Dead Wood Meeting & Course 2016

Participants, their affiliations, e-mail addresses and abstracts (if submitted) are listed in an alphabetical order of last names. The abstract of oral and poster presentations are displayed as submitted after obvious typos were corrected.

* Dead Wood Meeting only, ** Dead Wood Course only, *** special dates. Names of invited speakers and teachers are **underlined**, names of the organizing committee in orange.

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Wood structure in broadleaf and coniferous trees

The presentation will cover wood structure that forms a basis for fungal growth in woody tissues.

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***Steccherinum ochraceum* strains from different regiones of Russia.**
White-rot fungi as wood degraders are very important part of virtually all ecosystems. The process of degradation of lignocellulose substrates by these fungi includes a large number of steps and depends on the presence of an enzymatic system consisting of laccase (EC1.10.3.2) and various peroxidases, including the manganese (EC 1.11.1.13) and lignin (EC 1.11.1.14) peroxidases. The aim of our work was to study 8 different strains of *Steccherinum ochraceum* (Pers.) Gray from different regions of Russia. The morphological and physiological characterization of the strains has been performed. The strains ligninolytic potentials were estimated by plate-tests. The major laccase isoenzymes were isolated and partially characterized.

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Genetic diversity and population structure in the critically endangered *Hapalopilus croceus*. Swedish oak (*Quercus*) habitats have a great value of international importance; of the 170 red-listed oak fungi, several have a large part of their European population in Sweden. Among these, *Hapalopilus croceus*, is red-listed as critically endangered (CR) in many European countries. *H. croceus* is a polyporous, white-rot species with large, annually fruiting orange bodies. Its appearance generally marks the presence of old growth oak trees in mostly thermophilous deciduous forests throughout Central-European and Sarmatic region. The fungus first enters the host as a weak parasite, then becomes a lignicolous saprotroph inhabiting trunks or hollowed-out chasms below old branches. *H. croceus* is in decline due to mismanagement of existing old growth forests and over the next 100 years is expected to decrease further by 50%. If *H. croceus* is highly isolated, the species may exhibit low genetic diversity and genetic population structure can be compromised; possibly leading to inbreeding and reduced fitness. Thus, understanding the population structure, gene-flow, and even mating type is crucial to preserving this species.

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Wood-inhabiting fungi in European beech forests – local community drivers, continental biodiversity patterns and conservation. Fungal communities in dead wood are highly diverse, and many species are poorly known, both in terms of ecological functions and habitat needs. Based on two decades of research in European beech forest reserves it its evident that local habitat factors, especially relating to wood decay stage and log size, are crucial and consistent drivers of species richness and community composition at resource level. At the continental scale climate is an important factor affecting species composition at site level, and as forest history and climate is strongly correlated at the European continental scale, it has been a challenge to disentangle effects of forest history and climate on fungal communities. However, ongoing research strongly suggests severe effects of forest fragmentation and lack of naturalness on fungal communities. These effects include changes in guild structure, loss of specialist species and decreasing beta diversity in conservation areas situated in degraded forest landscapes. These findings highlights the importance of protecting larger remains of little disturbed forest in Central and Southeast Europe, and to enlarge conservation areas around remaining old growth forest patches in northern and western Europe, rather than expanding conservation efforts in areas lacking natural forest heritage.

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ON THE LARVAL MICROHABITAS OF FUNGUS GNATS (DIPTERA: SCIAROIDEA)
Fungal hosts are discovered for a total of 420 species of fungus gnats (Diptera: Bolitophilidae, Ditomyiidae, Diadocidiidae, Keroplatidae, and Mycetophilidae) that comprises 38% of the European fungus gnat

fauna (Sevčik 2010, Jakovlev 2011a). A list of recorded fungal hosts covers a total of ca 700 species of macrofungi (Jakovlev 2011b, Põldmaa et al. 2015) including a wide range of systematic and ecological groups. There are also numerous rearing records from larvae collected under bark, in decaying wood, soil and litter without indication of fungal host species.

Fungal groups and ***numbers of fungal host species***:	Fungus gnat groups and ***numbers of insect species*** reared from different fungal host groups						
	Bol	Dia	Dit	Ker	Scio	Myc	Total
With named fungal host species:							
- Agaricales, epigeic, ca 275	17	-	-	-	11	93	**121**
- Agaricales, lignicolous, ca 65	15	-	-	1	14	74	**104**
- Boletales, ca 70	10	-	-	3	20	64	**97**
- Russulaceae, ca 90	3	-	-	1	14	65	**83**
- Hydnums, ramarioids,clavarioids, ca 20	-	-	1	1	17	15	**34**
- Lycoperdales, ca 5	-	-	-	-	2	7	**9**
- Polypores, soft, ca 30	9	-	6	3	15	25	**72**
- Polypores, hard,ca 65	1	1	5	12	50	41	**122**
- Corticioid fungi, ca 30	-	1	1	5	24	37	**68**
- Jelly fungi, ca 10	-	-	-	2	8	15	**25**
- Ascomycota, Pezizales, ca 20	-	-	-	1	11	22	**34**
- Ascomycota, lignicolous,ca 15	-	-	1	1	5	7	**14**
- Myxomycota, ca 5	-	-	-	-	-	6	**4**
Without named fungal host species:							
- reared from decaying wood	8	6	5	39	161	141	**362**
- reared from soil and litter	1	3	0	12	34	14	**64**

Fungus gnat groups: Bol – Bolitophilidae, Dia – Diadocidiidae, Dit –Ditomyiidae, Ker – Keroplatidae, Scio – Sciophilinae s.l., Myc – Mycetophilinae

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Heat and moisture stress of wood-decomposing microbes. The physiological responses of microorganisms to environmental stress can alter ecosystem-level carbon and nutrient flows. The CO2 flux from dead wood (dead wood respiration) measured using an automated chamber system for two years in a secondary broad-leaved forest in Japan revealed heat stress in summer and moisture stress during rain events. In the short-term, dead wood respiration showed a clear diurnal pattern that followed the daily change in surface temperature of dead wood and the respiration increased exponentially with temperature. In summer, however, respiration declined during the daytime at wood surface temperatures higher than 30 ºC. In the long-term, daily Q10 decreased as daily mean temperature increased, and Q10 rapidly decreased above 25 ºC. Dead wood respiration decreased sharply with increasing water content during rain events. The respiration rate did not indicate drought stress in dry conditions. These findings suggests that decomposing microbes probably physiological acclimate to environmental stress.

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Mycorrhiza formation by ectomycorrhizal fungi can be promoted by maggots becomimg pupa in soil. Dipteran larvae are frequently found in wild sporophores. However, we have very little knowledge of the natures of the fungivorous dipteran larval feeding in sporophores. It is unknown whether dipteran larvae are able to play a role in spore dispersal. We studied dipteran larval feeding in sporophores of Agaricomycetidae with special interest in their spore ingestion by field sampling sporophores together with dipteran larvae in them. We investigated the rate of spore germination and formation rate of mycorrhiza after passed through larvae of *Muscina angustifrons* Loew digestive tracts. These results that larvae feed on spores frequently, without mechanically damaging most of the ingested basidiospores. The rate of spore germination in excrement were the same as that in controls, while, mycorrhiza formation were the higher by spores discharged under soil than that in soil surface. We discuss that certain larvae may facilitate mycorrhizal formation for ectomycorrhizal fungi.

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Elm Wood Nematode as the potential threat to the urban woodlands in the Russian North-West: provisional results of the laboratory tests

(Authors A.Ryss and K.S.Polyanina, lecturer of oral presentation: K.S.Polyanina). Dutch elm disease (DED) is an epiphytoty with an 90% infection rate of the *Ulmus* spp. in in St. Petersburg and suburbs. The DED consists of interaction of elm host and three causative agents: vector beetles *Scolytus*, fungus *Ophiostoma novo-ulmi* and newly discovered elm wood nematode *Bursaphelenhus ulmophilus* (EWN) with the nematode life cycle similar to quarantinized PineWood Nematode *B.xylophilus*. The laboratory test on 10 tree species was conducted to estimate the EWN host switch probability to other woodlands species. EWN has statistically significant multiplication on conifers (pine and larch), and sustainable population development on oak and elm. Thus the EWN host limitation in *Ulmus* sp. may be caused by feeding and multiplication preferences of the *Scolytus* vectors. The EWN is linked with 2nd and 3rd wood decay stages. Other nematode taxa associated with fungi and insects, were revealed. At 4th decay stages the bacterivorous *Rhabditidae* nematodes are dominants.

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Biodiversity of the Bialowieza Forest. The Białowieża Forest World Heritage Site straddles the border of the Republic of Poland and the Republic of Belarus. It is the unique temperate deciduous forest of primeval character with additional mixed and pure coniferous stands. This is the remnant core of the forests which prevailed in Europe in the past. The natural processes have been running here unbroken for thousands of years. The Forest is famous for the presence of rare fauna of forest dwelling birds, saproxylic invertebrates and fungi. It is the last place where the largest terrestrial mammal of Europe, the European bison, survived in wild until the beginning of the 20th century.

The size of the Forest ensures that all stages of natural forest development are present. The mosaic of natural phenomena and its' dynamic as well as the rich and diverse habitats are of outstanding international importance as an essential habitat for numerous species typical of natural forest ecosystems of temperate climate zone. Dead wood holds the vital importance for forest carbon budgets as well as is invaluable wildlife resource. Dead wood appears in many forms, sizes and positions including standing dead trees, dead branches in the canopy trunks and branches on the ground. Decomposition of a tree is a process that leads to disappearance of the habitat of some species. To persist, the decomposer species must be able to disperse to a new habitat patch within a proper time-scale. In forests under natural disturbance dynamics without human exploitation of wood, the input of dead wood is more or less constant in relation to the life-spans and dispersal abilities of decomposer species. Białowieża Forest is also renown for exceptional dimensions and age of trees. Most of the old growth tree species present here are distinct from their counterparts in Europe in terms of their height and breast-height diameter. The trees live here until natural death and the forest stands have a characteristic uneven-age and multi-layered structure.

Despite a relatively good knowledge of the biological diversity of Europe, new species of fungi or invertebrate fauna are still discovered in the Białowieża Forest. The Forest is also home to a whole range of ungulates present in Poland, large predators such as lynx and wolf as well as typical forest dwelling birds. The Forest has a large population of woodpeckers, among which the white-backed woodpecker and the three-toed woodpecker, which are typical species of old and natural tree stands, are particularly interesting.

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Potential new solutions for conservation of epixylic bryophytes. In recent years, information on epixylic specialist bryophytes´ distribution and status in Finland have increased. The next important phase in species conservation will be the red-list evaluation for 2020, which will start next year 2017. Old-growth forests, which are the main habitat of this species group, have been protected and different measures have been done to make also epixylic bryophytes future better. However, concern on epixylic bryophytes´ situation is not adequately secured, and new threats including climate change have become more prevalent. Thus, new approaches and methods are needed in epixylic species conservation tool-box. Studies and development programs on bryophyte ex situ -conservation including living collections, reintroductions and population strengthening have been initiated. First steps in research on this field have shown promising results, which open new potential and motivation for further studies.

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Traps for saproxylic beetles (course). My lecture will go over the different trapping methods for saproxylic beetles. Methods must be tuned to goals and not all methods are good for all goals. Hand capture has advantages and limitations: scarce beetles can be hand colleted but quantification is then difficult. If control of sampling effort is needed, standardized methods are preferible. Window traps, emergency traps, funnel traps, bottle traps and other devices are described. Sampling methods for target species are also being developed and there is much room for innovation in this area.

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Wood volume and carbon stock in coarse woody debris in pine forests of European North-East Russia. Coarse woody debris (CWD) is often overlooked in forest carbon (C) inventories, although it is an important component of C pools. Experimental data on structure, timber volume, correlation between living and dead biomass are needed for calculating conversion coefficients for estimating carbon cycle in a large regions using forest inventory data. We carried out the study at 11 sites that differed in forest type and age of pine stand. We estimated volume of timber in aboveground CWD that includes standing dead trees, downed woody debris (with separating to five decay classes), and stumps with diameter more than 6 cm. Stock C in CWD was computed with using data of basic density on different decay classes. This study was supported by project of Russian Federation President for young scientists МК-6670.2016.5.

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Environmental conditions affect deadwood decomposition of European beech (*Fagus sylvatica* L.) European beech is one of the most important European trees because of its expected role in the face of climate change and as a frequent species in forest reserves, national parks and the NATURA 2000 network. In this study, we processed a dataset of 4620 logs from beech-dominated primeval and natural forest reserves using Bayesian Survival Trajectory Analysis. Analysed time series have more than 40 years. We examined differences between residence times in the three climatic regions in three DBH classes and qualitative characteristics of fallen longs (mortality mode and position of logs during decomposition). DBH groups 10–24 cm and 25–54 cm had the longest residence time in Šumava (38 and 48 years, respectively) because of lower temperatures. In DBH group 55+ cm logs from Novohradské had the shortest residence time (43 years) because of a favourable combination of temperature, rainfall and fungal communities.

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Assessing fungi biodiversity: beyond the taxonomic impediment. Centuries of biological exploration have shown that biodiversity is not evenly distributed across the planet. However, virtually all we know about biodiversity derives from the study of charismatic organisms – mostly vertebrates and flowering plants – which constitute a tiny fraction of the total biodiversity of ecosystems, against, for example, 14-28% of diversity represented by fungi. We will test the relationship between diversity measured through taxonomic work and the genetic diversity measured from environmental samples in four Amazon locations, and then identify which environmental variable best predicts biodiversity. For this, we will develop and implement a dual sampling methodology consisting of Malaise insect traps and soil samples, coupled with next generation multi-locus sequencing, streamlined computation of phylogenetic diversity metrics, and multivariate statistical modelling. Our goal is assess biological diversity, and shed light on what controls biodiversity patterns across space and environments – with far-reaching consequences in ecology, conservation biology, landscape planning, and evolution.

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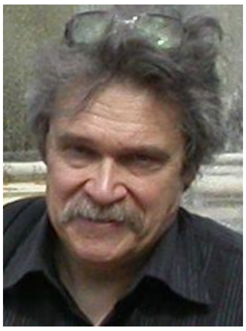

Alexander Ryss

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Wood-inhabiting nematodes, quick start lecture for beginners.
Introduction to nematology. Worm-like organisms inhabiting porous substrates: bottom grounds of water reservoirs, soil, dead organic materials, decaying wood. Nematodes – parasites of animals and plants. Stress resistance: dormant stages and survival. Biological models of the modern life science: *Caenorhabditis elegans* and other species. Nobel Prize awards for the research on nematodes: genes of apoptosis (programmed cell death) and RNA-interference. Nematode origin and position in classification of Animalia: phylum in Ecdysozoa which is close to Nematomorpha, Tardigrada and Arthropoda.
Nematode anatomy and morphology. Pharynx and intestine. Genital system. Life cycle and stages separated by a series of moults. Dormant stages and survival. Trophic groups. Participations in associations and nematode symbiosis.
Nematode role in the dead organic decomposition. Mycotrophic nematodes. An inclusion of the insect vectors in the nematode life cycle. Bacteriotrophic nematodes.
Addition: Two practical training lessons on the wood nematode monitoring, sampling, extraction, fixation and processing, slide preparation, culturing, provisional taxonomic identification.

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The effects of forest continuity on wood-inhabiting fungi. Long forest continuity, i.e. the availability of a suitable habitat for the target species or target species community over a long period of time, is a concept often associated with high species richness and a variety of specialist species. However, due to degradation, fragmentation and loss of natural habitats, forests and woodlands with long forest continuity are getting rarer all the time. We studied how forest continuity on microhabitat and stand level affects the communities of wood-inhabiting fungi on standing dead wood of Pinus sylvestris. We also looked whether the effects of these levels are different for fungal groups with different ecological status. Fungal communities were studied in 14 forests located in Central Finland that differed with respect to continuity. Microhabitat continuity was measured as the age of the study trunk, and stand level continuity as the amount and diversity of dead wood in the stand. I will present some preliminary results of the study.

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Copper incorporation as a bottleneck in the biosynthesis of recombinant laccase. High redox potential laccases could be used in a variety of biotechnological processes and the creation of an industrial producing strain is necessary. Therefore, the search for possible bottlenecks in the biosynthesis of recombinant laccase is a task of considerable importance. In this work comparative transcription analysis of *Trametes hirsuta* (high redox potential producer) with and without copper as inductor was performed. It allows to identify differentially expressed genes and choose the number of gene candidates taking part in the homeostasis of copper (namely ctaA, tahA, hPDI, BiP), and thus capable of affecting the synthesis of laccase. Strains *Penicillium canescens* containing plasmids with lacA and choosed genes individually and in pairs was created. Efficiency of transcription of selected genes in the obtained strains has been shown. The productivity of laccase by this strains were analysed. Based on the data obtained the construction of plasmids to get highly efficient laccase produser is discussed.

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The nematode communities of decaying oak wood succession. Alexander Ryss & Anastasia S. Sergeeva (speaker):Among nematodes there are free-living and parasitic species with greatly diverse habitats; many of them take part in the destruction of organic matter. The research is aimed to obtain the provisional data on the nematode communities' changes during the wood decay succession of oak, including following tasks: a) to reveal the insect-vectored biota; b) possible wilt-caused pathogenic agents. The nematode species of the genera *Aphelenchoides* and *Ditylenchus* were detected as possible indicators of the 2nd wood decay stage; both genera have the moderate phytopathogenic significance. At 3 and 4 stage the prevalence of the bacteriotrophic fam. Rhabditidae and Panagrolaimidae were revealed. Branch litter contained the bacteriotrophic *Panogrolaimus* spp. Wood of healthy oaks has no nematodes inside whereas a bark surface was populated by the bacteriotrophic *Plectus* spp. and mycophagous *Laimaphelenchus* spp.

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Molecular bar-codes for *Pleurotus* species. White-rot fungi of the genus *Pleurotus* include a number of economically important edible species such as *P. ostreatus, P. pulmonarius, P. eryngii, P. djamor, P. citrinopileatus* and others. Pleurotus species are also known to be good decomposer of various lignocellulosic substrates and wastes. Oyster mushrooms are much variable in morphology that sometimes complicates species determination. That is why a molecular identification technique needs to be applied. Molecular bar-codes based on ITS sequences were elaborated. Four restriction enzymes - AluI, BsuRI, HinfI and EcoRI - were proposed to easily discriminate *Pleurotus* species. We analyzed in detail the structure of matA locus in *P.ostreatus* based on genome sequence data (www.jgi.doe.gov). In silico analysis revealed difference in homeodomain (hd) genes composition within the MatA locus. Haploid strain PC9 has one copy of hd1 gene and one copy of hd2 gene; whereas the haploid counterpart (strain PC15) has two copies of hd1.1 and hd1.2 and one copy of hd2. The active transcription factor (the heterodimer) is formed by two interacted homeodomain proteins (HD1 and HD2) transcribing from matA alleles of opposite mating partners. A secondary protein structure of HD1 and HD2 proteins were predicted indicating specific dimerization sites and DNA-binding domains. The DNA-binding model for the heterodimer was also predicted.

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Patterns of wood decay and diversity of decay stage. Decaying wood is a complex matter and many organisms are involved in this ecological important mechanism. Here we treat this complexity by looking to the relationship between fungal interactions and the patterns of wood decaying. We investigated more than 50 beech logs and determined over 3500 fungal collections. One aim of our study was revealing the patterns of wood decay to get a more holistic picture of the diversity how the different decay stages appears and how wood decomposition took place from a fungal point of view. In this study we compared different concepts of determining woody decay stage. We also empirical measured the decay stage in the most cases of sporocarp removal and relating both datasets together. Our results showing the decay stage of the woody structure depends not only on time and the degradation of logs is not a simultaneous process.

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Differences between bryophyte communities on dead wood in central European natural forests along elevational gradient. In central Europe, several forest types are distributed along the elevational gradient. Each of them has specific type of dead wood inhabiting bryophyte communities. We studied eleven localities in Czech Republic representing five types of natural forests: flood-plain, oak, beech, beech-fir and spruce forest. The elevational gradient was from 154 to 1250 m above sea level. We observed that both species richness and species turn-over are positively correlated with elevation. These results agree with most studies describing positive linear relationship between bryophyte richness and elevation. This is caused by two factors: increase in humidity and bryophyte ability to tolerate extreme conditions. Bryophyte communities were also strongly distinguished by the host tree species. The richness of epixylic specialists was positively correlated with elevation and presence of conifers. On the contrary diversity of epiphytic species was higher at lower elevations dominated by deciduous trees.

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Functional traits of dominant bacteria associated with deadwood in natural temperate forests. Dead trees at various stages of decay differ in their properties and can thus harbour diverse communities of bacteria adapted to these specific conditions, strongly influenced by fungal decomposition of wood. Our aim was to characterize the bacterial community composition in the different phases of decomposition of deadwood in the temperate natural forest in Central Europe, to isolate dominant taxa and characterize their functional traits. Members of the most abundant taxa, including the genera *Granulicella*, *Burkholderia*, *Pseudomonas*, *Bradyrhizobium* and *Mucilaginibacter* were obtained by isolation and characterized. Genome annotation revealed the presence of genes encoding glycoside hydrolases involved in the decomposition of cellulose in wood as well as chitin, the component of fungal biomass. Age of deadwood was significantly more important for community structure than species of deadwood. Higher abundance of the phylum *Acidobacteria* together with characterized members from this and other phyla offer novel insight into the role of bacteria in the deadwood decomposition.

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A. Tokareva, S. Volobuev. **Aphyllophoroid fungi in forests of a middle part of the Luga River valley (Leningrad Oblast)**. New data on 110 species of non-agaricoid wood-inhabiting basidiomycetes collected in coniferous and mixed forests as well as floodplain deciduous forests (*Ulmus* spp., *Quercus robur*, *Tilia cordata*, *Populus tremula*) of the Yashchera–Lemovzha planned protected area in the Luga District (Leningrad Oblast) are provided. Most of species are common for hemiboreal and southern boreal zones, but along with them some fungal species, e.g. *Amylocystis lapponica*, *Crustoderma dryinum*, *Dentipellis fragilis*, *Dichostereum granulosum*, *Fomitopsis rosea*, *Hydnocristella himantia*, *Phellinidium ferrugineofuscum*, *Phlebia centrifuga*, which indicate old growth forests of high conservation value were found. New localities of nine species from the Red Data Book of Leningrad Region (2000) are revealed.

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Insect-fungus interactions take part in many processes of forest ecosystems including decomposition of woody materials. The genus of *Ganoderma* (Aphyllophorales: Ganodermataceae) has been known to produce enormous number of characteristic basidiospores which outer thick transparent substances coat brown-colored inner wall with projections. The heart rotting fungi, *Ganoderma applanatum*, is one of the most common species in Japan which may facilitate sylvan animal species diversity by yielding tree cavities as their nests. Thus it is interesting to explore their spore producing and dispersal system. We monitored spore discharging period, spore size and amount, spore feeding insect fauna, and their influence on spore germination rate in Kanazawa, Japan. We discuss the ecological roles of spore feeding insects those could be antagonistic or mutualistic for fungi.

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Differentiation of substrate preferences of wood-inhabiting aphyllophoroid fungi in the center of the Middle Russian Upland. Based on original collections of aphyllophoroid fungi from Oryol Oblast (N 51.93–53.65°, E 34.8–38.07°) the range of woody substrates was evaluated in three vegetation zones – hemiboreal and nemoral forests and forest-steppe. The highest diversity of substrates has been revealed for nemoral zone where aphyllophoroid fungi were registered on 23 genera of trees and shrubs including deciduous forest-forming trees (*Acer*, *Fraxinus*, *Quercus*, *Tilia*, *Ulmus*) as well as conifers (*Larix*, *Pinus*) and undergrowth (*Corylus*, *Padus*, *Sorbus*, etc.). Both for hemiboreal and forest-steppe zones the substrate spectrum has decreased to 15 and 16 plant genera respectively. Fungal species that are widely distributed on the studied area – *Antrodiella fragrans*, *Oxyporus populinus*, *Radulomyces confluens*, *Schizopora flavipora*, *Skeletocutis nivea*, *Steccherinum bourdotii*, *Xylodon crustosus*, – were analyzed in relation to occupied substrates in different vegetation zones. As a result the respective loyal substrates have been distinguished, in particular, hazel and birch for *A. fragrans*, birch and dead basidiomes of *Fomes fomentarius* for *S. flavipora*, hazel for *S. nivea*, oak, birch and aspen for *X. crustosus*.

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Biomass turnover and deadwood structure of natural temperate forest according to environmental gradient. Biomass turnover in natural temprate forests is still unknown because of lack of data. We analyzed 40 years long datasets from 12 fully censused natural forest reserves on the altitudinal gradient. The censuses were based on the stem position maps and were done in 70`s, 90` an 00`s on the total censused area more than 250 ha. Deadwood/living wood ratio varies from 0,18 to 0,56 according to different sites, tree species and disturbance events. Deadwood/living wood ratio is lower in the lowland forests than in mountain forests. Residence time of deadwood is shorter in the lowland forests than in mountain forests but the biomass turnover varies round 60 years for all localities. The DBH structure of snags demonstrates the "wave dynamics" of natural forests - after intensive selection of juvenile trees up to DBH 20 cm is possible to find the lack of snags with DBH 30-50 cm.

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Chemosystematics and evolution of Icelandic cetrarioid lichens (Parmeliaceae).
Traditional medicinal uses of several cetrarioid lichens, especially the lichen *Cetraria islandica*, have intrigued us to investigate their bio- and chemo-diversity and to test if phylogeny provides any insights in selection for medicinal plants. In total 102 Icelandic cetrarioid lichen specimens representing 13 lichen taxa of 6 genera (i.e. *Cetraria*, *Tuckermannopsis*, *Vulpicida*, *Cetrariella*, *Flavocetraria*, *Melanelia*) were incorporated into phylogenetic analysis, based on six genetic markers. Lichen metabolomic profiles correlated well with phylogeny of lichenized fungi, and the distribution of selected bioactive lichen acids (i.e. protolichesterinic acid and usnic acid) was also mapped on the phylogeny of lichenized fungi, where the phylogeny proposed that the biosynthesis of aliphatic lichen acids is facilitated in lineages lacking or producing less depsidones and dibenzofurans, and that the production of usnic acid does not follow the phylogeny but rather seems to have a convergent evolution pattern.

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