Abstracts from the talks

The abstracts are arranged in alphabetic order according to first author.

Wildbees and other sand living wasps in the county of Östergötland, Sweden

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Solitary bees and other Acuelata have increased in popularity the last years in Sweden. One reason is the Swedish Bee Project but perhaps also those insects great importance for pollination and the rapid decline of exposed sand areas are important explanations.

This study includes basically 50 sites in the county of Östergötland (200 km SW of Stockholm) with 5 white and 5 yellow cans each in three periods from May-August and for three days each period. Each site is only investigated one year. It also includes records from some other investigations such as window traps and collectings with insect net in the period 2002-2006.

The results show a lot of things. One example is the lack of knowledge manifested in 50 new species for the county and two new bees for Sweden, *Lasioglossum 4-notatulum* and *Nomada stigma*. The fragmentation of the seminatural grassland areas on sandy ground are shown through more Acuelata species on sites close to pastures with high diversity of plants. The rarest species found in this study (except the above mentioned) are the bee species *Andrena argentata*, *A. hattorfiana*, *A. labialis*, *A. marginata, A. nitida*, *Panurgus banksianus* and *Dufourea inermis*. Other interesting Acuelata species found are *Tiphia minuta* and *Hedychrium coriaceum*. The investigation is financed through the County Administrative Board of Östergötland.

Species action plans for threatened species in Sweden

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In cooperation with government agencies and the Swedish Species Information Centre, Per S-G was project leader designing the work with national species action plans (NAPs; or "recovery plans") for threatened species in Sweden 2004-2010. Seven interim targets of environmental quality objectives adopted by the Swedish Parliament explicitly address threatened species, and six of them NAPs to be introduced no later than in 2005-2006. Four of these six targets were achieved on time: i.e. for species in limnic environments, wetlands, forests, and in the agricultural landscape. Those for threatened species in montaneous environments and marine+coastal habitats, respectively, were not achieved on time. The seventh interim target states that due to improved conservation status, the fraction of red-listed species classified as threatened in 2015 is at least 30% smaller than in yr 2000. In total between 219 and 270 NAPs are needed.

NAPs are primarily used as a conservation tool for species whose status cannot be improved fast enough through exclusive use of protected areas or management in agri-environmental schemes. Criteria for selecting such species were developed by the Species Information Centre and its expert groups. Including NAPs in the national environmental quality objectives increased the awareness of policymakers, government agencies and other important actors to the situation of threatened species. Annual NAP funds increased from 0.86 to 9.12 million EUR during 2002-2006 and allowed the work to be re-organized and strengthened using a national network of NAP coordinators. Of 27 species subject to NAPs, the red-list situation 2000-2005 has improved for 9 of them, remains unchanged for 16, and 2 species have declined further.

Bengt E. has been hired as expert to write single-species NAPs for the beetles *Chalcophora mariana*, *Plagionotus detritus*, *Agrilus mendax* and a multiple-species NAP for beetles primarily or exclusively associated with lime (*Tilia cordata*). Actions for the recovery of these species include providing more breeding material (dead wood a.s.o.) and captive breeding for (re)introductions at old or new suitable localities. Overall, further inventories are needed to get better information about the occurrence of the species and to know how much breeding material we can expect on the different localities in the future. In multiple-species NAP it can be difficult to find actions and recommendations that are highly beneficial for all targeted species. Information about the genetic structure of populations is lacking for most insect species. We often have very little information about how long distances insects can disperse. But for many woodliving insects we have very good knowledge about what types of substrate they use. Providing good and updated information and guidelines to land-owners, County Administrative and Forestry Boards, and other stakeholders is crucial, of course.

Towards a phylogeny of the Staphylinidae tribe Athetini based on molecular and morphological characters

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The subfamily Aleocharinae is one of the major lineages of the beetle family Staphylinidae, counting about 12 000 species and 1000 genera world wide. The subfamily is universally recognized and well delimited, but within the subfamily several conflicting classifications reign, and no comprehensive studies have been done on the phylogeny of the group.

In our study, we concentrate primarily on the tribe Athetini, the largest of the Aleocharinae tribes. A prominent feature of this tribe is the monster genus *Atheta*, containing some 2000 species world wide. Neither the tribe itself nor the genus *Atheta* are believed to be monophyletic, but a serious investigation of their phylogeny has so far been missing.

We are hoping to make some headway in this respect by combining morphological and molecular data for a number of taxa from selected Aleocharine genera. My supervisor is supplying the morphological data set, whereas my focus has been on finding and using suitable molecular markers for the analysis.

I have concentrated mainly on mitochondrial genes, and my preliminary conclusion is that the most variable parts of these genes evolve too quickly to be used at our most inclusive level. They should prove useful for resolving the phylogeny within genera however. The more conserved parts seem promising for our deeper phylogeny, but they will need to be supplemented with more markers from the nuclear genome.

Excursions during the congress included a visit at the military shooting range at Marma, here with Niklas Jönsson, Johan Abenius and Nils Ryrholm valking in the somewhat cloudy weather. The sandy soil in combination with the disturbance of forest and ground layer has created good environments for many insects.

The types of darkling beetles described by Carl von Linné and Carl Peter Thunberg

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The types of darkling beetles described by Carl Peter Thunberg (1743-1828) and preserved at the Museum of Evolution, University of Uppsala, Sweden are studied and recognized as available names. New combinations are proposed.

The type of *Tenebrio spinosus* Linnaeus 1764 is found to be specifically different from the West Mediterranean taxa, currently named "*Akis spinosa*" after Herbst 1799 and Solier 1836, and belongs to *Akis elevata* Solier 1836 var. *sculpti-or* Koch 1935 syn. nov., a species from Egypt or from the Arabian Peninsule, probably collected by Peter Forskål 1763. Type material, bibliographic sources, consisting in iconography and text, clearly support this interpretation.

The species *Akis spinosa* (L.) is found to be *Akis trilineata* Herbst 1799. Several characters permitting easy separation are given. Several changes and synonymies proposed by the precited authors have been established without type examination and has to be rejected.

Recent advances in scarab phylogeny and taxonomy

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Systematics of scarab beetles (Scarabaeoidea) is currently moving forward as is the case with so many groups where traditional classifications are now challenged by new methods.

The first molecular phylogenies by Hawks et al, detailed morphological studies in several subfamilies, better infrasctructure among workers in the field, new nomenclatoral surveys by Smith et al, several cases in the ICZN, etc, are some of the factors encouraging new results. The traditional classification schemes have gained confirmation in parts and proved to need major reclassification in other parts. The fact that Bolboceratids seem to be the basalmost scarabs, and that Passalids seems to be a lineage among these rather than related to Lucanids is a surprise to many. The fact that the huge group of Melolonthinae s lat is not monophyletic and that several autapomorphic groups currently classified as subfamilies are scattered in the complex is very little surprise though, just like the fact that classification of both Lucanids and Dynastines lacks any phylogenetic support as it is based mostly on more or less allometric secondary sexual characters… A certain number of odd taxa remain quite enigmatic and may be of special interest.

Scientific use of the SMTP material

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The Swedish Malaise Trapping Project (SMTP) is a unique collecting effort, having run more than 70 Malaise traps for 3 years, covering all major habitats of the country. A lot of sorting

remains before the material will be available in its entirety. This presentation serves to suggest some uses of the material, based on all Cynipoidea wasps from some 20% of the samples.

The primary goal for the project has been to collect rich material of poorly known groups of Hymenoptera and Diptera. Thus one of the fundamental objectives has been simply to acquire material of undescribed and rare taxa for morphological and molecular study and the mere scientific description of new taxa.

Closely related to that is of course questions about coverage and representativity in terms of diversity, which are difficult to evaluate since there are no similar efforts based on other sampling methods. Still there is a lot to say about the material from this viewpoint.

Another obvious use of the material which is already possible, is in terms of securing quantitative evidence for certain autecological traits (in terms of phenology, habitat etc) which usually are cited from merely anecdotal evidence or even pure speculation.

When larger parts of the material has been identified, several other uses become possible in terms of quantifying diversity over time and in relation to a long row of variables, and much more…

The Swedish taxonomy initiative and the Encyclopedia of the Swedish flora and fauna

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In the footsteps of Linnaeus, the Swedish Taxonomy Initiative (STI; "Svenska artprojektet") is a huge and world unique government funded project. It aims at finding and describing every multi-cellular species in Sweden within 20 years. To that end, STI funds and organizes large-scale terrestrial (e.g. The Malaise Trap project) and marine inventories. STI also funds taxonomic research and a taxonomic school for Ph.D. studies in taxonomy. The results are published in international peer reviewed journals, but also in a popular science way in the planned 130 volume Encyclopedia of the Swedish Flora and Fauna (Nationalnyckeln). Hitherto, four volumes have been published and some 25 are under production. This talk will mainly focus on the Encyclopedia and the production of it.

Scale insects (Hemiptera: Coccoidea) as described by Linnaeus

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The article discuss 21 species of scale insects described by Linnaeus. Only 15 of these species, which belong to seven families, are officially recognised today. Details of the distributions of these species will be presented in this paper. Special attention is paid to the Polish cochineal insect, *Porphyrophora polonica*. Linnaeus was particularly interested in this insect due to its importance as a source of crimson dye.

Gertsson, C-A. In print. Scale insects (Hemiptera: Coccoidea) as described by Linnaeus. – Proceedings of the XI International Symposium on Scale Insect Studies, 24-27 September 2007, Oeiras, Portugal.

Strategies for winter active invertebrates in Fennoscandia

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Several invertebrates are active below, in or on snow during winter. Pitfall trapping below snow has documented an active *subnivean* fauna, for instance spiders, beetles, flies, mites and springtails. Most of these remain in the subnivean space, and little is known about the function of their winter activity. The *intranivean* fauna consists of ground-living springtails and mites which migrate up into the snow, maybe to avoid water logging or ice formation on the soil surface. The strongest specializations to winter activity are found among certain species of the *supranivean* fauna, which are active on the snow surface. Several Collembola species use the snow surface as an arena for long distance migration, and they are able to navigate by using the position of the sun. During late winter, the spider *Bolepthyphantes index* collects springtails in webs constructed in small depressions on the snow surface. The two wingless insects *Chionea* sp. (Diptera) and *Boreus* sp. (Mecoptera) are strongly specialized to winter activity. They occur regularly on snow in mild weather and use the snow surface for migration and occasionally for copulation. They retract to the subnivean air space via air channels along tree trunks, bushes etc. during cold periods, and lay eggs on the ground. *Chionea* deposits the eggs during midwinter while *Boreus*, which eats moss, deposits eggs throughout the winter. Many species of spiders and flies also visit the snow surface from the subnivean air space, but the function of this behaviour is badly understood. Maybe this is simply an extension of their continuous subnivean activity. Certain species among Chironomidae and Plecoptera occur on snow as a result of winter hatching from open rivers and brooks. Much interesting winter ecology remains to be studied in snow-covered areas.

Frequency dynamics of deer ked (*Lipoptena cervi*) in Finland

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Deer ked was for the first time observed in Finland in 1960 on elk (*Alces alces*). The species gradually spread over the country until it reached southern Lapland in the beginning of the 1990's. Deer ked reached Åland islands in the 1990's, where it also was observed on row deer (*Capreolus capreolus*).

The frequency of deer ked is generally related to the combined effect of frequency and seasonal behaviour of elk in Finland. In the 1950's the elk population was only about 5 000 and in the 1990's about 100 000. Since then the population has decreased to 50-70 000 because of more strict regulation.

In addition there is an annual variation in the frequency of deer ked depending on specific temperature conditions during the autumn of the preceding year and the spring of the current year.

Anopheles messeae as a vector of malaria in Finland

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The distribution of *Anopheles* species in Finland is reasonably well known. *A. messeae* is very common along the coasts, in the archipelago and in the southern part of the inland. *A. beklemishevi* is common in the east and in the north. *A. claviger* has only twice been found in the SW archipelago. There are no indications of such large scale ecological shifts which could have changed the species composition during the decline of malaria since the 1780's.

Malaria (*Plasmodium vivax*) was an indigenous disease in Finland until the beginning of the 1950's. In the Netherlands the disappearance of malaria has been associated with a well known shift in species composition from *A. atroparvus* to *A. messeae*. *A. messeae* has in part been considered a bad vector because it only occasionally takes a blood meal before hibernation. New observations on active hibernating *A. messeae* in Finland, however, support Hackett's corresponding observations in Italy in the 1930's. This strengthens the pattern of *A. messeae* still being a good vector of malaria.

One excursion during the congress followed the route that Linneaus often used between Jumkil and "the students' rest" some kilometers away up in the forest. The land use has changed dramatically since Linneaus times and grounds that probably were rather intensively grazed are nowadays forest. Åke Lindelöw (on the picture) guided during this excursion and showed among other things several forest entomological aspects.

Modern trends in taxonomy – and the future of entomological taxonomy

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The insects form the most species diverse group of organisms, and out of 1.6 million described species of organisms, 60% are insects. Careful estimates of the actual number of insect species says that there are around 10 million insect species out there, leaving 9 million species to be described. Based on these figures, recent major trends and challenges in entomological taxonomy are briefly discussed.

Colour forms of *Volucella bombylans* (Diptera, Syrphidae)

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Volucella bombylans (Diptera, Syrphidae) is a common hoverfly species which mimics bumblebees, *Bombus* (Hymenoptera, Apidae). In northern Europe four colour forms of *Volucella bombylans* are found (*Volucella bombylans* var. *bombylans*, *V. b*. var. *alpicola*, *V. b*. var. *haemorrhoidalis* and *V. b*. var. *plumata*). In Finland the most common form is var. *plumata* (51 % of the individuals), then var. *bombylans* (23 %) and var. *haemorrhoidalis* (21 %); var. *alpicola* (5 %) is the rarest. Towards the north, the proportion of var. *bombylans* decreases and the proportion of var. *plumata* increases. However, at the local level the ratios may vary. The phenology of all the colour forms was about the same. Also, the sex ratio was the same (1:1) for different forms.

The distribution of the different colour forms in other Nordic countries resembles the pattern found in Finland. Var. *alpicola* seems to be lacking in Central Europe. The proportion of var. *plumata* increases towards the east in Eurasia and var. *caucasica* is found in the Caucasian area.

Each of the *Volucella bombylans* colour forms mimics one or more bumblebee species (Batesian mimicry), although there is no clear model for var. *alpicola*. However, the distribution area of model bumblebee species is larger than that of *Volucella* colour form.

Beet webworm *Pyrausta sticticalis* L. during the period of its low density

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Beet webworm is a polyphagous pest, able to damage plants of about 200 species belonging to 40 families primarily in the steppe zone of Eurasia. Apart from Russia, damage caused by beet webworm was reported for north Mongolia and China, Kazakhstan, Iran, Iraq, Turkey, Turkmenistan, Ukraine, Moldova, Poland, Slovakia, Austria, Romania, Bulgaria, Hungary and Yugoslavia. Severe damage is caused during the pest outbreaks. Beyond outbreaks insect inhabits its natural habitat with a very low average frequency. Pest ecology has been rather intensively studied during outbreaks, whereas data on insect life history passed before and after insect outbreaks are virtually absent. We need to make up for this serious informational deficiency to understand the reasons of the pest outbreaks regularity and to improve the model of population density forecast of the beet webworm. For these purposes, the research on the pest biology is carried out since 2003 to 2006 at the Krasnodar Territory (West-North Caucasus).

During period of observations the beet webworm population density was descending in 2003, reached its minimum in 2004 and started to increase since 2005. In the period of low population density of beet webworm the adult females have low fecundity (the midvalue of this index varied from 4 to 200 eggs per one female), the hatchability of larvae tested in laboratory was low (4-55%) and its mortality was high (97%). It was demonstrated for the first time, that infection with microsporidia which are transmitted vertically and persist in host populations for a long time serves as an important factor of the beet webworm population dynamics. There was a tight negative correlation found between changes in imago abundance and microsporidia prevalence. In 2003, fluctuations of both insect density and microsporidia prevalence were moderate and its values were opposed to each other. In 2004, the maximal prevalence of the pathogen in the hibernated generation preceded the minimal density of the next generation. In 2005, a sharp decrease in microsporidia prevalence was followed with a significant rise of the insect number. The other factors, important for regulation of the beet webworm, were a) the hydrothermic coefficient during the flight period of the current generation and b) the complex of factors characterizing period of development of the previous generation (precipitation total, female fecundity, adults' density). The trends revealed allow forecasting the beginning of the pest density rise rather precisely even when only adult insects are found in nature. The research was partly supported by RFBR grant ## 06-04-48265, 06-04-63040.

How to recognize the original specimens in the Linnean collection

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Linnaeus started his entomological activities as a young man and had already in 1731 a collection of 400 insects. Careful attribution is required to separate his original specimen from his later aquisitions and from British additions. The Linnean collection is at the present unexpectedly complet. Of certain lepidopteran groups known to have been with Linneaus of the original specimens still around 85 % are there.

Predicting the progress of invasion pattern of potential arthropod invader within the novel environment, case study: Colorado Beetle (*Leptinotarsa decemlineata* Say) in Finland

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Developing reliable methods for predicting advance of potentially harmful invaders in a novel environment remains a persistent challenge to epidemiological and ecological modelers. The dominating demographic approaches handle space only implicitly and the spatio-temporal variation in the resources for invaders growth, reproduction, and spread are widely missed. Here we introduce a geographic automata based spread model for Colorado Beetle that attempts to capture both the inter-seasonal variation and the spread. Spread is modeled with active, wind-aided, and logistic-aided dispersals. With the model the resource base of the invader can be explored using the resource profiles of different temperature-categorized summers and winters at several scales. We use a case study of hypothetical aerial invasion of Colorado Beetle in Finland to demonstrate how the model can be used for exploration and prediction of invasion dynamics. The simulations are initialized by defining a seasonal resource array and by declaring the locations of first invaded cells and the densities of beetles in these cells. During simulation several spatio-ecologic metrics are updated. The analytics include also a map of average occurrence probability and a difference map between occurrence probabilities of selected time steps or intervals. The metrics aid the user in exploring the evolution of an invasion pattern at different scales and compare the regional differences in spreading rates between selected areas.

Diversity of bees and wasps in dry meadows of southern Finland

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Dry meadows are among the most important habitats of wild bees and aculeate wasps in Finland. However, the amount of dry meadows and other semi-natural grasslands has declined drastically due to changes in agriculture, as a result of which many bee and wasp species have become rare or threatened.

In 2004, the species richness and abundance of bees and wasps was studied by the Finnish Environment Institute on 40 dry meadows located in the regions of Uusimaa and Varsinais-Suomi in southern Finland. Ten of the meadows were managed by grazing. Bees and aculeate wasps were collected in June and July by means of yellow pan traps and direct netting. Also data on environmental factors, such as local habitat quality and weather conditions, were collected.

A total of 8167 solitary bees and bumblebees belonging to 135 species and 2750 aculeate wasps belonging to 162 species were recorded. On average, 35 bee species (max 65, min 7) and 23 wasp species (max 52, min 5) were found per

study site. Of the observed species 25 are classified as threatened or near threatened in Finland.

The species richness and abundance of bees and wasps did not differ between grazed and unmanaged meadows. According to a GLM-model, the species richness of bees was correlated with eight variables, e.g. wind exposure, the amount of nesting sites for above ground nesting species and tree coverage. The richness of wasps was also correlated with eight variables, such as wind exposure, grazing intensity and geographical location.

Factors influencing the species composition of bee and wasp communities were studied using NMDS-ordination. Geographical, topographical and climatic variables had the greatest influence on species composition of bees, whereas the quality of soil, ranging from mostly rocky to mostly sandy, was most important for wasps.

These results suggest that the remaining dry meadows in southern Finland have great importance for bees and wasps and should be managed by grazing or mowing in order to prevent their overgrowth. However, special care should be taken in maintaining enough flowers providing nectar and pollen, and nesting sites, such as dead trees and open sand patches.

Views of the phylogeny of bees

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Bees are among the most important insect pollinators and they contributed to the rapid diversification of angiosperms in the Early and Middle Cretaceous (124-90 Ma). For the present, the early evolution of bees has been only hypothetical in consequence of absence of fossil records. A fossil bee discovered recently in the Middle Cretaceous (100 Ma) amber from Burma (Myanmar) indicates that bees evolved from sphecoid wasps in the Early Cretaceous. The recently described genome sequence of the honeybee (*Apis mellifera*) and the other genome studies of bees give new insight into the evolution of bees. DNA data indicate that Dasypodaidae is a sister group to all extant bees and Melittidae to the rest of bees. Colletidae is traditionally regarded by reason of their ”primitive” characters as a sister group to all extant bees. According to DNA data, Colletidae is (together with Andrenidae and Halictidae) a sister group to ”long-tongued” Apidae and Megachilidae. The Genetic data also indicate that *A. mellifera* and *A. cerana* diversified already about 6-8 Ma and the honeybee has invaded at least twice from Africa to Europe.

In the tracks of *Nothorhina punctata* and *Tomicus minor*

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Natural pine forests contain unseen richness of species by builders of habitat on standing pine trees. The larva of the longhorn beetle *Nothorhina punctata* makes galleries which creates habitats for an assemblage of hole-nesting insects. *Nothorhina*-pines harbour a species-rich assemblage of bees and wasps, spider beetles and snake flies. This includes several threatened species, for example the snake fly *Inocellia crassicornis* and the digger wasp *Pemphredon fennicus* which are species utilizing the tracks of *N. punctata*.

Dying pines are another important unseen habitat in pine forests. Local assemblages of saproxylic beetles depend to a large degree on colonizing bark beetle species, creating specific habitats by gallery construction and fungus interactions. The pine shoot beetle *Tomicus minor* is together with the engraver beetle *Ips acuminatus* the only European bark beetles in the functional group of "phloeomycetophagous" bark beetles. They create a specific habitat since the later larval stages of these bark beetles feed on conidia and mycelium of fungi in the sapwood. Thus, it seems as the smaller pine shoot beetle (*T. minor*) is a key species for a specific assemblage of saproxylic beetles. This includes several red listed species as for example the darkling beetle *Corticeus fraxini* and the hister beetle *Platysoma lineare*.

These habitats and interactions are "out of sight and out of mind" for most people. However, we have to learn about key species in order to maintain viable populations of our other native species. Therefore, it is high time to see the tracks and not only the trees in our North European pine forests.

Intraspecific transfer of Cantharidin within Blister beetles (Coleoptera: Meloidae)

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Cantharidin ($C_{10}H_{12}O_4$) is a potent repellent compound against a wide variety of predators which is produced by blister beetles (Coleoptera: Meloidae) and oedemerid beetles (Col: Oedemeridae) where it is found in hemolymph and various tissues. Males of blister beetles transfer

large pockets of cantharidin along with sperm to the female during copulation. Cantharidin movement through different parts of male and female genitalia was surveyed to get a better time sequence of the pharmacodynamics of this compound. Since cantharidin titre in meloid beetles highly depends on the age, sex and mating record of the individuals, deuterated cantharidin (DC) was introduced into meloids' body by injection, mixed with artificial diet or floating the beetles' internal organs in Ringer plus DC solution. All samples were analysed by GC-MS, but because of the approximate coelution of cantharidin and DC, their exact measurement via normal MS seemed to be very difficult. Therefore, MRM (Multiple Reaction Monitoring) was developed for cantharidin/DC separation and independent quantitation. Cantharidin pharmacodynamic in male of studied species could be quite different over a period of time. As the accessory glands absorb high amount of DC in short term, they will eventually accumulate less amount than the testis. Confirming the previous studies, it has been concluded that post-farnesyl steps in the cantharidin pathway may occur entirely in the male's body outside the reproductive system but the ultimate product is transported into male internal genitalia via membrane of the accessory glands which should be permeable to the chemical. It transfers afterwards to epididimis and the vas deferens in higher volume comparing to the other organs of the male genitalia and finally absorbed by the testis. In females, cantharidin is first absorbed by spermatophoral receptacle in high volume while at the same time goes through ovary and is distributed upon eggs; by the way the up-taken volume by ovaries remains considerably lower than the receptacle. By time these two organs stopped accumulating of cantharidin, whereas the bursa copulatrix starts incorporating the gift actively. This reserved amount should be mainly supplied by the receptacle and ovaries directly, so that the internal way of the terpene transfer remains as the main transport way.

Changing fauna in a changing climate

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In recent years there has been a growing discussion about the global warming. By now it becomes more and more widely acknowledged that human lifestyle and activities progressively more influences the climate on Earth. The escalating number of weather extremes also increases the awareness among many people.

Insect encompass little concern about the reasons for changes in climate, but due to their short lifecycles and rapid reproduction rate they are the organism group on our planet that can respond most rapid on any change in climate. If the climate becomes more suitable for them they expand and become more abundant, if the weather deteriorates many species will succumb and vanish. Also the modest, at first glance, temperature changes that we have experienced during the past century in Sweden have had a clear impact on the Swedish Lepidoptera fauna. I will show some examples of the climatic development in Sweden during the past 150 years and particularly during the last 50 years, which I will connect to some examples of faunistic changes among butterflies and moths. I will also contemplate about where we and the insects are heading in the future.

Linnaeus´ names of butterflies deduced from mythological figures in the Trojan war

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In his Systema Naturae X from 1758, Linnaeus consistently used the names of the kings, queens, heroes etc. from the epos of Homer's Iliad, the Trojan war, to nearly all butterflies of the family Papilionidae which were known at the time. This paper will focus on how Linnaeus developed and refined his system to describe and classify the butterflies, from his first edition of Systema Naturae 1737 to his 10th edition of 1758, and how he got the idea to use the names in the Iliad.

I believe that I have traced some systems in Linnaeus way of giving these names, but I have also found that Linnaeus not always is following his own system, something which has caused many butterfly enthusiasts a lot of problems. I have also, from the specimens which belonged to Queen Lovisa Ulrica and which Linnaeus used when he gave these first butterflies their names, tried to restore her collection of butterflies as it was when Linnaeus visited her in the castle of Drottningholm. These old specimens are now all in the Museum of Evolution, Uppsala University. Fortunately Linnaeus also wrote a book consisting of 700 pages where he in Latin carefully described all the butterflies the queen kept in her natural cabinet. Today we are also greatly assisted by the magnificent paintings of the queen's collection of tropical butterflies, which were made by Linnaeus' friend Carl Clerck who was employed at the Royal Swedish Tax department.

Molecular analysis reveals hidden diversity of cuckoo wasps (Hymenoptera, Chrysididae)

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Chrysididae, commonly known as cuckoo wasps, is a cosmopolitan family among Hymenoptera with over 3000 species described to date. All members of the family are parasitoids or cleptoparasites and their primary host can belong to various families of Hymenoptera but also to walking sticks or silk moths. Parasitic lifestyle of Chrysididae has lead to many taxonomically unresolved species aggregations within the family. Most of the taxonomically problematical species in Northern and Central Europe fall into the *Chrysis ignita* species group. In present study we examine the phylogeny of the *C. ignita* species group using the molecular methods with an attempt to find also cryptic species.

We have sequenced ~1200 base pairs of mitochondrial rRNA genes: partial sequences of 12S rRNA, 16S rRNA and full sequence of tRNA^{Val},

of 80 cuckoo wasp specimens from all problematic taxa of *Chrysis ignita* species group from North and Central Europe.

Cladistic analysis of the DNA sequences support the species status of majority of the analyzed species. Species that should be considered as good species according to our study are: *C. angustula* Schenk, 1856, *C. comta* Förster, 1853, *C. corusca* Valkeila, 1971, *C. fulgida* Linnaeus, 1761, *C. ignita* (Linnaeus, 1758) form A Linsenmaier, 1959, *C. indigotea* Dufour & Perris, 1840, *C. iris* Christ, 1791, *C. leptomandibularis* Niehuis, 2000, *C. longula* Abeille, 1879, *C. pseudobrevitarsis* Linsenmaier, 1951, *C. ruddii* Schuckard, 1836, *C. rutiliventris* Abeille, 1879, *C. sculpturata* Mocsáry, 1912 and *C. subcoriacea* Linsenmaier, 1959. However our data does not support species status of taxa in two aggregations. *C. mediata* Linsenmaier, 1951 and *C. solida* Haupt, 1956 are not supported as separate species as well as three taxa in another aggregation consisting *C. ignita* (Linnaeus, 1758) form B Linsenmaier, 1959, *C. impressa* Schenk, 1856 and *C. schenki* Linsenmaier, 1968.

Our analysis also reveals 4 taxa that can not be associated with any known species. Some of them are probably cryptic species that were not recognized earlier.

Phylogenetic analysis demonstrates that generally well defined *C. ignita* species group is not monophyletic since *C. indigotea* Dufour & Perris, 1840 forms well supported clade with one of the outgroup taxon – *C. graelsii* Guerin, 1842. All other species of the species group fall into four major clades. Formation of these clades is probably related with the evolution of host preference since species in each clade have similar hosts.

Insect conservation in Estonia – current state and perspectives

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Estonia has undergone substantial habitat changes over the last decades. Analyses are needed urgently on the current status and trends in different invertebrate groups in order to identify and target conservation measures. An overview of insects in the Estonian nature conservation context is provided. Processes for national threatened insect conservation planning are outlined and the major species conservation documents (Nature Conservation Act and Red Data Book) are discussed. Insects, thanks to their diversity, ecology and indicative functionality, are key to strategies identified by conservation biology research and conservation policy implementation. But nevertheless insects as a group receive in Estonia minimal legislative protection and they still exist outside mainstream nature conservation. Advantages and shortcomings of listing insect species for conservation priorities are discussed, and main factors that confound insect conservation efforts across different levels of consideration are emphasized. Possible methods to improve the legislative and applied processes for enhanced insect conservation effects are suggested.

Impact of botanical insecticides on enzyme activities of *Toxoptera graminum* (Homoptera: Aphidinea)

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Development of novel insecticidal compounds is essential to combat multiple problems arising with the use of synthetic chemical insecticides. Botanicals containing active phytochemicals are being increasingly reconsidered recently as a potent source of novel pesticides, repellents, antifeedants and growth inhibitors of natural origin. Interactions of plant extracts with insect biochemical systems are crucial for understanding the modes of action of the xenobiotics and possible resistance patterns in target pests. Previously, we have assayed crude ethanolic extracts of as much as 88 plants collected in Kyrgyz Respublic against aphid *Toxoptera graminum*. Among these, crude extracts of *Tripleurospermum inodorum, Plantago major, Anabasis aphylla* and *Pyrethrum cinerariifolium* showed high aphidicidal activity and were assayed for inhibitory activity against two aphid enzymatic systems: carboxylic esterases (CE) and phenoloxidases (PO). When insects were treated with plant extracts and then the homogenates were assayed with the use of spectrophotometry and enzyme electrophoresis, no suppression of CE and PO activities was found as compared to control. However, when homogenates were prepared from naive aphids, incubated with equal volume of 1% extracts, spinned at 14000 g (to remove insoluble particles of the crude extracts) and assayed spectrophotometrically, a significant level of both CE and PO inhibition in vitro was observed. Suppression of CE was 2.4-fold to 2.9-fold for all extracts with the only exception of of *O. vulgare* that caused 6.2-fold suppression. Suppression of PO was 2.3-fold (*A. aphylla*), 2.5-fold (*P. cinerariifolium*), 8.4-fold (*O. vulgare*) and even 13.7-fold (*T. inodorum*).

Further analysis using enzyme electrophoresis and protein quantification showed that in vitro enzyme inhibition caused by *T. inodorum* and *O. vulgare* extracts was due to the protein binding to insoluble particles of the crude extracts which were removed by centrifugation. The other two extracts caused reversible inhibition as protein quantities as electrophoretic profiles were not changed and enzymatic activities were restored after electrophoresis (suggesting that inhibitor-enzyme complex was dissociated). The ability of some phytochemicals to suppress insect enzymes is very important as, besides implication in diverse vital functions, CE is responsible for xenobiotics detoxication and insecticide resistance while PO plays a major role in insect immunity against parasites and pathogens. The ability of the plant extracts to suppress CE and PO activity indicates their appropriateness for IPM, as this should facilitate sensitivity of target insects to other control agents. The research is supported by ISTC, project # KR-1122.2.