei Standorten bei Rumpin, Sachsen - Anhalt durchgeführt. Der Untersuchungszeitraum erstreckte sich über drei Phasen: abreifende Wintergerste, Ausfallgetreide und Wintergersten-Neuansaat in der Zeit von Anfang Juli bis Ende Oktober 2010. Die Abundanz der Zikaden wurde mittels Kescherfängen in der Saumstruktur, am Feldrand und im 100 m – Feldbereich erfasst. Die gefangenen Zikaden wurden bestimmt und molekular – biologisch auf Virusbelastung mittels PCR getestet. Außerdem wurden am Versuchsstandort aus dem Ausfallgetreide und dem Getreide der Neuansaat Pflanzenproben entnommen und mittels Elisa - Test auf Befall mit Gerstengelverzweigungsvirus (BYDV) und Weizenverzweigungsvirus (WDV) untersucht.

In der reifenden Wintergerste wurden 77 adulte Zikaden, im Ausfallgetreide 1359 adulte Tiere und in der Neuansaat 66 adulte Tiere gefangen. Insgesamt konnten im Versuchszeitraum 21 Arten nachgewiesen werden. Es variieren sowohl die Anzahl der Individuen als auch die Vorkommen der Arten in den einzelnen Feldbereichen (Saumstruktur, Feldrand, 100 m – Bereich im Feld) und Versuchszeiträumen. Die Ergebnisse der virologischen Pflanzenuntersuchungen zeigen, dass im Ausfallgetreide WDV als Infektionsquelle für die Neuansaat verfügbar war. Obwohl hier zusätzlich eine große Zikadenabundanz festgestellt werden konnte, kam es nicht zu einer Virusübertragung auf die folgende Wintergerste. Aufgrund der Witterungsbedingungen im Spätsommer 2010 wurde die Infektionskette vermutlich durch niedrige Temperaturen und ergiebige Niederschläge unterbrochen. Ergebnisse zur Virusbelastung der gefangenen Zikadenarten werden im Vortrag vorgestellt.

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Section 15 - Talk

Wie überwintern Glanzkäfer? – Ergebnisse von Freiland- und Laborversuchen

K. Gloyna & T. Thieme

In Deutschland werden derzeit knapp 1,5 Millionen ha Raps angebaut. Damit hat sich die Rapsanbaufläche in den letzten 15 Jahren fast verdoppelt. Parallel zu dieser Entwicklung nahmen auch Pflanzenschutzmittelanwendungen und -kosten stark zu. Rapsglanzkäfer, *Meligethes aeneus* (Fabricius, 1775) sind dabei die häufigste Ursache für Insektizideinsätze im Rapsanbau. Nicht vorhersagbare Massentwicklungen verursachten dennoch mehrfach Ertragseinbußen und teilweise Totalausfälle.

Zum besseren Verständnis der Populationsentwicklung des Rapsglanzkäfers, wurde daher die Bedeutung der Überwinterung in Freiland- und Laborversuchen untersucht. Neben der Frage der Winter-Mortalität, sollte geklärt werden, ob mit Winterlager-Daten Befallsprognosen für das folgende Frühjahr erstellt werden können. Dazu wurden an mehreren Standorten in Bayern, Niedersachsen und Mecklenburg-Vorpommern über drei Jahre Bodenproben entnommen und darin enthaltenen Glanzkäfer extrahiert. Zur Klärung des Einflusses der Temperatur wurden künstlich besetzte Proben verschiedenen Winter-Szenarien ausgesetzt und die Überlebensrate der Käfer ermittelt. Darüber hinaus wurde untersucht, ob pyrethroid-resistente Käfer eine geringere Winterfitness aufweisen, als sensitive Tiere.

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Section 15 - Talk

Populationsdynamik 2010 des Westlichen Maiswurzelbohrers an verschiedenen Standorten des Tessins unter Management durch staatlich verordneten Fruchtwechsel.

H. E. Hummel & M. Bertossa

Populationen des Westlichen Maiswurzelbohrers *Diabrotica v. virgifera* LeConte (Coleoptera: Chrysomelidae) stiegen im südschweizerischen Maisanbau zu Anfang des Jahrzehnts steil an. In der Folge entschieden sich die kantonalen und bundesweiten Autoritäten für ein herkömmliches Management-System mit Fruchtwechsel und ohne Insektizide. Seit 2003 wird durch billige Pheromon- und Kairomonfallen als Monitoring-System die Populationsentwicklung systematisch erfasst. Damit lassen sich Flugbeginn, -ende sowie -maximum räumlich sehr genau eingrenzen. Auch ist ein längerfristiger Trend erkennbar, der es erlaubt, die Wirksamkeit der Fruchtwechselstrategie zu verfolgen.

Im Sommer 2010 wurden 13 Standorte in der Magadino-Ebene und in umliegenden Tälern und Höhen beprobt. Folgende Fangergebnisse wurden erzielt: **(1)** Die Flugkurven liegen an allen Standorten zwischen dem 12. Juli bis 3. Okt. 2010. Das Flugmaximum ist vom 19. Juli bis 15. August. **(2)** Der Einzel-Standort Lostallo zeigt als Positivkontrolle mit N=530 Käfern unter sonst vergleichbaren Bedingungen ein Maximum an Befall und ist für mehr als 25 % aller Käferfänge verantwortlich. **(3)** Wiederum wurden, wie auch in vorangehenden Jahren, am Pass Mt. Ceneri Käfer auf einer Höhe von 530 m gefangen, obwohl dort keine Maisfelder stehen. Dieser Befund deutet auf eine Flugschneise für die Bewegung der Käfer von südlicher in nördliche Richtung. **(4)** Bemerkenswerterweise hat staatlich verordneter landesweiter Fruchtwechsel zum Absinken und Stabilisierung der *Diabrotica* Population auf ein niedrigeres Niveau geführt. Jährliche Schwankungen sind wahrscheinlich wetterbedingt. Das altbewährte Management-Konzept des Fruchtwechsels zeichnet sich durch weit geringere Kosten, Nachhaltigkeit und geringstmögliche Umweltbelastung aus, spart Ressourcen und ist zur Nachahmung durch andere Länder und Staaten empfohlen. Denn auf der Alpensüdseite ist man trotz jährlicher Präsenz von Käfern weit weg von ökonomischen Schäden an den Maispflanzen.

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Section 15 - Talk

The Western corn rootworm in maize fields: Comparison of two different sex pheromone preparations in the canton Ticino, Romania, and the State of Illinois, USA

H. E. Hummel, K. Mori, B. Kovalev, M. Bertossa & S. Dinnesen

Ever since its introduction into Europe in 1992, the Western corn rootworm *Diabrotica v. virgifera* LeConte (Dv) (Coleoptera: Chrysomelidae), a quarantine pest, is being monitored by a number of different trapping systems. Beyond these, the Metcalf sticky cup trap is the most sensitive and certainly the least expensive design imaginable. One of these traps, including lure after its identification and synthesis, costs only 15 cent. So far, stereoisomeric mixture of sex pheromone lure 8-methyl-decane-2-ol propanoate and its standardization attracted only little attention.

Data from a systematic comparison of two synthetic pheromone sources (with origin Mori and Kovalev) were obtained at three locations in Europe (Romania, Ticino/Switzerland) and Illinois/USA. Further analyses indicated that the beetles do not consistently and significantly prefer one of the two pheromones tested.

Thus, as long as the Dv populations are genetically uniform and the identity and purity of the synthetic pheromone sources are well characterised by chromatographic and spectrometric analysis, observed differences in the efficiency of trapping systems are probably more a consequence of ecological and weather factors prevalent at individual field locations and of trap design.

As conclusion, field experiments showed that for all practical intents and purposes, a stereoisomeric mixture of synthetic sex pheromone from either one of the two sources can be used as a reliable monitoring tool for Dv males.

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Section 15 - Talk

Notwendigkeit der Schaderregerüberwachung im Stadtgrün Berlins

B. Jäckel, M. Andrae & I. Feilhaber

Kontinuierliche Überwachungssysteme im urbanen Bereich sind eine wichtige Voraussetzung für den Schutz der sehr wertvollen Pflanzenbestände in der Stadt. Sie bieten die Möglichkeit frühzeitig, schon bei geringem Befall, mit mechanischen oder auch biologischen Maßnahmen Schadorganismen zu kontrollieren. Unterschiedliche Autoren berichten von Veränderungen im Schaderregerspektrum von Städten. An Beispielen aus Berlin wird gezeigt, dass besonders beißende Insektengruppen im Freiland deutliche Abweichungen von ihrer bisherigen Dynamik zeigen. An Beispielen der Bauwerksbegrünung werden weiterhin neue Probleme mit saugenden Schadorganismen vorgestellt. Die Ursachen für diese kurzfristigen Veränderungen sind vielschichtig. Eine Großstadt wie Berlin ist in der Pflanzenverwendung der Endverbraucher. Der Bedarf an Pflanzen ist seit Jahren sehr groß. Es werden diverse Pflanzenarten aus unterschiedlichen Herkunftsländern in Räumen, Außenanlagen und Gärten ausgepflanzt. In allen Bereichen des Stadtgrüns findet kein oder nur ein punktuell geringer Einsatz von chemischen Pflanzenschutzmitteln statt. So können sich die in ganz geringen Mengen an Pflanzen oder auch an Schnittware mitgebrachten Schadorganismen über längere Zeiträume, entwickeln, ausbreiten und etablieren. Diese Entwicklung kann nur mit professionellen kontinuierlichen Überwachungssystemen erfasst werden, da die Endverbraucher der Pflanzen Laien sind. Die Überwachungssysteme für die unterschiedlichen tierischen Schadorganismen des Gartenbaus und der Forsten sind nicht ohne weiteres auf urbane Flächen zu übertragen. Berlin ist mit 892 km² die flächengrößte Stadt Deutschlands und stark strukturiert, sodass auch die Verteilung der spezifischen Monitoringsysteme immer wieder neu berücksichtigt werden muss. Hierfür sind Anpassungsuntersuchungen erforderlich, dies wird an ausgewählten Beispielen demonstriert.

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Section 15 - Talk

Movento®: A new, ambi-mobile insecticide for the control of sucking pests.

A.M. Klueken, J. Meyer, P. Loesel, R. Nauen, U. Reckmann & A. Elbert

The tetramic acid derivative spirotetramat (Movento®) has an excellent activity against sucking insect pests such as whiteflies, aphids, soft and armoured scales, mealy bugs, psyllids and selected thrips species and is currently registered for use in vegetables, cotton, soybean, pome and stone fruit, grapes, hop, citrus, nut trees and banana. The product acts as an inhibitor of lipid biosynthesis and affects primarily juvenile stages with additional effects on adult fecundity. There is no known cross-resistance to any other insecticide mode of action.

Spirotetramat is a pro-insecticide that rapidly hydrolyses *in vivo* to its biologically active form (spirotetramat-enol), which has physico-chemical properties allowing ambi-mobile transport in plant vascular systems (i.e. up- and downward translocation in phloem and xylem) ensuring full systemicity. As spirotetramat acts mainly via ingestion, the penetration into the leaf tissue is of utmost importance to ensure the optimal transport of the active ingredient throughout the plant, thereby exploiting its full biological potential and guaranteeing a maximum of selectivity. Special advantages of ambi-mobile insecticides are the control of hidden and soil living sucking pests after foliar application and the protection of new growth subsequent to the time of application. A further advantage is that adverse effects on beneficial arthropods are minimized making the product suitable for modern integrated pest management (IPM) systems. These unique properties contribute to sustainable both the quality and quantity of the crop yield. In this presentation, the new chemistry is presented, advantages of ambi-mobile insecticides are shown and novel applications in IPM systems are discussed.

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A. Michael Klueken, Agronomic Development, Bayer CropScience AG, Monheim, Germany (Presenting Author).

Section 15 - Talk

European earwigs (Dermaptera: *Forficula auricularia*) increase abundances of the black cherry aphid (Aphidae: *Myzus cerasi*) on young cherry trees

S. Krause , F. Herzog & M.H. Entling

Aphids are major herbivores on a wide range of plants. Moreover they vector diseases on major crops. Several predators and parasitoids are known to reduce aphid densities. Especially the European earwig *Forficula auricularia* was known to contribute to aphid control. Aphid tending ants, on the other hand, can enhance aphid densities. We tested the interactions between aphids, predators, mainly *Forficula auricularia*, and ants on cherry trees. We established 30 groups of seven cherry trees each near Berne, Switzerland. Walking arthropods such as ants and earwigs were excluded from three trees per site by means of a glue ring. Five treatments were installed on each site. Three treatments were installed on trees with glue ring: (1) ant reduction, (2) earwig reduction, (3) ant and earwig reduction. Further two treatments were installed on trees without glue ring: (4) earwig reduction and (5) no reduction (control). Aphids, ants, earwigs and all other insects on the trees were regularly recorded by visual inspection on eight dates between May and September. Aphid abundance was significantly higher on trees to which earwigs had been added than on trees from which earwigs had been removed. On the basis of the visual inspection we didn't find any significant effect of other predators, which occurred naturally and unmanipulated on the trees, on aphids. On trees where earwigs had been added we recorded also a higher abundance of ants than on trees with reduced earwig densities. We conclude that earwigs had an indirect positive effect on the abundances of aphids. Possible reasons are that earwig predation on aphids reduces other aphid enemies, such as fungi, that could have a stronger negative long-term effects on aphids than earwigs. Alternatively, earwigs could evoke chemical reactions of aphids or themselves produce chemicals that attract aphid tending ants, which in turn promote aphids.

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Section 15 - Talk

Monitoring von Weizengallmücken in Deutschland 2007-2010

J. Lehmus & U. Heimbach

Die Orangerote Weizengallmücke (*Sitodiplosis mosellana*) und die Gelbe Weizengallmücke (*Contarinia tritici*) können in manchen Jahren im Weizen regional Ausfälle von bis zu 40% verursachen, während sie in anderen Jahren unbedeutend sind. Nach starken Schäden im Getreideanbau in Deutschland in 2003 erfolgte in den Jahren 2007-2010 ein Monitoring der Weizengallmücken an jeweils 30-40 Standorten verteilt über ganz Deutschland. Ziel des Monitorings war, das Schadauftreten der Arten besser zu verstehen. Zur Erfassung des Befalls beziehungsweise der Schäden wurden vier verschiedene Methoden angewandt. Zur Kontrolle des Fluges von *S. mosellana* wurden Pheromonfallen eingesetzt. Es erfolgte eine Ährenbonitur (Binokular) auf Larven beider Arten zur Befallskontrolle. Zur Erfassung der Abwanderung der Larven in den Boden wurden Weißschalen genutzt. Zur Schadensfeststellung wurden Ernteproben von den verschiedenen Standorten ausgewertet. Im Auftreten der beiden Arten zeigten sich deutliche Unterschiede. Im Süden und Südosten war der Befall im allgemeinen stärker als an den nord- bzw. nordwestdeutschen Standorten. Die Gelbe Weizengallmücke *C. tritici* trat an nord- bzw. nordwestdeutschen Standorten kaum auf. Dort war meist allein die Orangerote Weizengallmücke *S. mosellana* vorhanden. Anhand der Pheromonfallenfänge ließen sich der spätere Befall und der Schaden nicht vorher abschätzen. Pheromonfallenfänge waren vielfach nicht gut mit den zur Eiablage geeigneten Wachstumsstadien des Weizens korreliert. Ausweichen auf Ungräser wurde beobachtet. In Weißschalen wurden auch Larven anderer Gallmückenarten gefangen. Die Eiablage an Ähren mit unterschiedlichem BBCH im Bestand kann sehr unterschiedlich sein. Beide Weizengallmücken-Arten können dieselben Ähren befallen, jedoch selten dieselben Körner in der Ähre.

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Section 15 - Talk

Schad-Thripse in Ost-Afrika – Identifikation und Information mit LucID3.5

G. Moritz, S. Brandt & S. Subramanian

Zur Thrips-Fauna Ost-Afrikas liegen bis auf wenige sporadische Untersuchungen keine Informationen vor. Jedoch führen klimatische Veränderungen und urbane Einflüsse zu massiven Verschiebungen der Schaderregerspektren. Invasive, adaptive und hoch reproduktive Arten erlangen spürbaren Einfluss auf landwirtschaftliche Produkte, wobei neben ihrer Saugtätigkeit vor allem die Übertragung von Tospoviren ihr Schadpotenzial erheblich vergrößert. Aus diesem Grund wird im Rahmen eines gemeinsamen Projektes „Integrated Control of Thrips in Vegetables in Eastern Africa“ mit der Universität Hannover und dem icipe, Nairobi, ein Identifikations- und Informationssystem auf der Basis von LucID 3.5 entwickelt. Dieses Identifikationsverfahren wird in vielfältiger Form nutzbar sein, um einheimische Pflanzen sowie pflanzliche Exportgüter (Auberginen, Bananen, Baumwolle, Blumen, Bohnen, Getreide, Kaffee, Kakao, Mais, Luzerne, Tee, Tomaten, Zitrusfrüchte) effektiv auf invasive, virulente, sowie unter Quarantäne gestellte Arten (*Frankliniella occidentalis*, *F. schultzei*, *Thrips palmi*) zu kontrollieren. Dabei erlaubt die erfolgreiche Identifikation neben dem gezielten Einsatz von IPM-Programmen vor allem eine umfassende Erfassung der Biologie dieser Schaderreger, wie z.B. Reproduktion, Dispersion, Vektoreigenschaften sowie den Einsatz geeigneter Antagonisten (Pilze, Nematoden, Raubinsekten) unter unterschiedlichsten klimatischen Bedingungen. Zu den ca. 120 identifizierbaren Thrips-Arten sowie zu den in einem Subkey zu diagnostizierenden Antagonisten wird jeweils ein umfassendes „Fact Sheet“ bereitgestellt, welches zahlreiche Features aufweist, wie z.B.: mikroskopische Originalfotos (MontageLeica), umfangreiche Spezies-Beschreibung, Vergleiche mit ähnlichen Arten, Wirtspflanzenspektren, Vektoreigenschaften, Einbindung der GPS-Funddaten in Google-Maps sowie eine umfassende Bibliographie und wichtige Links.

Finanzielle Unterstützung: Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)

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Section 15 - Talk

Tireless defenders of the grain – mass rearing device for the granary weevil parasitoid *Lariophagus distinguendus*

S. Niedermayer & J. L. M. Steidle

Crop needs to be protected from insect damage. In addition to crop protection in the field post-harvest crop protection is very important. Stored products are threatened by many different insect pests mostly of the orders Coleoptera and Lepidoptera which need to be eliminated from storages. However in the last couple of years the number of registered insecticides against these pests decreases rapidly. Furthermore farmers face a growing market for organic products, with strict rules against chemical insecticides. Therefore alternative methods for crop protection need to be applied.

One of these methods is biological pest control, i.a. the use of antagonist arthropods against pest species. One of the major pests in stored grain in Europe is the granary weevil *Sitophilus granarius* L.. The biocontrol agent against this and other pests with a concealed development inside kernels or cocoons is *Lariophagus distinguendus* (Förster) a parasitic wasp belonging to the family of Pteromalidae.

Even so *L. distinguendus* is commercially available since a several years its use does not hold appeal to farmers as much as expected. One reason is that *L. distinguendus* needs to be applied several times a year at certain time intervals and at certain temperatures. To improve this method a mass rearing device was developed. The rearing boxes consist of parasitoids, hosts and host medium allowing a continuous release of freshly emerged wasps throughout the season.

For the development of the box the following steps were necessary:

A host other than *S. granarius* had to be found and tested.

A box opening holding back hosts but releasing wasps needed to be developed.

The initial amount of hosts and wasps for a continuous release throughout the season had to be determined in laboratory and field experiments.

The results of these steps will be presented and discussed.

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Section 15 - Talk

Toxicity and repellency of essential oils of *Lippia adoensis* to *Sitophilus zeamais* as influenced by leaf age

E. Nukenine, T. Gangue, D. Ulrich, Ch. Reichmuth & C. Adler

Essential oils extracted from the young (leaves 1-6) and old (> leaf 10) leaves of *Lippia adoensis* harvested in Ngaoundere, Cameroon, were evaluated in the laboratory for toxicity, persistence and repellency against *Sitophilus zeamais* on 7-cm filter paper discs. The essential oils were analyzed by GC-MC. The toxicity (0.19, 0.39, 0.78 and 1.56 $\mu\text{l}/\text{cm}^2$) and repellency (0.026, 0.104, 0.208, and 0.416 $\mu\text{l}/\text{cm}^2$) tests included four dosages and the persistence bioassay one dosage (1.56 $\mu\text{l}/\text{cm}^2$) of the essential oils. Mortality was recorded 6, 12, 24, 48, 72 and 96 h after infestation. Repellency observations were done 1, 2, 6, 12 and 24 h after introduction of the insects. The three dominant constituents were similar for the young and old leaves and were thymol (22.02% and 22.73%), thymol acetate (15.21% and 16.26%) and para-cymene (13.85% and 13.37%). However, the levels of other constituents like 3-aminopyrazole, B-phellandrene and fenchone were lower in the young (3.30%, 0.36% and 0.10%, respectively) compared with the old (5.20%, 0.54% and 0.29%, respectively) leaves. The two essential oils were significantly toxic to *S. zeamais*, although the oil from the young leaves (1.25 $\mu\text{l}/\text{cm}^2$) with lower 24h-LC₅₀ value was more toxic than that from the old leaves (6.05 $\mu\text{l}/\text{cm}^2$). Mortality generally increased with exposure dosages. For the young leaves, the oil left on filter paper at ambient conditions for 24 h (31.26%) before introduction of insects recorded lower mortality than that directly from the refrigerator (86.88%) ($t = 6.96^{**}$). No such differences in mortality were noted for the old leaves ($t > 0.05$). The oil from the young leaves was less repellent to *S. zeamais* than that from the old leaves. Leaf age may be an important factor for consideration in the integrated management strategy of *S. zeamais* involving the essential oils of *L. adoensis*.

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Section 15 - Talk

Schädlinge und Integrierte Schädlingsbekämpfung in Berliner Museen

P. Querner

Materialschädlinge wie Kleidermotten (*Tineola bisselliella*), Brotkäfer (*Stegobium paniceum*) oder Gemeine Nagekäfer (*Anobium punctatum*) sind als Museumsschädlinge aus Europa bereits lange bekannt und verursachen immer wieder große Schäden in Sammlungen von Kulturgütern. Seit den 80er Jahren wird in Museen und Depots integrierte Schädlingsbekämpfung angewendet um den Einsatz von Pestiziden gegen die Schädlinge zu reduzieren und einen Befall zu verhindern. Ein Monitoring mit Klebe- und Pheromonfallen spielt dabei eine große Rolle um einen Befall rechtzeitig zu erkennen und die befallenen Objekte zu finden. Wir berichten hier die Ergebnisse von Kontrollen (Monitoring) in einigen Berliner Museen der Stiftung Preußischer Kulturbesitz (Ethnologische Museum, Museum Europäischer Kulturen, Bode Museum, Islamisches Museum, Ägyptisches Museum, Kunstgewerbemuseum, Kupferstichkabinett, Musikinstrumenten Museum) und dem Technik Museum Berlin. Als häufigste Schädlinge wurden Kleidermotten (*Tineola bisselliella*), Brotkäfer (*Stegobium paniceum*), unterschiedliche Teppichkäfer (*Anthrenus* sp.) und Khaprakäfer (*Trogoderma angustum*, oder auch Berlinkäfer genannt) in den unterschiedlichen Museen und Gebäuden gefunden. Zur Bekämpfung der Schädlinge werden in den beschriebenen Museen fast ausschließlich inerte Gase wie Stickstoff oder Einfrieren angewendet.

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Section 15 - Talk

Populationsdynamik von *Aleyrodes proletella* an Kohlarten

E. Richter & G. Hirthe

In den letzten Jahren stieg der Befalls mit der Kohlmottenschildlaus *Aleyrodes proletella* (Homoptera: Aleyrodidae) an vielen Kohlarten stark an. Dies betrifft Gebiete mit intensivem Rapsanbau, wie z. B. weite Teile Nord- und Ostdeutschlands, aber auch Gebiete mit ganzjährigem und großflächigem Kohlgemüseanbau. *A. proletella* schädigt durch Entzug von Assimilaten. Durch die Ausscheidungen von Honigtau kommt es zu Verschmutzungen und bei sehr hohem Befall zu deutlichen Ertragseinbußen. Über die Populationsdynamik ist bisher wenig bekannt.

Bei Kontrollen von Rapsbeständen in Mecklenburg-Vorpommern (MV, Gülzow), Sachsen (SN, Raum Dresden) und Niedersachsen (NI, Raum Braunschweig) zeigte sich, dass Rapsfelder in Nähe von Flächen mit Kohlgemüse im Herbst einen hohen Besatz mit adulten Tieren aufweisen. Bis zum Frühjahr verringert sich diese Anzahl zwar, die überwinterten Tiere beginnen jedoch ab Anfang Mai mit der Eiablage und es entwickelt sich die erste Generation. Die adulten Tiere übersiedeln mit der Abreife des Rapses im Juni auf andere Wirtspflanzen, wie z. B. Kohlgemüsearten.

In Rosenkohlbeständen war der erste Zuflug 2008-2010 ab Anfang Juli zu beobachten. Bis Mitte September kam es zu einer Massenvermehrung mit bis zu 60.000 Larven je Pflanze. Erst mit sinkenden Temperaturen von unter 10 °C im Oktober nahm erst die Anzahl deutlich ab. Um die Verteilung des Schädlings an der Pflanze zu ermitteln, wurden die einzelnen Blätter der Pflanzen nacheinander separat ausgezählt. Die Eier wurden an den ersten jungen Blättern abgelegt, an denen später die ersten Larven zu finden waren. Die Adulten wanderten anschließend zu den jüngsten Blättern, so dass sie ebenso wie die Eigelege immer an den Triebspitzen finden sind. Adulte sind erst dann in tieferen Blattetagen zu finden, wenn sie aus den Puparien schlüpfen. Ebenso „wandern“ die Larven mit nach oben, so dass auf den unteren Blättern nur noch leere Hüllen zu finden sind.

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Section 15 - Talk

Mezium affine Boieldieu (Coleoptera, Ptinidae) – a potential test organism for the insecticidal efficacy of diatomaceous earths against stored-product pests

M. Schöller

Mezium affine Boieldieu, 1856 is quite common in natural habitats in the Mediterranean area, but it was also recorded from salt-mines in the Malian Sahara. Moreover, it occurs as a stored product pest in warehouses, granaries, cotton mills and spice shops. It may also infest historic houses and become a nuisance in residences. The beetles are able to tolerate excessive drying and to survive in the absence of food and water for up to 3 months, partly by entering into quiescence as adults.

Diatomaceous earths (DE) are applied for the control of stored-product and hygiene pests similar to residual insecticides. DE are fossilized remains of diatoms (Stramenopiles: Bacillariophyta) encased within a hard and porous cell wall made of silica (hydrated silicon dioxide). Once an insect is covered with DE, the dust damages the protective wax layer in the insect's cuticle, resulting in water loss and desiccation.

The insecticidal efficacy of a DE against *M. affine* was tested in the laboratory. Adults were exposed on surfaces treated with diatomaceous earth at three dose rates, i.e. 0.5, 1 and 2 g / m², respectively, at 22°C. Dead adults were counted daily. In a second trial, the weight loss of individual beetles exposed to the above-mentioned dose rates was determined.

The DE significantly increased both mortality and weight loss compared to the untreated control. However, the spider beetles were found to be comparatively tolerant against DE. The results were compared with the insecticidal efficacy of DE against other stored-product pests, e.g. *Tribolium* spp.. *M. affine* seems to be especially suitable to test sublethal doses of DE for empty room treatment.

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Section 15 - Talk

The influence of single temperature heat shocks during transport on the quality of *Bracon brevicornis* a braconid larval parasitoid in biological control.

R. Schubert, C. Volkmar & O. Zimmermann

The European corn borer (ECB) *Ostrinia nubilalis* is the most important corn pest in Germany. The biological control with the egg parasitoid *Trichogramma brassicae* is successful for more than 25 years. In the recent years farmers had growing problems to control the ECB e.g. because of a bivoltine variety and monitoring problems. *Bracon brevicornis* is a larval parasitoid of the ECB and is recently under investigation for its efficacy in initial field trials. The objective of this work was to evaluate the influence of high temperature on the quality of the braconid in prepupal and pupal stages in their cocoons during transport. Parameters were a) emergence rate, b) longevity of the emerging adults, c) sex ratio, d) rate of parasitism of emerged single females with larvae from *Ephestia kuehniella*. Before postal transport the braconids were stressed with single heat shocks for one hour at four different high temperatures in an incubator. Three treatments for each temperature were a) control at room temperature, b) heat shock and transport without cool pack, c) heat shock and transport with cool pack. The control and the treatment with cooling at 30°C showed the highest emergence rate from the cocoons with 90%. The emergence rates of the treatments without cooling were 79,4% (30°C), 65,0% (35°C), 70,1% (40°C) and 42,7% (45°C). The emergence rates in the treatment with cooling resulted in 90,4% (30°C), 69,1% (35°C), 84,8% (40°C) and 82,1% (45°C). The breeding of the F1-generation confirmed these results. Further trials indicated that older pupae (one to two days before emergence) were less sensitive than prepupae and early pupal stages. The use of a cool pack even in just a standard cardboard box (no styrofoam) could balance the one-hour heat shock up to 40°C where the emergence was reduced up to 20% compared to control. At 45°C strong negative effect with more than 50% reduced emergence of braconid adults from the cocoons was observed.

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Section 15 - Talk

Management of Western Corn Rootworm larvae with artificial CO₂ sources

M. Schumann, A. Patel & S. Vidal

Western Corn Rootworm larvae (WCR) use CO₂ to locate maize roots over longer distances. With the use of artificial CO₂ emitting capsules, the larvae can be lured away from maize roots so that they do not find anything to feed on and starve. This approach was tested in microhabitat containers (0.5 m²) with two maize rows of 4 plants each (row spacing 60 cm). The capsules were applied every 30 cm between the maize rows (30 cm from each row) and 120 WCR eggs were inoculated 15 cm from each plant 48 hours prior to hatch. 21 days after the first hatch, the larvae were extracted from the soil and the larval density per plant determined. CO₂ measurements in the soil were regularly taken 0, 15 and 30 cm from the plant to quantify CO₂ production by the capsules. This set up was tested at two different growth stages: BBCH 13-14 and BBCH 17-18 (N = 8). The CO₂ concentration increased with increasing distance from the plant over a period of 14-17 days when the capsules were applied. An opposite trend was measured in the control. The use of the capsules caused a significant reduction in WCR larval densities at BBCH 13-14 but not at BBCH 17-18.

In another experiment the capsules were combined with the soil insecticide Force 1.5G to test an „Attract & Kill “(A&K) approach against WCR larvae. The A&K set up was the same as described above, except that a capsule/Force 1.5G combination was applied between the maize rows. Besides the A&K treatment, containers with a conventional treatment (Force 1.5G was applied in the maize rows) were set up. The experiment was tested at growth stage BBCH 17-18 with two different application rates of Force 1.5G: 48 g a.i. /ha (high) + 24 g a.i. /ha (low) (N = 4). All treatments caused a significant reduction in WCR larval densities at both application rates. There was no significant difference in larval densities between the conventional and the A&K treatment at a high application rate; however, at a low application rate larval densities were significantly lower in the A&K treatment.

The integration of artificial CO₂ emitting capsules into WCR management can help to develop a more sustainable approach to target WCR larvae. As a next step the capsule formulation needs to be refined and evaluated in field studies.

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Section 15 - Talk

Looking behind the scene: the mechanisms of trap-cropping soil insect pests

K. Staudacher, B. Thalinger, N. Schallhart, C. Wallinger, A. Juen & M. Traugott

Wireworms within the genus *Agriotes* (Coleoptera: Elateridae) are generalist root feeders, abundant in arable soils and a serious pest. Here, a field experiment is presented where trap crops were used to reduce the feeding damage caused by *Agriotes* larvae in maize (*Zea mays*). The crop was grown in three different treatments: (i) in monoculture, (ii) in combination with wheat (*Triticum aestivum*) as a trap crop and (iii) together with a diverse trap crop mix comprising five plant species.

Within this experiment we tested whether the trap crops are consumed by the wireworms and, if so, whether this leads to a decrease in the consumption of maize. To test these hypotheses we employed a combined approach of molecular gut content and stable isotope analyses. Moreover, we hypothesized that the distribution of the larvae changes towards aggregation in the trap crops and that the wireworm-inflicted damage in the maize gets reduced by the presence of the alternative food sources.

The findings support all of our hypotheses: trap crops not only lured the larvae away from the maize but they were also preferentially consumed compared to the crop. Moreover, the trap crop mix offered a more attractive food source than the single species trap crop did. Within the trap crop treatments we also found maize damage to be reduced.

Our data shows that trap crops provide an attractive alternative food source for wireworms allowing to protect maize from below-ground feeding damage. Furthermore, we found conclusive evidence that increasing plant diversity in trap crops significantly increases the attractiveness of this alternative food source, maximizing the efficacy of the trap crop approach.

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Section 15 - Talk

Untersuchungen zur mikrobiologischen Bekämpfung des Pflaumenwicklers *Cydia funebrana* mit insektenpathogenen Pilzen unter Berücksichtigung verschiedener Formulierungen

D. Stephan

Im Rahmen des vom Bundesprogramm zur Förderung des Ökologischen Landbaus und anderen Formen der nachhaltigen Landwirtschaft (BÖLN) geförderten Projekts „Regulierung des Pflaumenwicklers und der Monilia-Krankheit im ökologischen Steinobstanbau“ wurde in Laborversuchen untersucht, ob potentielle Verpuppungsorte mit insektenpathogenen Pilzen behandelt und somit überwinterte Larven des Pflaumenwicklers *Cydia funebrana* kontrolliert werden können. Da keine Zucht des Pflaumenwicklers aufgebaut werden konnte, wurden neben Versuchen mit im Freiland gesammelten Tieren auch Versuche mit Larven des Apfelwicklers (*C. pomonella*), des einbindigen Traubenwicklers (*Eupoecilia ambiguella*) und des Pfirsichwicklers (*C. molesta*) durchgeführt.

Erste Laborversuche ergaben, dass alle Wickler-Arten Wellpappe und Rindenmulch als Verpuppungsort annehmen. Wurden Wellpappe und Rindenmulch mit dem Produkt Naturalis (*Beauveria bassiana*) behandelt, konnte keine befriedigende Wirkung durch den Pilz beobachtet werden. Jedoch wurde eine hohe Mortalität durch in Öl suspendierte Konidien von *B. bassiana* erzielt. Eine im Vergleich zur wässrigen Konidien suspension erhöhte Verpilzungsrate deutet darauf hin, dass neben der direkten Wirkung des Öls eine höhere Pilzinfektion erzielt werden kann.

Wurden verschiedene insektenpathogene Pilze (*Metarhizium anisopliae*, *B. bassiana*, *Lecanicillium lecanii*, *Isaria fumosorosea*) gegen die vier Wickler-Arten getestet, zeigte sich, dass *I. fumosorosea* eine bessere Wirkung aufwies.

Erste Untersuchungen zur Persistenz unter freilandnahen Bedingungen lassen vermuten, dass die getesteten *I. fumosorosea* Isolate dem *M. anisopliae* Isolat überlegen sind. Eine technische und praktikable Umsetzung der Ergebnisse wird diskutiert.

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(Presenting Author)

Section 15 - Talk

Die Blattrandkäfer *Sitona gressorius* und *Sitona griseus* (Coleoptera: Curculionidae) als Schädlinge an landwirtschaftlich genutzten Lupinen.

K. Ströcker, C. Struck, K. Kaufmann, B. Schachler, S. Wendt & W. H. Kirchner

Die Lupinenblattrandkäfer *Sitona gressorius* und *S. griseus* (Coleoptera: Curculionidae) sind spezifische Schädlinge an verschiedenen Arten der Gattung *Lupinus* (Fabaceae) in Europa. Die adulten Käfer fressen an den Blättern, die Larven an den Wurzelknöllchen der Pflanzen. Der resultierende Biomasseverlust und die sekundär an den Fraßstellen auftretenden Infektionen mit Schadpilzen verursachen schwere Schäden in landwirtschaftlichen Lupinenkulturen. Genauere Kenntnisse über die Wirtspräferenzen der Tiere können die züchterische Entwicklung von weniger anfälligen Lupinensorten ermöglichen.

In einem dreijährigen Forschungsprojekt wurde der Blattrandkäferbefall an verschiedenen Lupinengenotypen (hauptsächlich der landwirtschaftlich genutzten Arten *L. angustifolius*, *L. luteus* und *L. albus*) untersucht.

In Lupinenbeständen, die durch intensive Insektizidbehandlung befallsfrei gehalten wurden, konnte gegenüber unbehandelten, dem natürlichen Käferbefall ausgesetzten Flächen ein Mehrertrag von 26,4% (2009) bzw. 58,1 % (2010) erzielt werden. Im Vergleich verschiedener Lupinenarten waren Genotypen von *L. angustifolius* und *L. albus* deutlich stärker von Käferbefall betroffen als Genotypen von *L. luteus*. Zu Beginn der Abreife der Pflanzen dieser Arten waren 90-100% aller untersuchten Pflanzen an der Wurzel befallen, wobei 70-90% aller Wurzelknöllchen durch Larvenfraß zerstört waren. Bei Genotypen von *L. luteus* betrug der Befall 20-50% bei einer Wurzelschädigung von 20%. Alkaloidreiche Genotypen zeigten dabei einen ähnlichen oder höheren Befall als alkaloidarme Süßlupinen. Ein fraßhemmender Effekt der Lupinenalkaloide auf die Lupinenblattrandkäfer liegt nicht vor. Verhaltensversuche weisen auf eine hohe Bedeutung volatiler Substanzen bei der Wirtswahl hin.

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Section 15 - Talk

Monitoring der Sensitivität von Getreide- und Kartoffelaphiden gegen Pflanzenschutzmittel

T. Thieme & G. Petersen

2010 wurde in Zusammenarbeit zwischen BTL und dem Pflanzenschutzdienst der Landwirtschaftskammer Schleswig-Holstein ein Monitoring der Sensitivität von verschiedenen Aphidenarten gegen drei Pflanzenschutzmittel durchgeführt. Von den aus Getreide- und Kartoffelbeständen Schleswig-Holsteins eingetragenen Pflanzenproben wurden im Labor alle Aphiden entnommen und nach Entfernung von Prädatoren, parasitierten oder mit Pathogenen befallenen Tieren von jedem Taxon eine Zucht etabliert. Von Getreide konnten 3 Taxa (*Metopolophium dirhodum*, *Sitobion avenae*, *Rhopalosiphum padi*) in 19 Linien und von Kartoffel 2 Taxa (*Aphis nasturtii*, *Myzus persicae*) in 12 Linien bei $21\pm 2^\circ\text{C}$ unter Langtagbedingungen (16L:8D) gehalten werden.

Mit standardisiertem Tiermaterial wurden in Dipping-Tests Untersuchungen über die Sensitivität gegen Biscaya (6 Dosierungen), Talstar (5 Dosierungen) und Karate Zeon (6 Dosierungen) durchgeführt. Hierfür wurden je 20 Tiere (5 Wiederholungen) auf Blattsegmente überführt, nach 24h und 48h die Anzahl der überlebenden viviparen apteren Weibchen sowie der abgesetzten Larven bonitiert, und mit diesen Werten eine Probit Analyse durchgeführt. Für die meisten Aphidenlinien konnten EC-Werte berechnet werden. Die Ergebnisse gestatten die Charakterisierung des Niveaus der Sensitivität der verschiedenen Aphidenlinien gegen Pflanzenschutzmittel und werden unter den Aspekten des Einflusses der Insektizidapplikationshäufigkeit auf die Selektion von Aphidenstämmen auf Insektizidresistenz und der Verhinderung von Virusübertragungen diskutiert.

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Section 15 - Talk

Einfluss kurzzeitiger Hitzewellen auf die Kohlmottenschildlaus *Aleyrodes proletella*

C. Tölle-Nolting, R. Meyhöfer & H-M. Poehling

Im Allgemeinen führen Temperaturerhöhungen zu einer schnelleren Entwicklung und somit höherem Populationswachstum bei Schadinsekten, bei sehr hohen Temperaturen verlangsamt sich aber die Entwicklungsgeschwindigkeit und es kommt zu einer erhöhten Sterblichkeit. Wir haben im Rahmen des Verbundprojekts KLIFF (KLimaFolgenForschung in Niedersachsen) die Auswirkungen von kurzzeitigen Hitzewellen auf die Kohlmottenschildlaus *Aleyrodes proletella* untersucht. Die Kohlmottenschildlaus ist von besonderem Interesse, da durch regionales Massenaufreten ihre Bedeutung in den vergangenen Jahren stark zugenommen hat. Für die Kohlmottenschildlaus sind Temperaturen um die 30° C optimal. Sie kann sich aber auch bei geringeren Temperaturen (ab 10° C) entwickeln (Alonso et al. 2009). Allerdings fehlen Daten über das Verhalten und die Entwicklung unter Extremtemperaturen. In Klimakammerexperimenten haben wir einmalige Hitzewellen von 36, 39 und 42 °C simuliert. Es wurde die geschlechtsspezifische Mortalität (akut und verzögert), Eiablageaktivität und Larvalentwicklung der Kohlmottenschildlaus quantifiziert. Eine Hitzewelle von 36 °C hat keinen Einfluss auf die Mortalität der Adulten, aber die Fertilität nimmt um ca. die Hälfte ab. Bei höheren Temperaturen steigt die Sterblichkeit um das Vierfache an und die Anzahl der abgelegten Eier tendiert gegen Null. Eine kurze Hitzeexposition der Eier scheint den Entwicklungserfolg jedoch kaum zu beeinträchtigen. Bei diesen rapide steigenden Temperaturen kann die Sterblichkeit jedoch auch auf den Hitzeschock zurückgeführt werden. Deshalb ließen wir die Temperaturen langsam an- und absteigen, mit einem kurzen Hitzeplateau dazwischen. Auch hier hat eine hohe Temperatur eine hohe Mortalität zur Folge. Diese ist jedoch geringer als bei einem plötzlichen Temperaturanstieg. Dies deutete darauf hin, dass die Tiere sich sehr schnell an hohe Temperaturen anpassen können, sodass Hitzewellen, wie sie in Niedersachsen aufgetreten sind und auch zukünftig auftreten könnten, für die Kohlmottenschildlaus kein Problem darstellen sollten.

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Section 15 - Talk

Molecular analysis of food web interactions provides new insights how to foster conservation biological control

M. Traugott

Both pests and their natural enemies are embedded in food webs where they affect each other directly and indirectly. Consequently, a better understanding of food web interactions in these communities will help to further improve conservation biological control measures. Examining the links in these webs, under field conditions, however, is challenging. The large number of species involved and the difficulty in measuring specific trophic interactions usually impedes the application of conventional methodology.

In this talk I will demonstrate that DNA-based approaches of prey and parasitoid detection offer exciting possibilities to examine complex trophic interactions in invertebrate food webs. In a first case study the trophic interactions between aphids, primary and secondary aphid parasitoids as well as generalist predators have been examined. The data indicate strong intraguild predation links between parasitoids and predators, with high rates of predation on adult parasitoids. The data also suggest that parasitized aphids are regularly taken by linyphiid spiders.

In a second case study the trophic linkages between juvenile generalist predators and both extra- and intraguild prey have been investigated during autumn and winter, a topic where only little information is available so far. Detritivorous prey was found to constitute a major dietary component for the juvenile predators, suggesting that this type of prey retains and sustains generalist predators throughout their whole life cycle in agroecosystems.

The results from both studies highlight that trophic interactions need to be considered at the food web level to further improve pest control strategies. Based on these case studies, the advantages and future challenges of the molecular approach will be discussed as well.

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Section 15 - Talk

Zur Biologie und Ökologie der Kirschfruchtfliege *Rhagoletis cerasi* (Diptera: Tephritidae) im Hinblick auf ihre Bekämpfung

H. Vogt, T. Kaffer, J. Just, A. Herz, B. Fejoz & K. Köppler

Die Bekämpfung der Kirschfruchtfliege ist durch den Wegfall breitwirksamer hocheffektiver Insektizide zunehmend schwieriger geworden. Sowohl der Einsatz neuer Insektizide mit anderen Wirkmechanismen als auch die Entwicklung alternativer Verfahren, die am JKI in Dossenheim seit mehreren Jahren erforscht werden, erfordern ein umfassendes Wissen zu Biologie und Ökologie der Kirschfruchtfliege, um die Bekämpfungsmöglichkeiten optimal auszuschöpfen. Am JKI erfolgten daher mehrjährige Untersuchungen zu Schlupfzeitraum; Flugaktivität und Vorhersage des Flugbeginns; Korrelation zwischen Reife der Weibchen und Fruchtentwicklung; Eiablagezeitraum; Auftreten der Larvenstadien; Ausbreitungsverhalten der Adulten sowie zur natürlichen Mortalität im Boden. Wichtige Erkenntnisse: 1) der Schlupf der Fliegen aus dem Boden erfolgte von Mai bis Juni innerhalb von vier Wochen mit dem Hauptschlupf (90% der Fliegen) in zwei Wochen; 2) die mit Gelbfallen ermittelte Flugaktivität erstreckte sich von Mai bis Juli über acht Wochen mit dem Hauptauftreten der Fliegen (90%) in 40 Tagen; 3) die Temperatursummen (der durchschnittlichen Tagestemperaturen in 5 cm Bodentiefe abzüglich 5°C) ab Januar bis zum Flugbeginn variierten zwischen 347 und 415°C; 4) mit Gelbfallen konnten junge Weibchen, deren Ovarien nicht oder kaum entwickelt waren, erfasst werden. 8-10 Tage nach dem Fang der „ersten“ Weibchen betrug der Anteil der Individuen mit ausgereiften Ovarien ca. 50% und stieg in den folgenden Tagen stetig auf 90-100% an; 5) die Eiablage begann frühzeitig, in harte, grün bis grüngelbe Kirschen und erfolgte, solange Kirschen zur Verfügung standen, auch in reife Früchte; 6) von über 1000 freigelassenen markierten Fliegen wechselten nur 0,7% zwischen zwei Kirschquartieren über eine Entfernung (Luftlinie) von ca. 180 m; 7) die natürliche Mortalität im Boden bis zum Schlupf der Fliegen im Folgejahr war mit durchschnittlich 90% sehr hoch. Dies wirkte sich jedoch nicht befallsmindernd aus.

Heidrun Vogt, Julius Kühn-Institut (JKI) - Bundesforschungsinstitut für Kulturpflanzen, Institut für Pflanzenschutz in Obst- und Weinbau Dossenheim, Germany heidrun.vogt@jki.bund.de

Section 15 - Talk

Strain specific inbreeding depression in Bracon parasitoids

A.C. Weeda, A. Thiel, J.G. de Boer & T.S. Hoffmeister

In haplodiploid hymenoptera males (hemizygous) develop from unfertilized eggs and females (heterozygous) from fertilized eggs. However, in species with single-locus complementary sex determination (sl-CSD) diploid males can occur if they are homozygous at the sex loci. Those males originate from matched matings, i.e. if a female mates with a male carrying a sex allele matching one of hers. Diploid males accrue a strong genetic load on a population since they are often inviable or sterile and in most cases females they mate with are constrained to produce haploid sons only. Thus, small populations with sl-CSD rapidly show effects of inbreeding depression.

We investigated the effects of inbreeding on two species of parasitic wasps, *Bracon brevicornis* and *B. hebetor*. Both species have a high risk of inbreeding through sib-matings, since females produce clusters of eggs when parasitizing insect hosts. This holds especially for mass rearing in biological control programmes. We tested for diploid male production and extinction risk comparing inbreeding and random mating conditions. Further, the possibility to choose a mating partner freely seems to affect the degree of inbreeding depression. Surprisingly, different strains show a wide variety of diploid male production rates, with survival varying from death at the egg stage to full phenotypic development.

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Section 16 - Talks

Neuropterology in the 21st century

Section 16 - Keynote

Knowing the Neuropterida: what does the 21st century hold?

J. Oswald

As for previous centuries, the work of knowing the Neuropterida in the present century will build upon the knowledge of centuries past – but some things have changed. The end of the 20th century witnessed revolutionary technological innovations in molecular biology and digital electronics that continue to reshape the landscapes of science and human interaction. As we move forward into the 21st century, it is both prudent and instructive to consider how these forces will affect the science of neuropterology, and to contemplate the new opportunities that they create. We have discovered much about lacewings, antlions and their relatives over the past 300 years. Thinking broadly, what can we concisely state that we already know about neuropterid insects with respect to such scientifically fundamental areas as neuropteran biodiversity, biology, phylogeny and biogeography? What are the gaps in our current knowledge that should be addressed through new research efforts? What should our research priorities be in these areas? How do these areas link to and support other areas of basic and applied biology? How will modern technological forces shape the learning and dissemination of old and new neuropterological knowledge in the future? How can our community take advantage of new technologies to increase the pace of acquisition and documentation of new neuropterological knowledge? How can we shape old and new knowledge into shared syntheses at regional and global scales in such a way that they help to organize the neuropterological community and help to provide structure and direction for advancing community research priorities? Join me for an examination and discussion of the landscape of 21st century neuropterology.

John Oswald, Department of Entomology, Texas A&M University, Texas, USA,
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Section 16 - Talk

The family Inocelliidae (Neuropterida: Raphidioptera): A review of present knowledge

H. Aspöck, X. Liu & U. Aspöck

In recent years our knowledge of the snake-fly family Inocelliidae has been augmented considerably. In our monograph of the order (H. Aspöck & al. 1991) altogether 20 species of the family were recorded, today we know 31 clearly characterised and differentiated species. Of these, not less than 9 species have been detected in the mainland of China and in Taiwan within the past two years (Liu & al. 2010a, b). The southern parts of Eastern Asia seem to be of particular importance as an evolutionary centre of the family.

The distribution of the family is restricted to certain arboreal parts of the Northern hemisphere, namely the western parts of North and Central America as far south as to the Mexican/ Guatemalan border, Europe, the northwest of Africa, and Asia as far south as to Northern India, Myanmar, Thailand, and Taiwan.

So far, all southernmost records are from higher altitudes (transgression zones from the Holarctic to the Neotropic and Oriental regions respectively) so that the assumption is still valid that all species of the family need a decrease of temperature (winter) for their development. As far as we know, larvae of all species live under bark of trees, adults may take up pollen, but are not predacious. Inocelliidae are rare insects in general so that the biology still remains a large open research field.

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Liu, X.Y., Aspöck, H., Yang, D. & Aspöck, U. 2010a. The *Inocellia crassicornis* species group (Raphidioptera: Inocelliidae) in mainland China, with description of two new species. *Zootaxa* 2529: 40–54.

Liu, X.Y., Aspöck, H., Yang, D. & Aspöck, U. 2010b. Species of the *Inocellia fulvostigmata* group (Raphidioptera, Inocelliidae) from China. *Dtsch. Entomol. Z.* 57: 223–232.

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Section 16 - Talk

Molecular phylogeny of the Raphidiidae (Raphidioptera) and biogeographical implications

U. Aspöck, E. Haring & H. Aspöck

Six clades emerged in the trees of the most recent molecular analysis of the Raphidiidae: (1) the Nearctic genus *Agulla*, sister to the rest, (2) the Nearctic/Central American genus *Alena*, sister to the huge monophyletic Palaeartic clade, comprising (3) the Central Asian and eastern Palaeartic genus *Mongoloraphidia*, sister to (4) the mainly Palaeartic *Puncha* clade + (5) the western Mediterranean *Ohmella* clade, and (6) the predominant Palaeartic *Phaeostigma* clade. The present-day Raphidiidae are restricted to arboreal parts of the Holarctic (including transgression zones), but do not occur in the northern and eastern parts of North America. Fossil Raphidiidae, however, are known from South America and eastern parts of North America. Extant Raphidioptera need a cool period (winter) for proper development, the rich Mesozoic snake-fly fauna is, however, also known from a tropical ambience. This fauna died out at the end of the Cretaceous probably due to the climatic consequences of the K/T impact. Apparently only those lines of the Mesozoic snake-fly fauna adapted to cold climates survived. The essential questions concerning extant Raphidiidae are: How was America colonised? Which mechanisms isolated the *Mongoloraphidia* clade, the two west Palaeartic clades and the western Mediterranean clade? Presently the most plausible hypothesis is a multiple colonisation of America from eastern Asia before the K/T impact. The lack of snake-flies in the north of North America may simply be traced back to the low expansivity of these insects. The epicontinental sea dividing North America until the end of the Cretaceous might be an argument for the lack of the family in the eastern parts of North America. The Turgaj sea (160 My - 30 My), an epicontinental sea separating the eastern Palaeartic, could have caused the isolation of *Mongoloraphidia*. The western Palaeartic has not been a permanent continent but was a mosaic of lagoons – thus inducing the isolation processes of the *Puncha*- and the *Phaeostigma* clades. The Iberian peninsula represents an old isolated land mass on which the *Ohmella* clade originated.

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Section 16 - Talk

Zur Larvaldiagnose mitteleuropäischer Neuropteren und ihre Lücken

J. Gepp

Die Neuropteren Mitteleuropas gelten taxonomisch als weitgehend abgeklärt, die Faunistik ist regional unterschiedlich bedient, aber insgesamt ebenfalls am guten Weg, Biologie und Larvenstadien indes harren einer monografischen Betrachtung.

Die Neuropterenlarven Mitteleuropas wurden bisher in keinem Determinationsschlüssel befriedigend gegliedert. Die Gründe dafür sind vielfältig. Zumindest die Hälfte der Arten ist eher selten anzutreffen bzw. kaum züchtbar. Während die Lebendfärbung der Larven mehrerer Familien gute differentialdiagnostische Anhaltspunkte liefert, sind chaetotaktische Ansätze bisher in der Praxis an den unterschiedlichen Larvenstadien, aber auch an der allgemeinen Variationsbreite gescheitert. Nachfolgend der diesbezügliche Status der einzelnen Neuropterenfamilien Mitteleuropas (mit Schwerpunkt Österreich).

Die angewandt bedeutendste Gruppe, die Chrysopiden, ist zumindest im dritten Larvenstadium lebend gut differenzierbar. Offen sind die Probleme mit dem alten „carnea-Komplex“ und mit Larven der Gattung *Nineta*. Die Hemerobiiden sind larvalmorphologisch durchwegs wenig differenziert und in ihrer Färbung mitunter über Beutetieren variabel. Die Hemerobiiden-Gattungen sind differenzierbar, bei den Arten am ehesten die Spezies des Genus *Hemerobius*. Wenig larvaldiagnostisches Wissen liegt betreffend der Gattungen *Micromus*, *Symphorobius* und vor allem *Wesmaelius* vor. Betreffend Hemerobiiden gibt es umfangreiches Freilandmaterial in Alkohol – ohne gesicherte Zuordnung auf Artniveau. Die Coniopterygiden sind (mit Ausnahme der Gattung *Parasemidalis*) auf Gattungsniveau gut differenzierbar, innerhalb der Gattungen jedoch absehbar nur mit chaetotaktischen Schlüsseln. Die Ameisenlöwen (Myrmeleontiden) Mitteleuropas sind im dritten Stadium meist bestimmbar, wobei vor allem die Kopfkapseln sowie die Stemmborsten am Hinterleibsende relevant sind. Bei den Ascalaphiden sind zwar die Larven der mitteleuropäischen Arten bekannt, ein praktikabler Bestimmungsschlüssel fehlt. Die Sisyriden-Larven sind durch neuere Arbeiten durchschaubar, die Larven von *Osmylus fulvicephalus* und *Mantispa styriaca* wurden längst detailliert beschrieben. Immerhin ermöglicht der derzeitige Kenntnisstand des Autors die Determination von mehr als 80 % der mitteleuropäischen Neuropterenpezies im dritten Larvenstadium. Publizistisch ist allerdings keine zusammenfassende Darstellung (vergleichsweise mit KILLINGTON 1936 und 1937 für Britannien) gegeben; sie wird noch mehrere Bearbeitungsjahre in Anspruch nehmen. Möglicherweise gelingt es rascher, zwischenzeitlich einen einfachen Fotoschlüssel der bekannten Neuropterenlarven Mitteleuropas herauszugeben.

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Section 16 - Talk

Response of neuropterid communities to forest structure and management

A. Gruppe, M. M. Goßner, E. Kowalski, M. Lange, M. Türke & W. W. Weisser

Neuropterida are an important taxon of aphidopagous insects in all terrestrial ecosystems. There, most species are associated with certain type of vegetation or plant taxon. In forests, characteristic communities have been described for the main timber producing tree species. Furthermore it has been shown that increased tree species diversity increase neuropterid diversity. Most of these studies, however, were conducted within one region or focused on single tree species only. Thus our knowledge on how forest management and linked forest structure affect communities of Neuropterida on a broader spatial scale is still limited.

Here we analyse effects of forest management on communities of Neuropterida in the canopy of differently managed forest plots captured with flight interception traps in the biosphere reserve Schorfheide-Chorin (Brandenburg), the Hainich-Dün region including the Hainich National Park (Thüringen) and the biosphere reserve Schwäbische Alb (Baden-Württemberg) in 2008 within the Biodiversity Exploratories project. Significant differences in Neuropterida communities were found between regions and forest types. These might be linked to differences in regional species pools and differences in forest structure, respectively.

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Section 16 - Talk

Weitere interessante Neuropteren-Funde in Südwestdeutschland

E.J. Tröger

Seit den 1960er Jahren haben zunehmende Aufsammlungen von Neuropteren in Baden-Württemberg auch einige Neufunde - wie z.B. *Hemerobius gilvus*, *Coniopteryx arcuata* oder *Dichochrysa inomata* für die deutsche Fauna erbracht. Ein weiterer Schub erfolgte, als es möglich wurde Fallenfänge auszuwerten, die D. Doczkal (z.T. mit A. Ssymank) an verschiedenen Punkten in Baden-Württemberg und Rheinland-Pfalz im Rahmen von Naturschutz- und Biodiversitäts-Projekten mit Hilfe von Malaisefallen machte, die über Monate aufgestellt sind. So konnte u.a. die alpine Art *Wesmaelius fassnidgei* am Feldberg/Schwarzwald oder die südliche *Coniopteryx drammonti* am Hochrhein festgestellt werden. Von *Co. drammonti* liegen inzwischen auch weitere Funde vor. Im Jahr 2010 konnte im Raum Trier *Coniopteryx aspoecki* (erst kürzlich aus Bayern gemeldet) gefangen werden und bei Rastatt erschien *Chrysoperla mediterranea* (als vierte Art der Gattung) neu für unsere Fauna.

Ernst Joachim Tröger, Freiburg, Deutschland (Presenting Author).

Section 16 - Talk

The significance of brown and green lacewings (Neuroptera: Hemerobiidae, Chrysopidae) as aphid predators in the special crop hop

F. Weihrauch

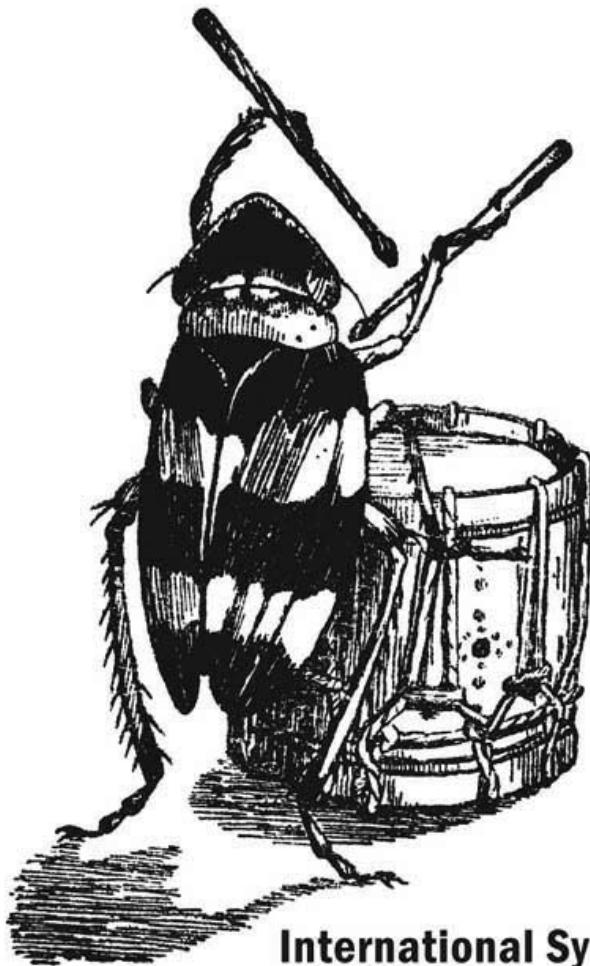
The damson-hop aphid *Phorodon humuli* is one of the two major pests of cultivated hop plants (*Humulus lupulus*). Without control measures, it is able to damage the quantity and quality of harvested cones, and in some years may completely destroy a crop. Within a wide range of beneficials that feed on *P. humuli*, like ladybirds (Coccinellidae), hoverfly larvae (Syrphidae) or flower bugs (Anthocoridae), the larvae of brown and green lacewings are considered as important aphid predators. Adults of 10 species of Hemerobiidae and 15 of Chrysopidae were hitherto collected in hop gardens of the Hallertau growing region (Bavaria, Germany). However, the role of lacewing larvae and other insects as aphid predators in hops had previously never been assessed by a factual quantitative investigation. As part of a large research project on *P. humuli*, a novel extraction method was developed for the monitoring of aphids and other arthropods from hop cones. By the use of modified Berlese funnels, arthropods were driven by light and heat from samples of green cones into small containers with a sampling liquid and then exactly counted. During the three-year project, altogether 1160 samples of 100 green hop cones, respectively, were evaluated from insecticide-treated plots and untreated control plots. In addition to aphids and other pest arthropods (thrips, hop flea-beetles, two-spotted spider mites) and many indifferent species like scavenging beetles or phorid flies, predators of six insect families were found in noteworthy quantities in the cone samples: Anthocoridae, Cecidomyiidae, Syrphidae, Chrysopidae, Hemerobiidae and Coccinellidae. The neuropteran predators were chiefly represented by larval *Chrysoperla* spp., *Hemerobius* spp. and *Wesmaelius* spp., and accounted for 5-10 % of all predators occurring per year. It is concluded that Hemerobiidae and Chrysopidae obviously constitute only a comparatively small, however essential building block in the range of natural aphid predators in hop culture.

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Entomologentagung
vom 21.-24. März 2011 in Berlin

Section 17 - Talks



International Symposium Berlin 2011
Vibrational Communication in Arthropods

Section 17 - Keynote

Acoustic Signals, and Biological species in the Auchenorrhyncha: a Historical Perspective

M. Claridge

Loud acoustic signals of cicadas (Hemiptera, Auchenorrhyncha, Cicadidae) have been known to be species specific since the classical Greek writings of Aristotle almost 2000 years ago. These often large insects use airborne calls as specific mate recognition signals. The other much more abundant and species-rich families of Auchenorrhyncha, which include leafhoppers, planthoppers, treehoppers, *etc.*, are now known (through the pioneering work of Frej Ossiannilsson in Sweden in the 1950s) to produce low intensity vibrational signals transmitted through the plants on which most live. These signals can be recorded by appropriate techniques, analysed and used in playback experiments with living insects.

Since the 18th Century writings of Linnaeus, species concepts have been controversial. Two major groups of related concepts are now widely recognised – 1. the essentially *morphological concept*, now developed broadly as various *phylogenetic concepts*, and 2. the *biological concept* emphasising natural interbreeding in the field and characterised by specific mate recognition systems that function during courtship and mating. Here I review briefly these ideas and conclude that the biological species is the most useful of them if we are to understand the nature and evolution of insect biodiversity.

I shall give a brief and personal overview of the development of our knowledge of leafhopper and planthopper acoustic signals over the past 60 years. Also I explore our current understanding of these signals as species characters and particularly their roles in species recognition and the resulting genetic isolation between biological species as a result of speciation processes.

Mike Claridge, School of Biosciences, Cardiff University, Wales, UK, claridge@cardiff.ac.uk
(Presenting Author)

Section 17 - Keynote

Mate searching and vibrational communication in treehoppers

R. B. Cocroft

The strategies used by animals to search for habitat, prey and mates are an important link between the structure of the environment and population-level patterns of dispersal and movement. Recent advances in tracking technology provide detailed information on animal search paths, which can in turn inform computational models of animal movement. However, there is usually little information available about the sensory input that guides the animals' decisions. I will discuss work in my laboratory on the searching behavior of insects that locate mates on the basis of plant-borne vibrations. Males of many vibrationally-communicating insects find mates by flying from plant to plant and producing advertisement signals. If the male detects a vibrational reply from a receptive female, it searches within the plant, periodically obtaining new directional information by exchanging signals with the female. Because searches occur over distances of a few meters or less, search paths can be analyzed in detail using video analysis. Furthermore, the environmental cues that guide behavior (e.g., the two-dimensional vibratory motion of the plant stem during female signals) can be characterized at each location where a directional decision was made. For mate-searching males of the membracid treehopper *Umberia crassicornis*, behavior changes during the search, depending on the quality of the information available: at greater distances from the female, males make less accurate decisions and travel farther between decision points. Directional accuracy is strongly correlated with the amplitude of the female signal, and on the degree of correspondence between the direction of stem motion and the dorsoventral axis of the male's body. Study of this searching process gives us a window into a range of perceptual processes, including vibration localization, female preference for male signal traits, and decision-making in the face of uncertain information.

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(Presenting Author)

Section 17 - Keynote

The importance of sound communication in insects and other animals

S. Drosopoulos

Usually, sounds emitted by males of a certain species are recognized only by females of the same species to the effect that the two sexes come into contact for reproduction. In the field this behaviour exposes the males to many enemies which can easily detect the males when singing. The phenomenon of males being more vulnerable to enemies, known as “male altruism”, is also seen in species that express colour polymorphism, where in females many more colour morphs are expressed than in males. Thus the females have a better chance to survive the long preoviposition period, often up to eight months after mating, until the occurrence of the particular foodplant needed for oviposition.

These two examples emphasize how complicated is the biology of each organism to ensure safe reproduction in an economical manner.

However, insects, the group most numerous in species in the world, provide an endless material for further studies.

In the book: *Insect sounds and communication*, edited by Mike Claridge and myself, one may find much information on various aspects of this subject published till now.

Sakis Drosopoulos, Agricultural University of Athens, Greece, drosop@aua.gr (Presenting author)

Section 17 - Keynote

Sound or vibration, an old question of insect communication

M. Gogala

About one hundred years ago one of the pioneers of bioacoustics, Johann (Ivan, Joannes) Regen, born in Slovenia and living later in Vienna, has been investigating acoustic communication in crickets and bushcrickets. Despite many convincing results he had difficult dispute with a zoophysiologicalist E. Mangold to prove his ideas about airborne sound communication in insects. Eventually, he succeeded to persuade him with a series of imaginative experiments with crickets and bushcrickets. However, his findings are by far not valid for all groups of insects. When I started to investigate acoustic communication in Heteroptera with my students and coworkers about half a century later, the question of their communication channel was not clear. After some critical experiments it became evident that they emit and receive substrate-borne vibrational signals. Similar experiments performed H. Strübing with “small cicadas” and also came to conclusion that they use substrate vibration as communication channel. Nowadays we know, that majority of Hemiptera and also many other insects use vibrational channel for acoustic communication, some other true sound or near field airborne vibrations, not to forget acoustic signalization in aquatic and semiaquatic insects.

However, there are examples that some insects use both channels for acoustic communication or orientation and one can expect to find more complex cases in some insect groups.

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(Presenting Author)

Section 17 - Keynote

Do Insect Drummers Actually Drum? Studying Vibrational Communication Across Taxa

P. Hill

Our study of vibrational communication in animals is perhaps in its earliest infancy. Observations of the use of information received from substrate-borne vibrations have been made for several hundreds of years; however, actual empirical studies of mechanisms were still rare in the second half of the 20th century. Observations led to questions and hypotheses and repeatable results and conclusions, but in the 1970s a vocabulary had to be built to describe sending and receiving mechanisms, categories of signals both as physical entities and within a behavioral framework, and even characteristics of the substrates. At the same time it became clear that almost everything that could be imagined could be confirmed. Now our knowledge base is growing exponentially, but just as with any other derivative-based model in the earliest stages of tracking, our sky-rocketing growth in hard data still resembles a line of very little slope, especially when we consider the size and scope of the phenomenon we are revealing.

I suggest that the work already in print has given us a framework to study vibrational communication across taxa, but especially in arthropods and vertebrates. Further, agreement on some commonalities and a standardization of vocabulary will benefit workers at all stages and provide for a more free exchange of ideas and sharing of technical skills.

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Section 17 - Talk

Ethological differentiation of *Hyalesthes obsoletus* (Hemiptera, Cixiidae) on field bindweed and stinging nettle

S. Grube, M. Maixner, R. Mühlethaler & H. Hoch

Since the early 1930s, the grapevine yellowing disease “Bois noir” (BN) associated to 16SrXII (stolbur) phytoplasmas, is reported from Germany. Main distribution at present are vineyards along the rivers Moselle, Rhine and Nahe. The only known vector (so far) of this disease is *Hyalesthes obsoletus* Signoret. In Germany primarily collected from field bindweed (*Convolvulus arvensis*), *H. obsoletus* was increasingly often observed feeding on stinging nettle (*Urtica dioica*) in recent years. From populations of the two main host plants two different types of stolbur were identified (type I in *U. dioica*, type II in *C. arvensis*). Morphometric and genetic studies provided evidence for a differentiation of the two *H. obsoletus* populations. Accordingly, an analysis of the insects’ intraspecific communication signals were conducted to clarify the species status of the separated populations. The signal repertoire of the two *Hyalesthes obsoletus* populations from nettle and bindweed was recorded (Magneto-Dynamic System) and analyzed. Since the study was based on field collected specimens, the song vouchers were tested for phytoplasma infection a posteriori. This provided a chance to examine the potential influence of phytoplasma infection on the signal patterns of both populations. Main results of the study are:

1. The repertoire of vibrational signals in *Hyalesthes obsoletus* is highly diverse and more complex than previously documented.
2. In the male “calling” signal, the *H. obsoletus* populations from bindweed and nettle show clear differences both in the number of pulses and the pulse length; providing further evidence for ecological differentiation of populations on different hosts.
3. Differences were also observed between infected and non-infected individuals within and between populations on bindweed and nettle.

Potential evolutionary implications of phytoplasma infection on the vector via influence on signal pattern differentiation is discussed.

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Section 17 - Talk

Vibratory drumming signals in two sympatric termite species *Macrotermes natalensis* (HAVILAND) and *Odontotermes badius* (HAVILAND)

F. Hager & W. H. Kirchner

The two sympatric termite species *Macrotermes natalensis* and *Odontotermes badius* build long foraging galleries which lead outwards from the nest to their foraging areas. When soldiers are disturbed they tend to drum with their heads against the substrate and create a pulsed vibration.

This study was conducted in the Soutpansberg near Louis Trichardt, South Africa. It aims at describing the trigger and distribution of these acoustic signals within the galleries and nests, the perception and the reaction of the nestmates, as well as the way of forwarding the signals within the galleries and nests. The signals consist of trains of pulses with a pulse repetition rate of 11Hz in *M. natalensis* and 14Hz in *O. badius*. The pulse repetition rate allows distinction between these two species. The duration of a single pulse is 6ms in *M. natalensis* and 15ms in *O. badius*. These differences in the duration of single pulses may, to some extent, be due to differences in the mechanical properties of invested plants and nest materials. The signals propagate with approx. 200m/s and are attenuated by approx. 25dB/m. Nestmates are extremely sensitive to these vibrations with a threshold amplitude of 12mm/s² in *M. natalensis*. Workers of both species respond by a fast retreat into the nests. Soldiers also start to drum with a reaction time of about 300ms and this leads to a relatively slow propagation (0.8m/s) of the signal. This social long-distance communication through chains of signal-reamplifying termites results in a propagation of the signal without decrement.

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Section 17 - Talk

The vibratory system of the legs of the mantis *Hierodula membranacea*

R. Lakes-Harlan, S. Gräbener & C. Meister

Insects possess various vibration sensitive scolopidial organs within their legs. In some orthopteran insects parts of these organs are transformed during evolution into hearing organs (Strauß & Lakes-Harlan, 2009). Here we investigate the sensory organs in all legs of the mantid *Hierodula membranacea*. The focus is on comparative neuroanatomy for phylogenetic reconstructions, but also on the question whether function-specific adaptations (foreleg versus mid-/hindleg) can be observed. Neuroanatomical labelings show that *H. membranacea* possess scolopidial organs in the proximal tibia. These organs can be differentiated into the subgenual organ (SGO), a distal organ and an accessory organ. In the foreleg 34-39 scolopidia could be labelled in the SGO. The number of labelled scolopidia in the SGO increases in the mid- and hindleg to 43-57, or 47-57, respectively. Interestingly, in Orthoptera usually the foreleg has most sensory cells. Thus, the caudally directed increase seems to be an adaptation to the specialized function of the foreleg. This specialisation seems also to be reflected in the threshold for vibratory stimuli. Extracellular recordings indicate that the mid- and hindleg responds more sensitive than the foreleg. Behavioural data show that the mid- and hindleg are often in contact with the substrate and therefore can function as vibration receiver. By contrast, the foreleg is held in the air for catching prey and therefore does not have to function as vibration receiver. Additionally, the central projection of the sensory cells has been studied. The basic peripheral and central neuroanatomy is similar to cockroaches and seems to represent a general scheme in the Dictyoptera.

Strauß, J. & Lakes-Harlan, R. 2009. The evolutionary origin of auditory receptors in Tettigoniodea: the complex tibial organ of Schizodactylidae. *Naturwissenschaften* 96: 143-146.

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Section 17 - Talk

Long range communication through substrate-borne vibrations in *Scaphoideus titanus* (Hemiptera Cicadellidae)

A. Eriksson , G. Anfora , A. Lucchi , M. Virant-Doberlet & V. Mazzoni

Although vibrational communication is widespread, especially in arthropods, the knowledge of this communication channel is still far from complete. Mating behaviour mediated by species-specific vibrations in the substrate is in the last few years one of the most frequently studied topics. The communication range of vibrational signals depends on the amplitude of the emitted signals as well as on the attenuation and degradation of the signals during the transmission in the plant. We studied vibrational communication of the Nearctic leafhopper *Scaphoideus titanus* Ball, a monophagous species living on grapevine (*Vitis* spp.). Previous studies of vibrational communication in *S. titanus* and other leafhoppers and planthoppers have been limited to one plant or on neighbouring plants that were connected by touching leaves. When partners were positioned on the same leaf, male call was followed by a courtship duet with a receptive female, performed until the male located and copulated with a responding female (Mazzoni et al. 2009). Here we investigated mating behaviour and signal transmission when males and females were positioned on different leaves of the same plant and on leaves without a contact. We also tested whether individuals without the antennae were still able to detect vibrational signals. Our principle findings were: (1) a complex behavioural sequence, consisting of different stereotyped stages, with two additional types of mating duet; (2) perceived intensity of vibrational signals determines the signalling and searching behaviour; (3) mating behaviour was observed despite discontinuity of substrate; (4) antennae are not relevant in the perception of such signals. We conclude that the communication range of vibrational signals is not limited by discontinuity of the substrate and that the behavioural response depends on the respective positions of the duetting partners.

Mazzoni, V., Prešern, J., Lucchi A. & Virant-Doberlet, M. 2009. Reproductive strategy of the Nearctic leafhopper *Scaphoideus titanus* Ball (Hemiptera: Cicadellidae). Bull. Entomol. Res. 99: 401-413.

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Section 17 - Keynote

Physical aspects of vibrational communication

A. Michelsen

The organizers of this symposium have asked me to review our present understanding of the physical aspects of vibrational communication. Almost thirty years ago we showed that vibration songs may travel as bending waves through plant stems, and we also estimated the energy costs of producing bending wave signals in plants. During the following years we carried out some studies of vibrational communication in honeybees. I then left the field and turned my attention to other matters like sound emission, the dances of honeybees, and the physics of directional hearing. This invitation is thus an opportunity for me to return to old ground and find out what has happened since my time.

I had expected that our study would inspire other investigators to question whether the carriers in plants were always bending waves. I had also expected to see many more calculations of the energy costs of vibrational communication. With a few exceptions, the research on the physics of vibrational communication has not come up to my expectations.

In the presentation, I will comment on some unsolved problems; compare the energetic costs of sound and vibrational communication in insects; and discuss which kind of waves the subgenual organs may respond to.

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Section 17 - Talk

Capabilities and advantages of non contact laser based vibration measurement and sound field visualization

R. Mühlethaler & R. Behrendt

In the last decades bioacoustic techniques became increasingly important in insect taxonomy. All leaf- and planthoppers produce substrate transmitted acoustic signals in contrast to the loud and prominent airborne songs of cicadas. Closely related species tend to differ clearly in their songs even though they show no or only weak morphological differences.

Previously we recorded the substrate vibrational signals using the gramophone pickup method developed by Claridge et al. (1985) or the magneto-dynamic system (Strübing & Rollenhagen, 1988). Freshly collected animals were put in a clear plastic box fitted with a short branch of their host plant. The gramophone pickup was attached to the plant stem and the initial signals amplified by a small battery charged preamplifier. The disadvantage of both mentioned method is that they interfere physically with the plant and therefore could affect the vibrations produced by the animals.

Laser vibrometers do not change the physical characteristics of the substrate (plant or animal) and we can measure vibrations precisely at a specified position either on the animal itself or on the host plant. Additionally sound fields produced by the insects (e.g. on a leaf) can be relatively easily visualized using a scanning laser vibrometer.

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Roland Mühlethaler, Museum für Naturkunde Berlin, Germany, roland.muehlethaler@mfn-berlin.de
(Presenting Author)



Section 17 - Talk

Complex tibial organs in non-hearing Ensifera: Comparative neuroanatomy and relations to vibrational signalling

J. Strauß & R. Lakes-Harlan

The chordotonal subgenual organ is a highly sensitive receiver of substrate vibrations, located in the leg tibiae of most insect taxa. Among Ensifera, the tibial chordotonal organs have been well investigated for species with tibial tympanal ears. Several atympanate (non-hearing) ensiferans are known to use vibrational signals in intraspecific communication (drumming of abdomen or legs on the substrate). The mechanosensory organs perceiving these signals, however, have not been investigated comprehensively in atympanate Ensifera. In a comparative study, the tibial organ of Schizodactylidae (“splay-footed crickets”), Stenopelmatidae (“Jerusalem crickets”) and Gryllacrididae (“raspy crickets”) were investigated. We were especially interested in possible anatomical adaptations related to the vibrational communication. The tibial organ in all three groups is anatomically highly elaborate, consisting of three chordotonal organs: the subgenual organ, intermediate organ, and an atympanate chordotonal organ corresponding to the auditory receptors (*crista acustica*) of tympanate tettigoniids, the so-called *crista acustica* homolog. Because of a homogenous serial organisation in all three leg pairs, these sophisticated tibial organs are most likely not former ears reduced during evolution. Sensory thresholds determined by summed recordings from the complex tibial organ to vibration stimuli cover a broad frequency range and show no specific tuning. Sophisticated atympanate complex tibial organs including the *crista acustica* homolog are present in taxa using defensive stridulation and intraspecific vibration signaling. As shown by electrophysiological recordings, this may contribute to the perception of vibration stimuli over a range of frequencies even above 1.5 kHz). Apparently, the evolution of complex tibial organs coincides with a diversity of both stridulatory behaviours and intraspecific drumming signals among Tettigonioidea.

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Section 17 - Talk

Frequency processing at different neuronal levels in a vibratory system of a cave cricket and the behavioural correlates

N. Stritih & A. Čokl

Cave crickets (Rhaphidophoridae) are non-hearing Ensifera that in the tibial chordotonal complex of the legs lack the auditory organ homologue, but possess two groups of vibration-sensitive sensilla such as are present in the hearing species. Similarly as in hearing Ensifera, vibratory receptor neurons recorded individually in the cave cricket *Troglophilus neglectus* respond best to frequencies between 200 – 2000 Hz. Thus unexpectedly, the majority of low-order vibratory neurons that we studied in the ventral nerve chord of *T. neglectus* are tuned to lower frequencies (50-200 Hz). We tested putative behavioural significance of this central frequency selectivity first with animals vibrated on a loudspeaker membrane. At high stimuli intensities cave crickets exhibited a startle response with a sharp tuning to 50 Hz, which matches response properties of a group of thoracic interneurons. We also investigated pre-mating behaviour of *T. neglectus* and recorded – first for any Rhaphidophoridae, male vibratory signals emitted during courtship and after copulation. These signals, produced by abdominal vibration and body tremulation, respectively, have most spectral energy in the range below 300 Hz and the dominant frequency around 100 Hz. The calculated intensities of courtship signals presumed to be received by the female (0.5 – 10 cm/s²) cover the response range of the most sensitive of thoracic interneurons studied. Preliminary recordings from vibratory neurons in *T. neglectus* brain indicate that, at least at near-threshold intensities, processing of low-frequency vibration (50-400 Hz) predominates also at higher neuron levels. So far the significance of information on high-frequency vibration components, mediated by the tibial organ in cave crickets, remains unexplained.

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Section 17 - Talk

Eavesdropping in vibrational communication networks

M. Virant-Doberlet, V. Mazzoni, A. Lucchi & W.O.C. Symondson

Most animal communication takes place in the presence of many conspecific and heterospecific individuals (i.e. within a communication network). Extracting information from signalling interactions in which a receiver is not directly involved has been defined as eavesdropping (McGregor 1993). Substrate-borne vibrational signalling is a widespread form of animal communication and has been generally regarded as an inherently short-range and private communication channel, free from eavesdropping by sexual competitors and generalist predators. Such a view would put vibrational communication in a unique position, since it would imply that vibrational signals, and signalling behaviour, are free from major sources of selection that applies to other communication modalities.

However, our work shows that, while the vibrational male-female duet is essential for successful localization of a female, it is also vulnerable and easily disrupted by alternative tactics. In the leafhopper *Scaphoideus titanus* (Hemiptera: Cicadellidae) intruding rival males can interrupt an existing duet between a courting male and a female by emitting disruptive signals, or by silently approaching a duetting female (Mazzoni et al. 2009a, b).

We also tested the hypothesis that predators can intercept and exploit vibrational signals used in sexual communication (Virant-Doberlet et al. 2011). First, we used molecular diagnostics to show which species of spider are significant predators of the leafhopper *Aphrodes makarovi* in the field. Playback and microcosm experiments then showed that one of these spiders, *Enoplognatha ovata* (Theridiidae), can use the vibrational signals of male leafhoppers as a cue during foraging and, as a result, killed significantly more male than female *A. makarovi*. Our results show that arthropod predators can exploit prey vibrational communication in order to obtain information about prey availability and use this information to locate and capture prey.

Mazzoni V., Prešern J., Lucchi A., & Virant-Doberlet M. 2009a. Reproductive strategy of the Nearctic leafhopper *Scaphoideus titanus* Ball (Hemiptera: Cicadellidae). *B. Entomol. Res* 99: 401-413.

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Virant-Doberlet M., King R.A., Polajnar R. & Symondson W.O.C. in press. Molecular diagnostics reveal spiders that exploit vibrational signals used in sexual communication. *Mol. Ecol.*, in press

Meta Virant-Doberlet, Department of Entomology, National Institute of Biology, Ljubljana, Slovenia, meta.virant@nib.si (Presenting Author)



Section 17 - Talk

Vibrational signalling in *Holcostethus abbreviatus*, and comparison with songs of three other stink bug species (Heteroptera: Pentatomidae)

A. Žunič, P. Pavlovčič & A. Čokl

Mating behaviour of stink bug *Holcostethus abbreviatus* (Pentatomidae) was observed and vibrational signals (songs) used in intra-specific communication were recorded as substrate-borne vibrations. Both males and females produced vibrational signals by vibrations of abdomen. Females emitted vibrational signals during calling phase, as a response to male's presence or calling. Female song triggered male searching behaviour and orientation towards the source of vibrations. Males emitted four types of songs, each associated with a different behavioural context: calling, courtship, rivalry and copulatory phase of mating behaviour. Songs of *H. abbreviatus* were compared with those of three other pentatomide species (*H. strictus*, *Nezara viridula*, and *Acrosternum hilare*). When recorded on a non-resonant substrate, the mean dominant frequency of male and female *H. abbreviatus* vibrational signals varied between 90 and 200 Hz, which is characteristic of the family Pentatomidae. In contrast, and also typical of Pentatomidae, greater differences between species were observed in temporal characteristics of songs, and in the song repertoire of males.

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Pavlovčič, P. & Čokl, A. 2001. Songs of *Holcostethus strictus* (Fabricius): a different repertoire among landbugs (Heteroptera: Pentatomidae). *Behav. Processes*. 53: 65–73

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Section 18 - Talks

Amber workshop

Section 18 - Keynote

Biodiversity of fossils in amber from the major world deposits

D. Penney

These are exciting times for amber palaeobiologists. The application of new technological approaches to the study of amber is revolutionizing how we can image and study these fossils, including digital dissection and three-dimensional modelling of inclusions in totally opaque ambers. Phenomena such as 'Verlumung', common in Baltic amber, no longer hinder the study of inclusions. New freely available photomicroscopy software now permits the production of sharp, high resolution, in-focus images without the need for access to highly specialized equipment. The new discoveries in recent years of fossiliferous Cretaceous amber deposits (including the first major deposits for Africa) have extended the known ranges of many extant groups back to the Mesozoic. Newly discovered Tertiary deposits, including the first major deposits for Australia and India will surely help us understand major historical biogeographical processes.

Work on the more familiar deposits continues apace, with interesting new discoveries and ever increasing palaeontological data sets, thus permitting the possibility of addressing large scale palaeobiological problems on a broad scale. In addition to the aforementioned, this talk explores and compares the biodiversity of fossils in different ambers, based on up-to-date summaries of the major world deposits presented in the new synthesis volume edited by the current author. Unusual elements of the various assemblages will be highlighted and discussed.

Arthropod inclusions in sub-fossilized copals are often ignored by palaeontologists on the grounds that they are not old enough to be of any significance. However, such sub-fossils have the potential to be highly informative at many different levels and some examples will be presented. Finally, it is now generally accepted that previous claims for extraction of DNA from amber inclusions were based on poor methodologies and that all such DNA reported to date was the result of Recent contaminants. The potential for extraction of DNA from inclusions in fossil resins will be revisited.

Penney, D. (ed.) 2010. *Biodiversity of Fossils in Amber from the Major World Deposits*. Siri Scientific Press, Manchester, 304 pp.

David Penney, Faculty of Life Sciences (Preziosi Lab), Michael Smith Bld, University of Manchester, M13 9PT, UK, david.penney@manchester.ac.uk (Presenting Author)

Section 18 - Talk

Acalyptrate Dipteren im Baltischen Bernstein – eine aktuelle Übersicht.

C. Hoffeins & M. von Tschirnhaus

Es werden die Ergebnisse der Identifizierung von mehr als 1.200 acalyptrater Dipteren im Baltischen Bernstein vorgestellt. 35 Familien gelten bislang als sicher nachgewiesen, deren Vielfalt wird an ausgewählten Beispielen erläutert.

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Section 18 - Talk

Systematische Beschreibung einer fossilen Bremse (Diptera:Tabanidae) aus dem mexikanischen Bernstein

Systematic Description and Ecological Remarks of a Fossil Horsefly (Diptera: Tabanidae) in Miocene Mexican amber

J. Strelow & M. M. Solórzano Kraemer

Mexican amber is mined in the vicinity of Simojovel de Allende in the state of Chiapas, Mexico. It is dated to be of Middle Miocene age (20 Ma), and can therefore be correlated with the Dominican amber deposits (Solórzano Kraemer, 2007). Because southern Mexico is considered to be a megadiversity region today the study of recent and fossil insect taxa is of great scientific interest for ecological and paleobiogeographical studies.

The Tabanidae are a very large and widely distributed family. On the contrary the fossil record of the family contains only 17 species. In the present study a specimen of Tabanidae from Miocene Mexican amber has been studied and described. It was identified to the lowest taxonomic level, the subfamily Tabaninae, the tribe Diachlorini and the genus *Stenotabanus*, which is restricted to the Neotropical region today. The specimen was compared to recent species of the genus known from Mexico and to two already described fossil tabanids from Dominican amber (*Stenotabanus brodzinskyi* Lane, Poinar & Fairchild 1988 and *Stenotabanus woodruffi* Lane & Fairchild 1989).

The comparison of the past tabanid faunae of the Caribbean Islands and of Central America is of special interest for former biogeographic relationships between Mexico and Hispaniola. Furthermore, a comparison of living species with the fossil from Mexican amber allows conclusions on the ecosystem of the extinct amber forest since the living species of tabanids are restricted to certain ecological conditions.

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Jonina Strelow, Steinmann-Institut für Geologie, Mineralogie und Paläontologie, Rheinische Friedrich-Wilhelms-Universität Bonn, Germany, jstrelow@uni-bonn.de (Presenting Author)

Section 18 - Talk

Die fossile und rezente Psychodiden Fauna Südmexikos

**The fossil and recent fauna of Psychodidae (Diptera) from Southern Mexico:
First results**

F. Stebner & M.M. Solórzano Kraemer

Psychodidae are small Nematocerans with a thickly haired body giving them the appearance of tiny moths. This today widely distributed family can be found in various aquatic and terrestrial habitats and is well known from the fossil record, principally of the Baltic, Dominican and Mexican ambers.

The present study comprises the systematic, palaeobiological and taphonomical analysis of 40 fossil Psychodidae from Miocene Mexican amber and more than 800 recent Psychodidae. The investigated specimens belong to recent genera within the subfamilies Psychodinae, Trichomyiinae and Phlebotominae. Because living genera of Psychodidae depend on certain ecological conditions the study of fossil specimens allows conclusions on the former environment, and thus contributes to the reconstruction of the Mexican amber forest. Larvae of recent representatives of the genus *Philosepedon* for example exclusively occur in shells of dead snails.

The recent Psychodidae have been collected in southern Mexico in framework of a current project. The collecting area is a mangrove region with a floral composition, climatic conditions and a geographic location quite similar to the Mexican amber forest. The comparison of these two faunal compositions can help to clarify taphonomical and fossilization processes.

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(Presenting Author)

Section 18 - Talk

Die Unterfamilie Bruchomyiinae (Diptera, Psychodidae)

R. Wagner

Die Unterfamilie Bruchomyiinae (Psychodidae) umfasst mindestens drei rezenten Gattungen: *Bruchomyia* (neotropisch), *Eutonnoiria* (afrotropisch) und *Nemapalpus* (hauptsächlich südhemisphärisch). Nur *Nemapalpus* ist aus baltischem (3-4 Arten) und karibischem Bernstein (1 Art) belegt. Eine noch unbeschriebene Art, *Nemapalpus velteni* n.sp., stammt aus burmesischem Bernstein. Die Art des karibischen Bernsteins ist nahe verwandt mit rezenten Arten der nördlichen Neotropis. Die Vertreter des baltischen Bernsteins bilden eine eigene Gruppe ohne deutliche Verwandtschaft mit rezenten Arten. *Nemapalpus* scheint stammesgeschichtlich am ältesten und hat sich offensichtlich in einen nördlichen und einen südlichen ‚Zweig‘ geteilt. Rezent sind mindestens drei Artengruppen, die Gattungsstatus erhalten sollten, zu unterscheiden: eine afrotropische (?), und mindestens zwei neotropische ‚Gruppen‘, eine davon mit Verbindung nach Neuseeland. Australien wurde wahrscheinlich erst in ‚neuerer Zeit‘ vom asiatischen Raum her besiedelt.

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Section 18 - Talk

Chironomiden des Baltischen Bernsteins im Vergleich zu Chironomiden aus anderen Bernsteinvorkommen der Welt

F. Seredszus & W. Wichard

Baltischer Bernstein ist für seinen Reichtum an Wasserinsekten bekannt. Die charakteristische Zusammensetzung der Chironomidenfauna des Baltischen Bernsteins wird vorgestellt und mit den bisher untersuchten Chironomiden anderer Bernsteinvorkommen verglichen. Der Vortrag gibt einen Überblick über den Bearbeitungsstand dieser fossilen Dipteren-Familie und stellt neue Vertreter aus Baltischem und Dominikanischem Bernstein vor.

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(Presenting Author)

Section 18 - Talk

**Eine winzige neue Kamelhalsfliege aus dem Libanonbernstein und
Bemerkungen zum phylogenetischen System der Raphidiopteren**

**A new tiny snakefly from Lebanon amber and a revised phylogenetic system of
Raphidioptera**

G. Bechly

A new genus and species of snakeflies is reported from the Lower Cretaceous amber of Lebanon. It is the smallest Raphidioptera known and quite similar to a few other fossil snakeflies from Cretaceous amber and other Cretaceous localities. For these four genera a new fossil subfamily is suggested within Mesoraphidiidae. The phylogeny and fossil record of Raphidioptera is discussed and the suborders Priscaenigmatomorpha and Raphidiomorpha are supported. A revised definition and composition of Mesoraphidiidae (incl. *Cretinocellia*) is suggested. The synonymy of Alloraphidiidae with Mesoraphidiidae is rejected and Alloraphidiidae is restored as separate family group taxon that probably represents the sistergroup of Mesoraphidiidae. The fossil genera *Caloraphidia*, *Styporaphidia*, and *Ororaphidia* are transferred to a new family that is closely related to Alloraphidiidae + Mesoraphidiidae. The genus *Metaraphidia* is excluded from Mesoraphidiidae and attributed to a new monotypic family, which is considered as sister group of crown group Raphidioptera (Raphidiidae + Inocelliidae). *Araripephlebia rochai* is transferred to Baissopteridae. New apomorphies are suggested for most monophyletic family group taxa of fossil and extant Raphidioptera.

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Section 18 - Talk

**Die Plecoptera-Familien Nemouridae und Leuctridae des Baltischen Bernsteins
und ihre paläo-biogeographischen Verbreitungen**

**The Plecoptera-families Nemouridae and Leuctridae of Baltic amber and their
paleo-biogeographical distributions**

C. Caruso & W. Wichard

Among the plecopterean superfamily Nemouridea, the nemouride genera *Ledina*, *Nemoura*, and *Podmosta* and the leuctride genera *Leuctra*, *Megaleuctra*, and *Zealeuctra* were found in Eocene Baltic amber. A further new genus *Rhopalopsole* (Leuctridae) is now detected in Baltic amber. *Leuctra* and *Nemoura* are holarctic distributed, whereas the extant species of *Megaleuctra*, *Zealeuctra*, and *Lednia* are endemic spread in the Nearctic. *Podmosta* and *Rhopalopsole* are today known to occur in Asia.

We discuss how the paleo-biogeographic spread of these stonefly genera could have taken place.

Caruso, C. & Wichard, W. 2010. Overview and descriptions of fossil stoneflies (Plecoptera) in Baltic amber. *Entomologie heute* 22: 85-97.

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(Presenting Author)

Section 18 - Talk

Über die systematische Stellung von *Baltimartyria* Skalski, 1995 (Lepidoptera, Micropterigidae)

W. Mey

Die Schmetterlinge (Lepidoptera) gehören mit zu den am wenigsten bekannten Insektengruppen des Baltischen Bernsteins. Aus der Familie Micropterigidae, der phylogenetisch ältesten Gruppe der Ordnung, ist bisher nur eine Art bekannt geworden. Sie wurde als *Micropterix proavitella* Rebel, 1938 beschrieben. Die spätere Revision des Holotypus hat ergeben, daß die Art nicht zu *Micropterix* gehört sondern eine eigene Gattung repräsentiert, die als *Baltimartyria* Skalski, 1995 aufgestellt wurde. Die Gattung ist nicht mit der paläarktisch verbreiteten Gattung *Micropterix* Hübner, 1825 enger verwandt, sondern steht Arten der südlichen Hemisphäre nahe. Anhand morphologischer Merkmale werden die verwandtschaftlichen Beziehungen zu diesen Arten bzw. Gattungen erschlossen und diskutiert. Eine zweite Art von *Baltimartyria* wird vorgestellt und beschrieben.

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Section 18 - Talk

Computed tomography recovers data from historical amber: an example from huntsman spiders

J.A. Dunlop, D. Penney, N. Dalüge, P. Jäger, A. McNeil, R. Bradley & P.J. Withers

Computed tomographic (CT) methods were applied to a problematic *fossil* spider (Arachnida: Araneae) from the historical Berendt collection of Eocene (ca. 45 Ma) Baltic amber. Original specimens of *Ocyptete crassipes* Koch & Berendt, 1854 are in dark, oxidised amber and the original description lacks key taxonomic details. Despite this, it was subsequently assigned to the living, cosmopolitan genus *Heteropoda* Latreille, 1804, and is ostensibly the oldest record of huntsman spiders (Sparassidae) in general. Given their large size, and presumptive ability to free themselves more easily from resin, it would be surprising to find a sparassid in amber and traditional (optical) methods of study would likely have left *O. crassipes* as an equivocal record; probably a *nomen dubium*. By contrast CT yielded exquisite morphological detail and thus 'saved' this historical record by revealing characters – particularly of the distal end of the legs and the mouthparts – which confirm that it is a *bone fide* member both of Sparassidae and the subfamily Eusparassinae. Characters such as cheliceral dentition, trilobate membrane, spination and eye arrangement allowed a precise referral to the extant genus *Eusparassus*, and *Eusparassus crassipes* (Koch & Berendt, 1854) *comb. nov.* is thus proposed.

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Section 18 - Talk

Zum Bearbeitungsstand der Inkluden des Bitterfelder Bernsteins

I. Rappsilber

In den vergangenen Jahren fand eine umfassende Literatursammlung zum Bitterfelder Bernstein statt (RAPPSILBER & KRUMBIEGEL 2009). Von 1982 bis 2010 beschäftigten sich mehr als 150 Arbeiten mit den Inkluden des Bitterfelder Bernsteins. Ausgehend von den beiden „Standardwerken“ (BARTHEL & HETZER 1982, SCHUMANN & WENDT 1989) kamen seit 1990 viele Detailuntersuchungen hinzu. In manchen Ordnungen wurden inzwischen einzelne Familien mit vielen verschiedenen Arten belegt. Teilweise reicht an anderer Stelle die Bearbeitung lediglich bis in das Niveau von Ordnung oder gar Klasse.

Die gesamte verfügbare Literatur zu den Inkluden des Bitterfelder Bernsteins wurde durchgearbeitet und die jeweils erwähnten Taxa in Tabellenform zusammengestellt. Diese Zusammenstellung zeigt eine beachtliche Vielfalt von rund 580 Arten aus mehr als 250 Familien aus Tier- und Pflanzenwelt, aber von Pilzen und Bakterien. Sie belegt auch das Nebeneinander von Lebewesen, deren Nachfahren heute in den verschiedenen Klimazonen der Erde – von arktisch bis tropisch – leben. Das wird als Hinweis gesehen, dass der Bitterfelder Bernsteinwald eine größere räumliche Erstreckung hatte und über einen längeren Zeitraum existierte.

BARTHEL, M. & HETZER, H. (1982): Bernstein-Inkluden aus dem Miozän des Bitterfelder Raumes.– Z. angew. Geol., **28** (7): 314–336; Berlin.

RAPPSILBER, I. & KRUMBIEGEL, G. (2009): Bibliographie zum Bitterfelder Bernstein.– *Mauritiana*, **20** (3): 485–497; Altenburg.

SCHUMANN, H. & WENDT, H. (1989a): Zur Kenntnis der tierischen Inkluden des Sächsischen Bernsteins.– Dtsch. Ent. Z., N. F. **36** (1-3): 33–44 ; Berlin.

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Section 18 - Talk

Die Bernsteinsammlung des Museums für Naturkunde Berlin

Ch. Neumann

Das Museum für Naturkunde besitzt eine große Bernsteinsammlung mit einem Umfang von ca. 60 000 Einzelstücken. Älteste Bestände stammen aus der Zeit der Gründung des Museums vor 200 Jahren. In der Sammlung überwiegt Baltischer Bernstein mit den bedeutenden Sammlungen von Berendt, Simon und Künow, um nur einige zu nennen. Besonders die Sammlung des Danziger Arztes Carl Georg Berendt (1790-1850) ist von hoher wissenschaftlicher Bedeutung, da in ihr alle Typen und Originale zur großen Berendt'schen Bernstein-Monographie erhalten sind. Darüber hinaus besitzt das Museum eine umfangreiche Sammlung Sächsischen Bernsteins aus der Grube Goitzsche/Bitterfeld, die in den sechziger und siebziger Jahren des vorigen Jahrhunderts über den „VEB Ostseeschmuck“ (Ribnitz-Damgarten) an das Museum gelangte.

Seit 2010 ist die Bernsteinsammlung in neuen Schränken untergebracht, neu geordnet und elektronisch erfasst worden. Es wird ein kurzer Abriss über ihre Geschichte und ihren Umfang gegeben. Am Folgetag besteht die Möglichkeit, die Sammlung zu besichtigen.

Christian Neumann, Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung an der Humboldt-Universität zu Berlin, Deutschland, christian.neumann@mfn-berlin.de

Section 19 - Talks

Free Topics

Section 19 - Talk

Wheat midges and thrips information system: Decision making in central Germany

N. Gaafar, N. El-Wakeil, M. El-Wakeil & C. Volkmar

An expert system is a computer program, which mimics behaviour of an expert in a particular area of knowledge. Expert systems have been developed and applied in many agricultural fields i.e. diagnose insects and diseases of various crops. Farmers across the world face problems like increasing cost of chemical pesticides, weather damage recovery, the need to spray, mixing and application, yield losses and pest resistance. The present work describes the development of an expert system designed to provide information to farmers and extension specialists as well as information for research purposes. Wheat Midges and Thrips Expert System (WMTES) is constructive computer software, giving the users a recommendation based on pheromone and water traps catches as well as infestation levels. These results were collected from our field experiments which conducted in three locations in central Germany (Halle, Silstedt and Salzmünde) during three years 2007- 2009. The observations of variability in trap catch, and how it related to subsequent infestations, were very relevant when deciding how best to use the traps for wheat midge risk assessment and were used to develop a decision support model. Computer programs can help in information recovery and decision support when dealing with pest problems. These decision support tools can provide farmers with easy, rapid access to accurate information that can help them to obtain the threshold to make adequate management decisions. Plans for future field testing and expert system implementation are also discussed. Using such as expert system for controlling wheat ear insects can be successfully applied to the solution of daily problems in plant protection programs for wheat producers. Finally, the obtained results would give a good guide for decision making which proved an efficient method of integrated plant protection for wheat ear insects as well as other insects in another crop.

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Section 19 - Talk

Life Tables: a basis for pest management, biological control, and bio-conservation, with a discussion of problems associated with using traditional female age-specific life tables

H. Chi & Y. B. Huang

Life table data provide the most comprehensive description of the survival, stage differentiation, and reproduction of a population. They can be used to project population growth, consumption of resources, and, in the case of economically important insects, damage to crops. Most life table studies have, unfortunately, been based solely on female age-specific life tables, which ignore the male population and variable developmental rates that occur among individuals. The age-stage, two-sex life table takes both sexes into consideration, and produces a much more accurate description of the predator-prey relationship. Both the mean female fecundity (F) and the net reproductive rate (R_0) are calculated based on the daily fecundity of females. The relationship of these two values can be mathematically proven. When female age-specific life tables have been used, either no relationship or erroneous relationships between R_0 and F have been reported. In the age-stage, two-sex life table, the preadult mortality can also be included. When using age-specific life tables, some researchers use “adult age”. This will inevitably result in errors in l_x and m_x , as well as erroneous population parameters. To accurately represent the survival curve, Weibull distribution and others should not be used to fit the curve. To correctly calculate the intrinsic rate, the Lotka-Euler formula: with age indexed from 1 or with age indexed from zero should be used. Relationships among GRR, R_0 , and preadult survival rate (l_a) can be used to detect errors in data analysis in the age-specific life table. Additional problems with the female age-specific life table will also be discussed. We demonstrate that the age-stage, two-sex life table produces a correct, complete, and comprehensive description on the stage-structured demography.

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(Presenting Author)

Section 19 - Talk

It's all about the caddisflies: Insights into the life and work of Georg Ulmer, an exceptional 20th century taxonomist

M. Kubiak & R. S. Peters

The collection G. Ulmer (1877–1963) at the Zoologisches Museum Hamburg (ZMH) is the most important collection of Trichoptera (caddisflies) in Germany and one of the most important ones in the world. It includes more than 500 type series and almost 40.000 specimens from 1.700 species, all collected and described in the first half of the 20th century. The collection Ulmer contains material from all over the world, but most of the species originate from Europe and Asia.

We report on the life and work of G. Ulmer, his outstanding contribution to trichopterology and the still valuable quality of his taxonomic publications, which is quite exceptional in comparison to most entomological taxonomy of the 19th and beginning 20th century.

Further, we report on curatorial status of the collection and provide some preliminary results of our revision of the Ulmer material including new and redescriptions, and stress the benefit of historical material for present biogeographic and biodiversity problems. Finally, we give an outlook on character complexes feasible for taxonomic and higher level systematic studies of Trichoptera.

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Section 19 - Talk

Formulation materials, methods and processes for agrobiologicals

A. Patel

A suitable formulation, especially capsule systems, can offer the following advantages for agrobiologicals:

- Easy handling
- Protection from extreme environmental conditions
- Enhanced shelf life
- Controlled release
- Enhanced efficacy

However, there is still little systematic research on formulation materials and methods.

Here we will present capsule materials such as alginates, guar gums, pectinates, chitosans, gelatins, cellulose derivatives, novel silica-alginate composites and waxes. Besides, capsule types such as beads, hollow beads and coated capsule systems which were successfully developed for the formulation of agrobiologicals and agrochemicals such as entomopathogenic nematodes and fungi, somatic plant embryos, antagonistic rhizobacteria, organic fertilizer, plant extracts, attractants for soil-borne insects pests, mycorrhiza, nematophagous fungi (Fig. 1A and B) will be shown.

Another technology is biological seed treatment by filmcoating on seeds. Here, we present a technical filmcoating process in a rotating drum where drying-sensitive pseudomonads are coated on commercial sugar beet pills with a survival of 40 %. A third formulation option is the development of spray formulations which are tested in comparison to capsule and seed treatment approaches.

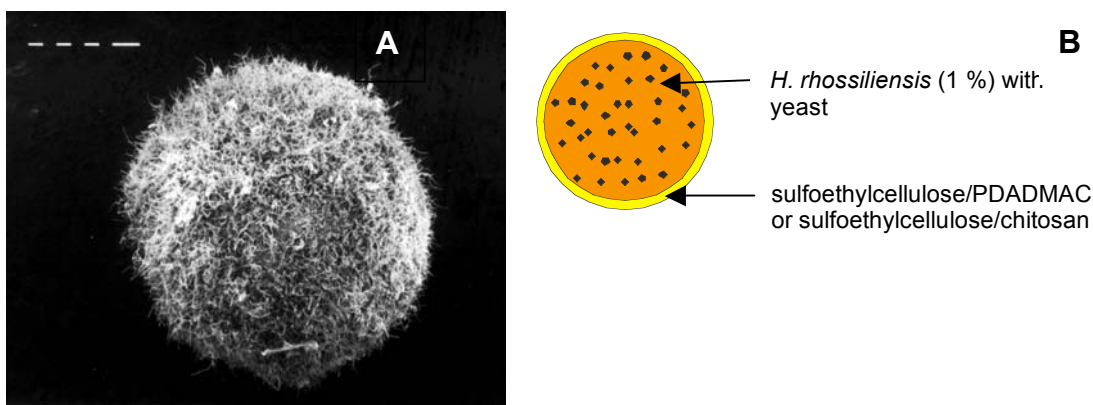


Fig. 1: "Microfermenter": nutrient reservoir in hollow beads to establish the nematophagous fungus *Hirsutella rhossiliensis* in soil; A: scanning electron microscopy (SEM) picture (50x magnification); B: Schematic diagram. (Patel et al (2011). Appl. Microbiol. Biotechnol. In press)

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Section 19 - Talk

Die optimale Körpergröße der Roten Mauerbiene *Osmia bicornis* (Syn: *O. rufa*)

K. Seidelmann

Weibchen von Solitärbiene können sowohl die Größe (über die Proviantmenge) als auch das Geschlecht (haplo-diploides System der Geschlechtsdetermination) ihrer Nachkommen bestimmen. Der Rahmen, in dem die Weibchen ihre Strategie für die mütterliche Investition optimieren können, wird durch das "Fisher-Axiom" der gleichmäßigen Investition in Söhne und Töchter vorgegeben. Durch diese Randbedingung wird das Geschlechterverhältnis in der Population auf Grundlage der Größe der Nachkommen determiniert. Die Körpergröße der Nachkommen ist dabei das wesentliche Fitness-Kriterium, da sie bei den Töchtern über die Leistungsfähigkeit bei der Verproviantierung entscheidet, bei den Männchen über den zu erwartenden Paarungserfolg.

Die optimale Körpergröße ist in beiden Geschlechtern von unterschiedlichen Faktoren abhängig. Für die Verproviantierungsleistung der *O.-bicornis*-Weibchen sind vor allem die Kapazität der Scopa zur Aufnahme des Pollens und die Leistungsfähigkeit des Flugapparates zu dessen Transport entscheidend. Während die Scopa allometrisch mit der Körpergröße wächst, sinkt der zum Transport zusätzlicher Lasten nutzbare Auftrieb (Excess Power Index). Diese gegenläufigen Effekte bedingen eine optimale Körpergröße für den Pollentransport. Bei den Männchen hängt die Fitness allein von Ihrem Paarungserfolg ab. Der Einfluss der Körpergröße wird hier durch das Paarungssystem bestimmt. Durch die opportunistische Polygynie gibt es keinen unmittelbaren Vorteil für große *O.-bicornis*-Männchen. Ein Einfluss der Körpergröße auf die Kopulationshäufigkeit konnte nicht nachgewiesen werden. Die optimale Körpergröße der Männchen ergibt sich somit als Balance aus ihrer Anzahl (Fisher-Axiom) und dem Größenvorteil bei seltenen direkten Rangeleien um rezeptive Weibchen.

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Section 19 - Talk

Indicator Species and the management of temperate forests

W.W. Weisser, M. Gossner, C. Fonseca

Assessing the effects of particular management or conservation measures on biodiversity requires suitable methodology in assessing organismic diversity. With respect to arthropods, an ideal biodiversity assessment would involve all species, which is an unrealistic aim. Several methods of identifying 'indicators' for total biodiversity have been proposed but it is still unclear how useful these approaches are. We used the recently developed methodology by Dufrene & Legendre (1997) for the calculation of indicator species to study the effect of land use on biodiversity in 150 temperate forest sites in three regions of Germany with different degrees of managements. Our main focus habitat were beech forests including unmanaged and differently managed beech forests but we also considered conifer age-class forests and mixed forest. We asked the following questions: (1) Can indicator species be derived for unmanaged beech forests and other forest management types? (2) What are the differences between trapping methods and taxon with respect to the incidence of indicator species? (3) Are all indicator species region-specific or are there indicators species that can be used in all of Germany? and (4) what are the traits of the indicator species? Our analysis shows that there is an surprising number of species that could act as indicator species for particular forest types, and that correlate well with overall biodiversity. These species are not rare but abundant enough to be monitored with standard methodology. We argue that the search for indicator species should be data-driven rather than based on a-priori judgements, and should include abundant and inconspicuous not just rare and eye-catching species.

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Section 20 -Talks

AK Xylobionte Insekten

Section 20 -Talk

Totholz im Wirtschaftswald als Lebensraum für Insekten

R. Zange

Totholz wird insbesondere im Biotop- und Artenschutz als Sammelbegriff für abgestorbene Bäume oder deren Teile verwendet. Grob unterteilt wird dabei zwischen stehenden Totholz und Trockenholz, also noch nicht umgefallenen abgestorbenen Bäumen oder deren Teilen und liegenden Totholz oder Moderholz, das bereits auf dem Erdboden liegt. Totholz entsteht durch den ständigen Alterstod der Bäume, Waldbrand, Windwurf Blitzschlag, usw. Totholz wird durch eine Vielzahl von Organismen genutzt, Insekten, Pilze, Moose, Flechten, Farne.

Es konnten im Gerolfinger Eichenwald insgesamt 328 Käferarten aus 47 verschiedenen Familien festgestellt werden, die in Totholz oder abgestorbenen Ästen vorkommen. Dieser Lebensraum ist für die Entwicklung der Käfer wichtig, da sie zwingend an das Vorhandensein von Totholz gebunden sind. Viele Tiere und Pflanzen, die auf Totholz angewiesen sind, stehen auf der Roten Liste der vom Aussterben bedrohten Arten in Bayern und Deutschland.

Vorwiegend Laubhölzer bevorzugt etwa der Hirschkäfer. Seine Larven leben an morschen Wurzeln alter Eichen, Ulmen, Kastanien. Größere Tiere bietet Totholz zum einen die Möglichkeit, ihre Bauten und Nester anzulegen, zum anderen sind sie Nahrung von Vögeln und anderen Wirbeltieren. Von den Insektenlarven ernähren sich Spechte und andere Heimischen Vögel. Amphibien Reptilien suchen liegendes Totholz als Tagesversteck oder zur Überwinterung auf. An diesen Beispielen kann man erkennen wie wichtig Totholz für die Naturbelassenen Wälder ist.

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Entomologentagung
vom 21.-24. März 2011 in Berlin

Posters

Posters

sorted by section

Section 01 Poster A-01

Impact of short term high temperature periods on the development, survival and reproduction of wheat aphid *Sitobion avenae* (Fabricius) (Hemiptera: Aphididae)

R. Al-Moalem & H-M. Poehling

Experiments were performed in the frame of the cooperative research project KLIF (Climate impact and adaptation research in Lower Saxony). *Sitobion avenae* is one of the three most important cereal aphid species in Germany and central European countries. High temperatures are known to play a detrimental role in the reproduction and survival of aphids. Experiments were conducted to assess the effects of future expected short term high temperature periods. Different developmental stages of *Sitobion avenae* normally (control) kept at 20 °C were exposed to 25, 30, and 35 °C with exposure pattern of 8 h /day for 1, 2, 4, and 6 days. Developmental time, survival and reproduction were determined. Increasing the temperature to 25 °C resulted in a slight decrease in development time, whereas the development time slightly slowed down when the temperature increased to 30 and 35 °C; however, the increase in development time was influenced by the duration of exposure and by development stage. High temperature periods of 30 and 35 °C resulted in drop in survival and fecundity of aphids. The lessened survival and fecundity was inversely related to exposure pattern.

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Section 01 - Poster A-02

Shift of trait - environment relationships of carabid beetles (Coleoptera: Carabidae) after an extreme flood event

V. Agostinelli, M. Gerisch & F. Dziock

One of the major facets of climate change is the intensification in the frequency and intensity of extreme environmental events. The rare studies on extreme events and their consequences demonstrate that such events can significantly affect ecosystems, driving them beyond stability and resilience because of their capacity to disrupt the species–environment relationships. In August 2002, the river Elbe was affected by the highest flood ever recorded: one of central Europe’s biggest natural disasters in living memory.

This study intends to analyse the impact of the extreme flood of the river Elbe in the summer of 2002 on floodplain ground beetle communities using their general biological traits. We intend to analyze the relationships between life-history traits of ground beetles and their environment before and after the extreme flood in order to assess any shift of these relationships within their habitat template.

In order to investigate environment-multiple traits relationships we use the RLQ analysis and fourth-corner permutation tests. Respectively, they allow us to directly relate multiple biological traits to a set of environmental variables (hydrological variables and vegetation structure) through the link of a community data table and to measure and test directly these relationships.

The Elbe flood and the long-term dataset with pre- and post-flood data we are analyzing in this study represent without doubt a very rare opportunity to study biodiversity changes after an extreme flood event.

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Section 01 - Poster A-03

**The taste of plants –
How grasshoppers cope with plant water stress**

A. Franzke, K. Reinhold

Extreme weather events like drought and heavy rain will increase with climate change and are likely to affect nutrient content in plants and may therefore influence the performance and population dynamics of herbivorous insects. It has been shown experimentally that grasshoppers can affect plant populations and community dynamics by e.g. suppressing abundant, highly competitive grass species and thus facilitating the evenness in grasslands. Therefore grasshoppers are important to study in the light of climate change and its possible effects to grassland communities and outbreaks. We conducted a common-garden manipulation experiment on food plants to investigate effects on fitness components to drought and moisture stress events in the generalist insect herbivore *Chorthippus biguttulus* (Orthoptera, Acrididae). Individuals of *C. biguttulus* that fed on drought stressed plants developed faster, were bigger, laid more egg cases that contained more eggs and had higher hatching success than grasshoppers that fed on control plants. The opposite was true for individuals feeding on plants grown under moisture stress conditions. We propose that herbivore performance is influenced by the occurrence of proteins and different amino acids in plants which were found in high amounts under drought stress conditions. We conclude that the water regime of food plants is an important parameter for fitness in grasshoppers. We suggest that these effects are due to an increased protein and amino acid content of drought stressed plants though we cannot exclude that grasshoppers benefitted from a decrease of plant investment into defense. The observed effects of water stress on the grasshoppers via plant-grasshopper interactions might have significant long-term impacts on herbivore pressure, community dynamics and ecosystem stability.

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Section 01 - Poster A-04

Energieholzanbau auf Rekultivierungsstandorten des Niederlausitzer Braunkohlereviere: Effekte unterschiedlicher Nutzungsformen auf die epigäische Webspinnenzönose (Arachnida: Araneae)

N. Bräsicke, C. Böhm & M. Elmer

Die Land- und Forstwirtschaft verfügt mit der Produktion von Energiepflanzen über vielfältige Möglichkeiten, den Ausstoß klimarelevanter Treibhausgase zu kompensieren. Gleichzeitig gewinnt die Produktion holziger Biomasse zur Sicherung der Energieversorgung zunehmend an Bedeutung. Dabei bietet der Anbau schnellwachsender Baumarten auf Kurzumtriebsplantagen eine gute Ergänzung zu den Energieholzsortimenten aus der Forstwirtschaft. In diesem Zusammenhang besitzen landwirtschaftliche Rekultivierungsflächen der Bergbaufolgelandschaften ein hohes Potential für den Anbau von Energieholz.

Im Rahmen des Forschungsprojektes „AgroForstEnergie“ wurden auf Kippenstandorten des Tagebaus Welzow-Süd bei Cottbus die Auswirkungen verschiedener Landnutzungskonzepte (Kurzumtriebsplantage, Agroforst: Alley-Cropping-System) auf die Struktur der epigäischen Spinnenzönose untersucht. Die Datenerfassung erfolgte auf im Frühjahr 2007 angelegten Versuchsfeldern. Sowohl die Kurzumtriebsplantage (ca. 10 ha) als auch die Gehölzstreifen des Alley-Cropping-Systems (ca. 8 ha) wurden mit Robinie (*Robinia pseudoacacia* L.) begründet. Auf den Ackerstreifen des Alley-Cropping-Systems wurde Luzerne (*Medicago sativa* L.) als landwirtschaftliche Nutzpflanze angebaut.

Die Ergebnisse basieren auf der Auswertung von mehr als 11.000 Araneae, die 2008 und 2010 mit Bodenfallen (n = 25) auf den Untersuchungsflächen erfasst wurden. Insgesamt konnten 103 Arten aus 19 Familien nachgewiesen werden. Der Vergleich von Arten- und Familienzahlen, standardisierter Artenzahlen, Dominanzstruktur sowie Aktivitätsdichte der Spinnenzönose erwies sich als geeignet, die Biodiversität von Energieholzflächen auf devastierten Böden des Tagebaus zu charakterisieren und Empfehlungen zur Förderung der Artenvielfalt abzuleiten.

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Section 01 - Poster A-05

Impact of elevated carbon dioxide on *Brassica* - aphid interactions

J. Klaiber, A. Najar-Rodriguez & S. Dorn

Atmospheric concentrations of carbon dioxide (CO₂) have significantly increased since industrial times. Climate simulations predict further increases which are expected to have profound effects on biological systems. Little is known as to how elevated CO₂ will affect plant species and their chemical characteristics and the subsequent recognition and acceptance of plants by insect herbivores.

In this study we used the system comprised of Brussels sprouts (*Brassica oleraceae* var. *gemmifera*), an important crop plant worldwide, and the cabbage aphid (*Brevicoryne brassicae*), a major pest of *Brassica* plants, to study some of the effects of elevated CO₂ on aphid behavior (host plant acceptance) and subsequent nymphal performance as well as on selected plant physiochemical parameters.

Available results show that as exposure time increases, elevated CO₂ affects the cabbage aphid and its host plant in several ways. It decreases aphid acceptance and nymphal performance on the plants while reducing volatile emission and stomatal conductance. Available data indicate that the concentration of a single glucosinolate known to be positively correlated with cabbage aphid fecundity was also reduced by elevated CO₂. However, the effects of elevated CO₂ were only evident after more than 6 weeks of plant exposure. Thus, we show for the first time that prolonged periods of exposure to CO₂ might be necessary in order to detect effects of CO₂ on both annual crops and associated insect herbivores.

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Section 01 - Poster A-06

50% of the national Fauna recorded with ATBI+M in three years

C.L. Häuser, A. Hoffmann, A.S. Kroupa & J.C. Monje

The biogeographic uniqueness of the Mercantour / Alpi Marittime national parks made it an ideal place for implementing an ATBI+M, i.e. large-scale field work efforts to record, identify, and document the entire biodiversity of a given area. As for most protected areas, there was a lack of comprehensive and accurate data about its biodiversity. In three campaigns between 2007 and 2010, 95 entomologists made up about 40% of all participating experts and recorded the occurrence of 5488 insect species from 17 orders during 1117 field days. More notably, 58100 fully geo-referenced datasets on their distribution were obtained. The most largely assessed orders were the Lepidoptera (37 experts, 309 field days) and Coleoptera (24 experts, 268 field days), with 2240 and 1461 species being documented, respectively. If these species numbers are compared with the data from Fauna Europaea (www.faunaeur.org), it becomes clear that it was not possible to record half of the national fauna neither for Lepidoptera nor for any other assessed group after three campaigns of documenting the biodiversity of Mercantour/Alpi Marittime. However, about 40% of the Lepidoptera species reported in Fauna Europaea could be detected with the ATBI+M approach. If one considers that the two parks comprise only 0.1% of France's and Italy's national territory, then the value 40% can certainly be regarded as truly high, especially considering the relatively short time lapse.

The obtained data allow for mapping the overall distribution of the Lepidoptera and Coleoptera in the two parks. With the visualization of the β -diversity it is also possible to show the areas of high and highest diversity. An attempt at looking to the influence of altitude on species diversity is presented. This could be a promising approach for this area, as the parks extend from 350 m to more than 3000 m at the highest six points. With coming surveys, the provided baseline for conservation management will be further strengthened.

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Section 01 - Poster A-07

The impact of grassland management on the invertebrate soil fauna and their trophic interactions

K. Lemanski & S. Scheu

Meadow and pasture management in Central Europe have drastically changed since the 1950s, which was mainly due to agricultural intensification. Fertilizer input approximately tripled and mowing frequencies also increased strongly. Losses of habitat for fauna and flora have been a direct consequence of this development. In permanent grassland this resulted in declining species diversity. While much research focused on the impact of land-use change on aboveground organisms little is known on organisms below the ground, though soils are among the most species-rich habitats of terrestrial ecosystems. Our study focuses on the diversity and functionality of the belowground fauna along a gradient in management intensity. The composition of animals, especially the macro- and mesofauna are analysed, but also microbial organisms are considered. We implemented a three-factorial grassland management experiment including two cutting frequencies (one and three cuts per year), two fertilization treatments (non-fertilized and NPK fertilized) and three diversity levels of the sward. The different levels of species richness were established by applying herbicides to a semi-natural moderately species-rich grassland in the Solling, Lower Saxony, Germany, prior to the start of the experiment, targeting monocotyledons or dicotyledons.

For investigating the structure of food webs in the soil and disentangling trophic interactions natural abundances of stable isotopes (^{15}N) in invertebrates will be analysed. In addition, a labelling experiment with ^{13}C is planned, aiming to differentiate between roots and leaf litter as sources of carbon for the soil food web.

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Section 01 - Poster A-08

**TIGER wasps – A preliminary review of the apoid wasp diversity in Thailand
(Hymenoptera)**

V. Lohrmann, L. Kirschey, S. Krause, M. Schulze & M. Ohl

Thailand is one of the countries in Southeast Asia with a remarkably rich but fragmentarily known insect diversity. Since its beginning in 2006, the Thailand biodiversity inventory, known as TIGER project, has resulted in about 5000 specimens of apoid wasps. Here we compare the preliminary results of our taxonomic analysis of this large sample with the published species diversity in Thailand. Until now, 155 species have been explicitly recorded from Thailand, representing 42 genera, but more than 500 species in 55 genera from Thailand including neighboring countries. The species diversity is rather unevenly divided between the genera. Numerous genera are represented by a single species each, whereas a few markedly diverse genera comprise the majority of species. Highly diverse genera like *Trypoxylon* and *Psenulus* are not only diverse in terms of species numbers, but are also markedly abundant in the TIGER material. As an example, about 30% (more than 1500 specimens) of the TIGER specimens studied so far belong in *Trypoxylon*, representing a still unknown number of species. Not surprisingly, the portion of stem-nesting species among the TIGER material is markedly large, as is well known from other tropical habitats. This bias towards stem-nesting is also reflected in the small average body size, although this might partially be the result of the collecting method, since smaller species are more likely collected by Malaise traps than large species. We also found a large number of hitherto undescribed species. Such newly found species are more common in genera with smaller species, which are more likely to be overlooked without Malaise traps and other mass collecting methods. As far as we can tell now, the total number of species and genera among the TIGER material will approach the total number of apoid wasp species and genera already recorded from Thailand, although we predict significant differences in the specific species composition.

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Section 01 - Poster A-09

Life-history trait shifts and functional diversity patterns of ground-dwelling arthropods (Carabidae and Araneae) along a coastal heathland successional gradient

J. Schirmel & S. Buchholz

Recently, several new functional diversity indices from multiple traits were developed. Hence, the incorporation of these indices in applied ecological studies has so far been rarely done and knowledge concerning shifts of functional diversity and life history traits along environmental gradients is to date poor. Along a coastal heathland successional gradient we therefore aimed at searching for patterns in species richness, life-history traits and functional diversity and tested common ecological hypotheses. The study was conducted on the Baltic island of Hiddensee, Germany. Sampling was done in five successional stages.

Species richness of both taxa did not differ among stages and we therefore rejected the habitat heterogeneity hypothesis. We observed shifts in several life-history traits: Body size of carabid beetles increased towards older successional stages, but decreased for spiders. Pale or light-colored species of both taxa were most common in open and young stages. The dispersal availability of carabid beetles differed among stages with the lowest number of flightless species in the youngest stage. For both taxa, most diurnal species occurred in the youngest stage. For both taxa Functional Dispersion (FDis), a measure of functional richness, was lowest in the youngest stage. Older successional stages represent more heterogeneous habitats and offer a broader range of niches, which might enhance functional richness. Functional Evenness (FEve) did not differ among successional stages indicating a similar distribution of species abundances in the functional trait space. Functional divergence (FDiv) differed among stages, however, indicating that niche differentiation may not depend on habitat heterogeneity. Based on our study we recommend the incorporation of functional diversity measures in the analysis of changes along environmental gradients, as these measures might reflect diversity in a much more instructive way than species diversity.

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Section 01 - Poster A-10

**Biodiversität von Laufkäfern (Carabidae) in Feldhecken I.
- „Partitioning Diversity“ -**

Florian Theves & Claus P. W. Zebitz

Am Beispiel von Laufkäfergesellschaften in Feldhecken wurden verschiedene Indizes zur Bewertung und Aufteilung der Diversität in α -, β - und γ -Komponenten verglichen. Über drei Jahre wurden mittels Bodenfallen Hecken mit unterschiedlichen Ausdehnungen in der Filderebene bei Stuttgart besammelt. Herangezogen wurden additive Entropie- (Gini-Simpson, Shannon) und multiplikative Diversitätsmaße (inverse Simpson-Konzentration, exponentieller Shannon-Index).

Die Ergebnisse aller Diversitätsmaße zeigten nur geringfügige Abweichungen in ihren Verhältnissen zueinander. Außer in einem Jahr (inverse Simpson-Konz., Gini-Simpson, 2008) lagen α - und γ -Diversitätswerte in großen Hecken über denen von kleinen. In letzteren nahmen α - und γ -Diversität von 2008-2010 stetig ab, während β zunahm. In ausgedehnten Hecken hingegen nahm β ab, während für α und γ kein so deutlicher Trend bestand. Eine mögliche Erklärung hierfür ist der Einfluß umliegender Feldkulturen. Je nachdem ob die angebaute Frucht Massenaufreten von Laufkäfern begünstigte oder verhinderte, verwischten oder verstärkten sich Unterschiede in der Diversität zwischen den Hecken. Diese äußeren Einflüsse waren in großen Hecken weniger extrem, da in diesen Randeffekte eine geringere Rolle spielten als in kleinen. Ein Vergleich der α -Diversitäten zweier Extreme (großer, alter vs. kleiner, junger Hecken) zeigte, daß die ausgewählten Indizes seltene Arten zu wenig berücksichtigten. In artenreichen, großen und alten Hecken, wurde die Diversität oft zu niedrig bemessen, während die kleiner junger Hecken trotz geringer Artenzahlen überschätzt wurde. Aufgrund dessen ist es notwendig, nach geeigneteren Methoden zu suchen, um Biodiversität auch auf andere Weise zu darzustellen.

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Section 01 - Poster A-11

**Biodiversität von Laufkäfern (Carabidae) in Feldhecken II.
- Alternative Ansätze -**

F. Theves & C.P.W. Zebitz

Biodiversität besteht neben bloßen Abundanzen von Arten und Individuen auch aus den ökologischen Eigenschaften dieser Arten und den daraus resultierenden Interaktionen. Diversitätsindizes allein werden diesem komplexen Thema nicht gerecht. Am Beispiel von Laufkäfergesellschaften in Feldhecken bei Stuttgart wurde untersucht, ob deren Diversität auch anders beschrieben werden kann.

Es wurde erwartet, daß sich über die Zuweisung ökologischer Eigenschaften zu den Arten Gilden ermitteln lassen. Dazu wurden acht wesentliche Attribute ausgewählt. Die Verteilung der Laufkäfer aufgrund dieser Eigenschaften wurde dann für jede Hecke in einer Korrespondenzanalyse dargestellt.

Die deutlichsten Differenzierungen ergaben sich zwischen großen, alten und kleinen, jungen Hecken. In ersteren ließen sich thermophile Wiesenarten gut von flugunfähigen Waldarten abgrenzen, während in letzteren diese Gilden allenfalls rudimentär vorhanden waren. Dieses Ergebnis ist mit der klaren Abgrenzung von Rand- und Innenbereich in großen, alten Hecken zu begründen. In kleinen, jungen Hecken dominieren eurytope Offenlandarten, die keiner Gilde eindeutig zuzuordnen sind. Die funktionale Diversität überwiegt somit in großen, alten Hecken. Diese Aussage wird auch durch Rarefaction-Kurven bestätigt, die einen steileren Verlauf für große, alte Hecken aufweisen.

Durch diesen Ansatz werden die oftmals wenig unplausiblen Ergebnisse von Diversitätsmaßen ergänzt und besser interpretierbar.

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Section 02 - Poster B-01

“Old” relicts at sky islands? - Divergence and phylogenetic history of European *Podismopsis* (Acrididae, Gomphocerinae)

B. Gottsberger & D. Berger

Sky islands give a good opportunity for evolutionary studies, because selection and genetic drift can be particularly strong in island systems. The five European species of *Podismopsis* are known from the European Alps (Switzerland: *P. keisti*, Austria: *P. styriaca*), from Montenegro (*P. relictata*), in the Carpathians (*P. transsylvanica*), and from northern Russia (*P. poppiusi*). All species are endemic to small montane and alpine areas at altitudes over 1800 m a.s.l. It is supposed that the cold adapted (boreoalpine) *Podismopsis*-species survived glaciations in the cold Asian steppes of Siberia (*P. poppiusi*) or in lower altitudes in Europe (all other species). The time of disjunction and whether the interglacial fragmented populations came into contact during latitudinal shifts during glacial periods is still unclear, but multiple climatic-induced vicariance events during Pleistocene could be suspected.

Because of the low species number, the immobility of all species, and the strong adaptation to alpine habitats we expect *Podismopsis* to be old relict species and therefore we study the differentiation processes through bioacoustical and molecular methods.

Until now we analysed *P. keisti*, *P. styriaca* and *P. relictata*. Our preliminary results show small phenotypic and genotypic divergence between these species. Therefore, it seems that at least these three species might be quite closely related despite their relict occurrence and expected ancient fragmentation.

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Section 02 - Poster B-02

**Bizzare Wasps on New Caledonia – a Revision of the Genus *Arpactophilus*
(Hymenoptera: Apoidea)**

L. Breitzkreuz & M. Ohl

The genus *Arpactophilus* belongs in the Pemphredonini within the digger wasps (Hymenoptera: Apoidea) and occurs exclusively in the Australasian region. It contains 43 described species and is morphologically highly diverse, which prompted Arnold Menke to speak of an 'evolutionary explosion' of *Arpactophilus* in that area. In the present project, I revised *Arpactophilus* from New Caledonia, where 17 species were currently known. I discovered 24 undescribed species, which brings the total number of *Arpactophilus* on New Caledonia to 41. Each species is diagnosed and described in detail. A remarkable new character is that in contrast to the majority of digger wasps, apparently including Australian species of *Arpactophilus*, the males of the New Caledonian *Arpactophilus* have 12 instead of 13 antennomeres.

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Section 02 - Poster B-03

What constitutes a “social“ thorax? – Morphological transformations of the thorax in the roach-termite-transition zone

C. Dressler & B. Wipfler

Eusociality is one of the most impressive and complex attainments in insect evolution. Termites (Isoptera) show a complex set of morphological, physiological, behavioural, and developmental characteristics entirely related to this lifestyle and xylophagous nutrition. The termite states that are composed of winged alates, and paedomorphic, wingless workers and soldiers play also an important ecological role, e.g. in tropical wood degradation.

The evolutionary origin of the traditional order Isoptera was lively debated for a long time and resulted in the placement of Isoptera within the roaches. Today a sistergroup relationship between termites and the wood-feeding, subsocial roaches of the family Cryptocercidae is widely approved.

The correlation between the evolution of social behaviour and the acquisition of hindgut symbionts as well as the morphological transformations of the genitalia are extensively examined. In contrast to this the thoracic adaptations that took place between heterophagous solitaire roaches, xylophagous subsocial Cryptocercidae, and highly derived termites are almost unknown. In the present study the external morphology, the skeletal and muscular traits of the complex character system thorax are examined in detail. The worker and the alate caste of *Mastotermes darwiniensis* which is considered to be most basal termite are compared to *Cryptocercus punctatus*, *Periplaneta americana* and the mantodean *Stagmomantis carolina*.

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Section 02 - Poster B-04

**Quantum of Sense: Phylogenetic implications from antennal sensilla in
Grylloblattodea and Mantophasmatodea (Insecta)**

K. Drilling & K.D. Klass

The cuticular fine structure of the antenna in the Grylloblattodean *Galloisiana yuasai* as well as the Austrophasmatidae *Hemilobophasma montaguense* and *Austrophasma caledonense* is described based on SEM studies. Altogether 9 types of sensilla were morphologically identified in the examined species. While scape and pedicel bear merely mechano- and chemosensitive s. chaetica B, hair plates of mechanosensitive s. chaetica A as well as a ring of mechanosensitive s. campaniformia at the distal margin of the pedicel, the flagellum constitute the focal sensory region of the antenna. Abundance and spatial arrangement of the different types of sense organs are described and illustrated. The antennae of Mantophasmatodea bear numerous autapomorphic features like the sharp border between basi- and distiflagellomeres and the subterminal cuticular pouches on distiflagellomeres D1 and D6. Also the previously unknown “branched sensilla” on the distiflagellomeres might constitute an autapomorphy of Mantophasmatodea. The arrangement of sensilla on the antenna of *G. yuasai* resembles the situation in Dermaptera and seems characterized by a considerable number of rather plesiomorphic features, which are found in several neopteran lineages. However, a single type of sense organs, “s.cirrata”, might be autapomorphic for Grylloblattodea. The new results are compared and discussed with regard to the relationships to other principal lineages of Neoptera.

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Section 02 - Poster B-05

***Wolbachia* infections in bees: possible implications for molecular taxonomy**

M. Gerth & C. Bleidorn

The maternally inherited intracellular bacteria *Wolbachia* alter the reproduction of their hosts by different mechanisms. Thereby, mitochondrial inheritance patterns are modified, possibly leading to misinterpretation of mitochondrial sequence data. By amplifying and sequencing of bacterial gene fragments, we tested the native German bee fauna (Anthophila) for the presence of *Wolbachia*. Out of 75 tested species, 54 (72%) were infected with *Wolbachia*. Many species bore identical or similar infections, suggesting a high rate of horizontal transfer. Supergroup A infections were recovered in most cases; only one species bore a supergroup F *Wolbachia* infection. Because of the high prevalence of *Wolbachia* in the German bee fauna and the limiting effects this may have on taxonomy based on mitochondrial markers, we argue that those markers should only be applied in combination with nuclear markers. In the light of recent large scale DNA barcoding projects, for which the bee fauna is an important target, we want to emphasize that using only mitochondrial COI will likely not be sufficient to delimit, identify or discover *Wolbachia* infected species— an estimated 66% of all arthropods.

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Section 02 - Poster B-06

A review of the wasp genus *Lyroda* from Thailand (Hymenoptera: Apoidea)

L. Kirschey & M. Ohl

The apoid wasp genus *Lyroda* belongs in the Miscophini and comprises 25 described species from all regions yet. Typical *Lyroda* are inconspicuous, mostly black wasps. Previously only one species was known to occur in Thailand. A large number of *Lyroda* from Thailand recently collected by the Thailand Inventory Group for Entomological Research (TIGER) gives us the possibility to re-examine the diversity of *Lyroda* in Thailand and neighbouring countries. At least ten undescribed species were found among the TIGER specimens. On the basis of external morphological characters, the new species were compared with already described species and with the relevant literature.

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Section 02 - Poster B-07

Biodiversity of Bugs (Insecta: Heteroptera) from Eocene fossil sites in Europe and North America

M. Koch, S. Wedmann, C. Labandeira & J. Hamlin

The evolution of insect biodiversity, the interrelationships between climate change and biogeographic diversity patterns are still under discussion. Investigations addressing the evolution and trends of insect biodiversity in the Cenozoic are rare. This is mainly due to the fact that there is no sound basis for the comparison of different taxa and sites. Difficulties concerning the comparison of taxa include the incompleteness of the fossil record and taphonomic influences, and fossil sites differ with regard to sampling efforts, deposition type and age. These issues will be tackled with the inclusion of different fossil sites from a narrow time epoch, and selection of a special insect group for this study.

In this project, mainly the faunal similarities of selected insects from Messel, Germany (47 Ma) and the Green River Formation, USA (53.5 – 48.5 Ma) will be studied. To handle the workload, bugs (Heteroptera) were chosen as a showcase for illuminating differences and similarities of fossil insect faunas in different Eocene sites. First, the bugs of Messel will be taxonomic classified and a detailed picture of the Messel bug fauna will be drawn. Furthermore, fossil bugs of Baltic amber, Russia and adjacent regions (40 – 35 Ma), from Menat, France (probably Paleocene) and from Eckfeld Maar, Germany (44.3 Ma) will be investigated to supplement the study. After studying the biodiversity of the bugs of these sites, the fossil faunas of the different sites will be compared to each other. Their differences and similarities will be analyzed with regard to taphonomy and possible sampling effects. With these results, biogeographic patterns, pathways and diversification of selected extant and extinct bug groups can be reconstructed and analyzed.

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Section 02 - Poster B-08

**Die Ultrastruktur der Spermien arrhenotok parthenogenetischer Thrips-Arten
(Thysanoptera)**

J. Teuber, J. Joel & G. Moritz

Insekten bilden ein Taxon mit mannigfaltig gestalteten Spermienstrukturen. So bestehen Unterschiede im Vorkommen, der Gestaltung und der Lage der Organellen sowie der Axonema. Im Gegensatz zum typischen 9 Doppeltubuli (DT) + 2 Muster der Metazoengeißel zeigen die Axoneme der meisten Pterygoten 9 periphere Einzeltubuli (ET) + 9 (DT) + 2. Tubulifera und Terebrantia durchbrechen diese, als Synapomorphie betrachtete Axonema-Struktur und zeigen zwar unterschiedliche, jedoch immer höhere Tubuli-Zahlen, als 18 + 2.

Nach Untersuchungen von Paccagnini et al. (2009) sind die von Bode (1983) und Baccetti et al. (1969) dargestellten unterschiedlichen Axonem-Muster von *Cryptothrips nigripes* (18 DT + 4 ET), *Thrips validus* (18 DT+9 ET) und *Haplothrips aculeatus* (18 DT + 6 ET) letztlich auf ein 3 x (9 + 0) Tubuli-Muster zu Beginn der Spermatogenese zurückzuführen. Die Spermien der beiden Unterordnungen unterscheiden sich somit nur durch das ausgeprägte Vorkommen eines Akrosoms bei den Tubulifera sowie die Lage des Nucleus und des Mitochondriumderivats. Zudem zeigen Vertreter der Phlaeothripiden mehrere Keimzysten, wobei sich die Spermatozyten innerhalb einer Zyste im gleichen Spermatogenese-Stadium befinden. Bei *Suocerathrips linguis* sind die Testes, in denen mehrere Zysten mit unterschiedlich entwickelten Spermienstadien zu finden sind, sehr groß. Die Organellen sind bei diesem Phlaeothripinen auf gleicher Höhe spiral umeinander gewunden, während bei *Echinothrips americanus* die paarigen Keimzysten nur ausgereifte Spermien aufweisen, deren Organellen mehr seriell angeordnet sind und nur im mittleren Spermienbereich im Querschnitt komplett dargestellt werden können. Die Axialfilamentkomplexe der untersuchten Spezies lassen sich deutlich auf ein, für Insekten ungewöhnliches, aber für Thripse typisches 3 x (9 + 0) Axonem-Muster zurückführen.

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Paccagnini, E., Lupetti, P., Afzelius, B., Dallai, R. 2009. New findings on sperm ultrastructure in thrips (Thysanoptera, Insecta). *Arthropod Structure & Development*, 38: 70-83.

Section 02 - Poster B-09

The earliest splits within the hexapod lineage: Phylogenetic signal and ambiguity of new morphological characters

N.U. Szucsich, A. Böhm, V. Jellinek, G. Pass

Despite of numerous morphological and molecular studies, the earliest splits within the hexapod lineage remain to date a controversial issue. For a long time morphologists broadly agreed with Hennig, in that the earliest split is between Ectognatha and Entognatha. Within the latter clade Diplura is usually thought to be the sister group of Ellipura (Collembola+Protura). More recently a number of authors proposed a sister group relationship of Diplura and Ectognatha, abandoning the monophyly of Entognatha. Other authors pointed out that the morphological support for monophyletic Ellipura is but very weak. Additional hypotheses are based so far solely on molecular data, like the proposed sister group relationship of Diplura and Protura, in a taxon named Nonoculata. In morphological research ambiguities in potential synapomorphies can be explained by a number of problems in character conceptualization, including: (i) ambiguous character polarization due to uncertainties to which character state the outgroup may be assigned or a priori polarization caused by unscrutinized traditional concepts of character evolution (ii) characters conceptualized as incomplete transformation series (iii) erroneous ground-pattern coding. These problems are exemplified on the characters, mentioned to support monophyly of the various clades of basal hexapods. Moreover, new characters will be proposed, which turn the balance among the conflicting phylogenetic hypotheses.

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Section 02 - Poster B-10

Weltkatalog der Pflanzenwespen (Hymenoptera: Symphyta)

A. Taeger, S.M. Blank, A.D. Liston, E. Schubert & E.K. Groll

Als Pflanzenwespen („Symphyta“) werden die basalen Hymenopteregruppen mit meist phytophagen Larven bezeichnet, deren Imagines eine „Wespentaille“ fehlt. Im „World Catalog of Symphyta (Hymenoptera)“ (Taeger et al. 2010) werden per 31.12.2009 insgesamt 803 Gattungen und 8353 Arten (123 Arten mit zwei oder mehr Unterarten) als valid abgehandelt. Bis zu diesem Zeitpunkt wurden in der Gruppe 15245 Namen vergeben (darunter auch Ersatznamen, infrasubspezifische Namen und nomina nuda). Der Katalog ist formal nach einem gängigen System gegliedert, ohne hiermit Verwandtschaftsbeziehungen darstellen zu wollen. Die Gattungen, Untergattungen und Arten sind alphabetisch mit den zugehörigen Synonymen aufgeführt. Die Beschreibungen der Taxa wurden bis auf 22 anhand der Originalpublikationen geprüft. Außerdem werden grobe Verbreitungsangaben und wichtige taxonomische Zusatzinformationen (z.B. Typusarten der Gattungen) bereitgestellt. Die Namen und deren bekannte spätere Schreibweisen und Kombinationen sind in einem Namensregister mit 31245 Einträgen verzeichnet. Portraits von 168 relevanten Autoren sowie Angaben zum Sammlungsverbleib wurden beigefügt. 2960 ausgewertete Literaturzitate bilden die Grundlage des Kataloges.

Die gedruckte Version des Weltkataloges konzentriert sich auf die nomenklatorisch relevanten Informationen über die Gruppe. Der Katalog ist in erweiterter, regelmäßig aktualisierter Form im Internet verfügbar (Taeger & Blank, 2010), aktuell mit 828 Gattungen, 8588 Arten, 9648 Literaturziten (115295 Links), 67728 genaueren Verbreitungsangaben, sowie Fotos von Typenexemplaren. In der näheren Zukunft ist vorgesehen, die Fotodokumentation deutlich zu erweitern, Futterpflanzenangaben bereitzustellen und biographische Daten der Autoren zu verbinden.

Taeger, A.; Blank, S. M. & Liston, A. D. 2010: World Catalog of Symphyta (Hymenoptera). Zootaxa, Auckland, 2580: 1-1064.

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Section 02 - Poster B-11

Per arborem ad astra: morphological adaptations to exploiting the woody habitat in the early evolution of Hymenoptera

L. Vilhelmsen, G.F. Turrisi

It is presented an overview on the morphological features of larval and adult wasps that undergo their entire larval development inside wood and interpret them in view of the lifestyle. The evolution of some of the characters is explored by mapping them on a recently published phylogeny of Hymenoptera. Based on this phylogeny, it is reasonable to assume that wood-living wasps evolved from a xylophagous/mycetophagous stage as displayed by woodwasps to a carnivorous/parasitoid lifestyle, preying on woodboring insect larvae. The latter mode of life is probably ancestral to the Apocrita which comprise the majority of the order; they share this lifestyle with their sister group, the Orussidae. However, most apocritan wasps have radiated into other habitats, the Orussidae and Stephanidae apparently being the only taxa that have retained the ancestral lifestyle of carnivorous wasps. Other apocritan lineages associated with wood (e.g., Aulacidae, Megalyridae, basal Cynipoidea and some Ichneumonoidea and Chalcidoidea) possibly entered this habitat secondarily and independently acquired morphological traits associated with it. The woody habitat was occupied by Hymenoptera during a crucial stage in their evolution where the transition from the phytophagous to carnivorous lifestyle took place. The anatomy of both larva and adults was extensively transformed in the process.

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Section 02 - Poster B-12

Attachment ability of sawfly larvae on smooth surfaces

D. Voigt & S. Gorb

Larvae of the sawfly *Rhadinoceraea micans* (Klug) (Hymenoptera, Tenthredinidae, Blennocampinae, Phymatocerini) adhere properly to the crystalline waxy surface of their host plant *Iris pseudacorus* L. (Iridaceae) by using three pairs of thoracic legs, seven pairs of abdominal prolegs, and a pygopod. On each leg and pygopod, smooth adhesive pads releasing a fluid were visualised using cryo-scanning electron microscopy. The attachment performance of living larvae was studied in centrifugal force experiments with smooth flat hydrophilic and hydrophobic glass surfaces. Such experiments with sawfly larvae or larvae of other insect species, having a similar stature, have not been carried out before. The body position on the centrifuge drum did significantly influence the friction force generation. Forces corresponded up to 19 times the larva body mass on normal glass and 14 on hydrophobized one. Although larvae generated significantly stronger forces on hydrophilic glass, they also attached properly to hydrophobic one.

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Section 03 - Poster C-01

**The phylogeographic analysis of a Dinaric and Siberian populations from
Pityogenes chalcographus (Coleoptera, Scolytinae)**

W.J. Hintsteiner, C. Bertheau, D.N. Avtzis, W. Arthofer, H. Schuler & C. Stauffer

Pityogenes chalcographus is a European conifer bark beetle belonging to the subfamily Scolytinae which exhibits a strong preference for the Norway spruce, *Picea abies*. There it has been responsible for frequent damage. In the middle of the 70s, an unidirectional incompatibility between females from Central Europe and males from Northern Europe was detected. A recent phylogeography study based on a mitochondrial marker revealed a more complex picture. Fifty-eight haplotypes were detected which corresponded to six different clades. One clade was dominant in North Europe, the second in Central Europe, the others represented the Dinaric and the Apennine region.

Here we aimed to analyze the Russian and the Dinaric area more thoroughly. We will report on the analyses of 208 individuals from Croatia, France and Russia using mitochondrial sequences. Fifty-eight new haplotypes were found, which gives rise to a total of 106 haplotypes once integrated into the phylogeography study. Thus, *P. chalcographus* had the highest haplotype richness compared to others bark beetles in Europe. The high diversity of the Dinaric populations enforced the hypothesis that *P. chalcographus* had the same refugium in this region parallel to *P. abies*. The analysis of two Siberian populations showed that this region was likely influenced only from Europe and the area north of Moscow.

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Section 03 - Poster C-02

**Evolution and biogeography of the genus *Rhyacophila* Pictet on the
Philippines
(Insecta, Trichoptera)**

W. Mey

The tropical fauna of the Philippines is remarkable for its high percentage of endemic species, which even exceeds that of Madagascar. In Trichoptera the rate of endemism is more than 90%. The study of the occurrence, taxonomy and distribution of endemic groups allows reconstruction of their biogeographical history and contributes towards elucidation of the origins of the Philippine biota. The genus *Rhyacophila* Pictet is one of the most ancestral groups in Trichoptera. Fossil species were described from Baltic Amber, and they provide evidence for an age of *Rhyacophila* older than that of the Philippines. To date 10 species are known to occur on the archipelago, all of them endemic. They belong to two species groups only, the castanea-group (4 species) and the new established spinosellata-group (6 species).

Outside the Philippines the distribution of the castanea-group encompasses continental South East Asia and Sundaland. On Borneo, the group is represented by *R. argentipuctella* Kim. It is a widespread and abundant species, whose ancestor immigrated along the Sulu-Archipelago into Mindanao and gave rise to the evolution of four species on three different islands.

The spinosellata-group is restricted to the Philippines. There are no close relatives in South East Asia and Sundaland. The origin of its species is enigmatic. The group belongs to a branch which includes the betteni- and the yosiana groups. The former is confined to North America and the latter consists of an endemic species swarm in Japan and two species in China and Korea. It is assumed that an ancestral species of the branch arrived in the Philippines and led to the evolution of the endemic spinosellata-group, whereas in South East Asia and in Sundaland its ancestors went extinct. This example points to the hitherto less considered function of the Philippines as a refuge, and survival area, of an older Asian fauna.

Today the Philippine fauna stands on the eve of comprehensive destruction caused by deforestation and the poverty of an increasing human population (Wilson 1992). The study of the fauna is an urgent task at least to save the information which are provided by each endemic species.

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Section 04 - Poster D-01

Butterflies (Rhopalocera) and grasshoppers (Caelifera, Ensifera) on short-rotation coppices: the importance of accompanying structures and the surrounding area

O. Brauner, J. Ruge & U. Schulz

The percentage of energy crops in the landscape is increasing and their influence on biodiversity has to be investigated. Therefore the diversity of diurnal butterflies (Rhopalocera) and grasshoppers (Caelifera, Ensifera) on different short-rotation coppices (SRC), their accompanying structures and surrounding areas was investigated between 2007 and 2009.

The alpha diversity of butterflies and grasshoppers on SRCs is small. Only 4 butterfly and grasshopper species were discovered within an 8-year-old poplar plantation, for instance (Thammenhain, Saxony). But 19 butterfly and 11 grasshopper species were observed on a grassland boundary rich in flowering plants between the SCR and arable land. In addition, 14 butterfly and 10 grasshopper species were found in a relatively euphotic internal border with a width of around 15m between two blocks of poplar. High densities of butterflies and grasshoppers were discovered on a hedge approximately 3m wide (which included field maple, hawthorn and other shrubs) and a grassland boundary at the edge of the SRC.

In total 32 butterfly species were observed in the area surrounding a young willow SCR (Jamikow, Brandenburg), but only 4 ubiquitous species on the one-year-old willow SCR.

The insect diversity of SRCs depends on the age of the plantation, on the structural richness within the poplar or willow blocks (e.g. canopy gaps in the plantation) and on the eschewal of pesticides. Source habitats in the surrounding landscape such as setasides also have a profound impact.

The conservational value of SRC for butterflies and grasshoppers is low. But it can be enriched by accompanying structures such as extensively used field boundaries, interior borders (along farm tracks between blocks of SCR) and hedges.

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Section 04 - Poster D-02

A Response of Hemiaquatic Insects to Ochre Pollution

C. Fehse

The research of ochre pollution in water bodies caused by human activities or by natural processes has been subject of several investigations. Only few of the papers deal with the abundance and inventory of invertebrate- species due to the poor living conditions in ochre polluted water. The present investigation is engaged with the impact of ochre pollution especially on the larves of native hemiaquatic insects and their emergence in the drain of a helocrene spring in the National Park Eifel (Germany). Not all of the taxonomic groups suffer in equal measure from the ochre deposit. Biological explanations are discussed.

Prange H. 2007. Ochre Pollution as an Ecological Problem in the Aquatic Environment - Solution Attempts from Denmark. Books On Demand.

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Section 04 - Poster D-03

Diversity, distribution and abundance of honeybees (*Apis mellifera*) and wild bees (*Apidae*) on a willow short-rotation coppice

A. Haß, O. Brauner & U. Schulz

The importance of short-rotation coppices (SRC) as a renewable energy resource is continuously increasing, but the impact of this on biodiversity and particularly on flower-visiting insects remains unclear. In consideration of this lack of knowledge, the diversity, distribution and abundance of honeybees (*Apis mellifera*) and wild bees (*Apidae*) were studied on a willow SRC in North Eastern Germany.

Transects were established over the young stocks of willow hybrids (*Salix spec.*) and four accompanying areas: an agricultural fallow, a field boundary, a boundary between the willows, and a path.

Overall 29 bee species were found on the SRC. Three of them were oligolectic and specialized on willows (*Salix spec.*). None of the species was categorized as “threatened” and most of them were very common.

The abundance of the bees depended on the flowering plant species in the different areas. At the beginning of April a very high density of bees was found on the willows and especially on the male individuals. By contrast, the density of bees in the other areas was very low. At the end of April and in May the reverse was true.

Additionally, the surrounding area was investigated for suitable habitat structures. Some habitats such as field boundaries rich in flowering plants and unimproved grassland were discovered close to the SRC which might increase the bee diversity on the SRC.

The results suggest that the accompanying areas are very important for species richness on the SRC. SRC can provide nesting and foraging habitats for wild and domestic bees and thus increase the biodiversity in intensively used agricultural landscapes. However, willow SRCs cannot replace semi-natural habitats such as fallows or unimproved grassland for wild bees. SRCs with male *Salix* flowers may constitute an important resource for honey bees.

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Section 04 - Poster D-04

**Dytiscus larvae: A fishermen's nightmare - A molecular diet analysis of
Dytiscus marginalis in fish ponds.**

S. Kehl, A. Hecker & K. Dettner

Dytiscus marginalis larvae are often described as fierce and dangerous fish predators in fish ponds. Observations and laboratory feeding experiments lead to derogatory common names like “watertiger” or “Mordwurm” (in German). Theoretical projections of Blunck (1923) showed that the offspring of one female *D. marginalis* consume 27500 fish fry during their larval development. Fish farmers see Dytiscus larvae as unwelcome guest in fish ponds and still today larvae and adult beetles are killed. The larvae and adults of widespread and common *D. marginalis* are not easy to distinguish from rare or nearly extinct species of Dytiscus (e.g. *D. latissimus*, *D. semisulcatus* and *D. circumcinctus*). The bad reputation of *D. marginalis* may harm also these endangered species. Therefore it is necessary to know how dangerous *D. marginalis* is and what influence it has on fish populations in the fields. Because of the extraintestinal digestion of the larvae field data so far do not exist apart from few observations. We present here the first accurate diet analysis of *D. marginalis* larvae from the fields with molecular methods.

Blunck, H. 1923. Wirtschaftliche Bedeutung und Bekämpfung des Gelbrands. – Zool. Anz. 57: 207-224.

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Section 04 - Poster D-05

**Photographic Atlas of the Planthoppers and Leafhoppers of Germany
(Hemiptera: Auchenorrhyncha)**

G. Kunz, H. Nickel, R. Niedringhaus, N. Znidaric & T. Wurzinger

As a supplement to the identification keys "Die Zikaden Deutschlands" (BIEDERMANN & NIEDRINGHAUS 2004), English translation: "The Plant- and Leafhoppers of Germany", 2009) and "The Nymphs of the Planthoppers and Leafhoppers of Germany" (STÖCKMANN, BIEDERMANN, NICKEL & NIEDRINGHAUS in prep.) we will publish Auchenorrhyncha species recorded the first photographic atlas of Auchenorrhyncha worldwide. The book will present all 629 from Germany (NICKEL & REMANE 2002, NICKEL 2010) in over 1.500 colour photographs including differing in colour morphs and numerous nymphs. The photo selection is based on a collection of more than 30.000 high quality Auchenorrhyncha pictures of living specimens taken on numerous excursions throughout Central Europe over the past 5 years. Less than 70 species had to be photographed from dead material.

BIEDERMANN R. & NIEDRINGHAUS R. (2004): Die Zikaden Deutschlands. – WABV, Scheeßel, 409 pp.

BIEDERMANN R. & NIEDRINGHAUS R. (2009): The Plant- and Leafhoppers of Germany. – WABV, Scheeßel, 409 pp.

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NICKEL H. & REMANE R. (2002): Artenliste der Zikaden Deutschlands, mit Angaben zu Nährpflanzen, Nahrungsbreite, Lebenszyklen, Areal und Gefährdung (Hemiptera, Fulgoromorpha et Cicado-morpha). – Beiträge zur Zikadenkunde 5: 27-64.

Stöckmann M, Biedermann R., Nickel H. & Niedringhaus R. (in prep.): The Nymphs of the Planthoppers and Leafhoppers of Germany. – WABV, Scheeßel

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Section 04 - Poster D-06

Forest management affecting the epigeic spider communities of oak forests

M. Langer & T. M. Ziesche

Spiders are the most abundant arthropod predators in many terrestrial ecosystems, supposedly playing an important role in ecosystem functioning throughout habitats. As generalist predators, they contribute to the regulation of herbivore populations in forest communities and thus occupy a strategic functional position in terrestrial food webs. While spiders in forest ecosystems contribute to the maintenance of insect community equilibrium, the distribution of species and the composition of assemblages are significantly influenced by environmental conditions.

We surveyed the soil dwelling spider communities of a nature state forest (*Naturwald Fünfeichen*) and the adjacent managed forest of one age class (75 yr). To show the effects of small-scale microhabitat heterogeneity of managed and unmanaged forests on the composition of spider assemblages we collected in a block design by pitfall traps (n = 72) in 4-wk intervals. The investigation focussed on three microhabitat types (i. vegetation, ii. dead wood, iii. litter cover) to describe the impact of relevant habitat factors in production forests.

The study shows that environmental factors and thus species distribution changed within the stand on a fine spatial scale. Our results document that the structure of production forests affects the composition of spider assemblages compared to managed forests significantly.

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Section 04 - Poster D-07

Wirkung von Agroforstsystemen auf die funktionale Biodiversität: Fördert die Kombination aus Baumstreifen und Ackerkulturen die biologische Schädlingskontrolle?

M. Langhof, K.-U. Schwarz & J.-M. Greef

In den heute in Deutschland vielfach anzutreffenden ausgeräumten, intensiv genutzten Agrarlandschaften fehlen weitgehend Strukturelemente, die Gegenspielern von wirtschaftlich bedeutenden Schädlingen Überwinterungsorte, Nahrungsquellen, alternative Wirts- und Beutetiere oder temporäre Refugien bieten. Maßnahmen, um die Ansiedlung und den Populationsaufbau von ökologisch wichtigen Nutzarthropodengruppen auf Agrarflächen nachhaltig zu fördern stellen die gezielte Anlage von Kleinstrukturen dar. Moderne Agroforstsysteme, als Kombination von in Reihen angelegten Baumstreifen mit Grünland oder Ackerkulturen, können diese Funktion erfüllen und sind daher für viele Standorte nicht nur aus Sicht der Strukturverbesserung ausgeräumter Agrarlandschaften eine interessante Alternative zur herkömmlichen Bewirtschaftungsweise. Die oft postulierte Wirkung von Agroforstsystemen auf die funktionale Biodiversität wird im Rahmen des Projektes AgroForstEnergie, einem Gemeinschaftsprojekt des Instituts für Pflanzenbau und Bodenkunde (Julius Kühn-Institut), der BTU Cottbus und der TLL Dornburg, anhand von Schädlings-Nützlings-Interaktionen am Beispiel der biologischen Kontrolle von Getreideblattläusen in angrenzenden Getreidebeständen untersucht. Dabei liegt der Fokus auf ihren wichtigsten Gegenspielern der funktionellen Gruppen Parasitoide und blattbewohnende Prädatoren (Chrysopidae, Coccinellide, Syrphidae, Linyphiidae). In Voruntersuchungen im Sommer 2010 auf einer etablierten Agroforstversuchsanlage wurden in einem Winterweizenbestand höhere Getreideblattlausdichten sowie tendenziell höhere Gegenspielerdichten in unmittelbarer Nachbarschaft luvseits eines Baumstreifens als in größeren Feldtiefen festgestellt. Leeseits des Baumstreifens war dieser Trend dagegen nicht zu beobachten. Das Poster stellt die bisher erzielten Ergebnisse der Schädlings-Nützlings-Interaktionen sowie die weiteren im Rahmen des Projektes geplanten Untersuchungen vor.

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Section 04 - Poster D-08

Temporal and spatial distribution of ants in tree crowns

M. Poetting, M. Kilg & A. Gruppe

Ants are of great ecological importance in all ecosystems. Assemblages in tree crowns are composed of ground dwelling species foraging in tree crowns and species that are arboricolous. Few data has been compiled of activities of the tree crown dwelling species yet. Because distribution and activity of arthropods in tree crowns is not equal this can also be assumed for ants. We investigated two different aspects of ant distribution in tree crowns: temporal and spatial distribution. Ants were captured by branch traps and with baited traps in oak crowns. The number of both, ground dwelling and arboricolous ant species did not vary much during the growing season (May – September). The spatial distribution of all ant species captured in tree crowns was not significantly different near the trunk, on main branches near the trunk or on twigs with leaves. In contrast, the number of arboricolous species was significantly lower in the outside part, i.e. on twigs with leaves compared to the core of the tree crown.

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Section 04 - Poster D-09

Ground beetles (*Carabidae: Coleoptera*) on short-rotation coppices and surrounding cropland – a comparison

D. Sachs, O. Brauner & U. Schulz

Short – rotation coppices (SRC) are propagated as an energy crop of the future. Too little research has been done until now to assess their influence on biodiversity. For the comparison of SRC and surrounding cropland ground beetles (*Carabidae: Coleoptera*) were used as an indicator group. Study areas were short-rotation coppices in Southern Brandenburg (Cahnsdorf) and Northern Saxony (Thammenhain), areas with prior agricultural use (crop fields) and one accompanying hedge structure. The ground beetle communities were compared with regard to their species composition, dispersion and dominance relationships by calculation of ecological indices. The usage of pitfall traps resulted in 68 found ground beetle species in spring. In the research area Thammenhain (partial parts: 8-year-old poplar plantation, crop field, hedge) the beetle community consisted of 49 species. In the research area Cahnsdorf (partial parts: 3-year-old poplar plantation, crop field) the beetle community consisted of 36 species. In this study area open land species were found dominant (genera: *Amara*, *Harpalus*, *Poecilus*) while forest species dominated in the study area Thammenhain (genera: *Carabus*, *Abax*, *Notiophilus*, *Badister*). The ground beetle community of the hedge resulted in species, which were not part of the captured spectrum of species in the field or in the poplar plantation, for example: *Carabus violaceus*, *Pterostichus vernalis*, *Syntomus truncatellus* and *Calathus melanocephalus*. Furthermore the highest number of ground beetle species was found in the accompanying hedge.

All in all the trend goes to higher numbers of species in areas which are farmed conventionally, than in short-rotation coppices. This relates to the higher shadowing when the short-rotation coppices get older.

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Section 04 - Poster D-10

**Zum Einfluss von *Fallopia japonica* auf die Verbreitung von Laufkäfern
(Coleoptera: Carabidae) in der Nationalparkregion „Sächsische Schweiz“**

C. Schmidt & H.-P. Reike

Als invasiver Neophyt ist der japanische Staudenknöterich (*Fallopia japonica*) bekannt für seine Konkurrenzstärke und die Ausbildung von Dominanzbeständen. Diese geht einher mit einer floristischen Verarmung bis hin zur völligen Degradation einheimischer Vegetationstypen, insbesondere nitrophiler Staudenfluren. Der Wissensstand zu Auswirkungen auf unterschiedliche Zoozönosen ist jedoch noch sehr gering. Als taxonomisch und ökologisch gut bearbeitete Familie eignen sich die Carabidae zur Indikation der von *F. japonica* verursachten Lebensraumveränderungen.

Im Bachtal der Sebnitz (Sächsischen Schweiz), wurden vom 01.04. bis 24.06.2010 Untersuchungen zur Carabidenfauna dreier Standorte mit unterschiedlich starker Dominanz des japanischen Staudenknöterichs durchgeführt (6 Fangperioden). Die Studie beschränkte sich auf einen Dominanzbestand von *F. japonica* (Standort I), einen unbeeinträchtigten, jedoch von der Vegetationsstruktur relativ eintönigen Standort (Standort II) sowie eine regelmäßig gepflegte, mosaikreiche Fläche mit gelegentlichem Auftreten von *F. japonica* (Standort III). Pro Standort kamen jeweils 10 Bodenfallen zum Einsatz (Fallenabstand 5m; Fangflüssigkeit: gesättigte Benzoesäure mit Zusatz von Spülmittel als Detergens, Fallenleerung aller 14 Tage). Die beiden bezüglich der Vegetationsstruktur eintönigeren Standorte (I und II) wiesen geringere Individuenzahlen auf als der mosaikreichere Standort III. Der *F. japonica*-Bestand wies eine Besiedelung mit typischen bis hin zu stenotopen Waldarten wie *Pterostichus oblongopunctatus*, *Abax ovalis*, *Molops elatus* und *Molops piceus* auf. Aufgrund der Ökologie dieser Arten ist eine hohe Ähnlichkeit des Mikroklimas von *Fallopia*-Dominanzbeständen mit dem schattigen und kühl-feuchten Klima geschlossener Waldbestände anzunehmen. Die relativ geringe kleinräumige Strukturvielfalt des *F. japonica* – Bestandes wirkt sich negativ auf die Besiedelung durch Carabidenarten geringerer Körperlänge aus.

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Section 04 - Poster D-11

**How insects spice up their lives
studies on pollination ecology of medicinal and aromatic plants**

K. Wowra, A. L. Müller & A. Hamm

While 35% of the world's crop production depends on flower visiting insects (FAO 2008), a pollinator decline can be observed. The protection and sustainable use of pollinators play an important role to ensure biodiversity and the function of both, natural and agricultural ecosystems. Against this background studies on pollination ecology of coriander (*Coriandrum sativum* L.) and fennel (*Foeniculum vulgare* Mill.) were made in plots at two differently structured areas. During the flowering period the spectrum of flower visiting species and the frequency of their visits were examined. Furthermore, the production of floral resources was quantified. Vegetation mapping was used to localize competing flora.

The guild of flower visitors consisted of six orders of insects. Among the two Apiaceae as well as among the study sites only minor differences were observed. Compared with that, the frequency distribution of the visitor groups showed significant differences: In both research areas coriander was predominantly visited by Hymenoptera, most notably *Apis mellifera* and *Andrena* species, while fennel was most frequently visited by Diptera (mainly Syrphidae or Califoridae/Muscidae, respectively). The appearance of Hymenoptera was influenced by the vegetation in bloom of the ambient area: Their attendance in the coriander stock was strongly reduced once *Impatiens glandulifera* started flowering and Diptera became the most common visitor group. Contrariwise they started visiting fennel when *Malva sylvestris* was harvested making up one third of the pollinators, mostly *Apis mellifera* and *Vespa* species. Hence it is recommended to raise coriander and fennel in areas with little competing flora to ensure the activity of a wide-ranging insect fauna for pollination. At once, in those likely poor structured regions these crops can fill a lack of floral resources (e.g. 34,6 m pollen per coriander plant). Also, under these conditions the input of honeybees can be efficient for an increase in yield.

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Section 05 - Poster E-01

Der Buchsbaumzünsler, *Cydalima perspectalis* (Walker 1859) (Lepidoptera, Pyralidae) in Südhessen – Vorkommen, Ausbreitung und Aussichten für eine biologische Regulierung mit Nützlingen

A. Herz, S. Feiertag, S. Göttig & F. M. Oellers

Der Buchsbaumzünsler, *Cydalima perspectalis* (Walker 1859), ist ein Schädling an Pflanzen der Gattung *Buxus* und wurde vor einigen Jahren wahrscheinlich mit Pflanzenimporten aus China nach Europa eingeschleppt. Seit 2007 ist die Art in Baden-Württemberg, Nordrhein-Westfalen und anderen Bundesländern auf dem Vormarsch. Im Frühjahr und Sommer 2010 wurden Massenvermehrungen von Raupen im Rhein-Neckar-Gebiet beobachtet. Ausgehend von diesen Verbreitungszentren wurde das Vorkommen der Art punktuell entlang des Rheins und der Bergstraße nach Norden bis zum Raum Darmstadt durch Sichtbeobachtungen an Buchspflanzungen in Friedhöfen und Parkanlagen erhoben. Danach gelang es dem Buchsbaumzünsler auch eher isolierte Lokalitäten zu erobern, wobei neben einer selbstständigen Ausbreitung eine Verschleppung mit bereits befallenen Pflanzen aus Gärtnereibetrieben oder Gartencentern nicht ausgeschlossen werden kann. Eine potentielle Regulierung dieser Art mit biologischen Methoden als Alternative zum chemischen Pflanzenschutz wird derzeit untersucht. Dazu wurde zunächst eine Laborzucht etabliert und erste Untersuchungen zur Entwicklungsbiologie der Art auf Buchs sowie vergleichend auf verschiedenen künstlichen Nährmedien durchgeführt. Larven der Florfliege *Chrysoperla carnea* nahmen Zünslerraupen als Futterquelle an, doch kam es zu einer deutlichen Entwicklungsverzögerung und einer erhöhten Mortalität der Räuber. Dagegen parasitierten Eiparasitoide der Art *Trichogramma brassicae*, *T. cacoeciae* und *T. evanescens* die Eigelege des Buchsbaumzünslers und konnten sich erfolgreich darin entwickeln. Weitere Versuche sollen die Eignung dieser und anderer einheimischer Gegenspieler für eine biologische Regulierung dieses Schädlings prüfen.

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Section 05 - Poster E-02

Vorkommen natürlicher Gegenspieler bei Populationen des Asiatischen Marienkäfers, *Harmonia axyridis* (Coleoptera, Coccinellidae) in Deutschland.

A. Herz & R. G. Kleespies

Der Asiatische Marienkäfer, *Harmonia axyridis*, ist seit mehreren Jahren in Deutschland etabliert und zunehmend als dominante Marienkäferart in verschiedenen Ökosystemen zu beobachten. Neben einer Verdrängung anderer Marienkäfer durch erhöhte Konkurrenzfähigkeit oder direkte Prädation ist auch eine Beeinflussung einheimischer Arten durch die Wirkung gemeinsamer Gegenspieler möglich. Um erste Erkenntnisse über das Artenspektrum und die Bedeutung des in Deutschland bei *H. axyridis* auftretenden Antagonistenkomplexes zu erlangen, wurden seit Beginn 2009 an mehreren Standorten (Südhessen, Bodenseegebiet, Niederbayern, Ahrtal) adulte Tiere gesammelt und im Labor auf das Vorhandensein von Parasiten und Pathogenen untersucht. Bei 20% der bisher seziierten 1080 Käfer lagen Befunde von invertebraten Parasiten vor. Ein Teil der Proben (617 Käfer) wurde dabei einer genauen Durchsicht auf mikrobielle Krankheitserreger unterzogen. Hierfür wurden die Käfer seziiert und Organpräparationen vorgenommen, die nativ im Phasenkontrastmikroskop diagnostiziert wurden. In Abhängigkeit von Jahreszeit, Standort und Lebensraum kam es zu einem deutlichen Auftreten des spezifischen Pilzes *Hesperomyces virescens* (Ascomycota, Laboulbeniales; Determination durch Prof. E. Arndt, Hochschule Sachsen-Anhalt). Zudem wurde erstmals ein Befall von *H. axyridis* durch eine parasitische Nematodenart festgestellt. Diese Antagonisten sind in Deutschland bisher vor allem bei der heimischen Art *Adalia bipunctata* nachgewiesen worden und könnten in *H. axyridis* eine neue Wirtsressource vorfinden.

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Section 05 - Poster E-03

**Ein neuer, nichtendemischer Sonnenblumenschädling in Europa - Fänge von
Strauzia longipennis in Berlin**

S. Lerche, T. Schober, P. Baufeld, B. Kummer & C. Büttner

Durch BRÜCKNER & KORNVEYEV wurde im Jahr 2010 das Erstauftreten des Schädlings *Strauzia longipennis* WIEDEMANN 1830 (DIPTERA: TEPHRITIDAE) in der paläarktischen Region festgestellt. Das natürliche Verbreitungsgebiet der Art liegt in Nordamerika (FOOTE ET AL. 1993). Bei dem von BRÜCKNER & KORNVEYEV (2010) durchgeführten Fang der Adulten der Art in Berlin-Johannisthal handelte es sich jedoch nicht um einen Einzelfund. Im gleichen Zeitraum konnten auch in Berlin-Wartenberg 4 Adulte der Art gefangen werden. Zusätzlich ist nachfolgend ein Fang aus dem Jahr 2009 aus Berlin-Lankwitz bekannt geworden. Die drei Fundorte liegen zwischen 11 und 21 km voneinander entfernt. Um das tatsächliche Ausmaß der Befallssituation des Schädlings zu ermitteln, ist ein weiteres Monitoring im Stadtgebiet aber auch in Brandenburg angezeigt. Es ist davon auszugehen, dass der Schädling an die hier herrschenden klimatischen Bedingungen angepasst ist. Da wiederholt Eiablageaktivität der adulten Weibchen beobachtet wurde und darüber hinaus die erfolgreiche Entwicklung der Fliegenmaden bis zu deren Verpuppung im Freiland festgestellt werden konnte, ist eine Etablierung des Schädlings in Deutschland nicht auszuschließen.

Brueckner, C. & S.V. Korneyev (2010): *Strauzia longipennis* (Diptera: Tephritidae), an important pest of sunflowers recorded for the first time in the Palaearctic Region. *Ukrainska Entomofaunistyka* 2010, 1(1): 55-57

Foote, R.H., Blane, F.L. & A.L. Norrbom (1993): Handbook of the fruit flies (Diptera: Tephritidae) of America North of Mexico. Ithaca, Comstock Publishing Associates, USA: 571

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Section 05 - Poster E-04

A chemo-ecological study on hostplant selection of the invasive ALB

F. Maibaum & S. Schütz

The invasive Asian Longhorned Beetle *Anoplophora glabripennis* (ALB) seems to prefer poplars from specific sections (Hu et al. 2009). The chemosystematic of poplars can be determined by comparing the patterns of secondary metabolites. Because some of these substances are volatile, we expect that one can differentiate different systematic levels by the pattern of the Volatile Organic Compounds (VOC). Therefore we currently investigate cuttings of different poplar species growing under defined conditions in the greenhouse for their VOC-pattern. With these patterns we will try to mirror the classification of the different poplar species into sections. Comparing the VOC-data, we will give an outlook for attractive or not attractive poplar species or hybrids to the ALB. This would be important for coming poplar plantations in the context of the production of renewable resources.

Hu, J. F. et al. 2009. Ecology and management of exotic and endemic Asian longhorned beetle *Anoplophora glabripennis*. *Agricultural and Forest Entomology* 11(4): 359-375.

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Section 05 - Poster E-05

Notes on *Blastobasis desertarum* (Wollaston, 1858) - a pest species of Microlepidoptera on ornamental plants (Lepidoptera, Blastobasidae)

W. Mey

Blastobasis desertarum was found in greenhouses in Berlin in 2005 for the first time . The larvae are internal stem and cambium feeders of *Aeonium* spp. and other species of Crassulaceae. They are feeding on the stems and roots near the soil surface or are tunneling in the roots. The species was observed together with *Oinophila v-flavum*(Lepidoptera, Tineidae). Both species can reach high abundances and are able to severely damage *Aeonium* spp. and other ornamental plants in greenhouses.

The species was described from Madeira and is regarded an endemic species to the Makaronesian Islands. This is the first record of the species on the European continent. It was certainly introduced incidentally with host plants from the Makaronesian Islands.

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Section 06 - Poster F-01

Impact of aphid cannibalism on the efficacy of parasitisation

H. Alkhedir, P. Karlovsky & S. Vidal

Cannibalism is common phenomenon in insect species. The underlying causes are in most cases related to starvation and high population density, and consequently cannibalism serves in regulation and maintaining of insect populations. Recently, cannibalism has also been found in pea aphid (*Acyrtosiphon pisum*), but neither the causes nor the consequences of cannibalism have been studied in details so far. We investigated whether different aphid population densities and parasitoids are causes of cannibalism and whether the efficacy of parasitisation is influenced by cannibalism. We found that increasing aggregation in aphids due to limited space as well as the presence of parasitoids nearby aphid individuals induces cannibalism among aphids. Introducing a parasitoid specimen into an aggregated aphid colony results in feeding on parasitoids female on small nymphs (host feeding), but also in cannibalism of aphid individuals on these parasitized aphids, thus reducing the parasitism rate. We hypothesize that, due to this behaviour, cannibalism is beneficial for the aphid under natural condition.

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Section 06 - Poster F-02

Deceptive trap flowers of *Ceropegia*: Different scents - identical pollinators

A. Heiduk, U. Meve, S. Dötterl

Ceropegia species (Apocynaceae, Asclepiadoideae) have pitfall flowers and are pollinated by small flies through deception. The attraction of the pollinating flies is supposed to be mediated by floral scent. However, for only one *Ceropegia* species, the emitted flower scent was studied using headspace and gas chromatography mass spectrometry methods (HS-GC-MS), and for only a few species scent was shown to be indeed attractive to the pollinating flies.

In the present study, the chemical composition as well as the spatial (intrafloral) emission pattern of floral scent was investigated in *C. denticulata*, *C. sandersonii* and *C. dolichophylla* by HS-GC-MS. Flies visiting these plants in a greenhouse in Bayreuth were determined and their antennal responses to flower scent samples of these three species were measured through gas chromatography-electroantennographic detection (GC-EAD).

In all three species the highest amount of floral scent was emitted from the tips of the corolla lobes where flies typically land. Flowers of all three species were visited by *Desmometopa* (Milichiidae) flies though scent clearly differed among the species. *C. dolichophylla* emitted compounds that did not occur in the other species, but *C. denticulata* and *C. sandersonii* had several compounds in common. Five of them elicited antennal responses in the *Desmometopa* flies and these compounds as well as the EAD-active ones in *C. dolichophylla* may be responsible for attraction of flies to these deceptive flowers.

Heiduk, A., Brake, I., Tolasch, T, Frank, J., Jürgens, A., Meve, U., Dötterl, S. 2010. Scent chemistry and pollinator attraction in the deceptive trap flowers of *Ceropegia dolichophylla*. S. Afr. J. Bot. 76: 762-769.

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Section 06 - Poster F-03

**Vergleichendes Klimakammerexperiment zum Einfluss unterschiedlicher
Tagestemperturverläufe auf Entwicklung, Fraß, Gewicht und Fettkörper von
Coccinella septempunctata und *Harmonia axyridis***

S. Krenzel, B. Freier, C. Brandsch & G. Stangl

Im Rahmen einer Reihe von Untersuchungen zum Einfluss erhöhter Temperaturen auf verschiedene ökologische Parameter von *Coccinella septempunctata* und *Harmonia axyridis* und ihr Potential zur natürlichen Regulation von Getreideblattläusen erfolgte im Jahr 2010 ein Experiment in drei Klimakammern mit jeweils exakt definierten, verschiedenen Tagestemperturverläufen.

Die dabei verwendeten, mit dem Potsdam-Institut für Klimafolgenforschung (PIK) gemeinsam abgestimmten, drei Tagestemperturverläufe T0 (normal mit $\bar{\theta} = 17,8$ °C), T3 (erhöht mit $\bar{\theta} = 20,8$ °C) und T6 (stark erhöht mit $\bar{\theta} = 23,8$ °C) wurden in 24-stufigen Tagestemperturverläufen in vollautomatischen, begehbaren Klimakammern realisiert. Im Mittelpunkt dieser Untersuchung stand der Einfluss der drei Temperturverläufe auf das geschlechtsspezifische Gewicht, die Fraßleistung und den Fettkörpergehalt der beiden Coccinellidenarten. Eier der beiden Coccinellidenarten wurden dafür einzeln in speziell entwickelten Versuchsgefäßen angesetzt und über die gesamte präimaginale Phase sowie 10 d nach dem Schlupf der Imagines den entsprechenden Temperturverläufen ausgesetzt.

Es konnten deutliche Unterschiede zwischen den beiden Arten und Temperturstufen festgestellt werden. Besonderes Interesse verdienten dabei die Unterschiede im Fettkörpergehalt der ad libitum mit *Sitobion avenae* gefütterten Imagines, besonders im Zusammenhang mit den bei höheren Temperaturen eher sinkenden Körpergewichten und steigenden Fraßmengen.

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Section 06 - Poster F-04

Zusammensetzung und Handling des Wehrsekrettropfens bei *Suocerathrips linguis* (Thysanoptera: Phlaeothripidae)

I. Freyer, G. Moritz & G. Tschuch

Ausgehend von den Arbeiten von Gehlsen et al. (2009) zum Wehrsekret von adulten *Suocerathrips linguis* Mound & Marullo 1994, in denen die Komponenten des organischen Anteils identifiziert wurden, konnten weitere Fragen zur Zusammensetzung und zum Handling beantwortet werden. Mittels individueller SPME-Beprobung und anschließender GC-MS-Untersuchung stellte sich heraus, dass alle beiden Larvenstadien und beide Geschlechter der adulten Tiere ein Wehrsekret produzieren, das sich in der Zusammensetzung zumindest bezüglich der drei untersuchten Hauptkomponenten (11Z-Icosa-11,19-dienylacetat, Octadecylacetat und Octadec-17-enylacetat) nicht unterscheidet. Die jeweiligen Streuungen in der Zusammensetzung zwischen unterschiedlichen Stadien unterscheiden sich nicht signifikant von den Streuungen, die zwischen einzelnen Individuen gefunden wurden. Weiterhin konnte festgestellt werden, dass die ungesättigten Acetate gegenüber UV-Bestrahlung stabil sind, was bei den Sekreten oder Semiochemikalen anderer Insekten gelegentlich nicht der Fall ist. Im Inneren der von den Tieren erzeugten, ansonsten farblosen und klaren hydrophoben Sekrettropfen finden sich meist mehrere unterschiedlich große kugelförmige Tropfen, die aus einer hydrophilen klaren und gelben Flüssigkeit bestehen. Da das gesamte Wehrsekret im Enddarm gespeichert wird, könnte die gelbe Flüssigkeit aus Exkreten, Exkrementen oder einem Gemisch aus beiden bestehen. Zur Stabilisierung des bei Stress am abdominalen Tubus hervorgebrachten Tropfens dienen eindeutig sechs (bei den Larven vier) lange Borsten, die in ihrer gesamten Länge auf der Tropfenoberfläche schwimmen. Diese Borsten sind an den Spitzen löffelförmig abgeplattet. Weitere wesentlich kürzere Borsten dienen wahrscheinlich dazu, dass das Sekret nicht am Körper der Tiere herunterläuft.

Gehlsen, U., Lindemann, P., Rettig, W., Moritz, G. & Tschuch, G. 2009. Terminal double bonds in the alkenes and acetates of defensive secretion from the thrips *Suocerathrips linguis* Mound & Marullo, 1994 (Thysanoptera: Phlaeothripidae). *Chemoecology*, 19 (2): 97-102.

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Section 06 - Poster F-05

On the morphology and chemistry of the abdominal defensive gland of the rove beetle *Xantholinus linearis* (Coleoptera, Staphylinidae)

T. Gasch & K. Dettner

Many taxa of the family Staphylinidae possess an exocrine gland system containing various biologically active compounds for protection against predators or microorganisms. Hitherto, only few representatives of the subfamily Xantholininae have been studied with regard to the morphology and chemistry of their abdominal gland system. Therefore, the gland of *Xantholinus linearis* (Coleoptera, Staphylinidae) was investigated using light microscopy and gas chromatography-mass spectrometry. In compliance with our expectations, the morphology of the abdominal gland of *Xantholinus linearis* differs strikingly from the gland system of its sister group, Staphylininae. Furthermore, we observed a sexual dimorphism concerning the gland's structure that also becomes apparent in the chemical composition of the secretion. Subsequently, our first results are presented and the possible biological function of the secretion is discussed.

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Section 06 - Poster F-06

Female – Male / Male – Female: Communication Breakdown in *Lariophagus distinguendus*

K. Hacker, J. Steidle, E. Griese, J. Ruther & S. Kühbandner

In the parasitic wasp *Lariophagus distinguendus* strains specialized on different hosts are reproductively isolated. To examine the hypothesis that development on different hosts leads to sender – receiver problems, mating behavior of wasps from the same strain, but from different hosts (granary weevil and drugstore beetle) was studied. The experiments revealed that in encounters of males and females from different hosts, males are less likely to recognize females and females are less likely to accept males as mating partners. This difference is most likely due to differences in CHC profiles and mandibular male pheromones and indicates that the quality of chemical signals depends on the developmental host. Thus, assortative mating can be achieved in *L. distinguendus* within one generation by development on different hosts.

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Section 06 - Poster F-07

Climate change in a nutshell: temperature dependent searching behavior in parasitoids and repercussions for host-parasitoid interactions

T.S. Hoffmeister & M. Sozio

Climate change will not only lead to higher ambient temperatures, but also to increasing variance in temperature, exposing ectotermes to a range of different ambient conditions. Here we tested how different ambient temperatures influenced the searching behaviour of *Leptopilina heterotoma*, a parasitoid of *Drosophila* larvae. We investigated walking speed and other searching parameters, as well as rate of parasitism, patch time allocation and searching efficiency in the parasitoid at 15, 20 and 25 ° C. Walking speed increased with temperature and resting decreased, increasing the searching efficiency at higher temperatures. In contrast, turning angles of the walking path were unaffected by temperature.

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Section 06 - Poster F-08

**Sexy females: Identification of a sex pheromone in the curious and bizarre
Twisted wing parasites (Strepsiptera)**

S. Kehl, T. Tolasch & S. Dötterl

Twisted wing parasites (Strepsiptera) are endoparasitoids in other insects and are one of the most curious and fascinating insect order. They have an extreme sexual dimorphism with typically neotenic, permanently endoparasitic females and free-living, winged adult males. After emergence of the short living males they begin flight in search of receptive females. The short life span of males makes an effective communication system between the sexes necessary, and it was suggested that females Nassonow's gland situated in the cephalothorax produces a pheromone that is detected by the antennal Sensilla coelonica of the males.

In *Stylops melittae*, a species parasitizing andrenid bees (here *Andrena vaga*) we were able to demonstrate that males respond to receptive females when excluding visual but offering olfactory cues, and determined the attractiveness of solvent extracts of cephalothoraxes obtained from receptive females. Electrophysiological and chemical analyses were used to isolate and characterize the female sex pheromone of *Stylops melittae*.

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Section 06 - Poster F-09

The challenges of optimal oviposition – ecological and developmental constraints

A. Koehncke, O. Leimar & P. Hammerstein

When an insect chooses where to lay an egg, it faces several challenges. Ideally, it would pick the host best suited for offspring development. But such hosts may be rare and search-times between oviposition events may be long. Choosing to lay eggs on sub-optimal hosts, however, leads to decreased larval performance. Ovipositing insects thus need to strike a balance between laying eggs only on optimal hosts and also accepting less favorable ones. Which mixture of generalism and specialism is optimal depends on developmental and ecological factors. This is because every oviposition event carries costs mediated by time – since the time used to find a rare but optimal host could have been used to find several more common but less optimal hosts – and costs mediated by eggs – since eggs placed on sub-optimal hosts would have brought higher returns on optimal hosts. The influence of these time- and egg-costs on optimal oviposition strategies is determined by the relative role of time- and egg-limitation, i.e. whether oviposition is limited by an individual's lifetime or by its total egg complement. Pure time-limitation makes egg-costs irrelevant so that accepting all hosts, complete generalism, is optimal. Pure egg-limitation eliminates time-costs and favors pure specialism on only the optimal host. Since insects neither are immortal nor carry an infinite number of eggs, both egg- and time-costs contribute to oviposition costs and shape oviposition strategies. We develop an analytical model of oviposition where egg- and time-limitation are endogenous and not pre-supposed. Our results show that previous approaches to optimal oviposition underestimate time-costs because they include in them only the time spent *during* oviposition but not the much longer time spent *searching* for oviposition sites. Our model helps to clarify the complex relation between time- and egg-costs. In doing so, our results strengthen the role of ecological over developmental constraints in optimal oviposition strategies – that is, the effect of host abundances vs. that of egg number.

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Section 06 - Poster F-10

Altersstruktur einer *Paederus riparius* - Population (Coleoptera: Staphylinidae) in Nordbayern und erstmalige Beobachtungen zur Parasitierung der Larven

C. Lang, M. Schott & K. Dettner

Im Rahmen einer Diplomarbeit wurde an einem See mit sumpfiger Verlandungszone im Landkreis Bayreuth eine große Anzahl von Kurzflüglern der Art *Paederus riparius* gesammelt. Nach der Geschlechtszuordnung wurden die weiblichen Tiere einer Altersbestimmung anhand der Ovarienmorphologie unterzogen. Es konnte erstmals eine Einstufung in vier Altersklassen bei dieser Staphylinidenart etabliert werden. Die Altersstruktur der Weibchen - Population lässt Aussagen über den Lebenszyklus dieser Käferart in einem ausgesuchten Habitat zu.

Aufgrund der enorm hohen Populationsdichte an diesem Fundort war es möglich, auch L2 – Larven im Freiland zu sammeln und im Labor zur weiteren Entwicklung zu bringen. Aus einigen Larven entwickelten sich jedoch keine *Paederus* – Imagines, sondern es schlüpfen Adulti des Parasitoiden *Phaneroserphus calcar* (Hymenoptera: Proctotrupidae). Dünnschichtchromatographische Voruntersuchungen zeigten, dass der Parasitoid ein Derivat des toxischen und von Mikroorganismen gebildeten Käfermetaboliten Pederin enthalten könnte.

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Section 06 - Poster F-11

A simple method to calculate and compare arthropod population growth

J.-P. Lawo & N.C. Lawo

A common parameter in entomology is the intrinsic rate of natural increase (r_m) to describe and evaluate the growth and adaptation of an arthropod population to certain environmental conditions. Following the method of Birch (1948) the r_m is the solution of an exponential equation which depends on the whole life cycle of each female and her survival time. A simplification of this equation was suggested by Wyatt and White (1977) which allows the study to be shortened since it does not depend on any survival times and only a part of the life cycle of the females. Thus this method became quite popular among entomologists especially when assessing life-table parameters for insects having a long life cycle, such as the grape phylloxera (*Daktulosphaira vitifoliae* Fitch). As a population parameter the r_m lacks any variance and thus a valid statistical comparison of r_m s for different populations is not straightforward and calculations often result in some statistical misconceptions. We briefly discuss the drawbacks of the two most used calculations, and present an easy to implement and consistent method for the comparison of r_m s. The methods will be demonstrated and discussed on a data set of phylloxera.

[Birch, L. C.] [1948]. [The intrinsic rate of natural increase of an insect population]. [J. Anim. Ecol.], [17]. [15–26].

[Wyatt, I. J. and White, P. F.] [1977]. [Simple estimation of intrinsic increase rates for aphids and tetranychid mites]. [J. Appl. Ecol.], [14]. 8757–766].

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Section 06 - Poster F-12

First insights into a metabolic fingerprint of grapevine roots upon phylloxera attack

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The grape phylloxera (*Daktulosphaira vitifoliae* Fitch) is a devastating grapevine pest worldwide. So far, it could be suppressed by grafting European vine on resistant American rootstocks. However, in the past decades more aggressive biotypes did appear. Therefore, there is an increase need to understand the phylloxera – root – interaction in more detail. This study uses the knowledge that many plant species respond to herbivore attack by an increased metabolic activity. Comparing young and mature phylloxera induced organoid root galls (nodosities) with uninfested root tips by gas chromatography-mass spectrometry (GC-MS) reveals first insights into a characteristic metabolic fingerprint due to phylloxera infestation. The metabolites were assigned to the major classes of terpenoids, C6- and aromatic compounds.

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Section 06 - Poster F-13

Zusammensetzung und Handling des Wehrsekrettropfens bei *Suocerathrips linguis* (Thysanoptera: Phlaeothripidae)

I. Freyer, G. Moritz & G. Tschuch

Ausgehend von den Arbeiten von Gehlsen et al. (2009) zum Wehrsekret von adulten *Suocerathrips linguis* Mound & Marullo 1994, in denen die Komponenten des organischen Anteils identifiziert wurden, konnten weitere Fragen zur Zusammensetzung und zum Handling beantwortet werden. Mittels individueller SPME-Beprobung und anschließender GC-MS-Untersuchung stellte sich heraus, dass alle beiden Larvenstadien und beide Geschlechter der adulten Tiere ein Wehrsekret produzieren, das sich in der Zusammensetzung zumindest bezüglich der drei untersuchten Hauptkomponenten (11Z-Icosa-11,19-dienylacetat, Octadecylacetat und Octadec-17-enylacetat) nicht unterscheidet. Die jeweiligen Streuungen in der Zusammensetzung zwischen unterschiedlichen Stadien unterscheiden sich nicht signifikant von den Streuungen, die zwischen einzelnen Individuen gefunden wurden. Weiterhin konnte festgestellt werden, dass die ungesättigten Acetate gegenüber UV-Bestrahlung stabil sind, was bei den Sekreten oder Semiochemikalien anderer Insekten gelegentlich nicht der Fall ist. Im Inneren der von den Tieren erzeugten, ansonsten farblosen und klaren hydrophoben Sekrettropfen finden sich meist mehrere unterschiedlich große kugelförmige Tropfen, die aus einer hydrophilen klaren und gelben Flüssigkeit bestehen. Da das gesamte Wehrsekret im Enddarm gespeichert wird, könnte die gelbe Flüssigkeit aus Exkreten, Exkrementen oder einem Gemisch aus beiden bestehen. Zur Stabilisierung des bei Stress am abdominalen Tubus hervorgebrachten Tropfens dienen eindeutig sechs (bei den Larven vier) lange Borsten, die in ihrer gesamten Länge auf der Tropfenoberfläche schwimmen. Diese Borsten sind an den Spitzen löffelförmig abgeplattet. Weitere wesentlich kürzere Borsten dienen wahrscheinlich dazu, dass das Sekret nicht am Körper der Tiere herunterläuft.

Gehlsen, U., Lindemann, P., Rettig, W., Moritz, G. & Tschuch, G. 2009. Terminal double bonds in the alkenes and acetates of defensive secretion from the thrips *Suocerathrips linguis* Mound & Marullo, 1994 (Thysanoptera: Phlaeothripidae). *Chemoecology*, 19 (2): 97-102.

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Section 06 - Poster F-14

High sensitivity of the oligophagous moths *Smerinthus ocellatus* and *Cerura vinula* towards host plants odors.

M. Paczkowska, C. Rachow & S. Schütz

Softwood species of forest margins like *Populus tremula* und *Salix caprea* harbour more than 80 Lepidoptera taxa including several red-list species. In order to examine the chemo-ecological requirements of this guild, two characteristic species were selected. Both feed on both tree species; *Smerinthus ocellatus* prefer sunny but humid expositions and *Cerura vinula* sunny and dry expositions. Analysis of host tree volatiles in different expositions by GC-MS/EAD revealed a set of compounds enabling the moths to select their favourite oviposition sites. Some of these compounds elicited EAG-response down to dilutions of 10^{-7} in paraffin oil. Behavioural tests showed species- and sex-specific attractant and repellent activity of these compounds at low concentrations. For example methyl-salicytate was attractive for *C. vinula* females and repellent for males. Nonanal was attractive for both sexes of *S. ocellatus* and for females of *C. vinula*.

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Section 06 - Poster F-15

Biology of a gall leafhopper

R. Rakitov & E. Appel

The world's only member of Hemiptera Auchenorrhyncha known to induce true galls, *Scenergates viridis* (Vilb.) (Cicadellidae: Deltocephalinae), is endemic to Central Asian deserts southeast of the Aral Sea, where it induces camelthorn (*Alhagi* spp., Fabaceae) leaves to grow into podlike galls, inside which individual leafhoppers feed and develop. Its unique biology has been briefly described by Ivan Mitjaev (1968). In September 2010 we examined >300 galls of *S. viridis* in Uzbekistan, 40 km S of Bukhara, to reconfirm and expand his observations. No new galls were being induced during that time, but according to Mitjaev these are initiated by 1st instar nymphs feeding on young leaves. The gall is formed by a leaf folded along its midrib into a succulent pod with two convex valves, their free margins pressed together, leaving but tiny ostioles at the basal and apical ends. Each ostiole is plugged from inside by a mix of dried leafhopper excrement, brochosomes, and crushed larval skins. Thin brochosomal lining of the chamber appears enhancing its repellency against leafhopper sticky excrement, preventing contamination. Nymphs develop singly in closed galls until the valves open and release adults. Apparently, mating (not observed) takes place outside, but females later return into the galls and insert up to 50 eggs into their walls from inside. The galls with ovipositing females are tightly shut, suggesting that they re-close after the return of females. The females die inside; while still alive they may engage in active protection of the eggs. Enemies of the eggs include Chalcidoidea egg parasitoids, thrips, and Gelechioidea caterpillars. The nymphs are parasitized by Pipunculidae. Despite their striking behavioral adaptations to galling, both nymphs and adults display typical cicadellid morphology (except being somewhat flattened) and are capable of jumping.

Mitjaev I.D. (1968) A gall inducing leafhopper. Transactions of the Institute of Zoology of the Academy of Sciences of the Kazakh SSR 30: 205-206. [In Russian].

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Section 06 - Poster F-16

***Folsomia* versus *Aspergillus* – a model system to explore the role of secondary metabolites in fungus-fungivore interactions**

M. Rohlf s & L. Stötefeld

In analogy to plant-herbivore interactions, the eco-evolutionary interrelationship between fungi and fungivores may be affected by the fungal ability to synthesize toxic secondary metabolites. Despite numerous correlative data, conclusive experimental evidence of fungal secondary metabolites being part of an evolved chemical defense against predators is scarce. We apply a multidisciplinary approach, comprising behavioral and life-history analyses, quantification of gene expression and fungal metabolite formation, to thoroughly explore the role of mycotoxin formation in the model fungus-fungivore system, *Aspergillus nidulans* and *Folsomia candida*. By using a transgenic chemical deficient *A. nidulans* strain ($\Delta laeA$), we demonstrate that secondary metabolite diversity in fungi play a distinct role in driving temporal and spatial dynamics in fungus-fungivore interactions. Importantly, fungal secondary metabolite formation may affect fungivore density-dependent population dynamics in a non-linear manner as *F. candida* growth rate appears to be affected by positive density dependence (Allee effect) when feeding on toxic wild type *A. nidulans*. In contrast, on chemical deficient $\Delta laeA$ *A. nidulans* *F. candida* growth rate is negatively affected by positive density-dependent competition.

Rohlf s, M., Albert, M., Keller, N.P. & Kempken, F. (2007) Secondary chemicals protect mould from fungivory. *Biol. Lett.* 3: 523-525.

Rohlf s, M. & Churchill, A.C.L. (2011) Fungal secondary metabolites as modulators of interactions with insects and other arthropods. *Fung. Gen. Biol.* 48: 23-34.

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Section 06 - Poster F-17

Einfluss von zwei verschiedenen Lepidoptera-Arten auf das aliphatische Glucosinolatprofil in Arabidopsis thaliana-Kreuzungslinien

F. Rohr, Ch. Ulrichs, M. Schreiner, C.N. Nguyen & I. Mewis

Glucosinolate (GS) sind Teil eines Zweikomponenten-Abwehrsystems, welches charakteristisch für die Ordnung Brassicales, einschließlich der Modellpflanze *Arabidopsis thaliana* ist. Ein determinierender Faktor für die Aktivität gegenüber Lepidoptera-Larven, Bakterien und Blattläusen ist die Seitenkettenstruktur der GS. Insbesondere die Seitenkettenstrukturen der von Methionin abgeleiteten GS variieren beträchtlich. Dies ist auf Polymorphismus in verschiedenen Loci (GS-AOP, GS-ELONG) im Genom von Brassicaceen zurückzuführen, welches zu einer modularen Veränderung insbesondere des aliphatischen GS-Profiles führt und damit eine schnelle Anpassung gegenüber Fraßfeinden ermöglicht.

Um zu untersuchen inwieweit sich die Variierung innerhalb des GS-Genotyps (AOP Gene) auf den Phänotyp, die GS-Induzierbarkeit sowie die Pflanzenresistenz auswirkt, wurde mit 20 Linien gearbeitet, welche bei gleichem genetischen Hintergrund ein unterschiedliches aliphatisches GS-Profil aufweisen. Dafür wurde der 3-Methylsulfinylpropyl-GS-produzierende Ökotyp Gie-0 mit einem 3-Hydroxypropyl-GS-enthaltenden Ökotyp (Sap-0) gekreuzt, um für AOP3 und AOP0 (kein funktionelles AOP2 und AOP3) homozygote Pflanzen in der F3 zu erzielen. In dieser Studie wurde die spezifische biochemische und molekulare Pflanzenreaktion auf zwei verschiedene nahrungsspezialisierte folivore Insektenarten, *Spodoptera exigua* (Hübner) und *Pieris brassicae* L. mittels HPLC-DAD und qRT-PCR untersucht.

Der Fraß von *S. exigua* und *P. brassicae* bewirkte eine unterschiedlich starke GS-Induktion in den Kreuzungslinien im Vergleich zur Kontrolle. Hauptsächlich wurden die aliphatischen Haupt-GS: 3-Methylsulfinylpropyl und 3-Hydroxypropyl durch die Larven beider Insektenarten signifikant induziert. Ein signifikanter Anstieg der Indolyl GS in allen Linien erfolgte nach Fraß des Spezialisten *P. brassicae*. Herbivorie beider Insektenarten führte zu ähnlichen Änderungen in den Genexpressionslevel untersuchter Gene der GS-Biosynthese.

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Section 06 - Poster F-18

First results on the biological significance of stereochemistry of pygidial gland components of the rove beetle genus *Stenus* (Coleoptera, Staphylinidae)

A. Schierling, S. Sinterhauf, T. Müller, K. Seifert & K. Dettner

In order to protect from predation and from microorganismic infestation *Steninae* are equipped with powerful chemical weapons. Most *Stenus* species store in their pygidial glands among others the deterrent compounds stenusine (N-ethyl-3-(2-methylbutyl)-piperidine) and norstenusine (N-ethyl-3-(2-methylpropyl)-piperidine), which are excreted after molestation. In addition the beetles impregnate their body surface with this secretion to eliminate microorganisms.

As a chiral molecule stenusine occurs with four, norstenusin with two stereoisomeres. The ratio of these stereoisomeres is definitely constant within all individuals of a species. However there are significant differences between various *Stenus* species (LUSEBRINK et. al 2006). By means of two-choice deterrency tests with ants and agar diffusions-tests with bacteria as well as behavioural tests and electrophysiological experiments with *Stenus*-beetles, the biological significance of the stereochemical composition of the *Stenus* pygidial gland secretion is investigated and a potential pheromone function is discussed.

Lusebrink, I., Burkhardt, D., Gedig, T., Dettner, K., Mosandl, A. & Seifert, K. 2007. Intrageneric differences in the four stereoisomers of stenusine in the rove beetle genus, *Stenus* (Coleoptera, Staphylinidae). *Naturwissenschaften* 94:143–147.

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Section 06 - Poster F-19

The Long and Smelly Way to Hosts - Long distance orientation of the Parasitic Wasps *Cephalonomia tarsalis* (Ashmead) (Hymenoptera: Bethylinidae), *Anisopteromalus calandrae* (Hymenoptera: Pteromalidae) and *Lariophagus distinguendus* (Förster) (Hymenoptera: Pteromalidae)

G. Schmid & J.L.M. Steidle

Grain pests cause much damage in food stores worldwide. Often chemical methods are used to control pests. An alternative method is biological pest control which uses natural enemies to control pests. Common examples for stored-product pests are the saw-toothed grain beetle, *Oryzaephilus surinamensis* L. (Coleoptera: Cuculidae) and the granary weevil *Sitophilus granarius* L. (Coleoptera: Curculionidae). Natural enemies of these pests are e.g. *Cephalonomia tarsalis* parasitizing *O. surinamensis* larvae, *Lariophagus distinguendus* and *Anisopteromalus calandrae* parasitizing larvae of *S. granarius*. A key problem of parasitoids is to find their hosts. *L. distinguendus* is attracted by the odor emitted from larval faeces (Steidle & Schöller, 2002). *C. tarsalis* is attracted by healthy and damaged grain as well as host faeces and larval trails (Collatz, unpublished).

Distances over which odors can be detected by wasps were determined for the parasitoids mentioned before. The active space of different odor sources such as damaged grain or larval faeces was detected in Plexiglas boxes to show up to which distance the parasitoids are able to find their hosts. Preliminary results show that the effect of odors spread only by diffusion seems to be shorter than expected. Consequences for the application of the three parasitoid species for biocontrol in storage buildings will be discussed.

Collatz, J.; Shcherbakov, D.; Steidle, J. L.M.: (unpublished): Travelling in space and between spaces-locomotion behavior of *Cephalonomia tarsalis* (Ashmead) in response to host-associated odors

Steidle, J. L.M.; Schöller, M. (2002): Fecundity and ability of the parasitoid *Lariophagus distinguendus* (Hymenoptera: Pteromalidae) to find larvae of the granary weevil *Sitophilus granarius* (Coleoptera: Curculionidae) in bulk grain. *Journal of Stored Products Research* 38 (2002) 43-53

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Section 06 - Poster F-20

Is Phylloxera a returning wine pest in Viennese vineyards?

S. Specht, T. Koennecke, C. Aigner, N.C. Lawo & A. Forneck

Around 1863 the grape phylloxera, *Daktulosphaira vitifoliae* Fitch, was introduced from North America to Europe. In Austria phylloxera firstly appeared in 1872 in Klosterneuburg and quickly became known as a devastating vine pest. The major damage is caused by their sucking activity on the roots resulting in nodosities and tuberosities, causing the eventual death of the vine. So far, plant protection may only be achieved by grafting European *Vitis vinifera* cultivars on tolerant American rootstocks

To assess any phylloxera abundance around Viennese vineyards on leaf-forming rootstocks, four different areas were monitored. Over the vegetation period in 2010 its occurrence and distribution was assessed and rated in nine categories. During May first leaf-galls appeared finding its peak density in August to the beginning of September followed by a decline until the middle of October. Over the period of time when leaf-galling phylloxera found their peak on rootstocks some leaf-galls could even be found in cultivated *Vitis vinifera* vineyards.

Based on our results we assume that leaf-forming rootstocks provide the source to infest cultivated *V. vinifera* vineyards. However, to draw any conclusions more observations over several years and areas are needed.

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Section 06 - Poster F-21

**Hear ye!
Are females of *Chorthippus biguttulus* able to hear how big and how healthy a conspecific male singer is?**

N. Stange

Many gomphocerine grasshoppers use acoustic communication to attract and to localize their mates. The “songs” are produced by rubbing the hind legs against a vein on the forewings. Typically males stridulate to attract females, but in several species a duetting mode of communication has evolved: females respond to the song of a conspecific male if they are inclined to mate. As males provide only sperm while females invest heavily in large eggs, the situation is typical for sexual selection. Females of the grasshopper *Chorthippus biguttulus* were indeed found to be choosy. Additional evidence exists that females evaluate males on the basis of their songs, i.e. the presence of certain attractive features. What acoustic features confer attractiveness to a song is currently investigated in behavioral experiments. We want to know what information about the potential quality of a male singer a female can extract from a heard song. In order to be useful indicators songs should be an honest signal. Do songs contain any reliable cues about the morphology or the immune competence of the singers? Special attention was given to features that are known to be decisive for acceptance of the song as stemming from a conspecific male. We found significant correlations between both song characteristics, the morphology and the immunocompetence.

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Section 06 - Poster F-22

Octopamin- und dopaminabhängige Neuromodulation des Suchverhaltens bei Parasitoiden

J.M. Uhlig, A. Thiel & T.S. Hoffmeister

Das räumliche Suchmuster und die zeitliche Allokation des Suchaufwandes über mehrere Patches hinweg bedingen die Sucheffizienz eines Tieres. Auf Grund der Variabilität der Umweltbedingungen müssen dabei beide Parameter auf der einen Seite eine hohe Plastizität in Reaktion auf unterschiedliche ökologische und artspezifische Bedingungen aufweisen, andererseits jedoch hochpräzise in der individuellen Suchsituation wirken können. Interessanterweise ist bislang kaum untersucht worden, welche physiologischen Mechanismen Systeme bereitstellen können, die beide Anforderungen vereinen. Auf der Basis von Ergebnissen, hauptsächlich aus der Bienen- und *Drosophiliden*-Forschung, haben wir uns entschieden, Neuromodulatoren einzusetzen, um am Beispiel von Parasitoiden die proximalen Grundlagen zu klären, mit denen Tiere nahezu optimales Suchverhalten erreichen. Parasitoide gelten auf Grund der intimen Kopplung von erfolgreicher Suche und Darwinscher Fitness als ideale Systeme zur Untersuchung des optimalen Suchverhaltens. Die vorhandenen theoretischen, empirischen und statistischen Grundlagen ermöglichen uns, klare Vorhersagen zu treffen, bezüglich des erwarteten Verhaltens und dessen ereignisabhängigen Veränderungen, wenn wir Octopamin und Dopamin als Neuromodulatoren experimentell einsetzen, um die Patchzeitallokation und das patchspezifische Suchmuster bei Parasitoiden zu manipulieren. Sie erlauben uns außerdem, den Einfluss dieser Neuromodulatoren auf positive wie negative Erfahrungen präzise statistisch analysieren zu können. Dieses Projekt ist unseres Wissens das erste, das sich mit den neurophysiologischen Grundlagen des optimalen Suchverhaltens bei Parasitoiden beschäftigt und stellt einen Ansatz zur Verbindung verhaltensökologischer und neurobiologischer Forschung dar.

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Section 06 - Poster F-23

Insektizide Wirkung sekundärer Inhaltsstoffe in *Parthenium hysterophorus* L.

Ch. Ulrichs, I. Roth, C. Büttner, T. Tessema & I. Mewis

Das einjährige invasive Wildkraut *Parthenium hysterophorus* L. (Parthenium) aus der Familie der Asteraceae ist in Süd-Amerika und um den Golf von Mexiko heimisch. In den letzten 50 Jahren wurde es nach Australien, Afrika und Indien eingeschleppt. Die Pflanze produziert allelopathische Substanzen – vorrangig Sesquiterpenlactone und Phenolsäuren - und gibt diese an ihre Umwelt ab. Extrakte von Parthenium untersucht wurde, ob die in Parthenium enthaltenen sekundären Pflanzeninhaltsstoffe eine insektizide und fraßabschreckende Wirkung auf verschiedene Blattlausarten (*Lipaphis erysimi*, *Aphis fabae*, *Myzus persicae*) besitzen. Hierzu wurden zunächst einfache Wasser- und Ethanol-Extrakte hergestellt, welche dann mittels HPLC analysiert wurden. Nachgewiesen werden konnten die Sesquiterpenlactone Parthenin und Coronopilin sowie die Phenolsäuren Chlorogensäure, Vanillinsäure, Kaffeesäure und drei verschiedene Isochlorogensäuren. Mit den Extrakten wurden kontakt-insektizide, systemisch-insektizide und fraßabschreckende Versuche durchgeführt und die Insektenentwicklung überprüft.

Mit Parthenium-Extrakten auf Wasserbasis konnten im Freiland Befallsraten von *L. erysimi* auf *Brassica juncea* um 70,7 % in drei Tagen reduziert werden. In Laborversuchen wurden mit Ethanol-Extrakten, die auf *A. fabae* gesprüht wurden, ähnlich hohe Mortalitätsraten (80 %) gemessen. In Versuchen zur systemisch-insektiziden Wirkung konnte der Befall von *M. persicae* auf *Brassica campestris* ssp. *chinensis* nach vier Tagen um 100 % reduziert werden. Eine kontakt-insektizide Wirkung der Extrakte ließ sich nicht nachweisen. Weiterhin zeigten Wahlversuche mit Wasser- und Ethanol-Extrakt behandelten Blättern von *Carthamus tinctorius*, dass die Extrakte eine repellierende Wirkung auf *A. fabae* haben.

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Section 07 - Poster G-01

A beetle-fungus symbiosis – physiological adaptations and indications for an evolutionary conserved relationship

G. Holighaus & S. Schütz

In the past 60 myr agriculture has independently evolved in ants, beetles, termites and not least in humans. Associations range from gathering to true “gardening” and favoured evolution of complex sociality. In a member of the primordial beetle superfamily Lymexyloidea, we found a strong semiochemical based interaction with its fungal cultivar, an ectosymbiotic yeastlike fungus. We investigated host tree and symbiont odours and the beetles perception by means of coupled gaschromatography-electroantennography (GC/MS-EAD, EAG). Trap experiments unraveled their behavioural importance. The olfactory system of the beetle *Elateroides dermestoides* turned out to be highly adapted towards specific fungal symbiont metabolites. Behaviourally those act as strong attractants and originate from an independent metabolic fungal pathway, as is deduced from chemical interrelationships. This interactive mechanism we found, suggests the presence of horizontal fungal transmission. Simultaneously the beetle passes the symbiont down generations by a mycetangium, a morphological key character of vertical transmission. Preference-performance hypothesis or fungal’s mating system may explain this coequal existence. Recently rediscovered amber fossils of *Elateroides* spec. and moreover a phoretic mite of the genus *Histiogaster* therein seem to resemble both the recent equivalent species. This suggests an origin of this symbiotic community of 30-60 mya and hints at a possible evolutionary origin of symbioses based upon infochemicals.

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Section 07 - Poster G-02

Molekulare Charakterisierung und Lokalisierung obligater Endosymbionten in Bodenwanzen, speziell in den Gattungen *Kleidocerys* und *Chilacis* (Heteroptera: Lygaeidae).

S. Küchler, K. Dettner & S. Kehl

Viele Vertreter der Gruppe Heteroptera sind mit spezifischen, bakteriellen Endosymbionten assoziiert, die zum einen extrazellulär in speziellen Darmanhängen (Caeca) oder intrazellulär in Bakteriomen bzw. Mycetomen lokalisiert sein können. Insbesondere die Familie der Lygaeidae weist diverse Formen der bakteriellen Unterbringung auf. Diese reichen von einer einfachen Darmsymbiose über die intrazelluläre Lokalisierung der Symbionten in Darmepithel, Fettkörper und Mycetomen.

In der vorliegenden Arbeit werden die verschiedenen Symbioseformen der Lygaeiden vorgestellt. Besonders Augenmerk gilt hierbei der Charakterisierung und Lokalisierung obligater Endosymbionten in *Kleidocerys resedae* und *Chilacis typhae*. Unter Anwendung von Fluoreszenz *in situ* Hybridisierung (FISH) konnte die Verteilung und Übertragung der symbiontischen Bakterien innerhalb adulter und larvaler Individuen aufgeklärt werden. Elektronenmikroskopische Aufnahmen (TEM) dienen der ultrastrukturellen Analyse. Abschließend erlaubten phylogenetischen Berechnungen, basierend auf den bakteriellen Genen von 16S rRNA und *groEL*, die phylogenetische Verwandtschaft der Symbionten zu ermitteln.

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Section 07 - Poster G-03

Wolbachia Infection in the Walnut-Husk Fly *Rhagoletis completa* (Diptera: Tephritidae)

H. Schuler, W. Arthofer, S. Krumböck, C. Bertheau & C. Stauffer

The Walnut-Husk Fly *Rhagoletis completa* is a serious pest of walnut trees. Native to North America, this species was introduced to Europe around 1990. *Wolbachia* is an endosymbiotic bacteria present in approximately 65% of insects. This bacterium manipulates the reproduction and causes male-killing, parthenogenesis, feminization and cytoplasmatic incompatibility.

Several tephritid-species as well as different *Rhagoletis* species like *R. cerasi*, *R. cingulata* and *R. pomonella* have been described to be infected by *Wolbachia* strains. Here, the detection of *Wolbachia* in an Austrian *R. completa* population applying PCR with *wsp* primers followed by Southern hybridization will be presented. Possible effects and application for biocontrol will be discussed.

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Section 07 - Poster G-04

Multiple *Wolbachia* Infections in *Rhagoletis pomonella* (Diptera, Tephritidae)

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Rhagoletis pomonella Walsh (Diptera: Tephritidae) is a model species for sympatric speciation through host race formation on apple and hawthorn. The bacterial endosymbiont *Wolbachia*, a manipulator of arthropod reproduction, is considered as a cofactor for speciation. *R. pomonella* was never carefully screened for the presence of *Wolbachia*. In this study we isolated *Wolbachia* from *R. pomonella* individuals from both host plants using Multi Locus Sequence Typing (MLST) and the surface protein *wsp*. By cloning and sequencing of 311 plasmids we found sequence types of at least four *wPom* strains. A complete MLST profile was obtained only for *wPom1* while MLST loci of the other putative strains were difficult to assign due to multiple infections and low frequencies. *wPom1* occurs in both host races whereas different sequence types were found at low frequencies only in apple infesting *R. pomonella*.

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Section 08 - Poster H-01

Upper thermal limits of honeybee (*Apis mellifera*) and yellowjacket (*Vespula vulgaris*) foragers

H. Käfer, H. Kovac & A. Stabentheiner

The viable temperature range of bees and wasps differs fairly. The ability of bees to heat-ball and kill predating wasps is an example for this difference at the higher end of their temperature range. We investigated whether their differing operational temperature ranges coincide with different upper thermal limits (critical thermal maxima, C_{Tmax}).

Following a standardized thermolimit respirometric procedure, we increased temperature up to 55°C at a rate of 0.25°C min⁻¹ for forager honeybees and vespine wasps. C_{Tmax} was defined as the temperature where visually observable activity ceased and cyclic CO₂ production stopped. The honeybees ($C_{Tmax} = 49.05^{\circ}\text{C}$, SD = 2.6, n = 11) deviated significantly from the yellowjackets ($C_{Tmax} = 44.87^{\circ}\text{C}$, SD = 1.34, n = 10; p<0.001, t test). Furthermore we recorded differences in the pattern of CO₂ production at the upper end of the insects' viable temperature ranges.

Our results revealed that the death of the wasps during heat-balling is caused by a failure of respiration at a lower temperature (C_{Tmax}) than in the bees. The different thermal preferences and operational temperature ranges of honeybees and vespine wasps (with the yellowjackets' one clearly shifted to the lower end of the scale) coincide with differences in critical thermal maxima.

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Section 08 - Poster H-02

Peptide profiling of the retrocerebral complex and characterisation of an adipokinetic hormone and short neuropeptide F in diapausing and non-diapausing cherry fruit flies *Rhagoletis cerasi* (Diptera: Tephritidae)

K. Köppler & C. Wegener

Data from blowflies suggest that peptidergic secretory neurons in the pars intercerebralis and pars lateralis play a role in diapause control of Dipterans. These neurons typically terminate in the retrocerebral complex (consisting of corpora cardiaca and corpora allata), where their peptide cargo is stored and hormonally released into the hemolymph. The neurohormonal control of diapause is, however, only poorly understood.

To address the role of peptides in the neuroendocrine control of diapause, we compared peptide profiles of the retrocerebral complex of diapausing and non-diapausing strains of *Rhagoletis cerasi*, a univoltine severe pest species in cherries. Though *R. cerasi* normally shows an obligatory diapause, non-diapausing individuals occur occasionally in different populations (Köppler, 2008). Direct matrix-assisted laser desorption ionization-time-of-flight (MALDI-TOF) mass spectrometric profiling indicates the presence of at least 12 different abundant peptides in the *Rhagoletis* retrocerebral complex. While the identity of most of these peptides remains unknown, we were able to characterize the adipokinetic hormone and the short and long form of short neuropeptide F1 (sNPF1) by tandem mass spectrometry. *Rhagoletis* AKH, sNPF1 and sNPF₄₋₁₁ are sequence-identical to the homolog peptides in *Drosophila* species and the cabbage root fly *Delia radicum*. This shows that these peptides are well conserved throughout the Schizophora. Interestingly, a mass peak indicating the highly conserved peptide hormone corazonin was not found in *Rhagoletis*. This may suggest that corazonin is either not stored as a hormone, or does not occur in the usual sequence. A qualitative difference of the peptide profile between diapausing and non-diapausing flies could not be found. It seems thus unlikely that the presence of diapause correlates with a simple presence or absence of a specific peptide hormone in the retrocerebral complex of the cherry fruit fly.

Köppler, K. 2008. Occurrence of non-diapausing pupae in *Rhagoletis cerasi* L. 6th TEAM Newsletter: 6-8.

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Section 08 - Poster H-03

The body temperature of hornets (*Vespa crabro*) and wasps (*Vespula sp.*) during takeoff and landing at the nest entrance

H. Kovac, A. Stabentheiner

The hornet (*Vespa crabro*) is the largest species of vespine wasps in Middle Europe. The thermoregulatory capacity of some insect groups is related with their body mass. Therefore we investigated the body temperature of hornets in comparison with two other smaller vespine wasps (*Vespula vulgaris*, *Vespula germanica*). By means of infrared thermography the surface temperature of thorax (T_{th}), head (T_{hd}) and abdomen (T_{ab}) was measured before departure and after arrival at the nest entrance. The entire range of ambient temperature (T_a : ~0-40°C) where the insects exhibited flights was investigated.

At the departure the mean T_{th} of *Vespula* was rather constant at a high level (T_{th} =36.0-37.5°C). However, the T_{th} of the hornets showed a stronger variation. It was high in the cold (T_{th} =38.5°C), decreased by ~5°C at medium T_a , and increased again to above 38.5°C when it was warm. At the arrival at the nest entrance after foraging flights the temperature of both, wasps and hornets, was quite similar. It was constant at low T_a <10°C (T_{th} ~30.0-31.5°C) and increased nearly linearly with T_a at T_a >10°C (T_{th} ~30.0-40.0°C). The hornets' thorax temperature was mostly ~1°C higher than that of the wasps. The thorax temperature excess ($T_{th}-T_a$) as a measure of the endothermic activity decreased strongly with T_a both at departure and arrival. The excess temperature of *Vespula* was ~2°C higher than that of the hornets during takeoff, but ~1.5°C lower after landing. The decline of the landing temperature excess with increasing T_a reveals that both *Vespa* and *Vespula* are able to regulate the body temperature in flight.

Despite the big difference in body weight of *Vespa* (477.5±60.0 mg, n=50) and *Vespula* (82.7±18.3 mg, n=170) they exhibited astounding similarities in the thermoregulative behavior during arrival and departure at the nest entrance.

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Section 09 - Poster I-01

A novel technology for protein expression in insects

G. R. Makert, S. Chabierski, N. Delaroque, M. Giese, M. Szardenings & S. Ulbert

This study describes an efficient and simple method to express foreign proteins in insects via feeding of plasmid DNA. For the proof of principle, the mealworm *Tenebrio molitor*, the fly *Musca domestica*, and the honey bee *Apis mellifera* were fed with a plasmid encoding the Enhanced Green Fluorescence Protein (EGFP). The DNA was mixed with the food specific for the species tested (sugar water or dry meal) and exposed to the animals up to several days. EGFP expression was detected over a period of several days by fluorescence microscopy and western blot. The protein was found in a variety of tissues in all insects analyzed, and no toxic side effects were observed. Furthermore, feeding of a plasmid coding for the arthropod-specific neurotoxin ω -atracotoxin Hv1a led to statistically significant mortality in insects, in comparison to control DNA. These results demonstrate that it is possible to transiently transfect insects via orally applying plasmid DNA and are applicable in several fields of biotechnology, including recombinant protein expression and insect pest control strategies.

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Section 09 - Poster I-02

**A portable GC-MS-EAD-SOMMSA device with multiple enrichment techniques –
The in situ - analysis of volatiles by mass spectrometric, antennal and sensory
response**

M. Schott, T. Gasch, C. Wehrenfennig, R.-A. Düring & A. Vilcinskas

In the context of the joint project LOEWE AmbiProbe – “Mass spectrometric *in situ* - analysis in the sectors health, environment, climate, and safety”, a transportable device to screen insect chemicals with a novel combination of analytical systems has been developed. So far, odour samples, which were, for example, gained by closed loop stripping analysis (CLSA), or even the entire insect had to be taken to a lab to analyse the associated volatiles via a gas chromatograph-mass spectrometer (GC-MS) and coupled electro-antennographic detector (EAD). The transport to a lab is time-consuming and may invalidate results. Hence, the endeavour of this project is to establish a portable GC-MS-EAD with a sensory array that provides the possibility of analysing volatiles perceivable by insects on site. The stream of volatiles sensed with the antenna is directly connected to a selective odorant measurement of a multi-sensor array (SOMMSA) of metal-oxide semiconductor (MOS) gas sensors. This combination offers the opportunity for a fast screening of sensory response to biological substances and to form the base on which highly sensitive biosensors and biomimetic sensors could be developed. As a consequence, we will be able to compare antennal and sensory response with respect to sensitivity and selectivity. In order to intensify the volatile concentration our system is equipped with solid phase microextraction (SPME) and in-tube extraction (ITEX). This poster will present the first insights into our studies.

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Section 10 - J-01

Honey bee maize pollen foraging in differently structured landscapes: Colony and single worker exposure to an important GM crop

S. Härtel, N. Danner, A. Schneider & I. Steffan-Dewenter

Abstract: Honey bees use pollen of a broad range of genetically modified (GM) crops as protein source. This makes honey bees a key non target organism (NTO) in risk assessment of transgenic crops. Despite its outstanding role as NTO, comprehensive information about the exposure of honey bee colonies or single worker bees to important GM crops in a landscape context is lacking so far. Here we studied the pollen content of the bee rectum and the amount of maize pollen collected in pollen traps in a range of maize field covers. We experimentally compared twelve complex agricultural landscapes with an increasing proportion of maize fields and varying availability of alternative food resources. A honey bee colony was placed in the centre of each landscape at the beginning of the maize pollen shedding period. Pollen traps were used to record the pollen spectrum collected by each colony. Pollen analysis of the recta of nine days old nurse bees (N=10 /colony) was used to analyse the individual ingestion of pollen. Our results show a strong correlation between the pollen diversity in the pollen traps and the ingested pollen composition within the gut of individual bees. Thus, pollen analysis of the rectum of individual worker bees could be used as a representative monitoring method to measure the pollen intake on a landscape scale. Our experimental data also suggest that the contribution of maize pollen to the protein diet of honey bee colonies is of minor importance. We recommend that studies to assess colony and single worker exposure to GM pollen on a landscape scale should be taken into account when establishing GM crop environmental risk assessment schemes for honey bees.

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Section 11 - Poster K-01

Latitudinal and altitudinal variation of the leafminer flies *Liriomyza huidobrensis* and *L. sativae* (Diptera: Agromyzidae) in low and highland regions of Peru.

N. Mujica & J. Kroschel

Leafminer flies (Diptera, Agromyzidae) are important agricultural pests worldwide. The objective of our study was to assess the distribution and relative importance of *Liriomyza huidobrensis* (Blanchard) and *L. sativae* Blanchard covering a distinct gradient from tropical to subtropical climate, and two altitudes. The study comprised two surveys during the main vegetable growing seasons in ten major vegetable production regions along the Peruvian coast from Tumbes (0°01'11" S) in the North to Tacna (18°21'05" S) in the South of Peru. Complementary studies on *L. huidobrensis* were made at two altitudes (500 and 3200 m above sea level) with potato (*Solanum tuberosum* L.) and faba bean (*Vicia faba* L.) as host plants. Abundance of the two leafminer fly species was influenced by the different climatic conditions along the Peruvian coast. The most dominant species was *L. huidobrensis* (76.6%) collected from eight regions and 23 crops with the highest incidence on faba bean bean (*Phaseolus vulgaris* L.), pea (*Pisum sativum* L.) and tomato (*Lycopersicon esculentum* Mill.). *L. sativae* was the second most dominant species (20.7%) but occurred mainly in the northern part of Peru. *L. huidobrensis* populations were affected by altitude, with higher adult population in lowland (1199.7±24.5 adults/trap/week) than highland (699.7±18.2 adults/trap/week) zone. According to our surveys, *L. huidobrensis* is clearly more abundant and adapted to the subtropical desert climate (average temperature of 19°C) of the central and southern coastal region south of Lambayeque, while *L. sativae* prefers the dry tropical climate (average temperature of 24°C) of the northern region. With regard to altitude, the coldest months (lowest mean temperature with low solar radiation and high rel. humidity) in the lowland zone and the rainy season (highest mean temperature, rel. humidity and precipitation) in the highland zone presented the most favorable conditions to increase the *L. huidobrensis* populations.

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Section 11 - Poster K-02

The male dimorphic damselfly *Paraphlebia zoe* (Odonata: Megapodagrionidae) in a Mexican cloud forest: site fidelity and related behavioural aspects

J. von Tschirnhaus, M. Rös & U. Schulz

Odonates have a wide and complex repertoire of territorial and reproductive behaviour. The males of some species even show evidence of correlated dimorphism in their morphology and behaviour. This has been proven for the neotropical damselfly *Paraphlebia quinta* Calvert 1901, for example, and more recently for *Paraphlebia zoe* Selys in Hagen 1861, too. *P. zoe* is endemic to Mexico and occupies specialized habitats such as seepages located in mountain cloud forests. The dimorphic males of *Paraphlebia zoe* are black-winged (BW) or hyaline-winged (HW).

On a small stream within a cloud forest in the Mexican state of Puebla, 410 *Paraphlebia zoe* adult males (BW and HW) and females were individually marked. The duration for which individuals remained at a given site was determined over a 66-day period and the dispersal distances and directions of marked males leaving the sites of initial observation were studied. Territorial behaviour of the different male phenotypes was observed during surveys. BW males were found to have high site fidelity, holding small territories for at least 66 days. HW males occupied larger areas and were present within these for shorter periods. Females were not found to have site fidelity. Site changes among BW males occurred infrequently and distances were mostly short. BW males generally perched close to the ground and behaved aggressively towards BW males and towards HW males, whereas HW males perched in higher vegetation and only behaved aggressively towards individuals of their own phenotype.

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Section 12 - Poster L-01

Cryptic or scarce: Distribution of the tick parasitoid *Ixodiphagus hookeri*

C.-T. Pfaff, J. Collatz, U. Mackenstedt, P. Selzer, R. Oehme & J. L.M. Steidle

The chalcid wasp *Ixodiphagus hookeri* is a parasitoid of ticks, which makes it a potential candidate for the biological control of ticks. However, much more information on the natural behaviour and distribution of the wasps is needed.

In this study the parasitization rate of *Ixodes ricinus* with *I. hookeri* on different sites in Germany was investigated by rearing the wasps from collected ticks or by detecting the wasps' DNA with the help of realtime-PCR. *I. hookeri* was found on all the investigated sites.

To study abiotic factors from natural habitats of *I. hookeri*, Ellenberg Indicator Values of plants occurring at wasp sites were determined. This allowed a first description of the ecological niche of the wasps.

Earlier studies showed that the wasps use odours of bigger mammals like wild boar or deer to find suitable tick hosts on mammals. This led to the hypothesis that parasitization rates of ticks at sites correlates positively with mammal density. However, preliminary data are contradictory to this hypothesis.

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Section 12 - Poster L-02

**The breeding habitat preferences of *Obsoletus* complex *Culicoides* species
(Diptera: Ceratopogonidae)**

D. Werner, C. Bauer, C. Schulz & H. Kampen

During the vegetative periods from March to December 2007 to 2010, insects were collected by emergence traps from various kinds of animal dung. The traps were set up on fresh, several-days-old, and piled-up decomposing dung produced by cattle, sheep, horses, llamas and ducks on eight animal holdings in Germany. For comparison, UV light traps were operated on the same farms. Culicoid biting midges were sorted from the catches and were identified to species by morphological characters. The focus of the study was on the sibling species of the *Obsoletus* complex and, within this complex, on males as only these can be reliably identified to species morphologically, by their genitalia. While the UV light trap collections generally contained the four most frequent and widely-distributed *Obsoletus* complex species in Germany at all sites, differences occurred regarding the origin and age of the dung from which they emerged. *Culicoides obsoletus* was mainly found to emerge from the several-days-old decaying dung of cows and llamas, *C. scoticus* from the rotten dung of sheep and horses, and *C. chiopterus* and *C. dewulfi* from rotten cow dung as well as from dung of mixed composition older than 10 days. *Culicoides chiopterus* also developed in decaying duck faeces. The detection of preimaginal stages of the *Obsoletus* complex in emergence traps indicates that the dung of different animal species is a suitable breeding habitat for these *Culicoides* species. This result holds out great promise for targeted vector control as species of the *Obsoletus* complex appear to play important roles in the transmission cycle of bluetongue virus in Central and Northern Europe.

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Section 13 - Poster M-01

Capture efficiency of pitfall traps is highly affected by sampling interval

S. Buchholz, S. Lenze, D. Katzmann & J. Schirmel

Pitfall trapping is the most frequently used sampling method for the study of surface-dwelling arthropods. Many factors such as the choice of the preservative or the trap design influence the efficiency of pitfall traps and the composition of their catches. But to date the impact of different sampling intervals has been poorly analysed. The aim of this study was to investigate the effect of three sampling intervals (weekly, fortnightly, monthly) on a broad spectrum of arthropods usually captured in pitfall traps (Apidae, Araneae, Carabidae, other Coleoptera, Formicidae, and Isopoda). We compared these sampling intervals by installing 15 pitfall traps per sampling interval in a grid consisting of nine rows with five traps in each row resulting in a total of 45 pitfall traps.

Statistical tests (one-way ANOVA, Kruskal–Wallis test) revealed that capture efficiency was highly affected by the sampling interval. For almost all studied arthropods the number of caught individuals decreased with longer sampling intervals. Thus, to achieve higher catch numbers shorter sampling intervals should generally be preferred although certain disadvantages like disturbance effects on flora and fauna have to be considered.

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Section 13 - Poster M-02

Ground beetle and spider communities of arable fields under different crop rotation

B. Peters, S. Kanz & M. Schindler

Spider and ground beetle communities of arable fields are directly and indirectly influenced by farming. Different farming operations as well as vegetation structure, soil parameters and microclimatic conditions can affect these invertebrates.

In the present study ground beetle and spider communities of arable fields in the intensively managed agricultural region "Zülpicher Börde" in North Rhine-Westphalia were examined. We compared arable fields of farms participating the agri-environmental scheme "diversified crop rotation" (DCR) as well as fields of farms cultivating narrow crop rotation (NCR). Commitments of DCR farms are e.g. the cultivation of at least five different main crops, at least seven percent legumes and a maximum of 66 percent of cereals. NCR farms cultivated only winter cereals and sugar beets. Studies were conducted in 2009 and 2010 on 11 farms (4 DCR farms, 7 NCR farms). Ground beetles and spiders were caught with pit fall traps (6 per field). Altogether 19 winter cereal fields, 19 sugar beet fields and 6 fields with legumes were investigated. Different landscape characteristics were recorded.

In total 55 ground beetle and 57 spider species were trapped. We found a higher number of ground beetle species (Median) in winter cereals on DCR fields whereas the species number in sugar beets was higher on NCR fields. Mean number of spider species (Median) in both crops was higher on DCR fields. In contrast the activity density of ground beetles was higher on NCR fields and the one of spiders on DCR fields. Our analysis revealed a higher ground beetle diversity (SHANNON) and evenness in winter cereals on DCR fields. Highest spider diversity and evenness was found on NCR fields. The results indicate a weak effect of higher local crop diversity only on ground beetle diversity. Further analyses suggest a positive impact of uncultured areas on the local diversity of ground beetle and spider communities of arable fields.

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Section 13 - Poster M-03

Effects of generalist root feeders (*Agriotes* spp larvae, Coleoptera: Elateridae) on grassland plant species

I. Sonnemann & S. Wurst

Generalist root feeders likely influence plant community structure because (i) they may preferentially feed on certain plant species and (ii) plant species may differ in their ability to cope with the root herbivore attack.

In two greenhouse experiments we investigated the impact of *Agriotes* spp larvae on grassland plant species. In the first experiment, 9 grassland plant species belonging to 3 functional groups were grown separately either with or without larvae. For herbs and grasses, the root herbivores reduced total plant biomass independent of plant species or group. Contrastingly, legume species were not affected by the root herbivores. Growth of *Agriotes* larvae was positively correlated with root biomass, but did not depend on plant species or group. In a second experiment, a community of six grassland plant species was grown in soil biota communities from two different grassland sites, either with or without larvae. Under interspecific competition, shoot biomass of two plant species out of six was decreased and increased, respectively, in the presence of the root herbivores, and this effect depended on the soil biota community. In a second phase, the plant community was grown in the previously herbivore-affected (trained) or unaffected (untrained) soil, again with or without larvae. In herbivore-trained soil, root colonization by AMF arbuscules measured in a model plant species, was less negatively and positively affected by larvae in the two soil communities, respectively, when compared to untrained soil. The decrease in shoot biomass by larvae was found for the same plant species again, whereas the positive effect on the second plant species disappeared in herbivore-trained soil.

We conclude that *Agriotes* spp may change interspecific plant competition by (i) feeding on the roots that are most abundant, (ii) affecting certain plant groups more than others. However, their impact may vary depending on the background soil biota community that may be able to adapt to root herbivory.

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Section 13 - Poster M-04

Molecular identification of *Agriotes* larvae allows examining species-specific traits

K. Staudacher, P. Pitterl, N. Schallhart, C. Wallinger & M. Traugott

Click beetle larvae within the genus *Agriotes* (Coleoptera: Elateridae), commonly known as wireworms, are abundant ground-dwelling herbivores which can inflict considerable damage to field crops. In Central Europe up to 20 species, which are likely to differ in their distribution, ecology and pest status, occur in arable land. However, the identification of these larvae, based on morphological characters, is difficult or sometimes even impossible.

Here, we present a DNA-based approach to identify 17 *Agriotes* species typically found in Central Europe. Diagnostic sequence information was generated and submitted to GenBank/BOLD. Based on these barcodes, the respective *Agriotes* species can be identified. Moreover, multiplex PCR assays were developed, allowing the rapid identification of the nine most abundant species within a single-step reaction.

The molecular identification system was evaluated by screening 1,242 field-collected *Agriotes* larvae from 85 field sites in Austria. Using multiplex PCR, six different *Agriotes* species could be identified (*Agriotes brevis*, *A. litigiosus*, *A. obscurus*, *A. sputator*, *A. ustulatus* and *A. lineatus/proximus*). These data, in combination with abiotic field data, is currently being analyzed to examine how soil and climatic parameters may affect the distribution of *Agriotes* species in Austria.

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Section 14 - Poster N-01

Risk assessment of bark beetle outbreaks after an avalanche occurrence in the Dürrenstein Wilderness Area

E. Blackwell, P. Baier & A. Schopf

Differences of bark beetle (*Ips typographus*)- infestation rates between the interior of the forest stand and a newly created forest border by an avalanche event were studied for this diploma thesis. The effect of severe bark loss on *Picea abies* primary and secondary wound reaction was examined by resin flow measurements and inoculation experiments with pathogenic fungi.

The study was conducted after a massive avalanche event in the Wilderness Area "Dürrenstein", Austria in 2009-2010. Infestation rate and spread were observed over a 17 month period after the avalanche. Border trees exposed to the south were infested first. Trees with bark losses were infested later than non damaged border trees. Vital, standing trees were successfully colonised even in the first year after the avalanche occurrence as bark beetle populations were very high. Possible spruce bark beetle development, -spread and population increase based on climatic data was prognosed using the phenology model PHENIPS and by continuous field controls. The model proved to be a reliable tool as prognosed developmental stages were confirmed in the field. Primary resin flow of six border trees with severe bark losses was measured and compared to six non damaged trees in the forest stand interior. No significant differences were found between these tree groups. Anatomical and physiological tree variables (water content, number of resin canals, size of resin canals, number of epidermal cells, phloem thickness and bark thickness) only showed few significant differences (water content and phloem thickness). Individual variables are discussed in correlation with their geographical position within the stand. The forest border trees with severe bark losses expressed significantly larger secondary wound reactions than the non damaged equivalents in the forest stand. This was tested by inoculating the trees with the phytopathogenic fungi *Ceratocystis polonica* and measuring the secondary wound reaction. A significant negative correlation between the mean secondary wound reaction and the infestation date was found. In addition, the two resistance mechanisms (resin flow and secondary wound reaction) were in negative correlation to each other.

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Section 14 - Poster N-02

Effects of breeding density and dispersal flight on the reproductive fitness of the spruce bark beetle, *Ips typographus* L. (Coleoptera: Curculionidae, Scolytinae)

C. Böll, K. Dworschak, A. Gruppe & R. Schopf

The pheromone-mediated mass attack of *Ips typographus* L. (Coleoptera, Scolytinae) often results in high breeding densities, and, due to intraspecific competition, in lower lipid reserves in the offspring. Lipids are important for dispersal flight, overcoming host tree defence, boring brood systems, and, in females, for oogenesis. We thus hypothesized that (1) high breeding density reduces flight capacity of the offspring and that (2) high breeding density and/or flight affect colonisation and reproductive success. Therefore, beetles were reared at two densities in the laboratory (50 and 300 brood systems / m²). The dispersal potential of the offspring was measured for 24 h with flight mills. As control, beetles were kept in the same room for 24 h without flying. Flown and control beetles from both densities were settled on logs to initiate brood systems at low density.

Offspring from both densities did not differ significantly in flight capacity. Fresh mass was only a poor predictor of flight distance. Higher density and/or flight did not have any significant impact on survival, host entrance success, or the ability to establish brood systems. Flight distance, fresh mass loss or fresh mass after flight did not correlate with egg number.

However, breeding density caused significant changes in reproductive behaviour of the offspring. Within controls, females from high density bored longer egg galleries and deposited more eggs compared to those from low density. When flown, females from high density reduced egg number, whereas those from low density increased it. The proportion of egg mortality did not significantly differ between all groups.

Flown and control females from high density deposited their eggs less densely than those from low density. We assume that females which experienced high density during development pursue a strategy to reduce intraspecific competition in their offspring.

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Section 14 - Poster N-03

Beteiligung des Buchenprachtkäfers (*Agrilus viridis fagi*) am Vitalitätsverlust der Rotbuche nach Trockenstress

C. Brück-Dyckhoff

Viele ältere Buchenbestände in Bayern zeigen - insbesondere seit dem Trockenjahr 2003 - Vitalitätsverluste in Gestalt von Kronenverlichtungen oder auch dem Absterben ganzer Bäume. Der Waldzustandserhebung 2009 nach weisen mehr als die Hälfte der Buchen „deutliche Schäden“ auf. Im Rahmen des Themenkomplexes „Klimaänderung und Forstschädlinge“ des Klimaprogramms Bayern 2020 (KLIP) wurde Anfang 2010 ein Projekt initiiert, um die Rolle von *Agrilus viridis fagi* in diesem Schadgeschehen zu untersuchen.

Die Larven des ausgeprägt thermophilen Rindenbrüters legen weitläufige Fraßgänge unter der Borke an und können so Äste und je nach Befallsintensität auch ganze Bäume zum Absterben bringen. Für Baden-Württemberg ist ein Schadholzanfall von mehreren 100.000 Festmetern nach einer Dürreperiode Anfang der 50er Jahre dokumentiert. In Westungarn kam es erst in den letzten Jahren zu großflächigen Kalamitäten, an denen man *A. viridis* großen Anteil beimisst.

Der Käfer ist in den ersten Jahren des Befalls oft nur in den Baumkronen aktiv und bleibt so häufig lange unbemerkt. Daher wurden in verschiedenen Regionen Bayerns Beobachtungsbestände eingerichtet, in deren Kronenraum Fallenfänge durchgeführt werden. Zudem wurden dort Fangbäume ausgelegt, die von *A. viridis* zur Eiablage genutzt werden. So sollen Kenntnisse über den Massenwechsel unter verschiedenen Umweltbedingungen erlangt werden. Ferner werden bayernweit Hiebsmaßnahmen in Schadbeständen begleitet und die Kronen der gefälltten Bäume auf Befall durch *A. viridis* und andere Schadorganismen untersucht. Auf diese Weise soll ermittelt werden, ob und in welcher Intensität der Buchenprachtkäfer in vitalitätsgeschwächten Beständen aktiv ist und welche Faktoren Bestand und Einzelbaum möglicherweise disponieren. Ferner soll für die Forstpraxis abgeleitet werden, welche Standortbedingungen und welches waldbauliche Vorgehen das Befallsrisiko beeinflussen können.

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Section 14 - Poster N-04

Ground beetle communities of post-mining landscapes: State of colonization and small scale distribution pattern 15 years after recultivation

Brunk, I., F. Heubaum & M. Roth

Due to active and former military training areas and numerous brown-coal mining sites the landscape of Lower Lusatia (East Germany) can be characterized as highly disturbed. Especially soils of post-mining landscapes (PML) show extreme and hostile environmental conditions, like deep groundwater levels, nutrient poor and very acidic soils (soil-pH: 2 - 3) caused by Pyrite weathering, wide C-N-ratios, high electrical conductivity, enhanced solubility of aluminum and heavy metals, as well as an extreme range of daily ground temperature (maximum 49°C). To restore these landscapes different strategies were under experience.

One of these large PMLs is Nochten, ranging actually over 25 km². Restoration started about 15 years ago with amelioration and fertilization of the soils and subsequent afforestation using several model tree species. In the meantime Nochten is covered by a patchy landscape, with open areas characterized by natural succession, monocultures of *Pinus sylvestris*, *Quercus rubra*, *Robinia pseudoacacia* and few other tree species, respectively, as well as by a few mixed stands.

To study the colonization of these patches by ground beetles an investigation was carried out in 2010. We compared ground beetle communities of 15 year old stands of *Pinus sylvestris*, *Robinia pseudoacacia*, and *Quercus rubra*. In addition an open area with natural succession, and a mixed stand with *Quercus petraea*, *Betula pendula* and *Alnus glutinosa* were part of the study design. Altogether at 10 sites the composition of the ground beetle community was studied. Ground beetles were sampled in two-week intervals between April and October using pitfall traps. To reveal drivers of the ground beetle distribution pattern environmental parameters, including soil and vegetation parameters, as well as climatic (datalogger) and structural factors were collected on a small scale level at 1x1 m plots around the pitfall locations.

Altogether only very low numbers of individuals were found. Mean activity densities were extremely low, at most small-scale plots they sum-up to only 20 individuals or less per year. In total 51 species were sampled. They belong predominantly to xerobiontic and xerophilous species. Sample sites were well differentiated due to their respective species compositions of ground beetle communities. On small-scale numbers of species and individuals and also environmental variables were highly variable.

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Section 14 - Poster N-05

**Regulation of diapause of the European Spruce Bark Beetle *Ips typographus*
(Col., Scolytinae)**

N. Dobart & A. Schopf

The European Spruce Bark Beetle, *Ips typographus*, is an important economic pest in spruce forests in Central and Northern Europe, which is known for more than 200 years. To study the endocrine regulation of the diapause behaviour of *Ips typographus*, the influence of different photoperiods were analysed within different voltinism types: a multivoltine population from a lowland site, a mostly univoltine population from a subalpine region in Austria, and an obligate univoltine population from Northern Sweden (Vindeln).

It is known that within multivoltine populations, short-day conditions affect a facultative diapause in adult beetles, which arrest inside their host tree and suppress the gonadal maturation. Under long-day conditions, however, they attain sexual maturity shortly after developing to the adult stage and emerge from their host tree in order to establish a new generation. On the other hand, populations which show an univoltine behaviour apparently have an obligate diapause. When bred under different photoperiods, diapause was already initiated even under long-day conditions, the beetles showed no differences according to their breeding behaviour and respiration rate. Obligate univoltine beetles need to undergo a cooling period to terminate diapause. Those beetles, which undergo a cooling treatment, showed a higher oxygen-consumption and breeding willingness than those of the same age without the treatment. Compared to this, beetles from multivoltine populations showed already photoperiodic induced effects in their behaviour and physiological status without a cooling treatment.

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Section 14 - Poster N-06

Effects of predators on microsporidia transmission in forest Lepidoptera

D. Goertz & G. Hoch

The behaviour of predators can influence interactions between pathogens and hosts. Predators may avoid or prefer infected prey, may or may not become infected by the prey's pathogen, may distribute or remove pathogen inoculum from the environment of the prey/host and therefore enhance or reduce the transmission of the pathogen. We studied this topic for two microsporidian species, *Nosema lymantriae* and *Vairimorpha disparis*, infecting larvae of *Lymantria dispar* and two predatory insects, *Calosoma sycophanta* (Col., Carabidae) and *Formica fusca* (Hym., Formicidae). *C. sycophanta* spread the spores of both microsporidian species. Transmission of *N. lymantriae* and *V. disparis* to uninfected *L. dispar* test larvae increased 2.6 and 14.9 times, respectively, due to preying activities of the beetle. Contamination of cages with feces of *C. sycophanta* that had been feeding on infected prey resulted in new infections of 69 % and 46 % of test larvae, respectively. Additionally, we tested the effects of *C. sycophanta* on microsporidia transmission under more natural conditions. Transmission of *V. disparis* was increased by early predation likely due to earlier release of spores of this microsporidium, which are produced in the host fat body. Transmission of *N. lymantriae* was not affected. *C. sycophanta* itself never became infected with either microsporidian species. Workers of *F. fusca* avoided *Vairimorpha*-infected and preferred *Nosema*-infected over uninfected *L. dispar* larvae. Predation of infected larvae by *F. fusca* did not result in a higher transmission of either microsporidian species in the laboratory. Under more natural conditions, the presence of *F. fusca* did not affect transmission of *N. lymantriae*. Transmission of *V. disparis* was negatively affected; when *F. fusca* preyed on infected larvae late in the infectious period, transmission was reduced possibly due to the removal of latently infected gypsy moth test larvae. *F. fusca* never became infected with either microsporidian species.

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Section 14 - Poster N-07

Threatening new diseases in silver fir- current distribution, etiology, prospects and recommended actions

R. John

At present a complex disease threatens the silver firs in Baden-Wuerttemberg. The most striking symptom of this disease is a bark necrosis which usually develops as a consequence of an infection through the balsam woolly adelgid (*Dreyfusia piceae*) lasting over several years. Successive pests like the Norway spruce weevil (*Pissodes piceae*), the bark beetle of fir (European fir engraver beetle/ fir bark beetle/ silver fir bark beetle) and bark cancer attack the silver firs as a consequence. An important tree-species of nature-oriented forestry is thus endangered in Baden-Wuerttemberg, on which big hopes have been placed especially against the background of the naturally and anthropogenically induced climatic warming.

The disease primarily occurs in forest stands that are homogeneous as far as age is concerned, the stands are between 40 and 80 years old. The silver firs are affected in pure stands as well as in mixed stands (often with common spruce).

The trunks of the firs are colored white in several sequential years, this justifies itself by the occurrence of *Dreyfusia piceae* in several succeeding years. Thus develop resin and mucilage flow from branches, dead branches and cracks of the bark. Following blackening of the trunk arises as an effect of sooty molds. At the same time the cenk of *Neonectria* are to be found and it comes to crack formation in the bark. The infestation by secondary parasites such as Norway spruce weevils and fir bark beetles leads to fall of the needles in the summer. Afterwards drillings of wood peckers are very soon present. In the final stage it comes to peeling-off of the bark, particularly at the root collar are lots of pupal cells of Norway spruce weevils. The Norway spruce weevils can actually develop high populations. In the subsequent year this species can become quite primary then and attack also hardly before-damaged or even vital silver firs. Two years long fir stands were observed, attacked and non-attacked sample trees were taken and stem discs, needle and branches were analyzed. Nearly all trees attacked with balsam woolly adelgid showed a reduced growth in the years 2003 and 2006. This were years with very small precipitation, in which the trees were gussed in water stress. From there it can be concluded that the phenomenon occurs only in stands that have experienced previous (latent) damage through the periods of aridness in 2003, 2006 and 2009.

The endangered stands must be inspected in regular intervals. If there are current signs of honey fungus and/or larger bark necrosis and/or an infestation through *Dreyfusia piceae* (i. e. drillings of woodpeckers, flaking-off of the bark, round exit (hatch) holes of the juvenile beetles, pupal cells), then those trees should be immediately felled, removed from the forest or their trunks should be debarked. Thus the treatment of silver fir stands that are affected by these bark-brooding insects (Norway spruce weevil and the silver fir bark beetle) should be the same as in the case of bark beetle infestation (for example European spruce bark beetle).

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Section 14 - Poster N-08

Der Einfluss von Parasitoiden auf aktuelle Massenvermehrungen nadelfressender KiefernSchadinsekten

K. Möller

Die ausgedehnten, oft gering strukturierten Kiefernwälder des nordostdeutschen Tieflandes weisen sowohl im geschichtlichen Rückblick als auch in der Gegenwart eine hohe Disposition gegenüber Massenvermehrungen nadelfressender KiefernSchadinsekten auf. Flächige Insektizideinsätze unter Anwendung von Pflanzenschutzmitteln finden als letztes Mittel, bei existenzieller Gefährdung des Bestandes und ausschließlich auf Grundlage fachkundiger Begutachtung statt.

Es wird an Hand aktueller Beispiele im Land Brandenburg dokumentiert, wie Parasitoide Gradationen von KiefernGroßschädlingen beeinflussen können und bei Entscheidungen über Pflanzenschutzmaßnahmen Berücksichtigung finden.

Im Herbst 2005 konnte z. B. für 2.000 ha auf einen Insektizideinsatz gegen Kiefernspinnerraupen verzichtet werden. Zwergwespen, *Telenomus laeviusculus* (Hym., Fam. Scelionidae), hatten die Eier des Kiefernspinners, *Dendrolimus pini* (Lep., Fam. Lasiocampidae) zu fast 100 % parasitiert. Ein aktuelles Beispiel für die Wirksamkeit von Eiparasitoiden des Kiefernspanners, *Bupalus piniaria* (Lep., Fam. Geometridae) ließ sich 2008 beobachten. Die flächige Überwachung der Kiefernbestände hatte im Winter 2007/2008 auch für den Kiefernspanner Dichten angezeigt, die Kahlfraß und damit Bestandesschäden befürchten ließen. Mitte Juli konnte auf Grund hoher Anteile durch *Trichogramma evanescens* (Hym., Fam. Trichogrammatidae) parasitierter Eier Entwarnung gegeben werden. Für Raupen- und Puppenparasitoide von *B. piniaria* konnten Grenzen aufgezeigt werden. Bei der Forleule, *Panolis flammea* (Lep., Fam. Noctuidae) war in den vergangenen Jahren neben Witterungsextremen die Parasitierung der Puppen durch *Banchus*-Arten (Hym.; Fam. Ichneumonidae) häufigste Ursache des Zusammenbruchs von Massenvermehrungen.

Die Beobachtungen unterstreichen die große Bedeutung der Einbeziehung der natürlichen Gegenspieler in die Überwachung der Forstschädlinge, um Entscheidungen über Insektizideinsätze nach ökonomischen und ökologischen Gesichtspunkten abwägen zu können.

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Section 14 - Poster N-09

Online-Modellierung der Entwicklung und der Phänologie des Buchdruckers (*Ips typographus*) auf Basis des Modells PHENIPS und täglicher Wetter- und Prognosedaten des DWD

L.-F. Otto, P. Baier, J. Pennerstorfer & A. Schopf

Das Modell PHENIPS ermöglicht es, anhand entsprechender Klimadaten (Lufttemperatur, Sonneneinstrahlung) den Schwärm- und Befallsbeginn im Frühjahr, die Anzahl der möglichen (potentiellen) Generationen sowie das Diapause- und Überwintungsverhalten des Buchdruckers zu simulieren (Baier *et al.*, 2007). Die Eignung des Modells zur Darstellung der Buchdruckerentwicklung in Sachsen wurde anhand detaillierter Beobachtungen der Brutentwicklung und durch Messung der Rindentemperaturen in Fangbäumen sowie anhand der Daten des Fallenmonitorings in Sachsen geprüft. Unter Verwendung der Daten sächsischer Waldklimastationen wurde eine Anwendung zur täglichen Berechnung und Darstellung der Entwicklung des Buchdruckers in Form laufend aktualisierter Diagramme im Internet etabliert (Baier *et al.*, 2009) (<http://iff-server.boku.ac.at/PHENIPS-sachsen/index.htm>). Seit April 2010 ergänzt dieses online - Modell eine Anwendung zur Darstellung der Buchdruckerentwicklung auf Basis der täglichen Witterungs- und Prognosedaten von ausgewählten Stationen des Deutschen Wetterdienstes (DWD) in Sachsen und Thüringen (<http://iff-server.boku.ac.at/PHENIPS-DWD/>). Anhand der täglich aktualisierten Diagramme und der Regionalisierung der stationsbezogenen Modellergebnisse sollen für verschiedene Nutzergruppen (private und staatliche Waldbesitzer sowie Forstbehörden) wichtige Informationen und Handlungsempfehlungen für die örtliche Schwerpunktsetzung und die terminliche Planung adäquater Forstschutzmaßnahmen bereitgestellt und somit zu deren rationellen Durchführung beigetragen werden.

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Section 14 - Poster N-10

Phylogeography of the green oak leaf roller, *Tortrix viridana* (Lepidoptera, Tortricidae)

H. Schroeder & B. Degen

In Western Europe *Quercus robur* L. is the forest tree with the highest number of herbivorous insect species. One of these, *T. viridana*, is an oligophagous moth. Its defoliating larvae cause severe damage to various species of the genus *Quercus*. During the last ice age, the genus *Quercus*, besides many other species of forest trees, survived in refuges in southern and southeastern Europe. For *Quercus* spp., three glacial refuges are recognized on the basis of palynological and molecular phylogeographic analyses: The Iberian Peninsula, The Apennine Peninsula and The Balkans. Therefore the main question of our study is, if the glacial refuges of the pest species *T. viridana* correspond with that of its host.

We sequenced a 374 bp long part of the cytochrom oxidase gene, subunit I, of 264 individuals of *Tortrix viridana* from 17 locations in Europe. In total, we defined 47 haplotypes with one dominant haplotype (HT1) found in every population in different frequencies. The calculated pairwise genetic distances based on these haplotypes are moderate to high revealing, among others, significant differences between Finland and Hungary, respectively, and most of the other populations. Significant differences are not explained by an isolation by distance ($p > 0.1$). We identified Italy and France as possible ice age refuges for the green oak leaf roller because of high genetic diversity and very low genetic distances to most other populations. This result corresponds with the already known facts for the host species.

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Section 14 - Poster N-11

Analyse des Borkenkäferbefalls im Vorfeld des Nationalparks Bayerischer Wald im Jahr 2010

S. Weist, T. Wittensöllner & G. Lobinger

Ziel des Projektes ist die Überwachung und Analyse des Borkenkäferbefalls im Randbereich des Nationalparks und in angrenzenden Waldgebieten. In diesem Zusammenhang wird auch die Fragestellung einer möglichen Verlagerung des Käferbefalls aus dem Nationalpark heraus in benachbarte Wälder untersucht. Mit Anfang der Käfersaison finden kontinuierliche Datenerhebungen statt. Im wöchentlichen Turnus werden Monitoringfallen geleert und die Bestände auf Stehendbefall kontrolliert. Parallel dazu wird dauerhaft die Lufttemperatur gemessen, um daraus die Anzahl der potentiellen Schwärmstunden (unteres Schwärmlimit 16,5 °C) abzuleiten. Weiterhin wird der Entwicklungsfortschritt der Brut regelmäßig in Fanghölzern überprüft. Im Jahre 2010 kam es witterungsbedingt zu drei zeitlich abgesetzten Schwärmwellen der überwinterten Käfer. Die vierte Schwärmwelle kennzeichnet den Ausflug der ersten Jungkäfergeneration und der Geschwisterbrut, deren Entwicklung aufgrund niedriger Temperaturen sehr stark verzögert war. Bedingt durch Starkniederschläge und Wind war eine frühzeitige Befallsdiagnose nicht möglich. Neue Käferbäume wurden daher erst mehrere Wochen nach Befall aufgearbeitet. Nach Auswertung einer im Herbst 2010 durchgeführten Waldinventur lässt sich eine erhöhte Prädisposition der Waldbestände im Grenzbereich erkennen. In diesem Bereich lagen auch die höchsten Käferfangzahlen und Schadholzmengen vor, sodass von einer Gefährdung dieser Bestände 2011 ausgegangen wird.

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Section 14 - Poster N-12

Analysis of the bark beetle infestation in the border area of the Bavarian Forest National Park in 2010

S. Weist, T. Wittensöllner & G. Lobinger

The objective of the project is the monitoring and analysis of bark beetle infestation in the border area of the Bavarian Forest National Park and the neighboring tracks of forest. In context to this, the question of a possible transfer of the bark beetle infestation out of the National Park into neighboring areas will be analyzed. With the beginning of the bark beetle season, a continuous data collection is kept. The monitoring traps are emptied weekly and trees are controlled for new bark beetle attacks. At the same time the air temperature is measured to calculate the potential times of bark beetle flight (lower swarming limit = 16.5°C). Further, the developmental phases of the bark beetle brood are controlled in trap logs. In the year 2010, there were 3 discrete peaks of swarming activity. These beetles spent the winter in the soil or under the bark of trees. The fourth period of flight was signed by young beetles of the next generation. These insects had a delayed development stage, on account to low temperatures. Assuming the lower swarming limit of 16,5°C it was possible to find out the number of potential swarming hours. Due to strong precipitation and thunderstorms an early diagnosis of infection was not possible. That's why freshly infected trees could only be harvested several weeks after attack. Depending on the analysis of a forest inventory, in autumn 2010, a higher predisposition of forest stands at the border area close to the National Park was determined. In this area also, the most bark beetles were trapped and a lot of infected trees harvested. For this reason these stocks are more endangered to bark beetle infestation than somewhere else in the remaining experimental area.

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Section 14 - Poster N-13

Ultrastrukturelle Untersuchungen der Antennen von *Tomicus* spp. (Coleoptera, Curculionidae, Scolytinae)

A. Yvon & R. Wegensteiner

Borkenkäfer der Gattung *Tomicus* sind weltweit verbreitet. In Europa finden sich die beiden Arten *T. minor* und *T. piniperda* sowie im mediterranen Raum auch *T. destruens*. Zur Unterscheidung der drei Arten können nur bedingt morphologische Charakteristika herangezogen werden.

Mittels Rasterelektronenmikroskopie wurden die Fühler-Keulen der drei Arten untersucht und die Verteilung von Haar-ähnlichen Sensillen darauf verglichen. Es zeigte sich eine unterschiedlich dichte „Behaarung“ je Art – allen gemeinsam sind jeweils drei Nähte mit Sensillen, die auf der spindelförmigen Keule angeordnet sind. Signifikant unterschiedlich viele Sensillen finden sich im Vergleich der Arten insbesondere in den Regionen zwischen den Nähten und auf der Fühlerkeulen-Spitze. Eine geschlechtsspezifisch unterschiedliche Dichte der Behaarung ließ sich nur für *T. destruens* feststellen.

Die längsten Fühler-Keulen finden sich bei *T. destruens*, gefolgt von *T. piniperda*. *T. destruens* weist auch die breitesten Keulen auf, gefolgt von *T. minor*. Ein geschlechtsspezifischer Unterschied in den Maßen der Fühlerkeulen innerhalb der drei Arten konnte nicht festgestellt werden.

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Section 14 - Poster N-14

Effect of structural components of oak forests on canopy arthropod assemblages

T.M. Ziesche

Biodiversity research is a complex subject in forest ecosystems due to the three-dimensionality of the habitat and multifactorial impacts along a gradient of the canopy the understory and the soil communities. Although the formation and stability of the crown stratum has a major impact on single tree growth little is known about the diversity and composition of species assemblages of the upper story. Since forest production, especially of oak forests aiming at the growth of high valued trees, afford a defined strategy affecting the tree habitus (effects on tree height, crown dimension and structure, support of superior trees) a fundamental shift in microhabitat factors are to expect. Knowledge of the canopy insect assemblages in forest stands of different age is important for the understanding of ecosystem functions and the estimation of effects following active forest management.

In the present study, we describe effects of forest management on the diversity of arthropod assemblages (Coleoptera) of the canopy. The study focussed on the characterization of the canopy of managed and nature state oak forests (*Quercus petraea*), conservation aspects, microspatial distribution and risk factors.

We found the stand age and the management treatment having a strong impact on the differentiation of environmental parameters and the composition of species assemblages. Statistical analyses confirmed the ecological value of unmanaged and structural complex stands comprising a number of endangered and primeval forest species in mature and old growth forests. Moreover, forests of comparable age, but variation in stand structure revealed consistently different community structures.

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Section 15 - Poster O-01

Resistance and physiological differences in the rice weevil, *Sitophilus oryzae* (L.) (Coleoptera: Curculionidae) exposed to diatomaceous earth

Ch. Adarkwah, P.G. Fields, Ch. Reichmuth, C. Büttner, D. Obeng-Ofori, C. Adler & M. Schöller

DE-susceptible and DE-tolerant *Sitophilus oryzae* (L) adult insects were compared for water loss, speed of movement and progeny production. For all the tests, the diatomaceous earth Protect-It™ was used at the dose of 0.3 g/kg wheat and exposed for 7 days. Tolerant strains lost significantly less water when exposed to DE-treated grain and moved more quickly through grain.

DE-tolerant *Sitophilus oryzae* produced less progeny. The speed of movement and activity in Petri dishes were different from the movement through grain. If this level of increased tolerance towards exposure to DE was present in insect populations found in commercial stores, it would probably cause control failures. However, if the tolerant species produced fewer offspring, as in these strains, tolerant strains would probably diminish with time.

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Section 15 - Poster O-02

Control of insect herbivores on winter oilseed rape by turnip rape trap crops

A. Döring, R. Wedemeyer, H. Saucke & B. Ulber

Winter oilseed rape (*Brassica napus* L.) production in Germany is severely affected by various insect pests. Due to extending resistance of pests to synthetic pyrethroid insecticides and to restricted control options in organic oilseed rape, the development of alternative control strategies is increasingly important. The specialist pest species on oilseed rape, like cabbage stem flea beetle (*Psylliodes chrysocephala* L.), pollen beetle (*Meligethes aeneus* F.) and cabbage seedpod weevil (*Ceutorhynchus obstrictus* Payk.), are known to prefer turnip rape (*Brassica rapa* L. *silvestris* Briggs) against oilseed rape as a host plant. When grown as a border strip around the oilseed rape crop, turnip rape trap crops might have potential to protect the oilseed rape main crop from pest infestation and to restrict insecticide applications to the border strip, respectively.

Field experiments were established in northern Hesse in two years. Border plots 6m wide and 60m long were sown along two edges of an oilseed rape field, with turnip rape alternating with oilseed rape. The level of pest infestation was assessed in the border plots and the adjacent oilseed rape crop at distances of 10m and 30m from the border plots.

The infestation by cabbage stem flea beetle and pollen beetle was significantly higher on turnip rape than on oilseed rape. However, there was no significant difference between pest infestation of the oilseed rape main crop adjacent to turnip rape border plots and oilseed rape adjacent to oilseed rape border plots. The yield of oilseed rape was not significantly affected by the turnip rape trap crop. From this it follows that turnip rape border strips are not able to protect the oilseed rape crop or to reduce its infestation without additional control methods.

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Section 15 - Poster O-03

Dispersal of the egg parasitoid *Trichogramma cacoeciae* (Hym.,: Trichogrammatidae) in orchards in relation to weather conditions and plant structure

H. Alkarrat & C.P.W. Zebitz

The dispersal behavior of *Trichogramma cacoeciae*, a potential biological control agent of the Codling Moth, *Cydia pomonella*, was investigated in both an orchard of apple and peach in Hohenheim, Stuttgart. The aims of this study were to quantify *T. cacoeciae* dispersal, and to determine the effect of wind speed and plant structure on the dispersal ability of *T. cacoeciae* from the release point. In 2008 during dry season, *Trichogramma* were released as blackened host eggs in small plastic tubes, fixed at 100 cm above ground in the center of each orchard. The dispersal of the wasps was monitored 24, 48 and 72 h after release along 8 transects (N, NE, S, SE, E, SW, W, and NW directions) at 2.5 m intervals up to 25 m using *S. cerealella* sentinel egg cards. Both in the apple and in the peach orchard, parasitization rate was negatively correlated with distance of host eggs to the release point (20.63 % at the release point to 0.98 % at 25 m distance). The parasitization rate in the two orchards was significantly higher at 90 cm height (23.26 % in apple and 17.44 % in peach) compared with the rate at 190 cm (20.52 % in apple and 12.81% in peach). Dispersal direction into SW, W and S was obviously correlated with prevailing wind direction (from NE) in both the orchards. Dispersal was significantly stronger at wind speed > 0.5 m/s. The impact of wind on the dispersal of the wasps was more pronounced in the apple orchard than in the peach orchard, whereas the parasitization rates were higher in apple field (44. 48%) than in peach field (34. 90 %). This was correlated with the age, foliage density and structure of the resp. orchards, where the apple orchard was younger with a less dense foliage than the older peach orchard with a closed foliage.

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Section 15 - Poster O-04

Effect of different pollen diets on fecundity and longevity of *T. cacoeciae* (Hym.: Trichogrammatidae) under laboratory conditions.

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The value of pollen of three different origins (birch, maize and sunflower) as additional food source for *Trichogramma cacoeciae* (Hym.: Trichogrammatidae) was assessed by testing the effect of different pollen diets (pollen with honey and pollen with water) on fecundity and longevity of *T. cacoeciae*-females. The females fed with honey alone had a significantly shorter longevity (10.48 days) than females fed with honey and pollen of birch, maize and sunflower pollen (16.36, 14.8 and 14.03 days resp.), but a significantly higher longevity than those supplied with water alone (3.9 days) or water and pollen (4.16, 4.0 and 3.03 days resp.). No significant differences in longevity were observed between the females feeding on pollen treatments. The number of parasitized host eggs by *T. cacoeciae* females fed honey alone was similar to those fed on honey suspension of pollen, but differed significantly compared to those fed on water and water suspension of pollen. The fecundity after 3 days was 45.06 eggs/female when fed on honey and birch pollen, which was significantly higher than 38.0 and 33.80 eggs/female for honey alone and honey with sunflower pollen, resp., but was not significant compared to 39.23 eggs/female for honey and maize pollen. Also no significant differences in fecundity after 3 days observed between water and pollen treatments. Pollen in honey increased the survival rate of *T. cacoeciae* females compared to honey alone, water alone and water with pollen. Adding pollen to adult food in mass rearing can thus contribute substantially to a higher productivity in *Trichogramma* mass rearing and increase survival and parasitisation success after releases greenhouses or stores where additional food may be offered.

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Section 15 - Poster O-05

Impact of Oilseed rape (OSR) production on functional biodiversity of predators and decomposers – development of management strategies for conservation and improvement in Croatia, Germany and Serbia

W. Büchs, S. Prescher, T. Gotlin-Culjak & T. Sivcev.

In a study in three European countries (Germany, Croatia and Serbia) oilseed rape is cultivated with different management methods: conventional and integrated cultivation and organic farming. The impact of the management methods on diversity and abundance of soil organisms is studied. Methods for recording the soil animals are pitfall traps, emergence traps, endogaeic pitfall traps and yellow water traps. Among the predators especially the ground beetles (Carabidae), rove beetles (Staphylinidae) and spiders (Arachnida) are evaluated. To assess the impact of the decomposers, the earthworms are collected and their weight, abundance and diversity in the cultivation systems will be compared.

At the field margins of the treatments with integrated cultivation and organic farming a trap crop strip with turnip rape is drilled to attract pests of oilseed rape plants. To evaluate its effectiveness as traps crop pest insects are collected and the abundance in the treatments is studied.

First results with pitfall traps (10.9.10-12.1.11) show that larvae of Carabidae are more active in the fields with organic farming than in the other treatments. The numbers of the pest cabbage stem flea beetle (*Psylliodes chrysocephala*) is distinctly higher in the trap crop strips with turnip rape than in the oilseed rape plots. This result confirms the high attraction of turnip rape in order to protect oilseed rape crop plants from pest infestation.

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Section 15 - Poster O-06

The molecular identification of South European *Frankliniella* species as a support to the morphological diagnosis

A. De Grazia, R. Marullo & G. Moritz

South European species included in the genus *Frankliniella* (Thysanoptera, Thripidae) are represented by *Frankliniella occidentalis* (Perg.), *F. intonsa* Trybom, *F. pallida* (Uzel), *F. tenuicornis* Uzel and *F. schultzei* Trybom, all phytophagous on crops and wild plants, as responsible of direct damages (feeding and oviposition wounds) , as well as viruses (TSWV) vectors , i.e. *F.occidentalis* and *F.schultzei*. Morphological identification of thrips species is not easy and it is possible only for professional taxonomists. Therefore, adequate plant protection strategy requires a rapid and reliable identification of pest species (for example in quarantine service). Classical morphological studies regarding *Frankliniella* group species show lacks in identifying both interspecific and in terms of natural strains of the same species. More recently, molecular techniques have been carried on in application with electronic and visual systems, in order to provide a valuable addition to the traditional phenotypic methods of pest thrips recognition (Moritz et al., 2004). A molecular technique to identify the most common South European *Frankliniella* species is presented. Specimens of *Frankliniella occidentalis* , *F. intonsa* , *F. pallida* and *F. tenuicornis* were collected from their host plants in southern Italy, and have been studied in order to provide a support to characterize their field strains.

Moritz G., Mound L.A., Morris D.C. and A. Goldarezena , 2004 – Pest Thrips of the world - visual and molecular identification of pest thrips. Interactive Cd rom distributed by Lucid, University of Queensland, Brisbane.

Section 15 - Poster O-07

Populationsdichten von *Dibrotica v. virgifera* und *Ostrinia nubilalis*, das Spektrum der *Fusarium* spp. und die Mykotoxinbelastung im westrumänischen Maisanbauggebiet unter Berücksichtigung der Fruchtfolge

S. Dinnesen, C. Büttner, M. Goßmann, H. E. Hummel, C. Ulrichs & T. Nedelev

Die durch *Fusarium* spp. verursachte Wurzel-, Stängel- und Kolbenfäule bei Mais führt durch mögliche Mykotoxinbelastungen des Erntegutes neben einer Ertragsreduzierung zu einer Gesundheitsgefährdung für Mensch und Tier. Schadinsekten können dabei durch ihre Fraßtätigkeit Eintrittspforten für Pilzsporen schaffen und so zur Verbreitung und weiteren Infektionsquellen von *Fusarium* spp. in der Pflanze führen. Hierzu wurde in der westrumänischen Region Banat 2009 an vier verschiedenen Standorten (Şag, Gottlob, Variaş, Şiştarovaţ) und insgesamt sieben Maisfeldern mit unterschiedlicher Fruchtfolge der Einfluss der Fruchtfolge und unterschiedlicher Populationsdichten der bedeutenden Schadinsekten *D. v. virgifera* und *O. nubilalis* auf das Auftreten von Kolbenfäulesymptomen, die Befallshäufigkeit der *Fusarium*-Arten und die Mykotoxinbelastung von Körnerproben untersucht. Das anhand morphologischer Merkmale identifizierte Spektrum an *Fusarium*-Arten bestand dabei vorwiegend aus *F. subglutinans*, *F. proliferatum* und *F. verticillioides*. Vereinzelt konnten auch *F. lateritium var lateritium*, *F. semitectum var majus* und *F. sporotrichoides* nachgewiesen werden. In den untersuchten Körnerproben konnten dabei keine Mykotoxinbelastungen nachgewiesen werden. Die höchste Symptomausprägung von Kolbenfäulen bei erhöhten Fraßschäden konnte an zwei Standorten in einer Weizen-Mais-Fruchtfolge nachgewiesen werden. Hier wurden dabei auch die höchsten Populationsdichten der Schadinsekten ermittelt. Insbesondere die Populationsdichten der adulten *D. v. virgifera* waren an allen Standorten und Fruchtfolgen, bis auf eine Gerste-Mais-Rotation am Standort Variaş, konstant hoch. Insgesamt zeigen die Ergebnisse, dass das Auftreten von Kolbenfäulesymptomen weitgehend von den klimatischen Einflussfaktoren bestimmt wird, aber Fraßschäden einen verstärkenden Einfluss auf die Symptomausprägung haben. Ein Einfluss auf die Mykotoxinbelastung konnte dabei aber nicht festgestellt werden.

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Section 15 - Poster O-08

Wirksamkeit von Sulfuryldifluorid gegen Eier von *Tribolium castaneum*

G. Flingelli, M. Schöller & Ch. Reichmuth

Der rotbraune Reismehlkäfer, *Tribolium castaneum* (Herbst, 1797) (Coleoptera: Tenebrionidae) ist ein gefürchteter Schädling in der Nahrungsmittelindustrie. Seit einigen Jahren dient anstelle von Brommethan, das wegen seines ozonerstörenden Potentials vom Markt genommen wurde, vorzugsweise Sulfuryldifluorid (SF) zu seiner Bekämpfung in Lebensmittelfabriken. In der Begasungspraxis treten verschiedene Temperaturen auf, die eine entsprechende Anpassung der Dosierung zur Erfüllung der Erfordernisse an die Schädlingsfreiheit von Lebensmitteln erfordern.

Die vorliegende Arbeit beschreibt deshalb systematisch und vergleichend die ausgeprägte Abhängigkeit der letalen Dosis LD₅₀ über den gesamten Temperaturbereich von 15°C bis 30°C. Wegen der deutlich höheren Widerstandsfähigkeit der Eistadien, insbesondere dieses Käfers, gegen SF konzentrierten sie die Versuche ausschließlich auf die Eier.

Die etwas schwierige Gewinnung einer großen Anzahl Eier dieser Insektenart wird beschrieben. Eine Erhöhung der Temperatur führte zur deutlichen Steigerung der Empfindlichkeit gegen SF. Die Abhängigkeit der letalen Dosis von der Temperatur bei unterschiedlich langer Begasung der Eier wurde in eine einfache mathematische Formel gefasst, die eine Bestimmung für eine beliebige praxisrelevante Temperatur ermöglicht. Im Bereich LD₅₀ konnte für die Faktoren Wirkstoffkonzentration c und Expositionsdauer t die Beziehung $c \cdot t = \text{const.}$ nachgewiesen werden.

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Section 15 - Poster O-09

***Amblyseius swirskii* Athias-Henriot zur Bekämpfung von *Varroa* -Milben -
Erfolg oder Gefahr?**

I. Goleva, S. Gerken, E. Moreau, P. Rosenkranz & C.P.W. Zebitz

Die Raubmilbe *Amblyseius swirskii* wird zur biologischen Bekämpfung u.a. gegen Spinnmilben, Thripse, Weiße Fliege unter Gewächshausbedingungen erfolgreich eingesetzt. aus der Literatur ist bekannt, daß *A. swirskii* eher als polyphager Prädator einzuschätzen ist, so daß sich für diese Art vielfältige Verwendungsmöglichkeiten im biologischen Pflanzenschutz eröffnen. Allerdings ist die wirkliche Breite des Nahrungsspektrums von *A. swirskii* nicht bekannt. Im Verlauf eigener Untersuchungen unter standardisierten Klimabedingungen (25 °C, 16:8 Std. H/D) hierzu wurden auch unterschiedliche präimaginale Entwicklungsstadien und Männchen der *Varroa*-Milbe angeboten und von *A. swirskii* als Beute akzeptiert. In Wahlversuchen zwischen Eiern und Larven der *Varroa*-Milben wurden Larven bevorzugt. Der Angriff der Raubmilben auf diese Stadien erfolgte nicht als Einzeltier sondern meist in Gruppen von 5 adulten Raubmilben, die bevorzugt ventral und an den Intersegmentalmembranen saugten. Nach einer Saugzeit von 8 Stunden waren die *Varroa*-Larven abgetötet. Lediglich adulte Weibchen wurden nicht als Beute akzeptiert. Damit stellen *Varroa*-Milben für *A. swirskii* eine attraktive Nahrungsquelle dar. Der Einsatz dieser Raubmilbe in der biologischen *Varroa*-Bekämpfung böte eine willkommene Alternative zur chemischen *Varroa*-Bekämpfung, die durch Resistenzbildung und auf Grund von nachweisbaren Akarizid-Rückständen in Wachs und Honig zunehmend Probleme bereitet. Um *A. swirskii* zur biologischen Kontrolle der *Varroa*-Milbe einsetzen zu können, bedarf es aber einer gründlichen Risiko-Analyse. Als omnivorer Räuber attackierte *A. swirskii* auch Eier der Honigbiene *Apis mellifera*, doch waren diese im Wahlversuch weniger attraktiv als *Varroa*-Stadien. Der Beitrag stellt erste Ergebnisse aus Laboruntersuchungen vor und entwirft eine Risikoanalyse für *A. swirskii* als Gegenspieler der *Varroa*-Milbe und für die Honigbiene nach eventueller Etablierung der Raubmilbe im Freiland.

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Section 15 - Poster O-10

Eignung von Pollen als Alternativnahrung für die Raubmilbe *Amblyseius swirskii* Athias-Henriot.

I. Goleva & C.P.W.Zebitz

Die Raubmilbe *Amblyseius swirskii* Athias-Henriot wird zur Bekämpfung verschiedener Schädarthropoden in Gewächshauskulturen eingesetzt. Neben der tierischen Nahrung wird dieser Raubmilbenart aber auch Pollen als Alternativnahrung zur Verfügung gestellt. Da *A. swirskii* von ihren Nahrungsansprüchen her eher als omnivor denn polyphag bezeichnet werden kann, die Nahrungsbreite (u.a. auch Pilzmyzel, unveröffentlicht) aber noch nicht ausreichend bekannt ist, wurden Versuche mit Pollen unterschiedlicher Herkunft als Alternativ- und Zusatznahrung durchgeführt. Die Ergebnisse sollen einerseits der Optimierung des Einsatzes dieser Raubmilbenart in gewächshauskulturen dienen, aber auch einen Beitrag zum Nahrungsspektrum nach möglicher Etablierung im Freiland leisten. Unter Fütterung von Pollen von > 20 verschiedenen Pflanzen wurde die präimaginale Mortalität Entwicklungsgeschwindigkeit festgehalten und mit den daraus entwickelten Imagines eine ausführliche Lebensstafelanalyse durchgeführt. Es zeigte sich, daß *A. swirskii* sich ausschließlich von Pollen ernähren kann, wobei sich Pollen von Birken, Blauglockenbaum, Mais und Kakteen als besonders geeignet erwiesen. Im Vergleich mit tierischer Nahrung (Spinnmilben und Thripse) führte Pollen als alleinige Diät zu einer signifikant längeren Lebensdauer und höheren Reproduktionsleistung. *A. swirskii* lässt sich daher auch durch Zugabe von Pollen als Streufutter zur Optimierung der biologischen Bekämpfung und Überbrückung beutearmer Perioden einsetzen. Zudem zeigen die Ergebnisse, daß *A. swirskii* sich nach Freisetzung im Freiland auch ohne tierische Nahrung etablieren könnte.

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Section 15 - Poster O-11

Organic Nanofibers Containing Insect Pheromone Disruptants: A Novel Technical Approach of Controlled Release with Potential for Process Mechanization

H.E. Hummel, D.F. Hein, M. Breuer, I. Lindner, A. Greiner, J.H. Wendorff, C. Hellmann, R. Dersch, A. Kratt, H. Kleeberg & G. Leithold

The search for suitable dispensers containing insect pheromones grew with the availability of these synthetic biotechnical tools beginning fifty years ago. Many economic entomologists and application engineers dearly wish they had the "smart, intelligent and ideal dispenser". More or less suitable approximations are available commercially, but none so far meets all demands. Under economic strictures novel inexpensive systems would be advantageous with release characteristics tailored to the specific life histories of pest insects and the numerous requirements of growers alike. Simultaneously, their field distribution should be mechanizable and be accomplished by one (or very few) application runs. The dispensers should be biodegradable, biocompatible, and sustainably applicable. In this report, we present first results of a novel organic, electrospun nanofiber with dimensions in the upper nanometer range. Its load of pheromone can be adjusted to be sufficient for 7 weeks of constant disruptive action in vineyards and can be directed against the European Grape Vine Moth *Lobesia botrana* (Lepidoptera: Tortricidae) which here serves as a readily available model. Mating disruption in *Lobesia botrana* and the related *Eupoecilia ambiguella* is a well studied and developed engineering process. Equally, nanofiber production (for a comprehensive review see Greiner and Wendorff, 2007) is well known and already has numerous applications in filtration technology, air conditioning, and medical wound dressing. Our goal was to bring together and successfully mate these (partly incompatible) technologies with technical tricks of a proprietary nature.

Even though we must double the lifetime and effectiveness of currently available nanofibers, we know the rather complicated system of their production and analysis well enough to identify the parameters that need future adjustment. Another challenge is the mechanical distribution of the fibers in the vineyards. Also here we have certain technical leads to follow up during 2011.

Technical details of fibers and fiber production are protected by patent applications via TransMIT GMBH Giessen-Marburg. We are very grateful to Schwarz Foundation for a starting grant and for support by the Innovation Program of the Federal Ministry of Agriculture and Nutrition. JKI Berlin as a federal independent authority kindly monitors in numerous test systems the compatibility of organic nanofibers for their effects on human and environmental health. So far no contraindications have been identified.

A. Greiner & J.H. Wendorff, *Angew. Chem.* **46**: 5670-5703

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Section 15 - Poster O-12

Twenty five years of azadirachtins (1985-2010)

H.E. Hummel, D.F. Hein, S.V. Ley, E. D. Morgan & H. Schmutterer

During 1985 and 1986, two research groups simultaneously and independently published the complete molecular structure of azadirachtin (aza), a natural antifeedant, insect growth regulator and sterilant found in the seeds of the neem tree, *Azadirachta indica* A. Juss.(Meliaceae). The leaders of these research groups were 1. Bilton et al. 1985 and Broughton et al. 1986 in England, and 2. Kraus et al. in Germany. Both groups involved were in agreement about the correct structural assignment because they had arrived at their results by two completely independent methodologies and strategies. Group 1 employed X ray crystallography, group 2 NMR studies with both ^1H and ^{13}C nuclei. Also, Ley's group at the University of Cambridge, England (Veitch et al. 2007), contributed decisively to the confirmation of the structure by the total synthesis of the rather complicated molecular architecture of aza. Earlier, Kalinowski et al. (1993) in Germany had determined the structure of a close analogue of aza from *Azadirachta excelsa* seeds, employing NMR spectroscopy. This analogue, called marrangin, in some insects even exceeded the biological activity of aza by a factor of 2.5. Aza and its analogues are tetranortriterpenoids originally discovered by serendipitous field observation (Schmutterer 1988, 1990, 2002), followed up by purification and isolation (Butterworth and Morgan 1968, 1972). The value of these biorationals for insect pest management without any appreciable vertebrate toxicity was recognized early on (Schmutterer 1988, 1990, 2002, 2005). In spite of their comparatively high prize, azas are highly favoured by the organic farming community (Hummel et al. 2007) where very few compounds only meet the highly restrictive use standard. Recently, azas are finding applications in veterinary science and medicine and are beginning to be a commercial success (Kleeberg and Strang 2009). Beyond field applications azas are also important probes for mechanistic studies in basic biology, insect physiology and neuroendocrinology (Rembold 2002, Mordue-Luntz 2002).

A complete list of citations will be supplied by the senior author.

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Section 15 - Poster O-13

**Rückblick auf ein halbes Jahrhundert Erfolgsgeschichte der
Insektenpheromone – ein Glücksfall für den Pflanzenschutz**

H.E. Hummel, K.-E. Kaissling & E. Hecker

Pheromone der Insekten feiern zwischen 2009 und 2011 die denkwürdige 50. Wiederkehr der Entdeckung ihres Prototyps BOMBYKOL, des Sexuallockstoffs des Seidenspinners *Bombyx mori* L. Adolf Butenandt, E. Hecker und Mitarbeiter am MPI für Biochemie München isolierten den Lockstoff 1959 und schlugen die Struktur (E,Z)-10,12-Hexadecadien-1-ol vor. Zwei Jahre danach folgte die strukturbeweisende chemische Totalsynthese dieses höchst wirksamen Prototyps innerartlicher Signalstoffe durch Butenandt und Hecker. Für die neuartige Wirkstoffklasse hatten P. Karlson und M. Lüscher 1959 den Terminus „Pheromone“ vorgeschlagen, der heute weltweit in Gebrauch ist. – Die Wirkungsschwelle des Bombykols wurde zwischen 1968 und 1974 im Labor von D. Schneider und Mitarbeitern zu 3000 Molekülen pro ml Testlösung bestimmt. Die wissenschaftlich ungemein fruchtbare und weitreichende Entdeckung des Bombykols hat während der vergangenen 50 Jahre zur Erstbeschreibung von rund tausend Insektenpheromonen und der zehnfachen Zahl von Originalarbeiten geführt.

Synthetische Lockstoffe der wichtigsten Schadinsekten aus den verschiedensten Insektenordnungen werden heute weltweit im praktischen Pflanzenschutz eingesetzt. Sie dienen dabei (i) zur Erfassung und Quantifizierung von Insektenbefall (monitoring), (ii) zum Massenabfang (mass trapping) und (iii) zur Paarungsstörung (mating disruption). Besser als viele andere Maßnahmen eignet sich der Einsatz von Pheromonen für einen nachhaltigen, umweltverträglichen und energiebewussten Pflanzen- und Vorratsschutz unter Vermeidung toxischer Stoffe. Pheromone sind auch im herkömmlichen Anbau- und Bewirtschaftungssystem mit allen anderen Methoden verträglich und haben zum Monitoring beliebigen und weltweiten Einsatz gefunden. Darüber hinaus wären ohne chemische Kenntnisse der Pheromone viele Beiträge zu Sinnesphysiologie, Orientierungsverhalten und chemischer Ökologie der Insekten undenkbar.

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Section 15 - Poster O-14

**Erkenntnisse zum Artenspektrum von Drahtwürmern und Schnellkäfern im
Ackerbau in Niedersachsen**

J. Lehmus

Drahtwürmer sind problematische Schaderreger in vielen verschiedenen Kulturen. Mit dem Wegfall der neonicotinoiden Saatgutbehandlungen treten Probleme durch drahtwurmbedingte Pflanzenausfälle vor allem im Mais auf, aber auch in Rüben und Getreide. Kartoffeln stellen ein Sonderproblem dar, da hier keine Pflanzenausfälle auftreten, aber massive Qualitätsverluste beim Erntegut. Generell werden in der Literatur *Agriotes*-Arten als bedeutendste Schädlinge unter den Drahtwürmern genannt. Mittels Pheromonfallen für 5 als Schädlinge bekannte *Agriotes*-Arten (*A. lineatus*, *A. obscurus*, *A. sputator*, *A. sordidus*, *A. ustulatus*) wurden an 9 verschiedenen Standorten in Niedersachsen Schnellkäfer gefangen und die Artenzusammensetzung der Fänge sowie der Anteil Fehlfänge für die einzelnen Pheromone untersucht. Ergebnisse für die Drahtwürmer wurden mittels Köderfallen an 6 Standorten in der Region um Braunschweig erhoben. Dabei handelte es sich um 3 Standorte, an denen auch Pheromonfallen für Schnellkäfer standen, und um 3 Starkbefalls – Standorte. Die Fallen waren mit einem vorgequollenen Weizen-Mais-Gemisch beködert. Außerdem wurden Aufsammlungen von Larven auf Artniveau oder Gattungsniveau determiniert, die von 5 Standorten stammten, an denen gleichzeitig Pheromonfallen für Schnellkäfer standen. Die Artenzusammensetzung von Schnellkäfern und Drahtwürmern variierten an den Standorten, aber generell dominierte in den Pheromonfallenfängen in Niedersachsen der Schnellkäfer *Agriotes lineatus* und bei den Drahtwürmern die Gattung *Agriotes*. An einzelnen Standorten traten aber auch Drahtwürmer anderer Gattungen häufig auf.

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Section 15 - Poster O-15

The molecular identification of South European Frankliniella species as a support to the morphological diagnosis

A. De Grazia, R. Marullo & G. Moritz

South European species included in the genus *Frankliniella* (Thysanoptera, Thripidae) are represented by *Frankliniella occidentalis* (Perg.), *F. intonsa* Trybom, *F. pallida* (Uzel), *F. tenuicornis* Uzel and *F. schultzei* Trybom, all phytophagous on crops and wild plants, as responsible of direct damages (feeding and oviposition wounds) , as well as viruses (TSWV) vectors , i.e. *F. occidentalis* and *F. schultzei*. Morphological identification of thrips species is not easy and it is possible only for professional taxonomists. Therefore, adequate plant protection strategy requires a rapid and reliable identification of pest species (for example in quarantine service). Classical morphological studies regarding *Frankliniella* group species show lacks in identifying both interspecific and in terms of natural strains of the same species. More recently, molecular techniques have been carried on in application with electronic and visual systems, in order to provide a valuable addition to the traditional phenotypic methods of pest thrips recognition (Moritz et al., 2004). A molecular technique to identify the most common South European *Frankliniella* species is presented. Specimens of *Frankliniella occidentalis* , *F. intonsa* , *F. pallida* and *F. tenuicornis* were collected from their host plants in southern Italy, and have been studied in order to provide a support to characterize their field strains.

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Section 15 - Poster O-16

Bioactivity of NeemAzal and neem products from Cameroon against *Sitophilus zeamais* on maize

E. Nukenine, H.K. TOFEL & C. Adler

In Cameroon, local products of the neem tree are used mostly for medicinal reasons with little attention on their insecticidal properties. The efficacy of three neem products, the commercial NeemAzal powder, local neem seed powder (NSP) and local neem seed oil (NSO), applied at four different rates, was assessed on adult *Sitophilus zeamais*. Mortality was recorded over a 14-day period, followed by the determination of F₁ progeny production as well as grain damage, population increase and grain germination rate. All products caused significant dose-dependent mortality to the weevil. At the highest tested dosage, NSO (8 ml/kg), NeemAzal (12 g/kg) and NSP (40 g/kg) caused 78%, 16% and 4% weevil mortality, respectively, within one day of exposure. Maximum mortality of 100%, 99%, and 96% were achieved for NSO (4 ml/kg, within 7 days), NeemAzal (12 g/kg with 14 days) and NSP (40 g/kg, within 14 days), respectively. In the same order, 7-day LC₅₀ values were 1.46 ml/kg, 0.02 g/kg and 12.44 g/kg. All the products greatly reduced progeny emergence, percentage grain damage and grain weight loss. The grains treated with NeemAzal, NSO and NSP recorded respectively up to 97%, 75% and 61% germination rate. Since the efficacy of local neem products against *S. zeamais* competed favourably with that of NeemAzal, the use of such local products as well as NeemAzal in stored product protection should be promoted.

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Section 15 - Poster O-17

**Einfluß N-Hohe für Weizen auf der Beeinträchtigung (Beschädigung) von
*Rhopalosiphum padi***

S. Petrova & C. Zebitz

Populationendynamik und EPG-Parameter von *Rhopalosiphum padi* wurde im Gewächshaus auf der Sorte Sobi mit verschiedener Erfassung des N-Hohe geprüft. Das Ausmass der Attraktivitätsveränderung war abhaengig vom Hoehe Stickstoffdüngung. Hier war eng und aufrecht Korrelation. Die größte Beträchtigung von Invasion, als Abnahme Yield PS II, wurde für Varianten N-75, N-100 und N-125 festgestellt. Auch wies 75% N-Versorgung des Pflanzen als besser Futtersubstrat auf. Hier erwies die Phloemsaftaufnahme sich als am längste. Offensichtlich wurde unterschiedliche EPG-Parameter auf die physico-mechanische Eigenschaften und biochemische Zusammensetzung des Phloemsaft zurückgeführt. Giebt es eine Voraussetzung, daß bei der Bewertung der Beeinträchtigung von Blattlaus-Invasion muß auf die Aphidenaktivität (Populationendynamik daneben) berücksichtigt werden.

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Section 15 - Poster O-18

Efficiency of NeemAzal-T/S against different developmental stages of the Black Vine Weevil *Otiorhynchus sulcatus* (Coleoptera: Curculionidae)

A. Reineke & M. Hauck

The black vine weevil *Otiorhynchus sulcatus* Fabricius (Coleoptera: Curculionidae) is a serious pest in a wide variety of horticultural crops worldwide. Adults and larvae of this insect are extremely polyphagous with adults causing damage by feeding on the foliage of their host plant, while soil-borne larvae feed on the roots, which could be lethal especially for younger plants or recently transplanted cuttings. Control of this insect is in general difficult, due to the adults being nocturnal and the hidden mode of life of larvae. Beside the use of entomopathogenic nematodes against *O. sulcatus* larvae or treatments of plants with chemical insecticides, there is an increasing interest in the availability of alternative control strategies, mainly due to toxicological and environmental constraints. Here, the product NeemAzal-T/S (a.i. Azadirachtin) was tested as a liquid formulation against all developmental stages of *O. sulcatus* and efficacies were compared to a chemical insecticide (Bayer Garten Calypso; a.i. Thiacloprid, 0.9 g ai/L). Very low levels of efficacies were evident after application of NeemAzal-T/S (0.3% and 0.5%) on *O. sulcatus* eggs. In pots containing *Euonymus fortunei* plants and *O. sulcatus* larvae, however, significantly fewer living larvae were found, when 0.5% NeemAzal-T/S was applied onto the soil once a week for a total duration of three weeks, compared to the untreated control. Efficacies of NeemAzal-T/S (0.5%, 3 applications) against adult weevils were low, but fertility of weevils was significantly reduced after feeding on NeemAzal-T/S treated *E. fortunei* plants. In summary, these results show that the botanical insecticide NeemAzal-T/S has a weak direct effect against *O. sulcatus* eggs and adults, but could help in a long-term reduction of population levels of this insect pest in nurseries or home gardens.

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Section 15 - Poster O-19

Stable isotopes reveal below- and above-ground dispersal of coleopteran pests

*N. Schallhart, M.J. Tusch, B. Thalinger., K. Staudacher, C. Wallinger, A. Juen
& M. Traugott*

Click beetles within the genus *Agriotes* are important coleopteran pests. Their larvae feed on roots and tubers of crops and other plants. Albeit highly relevant for the control of these insects, the dispersal abilities under natural conditions of both larvae and adults are poorly known. Here, we used a stable isotope approach to assess the dispersal abilities of agrioted beetles in arable land.

To examine dispersal of adult beetles, pheromone traps were installed at two study sites in Tyrol (Austria), each comprising a maize field and adjacent C3-grasslands. The different ¹³C signatures of these plants are reflected in the larvae and this signal is translocated to the wing covers of the adult beetles. Hence, adult beetles which developed in maize fields and moved into adjacent grasslands can be identified by their ¹³C signature. Similarly, the dispersal abilities of the *Agriotes* larvae can be examined, which was done in another experiment comprising both maize and C3-crops.

Beetles covered distances of at least 80 m beeline and ~20 % of the individuals caught in the grasslands originated in the maize field. However, no larvae with non-crop specific signatures were found in the adjoining crops. These findings show that adult *Agriotes* are capable to migrate over larger distances than previously assumed, whereas our data suggest that *Agriotes* larvae will not move between crops as long as they are provided with sufficient plant food.

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Section 15 - Poster O-20

“Attract & Kill” against Western Corn Rootworm larvae

M. Schumann, A. Patel & S. Vidal

Western Corn Rootworm larvae (WCR) use CO₂ to locate maize roots over longer distances. This behaviour can be used to lure the larvae to an insecticide with artificial CO₂ emitting capsules → Attract & Kill (A&K). We evaluated the A&K approach with a combination of the capsules and the soil insecticide Force 1.5G in thin soil layer arenas (50 x 30 cm; soil layer: 6mm), where movement and mortality of the larvae could be observed. The A&K approach was tested at two different maize growth stages: BBCH 13-14 and BBCH 32-33. The capsule/Force 1.5G combination was inserted 30 cm and 50 2nd instar larvae 15 cm from the plant base. Movement and mortality of WCR larvae were recorded 4 hours and every 24 hours past inoculation (N=6).

An A&K effect could be observed at both growth stages. At BBCH 13-14 the root system has grown to such an extent that the CO₂ source was 20-25 cm from the nearest root. 20% mortality was already measured after 4 hours and increased to 90% after 96 hours. At BBCH 32-33 the root system has grown throughout the whole arena so that the capsules were inserted in the root system. Mortality after 4 hours was only 4% but increased to 20% after 24 hours and up to 72% after 96 hours. Such a high mortality rate was unexpected as WCR larvae use CO₂ to locate roots over longer distances and tend to switch their orientation behaviour once they have located a root system. This implies that WCR larvae still use CO₂ for orientation within a root system.

The A&K approach is suitable to target WCR larvae; however, its efficacy depends on the maize growth stage. In the future, field application of different capsule systems and their potential to reduce insecticides in WCR management need to be tested.

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Section 15 - Poster O-21

Praxiserfahrungen zur Bekämpfung der Dörrobstmotte *Plodia interpunctella* in Getreidelagern durch den Einsatz der Ei- und Larvalparasitoiden *Trichogramma evanescens* und *Bracon hebetor*.

O. Zimmermann

Aufgrund der aktuellen Zulassungssituation für chemische Bekämpfungsmittel im Vorratsschutz steigt die Nachfrage nach alternativen Bekämpfungsmöglichkeiten. Durch den Wegfall von Verdunstungsstrips haben die Probleme mit Mottenbefall in Getreidelagern stark zugenommen. Im Leerraum sind chemischen Produkte nur sehr eingeschränkt zugelassen. Vorratsnützlinge, die in Frage kommen, sind vor allem parasitoiden Hymenopteren, sogenannte Schlupfwespen. Die Verwendung von *Trichogramma evanescens* zur Bekämpfung der Motteneier im Haushalt ist inzwischen etabliert. Das Interesse an solchen Verfahren für Getreidelager nimmt stetig zu, jedoch fehlt den Schädlingsbekämpfern meist die praktische Erfahrung.

In einem südhessischen Betrieb wurde ein Befall mit Dörrobstmotten (*Plodia interpunctella*) in einem Getreidesilo wissenschaftlich begleitet, um die Mottenbekämpfung mit Schlupfwespen unter Praxisbedingungen zu demonstrieren. Der Befall hatte sich über mehrere Jahre aufgebaut, bis es zu einer Massenvermehrung der Motten kam. Im Vorjahr der Untersuchung wurde dieser Befall zunächst durch mechanisches Abtragen der Silooberfläche und eine chemische Bekämpfung reduziert. Die Mottenpopulation konnte sich im Folgejahr aber wieder aufbauen. Daraufhin erfolgten der Nützingseinsatz und eine gezielte Hygieneberatung vor Ort. Durch ein konsequentes Monitoring des Mottenfluges und den kombinierten Einsatz von Ei- und Larvenparasitoiden (*T. evanescens* und *Bracon hebetor*) konnte der Befall stark reduziert werden und befand sich nach nur einer Saison im Bereich der Nachweisgrenze. Die Bekämpfung wurde mit Pheromonfallen begleitet, um anhand der rückläufigen Fangzahlen den Bekämpfungserfolg nachzuweisen. Die Untersuchung belegte, dass eine erfolgreiche Mottenbekämpfung mit Schlupfwespen im Getreidesilo möglich ist und problemlos in die betriebsübliche Praxis integriert werden kann.

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Section 16 - Poster P-01

Detecting prey in Neuroptera larvae by PCR

F.L.E.M. Meinzer & A. Gruppe

Larvae of most neuropteran species are known as generalist predators. However, for most species the real trophic relationships in the ecosystem are hardly known (Canard 2001). Analyzing predator-prey-food webs in natural ecosystems is a difficult, but well known issue for small animals like insects. Different molecular techniques have been developed for gut analysis of predators in the last decades (Symondson 2002). In this study a DNA *post mortem* prey analysis of a predator by PCR was developed. The prey *Ips typographus* was detected in the model organism *Chrysoperla carnea* larvae for a period up to 16h post feeding. Species-specific primer amplifying a 329bp fragment of mitochondrial COI gen were designed. In total, 79% of tested predators yielded positive amplification product. Amplification decreased over time post feeding. 16h post feeding prey was detected in 60% of predator specimens. If the assemblage of suggested prey and suitable gene sequences are available, PCR is a successful and sensitive tool to analyze trophic relations of neuropterid larvae.

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Section 17 - Poster Q-01

Vibrational communication in mason bees

T. Conrad, R.J. Paxton, F.G. Barth & M. Ayasse

In many animal groups acoustic and vibrational signals are used by various species when communicating, and commonly play an important role in mating (Hill 2008). Even though many bee species are known to emit vibrational signals during mating, there are almost no studies on the function of these vibrations. Do they signal physical strength of an individual and function as a pre-mating isolation barrier? Acoustic and vibrational signals are produced by bees through vibrations of the thorax and underlying muscles (Hrncir et al. 2006), as in the case of the precopulatory mating behavior of the red mason bee *Osmia rufa* (Seidelmann 1991). Given that it is the larger female that accepts a male for copulation, we hypothesized that a female might use these thorax vibrations to choose a suitable mate and, if these signals are species-specific, they can also be used as species isolation barriers. In order to investigate the function of these thorax vibrations, we measured and compared the male vibrations during precopulation of males that were accepted by a female for mating and males that were rejected using a laser vibrometer. For the role as a pre-mating isolation barrier we investigated vibrations of two subspecies of *O. rufa* using bees from England, Germany and Denmark (Peters 1978) and of the closely related sympatrically occurring sister species *O. cornuta*. Our results clearly showed that male vibration burst length was significantly longer in accepted than in rejected males (Conrad et al. 2010). Vibrations, being energetically costly, may therefore indicate vigor and assure that the males selected by females are in fact the healthier ones. Furthermore we found significant differences in the frequency and modulation of vibrational signals between *O. rufa* and *O. cornuta* and between the subspecies of *O. rufa*, supporting our hypothesis that they might have a function as a pre-mating isolation barrier.

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Section 17 - Poster Q-02

The effects of multiple heterospecific and conspecific signallers on male responsiveness in *Nezara viridula* (L.)

M. de Groot, A. Čokl & M. Virant-Doberlet

Masking of signals by other conspecific or heterospecific signallers, also known as the cocktail party phenomenon is a well known problem for signal receivers. Vibrational signals are often transmitted via 1-dimensional plant stems. In such situation recognition and discrimination between signals emitted from several sources may be especially difficult, since the receiver may perceive a compound signal as emanating from a single source. We investigated the ability of males of the southern green stink bug *Nezara viridula* to recognize conspecific female song in the presence of biotic noise originating from conspecific and heterospecific vibrational signals. We tested male responsiveness on a bean plant in unilateral and bilateral playback experiments (de Groot et al. 2010). One leaf was vibrated with conspecific female song while to the other one we either simultaneously applied heterospecific female song or conspecific signals that differed in their amplitude or signals were presented with various degree of time delay. When conspecific female calling songs applied simultaneously differed in their amplitudes, the presence of two sources had a positive effect on the male responsiveness, for as long as the signal repetition time of perceived song did not differ from the species-specific value. In contrast, when conspecific female song was emitted in alternation from two sources, male responsiveness was significantly reduced. Similarly, male responsiveness was reduced in the presence of heterospecific signals. These results suggest that one-dimensional environment encountered on plants imposes important constraints on vibrational communication.

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Section 17 - Poster Q-03

**Vibrational signals and reproductive isolation: a case study in the genus
Aphrodes (Hemiptera: Cicadellidae)**

M. Derlink, P. Pavlovčič, M. De Groot & M. Virant-Doberlet

Leafhoppers of the genus *Aphrodes* (Hemiptera: Cicadellidae) use substrate borne vibrations as their main way of communication. They produce vibrational signals to recognize and locate potential partners. Currently four closely related species are recognized in the genus: *A. bicincta* (Schrank), *A. makarovi* (Zakhvatkin), *A. diminuta* (= *centrorossica*) (Ribaut) and *A. aestuarina* (Edwards), of which the last is not present in Slovenia. Species were characterized by morphological differences in male genitalia and their ecological niche. However, morphological characters were shown to be unreliable and now vibrational signals are used for identification. Recently, a new type of male calling signal was found in Slovenia and playback experiments with females were done to determine their preference. Females have shown clear preference for conspecific signals, including for the new type of male calling signal, whereas phylogenetic analyses of mitochondrial COI gene have not shown any difference between the new type and *A. bicincta*. Furthermore, all the species, along with the new type, were found to be sympatric. Male-female duet is essential for successful localization of females and copulation, and although other factors may contribute to speciation in this genus, it is believed that vibrational communication plays an important role in prezygotic reproductive isolation. The aim of the study is to determine the role of vibrational signals in species divergence.

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Section 17 - Poster Q-04

The femoral chordotonal organ of adult *Drosophila melanogaster*

R. Lakes-Harlan & C. Lefèvre

Chordotonal organs are mechanoreceptors of insect that are composed of scolopidial units. They are located in between different joints of the insect body to detect position and movement. In the legs of adult *Drosophila melanogaster* the femoral chordotonal organ is a large sensory organ consisting of three groups. One large group is associated with the cuticular surface of the distal femur, whereas the other two groups are associated with femoral muscles (Shanbhag *et al.* 1992). The femoral chordotonal organ develops and differentiates during metamorphosis (Lakes and Pollack, 1990). Physiologically, a passive flexion of the tibial-femoral joint activates the femoral chordotonal organ and this in turn causes a resistance reflex (Reddy *et al.* 1997). In our study the physiology and anatomy of the femoral chordotonal organ was investigated. Therefore the forelegs of female adult *D. melanogaster* were stimulated with sinusoidal movements of frequencies ranging from 0.2 Hz to 500 Hz. The responses were extracellularly recorded with sharpened tungsten electrodes from the leg nerve. Analyses of phase histograms indicated phase coupled responses in a frequency range from 0.2 Hz to about 40 Hz. At 1Hz the phase coupling was usually at 120°, with a rough correlation of increasing degrees at increasing frequencies. Further physiological and anatomical investigations will show whether different receptor units are involved in this response. The data can be used for investigations on the biological functions of the sense organ and on sensory transduction processes.

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Section 17 - Poster Q-05

Triggers of male and female calling song in southern green stink bug (*Nezara viridula*)

V. Zgonik & A. Čokl

Southern green stink bugs (*Nezara viridula*) communicate by signals of different modalities: for long and short range communication they use chemical signals while vibratory, optical and tactile signals take part at shorter range. Substrate-borne sound communication enables stink bugs to locate and recognize each other on a plant. Calling songs involved in mate location and courtship songs used among others to recognize the mate have species and sex specific time characteristics. Females have been supposed to start calling spontaneously and males only to respond to them. In our experiments we studied signals of different modalities which trigger female and/or male calling. All the experiments have been conducted in the simulated natural conditions on a bean plant. Signals of only one modality have been applied in each test. In control experiments conducted in the absence of any external stimuli females emitted the calling song spontaneously in fewer cases than males. Spontaneous calling was in both sexes recorded more often in the light than in the dark. Experiments in the dark (red light) with male emitted chemical substances collected on filter paper showed that they trigger female calling song in more than 75%. The same response was recorded approaching a live male to the female in the dark over the air to avoid any physical contact. The same reaction has been observed in some cases also by males on a plant when another male (or male odour on a filter paper) was presented over the air. On the other hand presentation of a female in the dark evoked no male vibratory signalling. Neither females nor males were triggered to call by presentation of a model. Experiments with a pair of bugs show that male calling song is emitted usually at very close range in the presence of the visual and often of the tactile contact. Our experiments indicate that male emitted chemical signals trigger female calling and that male calling is not just a response to female signalling but in many cases represents the first song in a male/female duet.

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Section 19 - Poster R-01

Emergence in stream mesocosms before and after repeated short-term insecticide pulses

R. Berghahn, S. Mohr, R. Schmiediche, V. Hübner, M. Feibicke, W. Mailahn, S. Loth, E. Svetich-Will & R. Schmidt

In contrast to established biotests for assessing the ecotoxicological effects of chemicals, contamination of lotic surface waters by spray drift and run-off events generally occurs in multiple short pulses. Besides other endpoints like mortality and organismic drift, effects on the timing and the extent of insect emergence may be relevant endpoints. In 2009, a comprehensive experiment with the insecticide imidacloprid was carried out in the indoor stream mesocosms of the Federal Environment Agency in order to exemplarily investigate if the endpoint insect emergence besides other parameters can be used for risk assessment. 8 artificial streams were filled with sand and groundwater and equally stocked with macrozoobenthos from a reference creek. Organic straw was introduced as substrate and served as both hiding place and food for the invertebrates. After a short period of establishment in spring, 4 of the 8 streams were contaminated three times with 12 µg/L Imidacloprid in the evening at weekly intervals. Both the contaminated streams and the 4 control streams were flushed with uncontaminated water 12 h later. This scenario was repeated 4 weeks later in summer. Emergence was determined in the weeks before and after the pulses by means of 4 emergence traps which covered about 10% of the entire water surface in each stream. Repeated macrozoobenthos sampling allowed for the determination of the emergence relative to the corresponding population size. Direct and indirect (drift mediated) effects on insect emergence were detected.

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Section 19 - Poster R-02

Determination lebender Hummeln mit dem neuen „Feldbestimmungsschlüssel für die Hummeln Österreichs, Deutschlands und der Schweiz“ (Hymenoptera: Apidae)

J. F. Gokcezade, B.-A. Gereben-Krenn, J. Neumayer & H. W. Krenn

Hummeln (*Bombus* LATREILLE 1802) zählen neben Schmetterlingen und der Honigbiene zu den bekanntesten heimischen Blütenbesuchern. In Österreich, Deutschland und der Schweiz sind insgesamt 48 Spezies inklusive der Kuckuckshummeln (ehemalige Gattung *Psithyrus* LEPELETIER 1832) nachgewiesen.

Für die Bestimmung dieser relativ überschaubaren Gruppe standen im deutschen Sprachraum bisher zwei Bestimmungsschlüssel zur Verfügung. Da für die Artbestimmung ein Binokular benötigt wird und das Abtöten der Tiere erforderlich ist, sind beide Schlüssel nicht feldtauglich. Der vorliegende Feldbestimmungsschlüssel soll diese Lücke in der Bestimmungsliteratur für die heimische Fauna schließen und die Determinierung lebender Königinnen, Arbeiterinnen und Drohnen der Gattung *Bombus* im Feld ermöglichen. Bestimmt wird dabei hauptsächlich anhand der Färbung der Behaarung des Clypeus sowie der Terga des Meso- und Metasomas.

Begonnen wird im Übersichtsschlüssel, der über die Ermittlung des Geschlechts und der Färbung der Clypeusbehaarung zu den Schlüsseln A, B, C und E sowie der Artentabelle D führt. In den Schlüsseln werden die in Frage kommenden Arten weiter eingegrenzt und es erfolgt der Verweis auf eine Artentabelle. Hier sind nun Arten mit ähnlichen Farbmustern zusammengefasst. Zur Unterscheidung dieser werden morphologische Merkmale angeführt (wie zum Beispiel Proportionen des Kopfes und der Antennenglieder, Bezahnung der Mandibeln, Behaarung des Metatarsus, usw.), die mit einer Lupe an der lebenden Hummel erkannt werden können. Außerdem werden Angaben zu Höhenverbreitung und bevorzugten Lebensräumen der einzelnen Arten gemacht, was für die Bestimmung zusätzlich hilfreich sein kann.

Das Ziel dieses Bestimmungsschlüssels ist es, interessierten Personen eine möglichst unkomplizierte Einarbeitung in diese faszinierende Insektengruppe zu ermöglichen und die Arbeit im angewandten Naturschutz zu erleichtern.

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Section 19 - Poster R-03

**Arthropoden-Zuchten in Deutschland, eine wertvolle Ressource für
Wissenschaft und Forschung – jetzt ONLINE!**

A. Herz, J. Jehle, H. Hönninger, A. Wolck

Die Etablierung und die Erhaltung von Zuchten verschiedener Arthropoden (Insekten, Milben, Spinnen etc.) sind mit erheblichem Aufwand verbunden und daher arbeits- und kostenintensiv. Doch ist die Verwendung lebenden Materials definierter Herkunft grundlegende Voraussetzung bei der Durchführung von Versuchen im Pflanzenschutz und Hygienebereich, in der Medizin oder der biologischen Grundlagenforschung. Die rasche Verfügbarkeit bestimmter Organismen für Untersuchungen kann dabei sehr vorteilhaft sein. In Deutschland sind Arthropodenzuchten an einer Reihe von Institutionen wie Forschungsinstitute und Universitäten verwirklicht, ohne dass genau bekannt ist, wo welche Zuchten gehalten werden. Diese Informationslücke möchte eine als Themenportal gestaltete Datenbank im Webangebot des Julius Kühn-Instituts schließen. Unter <http://arthropodenzuchten.jki.bund.de> wird der Zugriff auf diese Datenbank ab Mitte 2011 möglich sein. Sinn dieser Datenbank ist die Schaffung einer Plattform für den Austausch derartiger Kulturen, für die Weitergabe wichtiger Informationen über verschiedene Zuchttechniken sowie die Möglichkeit, bei der endgültigen Abschaffung von Zuchtlinien diese an interessierte Institutionen abzugeben. Ziel ist es, diese Ressourcen sinnvoll gemeinsam in der entomologischen Forschung zu verwalten und effektiv zu nutzen.

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Section 19 - Poster R-04

Saftflussspezifische Nematoden in den Köpfen der arborealen Ameise *Lasius brunneus* (Formicidae, Hymenoptera)

A. Köhler

An drei Saftflüssen und vier Mulmkonzentrationen verschiedener Laubbäumen wurde Arbeiterinnen der arborealen Ameise *Lasius brunneus* gesammelt. Bei der Untersuchung der Ameisen (n=262) auf Nematodendauerlarven zeigte sich, dass 43,5% der Tiere Dauerlarven in ihren Köpfen aufwiesen. Die Nematodenbelastung lag im Median bei zwei Nematoden pro infizierter Ameise erreichte aber auch Extremwerte von bis zu 85 Nematoden pro Kopf. Den Dauerlarven konnten fünf Nematodenarten zugeordnet werden. Erstmals wurden die saftflussspezifischen Nematoden *Diplogasteroides spengelii* und *Halicephalobus similigaster* in Ameisen nachgewiesen. Auch zeigte sich, dass *Koerneria histophora* mit mehr als der Hälfte aller bestimmter Fadenwürmer wesentlich häufiger in Ameisenköpfen zu finden war als bisher in der Literatur angegeben.

Es zeigt sich, dass Nematoden (besonders *K. histophora*) nach dem Versiegen einer Saftstelle signifikant häufiger in den Ameisenköpfen zu finden war. Auch stieg die Anzahl der Nematoden pro infizierter Ameise signifikant an. Daraus kann geschlossen werden, dass die Fadenwürmer die Ameisen nicht nur als Phoret nutzen sondern auch als Überdauerungsort während ungünstiger Umweltbedingungen.

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Section 19 - Poster R-05

Morphology of necrophagous diptera larvae with forensic significance

R. Klug & K.-L. Ziegler

Lucilia sericata and *Calliphora vomitoria* are frequently found on decomposing corpses. The present study shows differences and variability not only between the three larval instars of these flies but also within the first, second and third instar depending from the age (in hours) of the larva. The maggots were reared on liver. They were collected three times in twelve hours and were fixed in Bouin's solution. 42 samples of *Calliphora vomitoria* and 34 samples of *Lucilia sericata* were analysed. The external morphology of the larvae and pupae was investigated using a scanning electron microscope.

Several morphological features change during the life span of the larval stages. The size of the antenno-maxillary lobes increases with each larval instar. The mouthhooks of the first larval instar have many small processes in both species and become more robust in the second and third instars. The sensillae of the terminal organ are surrounded by distinguishable cuticular rings the number of which increases with the age of the larvae (first larval instar: 1, early second larval instar: 2, late second larval instar: 3, and late third larval instar: 4).

The anal papillae are largest in early and middle third instar larvae, in the postfeeding larvae shortly before pupation they become smaller. Similar changes can be observed in the anal plate. The posterior spiracles provide characters also well known for other fly species.

Taking samples of maggots from laboratory colonies within short periods of time is an important approach to analyse morphological changes of necrophagous calliphorid larvae.

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Section 19 - Poster R-06

A lightweight stem enclosure for sampling of trunk volatiles

C. Rachow, P. Gester-Gerstmann, B. Weis & S. Schütz

Volatiles (Volatile Organic Compounds, VOC) play an important role as cues for host plant finding and host choice. In contrast to leaf volatiles, the release of stem volatiles was only seldom subject of examination. However stem volatiles are considered to be of significant importance during the host finding process of xylophagous insects. This study presents a new method for sampling of stem volatiles with reduced weight and time expenditure. The method is based on an oven bag and an extraction equipment. The oven bag is used to constitute an enclosure around a section of a stem. The air in the enclosure is constantly extracted for two hours. The samples are individually trapped on Tenax and desorbed thermally on a TDS system for final sample analysis on a gas chromatograph with a mass selective detector (GC-MS). The advantages of the method are the reduced time expenditure for the installation, the low costs for the flexible tubes and their low weight in contrast to the common enclosures made from steel and PTFE.

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Section 19 - Poster R-07

Porträtsammlung des Archivs des Senckenberg Deutschen Entomologischen Instituts (SDEI)

E. Schubert & A. Taeger

Der Archivbestand des Senckenberg Deutschen Entomologischen Instituts ist in den 125 Jahren seines Bestehens stetig gewachsen. Die hier gezeigten Bilder stammen überwiegend aus dem Bestand der Porträtsammlung, deren Anfänge etwa in der Mitte des 19. Jahrhunderts liegen. Noch vor der Gründung des Instituts im Jahre 1886 sammelte Gustav Kraatz (1831-1909) nicht nur Käfer, sondern trug auch eine reichhaltige Bibliothek, Nachlässe und eine Porträtsammlung zusammen, die er durch Schenkungen, Tausch oder Ankauf stetig erweiterte. Neben Fotografien von Entomologen und anderen Naturwissenschaftlern, wurden gezeichnete oder gedruckte Porträts systematisch erworben. Später kamen Ausschnitte aus Zeitungen und Zeitschriften hinzu.

Der Abschnitt „Portraits and collections“ aus dem „World Catalog of Symphyta (Hymenoptera)“ (Schubert 2010) dient u. a. als Beispiel für die Arbeit mit der Porträtsammlung. Für diesen Beitrag wurden nur Porträts von bereits verstorbenen Pflanzenwespenforschern verwendet. Trotz der je 12 Porträts auf 14 Tafeln ist selbst diese alphabetische Zusammenstellung von Autorenbildern noch lange nicht vollständig. Die Bilder wurden mit kurzen biografischen Angaben sowie Hinweisen zum Verbleib der jeweiligen Sammlung kombiniert, um den Nutzern so viele Informationen wie möglich zur Verfügung zu stellen. Die Präsentation zeigt z. B. eine Auswahl bzw. Neukombination der für den Katalog verwendeten Porträts.

Schubert, E. 2010. Portraits and collections. S. 690-706. *In* Taeger, A.; Blank, S. M. & Liston, A. D. 2010. World Catalog of Symphyta (Hymenoptera). Zootaxa, Auckland, 2580: 1-1064.

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