PAPER ABSTRACTS

Sexual selection in the drumming wolf spider *Hygrolycosa rubrofasciata*

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Males in the wolf spider *Hygrolycosa rubrofasciata* produce conspicuous audible drummings during their brief mating season in early spring. We have extensively studied the significance of drumming activity from the viewpoint of the general sexual selection theory. A particular attention has been in the possibility that drumming might act as an honest signal of male genetic quality. Males move around their habitat (forested bog or abandoned field) searching for females and tap with their abdomen on dry leaves to produce the drumming sounds. According to our laboratory experiments females mate preferentially with males of high drumming activity. Typically the drumming bout lasts for one second, and females are more likely to respond after relatively long signals. Female presence does increase drumming activity, and in this way we have been able to demonstrate that drumming is highly costly to males. These costs are likely to be associated with the high energetic costs of drumming. However, the males that are most active in drumming do survive better than the least active males. This seemingly contradictory result is actually exactly what is predicted from the theory of male sexual signals as conditional handicaps. It is the fittest males that are best able to bear the costs of signalling, and thus the signal is bound to be honest for choosy females. *H. rubrofasciata* has been particularly suitable study object for testing the basic assumptions and predictions of the handicap theory. The final question is whether females will get any benefits through their choosiness, and indeed a slight benefit in offspring survival appeared in an experiment where females were mated either with poor or good drummers. Interestingly male body size is not correlated with mating success or drumming performance, which may explain differences in the growth and maturation patterns of male and female offspring. Recently we have studied minute populations of the species in tiny bogs separated by forest to explore whether small population size causes viability problems in individuals. Indeed, drumming activity of males might be reduced in populations that have only very few individuals.

The influence of the 97-98 El Niño upon the Galápagos lycosid populations

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El niño is a worldwide climatological event occurring every 2 to 8.5 years. This event is associated with high sea-surface temperatures across the tropical Pacific and weak or reversing easterly trade winds. The combination of both leads to abnormally strong convective storms in the eastern Pacific and heavy rainfall in western Latin America (especially Ecuador and Peru) and in Galápagos.

The authors had the opportunity to witness the recent 97-98 El Niño event during their stay in Galápagos in March and April 1998. The effect of extremely wet conditions upon the *Hogna* populations of the islands Santa Cruz and Santiago and volcán Alcedo (island Isabela) could be observed.

Hogna albermarlensis, a coastal species, normally living in saline habitats near lagoons and in permanent wetlands beneath 600 m of altitude, exhibited an extremely aggressive expansion of its distribution all over the visited islands and volcanoes, occurring everywhere in very high densities, even outnumbering the top restricted species (species which evolved out of the founder species *H. albermarlensis*). A situation is created in which both species, the coastal species and the top species, meet each other during a certain period of time.

Every el niño event is followed by a number of extremely dry years (called la niña) resulting in the drying out of all temporary wetlands existing during the el niño period and restricting again the lycosid populations to their former areas.

El niño's have certainly played an important role in the speciation of the lycosid species on islands where the coastal species and a top species occur.

Hunting conditional strategy of a salticid spider *Yllenus arenarius* Menge, 1868

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A complex conditional hunting strategy was described in a dune-dwelling salticid *Yllenus arenarius.* In the experiments 2 types of naturally eaten prey were used: prey of high probability of escape (Homoptera, Diptera and Orthoptera) and one of low probability of escape (Lepidoptera - larvae and Thysanoptera). Hunting prey that could easily escape, spiders performed specific behaviour (stalk and movement masking) and varied greatly the speed of approach. They approached either very rapidly or very slowly and jumped from longer distances than while hunting the other type of prey. Hunting caterpillars and Thysanoptera, spiders did not perform any specific behaviour that could be interpreted as decreasing the probability of early detection. They approached the prey from the front and jumped from shorter distances. Their speed of movement gradually decreased as spiders approached this type prey.

Testing the efficiency of suction samplers (G-Vacs) for collecting spiders: The effect of increasing nozzle size and suction time

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The conversion of garden vacuums (G-Vac) designed to collect debris and leaves to suction samplers which could collected invertebrates from grassland swards was described by Alan Stewart and Ann Wright in 1995. Since then, G-Vacs have been increasingly used in ecological studies because of their low cost and weight and their high suction speeds. Consequently, G-Vacs have tended to replace the less efficient and more costly D-Vacs. However, G-Vacs have only received limited attention in terms of their sampling efficiency. In this paper, the efficiency of two G-Vacs was tested to examine the effects of increasing the suction nozzle area and the sampling time whilst keeping total sampling area constant (0.491 m^2). We tested *a priori* hypotheses that increasing nozzle area was important but that reducing sampling effort was not, using planned comparisons analysed with one-way ANOVA followed by contrast analysis. We found that when the nozzle diameter was doubled in size, significantly fewer species, individuals and numbers of *Pachygnatha degeeri*, *Centromerita concinna* and *Lepthyphantes tenuis* were collected. However, the effect of increasing the suction time tenfold did not significantly increase the numbers of spiders collected. We conclude that in studies of short grasslands, small differences in suction time are unlikely to introduce confounding effects of under sampling, but dramatically increasing the nozzle area may have serious and unwanted effects.

A computerised method to observe spider web building behaviour in a semi-natural light environment

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Spider webs are a record of the application of a series of behavioural patterns. The web building behaviour is of immense interest to ethologists and taxonomists studying the evolutionary relationships of spiders. However, due to the inability of the researcher to observe the spider around the clock during web building, many details of the behavioural patterns can go undetected. To overcome these problems, we developed a novel, computerised method to continually observe the spider during web building. The spider is kept in a temperature controlled room, on a reversed light cycle, confined to an observation arena placed in front of an infrared illuminated background. An infrared capable digital video camera is used to capture live pictures which are transferred to a high end computer where they are analysed in real time. The computer records the position of the spider at a maximal rate of 14 frames per second. A separate program allows a detailed analysis of the recorded movements, including various spatial and temporal analyses. It also allows exporting the movement patterns. The use of infrared light allows us to offer the spider a natural light cycle with "Osram Daylight" fluorescent bulbs. The method of observation and data analysis developed by us enables the detailed study of the web building behaviour of nocturnal spiders and eliminates most constraints encountered to date. Our method moreover enables the recording of web building behaviour of spiders that are otherwise disturbed even by the minimum amount of light required by a conventional video set-up.

A possible mating plug in *Latrodectus revivensis* and implications for mate selection

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The shape of the female genital system is assumed to determine the sperm priority patterns in spiders. These patterns are reflected in the mating behavior of a given species. Although, the female of the entelegyne spider *Latrodectus revivensis* possesses a conduit-type spermatheca, the male might be able to bias the outcome of mating by plugging the entrance of the spermatheca with its embolus tip. To estimate the importance of the embolus tip as a mating plug, I recorded the frequency of the loss of the tip during mating and examined the morphology of virgin and mated females' spermathecae and male pedipalps by means of scanning electron- and light microscopy. In 70 matings all males were accepted within 24 hours and 96% have lost the tip of at least one embolus. The morphological pictures revealed that the embolus possesses a defined breaking point. 92% of mated females collected in the field had not more than a single tip in one or both openings. These broken embolus tips were generally lodged deep inside the spermathecal opening. The defined breaking point, its frequent loss, its tight fit and its usually single occurrence support the idea that the male embolus tip acts as a mating plug. Males that successfully copulate with both pedipalps, losing both embolus tips, may be expected to fertilize all of the female's eggs. Nevertheless, females may control the number of successful copulations with a given male by rejecting or even cannibalizing him. Cryptic female choice in form of actively choosing sperm of the right or left spermatheca, each filled by different males, might be an additional tool of female mating strategies in *Latrodectus revivensis*.

An invertebrate inventory from different Alpine habitat types in the Hohe Tauern National Park (Salzburg, Austria)

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The invertebrate fauna of the Hohe Tauern region is, in common with other mountain regions and indeed most National Parks, extremely poorly understood. This makes protection of many of the invertebrate species difficult. A particular problem is that "blanket management" - which is based on the requirements of higher organisms and is derived from a "human-scaled" habitat mosaic - does not ensure the survival of small species. Also it is not possible to implement specific protection and management policies without a knowledge of the range and the habitat requirements of the species present which need to be protected and managed.

In view of this we initiated an inventory of the arachnid (excl.Acari) and carabid fauna occurring in a mosaic of alpine habitats along the Grossglockner Hochalpenstrasse, a panoramic road in the Eastern Alps lying between the political provinces of Salzburg and Carinthia. During the 1998 season we investigated the species communities of seven different sites (1960 - 2360 m a.s.l.) using pitfall traps and a suction sampler. Some of the more interesting results concerning arachnid species distribution, community structure, and phenology are presented and information concerning the newly rediscovered pseudoscorpion *Neobisium (N.) noricum* Beier, 1939 is given.

Effects of inbreeding: reproduction and offspring performance of the sub-social spider *Stegodyphus lineatus* (Eresidae)

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Sub-social behaviour in spiders may represent an intermediate step towards the evolution of true sociality. The study of sub-social spiders may thus help to understand the conditions that precede sociality and how sociality evolved in spiders. Sub-social spiders are characterized by extensive maternal care of young. The offspring disperse at a relatively late stage of development, but before maturation and breeding. Social spiders are hypothesized to have evolved via this "sub-social" route, by means of further delaying dispersal and by extending the period of brood feeding and co-operation typical of juvenile stages of the sub-social species. To produce the highly structured populations typical of social spiders from a sub-social species would require changes such as reduced dispersal and inbreeding. Inbreeding may be costly leading to lower fecundity and reduced offspring viability. This raises the question whether sub-social species have behaviours that reduce the likelihood of inbreeding, or if they tolerate regular inbreeding, as do social species. The aim of the study presented here is to investigate possible constraints of inbreeding in a sub-social spider by comparison of fitness consequences of mating between inbred and outbred crosses. The spider studied is *Stegodyphus lineatus* (Eresidae), which is semelparous and has extreme maternal care. Spiders from known families were raised to adulthood and mated with either a sib (inbred treatment) or a non-sib (outbred treatment). Female and male mating behaviour (e.g. time for male to enter female nest; female aggression) was recorded. Females produce egg sacs and raise the young until dispersal. The reproductive related response variables are: egg sac production, hatching success and number of dispersing spiderlings. Negative effects of inbreeding may show up as lowered offspring fitness, and will be assessed by measuring survival and growth rates of juveniles. Growth and development is assessed of young from inbred and outbred crosses raised either separately or in groups of offspring of the same brood. The groups of juveniles will further be assigned to four diet treatments: 1) ad lib, high quality food, 2) ad lib, low quality food, 3) shortage diet, high quality food, 4) shortage diet, low quality food. The comparison of singletons versus grouped spiders is the test for inbreeding cost, because the group imposes competition, which should be greater given a poor diet. If inbred individuals show inbreeding depression, they will do worse than outbred ones.

A spider community index to estimate the patrimonial value of the habitat: range and causes of index variability

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In a previous study, we have presented the principle of calculation of an experimental index to estimate the patrimonial value of a natural biotope. This patrimonial index was based on the combined rarity of spider species inhabiting an investigated area. National, biogeographical, regional or departmental data serve as reference bases. In the present case, an example of a practical use of this index is given as a contribution of the elaboration of the managing plan of a natural reserve in the west France. The patrimonial index (Ip) was calculated for different habitats of this reserve. The relative contribution of each habitat to the global patrimonial value is presented. Strong variations can be observed between the different values of the patrimonial indices depending on the vegetative cover and the human interventions. Set-asides or local furzes exhibit the highest values while areas submitted to animal trampling and grazing or fragmented shrubs exhibit the lowest ones ; we can notice a gradual increase of the values (from the lowest one to the highest one). A method is presented in order to define the minimal variation of the Ip which reflects a real change in the patrimonial value of the habitat. The species associated to the greatest or the smallest variations are pointed out. The analysis of the range of variability allows us to define clearly the degree of rarity of each species for each geographical scales. Moreover, the range of variablity of the Ip both related to the number of species analysed and to the collecting method is presented.

Spiders of the genus *Haplodrassus* (Aranei, Gnaphosidae) from South Siberia

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Eight *Haplodrassus* species are recorded from six areas of South Siberia (Tuva, Irkutsk Area, Buryatia, Chita Area, Amurskaya Area, Khabarovsk Prov.): *H.cognatus* (Westr.), *H.hiemalis* (Em.), *H.moderatus* (Kulcz.), *H.pugnans* (Sim.), *H.signifer* (C.L.K.), *H. soerenseni* (Str.), *H.taepaikensis* Paik, *H.sp.* Unknown male of *H.taepaikensis* is described, it is a new species for the fauna of Russia. One species is regarded as "sp. nov.". Species *H.dalmatensis* (L.Koch), *H.silvestris* (Blackw.), *H.umbratilis* (L.Koch) are excluded from the list of regional fauna as misidentifications.

Extensive spider community and diversity analyses for woodland site evaluation in Flanders (Belgium)

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The results of a complete year cycle of pitfall trapping in 56 sampling stations from 40 woodlands distributed over the entire region of Flanders rendered more than 55000 adult spiders belonging to 250 species. The relation between these spider communities and several measured abiotic and biotic parameters yields some interesting conclusions for the use of spiders as bio-indicators in the evaluation of forest site quality. Stepwise multiple regression shows that spider diversity is highest in those sites situated closer to forest boundaries (i.e. in smaller forests), probably as a result of increased edge-effects. Therefore small forests display a higher diversity than larger ones. Diversity in general also is negatively related to clay-content of the soil and Leaf-Area Index (LAI) (as an inverse measure of light intensity): a higher diversity therefore coincides with more open forests (low LAI) on sandy soil (low clay-content). Community analyses also show the importance of soil characteristics (and corresponding vegetation characteristics) in the explanation of observed spider assemblages (illustrated in TWINSPAN, indirect (DCA) and direct (CCA, DCCA) gradient analyses). The most important factors explaining the distribution of spiders in forests of Flanders seem to be soil texture (sandy versus sandyloam/loam with corresponding abiotic and biotic characteristics) and soil humidity. The correspondence between DCA results on the one hand and CCA, DCCA on the other hand clearly suggests that the environmental factors investigated in this study contain the most important characteristics responsible for the observed spider communities. Analyses with data from a shorter sampling period deviate substantially from those obtained for a complete year of sampling and suggest to use longer trapping periods in long term monitoring projects. Finally, some powerful indicator species have been derived from stepwise discriminant function analyses for several abiotic forest characteristics (clay-content, LAI-index, humidity, ¼. Such species could be useful for forest site quality evaluation and for long term monitoring, provided they are known to occur exclusively in woodlands.

Evolution of the chelicerate claws or apotele

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Character states are determined for the apotele, or claws, of the postcheliceral limbs in Chelicerata. The ground pattern, suggested by outgroup comparison with trilobites and apparently retained in basal members of Pycnogonida, Xiphosura and Scorpiones, is three short spines homologous with the empodial claw and two ungules of arachnids. Ingroup Pycnogonida and Xiphosura have enlarged the empodial claw, and lost the ungules. Some Eurypterida have tarsal spurs flanking the apotele, but their homology with ungules is questionable. More derived Scorpiones have legs (limbs III-IV) with a small empodial claw and large, paired ungules, as do (convergently) Araneae, Uropygi, Palpigradi and Trigonotarbida. Ungules on the pedipalp (limb II) are retained in Palpigradi and basal Acari, but only Palpigradi retain both the empodial claw and ungules here. Ricinulei have lost the empodial claw from the legs (an autapomorphy) and Opiliones have lost the ungules (a possible autapomorphy). The empodium, previously coded as synapomorphic for (Pseudoscorpiones + Solifugae), is interpreted here as manifestation of the pulvillus which is present in Acari and Amblypygi too (an apomorphy). It is probably a homoplasic character, characterising one order within the Tetrapulmonata, but may provide further support for an (Acari (Pseudoscorpiones + Solifugae)) relationship.

Evidence for strong isolation between populations of the forest-living spider *Coelotes terrestris*

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Habitat fragmentation results in the division of the original habitat into several smaller and isolated patches. Population genetics theory predicts a reduced population size in these small habitat fragments, which increases the risk of inbreeding and losing genetic variability. Only the exchange of genetic material between populations can prevent the occurrence of these negative effects. Random amplified polymorphic DNA (RAPD) markers were used to assess the population genetic structure of *Coelotes terrestris* (Agelenidae) in ten forests. Larger forests (> 100 ha) seemed to harbour a higher genetic diversity than smaller fragments. Populations occurring in forests that are situated closely together were not genetically more similar than geographically more distant populations. This means that there is no isolation by distance. Indeed, genetic differentiation between forests was very high ($F_{ST} > 0.385$) and highly significant between each pair of populations ($p > 0.001$). These findings suggest that the studied fragments are isolated from each other and that there is no genetic exchange between them.

Fungal and microbial infections of trapdoor spiders in Okinawa, Japan

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Populations of trapdoor spiders are not only controlled by predators but also by various infections and parasites. In this context I mainly deal with rikettsia and fungi.

As a great number of trapdoor spiders was kept in captivity during the past 24 years, the degree of infection could be compared between representatives from different families and from different populations of the same species originating from different habitats.

There are considerable differences in the rate of infections as moisture of the habitats is concerned.

Species of different families are also subject of different kinds of infections.

The role of spider position on orb-web design

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In orb-web spiders, foraging bears both profits and costs. While being active in the hub of an orb-web, a spider may suffer from exposition to predators and bad weather conditions, but will reach prey more quickly than spiders hidden in the retreat. When prey is entangled, it can only be localised by the spider proceeding from the hub. Therefore spiders hidden in the retreat may suffer from a longer distance to reach entangled prey via the hub. Consequently it is essential for prey capture success to keep the distance between retreat and hub as short as possible. Moreover, when staying in the hub, spiders should reduce hub-retreat distance to escape dangerous situations quickly. I used female *Larinioides sclopetarius*, a nocturnal orb-web spider that is usually found in the retreat, to test whether spiders alter web design according to retreat position. In most orb-webs the region above the hub is smaller and contains less silk than the region below the hub, creating an asymmetrical web; the retreat is usually located above the web. When the retreat was experimentally reversed to the bottom of the boxes, spiders also reversed asymmetry; less material covering a smaller area was used for the region below the hub compared to the region above, creating an untypical orb-web. Similarly, spiders reduced the retreat-hub distance by a lateral asymmetry, with the region next to the retreat reduced and the region away from the retreat enlarged. Therefore, spiders can optimise web design by reducing predator-prey distance.

The function of silk decorations of orb-web spiders

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A number of taxonomically diverse species of orb-web spiders adorn their webs with conspicuous silk structures, called decorations or stabilimenta. The function of these decorations remains controversial and several explanations have been suggested. These include: (1) stabilising and strengthening the web; (2) hiding and concealing the spider from predators; (3) advertising the web to larger animals such as birds, that may otherwise damage it; (5) providing a sunshield, or (4) attracting prey to the web by reflecting UV-light. Here, we review some of the evidence in support of various visual functions.

Changes in life-history of the spider *Erigone atra* when subjected to two stress factors, Dimethoate and starvation

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The changes in life-history parameters brought on by stress might enlighten our knowledge concerning the flexibility of the animal in question. The more flexible the individuals, the more resilient the population will be to change. This experiment aims to investigate the responses in life-history of the spider *Erigone atra*, when exposed to the insecticide Dimethoate and to starvation. Only the parent generation (mothers) were subjected to the two treatment factors, as the effects of maternal stress on the fitness of the subsequent generation was investigated as well. An additional factor considered was maternal age. Both insecticide treatment and starvation of mothers caused the hatchlings to have an altered shape of cephalothorax. Insecticide caused the cephalothorax of adult F_1 generation spiders to be longer. Insecticide treatment did not affect fecundity. Starvation caused a reduced fecundity, but did not have any main effects on F1 generation development and survival. Maternal age also reduced fecundity. There were several interactions between the stressing factors. Treatment mortality of mothers was increased when insecticide and starvation was combined, and so was the mortality of spiderlings fed a toxic prey, *Folsomia candida*. Additionally the survival of spiderlings fed *F. candida* showed an increased sensitivity to maternal starvation as the mothers aged.

Apomorphic apophyses supporting subgroups in the crab spider genus *Xysticus*

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Previous authors have recognised three crab spider genera, *Xysticus* CL Koch, 1835, *Psammitis* Menge, 1875 and *Proxysticus* Dalmas, 1922, all of which are currently considered part of a single *Xysticus* sensu lato group. Although *Psammitis* and *Proxysticus* are regarded as synonyms, the structure of the male palp includes apomorphic characters which can be used to define groups within *Xysticus* sensu lato. So far, characters have not been polarised, but outgroup comparisons with other thomisid genera and Philodormidae suggest that within the Middle European species a relatively flat tegulum (`*Psammitis*'-group) is plesiomorphic with a trend towards increasing development of the tegular apophyses from the '*Proxysticus*'-group to the most complex-structured *Xysticus* s.s. group. Secondly, outgroup comparison suggests that three tibial apophyses ('*Proxysticus*'-group) are plesiomorphic with a reduction to two tibial apophyses *Xysticus* s.s. and '*Psammitis*'-group. The retrolateral apophysis is sometimes modified to a hook-like structure in the latter group. Clypeus morphology, body spination and the female vulva may also help to resolve relationships. Whether these characters justify resurrecting *Psammitis* and *Proxysticus* is unclear at present since there are other potential subgroups with unusual male pedipalpal characters.

The two faces of the spider silk precursor

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Circular dichroism spectroscopy of the extract from the major ampulate gland of *Nephila edulis* has revealed that the molecular structure o the silk fiber precusor protein(s) is biphasic with an irreversible transition to an apparently beta-rich state. This supports the widely accepted (though not so widely proven) model of protein fiber formation (e.g., amyloids) and correlates well with the x-ray fiber-diffraction data on silk. Not only does this work have implications on silk fiber formation, but also on the formation of medically important pathogenic fiber-forming proteins, such as the prions of Mad Cow disease. This work is recent, novel and unique.

Effect of experimentally controlled mating duration on sperm-competition in *Pardosa agrestis* (Lycosidae: Araneae)

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Mating duration varies considerably between wolf spider species. We found it to be between 2 and 3 hours for *Pardosa agrestis*, the most common epigeic spider in Hungarian agricultural habitats. Our previous results have shown that females can mate at least twice despite the fact that one interrupted mating of 10 minutes is enough for complete fertilization. Our hypothesis for the present study was that mating duration is a sexually selected trait. We hypothesize that long mating duration has evolved, because long mating males could gain an advantage in sperm competition. We examined sperm priority pattern in case of double mated females, where the first, the second or none of the two mating events was interrupted 15 minutes after its start. We used irradiated ("sterile") male technique for determination of paternity. We found that without the manipulation of mating time virgin females mated for significantly longer time than mated ones. However, we do not know if the female or the male partner determines the end of mating. Out of the single mated females, the ones that mated with non-irradiated males only for 15 minutes (interruption), produced complete and viable clutches, while eggs of females mated with irradiated males (X-ray 30 grey) were sterile. In the double mating treatments, when none of the matings was interrupted a slight first male priority (60 %) was observed. When one of the mating events was interrupted, the fertilization success of the other (complete mating) males were significantly higher compared to their rivals. These results suggest that males increase their relative fertilization success by longer mating and this might be the main driving force for the evolution of long mating duration in *P. agrestis*.

The taxonomic status of the miratemnids (Pseudoscorpionida: Atemnidae)

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The family Atemnidae was erected by Chamberlin in 1931. It was later divided in two subfamilies by Beier in 1932, Atemninae and Miratemninae, based on the differences in the position of the seta on the 4th tarsus and granulation on the carapace. Dumitresco and Orghidan (1970) finally raised the miratemnids to family level based on several characters including the orientation and configuration of the male genital organ. Since then the family has obviously been accepted by several authors, using this taxonomic level in their works. In later years Harvey (1992, 1993) has argumented against the family level of the miratemnids and has included them once again in the Atemnidae.

In his opinion the diagnostic characters given by Dumitresco and Orghidan are not particularly useful on family level. The family level of the miratemnids thus seems to be connected with a certain degree of conjecture.

This study deals with the configuration and orientation of the male genital organs of atemnids and miratemnids since this seems to be one important point in the discussion. Male organs from 43 species of 14 different genera have been investigated; species from 3 of the 4 genera of miratemnids have been included. Investigation of the chitinised parts of the the male genital organs reveals a marked consistency in their configuration. The mutual position of the apodemes and their diverticules are the same whether they are atemnids or miratemnids. The differences lies mainly in the size of the genital organs and the degree of sclerotisation and coloration of the apodemes. Although there are differences in the shape of the lateral apodemes and the lateral rods, these are not more pronounced between the atemnids and the miratemnids than what can be found between genera inside the atemnids. The orientation of the genital organ as a whole is more anteriorly directed in the atemnids and more posteriorly in the miratemnids. Although this seems to be more or less constant I do not consider this a critical character on family level. In summary there are no differences in the male genital organs between the two groups which support a division in two families.

Bizarre copulatory behaviour in *Tidarren* and *Echinotheridion*: mate castration and cannibalism (Araneae, Theridiidae)

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Males of *Tidarren* and *Echinotheridion* amputate one of their palps a few hours after the penultimate moult (Branch, 1942: *Bull. South Calif. Acad. Sc.*, 41, 139-140; Knoflach & Harten, 2000: *J. nat. Hist.*, in press.). Palpal loss, single palp copulation and obligatory mate consumption were studied by the authors in *Tidarren cuneolatum* (Tullgren, 1910) from Yemen and Cap Verde Islands. Females court actively, signalling receptivity by continuous leg movements. Males construct a mating thread, where copulation takes place. At the end of the single insertion the male is sucked out. Thus, only one receptaculum is inseminated during copulation. Females are polyandrous, males monogynous owing to mate consumption. This sex role reversal is probably indicated by the active courtship of females and also implicates male choice owing to his high investment.

A new *Tidarren* species from Yemen shows an even more exceptional copulatory behaviour (Knoflach & Harten, submitted). As soon as genitalia coupling is achieved, the single male palp becomes torn off by the female, remaining attached to her epigynum for *c.* 4 hours and functioning independently like the hectocotylus in some cephalopods. In the meantime the palpless male is sucked out. Castration synchronises mate consumption and sperm transfer and lengthens the interval between copulations. A similar mode of copulation was also observed in *Echinotheridion gibberosum* (Kulczynski, 1899) from the Canary Islands.

Spiders and harvestmen in light-traps (Arachnida: Araneae, Opiliones)

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Is the application of light-traps a useful way of collecting arachnids? Faunistic investigations in different biotope types and altitudinal zones in southern Austria allowed comparison of the results of conventional sampling methods with the arachnological output of light-traps. Apart from some eurytopic species, the application of light-traps leads to a distinct spectrum of rarely collected, especially crepuscular and not epigeic taxa, which seem to be under-represented in the majority of arachnological studies. An attractiveness of light-traps for particular harvestmen and spiders is obvious. It results in an interesting and characteristic coenosis of phalangiids, theridiids, linyphiids, tetragnathids, araneids, pisaurids, gnaphosids, philodromids and clubionids. Rarely collected arachnids from light-traps include: *Opilio dinaricus, Enoplognatha caricis, Scotophaeus scutulatus, Philodromus corticinus, Cheiracanthium punctorium*, *Clubiona germanica, C. pallidula* and *C. reclusa*. Consequently more consideration of the additional species of the non-butterfly-output of light-traps is advisable.

Spider fauna of peatbogs in southwestern Finland

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Communities of ground-living spiders on peatbogs are compared in southwestern Finland. Material from an *Eriophorum-Sphagnum* peatbog (where ca 100 species were caught during a two-year study) near Turku is used as the basic data for comparisons. Special attention is paid on distribution types of bog spiders, like on northern (e.g. *Pardosa hyperborea, Tricca alpigena, Gnaphosa lapponum*) and southern (e.g. *Zora parallela, Glyphesis cottonae, Taranucnus setosus*) bog specialists. The possible effects of isolation, size, continentality and certain other factors of the peatbogs are discussed.

Why no subspecies in spiders?

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Even a short check of current catalogues of hitherto named spider species demonstrates that authors almost exclusively described and continue to describe monotypic species. Only in a very few instances subspecies were named. It appears that they all do not correspond with the polytypic species concept sensu Mayr. Instead, nearly all subspecies were simply coined when structural differences were fairly slight, and authors accordingly hesitated to describe a species. As spider taxonomy still relies on typology, it remains difficult to decide whether morphospecies of this kind really represent biospecies, and there is little information on the presence of cryptic species. As compared with other groups of terrestrial organisms this situation seems to be exceptional. As far as known, many (morpho)species seem to be endemic to fairly limited areas, e.g. in alpine habitats, or in caves. This may at least indicate modes of allopatric specieation. Others are even of holarctic or pantropical distribution. Extremely vast distribution areas of this kind were generally explained by assuming that such species originally were of allopatric origin but were more successful than their direct relatives in extending their ranges. Could it be that the holarctic species *Araneus diadematus* consists of one single panmictic population? Species of this kind may be barred from geographid speciation.

Despite of this, most differentiation seems to be the result of quite regular allopatric, i.e. geographic speciation. But if this would be true, a crucial problem arises from the fact that there is practically no variation, especially in genitalic structures: intermediate populations or at least single specimens intermediate between different species (indicating the existence of subspecies) are almost entirely unknown in nature. This explains on the one hand why authors continue to "stamp" morphospecies; there may be only some rare cases where it is not possible to assign even a single specimen with certainty to morphospecies A, B, or C. On the other hand and much more important, the evolutionary biologist is confronted with a crucial problem: how could one understand this kind of non-variation? May this be induced by a high selective pressure towards perfect co-adaptation of male and female genitalic structures (Eberhard's female choice hypothesis)? Then, the lack of transition zones or at least belts would be understandable, and subspecies could be potentially masked by such factors.

Cocoon care in the social spider *Stegodyphus dumicola* (Araneae, Eresidae)

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Before facing the problem of cocoon care in spider societies, it is necessary to recall some general problems of societies and social behaviour. Ecological studies have revealed both costs and benefits of sociality and have shown that social behaviour is maintained only under special ecological conditions. Thus sociality must not necessarily be preferred over a solitary lifestyle.
Spiders are usually solitary, exhibiting aggressive behaviour towards other animals, including conspecifics. Communal and cooperative living patterns have been observed in a few species from several families (0.2% of about 30 000 known species).

The genus *Stegodyphus* which is common in arid regions of Africa and Asia has three species groups (*miranda-, dufouri-* and *africanus*-group), each including both social as well as solitary species, making it a very interesting spider genus for the study of social behaviour. The development of permanently social life patterns in *Stegodyphus* seems to be the result of extending the early social stage in subsocial species due to brood care. This could finally lead from communities of juveniles to permanent social colonies (Kraus & Kraus,1988).
In this context **parental care** seems to be one of the main steps in the origin of sociality in *Stegodyphus*.

Discrimination of conspecific unrelated individuals is a general phenomenon of real societies and was explained by the concepts of "inclusive fitness" and "kin selection" (Hamilton, 1964). Several references (Krafft 1982a, Kullmann 1974, Kraus 1988, Seibt & Wickler 1988) suggesting that spider societies are open systems without kin recognition contradict the concept about societies where individuals invest valuable cooperative efforts. Kin selection assumes that natural selection will favour social or altruistic behaviour. If there is no kin recognition found in spider societies no cooperative investigations should be expected because of the increased risk of social parasitism. But **cooperative brood care** has been shown several times for permanent social species in *Stegodyphus* (Kullmann et al. 1974, Seibt & Wickler 1988, Kraus, M. 1988).

These facts lead to following questions
• Are colonies of *S. dumicola* open systems?
• Does cooperative cocoon care exist in *S. dumicola*?
Field work was done from 1996/97 on the Farm Otjiseva, located in the Khomas Highland of Namibia. Laboratory experiments under nearly natural conditions took place in a temperated conservatory of the University Würzburg. Following results were found.

- Several observations in the field and under laboratory conditions confirm the existence of an open spider society in *Stegodyphus dumicola.*
- Cocoon exchange experiments showed that females cared only for their own cocoon. Thus cooperative cocoon care in females of *S. dumicola* was not found.
- Observations of cocoon guarding behaviour in colonies of *S. dumicola* showed the existence of biparental guarding Males were also guarding cocoons and showed defence behaviour towards predators and parasitoids.

- Two different reproductive strategies in males were found: Smaller males emigrate in groups to other colonies for reproduction, bigger males stayed in their own colony, guarding and defending cocoons.

Generic revision of the thomisid subfamily Coriarachninae

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The dominant Holarctic thomisid group consists of brownish spiders with no green pigment. The tropical genera of this group are in minority everywhere among thomisids and mostly poorly known. The dorsal setae are often somewhat modified, mainly club-shaped. Another evolutionary trend is the development of one or two tegular apophyses in the male palp, a character not known in other groups of crab spiders. These spiders were originally placed in several tribes of Thomisinae by Simon (1895). This group has been treated before higher than tribe as Dahl (1907) created the family Xysticidae with a delimitation different from the group discussed here. The best known genus of this group is *Xysticus* C.L. Koch 1835, but a suprageneric group must be named according to the oldest suprageneric name included in the present delimitation.

The taxonomic treatment of crab spiders of the widespread and large *Xysticus* s.lat. has been quite variable during the last hundred years, but acceptance of more than one supraspecific taxon in this group has gradually become a common practice, less so in *Ozyptila* s.lat., although the evolution of male palpi in both groups has been widely parallel.

The thomisid tribe Coriarachneae Simon, 1895 is here radically delimited and treated as a subfamily, as Dahl´s splitting of Thomisidae to several families cannot be accepted. Coriarachninae is possibly the most plesiomorphic branch of the Thomisinae s.lat. Some groups of Simon´s Thomisinae most probably must be treated as additional subfamilies, but are not discussed here in more detail. Coriarachninae is mainly Holarctic (*Xysticus* C.L. Koch 1835, *Psammitis* Menge 1876, *Coriarachne* Thorell, 1870, *Bassaniana* Strand, 1928, *Spiracme* Menge 1876, *Bassaniodes* Pocock, 1903, *Ozyptila* Simon, 1864, *Modysticus* Gertsch, 1953) with some Oriental and Melanesian species in *Pycnaxis* Simon, 1895, *Narcaeus* Thorell, 1890, *Demogenes* Thorell in Simon, 1895, *Senoculifer* Balogh, 1935, and *Takachihoa* Ono, 1985. The large Asiatic genus *Lysiteles* Simon, 1895, a new Himalayan genus as well as the tropical genera *Philodamia* Thorell, 1894 and *Haplotmarus* Simon, 1909 possibly constitute another tribe of Coriarachninae. *Wechselia* Dahl, 1907 is possibly the only Neotropical genus of Coriarachninae, but African and South-American thomisids have not been revised with the same intensity and there are possible additional genera. However, the inclusion of *Wechselia* is not certain. Generally accepted synonymic generic names of this group are not discussed here.

Coriarachneae originally included *Tharpyna* L. Koch, 1874 in addition to the type genus and Roewer (1954) added *Firmicus* Simon, 1895, most probably according to its flat body, a parallel adaptation. These genera are excluded here, as their genital organs do not fit to this group.

Four generic synonyms are presented. There are at least five new genera (one European, two Asiatic, one Madagascan, one New Guinean) within the accepted limitation of Coriarachninae, but they are neither named nor described in this abstract, in order to avoid nomenclatoral problems.

Reproduction in scorpions, with special reference to parthenogenesis

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Scorpions are unusual among terrestrial arthropods in several of their life-history traits : ritualized and complex courtship with fecondation by a spermatophore ; viviparous embryonic development, which can last from several months to almost two years ; maternal care, sometimes followed by a degree of social behaviour; and post-embryonic development times that can be extraordinarily long, lasting from 7 to 85 months.

Because of these unusual life-history traits, many aspects of the reproductive biology of scorpions were poorly understood by early authors, such as the classical « promenade à deux » described by Maccary (1810) and Fabre (1907). In the mid-1950's, several researchers, apparently independently, discovered that sperm transfer is accomplished by means of a spermatophore. However, this discovery should first be attributed to Angermann (1955). More detailed studies of scorpion embryology were carried out by Laurie at the end of the 19th century (1890, 1891, 1896a,b), followed by the publications of Pavlovsky (1924, 1925) and Pflugfelder (1930). After these contributions, little attention was paid to the embryology of scorpions and only a few isolated publications have provided additional information (e.g. Mathew, 1956, 1960 ; Anderson, 1973 ; Yoshikura, 1975 ; Lourenço *et al*., 1986 ; Kovoor *et al*., 1987).

The first paper on the post-embryonic development of scorpions was published by Schultze (1927). Starting on the mid-1950s and during the 1960s, several reports were published on aspects of the reproductive biology--in some cases on the entire post-embryonic development--mainly by biologists such as Alexander (1956, 1957, 1959), Auber (1959, 1963), Matthiesen (1962, 1969), Maury (1968, 1969), Shulov & Amitai (1958), Shulov, Rosin & Amitai (1960), Varela (1961) and Williams (1969).

It was only by the mid-1970s that there was a renewed interest in the study of the reproductive biology of scorpions and in particular post-embryonic development. These studies have been multiplied during the 1980s and continued during the 1990s. Interestingly, most of the authors were basically taxonomists who, in addition to the biological information, were interested in obtaining data on the ontogenetic variability of the characters used in taxonomy (various publications of Armas, Francke, Lourenço and Sissom). Only Polis & Farley (1979, 1980) have attempted to explain reproductive traits in the context of evolutionary ecology.

In regard to the known biological data, a great disparity clearly exists concerning the methods used and the quality of the observations. In many cases, the information may be simple speculation or even fallacious. I will not, however, discuss these aspects here. After this brief synopsis, I will conclude my talk with the presentation of the phenomenon of parthenogenesis. Of almost 1600 species of scorpions distributed throughout the world, only eight are known to be parthenogenetic (Lourenço & Cuellar, 1994, 1999). The first case was reported by Matthiesen (1962), in the Brazilian species *Tityus serrulatus* Lutz & Mello. Since then, *T. serrulatus* has been synonymized with *Tityus stigmurus* (Thorell) (Lourenço & Cloudsley-Thompson, 1996a), a parthenogenetic species consisting of at least four distinct all-female morphs (Lourenço & Cloudsley-Thompson, 1999a), one of which is the original *T. serrulatus*. The other seven known parthenogenetic species

are *Tityus uruguayensis* Borelli from Uruguay and Brazil, *Tityus columbianus* (Thorell) from Colombia, *Hottentota hottentota* (Fabricius) from West Africa, *Tityus trivittatus* Kraepelin from Argentina, *Liochelis australasiae* (Fabricius) from the South Pacific, *Ananteris coineaui* Lourenço from French Guyana, and *Tityus metuendus* Pocock from Peru and Brazil (Lourenço & Cuellar, 1994, 1999).

The parthenogenetic pattern observed in scorpions corresponds in all cases to the model defined by Vandel (1928) as « geographic parthenogenesis » and can be tentatively explained in terms of the life history strategies of the populations.

A program of studies on the neotropical parthenogenetic populations will be developed until at least 2003, with the collaboration of researchers in the USA, Brazil and Colombia.

An evaluation of the possibilities to incorporate spiders in a monitoring scheme for wet heathland habitats

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To be able to evaluate on a regular basis the results of nature conservation efforts, monitoring systems should be designed. Abiotic and biotic indicators of the evolving nature value and biodiversity as a result of nature management measures will have to be tested and evaluated for what concerns their possibilities in that respect. The aim of our contribution is to investigate and to evaluate if and how spiders can be used in that context of applied ecological research. Indicator potentiality as well as practical feasibility is considered.

Fire regime and spider community: is there any relationship?

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"Fire and biodiversity" is a much-discussed dual concept based on research in different countries under different environmental conditions and fire regimes. Nevertheless, at present, no studies have been done on faunistical post-fire biodiversity in winter fire-prone ecosystems such as the deciduous forests on the southern slope of the Alps. The basic objectives of this study were to analyse the effects of single and repeated fires on spider diversity and on spider communities and to describe the ecological response of forest floor habitats to wildfires in the chestnut forests in southern Switzerland, using epigeic spider as bioindicators. A total of 140 spider species were sampled from April to September in burnt and control sites of chestnut coppice forests using pitfalls. About 47% of the species were trapped exclusively in burnt sites (only 11% exclusively in intact forests). Our results show that the species richness and the community composition varies as a function of the fire frequency and on the time elapsed since the last fire. Moreover the results indicate that the post-fire succession started from the individuals which have survived. No pioneer species were observed in the burnt sites. Our data show that the community composition was influenced from the post-fire dynamic of the environment and the interactions among the species. After a single fire, changes in the communities were observable within the two first years after the fire only. Changes persisted in cases of repeated fires. In this case the communities were characterised by the eudominance of only one specie *(Pardosa saltans)* and the increase in species richness and in species diversity. The ecology of species belonging to the differential spider species sampled in "repeated fires sites" indicates a mosaic structure of the environment and the microclimate conditions at the epigeical level, with a predominance of xerical conditions. It seems clear that the important selvicoltural treatments until the fifties as well as to the intense fire history have played an important part in the evolution of the spider communities on the chestnut belt.

Range boundaries in congeneric arachnid species in the Northern Alps

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Factors limiting the geographical range of a species are broadly debated in biogeo-graphy, ecology and conservation science. In various taxonomic groups ranges of congeners belonging to the same guild were analysed to investigate the influence of interspecific interactions on distribution pattern. Data obtained from pitfall transects in the subalpine and alpine zone, covering a distance of 220 km in Bavaria and Salzburg, provide examples of frequency shift for arachnids along the northern margin of the Alps.

Three major types of substitution can be recognized. Some species replace each other abruptly without an overlapping zone, thus showing a vicariance pattern. This category is examplified by the nemastomatids *Nemastoma triste / lugubre*. The former species is abundant in all biotopes and altitudes east of the river Lech, but is absent in the Allgäu Alps, where *N. lugubre* occurs exclusively. This pattern strongly suggests interspecific interaction, as apparently no strong environmental gradient exists.

In other species, a small transition zone of sympatric occurence was found. From the Chiemgau Alps westwards *Coelotes terrestris* (Amaurobiidae s. Platnick) is widespread in the subalpine zone, but it is replaced in the east of the research area by *Coelotes solitarius*. From the intermediate Berchtesgaden Alps, both species were reported.

Some species finally replace each other gradually over a wide geographic scale. Surprisingly such a pattern was found in the common lycosids *Pardosa blanda / oreophila*. *Pardosa blanda* is a dominant species in alpine grassland of the Allgäu and Ammergau Alps, but becomes rare further to the east. Nevertheless it still occurs at the eastern margin of the Alps. *Pardosa oreophila* apparently shows a reverse trend.

Alternating abundance gradients along the Northern Alps were also observed for *Centromerus arcanus / subalpinus* (Linyphiidae), *Cryphoeca lichenum lichenum / silvicola* (Hahniidae s. Platnick), *Zelotes apricorum / subterraneus* (Gnaphosidae) and *Platybunus bucephalus / pinetorum* (Phalangiidae). The patterns may imply shifts in habitat and altitudinal preferences. They also reflect postglacial recolonisation processes.

Spiders of Central Europe: An internet identification key

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A short analysis of the most common books for the identification of spiders in Europe is presented. It shows that there is a clear need for a new identification tool, which should cover an as large area in Europe as possible. It should also include approximately a dozen figures per species, not necessarily from the same author. Additional informations (e.g. distribution maps) are desired but not crucial. An important criterion is the flexibility of a medium with respect to changes, e.g. due to taxonomic re-arrangements of genera or families or the incorporation of new species. A very preliminary marketing analysis shows clearly that such conditions can only be fulfilled by an internet version of an identification key.

At the occasion of this congress we report on the progress of our joint project during the last two years and we will make our current work available for the public. This premiere does not mean that our identification key is perfect: we include meanwhile 43 families, 335 genera and approx. 1250 species. These are presented by more than 8000 figures from books or articles published by more than 50 arachnologists which gave us their reproduction permit. Our work includes also a large reference chapter and a lexicon which explains all technical terms.

In the next years we intend to ameliorate our product. This means that we will perform a lot of corrections and additions, we will also have to translate the texts into English as main language (current language is German). Additional ideas concern the enlargement of the geographical area into the Mediterranean countries and we could also include distribution maps.

Responses of Glutathione S-transferase and Glutathione Peroxidases to diets of different quality in a wolf spider *Pardosa prativaga*

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Detoxification enzymes such as glutathione S-transferase (GST) and glutathione peroxidases (GSH-Px) may be involved in the degradation of xenobiotics contained in food or in removal of hydroperoxides created during food metabolism. Thus, they can be expected to respond to the quality of the prey, especially if these contain chemical defenses.
Several common prey types are known to be of low quality to spiders. The spiders´ consumption rate of these prey are far below what is expected from their food demand as indicated by their potential consumption rate of high quality prey. Thus, spiders being held on low quality prey may be starving in the sense that energy intake is far below demands for normal performance. In this study groups of spiders with approximately the same weight were held on restricted, mostly single-prey diets for 1-3 weeks. GST and the GSH-Px´s were assayed and the results of these measurements were compared to weight changes and the respiratory metabolism of the same individuals.

Host invasion of the parasitoid *Acrocera orbicula* (Diptera: Acroceridae) and the effect of acrocerid parasitism on *Pardosa prativaga* (Lycosidae: Araneae)

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A novel host invasion strategy was observed in the acrocerid *Acrocera orbicula*, an endoparasite of spiders. In laboratory experiments with hatchlings of *Pardosa prativaga* the free-living, host-seeking first instar larvae did not invade the body of the host, but they attached themselves firmly to the spiders' integument by the mouth parts, cutting a tiny hole through the integument. Most of the larvae attacked the spiders' legs. A week after the infection the parasitoids moulted and a small, flexible, and glabrous second instar larva left each of the attached first instar exuviae and invaded the host through the attachment hole of the first instar larva. The spiders shed the abandoned first instar exuviae with their old skin. As in other species of Acroceridae the endoparasitic larvae of *A. orbicula* migrated to the host opisthosoma, where the larval development is completed. We suggest that the mode of host invasion observed and the gross morphology of the invading larva reduce physical damage to the host in the initial phase of endoparasitism, enhancing parasitoid survival. Additional laboratory experiments suggest that at 25 ^{o}C the growth and survival of *P. pardosa* hatchlings invaded by a single second stage parasitoid larva were not significantly affected, whereas multi-parasitism resulted in higher spider mortality.

Foraging behaviour of two ant-eating spiders (Araneae, Zodariidae)

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Foraging behaviour of two ant-eating zodariid spiders, *Zodarion germanicum* and *Zodarion rubidum,* is presented. The spiders were offered various ant species and other insects in order to find their preference. Study spiders were able to subdue many ant species but the best success was obtained with medium-sized ants. Other insects (termites, aphids, silverfish) were ignored. The attack tactic consisted of a rapid lunge followed by stabs into any ant limb. Afterwards spider retreated and returned to the ant as soon as it was paralysed. Then it began to feed. In order to find how zodariids identify ants, modified ants, including change of their colour, gait and smell, were offered to spiders. Ants with excised antennae, excised legs, washed in alcohol, and lures driven by magnet were readily attacked and accepted for feeding. Ants covered with oil were readily attacked but often discarded before feeding. Coloured ants and passive lures were attacked less and seldom fed on. Orientation and attack were primarily elicited by ant walking pattern. While for orientation vibratory cues perceived by slit sensilla or trichobothria were important, attack was stimulated by visual cues detected by anterior lateral eyes. Then the spider tapped ant presumably to receive tactile stimuli released by pilose body. A chemical signal seems to be perceived during prey location and handling of prey. The prey discrimination thus occurs at several steps during prey capture. However, more neuroethological research shall be carried out to support or refuse presented hypotheses.

Morphometric variability in some cave-dwelling *Roncus* spp. populations from the Eastern Rhodops Mountain, Bulgaria (Arachnida, Pseudoscorpiones)

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There are 41 species of *Roncus* (Neobisiidae) recorded to date from the Balkan peninsula. Many original descriptions of cave-dwelling *Roncus* species have been based upon very few individuals which has led to an accumulation of species of uncertain taxonomic status. Their intraspecific and interspecific morphometric and morphological variability have been poorly studied. Four *Roncus* species have been recorded from Bulgaria, of which two are cave dwellers. I have studied 162 specimens collected from 17 underground localities situated in a 4172 sq. km region. All specimens could be referred to the *Roncus parablothroides* group due to the lack of microsetae proximal to the trichobothria EB and ESB. Discrimination function analyses utilising nine pedipalpal measurements and five ratios enabled the samples to be best distinguished. Length of the femur, its ratio length vs. breadth and length of the tibia have the best discrimination power. Specimens were classified and clustered upon a set of characters (factor and cluster analyses) or simply plotted into two-dimensional morphospace. Morphometrically, females were best distinguished from males by the form of the tibia, i.e. length vs. breadth. On a local scale, at least three groups of allopatric populations were recognised. In some samples, within-population variability remained stable after 25 or more specimens were analyzed. Thus previous interspecific comparisons based on only a few individuals could not reflect the true morphometric relations between certain congeners. In most of the cases, similarity between populations decreased with an increase of distance between the underground stations. Pedipalpal characters of parapatric soil and litter *Roncus* spp. showed no morphometric overlap in comparison to the cave-dwelling specimens. Due to the common geological history of the region, no significant correlation was discovered between the parameters of the cave environment and degree of the pseudoscorpion troglomorphy within different populations. Considering the greater size of the pedipalps and some morphological features, two of the samples were supposed to consist of an undescribed *Roncus* species related to *Roncus giganteus* Mahnert. On a larger scale, I compared the samples from the Eastern Rhodops Mountain with 65 specimens which originated from 14 caves located in northern Bulgaria and discovered a general trend for an increase in the size of the pedipalps towards the south. On the other hand, members of presumably the same phyletic series of Greek species (*R. corcyraeus, R. giganteus and R. liebegotti*) have lower average values of the pedipalpal measurements. Finally, I believe that the present knowledge concerning the diversity and distribution of the Balkan cave-dwelling *Roncus* fauna is still insufficient to draw confident conclusions and new field and laboratory data are needed to fully assess the composition and evolutionary history of the fauna.

Diversity and community structure of epigeic spiders (Araneae) in different bog and forest habitats in Geitaknottane Nature Reserve, western Norway

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The aim of this study was to investigate and describe epigeic spider communities in different vegetation types in a forested area (1,5 km^2). Fifty sites with eight pitfall traps in each site were distributed in different vegetation types: 7 bogs, 15 *Calluna* - pine (*Pinus sylvestris*) forests, 12 bilberry (*Vaccinium myrtillus*)-pine forests, 1 spruce (*Picea abies*) plantation and 15 deciduous forests. The trapping period was April-November 1997.

In all, 16628 adult spiders (154 species) were found, and *Europhrys frontalis* (Salticidae), *Maro lepidus* (Linyphiidae) and *Porrhomma oblitum* (Linyphiidae) were recorded for the first time in Norway.

Results from Detrended Correspondence Analysis (DCA) based on the species composition alone resulted in a comparatively clear-cut community division. Essentially the same classification resulted from the Detrended Canonical Correspondence Analysis (DCCA) where different environmental variables were taken into consideration. Increasing productivity ($p = 0,01$), decreasing humidity ($p = 0,01$), increasing bush cover ($p = 0,015$), increasing tree cover ($p = 0,05$) and increasing slope ($p = 0,021$) were the significant explanatory variables for the distribution (ordination) of communities and species of spiders along the first axis in DCCA. Increasing heat index ($p = 0,21$) was the only significant explanatory variable for the second axis.

The TWINSPAN-analysis, based on the species data alone, gave almost the same result as the multivariate analyses. Five fairly well-defined groups of spider communities could be identified. TWIN 1: spiders in moist, open bog habitats and TWIN 2: spiders in open, warm habitats (*Calluna*-pine forests). TWIN 3: spiders in more shaded, medium-humid, bilberry-pine vegetation, TWIN 4: spiders in the various dark, humid deciduous (*Alnus incana*, *Prunus padus*, *Betula pubesence*) forests and the one spruce plantation, and TWIN 5: spiders in various drier deciduous (*Ulmus glabra*, *Fraxinus excelsior*) forests.

Most species in the families Lycosidae, Gnaphosidae, Hahniidae, Salticidae and Clubionidae were found/ordinated and concentrated in the open localities (bogs and *Calluna*-pine forests) in the multivariate analysis. Species of Linyphiidae were represented at all sites, but were the dominant family in the bilberry-pine and deciduous forests.

Spiders characteristic of various groups are: bogs (TWIN 1): *Pirata hygrophilus*, *Notioscopus sarcinatus*, *P. piraticus* and *Pocadicnemis pumila*; the open *Calluna*-pine forests (TWIN 2): *Pardosa pullata*, *Gnaphosa bicolor, Zelotes clivicola* and *Hahnia ononidum*. No single species is characteristic of the deciduous forests. The dominance of the different forest species *Lepthyphantes (Thenuiphantes) tenebricola*, *L. (T) alacris*, *Dicymbium tibiale*, *Diplocephalus latifrons* and *Pardosa lugubris* varies within these sites (TWIN3, 4 and 5).

Spider community ordination (DCCA) is principally in accord with the vegetation types of the different sites. Some exceptions will be discussed, indicating that the structure of the vegetation is of importance in regard to community structure of epigeic spiders.

This study is part of the Norwegian project "Environmental registration in forests", directed by the Norwegian Forest Research Institute (NFRI).

Current research of Lithuanian peat bog spider fauna: relationships between peat bogs and surrounding areas

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The first investigations of Lithuanian peat bog spider fauna were started in 1999. 6 sites in 4 peat bogs were chosen for studies by means of pitfall traps during that year. Investigations of other 15 sites in 12 peat bogs were started in 2000. High variety of Lithuanian peat bogs differing in size, water level and anthropogenic impact could be found between more than 3000 peat bogs or peat bog fragments currently known in Lithuania.

One of the aims of the investigations is to evaluate an impact of immigrating spider species from diverse surrounding areas on spider communities living in peat bogs. Some sites investigated in 1999 were used in the analysis. 3 epigeic spider communities studied in Cepkeliai Strict Nature Reserve (located in the South of Lithuania, near the border with Belorussia) were compared. Two of these communities belong to peat bog habitats while the third one presents the community of spiders of homogenous dry grass pine forest. Such forests surround Cepkeliai mire complex. Two peat bog habitats (open hummocky raised bog and pine raised bog wood) were close to surrounding pine forest. Pine raised bog wood was located between dry pine forest and open area in distances of about 100 m.

109 spider species were registered from all sites during the investigations. Despite of very small differences in numbers of species (54, 57, 54) and numbers of specimens (962, 955, 843), distinct differences in species composition were registered. Only 8 spider species ocurred in all three communities (*Alopecosa pulverulenta, Haplodrassus signifer, Zelotes latreillei, Agroeca brunnea, Agroeca proxima, Zora spinimana, Diplocentria bidentata, Walckenaeria alticeps*). Immigration of *Diplocentria bidentata* and probably *Walckenaeria alticeps* from surrounding pine forest could be recognised. 26 specimens of *Diplocentria bidentata* were found in dry pine forest, 1 in bog wood and 2 in open area. What concerned *Walckenaeria alticeps,* 19, 2 and 2 specimens were found in these communities respectively. Other 8 species were dominant or subdominant in surrounding pine wood and they did not occur in peat bog communities. Dry pine forest subdominants *Centromerus sylvaticus* and *Zelotes clivicola* were found only as singletons in the pine bog wood.

The conclusion can be made that migration of spiders from surrounding pine forest to peat bog habitats is very low. The migration from this habitat is at the same level as migration from wide distanced open or areas (3 specimens of *Pardosa prativaga*, 2 of *Pardosa pullata*, 2 of *Drassylus pusillus* and 1 of *Xysticus cristatus*).

The nature of agrobiont spiders: an example of cereal spider communities in Hungary

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Within the framework of a national survey of spider assemblages of agricultural areas the arachnofauna of cereals has been systematically investigated in Hungary, since 1992. Samples by pitfall trapping and/or suction sampling took place at 16 different locations, representing five smaller regions of Hungary. As a result over 10000 specimens, representing more than 150 species were caught. An analysis of the similarities and differences between the spider assemblages found in the various fields, regarding dominant species, diversity and community structure is given. It is established, that cereal spider communities in Hungary are dominated by a well defined and limited set of species, which are more or less ubiquitous in every field. These most dominant and widespread agrobiont species are: *Pardosa agrestis, Meioneta rurestris, Oedothorax apicatus, Pachygnatha degeeri, Tibellus oblongus*. Apart from the agrobionts, cereal fields had a diverse spider community, reaching an estimated species richness of 110 species at several locations. Indicator species analysis showed, that for the cereal fields, as such, there were no strictly specific, indicator spider species. Considering arable fields in general (cereals plus alfalfa) these habitats had few indicator species when compared to natural grassy habitats. These species are mostly native to wetland habitats. We propose that they could became widespread in agricultural habitats, because through dispersal and life history characteristics they became pre-adapted to the ephemeral conditions of agricultural fields.

Phylogeny of the Symphytognathidae *sensu* Forster, 1959 (Araneae, Araneoidea)

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It is still an open question whether the Symphytognathidae *sensu* Forster, 1959 are a monophyletic taxon or only a polyphyletic heap of spiders solely hold together by their minute sizes and characters that come along with dwarfing. This family can look back on an eventful taxonomic history in which groups were added and removed, melted and split. It is currently hypothesized that the taxon raised by Forster consists of two major groups that are placed far apart in two different, not closely related superfamilies (Araneoidea and Palpimanoidea).

In this study the first phylogeny that includes representatives of all clades of the Symphytognathidae *sensu* Forster, 1959 is presented. In a cladistic analysis using parsimony exemplar species of all currently described groups (Anapidae, Micropholcommatidae, Symphytognathidae *s. str.*; Mysmenidae, Synaphridae) as well as outgroup representatives were scored for 58 morphological characters. The results support the monophyly of the Symphytognathidae *s. lat.* and are thus incompatible with the concept of the Palpimanoidea. The relationship of the major clades are discussed.

Tactile body raising: Neuroethology of a 'simple' behavior in spiders

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We are interested in the sense organs, the central nervous elements, and the neuronal mechanisms responsible for relatively simple behaviors of spiders. In *Cupiennius salei* (Keyserling 1877) (Ctenidae), a large tropical hunting spider, stimulation of tactile hairs on the ventral aspects of the body and the legs, evokes reflex activity in several leg muscles. Coordinated contraction of these muscles raises the body -- as in doing "push-ups".

Using this reliable reaction we have examined the neuronal circuitry underlying body raising behavior. Electrophysiological recordings from particular leg muscles and from single, identifiable neurons in the leg ganglia reveal interneurons whose (electrical) activation causes the muscle reflexes. Depending on the exact stimulus situation (tactile and/or displacement stimuli), we have found local and plurisegmental responses and sequential activation of local and plurisegmental interneurons. The results provide a first glimpse of the architecture and functional hierarchy of single, sensory-motor elements in the fused central nervous system of spiders.

[The experiments were done in close cooperation with Christiane Bickeböller, Klaus Hammer, Michael Kadel and Jürgen Milde. Supported in part by the DFG]

Early season biological control of insect pests in rice by spiders, and some factors in the management of the cropping system that may affect this control

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Unsprayed, irrigated rice fields have few insect pest problems. This is largely attributed to natural enemies, which are also known to keep planthoppers, most notably *Nilaparvata lugens* Stål (Hemiptera: Delphacidae), the brown planthopper (BPH), in check. Early biological control can mainly be attributed to spiders. Until 35 days after transplanting of rice the dominant predators in irrigated rice are the lycosid *Pardosa pseudoannulata* (Bosenberg & Strand) and the linyphiid *Atypena formosana*. Both are considered important predators of BPH and *Nephotettix virescens* (Distant) (Hemiptera: Cicadellidae), the green leafhopper (GLH). Until the green revolution BPH was considered a minor pest, but during the seventies it became a major pest in rice. This demonstrated the effects of "turning off" the biological control of this pest, which is normally controlled at low levels by the many predators, and other natural enemies. Today the irrigated rice cropping system is facing other changes, which may have equally strong effects on the characteristics of the system, and may in turn affect the biological control of insect pests in rice. With growing cities there is less available water and labor for rice farming. It is foreseen that production will move towards direct seeding instead of transplanting, and other potentially water and labor saving methods, such as mechanization, larger field sizes and more synchronous cropping. Presently, herbicide use is rising, as the area under direct seeded rice grows, and hand weeding is becoming more expensive. Genetically modified rice may also affect the cropping system in ways not yet fully anticipated. For example, bt-rice may create a crop with no lepidopteran prey. Understanding of the biology of insect pests, their natural enemies and the factors in the management of the cropping system, which may affect this control, can be an important tool in maintaining the desirable traits of the current irrigated rice ecosystem as the rice cropping system changes. The abundant detrivores and plankton feeders early in the season may be one such key to the success of the current rice agroecosystem. The levels of these alternative preys in turn depend on available decaying organic material available in the field. Field and laboratory data from research at IRRI and elsewhere indicates that spiders survive and build up their populations on alternative prey, such as collembola and dipterans, before the crop is established and in the first weeks after crop establishment. The dietary value of alternative prey in term of immature survival and development, and adult fecundity can be high, as found in a recent study at IRRI. In contrast BPH and GLH are of low quality to *A. formosana*. Similar results were obtained for *P. pseudoannulata* with fecundity as a fitness parameter, but BPH was of intermediate to high quality for this predator. These findings suggest that spiders would perform less well in an agroecosystem with little alternative prey. The bunds surrounding the rice fields provide refuges for predators during fallow as well as during farm operations. Bunds may be particularly important for predominantly walking predators, such as *P. pseudoannulata*, and may be less important for linyphiids as *A. formosana*, which colonizes the rice field by ballooning. Preliminary results from a study of the directional movement of predators between the ricefield and the bund show that *P.*

pseudoannulata is an early colonizer of newly established rice, with the highest relative abundance of *P. pseudoannulata* in the bund, stressing the importance of this habitat. Three or four weeks after transplanting of rice the directional movement changed and the field may have become a source of *P. pseudoannulata* to other fields. Larger field sizes and more synchronous planting may delay colonization by predators also reducing the benefit gained from the abundant early season alternative prey.

Is the nuptial gift in the spider *Pisaura mirabilis* a sensory trap?

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The nuptial gift in *Pisaura mirabilis* is a prey, wrapped up in silk to a white and round parcel. During courtship the male exposes the gift in a characteristic display. If the female is receptive, she grabs it with her jaws, and starts to eat. While she is eating, the male transfers sperm. The nuptial gift has a close resemblance to the white and spherical egg sac in this species. The female is probably under severe selection to take care of her sac, and she carries it in her jaws continuously for 3-4 weeks.

Because wrapping with silk turns every prey into a white object the actual appearance of the gift may be of importance in courtship. To test this I investigated female response towards males with (1) normal gifts (N), (2) brown painted gifts (B), and (3) gifts painted extra white (EW). All attempts resulted in copulation, but the display time until females accepted the gifts differed significantly between treatments. EW gifts were quickly accepted, N gifts gave intermediate responses, whereas B gifts had to be exposed the longest time before acceptance. The intensity of reflected light was highest in EW gifts, intermediate in N gifts, and lowest in B gifts. Egg sacs had a reflectance intensity between EW and N gifts.

My results indicate that a sensory trap is operating in *Pisaura mirabilis* as (a) males are able to imitate a stimulus to which females respond and (b) the female response is appropriate to increase the male's chances of fertilising her eggs.

Taxonomic problems in European Amaurobiidae

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Species composition and ranges of European "*Amaurobius*" are still incompletely known, see recent descriptions from Italy and from Greece (Thaler 1990, Pesarini 1991, Thaler & Knoflach 1995, 1998). Problems encountered in some taxa due to variability are discussed: "abnormal" character states in *A. pelops*, vicariance pattern in *A. erberi* and *Callobius claustrarius*, local variation in "*A. cretaensis*".

Experimental application of *Xysticus kochi* subadults against *Myzus persicae* in growing chamber

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Pepper plants with four foliage leaves were infested with ten *M. persicae* adults. As a treatment, one *X. kochi* subadult was put on every second infested plant. Spiders were able to control aphid populations only in the first two weeks. There was no significant difference between the development of the treated plants and the uninfested control plants within this period. The average height and number of leaves of the infested, untreated plants remained significantly lower than that of the treated ones. Data suggest that the presence of spiders stimulated wing formation of aphids. Spiders grown on aphid monodiet were able to reach maturity and produce eggs after mating. The newly hatched spiderlings were viable.

Arachnotron – a new breeding box and technique for mass-rearing spiders

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Egg-sacs of foliage dwelling non web-building spiders (e.g. *Xysticus* spp., *Tibellus* spp., *Philodromus* spp.) are placed into beehive-like, closed breeding boxes. The inner structure - covered with a removable material - provides the spiders with a large surface within a relatively small volume, in order to decrease cannibalism. There are holes on one side of the box, where changeable tubes - containing fruit fly (*Drosophila melanogaster*) culture - are connected to the box. The inner side of the box is coated with Teflon, or with a Teflon-like material that spiders are unable to climb so that they cannot get into these tubes. From hatching to egg-laying, spiders feed on fruit flies emerging from the tubes. At the bottom of the box there are larvae of flour-beetles (*Tenebrio molitor*), which continuously clean up the dead fruit flies, preventing the underlay from mildewing. The maintenance of the breeding means the regular change of tubes - containing old cultures - to fresh ones. Simultaneously hatched spiders become mature and breed at the same time and attach their egg-sacs to the inner structure of the box. Egg-sacs are removed from the box together with the carrier surface and they are kept on low temperature to postpone hatching until application. Egg sacs can be applied in greenhouses or in lab tests.

Female genital morphology and sperm priority patterns in spiders

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For spiders, gross female spermathecal morphology has been generally accepted as the major determinant of sperm priority pattern. This assumption goes back to an hypothesis brought forward by Austad in 1984, who speculated that spider spermathecal morphology may represent a phylogenetic constraint which species are subjected to and which lead to a non-adaptive pattern of sperm priority. Two types of spermathecae were classified depending upon whether a single duct or two ducts connect with the spermathecae. These types, the "cul-de-sac" and the "conduit" spermathecae, occur roughly along phylogenetic lines, the former condition occurring in haplogyne spiders and the latter in entelegyne spiders. Thus, spiders with cul-de-sac spermathecae should exhibit last male sperm priority, representing a last-in first-out system, whereas spiders with conduit spermathecae should exhibit first male sperm priority (first-in first-out).

In order to test the basic assumptions, I investigated genital morphology for two haplogyne species (*Pholcus phalangioides,* Pholcidae; *Dysdera erythrina*, Dysderidae) and two entelegyne species (*Nephila clavipes*, Tetragnathidae; *Pityohyphantes phrygianus*, Linyphiidae). Female genital anatomy deviates markedly from the expected pattern in all cases. In addition, knowledge of the copulatory mechanism is shown to be crucial in evaluating the possibilities of male manipulation inside the female reproductive tract. Such manipulation may lead to paternity values that cannot be explained by female anatomy alone.

Thus, the hypothesis of non-adaptive sperm priority patterns based on phylogenetic constraints must be refuted. Even if the hypothesis is evaluated independent of phylogenetic lines and merely on gross female genital anatomy, the presence of one or two spermathecal ducts does not allow predictions regarding the occurrence of last- or first-male sperm priority. Female genital morphology shows a high degree of variability, even among closely related taxa, which strongly suggests adaptivity. A tentative compilation of available data, however, shows that paternity values can be explained by detailed information on the actual design of female genital morphology together with knowledge on copulatory mechanisms. Thus, female genital morphology leads to precedence patterns that are in line with female interests but can be altered by male manipulatory mechanisms.

Spider's webs and silks

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Spider silks are composite materials with often complex microstructures. They are spun from liquid crystalline dope using a complicated spinning mechanism which gives the animal considerable control. The material properties of finished silk are modified by the effects of water and other solvents, and spiders also make use of this to produce fibres with specific qualities. The surprising sophistication of spider silks and spinning technologies makes it imperative for us to understand both material and manufacturing in nature before embarking on the commercialisation of biotechnologically modified silk dope.

The spider fauna of Polish balks in comparison to field margins in other European countries - preliminary results

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The preliminary results of 1-year studies of the spider fauna of three balks in a mosaic of agrocoenoses in eastern Poland are presented. Spiders were collected by pitfall trapping and sweep netting. In total, 1927 specimens representing 72 species were collected. Spider abundance depended on vegetation structure and the width of the balk, but not on plant species richness. The most diverse spider fauna occurred on the balk with fewer plant species but with a denser vegetation cover. In comparison to field margins in other countries, Polish balks seem to be quite exceptional. Despite being much narrower (about 1.5 m) their fauna was richer and more diverse because the balks were unmanaged and, therefore, stable. Data from other parts of Europe, e. g. from Switzerland, Belgium and Hungary, indicate fewer species in field margins: 56, 70 and 52 respectively. A comparison of the arachnofauna of a balk and a rye field showed a higher species diversity on the balk (46 species) than in the rye field (32 species) and different species composition. In other countries the similarity index between fields and their margins or edge zones is lower than in Poland. This means that spider communities in crop fields of eastern Poland are more influenced by refuge areas (balks, shelterbelts, abandoned land) than in other countries. The mosaic structure of Polish agrocoenoses influences their unique character. The balks are essential elements of the agricultural landscape, enriching biodiversity in agroecosystems. They have also a distinctive role as hibernation sites for many animal species. In this study this is reflected by the fact that the abundance of dominant spider species on the balk increased in autumn and fell in spring. Therefore it is thought that maintenance of balks and field margins, together with fields of small area, are important factors for the protection of fauna in farmland and for the development of sustainable agriculture.

Form and function of the orb-web

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Has the orb-web a monophyletic or a polyphyletic origin? This old question still remains unanswered. Many have argued in favour of a monophyletic origin, because orb-webs generally share many common features: all orb-webs have a sticky spiral placed on radial threads which converge at a central location, the hub; typical orb-webs are highly regular structures which are more or less round and flat; during the construction of orb-webs, an auxiliary spiral is built; etc. However, all these features may be or may not be an indication for a common origin. We have to analyse the physical constraints of webs to find out whether they are an adaptation to the function of the finished web, or an adaptation to the web construction process or whether orb-webs share a feature because of common ancestry.

In my contribution, I review physical and biological constraints spiders face when they construct and use an orb-web and I show, how these constraints influence the form of the orb-web. Using the orb-web of the common garden cross spider *Araneus diadematus* as an example, a number of aspects of the orb-web are illustrated, explained and possible alternatives (often employed by other spiders in their webs) are shown.

The riparian spider fauna (Araneae) of Gaula, Central Norway. Implications for conservation efforts

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The riparian spider fauna of the river Gaula near Trondheim, Central Norway, has been investigated in spring/summer 1994 by means of pitfall traps and limited sieving and hand picking. Sites varied from sand and gravel banks completely devoid of vegetation to sand/silt deposits with or without vegetation to *Salix triandra*/*Alnus incana* forests with sandy ground.

These special habitats turned out to harbour a very special and remarkable spider fauna. Two species were recorded for the first time in Fennoscandia; *Arctosa stigmosa* (Thorell, 1875) (Lycosidae) and *Caviphantes saxetorum* (Hull, 1916) (Linyphiidae), both being the northernmost records in Europe. Two species were new to Norway: *Singa nitidula* L. Koch, 1844 (Araneidae) and *Myrmarachne formicaria* (De Geer, 1778) (Salticidae). The following were new regional records: *Clubiona lutescens* Westring, 1851 *Kaestneria pullata* (O.P.-Cambridge, 1863), *Oedothorax agrestis* (Blackwall, 1853), *O. apicatus* (Blackwall, 1850), *Porrhomma pygmaeum* (Blackwall, 1834), *Silometopus reussi* (Thorell, 1871), *Tapinocyba insecta* (L.Koch, 1869), *Troxochrus scabriculus* (Westring, 1851), *Walckenaeria vigilax* (Blackwall, 1853) and *Erigonella hiemalis* (Blackwall, 1841).

The spider fauna of the river banks consists of the following ecological groups: (1) riparian species, both psammophilous and lithophilous, (2) hygrophilous species, (3) pioneer species, (4) ubiquitous species and (5) accidental guests from nearby habitats. Group (1) represents about 25 % of the total number of species.

The isolated occurrence of rare riparian species is paralleled by distribution patterns of riparian beetles (Coleoptera). Central Norway harbours one of the richest and most diverse riparian faunas of Northern Europe.

The river Gaula is protected by law against hydroelectric exploitation but about 65 km of the river banks have been destroyed by the construction of flood preventing walls and both riparian beetles and spiders have disappeared from many sites. Most of the riparian species are vulnerable to human disturbance and changes in the flooding pattern of the river and four are included in the Norwegian Red List having the status "Declining, Care Demanding". Protection measures include reduction of silt/sand removal, adaptation of flood preventing walls to suit the riparian fauna, reduction of leisure activities on particularly vulnerable localities and the designation of certain particularly valuable sites as Nature Reserves or Protected Sites. Clear-cutting and management of vegetation in order to maintain the open areas should also be considered.

POSTER ABSTRACTS

Value of Collembola from agricultural soils as food for the predatory mite *Hypoaspis aculifer*

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The value of the seven Collembola: *Isotoma anglicana* (Lubbock), *Isotoma notabilis* (Schäffer), *Folsomia fimetaria* (Linné), *Pseudosinella alba* (Packard), *Heteromurus nitidus* (Tempelton), *Mesaphorura macrochaeta* (Rusek) and *Protophorura armata* (Tullberg) as prey for juveniles and adults of the mesostigmate mite *Hypoaspis aculeifer* (Canestrini) was evaluated. The quality assessment of the prey species was based on egg production, conversion of food into eggs i.e. suitability, size of hatchlings, hatching time and -succes, duration of the proto- and deutonymph stages and adult size. All the seven collembolan-species appeared to be good quality prey to the soil-living *H. aculeifer*. In a number of respects, including egg production, suitability and size of adults, the two species *P. alba* and *H. nitidus,* both members of the family Entomobryidae proved to be of excellent quality compared to the other species. A high suitability was also found on diets of *F. fimetaria* and *I. notabilis*, while *P. armata* , *I. anglicana* and *M. macrochaeta* were less suitable prey. *F. fimetaria* and *I. notabilis* does not seem different from diets of *I. anglicana*, *M. macrochaeta* and *P. armata* with respect to egg production and weight of adults. There were no significant effect of the food type on the hatching time and -success, however, it is indicated that the hatching time and the food value are inversely related. Generally the soil-living mite *H. aculeifer* is better adapted to a mixed collembolan-diet than surface-living predators like the linyphiid spider *Erigone atra* and the carabid beetle *Bembidion lampros*. Possible reasons for the observed differences will be discussed.

Spiders, why do you tend to light ?

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Light is an attractive factor for most insects, but also for other invertebrate animals, like spiders. Results of behavioural and faunistic studies of spiders collected during capturing of nocturnal butterflies are presented. It was observed, that some spiders were found near light trap or coming to lighted entomological screen. Some of them placed their webs near source of light in very short period, 2-3 hours. List of spider species captured in this condition in various habitat is presented. Spider material was collected manually. An attempt of interpretation of this result from different points of view are made.

A characteristic of spider fauna of selected habitats of Bialowieza Forest

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Spider material was collected by students of University of Podlasie in Siedlce during Student Scientific Camp in managed part of Bialowieza Forest. Faunistic analysis of spiders from three habitats: meadow, pine forest and swamp-alder forest was made. Pitfall trapping, sweep netting and sieving of litter were used as methods of spider capturing. Spiders were investigated for one week from 15th to 31st July 1999 to find differences in fauna of mentioned habitats. In total 138 specimens belonging to 40 species were collected. Next 9 species were found as a result of observation of spider webs and egg sacs. The meadow neighbouring the forest was the most abundant in spiders species as a forest-meadow ecotone. Both forest species and open areas species were found there. The least number of spider species was stated in pine forest. This can be explained by lack of herbaceous layer. The given data are only part of real spider fauna composition of this area. In spite of this fact they are valuable, because spiders were not earlier investigated there.

Observations on Gnaphosidae (Araneae) of the Nature Reserve "Oasis of Simeto" (Italy)

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New data on the Gnaphosidae fauna of the Nature Reserve "Oasi del Simeto" (Sicily - Italy), are reported. The Reserve is in the eastern part of Sicily near the mouth of the Simeto river, a few kilometres from Catania and it is one of the larger and more interesting riparian areas of the Island. The specimens were collected by pitfall traps filled 2/3 full with acetic acid and 5 % formalin for 13 months from may 1994, 5 traps were distributed in 4 different environments, each characterised by a specific plant community of wetland: Quagmire area, plant community: *Juncetum-maritimo-acuti* Horvatic 1934,. Tamarisk area, plant community: Salt-wort area, plant community *Salicornietum radicantis* BR.- Bl. 1993, Dunes, plant community (*Centaureo-Ononidetum ramosissimae.* Br.-Bl & M. Frei 1937. The reseach included sampling even in other 2 areas but they have been only partially investigated for human disturbance. These environments were a pine forest and an adjacent area characterised by the presence of plant typical of dunes like *Agropyrum junceum, Ammophila arenaria* and *Eryngium maritimum* .

Among the identified species there are some particularly interesting as their morphology, distribution and ecology are not well-known. *Poecilochroa furcata* Simon, 1914 and *Poecilochroa senilis* (O.P. Cambridge, 1872) that have been found for the first time in Italy and *Leptodrassus albidus* Simon, 1914 found for the first time in Sicily.

Differences among the 4 investigated environments have been recorded both in number of species and in the number of individuals, the Quagmire is the richest for the number of species while Salt-wort is the richest for the number of individuals. This result may depend on the presence in Salt-wort of numerous specimens of *Trachyzelotes lyonnetii*, that seems to be dominant in this environment.

The greatest number of species examined have a prevailing Mediterranean distribution, except *Drassodes lapidosus*, *Haplodrassus dalmatensis*, and *Scotophaeus blackwalli* with a wider distribution and *Zelotes atrocaeruleus* which has an European distribution.

The Carboniferous arachnid *Plesiosiro*

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Plesiosiro madeleyi Pocock, 1911, is the monotypic representative of the extinct Upper Carboniferous order Haptopoda. It is known only from eight specimens from one UK locality. These fossils have been restudied and a new reconstruction of the animal is presented here. The systematic position of *Plesiosiro* is difficult to resolve. In overall appearance, with its broad prosoma-opisthosoma junction, it resembles both cythophthalmids and trogulids (Opiliones). However, it also resembles whip-scorpions (Thelyphonida) and appears to have a large genital operculum: a synapomorphy of Tetrapulmonata. A divided sternum and divided tarsi tentatively support a (*Plesiosiro* (Amblypygi (Thelyphonida + Schizomida))) relationship within the tetrapulmonate clade.

Olfaction and mate attraction in a burrowing wolf-spider

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Chemical stimuli play a doubtless role in lycosid mate attraction, but the relative contribution of olfactory and contact sex-pheromones is far from fully established. In a burrowing wolf spider (*Lycosa tarentula fasciiventris*) inhabiting dry and open areas in the Iberian Peninsula, courtship is chemically released, but males do not orient towards the female burrow on this exclusive basis. As olfactory stimuli may play a role in male behaviours other than orientation, we analysed the male response when exposed to olfactory stimuli in a two-side olfactometer. Additionally, we tested for the effectiveness of odour traps as male attractants in the field. Males oriented randomly in the olfactometer, and there was no effect of the presence of an adult female (F), a female with its exuvia (FM) or an empty cage (C) in one of its sidewalks ($\chi^2_2 = 0.3$, $p = 0.985$, $n = 44$). The stimulus did neither affect the latency of the male orientation response (Kruskal-Wallis test: $\chi^2_2 = 0.397$, $p = 0.82$) or the percentage of time spent in the stimulus sidewalk (Friedman test:$\chi^2_2 = 2.317$, $p = 0.314$), which was similar in both sides. This lack of stimulus effectiveness was not an experimental artifact. In natural populations, randomly placed pitfall traps containing adult, subadult females or draglines were not more effective as male attractants than control traps (Chi-square test:$\chi^2_1 = 0.615$, $p = 0.433$, $n = 340$). This lack of effectiveness was not due to the placement of the stimulus in the bottom of the trap, as it was the same when the female was suspended above (Chi-square test: $\chi^2_1 = 0.943$, $p = 0.624$, $n = 74$). In our experiments, we found no evidence that males *Lycosa tarentula fasciiventris* use olfactory cues provided by females or female draglines to find their mates.

Epigeic spider communities of a coastal dune habitat mosaic in the Hanstholm Reserve (NW Jutland, Denmark)

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88 pitfall traps were operated through a full year in dune and heathland habitats close to the North Sea coast. Transect lines were laid out in the dune adjacent to the beach, and dunes 300 m from the shore. The following main habitat types could be distinguished: yellow dune, grey dune, Empetrum/Calluna heathland, low pine plantation, sandy areas with sparse vegetation and Sphagnum bog. The total yearly catches of every trap were analysed with Canonical Correspondence Analysis (CCA), using registrations of plant species and their coverage and height as environmental variables.

The greatest faunistic differences were between the near-beach communities and the rest. Several species were characteristic of the yellow dunes and were not found in the grey dunes only 300 m inland. Separate CCA of the "inland" traps grouped the data nicely according to the botanical habitat types indicated above.

Fauna and zoogeography of gnaphosid spiders (Aranei Gnaphosidae) of northeastern Siberia

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In Magadan region from North-East Siberia are 31 gnaphosid species whom belong to genuses: *Callilepis* (1 species), *Drassodes* (3), *Gnaphosa* (9), *Haplodrassus* (6), *Micaria* (6), *Parasyrisca* (2), *Zelotini* (4). In comparison with Finland (Palmgren,1977) and NW Nearctic (Dondale et al., 1997), the NE Siberian fauna is rich in *Gnaphosa species* (9:6:10 respectively), *Drassodes* (3:2:3), *Haplodrassus* (6:3:6). At the same moment fauna of *Zelotini* is rather poor (10:4:4). In Scandinavia this tribe is represented by the three genera (*Zelotes, Drassylus & Trachyzelotes*) while in Siberia and NW Nearctic only by *Zelotes*.

For each of gnaphosid species is given the map of the distribution in Holarctic and the short zoogeographical survey. North-East Siberia is compared with North- West American and with fauna of Finland and Scandinavia.

Spiders (Araneae) and other invertebrate groups as ecological indicators in wetland areas – with locality maps shown

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The species composition of spiders and other invertebrate groups were related to a set of environmental variables from 21 wet grassland areas in southwestern Denmark. The relationships between species composition and environmental variables were analysed with CANOCO (Ter Braak, 1990), using Forward Selection and Monte Carlo permutation technique. Before the analysis in CANOCO, groups of closely correlated variables were synthesised using Principal Component Analysis (PCA). Use of this procedure reduces the problem of closely correlated environmental variables. The environmental variables examined were a combination of natural factors and management practices.

During the investigation period, the time since dyking and the height above water level of the nearest river were important factors in relation to spider species composition. The time of mowing or grazing in these grassland areas is also an important factor. This follows roughly the findings of Döbel et al. (1990), who showed, that vegetation structure and flooding intensity in marsh areas is important factors for the species composition of spiders.

The analysis revealed a pattern for the species compositions of ground beetles, weevils and butterflies that was similar to that found for spiders. These groups are also dependent on the time since the area was dyked as well as the height above water level in the nearest river. In addition to these two factors, the species compositions of these three invertebrate groups were also dependent on the soil type. Ground beetles were particularly dependent on the soil texture. If the area was cultivated earlier, the species composition of weevils seemed to depend on the vegetation succession after ploughing and the establishment of a new vegetation layer.

The poster present a detailed locality map of the research area in southwestern Jutland in Denmark. In relation to the locality map, a CANOCO diagram is shown, with species and sampling sites located.

Linyphiid populations in relation to wheat growing practices

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Linyphiid web densities were estimated in experimental fields, where wheat was grown in either a permanent clover vegetation or grown in a conventional way with ploughing each year and by using fertilizers and pesticides at a normal level. Average web densities were two to three times as high in the permanent bi-crop systems compared to fields managed in a conventional way. The estimated levels in the bi-crop systems were at maximum between July and September at 200-250 webs/m^2. In the conventional system the web density peaked at 100-150 webs/m^2.

Positive correlation was found between the linyphiid web densities and vegetation density for all sample sites pooled together.

It is the intention to present a path analysis diagram of the relationship between the estimated web densities and food availability, environmental variables and juvenile production. The diagram will be made by the use of AMOS (Analysis of Moment Structures; Arbuckle and Wothke, 1999). Adult linyphiids were caught by hand-searching inside enclosures. Twelve linyphiid species were found in each of the bi-crop systems compared to five species in the conventional wheat fields with normal use of fertilizers and pesticides. The number of species found in the conventional fields with low fertilizer input and no use of pesticides was eight. The results of the density estimates of the adults will be presented for all species in relation to the different growing

Catalogue of the Spiders of Denmark (Araneae)

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The last comprehensive checklist of Danish spiders dates back to 1928. It was compiled by J. Brændegård and was published as an appendix to Emil Nielsen's book "De Danske Edderkoppers Biologi" ("Biology of Danish Spiders"). The list comprise 347 species of which 24 was then considered new to the Danish fauna. The list was build from published records and personal findings of private collectors, but did not include vouchers and many of the species on the list are therefore difficult to verify today. The old list of Brændegård is now completely outdated and the need for a new verified catalogue of Danish spiders is urgent. Partly because the nomenclature of most species have changed and partly because a lot of new information has been gathered by an increasing number of active Danish arachnologists during the last 72 years.

The information on which the new catalogue is build comes from a number of private collections and the collections of the Zoological Museum in Copenhagen and the Natural History Museum in Århus. Information about a species is only included if there exists a voucher specimen in a collection. The voucher will act as a reference specimen and can be checked in the future, if necessary. The classification and nomenclature of the species in the catalogue follow the latest World Catalogue of Platnick (1997) and genera and species are thus listed in alphabetical order. In addition to a verified list of Danish spider species, the catalogue includes distributional data for all species in 11 faunistic districts. When a species is recorded as present in a district it means that at least 1 specimen has been recorded and stored in a collection (as a voucher specimen). Many more records of the species may exist for the same district. Records have been referred to two periods of time. Those from before 1960 are marked with a triangle and those from 1960 and later have been marked with a filled circle. Priority has been given to the most recent finds i.e., from 1960 and later.

The spiders of some swamp–alder forests in eastern Poland

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Spider community composition and dominance in three swamp-alder forests (*Carici elongatae – Alnetum*) situated in eastern Poland were compared. In Bialowieza Forest there were two plots: Bialowieza National Park – strict reserve (1) and managed forest (2). The third plot (3) was on wetland of Polesie in Poleski National Park. Spiders in Bialowieza Forest were collected in 1998-1999 and in Poleski National Park in 1995-1998. Sampling methods included pitfall traps, sweep net and bark traps. Altogether, 14156 specimens representing 178 species were collected. The highest number of species (133) was found in primeval old-growth forest (plot 1). On each of both plots: 2 and 3, the same number of species (112) were caught. To compare species composition, coefficient of similarity (Sørensen - S) was used. It amounted for epigeic spiders: for plots 1:2 S = 61.2; 1:3 S =56.8; 2:3 S = 48.8; for epiphytic spiders: 1:2 S = 73.0; 1:3 S = 63.0; 2:3 S = 52.4 and for spiders from tree trunks: 1:2 S= 62.9; 1:3 S = 38.9; 2:3 S = 44.4. To compare epigeic spider communities, Renkonen's index of similarity (Re) was used: 1:2 Re = 70.9; 1:3 Re = 59.1; 2:3 Re = 55.6. In spite of differences in forestry management and location of study areas, species composition and structure of spider communities showed considerable similarities. *Pirata hygrophilus* was the most numerous epigeic species, reaching above 30% of all specimens on each plot. The second mutual dominant (above 5%) was *Pachygnatha listeri*. In the investigated forests several rare species were found: *Centromerus laevitarsis, Centromerus semiater, Clubiona rosserae, Ero cambridgei, Meioneta affinis, Meioneta innotabilis, Pirata tenuitarsis, Taranucnus setosus.*

Distribution of orb web spiders (Araneidae) in Slovakia

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From the zoogeographical point of view, the territory of Slovakia is divided into 3 main units, viz. Pannonian district of steppe province, Subcarpathian district of deciduous forest province, and two districts (the West Carpathian and the East Carpathian) of sub-province of Carpathian Mountains belonging to the province of Central European mountains. 52 species of orb web spiders was recorded on the territory of Slovakia, 48 of them were registered recently and are included into the analyses, and four species not reported in last decades were omitted. The distribution of the orb web spiders was analysed in 50 natural territorial units used as operational units in the informational system of Databank of fauna of Slovakia. The analyses were performed by cluster analysis and ordination. As result, five clusters were recognised as optimal cluster number. These clusters are not identical with zoogeographical units and orb web spiders do not follow the zoogeographical classification strictly. The sub-province of Carpathian Mountains is characterised mainly by the absence of several species; only two species, viz. *Araneus nordmanni* (Thorell, 1870) and *Nuctenea silvicultrix* (C. L. Koch, 1844) are distributed exclusively in this sub-province. The differences between the West Carpathian and the East Carpathian districts of Carpathian Mountains are not significant. The territory considered for Pannonian district of steppe province is not clearly bounded; it is characterised by exclusive occurrence of *Argiope lobata* (Pallas, 1772) and by higher frequency of thermophilous species, e. g. *Argiope bruennichi* (Scopoli, 1772), *Gibbaranea gibbosa* (Walckenaer, 1802), *Gibbaranea ullrichi* (Hahn, 1835). The highest species richness of orb web spiders was found in the Subcarpathian district of deciduous forest province. In general, the distribution of orb web spiders in Slovakia follows mainly altitude, climatic condition, and vegetational zones.

Observations on parasitoid fly-larvae (*Ogcodes spp.*, Acroceridae: Diptera) induced behavior in *Pardosa agrestis* (Lycosidae: Araneae)

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More than 600 *Pardosa* spp. (mostly *P. agrestis*) were collected in juvenile and subadult stages in April 1999 in an alfalfa field at the NW border of Budapest. The spiders were treated in thermostat chambers on ad libitum *Drosophila* supply at 26 °C. In May seven fly-larvae of *Ogcodes spp.* emerged from juvenile and subadult spiders of both sexes (one larva from one spider in all cases). 3 of the 7 flies belonging to the *Ogcodes* genus of Acroceridae family (Diptera) were identified (2 *Ogcodes pallipes*, 1 *Ogcodes gibbosus*). Larvae of flies of this family are known to be spider specific endoparasitoids. We observed repeatedly how the larvae of these flies changed the behavior of their host before its death. 10-15 hours before the larva leaves its spider-host, the infected spider prepares a special globular silken nest of a diameter of ca. 2 cm. This construction is similar to the temporary globular nest of female *P. agrestis*, which is used as a shelter during the eggsac making process (phenomenon not described yet). As the time of larval hatching approaches, the host spider seems to be more and more constrained into a special position, hanging upside-down inside the top of the nest. Finally the spider becomes immobile in the described position and the larva leaves the host body by the ventral surface of the opistosoma, which takes 30 minutes approximately. After hatching the vulnerable larva fixes itself to the silken nest and pupates protected in the nest. The imago leaves the shelter in 4-6 days after the larva left the host spider body. We do not know by what mechanism the fly larva induces changes in the spider-host behavior. According to the data, the rate of parasitism by these flies is very low and their role in population regulation of *Pardosa spp.* seems to be very restricted in the region from which the observed spiders originated.

How does hunting success relate to temperature and light conditions in generalist predators?

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Insects are ectotherms; i.e. they rely on external sources of heat. Temperatures higher or lower than the metabolic optimum negatively affect the survival of the insect. At a lower than optimal temperature, an insect may be slow to obtain its resources and inept at escaping its predators. Most significant of all, the insect may be capable of growing, developing or reproducing only slowly. The effects of temperature on these different processes are a part of the insect's whole life cycle and its ability to leave descendants.

Prior to experiments the predators were kept at 15 °C. Hunting success was recorded at temperatures ranging from 5 to 30 °C in light and darkness. During experiments each predator was kept in a petri dish Æ140mm with a lid. The petri dish contained a layer of moist sand and a container with water. Both predator and prey were allowed one hour of acclimatization. After acclimatization, ten fruit flies, *Drosophila melanogaster* were introduced into each petri dish and after 12 hours the number of eaten fruit flies was recorded.

The results showed that the hunting success of the wolf spider *Pardosa prativaga* increased with temperature. Two carabid beetles, the nocturnal *Calathus fuscipes* and the diurnal *Pterosticus versicolor,* had highest succes at the low temperatures, except that *C. fuscipes* in light was inactive at all temperatures.

Maternal care in *Gandanameno echinatus* (Araneae, Eresidae)

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Studies on taxa including both solitary and social species may provide insights into behavioural traits and ecological conditions that favour the evolution of sociality. Two possible evolutionary paths to sociality have been defined and designated as parasocial and subsocial characterised by different intermediate levels. Along the first path, eusociality is reached by means of the association of non-related adults, which forms a basis for further social evolution (Michener 1958). On the second path eusociality may be reached via the extension of the early social stage of parental care (Wheeler 1923).

Within Eresids the genus *Stegodyphus* developed three permanent social species (Kraus & Kraus 1988). Parental care seems to be one of the main steps in the origin of sociality in Eresids. It is possible that in the early stage of the subsocial species communities of juveniles were able to develop to colonies of adults. Thus, the subsocial path seems to be the decisive way to the origin of permanently social species in *Stegodyphus* (Kraus & Kraus 1988)

The maternal care in Eresids can be subdivided into two categories:

- The cocoon care shows attention to cocoons (protection against predators and parasitoids), transport of cocoons (temperature regulation) and the opening of the cocoons to facilitate hatching for spiderlings,
- Care for the young means feeding the young by regurgitation, offering prey to the young and at finally gerontophagy (maternal female is sucked out by the young) in Eresids.

To find a species within Eresids that shows no intensive parental care could be a great chance to gather further information about the development of sociality in Eresids.

Gandanameno echinatus is a subsocial spider (a social organisation formed by a group that consists of the young and at least one parent is called subsocial (Wheeler, 1923; Wilson, 1971)) belonging to the same family (Araneae, Eresidae) as the permanent social spider *Stegodyphus dumicola*. Both species are common in the thorn-bush savanna of Namibia. *G. echinatus* lives in silken tubes under stones and in crevices in the bark of camel thorn trees (*Acacia erioloba*). In the field several live females were found with 2-5 empty cocoons within their tube but no spiderlings. Laboratory experiments were carried out from 1996 to 1999 to answer following question:
Does *G. echinatus* show the common maternal care behaviour of Eresids?

Laboratory investigations showed that females of *G. echinatus* take no care of the young. Every female produced about 3-5 cocoons within 4 years. Usually the females did not feed the young and offered no prey . The young left the maternal tube 3 days after hatching and dispersed after a gregarious period of 3-5 weeks. If the spiderlings were prevented from dispersing after hatching the behaviour of the mother changed: Females offered prey to the young for about 6 months, but no regurgitation or gerontophagy took place.

The current status of the knowledge on the Salticidae of Northern Asia

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This is a brief review of the Salticidae fauna of Northern Asia, *viz* the area lying from the Ural Mountains in the west, throughout Siberia and the Russian Far East to Japan (only Hokkaido included) in the east; in the south, this area is restricted to Mongolia and the northern provinces of Kazakhstan and China. There are 215 species from 39 genera so far recorded from Northern Asia; this numbers comprise only 4.9 % of the world species diversity (7.8% of the generic diversity) of the Salticidae (according to Prószyñski, 1990; 4373 species from 498 genera). In the fauna at hand, 118 species (55% of the total fauna) were originally described from Northern Asia (*i.e*. their type localities lie within its limits), of which 19 species (8.8%) are considered (sub)endemics of Siberia, 35 species (16.2%) – (sub)endemics of Inner Asia (Mongolia + Mts of S-Siberia) and 36 species (16.7%) – (sub)endemics of the Manchurian-Japanese Region. The body of the fauna (ca. 45%) consisted of the genera showing either Holarctic (e.g. *Sitticus*, *Talavera*, *Pellenes*, *Chalcoscirtus*, *etc*.), or Palaearctic (e.g. *Pseudeuophrys*, *Asianellus*, *etc*.) distribution. The genera represented in Northern Asia by one-two species display either Oriental (e.g. *Rhene*, *Yaginumaella*, *Synagelides*, *etc*.), or Mediterranean (e.g. *Ballus*, *Philaeus*, *etc*.) distribution. The latter two groups compise about 25% of the total generic diversity of the N-Asian salticids, but only 6.5% of their species diversity. The best explored areas of Northern Asia are Tuva (64 species), Transbaikalia (76 species), and the Russian Far East (82 species). It is estimated that about 80-85% of the salticid fauna of Northern Asia have so far been described. No more than 13 N-Asian salticid species (6%) have been subjects for special natural history (ecology, behaviour, *etc*.) studies, mainly performed by a few European and Japanese authors.

Circumpolar diversity of spiders: implication for conservation and management

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The number of spider species found in faunas north of 60EN varies from 620 (Finland) to 300 (Yukon). The faunal similarity (as percentage of jointly-occurring species) between Finland and chosen circumpolar faunas varies from 90 % in North Europe (Norway and Iceland) to 60 % (Altai Mts) or less in Siberia, and to 15-20 % in boreal Canada. Faunal lists allow to show the most interesting and important areas of species diversity. Only two areas, divided by the Beringian Strait, namely Northeast Siberia and Northwest North America have marked proportion of endemic spider taxa. There are still some areas in Eurasia which could be regarded as unstudied "white spots" and therefore investigations are required e.g. in West Siberia, Northwest Yakutia and in northern parts of the Verkhoyanski and Cherski Mountain ranges. High level of endemism, together with rather high species diversity in NE Siberia (550 spider species) and NW Nearctic (about 500 species) in spite of inadequate level of investigation in these areas show high necessity of further studies and of founding of a network of protected areas at least in NE Siberia.

Spider communities in inland dunes in the lowlands of Northern Germany

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Inland dunes and other open, dry and sandy areas are rare habitats in the lowlands of Northern Germany. They are sparse in plants but contain a large number of specialised and rare spider species.

The composition of the spider community of 13 open inland dunes has been compared. The spiders live in the *Spergulo-Corynephoretum*: The open sand is sparsly covered with *Corynephorus canescens*, *Carex arenaria* and sometimes with lichen and moss.

The investigation areas lie scattered in the lowlands of Northern Germany: along the rivers Ems, Weser, Elbe and Oder and in the Lüneburg Heath (a great sandy heathland area 40 km south of Hamburg). The greatest distance between the western areas along the Ems and the eastern area along the Oder is about 500 km. The climate differs from atlantic in the west to more subcontinental in the east. The investigation areas differ in vegetation cover (particularly in connection with lichen, moss and herbs), neighbouring habitats, size and geographical location.

The following questions will be answered and discussed: Is there a community of spider species which is stenotopic in open inland dunes and characteristic of these habitats? In what way do the distinguishing features of the habitats influence the species composition? Which part does the geographical location play? Which factors are most important for the preservation of the specialised spider species?

Altitudinal and biotopic distribution of the spider family Gnaphosidae in North Ossetia (Caucasus Major, N macroslope, central part)

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Analysis of the fauna, distribution and zoogeography of spiders of the family Gnaphosidae of North Ossetia is provided. Material was caught mainly in 1985 by pitfall trapping. More than 700 specimens are gathered. 42 biotopes in 4 mountain ranges are encompassed. Totally, 25 species are reported from the area studied. Biotopical arrangement of the species found is given, dominate species are indicated. The most of the species have wide European and Euro-Siberian ranges. Several new species of the genera *Zelotes* and others are found.

Altitudinal and biotopic distribution of the spider family Thomisidae in North Ossetia (Caucasus Major, N macroslope, central part)

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Analysis of the fauna, distribution and zoogeography of spiders of the family Thomisidae of North Ossetia is provided. Material was caught mainly in 1985 by pitfall trapping. More than 500 specimens are gathered. 42 biotopes in 4 mountain ranges are encompassed. Totally, 20 species are reported from the area studied. Biotopical arrangement of the species found is given, dominate species are indicated. The most of the species have wide European and Euro-Siberian ranges. Several new species of the genera *Xysticus* and *Ozyptila* are found.

Path integration in radius construction by *Araneus diadematus* Clerck

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The web of *Araneus diadematus* is many times larger than the animal and there are considerable detours involved in the building process. In spite of this, the result of the radial construction by *A. diadematus* is a wheel with remarkably precise spacing between the spokes. Based on results from experiments done with other spider species, it seemed possible that *A. diadematus* is capable of making predetermined angle sizes between the radii using an ideothetic memory map in which it integrates distances and directions traveled. This hypothesis of the spider using path integration was tested by displacing threads in the web during the spiders' radius construction and comparing the results with a mathematical algorithm assuming path integration.

Does relative hunger state determine cannibalistic success in the wolf spider *Pardosa prativaga*?

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It is well known that the frequency of cannibalism is positively correlated with the hunger state of the animal. For a certain size difference (or ratio) a hungry individual is more willing to run the risk of a counterattack than a satiated individual. But who would win such an encounter; the aggressive, starved spider or the well fed spider, the one in presumably better condition? Individuals in nature have variable feeding success rates and thus there will be different hunger states all through the population. If the starved spider is more successful in cannibalistic encounters, cannibalism will tend to equalize individual success, whereas the opposite will occur if the satiated spider wins. Wolf spiders of the species *Pardosa prativaga* was hatched and raised in the lab. During their life, they were never exposed to any other spider before the experiment. The experiments took place at different ages, but every spider was only used once. Before every experiment the spiders were either well fed or starved for 7 days. A well fed and a starved spider, with a 1:1 weight ratio, were staged together in a petri dish.

The results showed that not only did the hungry attack the well fed one, but it would surprisingly also win significantly more often. However, preliminary observations indicate that lab raised spiders have a higher cannibalistic rate than spiders from the field. We are currently investigating the hypothesis that experience with conspecifics influences cannibalistic tendencies in wolf spiders.

Overwiev of Gnaphosidae and Liocranidae of the Baltic States with remarks on the species new to Lithuania

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Recent studies and literature data on spiders belonging to famillies Gnaphosidae and Liocranidae known from the Baltic States (Estonia, Latvia and Lithuania) are analysed. In total, 42 Gnaphosidae and 11 Liocranidae species are registered in this region. No data on *Trachyzelotes pedestris* are available for the last 25 years. 2 species (Gnaphosa sticta [as *G. intermedia*] and *Gnaphosa leporina*) which are known from Estonia were registered only as female singletons. It is stressed that records and materials of *Zelotes apricorum* (4 females from Estonia and 2 females from Latvia) could belong to *Zelotes subterraneus* which is a common species in the whole region. Some regional differences in occurrence of some species are pointed out. Numerous specimens of *Berlandina cinerea, Haplodrassus dalmatensis, Zelotes exiguus* and *Gnaphosa nigerrima* are known only from several localities in Lithuania. The data on species belonging to Gnaphosidae (*Haplodrassus moderatus, Gnaphosa microps* and *Zelotes aeneus*) and Liocranidae (*Agraecina striata, Agroeca dentigera, Phrurolithus minimus, Scotina gracilipes* and *Scotina palliardi*) are presented. These species are new for Lithuanian fauna.

Life history of *Caribetityus elii* (Armas) from Dominican Republic (Scorpiones, Buthidae)

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The genus *Caribetityus* Lourenço was established for two species from the Dominican Republic, previously described in the genus *Tityus* Koch: *Caribetityus quisqueyanus* (Armas) and *Caribetityus elii* (Armas & Marcano Fondeur). Before now, nothing was known about the biology of these scorpions. The life cycle of *Caribetityus elii* has recently been investigated. The duration of embryonic development in this species averaged 3 months, while the moults to the different juvenile instars and adult took place at average ages of 6, 155, 313, and 447 days. These developmental periods are only slightly greater than those recorded for several species of genus *Tityus*. Also, the mean values of the growth rates observed between different instars are not significantly different from those observed for *Tityus*. However, *Caribetityus elii* completes its postembryonic development with only four moults, rather than the five or six observed in *Tityus* species. This reduced number of moults had previously been observed only for species of the genus *Microtityus* Kjellesvig-Waering. A comparative analysis of the reproductive traits of both genera is attempted.

Spiders on the dead and living tree trunks – preliminary results

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Spiders on dead and living tree trunks in the strict reserve of Bialowieza National Park in eastern Poland were studied. Samples were collected in the different types of primeval old-growth deciduous forests: swamp-alder forest (*Carici elongatae-Alnetum*), ash-alder forest (*Circaeo-Alnetum*) and oak-lime-hornbeam forest (*Tilio-Carpinetum*) from hornbeams, oaks, limes, alders, ashes and spruces.

Spiders were caught once a month from March to September in 1999 by visually searching for 20 min. from standing and fallen dead tree trunks, and by bark traps (corrugated paper, width 30 cm) - for spiders from living tree trunks.

From living tree trunks 1784 individuals representing 36 species were collected. From dead trees 326 individuals belonging to 30 species were taken. The comparison of species composition of both habitats investigated showed a Sørensen similarity index of S = 54,5. On dead trees except for typical spider tree-trunks dwellers, litter-dwellers were also found; they made up 33,3% of all species. The most numerous species on the dead and living trees were: *Amaurobius fenestralis, Anyphaena accentuata, Segestria senoculata*.

During the study a few rare and very rare species were also recorded: *Micrargus apertus, Dipoena nigroreticulata, Meioneta innotabilis*.

Some considerations on the genus *Iomachus* Pocock, 1893 (Chelicerata, Scorpiones, Ischnuridae) and description of a new species

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A revision of the genus *Iomachus* Pocock, 1893 was selected as the subject of a MSc. Thesis, now in preparation by the senior author. The preliminary study of some specimens of *Iomachus* deposited in the Natural History Museum, Paris leads to some considerations about this genus, and the description of a new species from Tirupati in the south of India.

Bacelarella (Araneae, Salticidae) in Eastern Côte D'Ivoire: salticid radiation in a poorly lit environment

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Seven species of closely related, soil dwelling *Bacelarella* were discovered to live in sympatry in rain forest in eastern Côte D'Ivoire. Six of the species are new and are described in a paper in preparation: *B. tentativa, B. pavidus*, *B. conjugans*, *B. dracula*, *B. iactans, B. tanohi*. The seventh is the type species of the genus: *Bacelarella fradei* Berland et Millot, 1941 described from Côte d'Ivoire.

The genus is characterized by the presence of paired external atria in the female and the combination of a lateral tegular apophysis and a flattened embolus in the male. The female of *B. tentativa* is still unknown and is only tentatively attached to the genus; it might be the most ancestral species in the cline. The case is an excellent example of evolutionary acquisition of complex secondary genitalia under relative somatic stability. It is assumed that in the poorly lit forest floor habitat, instead of the elaboration of courtship, the evolution of complex secondary genitalia is favoured. The study emphasizes that the use of genitalic characters, as embolus size, which have often been used to delimit genera, should be used with great care.

Cold tolerance of two common Spiders in Denmark, *Meta segmetata* (Clerck 1757) and *Meta mengei* (Blackwall 1869) (Araneae: Tetragnathidae)

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Adult females of *Meta segmenata* (Clerck 1757) and *Meta mengei* (Blackwall 1869) were collected and acclimated at two different temperatures (15 °C and 4 °C) for one to two weeks without food. After the acclimation the spiders furthermore were kept at 15 °C and 4 °C and fed with *Drosophila sp*. for 23 to 25 days.

Finally the whole body supercooling point (SCP) and melting point of the hemolymph (MP) of the spiders kept at the two different temperatures were measured. SCP and MP of field collected adult females of the same species were also meassured. The spiders displayed only little differences in SCP and MP.

SCP varied from -6,00 °C to -7,22 °C. The field collected spiders had the highest SCP. The SCP of *M. segmentata* and *M. mengei* was -6,00 °C and -6,02 °C. *M. segmentata* (15 °C og 4 °C) and *Mengei* (15 °C) had middle values; -6,28 °C, -6,67 °C and -6,43 °C respectively and *M. mengei* (4 °C) showed the lowest SCP: -7,22 °C.

MP varied from -0,76 °C to -0,86 °C. *M. segmentata* (15 °C) and *M. mengei* (15 °C) had the highest MP: -0,77 °C and -0,76 °C respectively. The field collected spiders of both *M. segmentata* and *M. mengei* and *M. mengei* (4 °C) had middle values (-0,82 °C, -0,84 °C and -0,84 °C respectively). *M. segmentata* (4 °C) had the lowest MP: -0,86 °C.

The influence of the temperature, cooling rate and the presence of ice nucleating agents in the gut will be discussed.

Validation of an inexpensive, simple method for monitoring aerial activity of spiders

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"Sticks", a simple, low-tech and cheap method for measuring spider aerial activity is described. A comparison of this method and suction trap catches of spiders showed that "sticks" was accurate for the detection of aerial activity of spiders. The circumstances under which this method may be useful are discussed.

Narrow hedges in cultivated land contain spider species characteristic of non-agricultural habitats

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To characterise arthropod biodiversity supported by non-cultivated habitat patches in a cultivated Danish landscape, ground-active arthropods were collected by pitfall traps in three hedgerow types near Bjerringbro, central Jytland, Denmark. Three each of hawthorn (*Crategus monogyna*), rowan (*Sorbus intermedia*), or white spruce (*Picea glauca*) hedgerows were sampled; all of them old, single-row type ones. The nine sample locations were at a distance of 300 m – 4 km from each other, within a 4 km x 5 km area. Individual hedgerows were sampled twice yearly, in early (June) and late summer (late August), for one week at each sampling time, using 20 pitfalls per habitat patch. Ten of the traps were set at the edge, and ten in the centre of the hedgerow, at a distance of 10 m between individual traps. Neighbouring traps alternated with respect to position.

A total of 71 spider species were identified among 1422 individuals: 33 species (515 ind.) found in hawthorn hedges, 52 species (653 ind.) in rowan, and 48 species (254 ind.) in spruce. Principal Component Analysis clearly separated the spider assemblages by hedgerow type, with the non-transformed data giving the clearest separation. At the assemblage level, there was no difference between the edge and the central traps. Most species captured were characteristic of non-cultivated land, eg. *Stylophora concolor*, *Diplocephalus latifrons*, *Oxyptila praticola*, *Zelotes pusillus*. Other dominants are associated with both cultivated and uncultivated open habitats, eg. *Pardosa prativaga*, *Pachygnatha degeeri*. Species otherwise typical of cultivated agricultural fields were infrequent (eg. *Erigone atra*, *Bathyphantes gracilis*, *Oedothorax apicatus*) or missing altogether (eg. *Meioneta rurestris*, *Araeoncus humilis*). Thus, the narrow single-rowed hedges are faunistically very little influenced by the cultivated matrix habitat enclosing them.

An improved version of the "aspirator gun"

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Lung-operated aspirators provide a continuously controlled long airflow, but their use can cause discomfort. Motorised aspirators require additional energy sources, e.g. batteries. Mechanical aspirators – including different types of aspirator pistols – provide only short and pre-set airflow. The new device is non-motorised, comfortable and one-handed. The main structural invention is that while the old aspirator gun contains one pump and two check valves, the new device contains two pumps, four check valves and a direction switch. The airflow can be either long and controlled (e.g. to vacuum many ants or fruit flies) or short, pre-set and triggered (e.g. to capture fast-moving insects or spiders). The direction of the airflow is alterable, so that the captured insects can be blown out.

Mating behaviour of the southeast asian whipscorpion *Ginosigma schimkewitschi* (Tarnani, 1894) [Uropygi: Thelyphonidae]

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Courtship behavior and sperm transfer of the southeast asian whipscopion *Ginosigma schimkewitschi* (Tarnani, 1894) are described. The behaviour during courtship takes several hours but sperm transfer is very simple, the male leads the female over the spermatophore. The sperm packages are grasped by the female gonopore and then pulled from the spermatophore, the male does not embrace the female opistosoma. After the female has pulled the sperm packages from the spermatophore, the partners separate and the male turns to eat the remains of the spermatophore.

Comparison of the courtship and mating duration of three *Pardosa* (Lycosidae) species, *Pardosa agrestis*, *P. hortensis* and *P. alacris*

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Some elements of the reproductive behaviour of three *Pardosa* (Lycosidae) species, *Pardosa agrestis*, *P. hortensis* and *P. alacris* were compared. These species living in different habitats (*Pardosa agrestis* in dry, disturbed grasslands, *P. hortensis* in closed grassland without disturbance and *P. alacris* in deciduous forests) seem to have very similar biology (anatomy, size, hunting strategy, brood care etc.).

It was analysed and compared the courtship pattern of the three species using video tape records. The time of courtship and the duration of mating of virgin pairs was observed in laboratory, closed together in Petry-dishes.

P. agrestis mated for 2-3 hours and the courtship took several hours also. Females often refused to mate with courting males. In case of *P. hortensis* a shorter courtship (in general less than half an hour) was followed by mating taking 20-40 minutes. The number of refused males was less than in case of *P. agrestis*. *P. alacris* males courted for less than one hour and mated for extremely long time (more than six hours in average). Courting males were in almost every occasion accepted for mating by females.

The results can be explained in the case of *P. alacris* by the aggressive behaviour of the male, in the case of *P. hortensis* and *P. agrestis* by the refusal or acceptor behaviour of the female.

Structure of the ovari-uterus of Scorpion female *Euscorpius carpathicus (L.)* before fecundation

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We have studied the ultrastructural evolution of the ovari-uterus of the female Scorpion *Euscorpius carpathicus* (L.) before fecundation.

The ovari-uterus of *Euscorpius carpathicus* is composed of a pluristratified epithelium containing high cells and of smooth muscular cells. The very joung germinal cells arelocalized inside the epithelial wall and appear as very clear cell. Afterwards, they pass outside the ovari-uterus and stay there until fecundation in the case of apoïkogenic scorpiones.

The muscular wall is interrupted at the level of the ovocyte. Follicular cells are well structured as soon as formed and they progressively degenerate.

The peduncular cells differentiate directly from ovari-uterus epithelial cells and progressively change their direction and cytological structure. The peduncle differenciates later in two different parts: a zone for inplantation and a zone for support which may have a feeding function.

The ovocyte elaborates a zona pellucida at first discontinuous, which becomes continuous and thicker. Numerous macrovilli develope progressively.

Four stages in the ovocyte evolution are observed : two stages of previtellogenesis, then a primary and a secondary vitellogenesis stage. Their identification is done according to the repartition of the cytoplasmic organites as well as the repartition of the yolk reserves in the ovocyte.