FONDAZIONE EDMUND MACH

IUFRO

IUFRO 7.03.10
**Methodology of forest insect and disease survey
in central Europe
"Fluctuation of Insects and Diseases"**

WORKING PARTY MEETING
*S. Michele all'Adige, Italy
22-26 June 2015*

**Programme
Book of Abstracts**

drawing of: L. Sottovia

MEETING PROGRAMME

Monday 22nd of June 2015

10:00 - 17:00   Arrival

15:00 - 17:00   Registration

17:30   Welcome drink - visit to the historical wine cellar

19:30   Dinner

Tuesday 23rd of June 2015

07:30 - 08:30   **Breakfast and registration**

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09:00 - 09:10   **Conference welcome and opening**

                 Prof. Andrea Segrè, President *Fondazione Edmund Mach*

                 Giorgio Maresi, Cristina Salvadori, *Fondazione E. Mach:* General information

09:10 - 09:30   **Alessandro Wolynski**, *Servizio Foreste e fauna Provincia autonoma di Trento:* Forests in Trentino: characterization and management

Session 1 - Chair: Massimo Faccoli

09:30 - 09:50   **Markéta Davídková:** Climate change and bark beetle phenology: a comparison of recent and historical data on sister broods in the spruce bark beetle, *Ips typographus* (L.)

09:50 - 10:10   **Roman Modlinger:** An analysis of the dendrometric stand parameters influence on the number of emerged beetles *Ips typographus*

10:10 - 10:30 **Rastislav Jakuš:** The use of satellite data time series for bark beetle population dynamic analyses: DSS TANABBO

10:30 - 10:50 **Oliver Jakoby**: Modelling phenology and infestation risk of the European spruce bark beetle (*Ips typographus*) in Switzerland

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10:50 - 11:20 **Coffee break**

Session 2 - Chair: Miloš Knížek

11:20 - 11:40 **Mihai-Leonard Duduman:** Comparative analysis of development duration of *Ips duplicatus* and *Ips typographus* bark beetles

11:40 - 12:00 **Petr Zahradník:** How can be affected the efficacy of pheromone traps in forests protection against spruce bark beetle *Ips typographus* L. (Coleoptera: Curculionidae: Scolytinae)?

12:00 - 12:20 **Andrea Battisti:** Distribution of Norway spruce bark and wood boring beetles along Alpine elevational gradients

12:20 - 12:40 **Jon Sweeney:** Effect of trap placement and lure combination on detection of bark and wood boring beetles in Poland and Canada

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12:40 - 14:00 **Lunch**

Session 3 - Chair: Andrea Battisti

14:00 - 14:20 **Cristina Salvadori, Francesco Dellagiacoma:** Results and perspectives of forest health monitoring in Trentino

14:20 - 14:40 **Agnis Šmits:** Forest Pest Monitoring Program in Latvia

14:40 - 15:00 **Siliņš Ingars:** Future perspective for outbreak of 25 significant forest pest species in Central and Western Europe

15:00 - 15:20   **Bernhard Perny:** Documentation of Forest Damage Factors - Introduction and Critical Review

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15:20 - 15:50   **Coffee break**

15:50 - 16:10   **Nathan Brown**: Monitoring forest diseases and syndromes: the case of Acute Oak Decline

16:10 - 16:30   **Paolo Capretti:** Recent surveys in Tuscany on fungal harmful pathogens for Fraxinus and Pinus: *Hymenoscyphus fraxineus*, *Gibberella circinata* and *Caliciopsis pinea***.**

16:30 - 16:50   **Giorgio Maresi:** *Ostrya carpinifolia* canker in Trentino and Veneto: first investigation on the bio-ecological factors involved

16:50 - 17:10   **Massimo Faccoli:** Life-history and spatial distribution of the walnut twig beetle, *Pityophthorus juglandis* (Coleoptera: Curculionidae, Scolytinae), in southern Europe

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17:10 - 18:00   **Free time**

19:30   **Dinner**

Wednesday 24th of June 2015

07:30 - 08:30   **Breakfast**

08:30 - 18:00   **Excursion** (takeaway lunch): West Trentino (Toblino and Valle dei Laghi, Val Rendena, Pinzolo)

19:30   **Dinner**

Thursday 25th of June 2015

07:30 - 08:30   **Breakfast**

09:00 - 09:20   **Vladislav Soukhovolsky:** Modeling of forest insect population dynamics: ARMA-models and potential functions

09:20 - 09:40   **Douce G. Keith:** EDDMapS: Information Technology tools that can be used to survey, report and map native and IAS across Europe

09:40 - 10:00   **Marzena Niemczyk:** Assessment of influence of environmental factors on cockchafers occurrence (*Melolontha* spp.) in forest stands

10:00 - 10:20   **Hannes Lemme:** Monitoring of Pine Beauty *Panolis flammea* in Bavaria

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10:20 - 10:50   **Coffee break**

10:50 - 11:10   **Davide Rassati:** Early-detection of alien species in high-risk sites: the case of wood-boring beetles

11:10 - 11:20   **Hoyer-Tomiczek:** Evaluation of the dog detection method for *Anoplophora glabripennis* and *A. chinensis*

11:20 - 11:40   **Gianfranco Anfora:** *Halyomorpha halys*: a new invasive species between forest and agroecosystem

11:40 - 12:00   **Giorgio Maresi:** Impact of some recent biological invasions on Trentino woods

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12:40 - 14:00   **Lunch**

Session 7 - Chair: Paolo Capretti

14:10 - 14:30   **Jean Berube:** Early detection of emerging fungal diseases from spores in urban centres

14:30 - 14:50   **Anna Żółciak:** Fir broom rust, *Melampsorella caryophyllacearum* (DC) Schroet. - a serious problem of Silver fir *Abies alba* Mill. regeneration in south-eastern Poland

14:50 - 15:10   **Anna Żółciak:** Ligninolytic activity of *Heterobasidion parviporum* and *Armillaria ostoyae* strains

15:10 - 15:30   **Claudia Longa:** Preliminary results of *Armillaria* species distribution in Trentino-Alto Adige

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15:30 - 15:50   **Coffee break**

Session 8 - Chair: Beat Forster

15:50 - 16:10   **Åke Lindelöw**: Changes in area of distribution - Barkbeetles in Sweden as colonisers, immigrants, or loosers

16:10 - 16:30   **Salih Parlak:** Mechanical Trap for Capture of Pine Processionary Caterpillar (*Thaumetopoea pityocampa* (Den. & Schiff.) and Survey Method

16:30 - 16:50   **Lidia Sukovata:** Instars and color forms of overwintering *Dendrolimus pini* larvae at different population densities and outbreak phases

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17:00 - 17:30   **Businesses meeting**

17:30 - 18:30   **Poster Session**

19:30   **Conference dinner**

Friday 26th of June 2015

07:30 - 08:30   **Breakfast and check-out**

09:00   **Visit to Musem of S. Michele all'Adige** (MUSEO DEGLI USI E COSTUMI DELLA GENTE TRENTINA, walking distance)

http://www.museosanmichele.it/en/

ORAL PRESENTATIONS

SESSION 1

Climate change and bark beetle phenology: a comparison of recent and historical data on sister broods in the spruce bark beetle, *Ips typographus* (L.)

Markéta Davídková[1,2], Petr Doležal[1,2]
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The effect of climatic changes on bark beetle development has recently been documented by numerous studies. The most evident examples include earlier onset of swarming and more complete development of generations established at the end of vegetation season. The aim of present study was to obtain data on sister brood production in the spruce bark beetle, *Ips typographus*, at different elevations. Physiologically, the establishment of consequent broods is limited by the number of ovarian cycles. Females of the spruce bark beetle may have up to four ovarian cycles separated by periods of so called regeneration feeding. To enable a direct comparison with historical data, we repeated the experiments of prof. Martinek, who studied sister brood production in the spruce bark beetle in late 1950s and whose results remain largely unknown. He recorded 2 sister broods in lowlands and only one at 1000 m a.s.l. Our results indicate that increase of average temperatures resulted in a distinct shift to three sister broods in lowlands and two at 1100 m a.s.l. The timing of re-emergence, duration of regeneration feeding and the number of sister broods strongly depended on temperature (elevation). The differences in physiology of ovaries and other parameters are discussed.

An analysis of the dendrometric stand parameters influence on the number of emerged beetles *Ips typographus*

__Modlinger Roman[1]__, Knížek Miloš[1], Adam Dušan[2], Liška Jan[1]
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[2] *Department of Forest Ecology, The Silva Tarouca Research Institute for Landscape and Ornamental Gardening, Lidická 25/27, 602 00 Brno; Czechia*

Stand factors influencing the attack of European spruce bark beetle (*Ips typographus*) were determined on 157 fallen trees after two wind storms in two virgin forests national nature reserves Boubín and Žofín. Infestation of fallen trees was evaluated by means of number of *Ips typographus* emergence holes in sections at four relative distances. Three evaluation surfaces of 0.15 m^2 (30 x 50 cm) in each section were evaluated: top and two (right and left) lateral areas. Two buffer polygons, oblong (1.5 x 3 m) and round (20, 40 and 60 m in radius) using SW ArcGIS^{TM} 9.1 were stated for all evaluated trees in stem position map. For both buffer types were defined: number, basal area at breast height and volume of: i) laying spruces, ii) other laying tree species, iii) standing spruces, iv) other standing tree species. Dendrometric parameters values were recalculated to the whole buffer surface when buffer polygon surface exceeded the forest area. In total, 60 variables of environment influence were considered. Multiple linear regression was used for their reduction and evaluation. Number of emerged beetles on laying trees increased with the size of area disturbed (factor of laying spruces number within buffer r = 60 m), and was inversely proportional to standing forest integrity (basal area at breast height of standing spruces within the buffer r = 20 m). Prediction ability of the resulting model was relatively low (coefficient of determination D = 0.22).

The use of satelite data time series for bark beelte population dynamic analyses: DSS TANABBO

Rastislav Jakuš[1], Milan Koreň[2], Ivan Barka[3], Maria Havašová[1], Miroslav Blaženec[1]
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The satellite data time series are key input into decision support system TANABBO. In the model study areas we use available public data archives in order to reconstruct bark beetle caused tree mortality. The procedure is partially automatic in TANABBO input modules. The maps of tree mortality are used for analyses of bark beetle outbreak in time and in space. The results of bark beetle outbreak diagnostic are used for predictions of spruce mortality.

Modelling phenology and infestation risk of the European spruce bark beetle (*Ips typographus*) in Switzerland

Oliver Jakoby[1], Golo Stadelmann[1], Beat Wermelinger[1]
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The European spruce bark beetle *Ips typographus* (L.) is the most significant insect pest in European spruce forests. The predisposition of a forest stand to bark beetle infestations depends on a multitude of different biotic and abiotic drivers including stand characteristics (e.g. age, species composition), climate factors (e.g. temperature, precipitation) and disturbances (e.g. windthrows). These factors influence several ecological interactions between the bark beetles and the spruce (*Picea abies*) host and may be altered due to management and climate change. For an adequate pest management it is crucial to know which changes in the beetles' phenology and the forest predisposition are to be expected at different time scales. Therefore, we developed a dynamic simulation model, (i) to provide the daily and forecasted bark beetle development on an online platform, and (ii) to simulate the future risk of bark beetle infestations under different scenarios of climate change.

To investigate the effect of different climatic drivers we developed dynamic models that estimate the beetles' relative population density of different developmental stages, their flight periods and number of generations as well as the drought stress of spruce hosts. Furthermore, we combined these dynamic with static modelling approaches to assess the overall predisposition of forest stands to spruce bark beetle infestation.

In this study we investigate different drivers affecting the potential infestation risk on a national scale for Switzerland. We illustrate the bark beetle phenology and the predisposition of forest stands under current environmental conditions and how this is likely to alter under climate change scenarios. This approach allows to identify regions with increased future infestation risk, e.g. due to faster beetle development or increased drought stress of the host trees. Moreover, we demonstrate how the models are made available online to the practice. Our information platform (www.borkenkaefer.ch) provides nation-wide information of the flight activity of the bark beetle generations on a 2x2 km grid, considering the varied Swiss relief. Furthermore, detailed information on developmental stages of regional populations and their flight patterns are shown for several altitudes and expositions. Additionally, the platform provides general knowledge on the biology and management of the spruce bark beetle and adds survey data on the recent regional infestation history.

The information provided by both the model and the online platform can be used by stakeholders and practitioners to evaluate short- and long-term management strategies. Altogether, this study demonstrates how models can be used to evaluate environmental risks and how scientific knowledge can be transferred into practice to support ecological risk assessment in forests.

SESSION 2

Comparative analysis of development duration of *Ips duplicatus* and *Ips typographus* bark beetles

Mihai-Leonard Duduman[1], Nicolai Olenici[2], Adina Nuțu[1]
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The European spruce bark beetle (*Ips typographus* (L.)) and the northern spruce bark beetle (*Ips duplicatus* (Sahlberg)) are important pests of the Norway spruce in Romania. In the last years, these species caused serious damages in many spruce stands located at the lower altitudinal limit of spruce natural range, especially in the north-eastern part of the country. In this context significant developmental differences were noted compared with our previous knowledge on *I. typographus* in the mountain zone, but also between these species. Consequently some research was necessary to assess the duration of development for these pests, an essential aspect for correct timing of the control measures.

The study was conducted in laboratory using the rearing method of Wermelinger and Seifert (1998) ("Sandwich" devices). The two species were reared within climatic chamber at three temperature levels: 20^oC, 22.5^oC and 27.5^oC and 50% RH, in total darkness. To avoid the bark desiccation and its contamination with mould fungi, the devices were sealed with moisture-proof paper. For each temperature level, all bark pieces used in rearing devices were prepared from the same spruce tree.

According to the above temperature levels, the development of insects from egg to mature adult lasted 37.4 (±2.9) days, 33.9 (±2.8) days and 25.4 (±1.1) days in *I. duplicatus*, and 47.8 (±3.8) days, 39.4 (±3.5) days and 29.3 (±1.7) days in *I. typographus*, respectively.

Laboratory results confirmed field observations which indicated that the northern spruce bark beetle develops more quickly than the European spruce bark beetle in the same environmental conditions. This fact allows completion of three generations per year in the first species at 450-500 m a.s.l., but only two in the second one.

How can be affected the efficacy of pheromone traps in forests protection against spruce bark beetle *Ips typographus* L. (Coleoptera: Curculionidae: Scolytinae)?

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The efficacy of pheromone traps at the *Ips typographus* population (L.) reduction is dependent primarily on the population density of the pest and the resources of primary and secondary attractant. Other factors are:
- ➢ type of pheromone traps;
- ➢ type of pheromone dispenser;
- ➢ distance of pheromone traps from the stand wall;
- ➢ spacing between pheromone traps;
- ➢ set-up of pheromone traps.

In the Czech Republic there are currently used barrier traps - Theysohn and Ecotrap type and 15 kinds of dispensers were registered at the time of experiment and around another 10 kinds were used last years from production of the Czech Republic, Slovakia, Germany and Austria. Two of these dispensers have a combined effect on two species of bark beetles - *I. typographus* L. and *Pityogenes chalcographus* (Linnaeus, 1761). The intention of this experiment was to establish the relative efficacy of pheromone dispensers in use in the Czech Republic and the length of efficacy because of its possible impact on the beetles' flight curve.

It is possible to divide the pheromone dispensers into 3 groups according to changes in their efficacy during *I. typographus* flight activity:
- ➢ Pheromone dispensers with unchanged efficacy during whole flight activity of *I. typographus*: IT Ecolure Tubus, Pheagr IT, Pheagr IT Extra.
- ➢ Pheromone dispensers with slightly decreased efficacy in the second part of flight activity: FeSex Typo, IT Ecolure Mega, Pheagr IT Forte, PCHIT Etokap.
- ➢ Pheromone dispensers of low efficacy in the second part of flight activity: IT Ecolure Extra, Pheroprax A, PCIT Ecolure.

Experiments studied the distance of pheromone traps from the stand edges (every 5 m from 5 m to 25 m) had proved that trappings decreased with increasing distance, while the most significant difference was between the distances of 5 and 10 m, in the case of other distances differences were relatively insignificant.

Experiments with pheromone traps spacing studied impact of spaces between traps (from 5 m to 25 m) on their efficacy. With increasing number of traps along the stand edge increased trappings but also financial costs of protection. There was no statistically significant difference between single spaces.

Pheromone traps are standardly placed along a forest edge at a distance of 20 m between each other. It has been shown that the set-up where the line of pheromone baited traps is placed in the middle of a stocking area with no space between single traps with every trap baited is equally efficient. This may lead to easier emptying of traps. The decrease in trappings occurs if not all of pheromone traps are baited with pheromone dispenser.

Distribution of Norway spruce bark and wood boring beetles along Alpine elevational gradients

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Temperature is probably the most important driver of insect response to climate change and has many implications at both individual and population levels. This paper explores how elevation, as a proxy for temperature, affects abundance and diversity of bark and wood boring beetles associated with Norway spruce (*Picea abies*) along its southern range. We selected three elevational gradients (c. 900-1500 m) in spruce stands in the south-eastern Alps, each consisting of four locations. From April to September 2011, four traps of different types were installed at each location, three baited with generic lures (α-pinene and ethanol) and one baited with a pheromone specific for *Ips typographus*. In addition, three fresh spruce logs were exposed on the same locations. Species richness did not vary significantly with elevation while the abundance of most individual species did. Generally, aggressive species responded positively to higher temperature while most non-aggressive species responded negatively. In a warming scenario it is likely that spruce forests will face increasing damage from aggressive species. This will threaten the growth and survival of Norway spruce at low elevation, especially at southern latitudes.

Effect of trap placement and lure combination on detection of bark and wood boring beetles in Poland and Canada

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Exotic bark- and wood boring beetles, particularly those in the Cerambycidae, Buprestidae, and Curculionidae families, include some of the most damaging forest pests in Canada, and in spite of recent implementation of international phytosanitary regulatory policies such as ISPM 15, continue to be intercepted in solid wood packaging at ports in Canada and the US. Recent research has demonstrated that numerous species of longhorn beetles respond to pheromones such as hydroxyketones, hexanediols, fuscumol, fuscumol acetate, and monochamol. We report here results of field experiments conducted in 2013 and 2014 that tested the effects of trap lure and trap height on the efficacy of detecting species of longhorn beetles in Lindgren 12-unit funnel traps. In general, the number of longhorn species detected per site was increased by baiting traps with pheromone-enhanced lures, by placing traps in the upper tree canopy as well as in the understory, and by increasing the number of traps per site. We also present preliminary data suggesting that it takes an average of only 4.5-6 minutes longer per trap and costs about $2.50 more per trap to place traps in the upper canopy compared to placing traps at the standard 1.5-2 m heigt.

SESSION 3

Results and perspectives of forest health monitoring in Trentino

Cristina Salvadori[1], Giorgio Maresi[1], Francesco Dellagiacoma[2]
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Climate change, which is predicted to be stronger in the alpine area, is going to impact heavily on forest ecosystems because of the long life cycle of forest plants and complexity of the forest ecosystem. Alpine forests deliver much more than wood, from erosion and flood prevention, to improvement of water quality and storage, from nature and biodiversity conservation to climate and air quality protection, to recreation, scenary and well-being. To deliver continuously these ecosystem services forests need to be in balance. The forest health monitoring is very important for prevention, control and response to biotic and abiotic damages.

In 1990 the Forest Unit of E. Mach Foundation developed a method for the monitoring of known damages in Trentino woods: since then monitoring was carried out in collaboration with the personnel of the Forest and Wildlife Service of the Autonomous Province of Trento.

In the last decades, we collected a long series of data on the main types of damages; all the data are georeferred and recorded through the WebGIS system. The processing of datasets allows the evaluation of the pests and diseases diffusion and their impact on forest functionality. The comparison of this information with the dendrological and environmental data from Forest Management Plans enabled us to identify some factors which can predispose to the outbreaks. The analysis of the structural and ecological characteristics of affected woods permit to draw risk maps for the main phytosanitary problem. Furthermore, the extensive forest monitoring proved to be an essential tool in the early detection of biological invasions.

Data from the monitoring have been used in forest planning to define potential risk areas related to the main damages and influence silvicultural choices on structure and composition of target forest and forest measures. Some data on abiotic and biotic damages to forests in the municipalities of the district Valsugana and Tesino are presented.

Forest Pest Monitoring Program in Latvia

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Forest Pest Monitoring Program in Latvia was initiated in 2014. This program is carried out in Latvian State Forest Research Institute "Silava". Program consists of several activities. Pheromone traps are used for monitoring nun moth (*Lymantria monacha*), Gypsy moth (*Lymantria dispar*) and spruce bark beetle (*Ips typographus*). Litter control is carried out in May to assess the overwintering stages of insect pest species such as pine looper (*Bupalus piniarius*), common pine sawfly (*Diprion pini*), pine hawk-moth (*Hyloicus pinastry*) and others. 26 sample plots are evenly distributed throughout the country for litter control, volume traps for moth and black slit traps for *Ips typographus*. Three pheromone traps are used in each of the sample plots. In addition spruce bark beetle damage in spruce stands is evaluated in 300-400 stands using transects to assess proportion of trees colonized by *Ips typographus* in the current year. Another activity includes identification of defoliation agent in Forest Health Monitoring program (ICP Forest) if average defoliation of trees exceeds 30%. Besides systematic monitoring, additional information on forest pest damage comes from other sources like State Forest Service and forest owners. Every report about forest pest damage is examined by experts. Several outbreaks of insect pest species were observed in 2014. Of major concern is an outbreak of great pine web-spinning sawfly (*Acantholida posticalis*) near of the city of Daugavpils. Although the affected area is relatively small- 200 ha, overwintering larva density in the soil in primary outbreak region exceeds 400 per m^2. Approximately 50% of sawflies are expected to emerge in spring 2015, threatening complete pine defoliation early in the season. Several less destructive outbreaks are observed in the Western part of the country. Outbreak of European pine sawfly (*Neodiprion sertifer*) covers approximately 500 ha with average defoliation 30%-50%. Outbreak of European oak leafroller (*Tortrix viridana*) covers approximately 100 ha. Heavy defoliation of oaks observed in June was hardly noticeable in late summer due to intensive production of new leaves by oak trees. Population of *Ips typographus* remains endemic with an average of 3654±561 beetles caught per trap from May 1 to September 30. The same is reflected in spruce stands where the proportion of spruce trees older than 50 years that were killed by *I. typographus* was 0,22%.

Future perspective for outbreak of 25 significant forest pest species in Central and Western Europe

Silinš Ingars[1], Šmits Agnis[2], Jansons Āris[3]
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It is crucial to understand reasons behind insect mass outbreaks for correct forestry planning and practice (Allard _et al._, 2003; Barbosa _et al._, 2012). There are almost countless factors affecting propagation of widely known dendrophages - such as inner concurrence, dynamics of natural enemies, host plant quality and availability, etc. Lot of those still remains unknown (Allard _et al._, 2003; Roques _et al._, 2006; Barbosa _et al._, 2012).

This meta-analysis study serves as summary of 25 aggressive dendrophagous pests (_Limantria dispar, Lymantria monacha, Ips typographus, Ips acuminatus, Hylobius abietis, Bupalus piniarius, Neodiprion sertifer, Phymatodes testaceus, Scolytus ratzeburgi, Euproctis chrysorrhoea, Aradus cinnamomeus, Xyleborus dispar, Cryphalus piceae, Archips crataegana, Melasoma populi, Phalera bucephala, Diprion pini, Rhyacionia buoliana, Saperda carcharias, Panolis flammea, Melolontha melolontha, Dendrolimus pini, Pityogenes chalcographus, Tomicus piniperda, Tomicus minor_) outbreak history in Western and Central Europe with aim to modeling and determine differences in outbreak trends in future. To set predictions we reviewed outbreaks from 1950 till 2013. Information was collected from EFI (European Forest Institute), GISD (Global Invasive Species Database), EPPO (European and Mediterranean Plant Protection Organization), FED (Fauna Europaea Database) and scientific publications to make outbreak prognoses. Historical data have been analyzed by generalized least square model (GLS) in R program to derive outbreak projections till 2040. As at beginning diagnostics of model residuals showed high autocorrelation values between time series, models appended with autocorrelation structure. GLS analysis were applied for time series of outbreak area volumes and total outbreak number per year. Respective meteorological data from 53 outbreak regions were collected using CRU (Climatic Research Unit) datasets and were compared with outbreak data.

The greatest possibility for outbreak area increase till 2040 found in pest species (_R. buoliana, X. dispar, A. crataegana, S. carcharias, P. buchepala_) with comparatively small historical outbreak volumes. _M. melolonontha_ showed slowest possible increase outbreak projected till 2040. We also found interesting similarity in outbreak volumes between scolytid species during 1950 - 2013.

Documentation of forest damage factors introduction and critical review

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The Documentation of Forest Damage Factors (German abbr. DWF) provides data on important forest pests, diseases, vertebrates and abiotic damages, collected by means of a survey on forest district basis in all private and public forests of Austria. Since 2011 the data ascertainment was based on the estimation of 72 damage factors. Due to the reorganization of forest districts the number of assessment units has increased by 1, amounting now to 240. The number of interpretation units (74 forestdistricts) remained constant. The results for the total federal territory of Austria are illustrated by 66 maps of the forest districts allowing a good overview on the forest health situation and acknowledging the trend of the previous year. For 20 damage factors the damage was documented in terms of volume of the damaged wood (in m³), for 46 factors in terms of damaged forest areas affected (in hectares). For the remaining six factors only the occurrence was assessed. In 2015 a critical review of the documentation system has begun, to provide and improve a better quality and quantity of data.

SESSION 4

Monitoring forest diseases and syndromes: the case of Acute Oak Decline

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In recent years, in the UK, an atypical form of oak decline with distinctive stem symptoms has become apparent. Acute Oak Decline (AOD) develops faster than the long-known chronic form of decline. Evidence suggests that AOD is a consequence of the interaction between _Agrilus biguttatus_ and several species of bacteria. Study of this newly defined syndrome has involved a multidisciplinary approach to answer some of the many unknowns surrounding its epidemiology. Here we present a few of the key findings from two mapping and monitoring exercises:

1) At the stand level long term monitoring plots were established to investigate disease dynamics within the system. In addition to rates of transmission these data revealed a further process that regulates the rate of disease development. This process involves the growth of callus tissue over of lesions and larval galleries, resulting in the remission of lightly infected oak and offers hope that management and selection within infected stands can mitigate the impact of AOD.

2) At the landscape scale information initially collected through citizen science has been enhanced and verified through a national woodland survey. From these data it has been possible to estimate the spatial distribution of AOD occurrence across Great Britain using a stochastic optimisation method. The survey data will now be used to inform future work relating the distribution to climate and biogeographical variables, especially those that influence water availability.

Recent surveys in Tuscany on fungal harmful pathogens for *Fraxinus* and *Pinus*: *Hymenoscyphus fraxineus*, *Gibberella circinata* and *Caliciopsis pinea*.

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Forest ecosystem services may be threatened by the outbreak of new plant pathogens, which could cause the disturbance of the natural balance, through the erosion of biodiversity, and lead to worse environmental conditions, causing economic damage and, in some cases, threaten human health. During these last years the health status of forests has been intensively investigated in Tuscany (Italy). Special attention was given to disease and damages due to native and introduced fungi and insects. Recently, the attention was mainly focused towards monitoring the presence of harmful fungal pathogens at risk of introduction, on native, such as Ashes (*Fraxinus angustifolia*, *F. excelsior* and *F. ornus*) and cultivated tree species, such as *Pinus radiata*. Both these species are subjected to serious damages in other European countries: Ash trees are heavily damaged by *Hymenoscyphus fraxineus*, the agent of Ash dieback in north and central Europe; while *P. radiata* is hit by a *Gibberella circinata*, the agent of Pitch canker, in Iberian peninsula. Ash trees were monitored both in forest and plantations. The survey gave the possibility to map the distribution of Ash trees in Tuscany; inspect different sites and collect samples. Samples showing necrotic area, cankers, or other symptoms were analyzed in lab for the presence of *H. fraxineus*. Finally thematic maps of areas considered at risk for the possible spread of *Hymenosciphus fraxineus* were produced. Furthermore, reference strains of *H. fraxineus* were grown on different substrates obtained by leaves of different Mediterranean Oleaceae species. The results showed the possible increasing of the number of Mediterranean host species, as reservoir of inoculum of the fungus. In Tuscany *Pinus radiata* was planted as a fast growing species for timber production. The possible presence of *Gibberella circinata* was actively monitored. As for ashes, pines showing disease symptoms resembling those of Pitch canker were accurately analysed. *G. circinata* was never isolated, but cankers on stems and branches were associated to *Caliciopsis pinea*, a relatively rare fungal parasite described in the past years on *P. radiata* and several different native pine species, such as *P. pinea*, *P. pinaster* and *P. halepensis*. This fungus is able to cause relevant damages just in presence of environmental stress able to weaken trees.

***Ostrya carpinifolia* canker in Trentino and Veneto: first investigation on the bio-ecological factors involved**

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Cankers and diebacks of European hop hornbeam (*Ostrya carpinifolia* L.) have been observed in Trentino since 2001. In 2013 and 2014, field and laboratory investigations were carried out in the provinces of Trento; Padova and Verona (northern Italy) to assess the presence and spread of the disease on *O. carpinifolia*. Environmental and dendrometric data had been collected and analyzed for a better understanding of the phenomenon, and material for the laboratory assays was collected.

From fungal isolations, confirmed by morphological and molecular analyses, *Botryosphaeria dothidea* (Moug.) Ces. & De Not resulted as the main agent involved in the disease, with also *Dothiorella parva* Abdollahz., Zare & A.J.L. Phillips isolated from some infected tissues*.* However, both isolated fungi were obtained also from healthy tissues, confirming their role as endofites or/and latent pathogens. In inoculation tests both species proved to have weak pathogenicity, but they showed different growth behaviour in relation to temperature. The measured annual canker growth on hornbeam also suggests a correlation to higher fall temperature.

Severe attacks and multiple infections were often observed in the field, even though the decline symptoms were seldom observed. The analysis of the disease presence in 270 surveyed points showed a strong correlation with the altitude, with a greater presence of symptoms at low ones. This has led us to investigate the role of temperature on the distribution of the disease and has subsequently showed a correlation between the manifestation of cankers and the highest average temperature during the growing season. No other correlations were shown in observed environmental and dendrological data.

Life-history and spatial distribution of the walnut twig beetle, *Pityophthorus juglandis* (Coleoptera: Curculionidae, Scolytinae), in southern Europe

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In September 2013, the Walnut Twig Beetle (WTB) *Pityophthorus juglandis* Blackman, a species native to Mexico and South-Western USA (California, Arizona and New Mexico), was recorded for the first time in Europe in Northern Italy (province of Vicenza, Veneto region). In the native areas, the insect is associated with the fungus *Geosmithia morbida* Kolařik (Ascomycota: Hypocreales), an extremely aggressive pathogen inducing the Thousand Cankers Disease (TCD) on walnut species (*Juglans* spp.). The individuals of WTB collected in Italy were found to be vector of *G. morbida*, both in black (*J. nigra*) and English (*J. regia*) walnuts. Because any information concerning WTB was still available for Europe, an intensive survey of the main walnut plantations occurring near to the first finding site was carried out in spring-summer 2014 to determine the spatial distribution of the species and the potential pathways of introduction of this new pest. At the same time, a sampling of infested trees and a trap monitoring were done to investigate the main aspects of biology, phenology and voltinism of the European populations of WTB. WTB is a minute (1.5-1.9 mm) bark beetle reproducing under the bark of many walnuts species. In spring the beetles colonize the base of twigs in rough areas of bark, although large branches and even the trunk can be infested as well; the underside of branches is preferred, especially when located on the warmer side of the tree. Males excavate small nuptial chambers under the bark where they are reached quickly by 2-6 females, usually 2-3. After mating they bore short tunnels on the phloem where eggs are laid along both the sides of the galleries. Egg galleries usually radiate transversely (across the wood grain) from the nuptial chamber, while larval mines directed longitudinally (with the wood grain). Larval development usually takes 6-8 weeks to complete, with generally two overlapping generations per year. Adult beetles were caught in traps from mid-May to late October, while winter was spent as adult under the bark of the host trees infested in late summer. The WTB was found in the 56% (14) of the 25 monitored walnut plantations occurring around the first collection localities. The infested sites were spread over 4 different non-contiguous administrative provinces (Vicenza, Treviso, Padova, Mantova) belonging to two regions (Veneto and Lombardy) of North Italy. The most distant infested plantations were about 130 km apart along a west-east gradient, and about 70 km along a north-south gradient. In this respect, the distribution area of WTB in North Italy may be estimated prudentially in about 4,200 square km. All the monitored sites occurring within a radius of about 30 km around the first recorded infestation were found positive to the WTB presence. Interesting, the western infested plantation – located in Lombardy (Marmirolo) – resulted to be isolated from the others. The most likely pathway of introduction of the WTB in Europe is the importation of infested wood (with bark) from the USA.

SESSION 5

Modeling of forest insect population dynamics: ARMA-models and potential functions

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Weather impact, parasites and predators are basic variables influencing on forest insects population dynamics. However, in many cases, these variables are unknown which makes it difficult to predict the changes in population. The paper considers several methods to model population dynamics when information about impact of various factors on insect population is limited. The proposed approach is about the model that does not include the impact of regulatory factors (predators and parasites) and does not determine the function of susceptibility to insect populations modifying factors (weather). We use the ARMA-model (Auto Regression Moving Average) to simulate and forecast the short-term population dynamics of insect phyllophages:

$$L(i+1) = a_0 + \sum_{j=1}^{n} a_j L(i-j) + \sum_{k=0}^{m} b_{k+1} W(i+1-k),$$

where $L(i)$ - regular normalized logarithmic population density in season i; $W(i)$ - weather indicator (for example, hydro-thermal coefficient of vegetation season), L_0, a_j, b_k, n, m - free coefficients. Population dynamics data of phyllophages is used to calculate the parameters of the ARMA-model. Time series *of Zeiraphera griseana* in Alps, *Bupalus piniarius* in the pine forests of Thuringia (Germany), *B. piniarius* and *Dendrolimus pini* in the pine forests in Central Siberia (Russia), *Lymantria dispar* in Europe, *Tortrix viridana* in European part of Russia were used as the objects of modeling. The model contributes to estimating the contribution of weather factors in the change of population density, determining the delay of reaction of host population to changes in the parasite population density. The margin of stability and robust stability of the ARMA-models of population dynamics of forest insects were calculated. These calculations allowed to estimate the change in population state after environmental transformations and changes of the actual characteristics of the population. The proposed approach allowed to obtain a short-term (2-4 years) forecast of population density. Potential function $G(x)$ was proposed to model the long-term population dynamics of insect phyllophages:

$$G(x) = \frac{1}{p(ln\,x)},$$

where x - population density; $p(ln\,x)$ - probability of population state with density $ln\,x$. We propose to classify the types of potential functions for species with different types of population dynamics. We assess the risk of outbreaks depending on the characteristics of the populations and the variability of weather factors.

EDDMapS: Information Technology tools that can be used to survey, report and map native and IAS across Europe

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European forested systems and landscapes are under constant pressure from new and invasive insects and diseases. In recent years the European Union (EU) has recognized the need for improved European focused Invasive Alien Species (IAS) information system(s) that would enhance the gathering and sharing of knowledge to better enable informed decision-making about Invasive Alien Species (IAS) issues at all levels. There has also been an increased realization of the need for improved Early Warning and Rapid Response (EWRR) tools and protocols, and for incorporating Citizen Scientists into the reporting and decision-making process.

The Bugwood Center for Invasive Species and Ecosystem Health (Bugwood Center) www.Bugwood.org has identified similar needs and issues in North America and has evolved programming, educational partnerships and information technology tools and systems to address help address IAS issues. These IAS programs have been designed to leverage information sharing and to enable educators, regulators and citizens to address problems being caused by IAS across North America.

Bugwood information technology systems include a North American IAS information system that enables collection and consolidation of information from existing or historical AIS programs; a web accessible system with an extensive array of educational information and tens of thousands of images available for direct use by individuals or that can be adapted and incorporated into ongoing educational programs, as well as operational EWRR system that utilized and leverages web based and Smartphone based identification and reporting system EDDMapS www.eddmaps.org and BugwoodApps http://Apps.bugwood.org/. A key component of the Bugwood systems is the improvement of flow of reporting information utilizing the expertise of key local experts, and other professionals located in key agencies that have managerial responsibilities.

In this presentation we will report on a how we are proposing to utilize and adapt the framework currently operational across over 45 U.S. states and 5 Canadian provinces in North America for use in Hungary. We will provide an overview of the progress to date as well as also discuss why we believe that this framework can be successfully utilized across not only Hungary but across Southeastern European countries and perhaps European wide.

Assessment of influence of environmental factors on cockchafers occurrence (*Melolontha* spp.) in forest stands

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Common and forest cockchafers (*Melolontha melolontha* and *Melolontha hippocastani*) are some of the most damaging forest insect pests in Europe. This study evaluated risk factors that influence the occurrence of cockchafer grubs in forests, including location of the stand relative to open space, the stage of stand development, tree species composition, canopy openness, and cover of forest floor vegetation. To determine grub infestation in soil and to characterise forest stands, 300 sampling pits ($1 \times 0.5 \times 0.5$ m) were excavated in 12 stands in major centres of *Melolontha* spp. outbreak in Poland. Additionally, in stands bordering on meadows 5, 250 m long transects were established to check the distribution of cockchafer grubs. Each transect consisted of 6 pits in a regular distance of 50 m with the first pit on an open space bordering on forest. Our results show that the boundary between open space and forest is associated with a significantly higher probability of occurrence of cockchafer grubs. Stands adjacent to meadows are particularly susceptible to infestation, however cockchafers occurrence is more frequent in the forest interior than in an open space or at the forest-meadow ecotone. The high numbers of grubs were observed in most stages of stand development. Characteristics associated with increased numbers of cockchafer grubs included moderate canopy openness (21-35%) and the presence of dense vegetation cover (>75%). Stands containing deciduous trees (beech, birch, oak) had slightly more cockchafers than stands containing pine, for which the predicted number of grubs was significantly lower.

Monitoring of Pine Beauty *Panolis flammea* in Bavaria

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The Pine Beauty *Panolis flammea* (Lepidoptera, Noctuidea) is one of the most dangerous insect pests of Scots Pine in central Europe. Caused by the early feeding of young larvae a single total or heavy defoliation is sufficient to induce the destruction of forest stands. In the last century serious outbreaks have been recorded in Scots pine regions of northeast as well as southeast Germany. With the development of effective pesticides forest owners received the tools to manage outbreaks of forest insect pests. However, the basis for an application of pesticides is the development of sample method of the pest species as well as a scientific reasoned density-damage relationship. Schwerdtfeger developed in the 30s a makeshift critical density for *Panolis flammea*, forced by a pending outbreak. The cardinal point of these values was the determination of the food demand of a larva. Based on this food demand the Pine Beauty density which will cause a total defoliation was calculated. However, still today the critical values, used by some forest services in Germany, are based on this food demand as defined by Schwerdtfeger. After the World War II to the 60s the Bavarian Forest Service used always higher critical values for *Panolis flammea*, as proposed by Schwerdtfeger. Also a comparison of critical values for *Panolis flammea*, developed independently from Germany, like in Scotland or former Soviet Union, shows substantial higher critical densities. In recent years the monitoring procedures have been revised in Bavaria. The new sample method is based on historical experiences in Bavaria as well as published density-variance relationships of pupae from former Soviet Union and Germany. Currently we monitored *Panolis flammea* with the winter soil survey in 150 stands in Bavaria. The goal of the survey is to identify densities higher than 5 pupae/m^2. We examine 6 plots á 0.5 m^2 per survey forest stand.

SESSION 6

Early-detection of alien species in high-risk sites: the case of wood-boring beetles

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Wood-boring beetles (especially Scolytinae, Cerambycidae, and Buprestidae) include a high number of invasive species and represent an important threat to all forested countries. Early detection of alien species is of primary importance to improve the chance of eradication and is usually achieved through direct inspection methods and sampling strategies such as trapping. Resources available for these activities are however limited and the number of sites which should be monitored is extremely high. For this reason, it is necessary to find the most vulnerable locations where to concentrate the surveillance efforts. We present the results obtained from a two year long study (2012-2013) conducted in Italy in collaboration between the University of Padova and the Regional Plant Protection Organizations. In 2012, we focused on ports and surrounding areas, in order to explore how port size, in terms of amount of imported commodities, and characteristics of the landscape surrounding the ports, in terms of forest cover and forest composition, may influence the occurrence of alien wood boring beetles. From May to September, 15 Italian international ports were monitored with multi-funnel black traps, three in each port and three in forests located 3-5 km around each port. Forests were classified into broadleaf or coniferous forest according to tree composition. Traps were baited with a generic multi-lure blend previously tested in a pilot experiment. A total of 81 wood-boring beetle species were trapped, 67 native and 14 alien. The number of alien species was positively affected by volume of imported commodities, trap position and forest composition. In particular, the mean number of alien species per trap check was higher in broadleaf forests than in ports, but it had similar values in coniferous forest. The results suggest that surveillance should be concentrated in large ports and in the surrounding broadleaf forests. In 2013, we explored the role of wood waste landfills in wood boring beetles' invasion process. In the last 30 years, cargo has increasingly shipped in large containers and only a fraction of the latter are opened and inspected within ports. Commodities and associated wood packaging materials are often transported directly to their final destinations, such as industrial or commercial areas. Wood packaging materials are then sent to wood waste landfills where, before being destroyed or recycled, they can act as a source of alien wood boring species. A subset of 11 ports monitored in 2012 was selected. Each port and the corresponding wood waste landfill were monitored using the same traps and lures than 2012. Number and composition of trapped alien species were similar in ports and in wood waste landfills. This suggest that wood waste landfills have the same importance than ports in wood boring beetles' invasion process, representing a crucial site where detecting alien species associated with wood material, even in continental areas far from the coasts.

Evaluation of the dog detection method for *Anoplophora glabripennis* and *A. chinensis*

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Since the beginning of the 21th century, global trade caused infestations of the Asian Longhorn beetle (ALB), *Anoplophora glabripennis* and the Citrus longhorn beetle (CLB), *Anoplophora chinensis* in several European countries. ALB is mostly introduced with wood packaging material, CLB mostly with plants for planting. Both species are quarantine pests for the European Union. Monitoring in infested areas and inspection of imported goods currently depends on visual detection of infestations. Scent detection by dogs is a promising alternative. Since 2009 the Austrian Research Centre in Vienna has been training dogs for the detection of ALB and CLB. This method has already been successfully used in several infestation areas and at import controls in Austria, Germany, Italy, Croatia, United Kingdom, Switzerland and the Netherlands. In this study, two sets of experiments were carried out to quantify the sensitivity of the dog detection method towards ALB. One set was carried out with 10 dog teams and was focused on the detection of different scent material of ALB under abstract standardized conditions. The other set involving 14 dog teams focussed on detection of ALB saw dust in realistic environments under standardized conditions. Each set of experiments consisted of 4 different experiments with 3 repeats each. Each experimental setup consisted of 2 positive and 6 negative samples in random order. Additionally, the wind direction and strength, the temperature, air humidity and the duration of the search, which was limited to 8 min each, were recorded. In the first test series, ALB scent material was placed invisible for dog and handler in the following situations: (1) ALB wood shavings in hollow building blocks, (2) living ALB larvae in hollow building blocks, (3) pieces of ALB-infested wood plus living larva in hollow building blocks, and (4) pieces of ALB-infested wood hidden under tree stems on the ground. The experiments ascertained an overall sensitivity of 85-95 % (correct positives of all positives) and a specificity of 79-96 % (correct negatives of all negatives). In the second series under more realistic but also standardized situations were tested: (1) ALB wood shavings hidden in ground vegetation at base of young poplar trees in a plantation, (2) ALB wood shavings in tubes at height of 1.8 m on these poplar trees, and (3) ALB wood shavings hidden in crevices of old trees at height of 1.8 m in an orchard. (4) In an additional experiment, living ALB larvae in hollow building blocks were offered invisible. The experiments ascertained an overall sensitivity of 75-88% and a specificity of 85-96 %.

The good experiences of the practical use of the detection dogs in different fields are supported by the results of the two experimental evaluations. The wide range use of Anoplophora detection dogs for the investigation of growing or felled trees in infestation areas, of imported plants and wood packaging material in natural or urban environment, in ports, airports, packing centres, nurseries, garden centres or at importers can significantly improve the finding ratio of infested plants or WPM.

Halyomorpha halys: **a new invasive species between woodlands and agro-ecosystems**

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The brown marmorated stink bug, *Halyomorpha halys* (Stål, 1855) (Heteroptera Pentatomidae), is an invasive pest with a rapidly expanding range worldwide. *H. halys* is highly polyphagous with hundreds reported host plants both in woodland and in agro-ecosystems. In particular, numerous tree fruits (i.e. peach, nectarine, apple, pear), ornamental and forest plants, vegetables and field crops (i.e. maize, soybean, tomato, pepper) could potentially be heavily attacked. Feeding injury causes deformities, necrotic areas on the surface of fruits, spots on the leaves, seed loss, and possible transmission of secondary infections. It is also a nuisance pest due to its tendency to aggregate inside buildings to overwinter. The first occurrence of *H. halys* in Italy was recorded during an insect collection for educational purposes in September 2012 in Modena (Northern Italy), in a territory with extensive areas of high value fruit crops. Subsequently, a survey that combined active search and citizen science was initiated and is still ongoing. Data, collected during 2013, indicated established populations in different locations in Emilia Romagna, Lombardy, Piedmont (Northern Italy), and records from 2014 indicate a progressive expansion in the same regions and new nuclei in Veneto and Friuli-Venezia Giulia (Northern Italy), Marche and Lazio (Central Italy). The findings suggest a high risk of damage by *H. halys*. These data are crucial to establish field monitoring plans and management programs in agricultural crops and woodlots.

Impact of some recent biological invasions on Trentino woods

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In the last decades, the records of biological invasions increased dramatically, because of generalized globalization, changes in social conditions and climate change effects. Italy, due to its geographical position, represents a strategic crossroads for the introduction in Europe of new species; furthermore, the richness of forest coverage may increase the variety of new invasions in woodlands. Thanks to the forest health monitoring program, the arrivals of several invasive forest damaging organisms were promptly detected in Trentino in the last years; thereafter it is possible to follow their spread and evaluate the impact. Some of the new forest pests as *Parectopa robiniella* Clemens, *Phyllonorycter robiniella* (Clemens) and *Obolodiplosis robiniae* (Haldeman) were able to colonize quickly the whole distribution area of the host but their presence didn't produce impressive damage. Also the western conifer seed bug (*Leptoglossus occidentalis* Heidemann), after a early massive infestation, is now rarely observed in urbanized contexts, suggesting its good integration in forest ecosystems with no evidence of real damages. *Dryocosmus kuriphilus* Yasumatsu appears to be well controlled by the specific parasitoid *Torymus sinenensis* Kamijo, justifying the heavy work and the investments on its release in our chestnut stands. *Melampsoridium hiratsukanum* Ito and *Aproceros leucopoda* Takeuchi are colonizing minor species, such as the grey alder and the surviving elms, but their effect could be more notable on the long term, threatening the survival of fragile habitats, already invaded by several alien botanical species. The impressive colonization of *Hymenoscyphus fraxineus* (T. Kowalski) Baral, Queloz, Hosoya is still too recent to evaluate its effects, but first data show heavy damages especially on natural regeneration, with worrying of a possible worsening.

SESSION 7

Early detection of emerging fungal diseases from spores in urban centres

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Urban trees are often the first target of forest invasive alien pests due to their proximity to transport nodes, ports, storage yards and tree nursery retailers. Early detection of emerging diseases, after introduction but before their establishment, is often difficult due to their inconspicuous nature and thus represents an important risk to Canadian forests. We developed an early warning method based 454 pyrosequencing to detect new potential alien fungal pests. We made 28 aerial spore collections in 2 Canadian urban centers and pyrosequenced the PCR-amplified fungal nuclear ribosomal internal transcribed spacer (ITS) DNA present to reveal fungal diversity. We obtained 213,000 DNA reads which showed after bioinformatics analysis to represent 233 fungal OTUs, our proxies for fungal species. From these 106 where identified to the species level using Genbank and 127 could only be identified to family, order or higher levels, indicating they are probably unknown to science. On average we found 77 (stdv ± 23) OTUs per sample. These fungi were generally cosmopolitan fungi, represented no added risk to Canadian forests and none of them were on unwanted forest pathogen lists. This method is not target limited but wide scope, it may allow early detection of fungi that are potentially invasive and linked to an introduction pathway. It is an efficient screening tool that will become more cost effective with next generation sequencing methods (Ion Torrent, paired-end Illumina). As prevention is probably the best and cheapest control measure against emerging forest diseases, this method shows the potential of early detection and eradication before establishment as a management tool.

Fir broom rust, *Melampsorella caryophyllacearum* (DC) Schroet. - a serious problem of Silver fir *Abies alba* Mill. regeneration in south-eastern Poland

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For several years fir broom rust, *Melampsorella caryophyllacearum* (DC) Schroet., occurs commonly in old Silver fir *Abies alba* Mill. stands in the Carpathians, although since 2004-2005 the disease started to spread on young trees from both natural and artificial regeneration. In 2009-2014 the area with visible disease symptoms (witches'-brooms, canker or galls on stems and branches) in south-eastern Poland was over 1.1 thousand hectares, mainly in the forecrop stands submitted to conversion towards final species composition. The main objective of presented, still ongoing research is to assess the variability of the disease intensity in order to define the factors that can stimulate or mitigate infection level, assess its actual and future importance and propose possible forestry approach. In 2013-2014 a set of 33 research plots was established within the area of disease occurrence, each plot consisting of 100 numbered trees. The intensity of the occurrence of disease symptoms in relation to selected features describing studied trees, such as: regeneration origin (natural vs. planting), spatial structure (schematic vs. grouped planting), presence of admixtures, canopy cover (under old stand vs. open area), age of trees, and soil origin (forest vs. post-agricultural), was assessed twice a year. On each of the trees the height was measured and the presence of damage caused by game animals was assessed. The inventory of plants known as alternate hosts (from Caryophyllaceae family) was done on the plots and the presence of pathogen on individual plant species was assessed in order to define the most important for disease spreading. Some methods of direct intervention, such as pruning of branches with witches'-brooms and cankers, spraying with glue during spore propagation, and the use of organic growth stimulators enhancing tree resistance, were tested. Based on preliminary results the trees from artificial regeneration are more susceptible than those from natural one, and the lack of canopy covering the regeneration is a factor stimulating the disease. Plantations established on post-agricultural soils seem to be more susceptible than those growing on historically forest soils. The presence of admixtures seem to be important for both spreading of risk and positive impact on young firs. The results are still under processing. It seems that there is no real effect of direct control measures on the disease intensity, as the infection potential represented by old firs with disease symptoms, and by alternate hosts, can not be limited. The only possible approach is the indirect influence on the susceptibility of regenerations to pathogen infection, by a set of sylvicultural measures adopted to the local features. The project is financed by General Directorate of State Forests in Warsaw.

Ligninolytic activity of *Heterobasidion parviporum* and *Armillaria ostoyae* strains

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Root and butt rot in Norway spruce [*Picea abies* (L.) Karst.] causes severe economic losses to the forest sector in Europeans countries. The infections are mainly caused by *Heterobasidion parviporum* (Fr.) Niemelä & Korhonen and *Armillaria ostoyae* (Romagn.) Herink. They are white rot fungi, microorganisms able to degrade and to metabolize both lignin and polysaccharides. Although the ligninolytic system of these fungi has been studied during the last couple of decades, there are still many problems to solve by researchers. The aim of this study was to determine the activity of laccase, peroxidase, the level of micromolecular compounds, protein concentration in three *H. parviporum* and two *A. ostoyae* strains, grown on Norway spruce wood pieces (sapwood and heartwood). Laccase activity, manganese - dependent peroxidase (MnP) activity, lignin peroxidase (LiP) activity, versatile peroxidase (VP) activity, the level of hydroxy- and methoxyphenols and protein concentration were periodically detected, i.e. following 10, 20, 30, 40 and 50 days (on 3 replicates). The preliminary study indicate that *H. parviporum* strains excreted laccase, MnP, LiP, VP and hydroxy-, methoxyphenols. These results were obtained for mycelium grown on both sapwood and heartwood of Norway spruce wood. Ligninolytic activity of *A. ostoyae* strains was very low or absent (in some cases). *A. ostoyae* strains excreted hydroxyphenols and methoxyphenol and all investigated enzymes except for LiP.

Preliminary results of *Armillaria* species distribution in Trentino-Alto Adige

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The genus Armillaria, commonly known as honey fungus, includes opportunistic pathogens that cause root and butt rots in a large range of host plants worldwide. Armillaria species are facultative pathogens that spend most of their life as saprophytes with an important ecological role in the decomposition of dead wood. A survey to identify Armillaria species and their distribution have been conducted in the Alpine mountain range of the provinces of Trento and Bolzano in the Northeast Italy. Basidiocarps and rizomorphs were sampled from the wood or stumps of symptomatic or dead trees. Armillaria species were identified by morphological characteristics of basidiocarps and, furtherly in lab, by the molecular analyses of EF1a sequences. Regard basidiocarps, five species of Armillaria were identified by molecular method among the 80 samples in the following order of frequences: A. borealis (25%), A. gallica (22%), A. cepistipes (21%), A. ostoyae (19%) and A. mellea (10%). A. borealis were the most common specie in Bolzano province, whereas A. gallica, A. cepistipes and A. ostoyea, in the respective order, were the most common species in Trento province. A. mellea was recorded only in the most temperate Trento province. Regard rizomorphs, almost all samples (215), from two natural parks of Trento province, belonged to A. cepistipes (96%) and were associated at 82% with the main host Picea abies. A. mellea was not found in the sampled Parks, perhaps because the relatively high elevation. A. tabescens and A. ectypa, which are considered among the species of Armillaria that could occur in Italy, were not found neither as rizhomorph/basidiocarp nor with mophological or molecular methods. In general, there was an acceptable association between morphological and molecular identification methods. In most of the wrong basidiocarp identifications, the morphological A. cepistipes or A. ostoyae revealed to be A. gallica with the molecular method. The detection of relative few strains of A. ostoyae, the most aggressive species for the conifer forest, shows a relative good heath status of the regional forests.

SESSION 8

Changes in area of distribution - Barkbeetles in Sweden as colonisers, immigrants, or loosers

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The bark beetle (Subfam. *Scolytinae*) fauna of Sweden have changed since 1950. Species have been overlooked, naturally expanding, introduced or disappeared. The total number of known species has increased from 80 in 1950 to 90 in 2014 (12,5 %). *Ips sexdentatus* has probably disappeared whereas *Ips cembrae* and *Ips amitinus* have been discovered in the last decade. Two non-European species are known to have established, *Xyleborinus attenuatus* and *Cyclorhipidion bodoanus*. Observed changes are discussed in relation to forest practice, trade, and natural spread.

Mechanical trap for capture of pine processionary caterpillar (*Thaumetopoea pityocampa* (Den. & Schiff.) and survey method

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Pine processionary caterpillar is harmful for pine forests in all Mediterranean Basin and causes economic losses in coniferous species by decreasing annual incrementand human health problems. There are various fighting methods against pine processionary caterpillar such as: mechanically collecting egg batches and nests, using *Calosomo* spp and *Bacillus thuringiensis* var. kurstaki preparations and pheremon traps. All of these methods are not sufficiently effective in control of the population. They are either very expensive or have very low effect or have environmental and health drawbacks. Considering these drawbacks and costs, a cheaper and more effective fighting method has been searched and as a result of these efforts a new trap which is practical, much cheaper and extremely effective has been developed. This trap developed by observing biological behavior of the caterpillar during descending from tree to ground to become a pupa. By mounting the trap on tree trunk they have been prevented to become a pupa because they only climb down as series of caterpillarsthrough tree trunk. It has been observed that almost all of the descending caterpillars have been captured by the trap. Scales have been developed for counting numbers of caterpillars and measuring efficacy because two kinds of traps have been implemented. Caterpillar counting has been realized using scales regarding the angle between trap and tree trunk and diameter. In the study area,numbers of caterpillars per tree have been determined as 265 in 2013, 117 in 2014 and 56 in 2015. The decrement trend is still going on.

Instars and color forms of overwintering *Dendrolimus pini* larvae at different population densities and outbreak phases

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The pine moth *Dendrolimus pini* L. is one of the most harmful defoliators of the Scots pine stands in Poland. The larvae overwinter in the forest litter at different instars and different color forms (e.g., grey, brown, rufous, etc.) of larvae have been observed. In the literature, it has been suggested that the proportions of different larval instars and color morphs within a population depend on population density/outbreak phase, e.g., dominance of the old larval instars and rufous forms indicates an increasing outbreak phase. The aim of our research was to validate this information by: 1) determining the relationship between larval instar and head capsule width, 2) assessing the percentages of three instar groups: L1-L4 (young), L5, and L6-L9 (old) larvae at different levels of the Scots pine stand threat reflecting different population densities and outbreak phases; 3) assessing the percentages of the five color forms (grey, grey-rufous, rufous, grey-brown and brown) of the L4-L9 larvae in the stands at different threat levels. The threat to the pine stands from *D. pini* was classified to one of five classes (no threat, warning, low, medium or high level) on the basis of the larval density (larvae/5 m^2) and stand age (according to the Guideline for forest protection (2012)). We measured head capsules of 4772 *D. pini* larvae using the stereomicroscope Zeiss SteREO Discovery V8 with a micrometer. A histogram of the distribution of head capsule sizes was used to determine the location of the boundaries between nine size classes of the head capsule representing respective larval instars. To determine the percentages of three instar groups or five color morphs of larvae at different stand threat levels, we analyzed samples of larvae collected in 2011 and 2012 during autumnal searches in forest litter (10 plots of 0.5 m^2 per stand) of 1769 stands located in different regions of Poland. A dependence of the proportions of three larval instar groups on an outbreak phase was estimated on the basis of data collected similarly in the Dąbrowa Forest District during the outbreak of *D. pini*. We found that the percentage of the young larvae was lowest and the percentage of the old larvae (L6-L9) was highest in unthreatened stands and that both percentages differed significantly from those in stands at other threat levels. The median percentage (M_p) of young larvae gradually increased from 77.8% to 98.9% as the threat level increased. The highest percentage of L5 larvae was in the stands threatened at the warning level. The dependence of the percentages of different larval instars on outbreak phase had a similar trend, and was even more apparent. M_p of the young larvae was very low (0%) at the beginning of the outbreak and increased to 100% at increasing and culmination phases. M_p of the old larvae changed inversely, from 67% at the beginning of the outbreak to 0% in the following two phases. The percentage of grey forms among the L4-L9 larvae was significantly higher in the stands with no threat than in the stands threatened at low, medium or high levels. In contrast, the proportion of brown larvae was significantly lower in unthreatened than in the threatened stands. In conclusion, out results did not confirm the dominance of the older instars and rufous forms of *D. pini* larvae at the increasing phase of the outbreak. Rather, this outbreak phase may be indicated by high percentages of L1-L4 instars and brown forms of larvae.

POSTERS

1. Methodology of manipulated experiment with Eurasian spruce bark beetle (*Ips typographus L.*) in living trees

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Manipulated experiment was realized in the years 2012-2014 and was the part of the study focused on water-limiting conditions and predisposition of Norway spruce to Eurasian spruce bark beetle attack. Two groups of trees were selected in a spruce stand, one irrigated and one non-irrigated group, each consisting of 10 individuals. The experimental plot was situated in 28 years old spruce stand (670 masl). Mean tree height was 18m, and mean diameter at breast height $d_{1.30}$ was 21cm. The experiment was conducted each year during the summer swarming period, from the end of June to mid July. Six days every year. During summer swarming one pheromone dispenser (IT Ecolure) was installed on each tree at breast height, which attracted *Ips typographus* and caused its mass attack on the trees. On the third day after the installation of the dispensers, the trees were infested and dispensers were replaced with repellents (IT Ecorep). On the fourth and fifth day, we assessed the following gallery parameters: number of entrance holes on the trees, level of primary resin production in gallery, area of secondary resin production in gallery, area of nuptial chambers, number of parental adults in the galleries, number of maternal galleries, length of maternal tunnels, and number of eggs per one maternal tunnels.

The number of entrance holes was counted on tree stems up to the height of 260 cm. The entrance holes were identified by the boring dust extruded from the hole. On the fourth day of the experiment, every identified entrance hole was marked with the color pin. The gallery parameters were analyzed around the pheromone dispenser ($d_{1.30}$) inside the 297 mm wide stripe after the places around the entrance holes had been debarked. If we did not find the sufficient number of entrance holes within the stripe, we also analyzed outer galleries located close to the stripe. The level of primary resin production was assessed after the gallery had been uncovered. We used five-level classification according to the amount of the resin flowing into the gallery: 0 - no production, 1 - low production, 2 - moderate production, 3 - intense production, 4 - extreme production. The area of secondary resin production (mm^2) and the area of nuptial chambers was calculated from its width and length. After the whole gallery had been uncovered, we assessed the number of parental adults (pieces), number of maternal tunnels (pieces), length of maternal tunnels (mm) and number of laid eggs per one maternal tunnel (pieces).

Three trees died during the study period of the experiment, one tree per year. The possible reason of the infestation of two trees was near attacked trees (<10m) unnoticed when the experiment was established.

2. Thermal characteristic of physiological stressed norway spruce trees in the aspect of bark beetles attack susceptibility

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Thermal profile of *Picea abies* (L.) Karst. trunk phloem was characterized for six trees during the summer season of 2012 (1st June till 18th August) in the Norway spruce stand of Jeleśnia Forest District (the Beskid Żywiecki Mts., southern Poland). The objective of the study was to determine the impact of physiological stress of Norway spruce threatened by bark beetle mass attack on phloem thermal and to specify the temperature level at which spruces become the most attractive for cambiophagous insects. The phloem temperature measurement was based on authorial described method with use of common data logger (HOBO Pro v2) produced by U.S. Onset Co. equipped additional with specially constructed electronic modules. The temperature of trunk was measured at three different tree heights, three times a day and at main cardinal directions. It was proved that phloem thermal of both healthy and weakened Norway spruce tree trunks varies depending on the tree crown exposition. The south - west and east exposition emerged the highest temperatures of trunk phloem, then decrease towards the west and further north and south cardinal direction. Variations in temperature on the west and north direction within the measurement period were the largest among physiologically stressed and healthy spruces, however were smaller at the east direction and lowest in the south. Thermal profile changed relative to the height above ground level. The temperature variation of phloem at single tree had varied respectively to height, i.e. the phloem temperature in the upper part of the tree was the lowest, whereas intermediate temperature characterized the middle trunk section, which was higher than the upper section, and lower than the phloem temperature at bottom section of tree. It has been also proved that the physiological stress is the primary factor that determines the phloem temperature rise up at all cardinal directions and the different heights of the tree's trunk. However, in the days of relatively low ambient temperature of air weakened Norway spruces were characterized by lower temperatures than the healthy trees.

3. Chemicals identification in the insect's bodies to serve sex determination of selected bark beetles

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In order to accomplish insects sex identification procedures as a part of the bark beetles outbreaks monitoring and improvement of forests protection methods, the studies concerning the determination qualitative and quantitative content of steroid compounds, that may differentiate imagines gender of the most dangerous bark beetles in Poland were conducted. Adults of *Ips typographus*, *Pityogenes chalcographus*, *Trypodendron lineatum* and *T. domesticum*, originating from pheromone baited Theysohn® slot traps, Borregaard® pipe traps and trap trees (*I. typographus*), lied out in 2013 in Norway spruce stands of the Beskid Żywiecki Mts. (Jeleśnia Forest District) and Scots pine stands (Jędrzejów Forest District), southern Poland, were analyzed. Using optical methods insects gender was separated and tested for the chemical composition determination by extraction and gas chromatography (GC). The analysis showed the existence of differences in the chemical composition of examined bark beetles. The substances identified as pheromones characteristic of *P. chalcographus* sex was confirmed. Isolated common substances from male and female bodies of the six - spruce bark beetles, in spite of occurring in other bark beetles species (*I. typographus* and *Trypodendron* spp.) noticed during the whole insects swarming period, due to slight differences in the concentrations and their instability at the insects bodies of opposite sex, indicate a lack of opportunities to use them to identify the insect gender. Furthermore there were detected unidentified so far 10 compounds from the group of sterols, presumably for the preparation of cholesterol, including substances which can potentially function as sex hormones. The presence of ecdysone and 20-hydroxyekdysone in the studied bark beetles bodies was demonstrated. However, a small differences in the content of ecdysteroids in the bodies of male and female may indicate only the remains after the insects transformation. It has been also proved that the place of insects collection does not affect the qualitative and quantitative composition of isolated substances.

4. Preliminary phylogeography and population dynamics of the european pine bark beetle *Ips sexdentatus*

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The twelve-toothed pine bark beetle, *Ips sexdentatus,* is one of the most common scolytid of central and southern Europe feeding predominantly under the bark of old and stressed Austrian and Scots pine trees. As this species has never been investigated before throughout its natural range of distribution, we sampled more than 400 individuals from 43 populations located in 15 European countries and analyzed about 700bp of the mitochondrial Cytochrome Oxidase One gene. This resulted in 81 haplotypes with a maximum of 64 single nucleotide polymorphisms (SNP's). Nevertheless, with an average number of 3.7 nucleotide differences among haplotypes, it became apparent that intraspecific divergence remained relatively low, quite likely due to unimpeded gene flow among populations. Even though the initial phylogenetic data revealed a pattern governed by shallow relationships, individuals from Italy, Greece and Bulgaria seemed to be genetically separated from the rest, supporting the impact of potential refugial areas in these regions. However, to clarify this preliminary outcomes, we need to analyze additional individuals from marginal populations, and employ nuclear markers to deeply investigate the phylogeography of *I. sexdentatus* in Europe.

5. Occurrence of native parasitoids to control the invasive chestnut gall wasp *Dryocosmus kuriphilus* in Friuli Venezia Giulia (north-eastern Italy)

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The occurrence of the exotic chestnut gall wasp, *Dryocosmus kuriphilus* Yasumatsu (Hymenoptera, Cynipidae), was detected for the first time in Friuli Venezia Giulia during 2008 in the eastern part of the region, near the border with Slovenia. In this area both wild and cultivated chestnut trees are very common. In the following years new infestations were detected in other Pre-Alpine areas and in a few years *D. kuriphilus* was widespread in all the region. Severe damage to chestnut trees was observed in the last years, even due to high incidence of *Cryphonectria parasitica* infections, with a reduced production of fruits and honey. In the summer 2014, in some chestnut areas of the region, individuals of the non-native parasitoid *Torymus sinensis* Kamijo (Hymenoptera, Torymidae) were released by a private association. In order to detect the occurrence of native chalcid species and to assess the parasitism level of *D. kuriphilus* galls, during 2014 over 17500 newly formed galls were collected in 11 sites of the region (3 samples were taken from each site between late May and early August); the galls were randomly collected in 10 chestnut stands in mixed forests and in one chestnut orchard. The galls were put in cardboard boxes provided with an extractable transparent tube. Periodically the emerged wasps were collected and inserted into tubes with ethanol. Then the collected specimens were examined under a stereomicroscope for a preliminary separation of *D. kuriphilus* specimens and other wasps (parasitoids). All the specimens were then set for a detailed identification. Hymenoptera parasitoids belonging to five chalcid families were detected: Torymidae (genera *Torymus* and *Megastigmus*), Eulophidae (Genn. spp.), Eurytomidae (genus *Eurytoma*), Pteromalidae (genus *Mesopolobus*), Eupelmidae (genus *Eupelmus*). At the moment, among the identified species, *Torymus flavipes* (Walker) and *Eupelmus urozonus* Dalman were found in the majority of the sites. Instead, *Megastigmus dorsalis* (Fabricius), *Mesopolobus tibialis* (Westwood) and *Eurytoma brunniventris* Ratzeburg were detected in a small number of sites. Overall, the percentage of gall parasitism (to be intended as the rate of parasitoids on the total of emerged insects) appeared noticeable, with an average around 42%. In one site the parasitism rate was up to 68%. Until now, no specimens of *Torymus sinensis* deriving from releases were found. The occurrence of a significant number of parasitoid species and the considerable percentage of parasitism suggest the importance of the native chalcid wasps to control *Dryocosmus kuriphilus*. The observation of some wild chestnut trees apparently free of galls, in close proximity to other heavily infested, suggests that other natural factors can act in limiting chestnut gall wasp infestation.

6. Biological control of *Dryocosmus kuriphilus* in Trentino chestnut stands

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Since its first report in Italy in 2002, *Dryocosmus kuriphilus*, the Asian chestnut gall wasp (ACGW), has spread very rapidly, reaching Trentino-Alto Adige in 2007. Even though the evaluation of the direct damage caused by the ACGW to fruit production is difficult, severe infestations can weaken the trees and reduce their vegetative development.

All the eradication attempts carried out failed and this pest is now established in all the Italian chestnut growing areas. Therefore, a biological control strategy was adopted in Italy to control the ACGW populations by means of the specific parasitoid *Torymus sinensis*. This hymenopteran lays eggs within ACGW galls and develops as ectoparasite on ACGW larvae.

T. sinensis individuals, reared under semi-field conditions, were coupled in the lab and then released in the forest. The adaptation and spread of its populations were checked by collecting and rearing ACGW galls after each release. Moreover, a multiplication area was established in 2011 to increase the number of parasitoids to release. In Trentino, between 2010 and 2014, 123 releases of *T. sinensis* were carried out in chestnut stands of Trentino, covering the most infected areas. Surveys conducted in the field show that the parasitoid has established and can reproduce successfully, colonizing the entire chestnut growing area of the province. The parasitisation rates (number of *T. sinensis* larvae/larval chambers) observed in summer 2014 reached values of 80% and in 2015 a decreased amount of galls was observed. These results are very encouraging and suggest a good efficacy for this biological control method.

7. The system of forest insect pheromone communication: stability of "information" molecules against environmental factors

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Assessment of pheromone molecules' stability against environmental influence was considered for two Lepidoptera insect species: the Siberian moth (*Dendrolimus sibiricus* Tschetv.) and the gypsy moth (*Lymantria dispar* L.), as well as for three Coleoptera insect species, i.e. the spruce bark beetle (*Ips typographus* L.), the black fir sawyer (*Monochamus urussovii* Fish.) and the pine sawyer (*Monochamus galloprovincialis* Oliv.) Pheromone molecules' properties were calculated using B3LYP quantum-chemical method. It is demonstrated that photochemical processes (i.e. chemical and structural changes) as well as photophysical processes (molecule's excitation due to absorption of quantum of light) can take place when pheromone molecules absorb electromagnetic radiation. Structural changes in pheromone molecules resulting from light exposure are significant enough to excite those molecules, thus they can consequently interact with airborne substances (water, for example) Lifetime of pheromone molecules depend on where a studied insect specie is located, because power of UV-component of solar radiation vary at north and south latitudes. For instance, in Siberia pheromone molecules of Siberian moth may undergo reaction during morning hours, when solar radiation is already intensive enough, while, on the other hand, humidity is still high. Information losses due to Siberian moth pheromone molecules inactivation during evening time and night time, the time when insect females are calling and therefore males are flying, would be minimal because solar radiation intensity is not sufficient.

8. The reliability of pheromone communication: modeling attractivity of pheromone traps to lepidopterous forest insects

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We propose an agent-based simulation model search. This model allows us to evaluate effectiveness of different search strategies that may possibly be employed by Lepidopterous males while searching for a calling female. We consider the simplest case of the search, when there is only one pheromone source. In the model both single-component and multi-component versions of insect pheromone are proposed. It is shown that the presence of several pheromone components can hold additional information on the distance to the source and thus improve a search algorithm. It is assumed that insects are able to detect pheromone molecules via sensory cells, which generate action potentials for some time when they come in to contact with pheromone. Thereafter pheromone molecule gets inactivated. This progression can be viewed as a so-called "memory" of an individual. The model also assumes that an insect is capable of anemotaxis. Proportion of individuals who have reached the source is selected as an integral indicator of the search efficiency. To evaluate efficiency computational experiments were performed under different conditions: random walk, search algorithm without "memory", and finally algorithm with both "memory" and a turning mechanism. The resulting efficiency of source localization by insects for flight in turbulent flows is ~ 70%, which agrees with experiments on live insects (literature data). In this case, the proposed pheromone plume following algorithm is quite simple, which indicates that it might well be biologically valid. Conducted model analysis can be a starting point for planning field observations and designing pest monitoring systems using pheromone traps.

9. Changes in radial growth of Scots Pine (*Pinus sylvestris L.*) related to outbreaks of pine looper (*Bupalus piniarius L.*) and pine sawfly (*Gilpinia pallida Kl.*).

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Insect outbreak is a natural process that occurs in both - managed and unmanaged forests. Frequency of insect outbreaks and outbreak species composition are changing during time. It is observed that such species as pine looper and pine sawfly outbreaks occur more often in the last decades. Feeding on the needles, these insects cause defoliation of pine crown. The aim of this study is to find out how radial growth of pine changed in years when pine looper (*Bupalus piniarius*) and pine sawfly (*Gilpinia pallida*) outbreak is observed. Tree-ring samples from pine were collected in two sites in Latvia. History of outbreaks of analyzed insect species in these territories was well documented. There was pine sawfly outbreak observed in years 1994 and 1995 in Site 1, and three pine looper outbreaks in time periods 1981-1983, 1989-1992 and 1998-2000 in Site 2. The information about defoliation degree of each tree in sampling site 1 during pine sawfly outbreak was available. Tree ring series were crossdated. There were 443 crossdated samples from 233 trees included in data analysis from site 1, and 338 crossdated samples from 174 trees included in data analysis from Site 2 The linear regression analysis of tree-ring increment and defoliation degree was performed. Pointer-years were calculated. The study found that there is a negative relation between tree- ring increment and the degree of crown defoliation. Pine radial increments in specific sites were significantly reduced in years when there was insect outbreak. Characteristic feature of outbreak impact on pine was also a large number of trees which formed missing rings.

10. Multi-decadal patterns in gypsy moth fluctuation in the central Europe

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Gypsy moth (*Lymantria dispar* L.) is the most important defoliator of broadleaved forests in the Northern Hemisphere with specific cyclical abundance. We explored the patterns in gypsy moths long-term dynamics in seven countries in the Central and South-Eastern Europe stretching into the mountain range of Carpathians. We used the long-term time series on outbreaks covering approximately the period 1947-2013. We investigated how the length of outbreak periods and trends in the size of outbreak areas differ among the countries. Additionally to the evaluation of periodicity we studied spatial patterns of population synchrony and principles of geographical gradient control over outbreak period length in study region. The outbreak period length was found to range between 13 years in the north-west to 8 years in the south-east; the periods were statistically significant in 6 out of 7 countries (α=0.05). The long-term trend in the size of outbreak areas was found to differ among the countries, and indicated potentially growing damages to forests in the central to north-western part of the investigated region. In countries in the south-east, where the period of ca 8 years occurs, no clear long-term trend was present, and an occasional incidence of extremely large outbreaks seems to be a pattern typical of this region. Gypsy moth cycles showed moderate synchrony among investigated countries, including a varying degree of outbreaks synchronisation and different length of outbreak periods, which was found strongly responsive to geographical gradients. Longitudinal and latitudinal gradients were found to explain ca 85 % of variability in the length of outbreak cycles, what corresponds with the linearly decreasing synchrony between the outbreak cycles.

11. Monitoring flight of *Monochamus spp.* (Coleoptera, Cerambycidae), potential vectors of the pine wood nematode, in Austria with pheromone-kairomone baited traps

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Monitoring and controlling vectors is a central component of every control strategy against the pine wood nematode, *Bursaphelenchus xylophilus*, the causal agent of pine wilt disease. Effective lures are available for *Monochamus galloprovincialis*. In a series of experiments, we ascertained that *Monochamus sartor* and *Monochamus sutor*, which could function as vectors if the nematode expands its range in Europe, positively respond to the generic *Monochamus* pheromone compound 2-undecyloxy-1-ethanol. It was further demonstrated that the blend developed for *M. galloprovincialis* consisting of the pheromone plus the bark beetle kairomones 2-methyl-3-buten-2-ol and ipsenol is suitable for trapping *M. sartor* and *M. sutor*. Based on this knowledge, a network of multi-funnel traps baited with this blend was set up in different areas, elevations and forest types in Southern and Eastern Austria for monitoring occurrence and flight phenology of *Monochamus* spp. In 2013 and 2014. *M. galloprovincialis* was primarily caught in *Pinus sylvestris* and *Pinus nigra* forests at lower elevations. *M. sutor* and *M. sartor* were caught in spruce dominated forests in the mountainous zone. *M. sartor* was found only in forests with substantial amount of dead wood of larger dimension; *M. sutor* was more common also in intensively managed throughout Austria. *M. saltuarius* was caught in lower numbers at both low and high elevation sites. Flight of all species started in June and stretched throughout the entire trapping season until end of October. Captures of *M. galloprovincialis* peaked end of June, captures of *M. sutor* and *M. sartor* in July - with *M. sartor* about two weeks later. Generally, weekly trap catches were positively correlated with mean air temperatures. In 2014, the first *Monochamus* traps were set up in high risk areas to sample beetles for the *Bursaphelenchus xylophilus* survey.

12. A case of pine dieback due to *Bursaphelenchus mucronatus* in Trentino

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The accidental introduction of *Bursaphelenchus xylophilus*, a pine wood nematode native to North America, to Portugal and its subsequent report in Spain represent a great danger for pine stands across Europe. Therefore, also the potential risk areas of Trentino are subjected to a continuous monitoring activity.

In November 2013, as severe and anomalous wilt symptoms were observed in a pine (*Pinus sylvestris* and *P. nigra*) stand of Non Valley suffering for previous drought periods, surveys were carried out to assess the presence of this invasive nematode. The trees, which were completely desiccated, showed the typical symptoms associated with nematode attacks, such as lack of oleoresin flow from wounds and blue-stain fungal growths in the wood. Therefore, they were cut and removed from the area and some samples were collected in order to extract nematodes and isolate fungi. The nematodes and the fungal mycelia were then identified by the microscope observation of morphological characters and molecular analyses.

The taxonomic identification of the nematode species confirmed the presence of the European type of *B. mucronatus*. This species, which is widely distributed in Europe and Siberia, is morphologically close to *B. xylophilus*, but has a very low virulence in comparison to it. It can be associated with dead trees as fungal feeding species and has a weak pathogenicity. Regarding fungi, the blue-stain growths resulted due to *Diplodia sapinea*, an endophytic fungus which had never been described in association with these nematodes before.

The evolution of the symptomatology was surveyed in summer 2014 by visual inspections in the same area and attractive traps were exposed to monitor the presence of long-horn beetles of the genus *Monochamus*, the natural vectors of pine wood nematodes. So far, no new symptoms of decline have been observed and no individuals of *Monochamus* spp. have been collected.

13. Data on the parasitoid complex of the *Tischeria ekebladella* (Bjerkander, 1795) (Lepidoptera: Tischeriidae) leaf miner in Hungary

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Climate change may influence the frequency and intensity of forest insect outbreaks. Formerly-considered negligible and even rare native herbivore species may become severe pests, causing substantial outbreaks. For example, the *Tischeria ekebladella* leaf miner is widespread in all oak forests, without usually causing any serious damage. But locally, and occasionally, this species may defoliate several thousand hectares of oak forest. It is always important to study the regulating potential and the species composition of the natural enemy complex of such species. On this poster, we present the parasitoid species list from our rearings, along with the main biological characteristics of the important parasitoid species. We studied the parasitoid complexes of various leaf miners during a period of three years (2011-2013). A total of 1,202 leafmines of *Tischeria ekebladella* were collected from *Quercus petraea*, *Q. robur*, *Q. cerris* and *Q. pubescens* from 16 localities across Hungary. The mines were cut out from the leaves and after a short period for drying, were placed individually into air-ventilated plastic rearing-tubes. The parasitoids that emerged were preserved in 95% ethanol. From the leaf mines collected, a total of 165 parasitoid specimens emerged from 138 (n) parasitized hosts, and 20 parasitoid species were identified, of which 16 belonged to Eulophidae, 3 to Ichneumonidae, and one to the Encyrtidae family. The dominant species of the complex was the solitary koinobiont *Crysocharis nephereus* (38.4%, n = 138). Other important species of the host were the gregarious idiobiont *Baryscapus* species (9.4%) followed by the solitary idiobiont *Pnigalio agraules* (7.9%), the solitary koinobiont *Closteroceros trifasciatus* (6.5%) and the solitary koinobiont *Chrysocharis pentheus* (6.5%). In 0.5% of the samples we found co-existing parasitoids. The specie pairs are mainly composed of the species dominating the complex. The parasitoid assemblages of *T. ekebladella* varied greatly, geographically, and were strongly influenced by the diversity of the leaf mining assemblages in the surroundings.

14. Quantified of some oak stands decline in Romania using by relevant predictors

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The stands decline can be related to some disturbances structural or functional, in several categories of factors disruptive or harmful interact in different ways and directions, but whose outcome is weakening vigor trees and culminating in death of trees. Abiotic or biotic agents,can be and the latter include bacteria, fungi and insects that are unable to invade normal conditions to cause significant damage to healthy trees, but can be very destructive when attacked trees devitalized.

This combination of factors causing imbalance varies from one area to another, from one year to another, from one body to another forest, so that the symptoms will be very varied, being strongly influenced by the environment and the numerous interactions biological. Factors involved acting on different levels simultaneously or sequentially. Thus, in the crown are felt negative effects of prolonged drought, late frosts, defoliation, attacks by pathogens, pollution, etc., the effects felt in the short or medium term is to reduced of photosynthesis, nutritional imbalances and resulting final, crown loss. The purpose of this study is to identify the specifically predictors of decline phenomenon especially in cases where the biological balance suffers interference that may cause major imbalances, leading to environmental degradation and structural components stands These predictors of decline phenomenon under specific literature are those which can be established through annual observations of the state stands. The most important changes are those that play on the amendment to the crown shape, size and transparency.

15. The appearance of different pests and pathogens in energy plantations

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Establishing energy plantations has recently become increasingly popular in Hungary. In a 2-3 year cutting cycle, these plantations produce a considerable amount of wood biomass. It is among the core tasks of the Hungarian Forest Research Institute to provide relevant cultivation methods in a safe environment, with acceptable production in every year. To determine the tolerance level against different diseases it is necessary to examine the peculiarities of experimental clones of the improved hybrid poplars and to draw the consequences. During the research we used two energy tree plantations, which consisted of four poplars, two willows and one black locust and numerous health condition assessments were performed in order to determine the susceptibility how the trees reacted to different pathogenies and pests. Test were conducted in 2013 and 2014 twice a year (spring and autumn), when the level of infection and the extent of damage were measured. The results clearly demonstrated that the varieties of poplar and willow show a different susceptibility to pathogens and insects, which appear regularly. Among poplars and willows the most common pathogen were leaf rust (*Melampsora populina*), and Marssonina leaf blight (*Drepanopeziza punctiformis*). It showed however a significant frequency of occurrence on the different poplar and willow species. In 2013, only a negligible amount of fungal infection was observed, whereas in 2014, as a result of the rainy summer weather, a significant fungal infection occurred. By the end of September, 2014 almost 100% of 'Pannonia' and '*Kopecky*' poplars were infected (*Marssonina leaf blight*) with a rate of 90% defoliation, meanwhile, less than 5% of the *'Kornik 21'* and '*I-214'* varieties were infected. A similar phenomenon was observed in the case of leaf rust in 2013 when the infection was hardly noticeable. On the contrary, in 2014, the symptoms started appearing early summer in large quantities on the susceptible varieties of poplars and willows. According to the observations, while the older plantations were hardly affected by leaf rust, on younger, denser and lower plantations (cut and coppiced in 2014 February) a 70-90% density of infection was recorded on some varieties by the end of September.

The most common damage caused by an insect is by the poplar leaf beetle (*Melasoma populi*). From early spring until late summer the larvae and the adults are constantly chewing the leaves, but no significant difference was noted between the various tree species in leaf damages. Nevertheless, an average of 5 to 10% of leaf eating was observed in 2013, it remained below 5% in 2014. All in all, only the '*AF-2'* was affected more than the average (20%) due to leaf eating.

16. Use of Temperature of Trees and Light Regime in Monitoring of Norway Spruce Health Condition

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Bark beetles are the most damaging group of insects affecting Norway spruce forests around the world. Early diagnostics of bark beetle attacked trees, felling or sanitary measures applied to these trees are topical challenges in the area of forest protection. According to previous studies of tree health condition, temperature was the major indicator of the stress exerted on the plants. Trees attacked by bark beetles show disturbances in their sap flow, manifested through tree overheating. Therefore the aim of this study was the investigation of temperature changes of Norway spruce trees in different health conditions and place in the forest.

A thermal camera can be used as an effective tool for the study of these thermal characteristics in varied physiological states of trees, and for assessing, in such a way, their health condition. In addition, with determining of the light regime for trees through their geometry (height, height of live crown, etc.), radiation and temperature will provide valuable and accurate information about the health condition of trees.

In the first experiment comparing temperature course between a forest edge and the forest interior was carried out in a mature spruce forest stand. Inside the stand, there were inspected 5 dominant trees; at the forest edge created after clear-cut in 2011 there were chosen 5 vital trees and 5 trees dying attacked by bark beetles.

Light regime was evaluated through software MIXLIGHT with accurate geometric characteristics obtained from terrestrial laser scanning. The obtained results support the suitability of this method for searching trees predisposed to bark beetle attacks or bark beetle attacked trees not showing yet visible symptoms of needle color change.

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