IUFRO JOINT MEETING

7-03-01 Cone and Seed Insects

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7-03-14 Entomological Research in Mediterranean Forest Ecosytems "MEDINSECT"

09-14 APRIL 2014
ANTALYA-TURKEY

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ORAL PRESENTATIONS

Turkish forests and forestry: Past and future

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Abstract: Turkish forests are diverse and rich in terms of forest composition and structure with 21.7 millon ha areas (27.6%). They include both managed and pristine natural mixed forests, dominated by softwood such as pine, fir, spruce and hardwood such as beech, oak, alder, walnut, hornbean. Turkey accommodates nearly three quarters of biodiversity across Europe. The country has several distinct biogeographic regions with specific forest types such as Caucasian mountain temperate forests and alpine ecosystems of the North East Black Sea Coast; steppe grasslands of the Central Anatolian plateau; and the European and the Mediterranean regions, which, respectively, include probably the largest remaining stands of pristine alluvial and Cyprus forests. In addition, one of the three major flyways for millions of migratory birds passes through Turkey. Forest resources of the country have been systematically planned and sustainably managed under government jurisdictions over approximately 51 years.

Starting in 1937, the Turkish forest law established the basis of principle forest policy for protection/conservation, rehabilitation and multiple uses of the forest resources. Now forests are managed for various forest values such as timber, recreation, water production, soil protection and biodiversity conservation. Information and communication technologies particularly geographic information systems, remote sensing, vehicle tracking systems, fire monitoring systems, and operational research have been actively used in Turkish forest sector. Over 173 years of experiences, technical capacity of Turkish Forest Service reached over 41,000 employees providing cross boundary expertise in various fields. This presentation touches upon the past and present structure of Turkish forest resources and forestry and focuses on the philosophy, principles, regulations, socio-cultural and organizational structure, and implementation of forest management activities across the country. Particular focus of the presentation covers the forest management planning and the associated accomplishments in Turkish forestry. Finally, major accomplishments as well as the future perspective of Turkish forestry are presented.

Structure and topics of the forest entomology research and pest control in Turkey

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Abstract: Entomological research and pest control activities related to forestry are mostly conducted by research teams at the universities and in forest research institutes. Selection of the research topics by the universities and forest research institutes may differ. Forest research institutes function under the General Directorate of Forestry. While the general functioning and the structure of the research institutes are not totally comparable with those of technical managerial units in GDF, they are mostly dependent on the decision, demand and requirements of GDF concerning research topics.

Entomological research in Turkey has been shaped by the regional requirements. Each region has its unique pest problems. In general, bark beetles are the most significant forest insect pests in the country. Bark beetles include primary tree-killing species such as *Ips sexdentatus* (Boerner), *Ips typographus* (L.), *Pityokteines curvidens* (Germar), *Cryphalus picea* (Ratz.), *Orthotomicus erosus* (Woll.), *Tomicus minor* (Htg.), *T. piniperda* (L.), *Dendroctonus micans* (Kug.), and *Pissodes notatus* (Fabr.) (Coleoptera: Curculionidae), plus other secondary species that can be devastating when trees are sufficiently stressed by drought or other factors. While some of these species are regional pests depending on the host trees, some are country-wide.

D. micans and *I. typographus* are only found in spruce forests in the Eastern Blacksea Region. I. sexdentatus, however, can be found on spruce and pines. Therefore, it has a country wide distribution. *P. curvidens* attacks fir species found in three geographically different regions. *O. erosus* may be found in pine and spruce stands where climate is temperate. However, heavy infestations of this pest occur in the mediterranean basin on calabrian pine. The research on forest insect pests in the region has been heavily concentrated on the biology, ecology and natural enemies of these three bark beetle species. An extensive biological control program has been conducted against *D. micans* and about 8.500.000 Rhizophagus grandis (Gyllenhal) (Coleoptera: Rhizophagidae) adults have been reared and introduced into infested trees. As *I. typographus* is the most threatening bark beetle of spruce forests. There has been a heavy use of aggregation pheromones of the beetle in traps for mass-trapping during infestation period for several years. But, the results were not favorable. Pheromone traps are being used in a large scale for monitoring the bark beetle populations. Monitoring based on pheromone traps can provide information on beetle population density and flight periods.

As a general principle, the entomological research and pest control endeavors by the research institutions and faculties has been directed towards biological control methods. These efforts are mostly concentrated on predator species such as *Calosoma sycophanta* (L.), *Thanasimus formicarius* (L.) and *Rhizophagus depresus* (Fabricus) and bird species such as passerines and woodpeckers, as well as Formica rufa group ants.

SESSION 1

INSECT BIODIVERSITY AND POPULATION GENETICS

Landscape genetics: A useful approach to understand population functioning

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Abstract: Landscape genetics is a ten years old discipline combining population genetics and landscape ecology. This approach is of a major interest for understanding population functioning, especially in the context of an increasing demand of environmentally-friendly agriculture and forestry. Both conservation biology and agro-ecology, including plant protection against pests and diseases, call for a better understanding of ecological continuities. In comparison with classical population genetics approaches, landscape genetics presents the advantage to explicitly take into account the role of spatial heterogeneities in driving gene flows as well as new insights in dispersal.

Here, we review the approach and provide an illustration for a forest pest, the pine processionary moth (PPM). We designed a sampling grid with a mesh size of 16 km covering about 60000 km^2 in the southern part of the Paris basin where the moth has colonized wide territories during the last twenty years. This region consists of different land uses, including forests with native broad-leaved trees and exotic conifers, wetland and meadow areas, wide open-fields and large urbanized territories. If we only consider the distribution of the host tree resources, the different habitats of the PPM could be grouped into two main categories: forest lands with large artificial pine stands and non-forest lands with small stands and scattered ornamental pines. Previous field observations suggested that moth expansion could have been accelerated in areas where host trees are scarce whereas large forest stands could have retained philopatric females. We modelled the distribution of the potential host trees using our own inventories of TOFs and forest inventory data from the French institute of geographic and forestry information (IGN). Assuming a philopatric behavior of the moth when large resources are available, this allowed to calculate not only the Euclidian geographic distances between all the cells of our sampling grid, but also the least cost-path distances taking into account the main landscape features for the moth. Moreover, five individuals were collected in each cell and genotyped for eleven microsatellite markers in order to assess the spatial structure of genetic data at a fine scale.

The comparison between the matrices of Euclidian and landscape distances and the matrices of genetic distances revealed that gene flow pattern was influenced by the landscape features assumed to play a role. Our results highlight the role of ornamental trees in the expansion of the PPM and call to take into consideration non-forest lands and ‘invisible’ trees in forest health management.

Analysis of a hybrid zone in the genus *Thaumetopoea*

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Abstract. The two pine processionary moth (PPM) sister species, *Thaumetopoea pityocampa* and *T. wilkinsoni*, whose larvae causes allergies in mammals and are dangerous defoliators of Mediterranean pines, exhibit highly similar habitat requirements and reproductive behavior. *T. pityocampa* occurs in Europe, western North Africa, and northwestern Turkey, whereas *T. wilkinsoni* occurs in Turkey, Syria, Lebanon, and Israel, as well as the islands of Cyprus and Crete. Thereby, western Turkey is the only region where the two species come into contact, and could possibly hybridize as they display close ecological characteristics.

We aimed to (i) describe the exact distribution of the two species in this region; (ii) determine both whether a contact zone actually occurs in Turkey and it results in any hybridization event, and (iii) assess the level of gene flow between the two species, eventually leading to the identification of a hybrid zone between these sister taxa. For these purposes, we conducted an extensive sampling from Bulgaria and Greece to the entire PPM range in Turkey, and sequenced one mitochondrial (COI) and two nuclear (ITS-1, photolyase) markers for each studied individual. Furthermore, we gathered microsatellite data in order to test the geographic structuring of genetic diversity and estimate gene flow. By checking the congruence between mitochondrial and nuclear markers, we were able to identify individuals that belonged to each pure parental species as well as introgressed individuals (i.e., molecular identification differing between markers for the same individual). Microsatellite markers further allowed toexplicitly look for first or second generation hybrids and back-crosses. In conclusion, we clearly showed that the two species co-occur in western Turkey at a local scale (both species sometimes attacking the same tree), and we identified mitochondrial introgression from *T. pityocampa* to *T. wilkinsoni*. However, we could not find any F1 hybrid in this study.

The pattern observed here, namely asymmetric mitochondrial introgression, could result from natural (or reinforcing) selection against hybrids, which causes limited or differential gene flow. This scenario is supported by the "secondary contact hypothesis" which is consistent with recent studies showing expansion in PPM's range. However, phenological differences alone could also cause the same pattern by acting as prezygotic barrier to limit hybridization. Further investigations will be needed to characterize the ecological and phenological differences between the two sister species, and to accurately analyze the introgression process.

Contrasted genetic patterns in two egg-parasitoids associated with the complex species of the processionary moth *Thaumetopoea pityocampa/wilkinsoni* around the Mediterranean basin

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Abstract: The winter pine processionary moth is a major pest that causes heavy pine defoliation around the Mediterranean basin. It is also a major public health concern because the late instar larvae bear strongly urticating hairs and cause allergic reactions both for human beings and domestic animals. This well-known forest Lepidoptera has been proved to belong to a species complex, comprising *Thaumetopoea pityocampa* and *T. wilkinsoni* which are respectively distributed in the Western part of the Mediterranean Basin and in the Middle-East. Previous mitochondrial data showed that each species exhibited a strong geographical structure over most of its geographical range. A highly differentiated clade was further identified in Eastern North Africa. Due to the contemporary climate warming, this pest species is expanding northwards and towards higher elevations, and shows a reduced genetic diversity in the recently colonized habitats.

All over the Mediterranean Basin, the pine processionary moths are associated to a rich community of natural enemies that comprises both parasitoids and predators. Among these, egg parasitoids have been extensively studied because they can act as biocontrol agents against the eruptive dynamics of their host. Our goal was to study the patterns of genetic diversity of two species of egg parasitoids, the generalist species *Ooencyrtus pityocampae* (Hym., Chalcidoidea, Encyrtidea), and the specialist *Baryscapus servadeii* (Hym., Chacidoidea, Eulophidae). Using mitochondrial markers, we analyzed the phylogeographic patterns of both parasitoids species in order to determine if their evolutionary histories were similar, and to compare the main genetic structures between the parasitoids and their hosts throughout the Mediterranean Basin. The results showed that genetic diversity was very high in the specialist parasitoid, and that differentiated clades occurred in (i) Crete, (ii) North Africa and parts of Corsica, and (iii) the rest of the range. In contrast, genetic diversity was limited in *Ooencyrtus pityocampae*, and no phylogeographical signal could be identified in this species, in which 64% of the studied individuals had the same haplotype. Still, both species showed clear geographic structures, that did not correspond to the main mitochondrial clades and sub-clades identified in the pine processionary moth. The distribution of genetic variation on both parasitoids could not be explained by a host-plant effect. We further discuss whether congruent patterns could be identified at regional scales between partners. Interestingly, both parasitoid species were proved to have a very reduced genetic diversity along the latitudinal expansion corridor of the pine processionary moth in France, which suggests that these natural enemies also recently expanded northwards.

Algerian populations structure of *Thaumetopoea pityocampa* using molecular markers

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Abstract: The pine processionary moth is a Mediterranean forest pest endangering pine and cedar plantations. Scattered populations in Europe, Northern Asia and North Africa belong to different genetic clades. The purpose was to explain the differences in the ecological behavior of the two known clades in the Algerian forest and more importantly to define a potential hybridization zone. Samples of *T. pityocampa* were collected in 10 localities from Aleppo pine and 4 localities from Atlas cedar living in three different bioclimatic areas across Algeria. A total of 176 individuals were sampled for nine new microsatellite loci. The genetic structure was inferred from different molecular parameters. A very high significant correlation was found between allelic richness and the geographic distance for each population to the western-most locality (Mostaganem). Six populations have significant excess of homozygotes according to *Fis* values. High null allele frequencies correspond significantly to populations in deviation from Hardy-Weinberg Equilibrium. Populations seem to be more or less differentiated. This is supported by a positive correlation between the pairwise *Fst* values and the geographic distance of each population to Mostaganem locality. A high number of first-generation migrants showed a significant gene flow between the central and the most remote populations (over 320 Km away) meaning a re-colonization of *T. pityocampa sensu stricto* areas by Eastern-North African clade populations. An obligatory adaptation pattern to winter warming may result in breeding between individuals from ENA populations and pityocampa clade populations. Interestingly, a new 'hybrid clade' would appear with a new gene pool enabling the re-colonization of all the Palearctic under extreme climatic conditions.

Keywords: Mediterranean basin, forest pest, population structure, genetic differentiation, geographic isolation, gene flow, contact zone

Genetic variation among populations of *Platypus cylindrus* (Coleoptera: Platypodidae) from Tunisia and Portugal

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Abstract: *Platypus cylindrus* is an important wood borer of *Quercus suber* trees in the Iberian Peninsula, namely in Portugal, where its incidence has increased since the 80s of last century, following the loss of vigor of cork oak stands. Nevertheless the insect is not a relevant pest in the North Africa region, and particularly in Tunisia.

The general aim of this study is to investigate if the differential behavior noticed between Tunisian and Portuguese populations of *P. cylindrus* is correlated with some degree of genetic differentiation and to use this information as a tool for assessing protective measures.

Sampling was carried out during the year of 2012 in six cork oak stands of Tunisia (Ain Beya, Mzara and Babouch forests) and two forests in Portugal (Chamusca and Crato stands).

One symptomatic tree from each stand was randomly selected, cut and sectioned. The logs were installed in the laboratory and insects were captured being the molecular characterization conducted during 2013.

The first approach for the assessment of genetic differentiation among samples was conducted on ten specimens of *P. cylindrus*, using the mitochondrial gene cytochrome oxidase I (COI) sequences. Multiple alignment analysis of all the obtained partial COI sequences revealed high similarity among all specimens. Subsequently, for resolving and assessing genetic variation within species, the amplification of the ribosomal internal transcribed spacer region (ITS) was used. The PCR products exhibited multiple bands, observed either among individuals or within individual, which can indicate intragenomic variation within the ITS1 and ITS2 regions. The number of bands and their relative abundance appeared more similar within populations from Portugal than from Tunisia, though interpopulation differences were observed.

Therefore, our data does not support that the intra-specific genetic variation among populations of the insect *P. cylindrus* would explain the differences in the aggressiveness of *P. cylindrus* observed in Tunisia and Portugal. Other variables related with the ecology of the insect, its associated fungi and forest management should be comparatively studied for a better understanding of the pest status in the Mediterranean countries.

Keywords: *Platypus cylindrus*, Portugal, Tunisia, Cytochrome oxidase I, ITS region

Intraspecific Genetic Diversity of Cedar Bark Beetle (*Orthotomicus tridentatus* Eggers) Populations on the Taurus Mountains of Turkey[i]

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Abstract: The widest natural distribution area of Taurus cedar (*Cedrus libani* A. Rich) in the world is in the Taurus Mountains of Turkey. *Orthotomicus tridentatus* Eggers (Col.: Curculionidae, Scolytinae) which is endemic species for Turkey, causes significant damages to the cedar forests. In this study, specimens were collected from 10 different populations of *O. tridentatus* in Isparta (ISP), Antalya (ANT), Mersin (MRS), Adana (ADA) and Kahramanmaraş (KMR) provinces and its intraspecific genetic diversity were studied by the mitochondrial gene cytochrome oxidase I (COI). A total of 29 haplotypes were detected. Molecular distance matrix among haplotypes was determined and Maximum Likelihood dendrogram was obtained based on this matrix. Analysis of variance revealed that the highest genetic variance (91%) was present within populations and a significant partitioning of variance (8.9%) was found among groups. Furthermore, nucleotide diversity within populations were determined as 0.025 ±0.015, 0.036 ± 0.021, 0.024 ±0.015, 0.0187 ±0.012 and 0.0187 ±0.012 for KMR, ADA, ISP, ANT and MRS populations respectively. Consequently, the present study indicates that there is no discrimination among regional gene pools and the *Orthotomicus tridentatus* haplotypes found in different populations have a significant amount of genetic diversity.

Keywords: *Orthotomicus tridentatus,* genetic diversity, *Cedrus libani*, Turkey

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Genetic diversity of an oak Dependent gall wasp species: Preliminary analyses of *Cynips quercusfolii* (Hymenoptera: Cynipidae) from Turkey

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Abstract: Turkey hosts more than 23 oak taxa including white oaks and the hybrids between these oak species. *Cynips quercusfolii* Linnaeus, 1758 (Hymenoptera: Cynipidae) is an obligate parasitic gall wasp species and its parthenogenetic generation galls are formed on the underside of the leaves of white oak species from the section *Quercus*. The distribution range of *C. quercusfolii* is known to cover all over the territory from East and Central Europe to Iran including Turkey where large oak populations are present.

In this study, 294 *C. quercusfolii* asexual generation individuals were collected from 38 locations in Turkey. Mitochondrial cytochrome b gene sequence data were used to reveal phylogenetic and phylogeographic structure and genetic variation of the Turkish *C. quercusfolii* populations. Eighty eight out of 128 determined haplotypes were singletons; with respect to the haplotype number Kütahya had the most diverse types of haplotypes (N_{hap} =9 N=10). All of the remaining populations showed a range of haplotypes from 2 to 8. Genetic diversity estimates for most *C. quercusfolii* populations were fairly high. Average haplotype diversity was 0. 9998 +/- 0.001 and the nucleotide diversity was 0.0266 +/- 0.00145. Highest haplotype diversity estimate was detected in the Bartın, Düzce, Ordu, Tokat, Tunceli and Yozgat populations (h= 1,000), and the highest nucleotide diversity estimate was in the Konya population (π= 0.028843). On the other hand, phylogeographic analyses through using mtDNA cyt b gene sequence data revealed two main clades as east versus a polytomic clade comprising east, west and east and west mixed haplogroups. Our current preliminary analyses overall show that this Turkish oak dependent wasp species indicate congruent results obtained through several other Turkish plant and animal taxa and present supporting evidence for a general phylogeographic pattern in Turkey.

Keywords: *Cynips quercusfolii*, genetic diversity, oak gall wasp, Turkey

Diversity of Lepidoptera on *Quercus afares* in the north west of Tunisia

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Abstract: *Quercus afares* Pomel is an endemic species that grows as small relict population in the northwest of Tunisia. It is considered to be a fixed hybrid between *Q.suber* and *Q. canariensis* and is restricted in "Ain Zena" (north-west of Tunisia) forest covering of 47 ha, mixed with cork oak and zen oak. This species is nearing extinction (in the medium term) because of its difficulty to renew itself naturally. Significant defoliation caused by defoliating Lepidoptera pests has been observed in 2009, in Ain Zena". In spring 2010 and 2011, larvae of Lepidoptera were collected each week (from March to May) randomly from 8 branches (50 cm of length) from 8 trees. This study is the first performed on these pests in Tunisia, it aims to clarify the diversity and identify these insects. A total of 1039 individuals representing 4 families (Noctuidae, Geometridae, Tortricidae and Pyralidae) and 14 species were found in this forest. *Operophtera brumata* was the most abundant species in this forest presenting 72%. The low Shannon index indicates that the lepidopterous fauna is poorly diversified. Species distribution appears balanced.

Keywords: *Quercus afares*, Lepidoptera, Infestation, Diversity, Tunisia

Genetic Break between East and the West: An evaluation of the Turkish oak gall wasps

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Abstract: Current genetic structure of many species and the distribution of the genetic variation across a species range are shaped both by historical and contemporary factors such as topographical barriers, presence of micro- and macrohabitats, complex geologic history and past climatic fluctuations. Signatures of the past events and the varied topography can be observed not only in plant taxa but also in the obligate parasites of plants such as oak gall wasps.

The existence of mountain range barriers, the Anatolian Diagonal, running from the southeastern towards the northern part of Turkey is accepted as a major faunistic and floristic belt and is thought to underlie much of the genetic diversity in the region. Indeed, recent phylogeographic studies on oak gall wasps indicate a genetic divide mainly into east and west creating distinct genetic lineages. Several oak gall wasp species studied across Turkey revealed the presence of this notorious pattern into west and east division of the genetic variation with respect to the location of the Turkish highlands. Current findings show that Turkey as an area with a complicated geological history and the presence of a variety of mountainous areas has left an imprint on the phylogenies and biogeography of oak gall wasp taxa. Evaluation of the distribution and the allocation of the genetic diversity of several oak gall wasp species from three genera, distributed in Anatolia located at the junction of several phytogeographical provinces, express the importance of an apparent genetic break in all of the examined oak gall wasp species and it seems that gall wasps are a good model for searching the effects of physical barriers in Turkey.

Keywords: Anatolia, Oak gall wasps, Genetic divide, Physical barriers

Saproxylic beetle fauna on old oaks (*Quercus* spp.) at different sites in Turkey have both high inter and intra specific diversity

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Introduction: Old oaks (*Quercus* spp.) and its beetle fauna are rare and threatened all over Europe and Turkey. The reason is lack of suitable trees from unfavourable management or habitat conversion. The aim with the study is to describe the diversity and compare the similarity of this fauna in different areas with old oaks in Mediterranean part of Turkey. But later also compare with studies in similar habitats in different parts of Europe. We have also studied how the old traditions with regularly cutting branches (pollarding) from the oaks effect the species composition and richness. This management method of the trees is a very old tradition all over the world to get fodder for the animals and fire wood.

Methods: At six different sites in the Mediterranean part of Turkey the saproxylic beetle fauna on old hollow oaks (*Quercus cerris*, *Q. infectoria, Q. ithaburensis*, *Q. brantii*, *Q. vulcanica*, *Q. pubescens, Q. trojana, Q. libanii* and *Q. frainetto*) have been surveyed with window- and pit- fall traps. At each site 10-20 trees were examined with one trap of each type per tree during one season. The window traps consisted of a 30x60 cm wide transparent plastic plate with a tray underneath. They were placed near the trunk (< 1 m), beside or in front of a cavity entrance. Their positions were 1.5-7 m from the ground, depending on where the cavity entrance was situated on the studied tree. The pitfall traps were plastic cups with a top diameter of 6.5 cm. They were placed, in the wood mould in the bottom of the cavity, with the opening on level with the wood mould surface. Both types of traps were partially (about ½ of the volume) filled with ethylene glycol and water (50:50 v/v), adding some detergent to reduce surface tension. The traps were placed in the trees in mid April, were emptied every third week and eventually removed in September.

The species diversity was high at the different studied sites and large differences were found between the studied sites. In total more than 350 species have been identified and 25 species new to science have been and described during the studies. In addition 13 of the species are on the European redlist and three species is listed in Annex II of the EC Habitats Directive.

Conclusions: The high number of species at each site and the low similarity of species composition between the sites and the high number of new and endemic species point out Turkey as a hot spot for saproxylic oak fauna. The records of many species rare and protected in Europe also show the importance for Turkish authorities to protect oak forest and areas with pollarded oaks of different kind and spread these areas all over the Turkey.

The Cork oak forest's Coleptera in North Eastern Algeria: Inventory and ecological role

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Abstract: The entomological fauna of Algerian cork forests play a decisive role in the management and conservation of these forests through the diversity, the ecological major role as well as the bio-indicator character of some species. Many attacks of pest insects affecting primarily the leaves, the acorns and the trunk of the oak have been reported. The action of some phytophagous Coleoptera (Curculionidae …) is one of the main causes of defoliation, the xyllophagous weakening the tree while acorn's pests have a direct impact on regeneration. These attacks can cause weakening of the population of cork oak and contribute to its decline.

An inventory of Coleoptera was conducted to determine the richness, the diversity, and the ecological role of inventoried species. The sampling was conducted at two cork forests in the North-Eastern Algeria (El Kala and Souk Ahras) using the different techniques used in the field of entomology (Visual collecting, Pitfall Barber, and aerial traps).

We identified 59 species of Coleoptera belonging to 17 different families with a diversified feeding type (Coprophagous, Saproxylic, Predatory, Herbivorous or Decomposers). The calculation of the ecological indexes allows to situating the different populations in their environment.

Keywords: Cork-oak, Entomology, Coleoptera, El Kala, Souk-Ahras

Les Coléoptères des subéraies du Nord-Est Algérien: Inventaire et rôle écologique

Résumé: La faune entomologique des subéraies Algériennes joue un rôle déterminant dans la gestion et la conservation de ces forêts à travers sa diversité, son rôle écologique majeur ainsi que le caractère bio-indicateur de certaines espèces. De nombreuses attaques d'insectes ravageurs touchant principalement les feuilles, les fruits ainsi que le tronc du chêne ont été signalé. L'action de certains Coléoptères phytophages (Curculionidae,..) est l'une des principales causes de la défoliation, les xyllophages affaiblissent l'arbre tandis que les ravageurs des glands ont un impact direct sur la régénération. Ces attaques peuvent provoquer l'affaiblissement du peuplement du chêne- liège et contribuent à son dépérissement.

Un inventaire des Coléoptères a été réalisé afin d'en déterminer la richesse, la diversité, et le rôle écologique. L'échantillonnage a été effectué au niveau de deux subéraies du Nord-Est Algérien (El-Kala et Souk-Ahras) en faisant appel aux différentes techniques utilisées dans le domaine de l'entomologie (Récolte à vue, Pots Barber, Pièges aériens). Nous avons recensé 59 espèces de Coléoptères appartenant à 17 familles différentes présentant un régime alimentaire diversifié (coprophages, saproxyliques, prédatrice, phytophages ou décomposeurs). Le

calcul des indices permet de mieux situer les différentes populations dans leur habitat.

Mots clés: Subéraie, Entomofaune, Coléoptères, El Kala, Souk-Ahras.

Preliminary inventory of Hymenoptera Ichneumonidae from Morocco

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Abstract. So not to say that Hymenoptera are nonexistent in Morocco, they are rarely studied in this lather. The aim of this work is to fill that gap by inventorying and identifying eventually the hymenoptera parasitoids of pests of cork oak from the forest of Maâmora. After selecting three study sites, we have installed a one Malaise trap per site and the Harvests were made weekly. The preliminary results revealed a richness of Hymenoptera Ichneumonidae. In addition, we identified the subfamily of Campopleginae recognized parasitoids of Lepidoptera. In conclusion, the identifications were very interesting and promising albeit our Fieldwork show that must be multiplied the sites of sampling and large number of morphospecies with unique records strongly suggest that this study is far from exhaustive. Well as this work has provided training a taxonomist about the Hymenoptera in Morocco.

Keywords: Hymenoptera, Ichneumonidae, Systematics, Cork oak forest, Morocco

Seasonal distribution of soil fauna in cedar forests in the National Park Thneit El Had (Algeria)

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Abstract: The National Park of Theniet El -Had is is located in North -West Algeria in the province of Tissemsilt, few kilometers from the eponymous town of El Had Theniet in the heart of the Atlas Tell . The cedar forests of the park are unique in Western Algeria. The flora includes 450 species, many of which are endemic to Algeria. The canopy comprises of 1000 ha of Atlas cedar (*Cedrus atlantica*), 1000 ha of Holm Oak (*Quercus ilex*), 504 ha of Zeen Oak (*Quercus faginea*), 460 ha of Cork Oak (*Quercus suber*); and 460 ha of other species. 289 species have been identified and inventoried at the park most of which are protected as hyena, caracal thegenet, wild cat, weasel, porcupine, etc. The bird arena is marked by the presence of the golden eagle, hawk, vulture buzzard, tawny owl, bee-eaters, and the woodpecker finch. More than 300 species of insects have been inventoried in the park as well. The majority belongs to the order of Coleoptera and Hymenoptera.

In terms of basic research, we note that a systematic inventory and distribution of fauna soil of this park are still poorly understood. This is a gap to fill. We limit ourselves to present the different stands of fauna soil and its distribution in five stations in the Blida Atlas. Several sample methods were done according to the four seasons.

The best represented groups are Oligochaeta, Gastropods, Ants, Arachnids, Beetles, Centipedes, Diplopod, Hymenoptera and different Insects Larvae.

Arthropedofaune of the cedar forests in the Notional Park of Chréa

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Introduction: The Atlas cedar (*Cedrus Atlantica* Manetti) is endemic to North Africa. It is an essence that has always attracted significant interest because of its many forest attributes such as maintaining a biological balance. It has long been known for its ability to withstand drought unfortunately, this ability has limits, and it is now endangered. The decline of this cedar population is a complex phenomenon whose factors managers can be very diverse (Mouna, 1994), and lead to a general deterioration, thus promoting the installation of insect herbivores and pathogens and boring leading to dieback and mortality where their interest in this study

Study site: This study was conducted at the National Park Chréa. It is located 50 km south of Algiers in Blida. It is essentially a mountain park, located in the heart of the blidéen massif (part of the Tell Atlas). It is home to vast forests of cedar trees. The site is east-west with the following coordinates: 36° 25' to 36° 27' N and 2°50' to 2° 56' E.

Methodology: For the realization of this work, it was carried out using traps buried in the soil (pots Barber) that capture arthropods walkers. The equipment used consists of containers of 15 cm diameter and 18 cm high. Each trap is buried vertically and its opening is at ground level. The earth is packed around the opening to prevent the barrier effect of the various species. Each pot is filled with water to three quarters of its height. A detergent is added to prevent arthropod escape. Monthly monitoring of 10 months was the duration of this study.

Result: The results of this study have identified 1,367 individuals representing 125 species divided into 6 classes (Oligocheta, Gastéropoda, Arachnida, Crustacea, Myriapoda and Insecta). The class of the insects with a rate of 94% is best represented. The calculation of the Shannon- Weaver index (5.04 bits) shows that the cedar forest Chréa, has a very diverse community. Among insects we note the presence of Coleoptera, Hymenoptera and Lepidoptera which sub- arboreal species and xylophages cause the greatest damage

Conclusion: The present study showed that the study site shows a rich fauna. This may be confirmed by the theme that the decline of cedar population generates installing fauna (plant-eating insects and borers) involved directly or indirectly in the mechanism of deterioration of these tree species.

Keywords: Atlas cedar, Deterioration, Insect, Xylophages, Weaver index

SESSION 2

EMERGING AND EXOTIC PESTS

Are Mediterranean areas especially suitable to the establishment of exotic pests?

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Introduction: Invasive alien species involve a high cost for agriculture, horticulture, and forestry every year. Considering climate change and the increase in international trade, the number of species that can arrive and establish in a new environment will continue to rise in the coming years. Among alien species, invasion of wood boring beetles (mainly Scolytinae, Cerambycidae, and Buprestidae) is considered a major threat to forest health worldwide, as these organisms can be easily transported in live plants, plant products, wood packaging material, and cargo containers where they are often sheltered from detection. The success of a biological invasion result from the combination of the three phases characterizing this process: arrival, establishment and spread. The key factors affecting the arrival and the first establishment of alien species are the propagule pressure, which is strongly influenced by the amount and frequency of imported commodities, and the conditions of local environments.

Methods: The relative importance of the amount of international trade and several environmental variables of the recipient regions on species richness of established exotic wood boring beetles were investigated in Europe by literature data analysis and specific field experiments.

Results: Alien wood boring beetles, mainly bark and Ambrosia beetles, are unevenly distributed throughout Europe. The number of alien species per country significantly decreases moving from the Mediterranean area to eastwards and northwards, with Spain, France and Italy hosting the largest number. Mediterranean countries are followed by continental ones such as Austria, Switzerland, Germany and United Kingdom, while the northernmost and easternmost European countries show the lowest number. Alien species per country are correlated positively with country importation values and negatively with latitude, indicating that alien establishment is favoured by human trade, warm climate and flora complexity. The importance of the different factors changes, anyway, when considering separately insects with different feeding guilds, such as – for instance – bark and ambrosia beetles: while the amount of import is a strong predictor of the number of exotic bark beetle species, climate becomes the main factor influencing the establishment of exotic ambrosia beetles. In this respect, bark beetles are much more host-specific than ambrosia beetles are, suggesting an effect of environmental heterogeneity stronger for bark beetles. Bark beetles are, hence, less influenced by local climatic conditions as they can establish wherever a suitable host species is present. The highly polyphagous ambrosia beetles, instead, are strictly dependant on climatic features, such as temperature and precipitations, required for the growth of their symbiotic fungi.

Conclusion: Mediterranean regions are especially suitable to the establishment of exotic scolytids because bark beetles find a high degree of environmental heterogeneity, *i.e.* higher possibility to find suitable hosts, while Ambrosia beetles find the climatic conditions needed for their symbiotic fungi. Our findings suggest that if the current density of alien species arriving in imported plants and wood packaging material will continue, then increasing international trade in Europe will likely lead to more establishments of exotic wood boring beetles with concomitant negative effects on forest health, mainly in Mediterranean countries.

Management of Invasive Insects on Eucalyptus in California

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Abstract: Although free from insect herbivores for more than 100 years, 16-18 eucalyptus herbivores in four different feeding guilds have been introduced into California in the last 30 years. The biology and ecology of the insects were studied in the novel environment to determine the best way to manage the growing community. Cultural management, including timing of pruning treatments, irrigation management, and fertilization, were integrated with limited insecticide applications where appropriate. Introduction of natural enemies has established very effective biological control. The populations of herbivores and natural enemies must be evaluated as an interacting community to achieve sustainable management strategies.

The Eucalyptus gall wasps in the Mediterranean: biological control, host plant range, and host-galler interactions

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Abstract: Eucalyptus plantations in the Mediterranean Region are an important source of income for the timber industry, and provide multiple non-wood products and services, being used as major source of nectar and pollen for honeybees, for soil conservation, as shelterbelts from drifting sands and air pollution and windbreaks. Since the early 20th century, 12 Australasian insect species of different feeding groups were established in the Mediterranean Basin affecting Eucalyptus trees. Among the more severe pests, three are eulophid gall wasps arrived in the late 1990 and early 2000. *Ophelimus maskelli* and *Leptocybe invasa* were found on several species of eucalypts but inflicted severe damage mainly on the river red gum *E. camaldulensis* and closely related species of the section Exsertaria. Another and probably undescribed *Ophelimus* sp, was more recently detected in Southwestern Europe, attacking the blue gum *E. globulus* and related species. All three gallers were unknown in Australia prior their discovery in the Mediterranean. Here, we present an overview of the research results achieved so far with the Eucalyptus mainly with the two former species. The occurrence of *O. maskelli* and *L. invasa* in Australia was revealed during the search for their natural enemies. Six parasitoid wasps belonging to Eulophidae (*Quadrastichus mendeli*, *Selitrichodes kryceri* and *Closterocerus chamaeleon)* Mymaridae (*Stethynium ophelimi* and *Stethynium breviovipositor)* and Torymidae *(Megastigmus leptocybus*) were collected in Australia and introduced in the Mediterranean basin but few of them led to successful biological control of these gallers. We bring data on host switch of local *Megastigmus* spp., which has broadened their host range to parasitize these gallers. Our research focused mainly on plant host range and host suitability. Finally, we present results from the gall wasp-plant interactions, showing that indirect benefit of *E. camaldulensis* may occur from the association with *L. invasa*, which provides new insight on the galler-plant system.

Abundance and seasonal activity of two Eucalypt borers; *Phoracantha* spp. and their egg parasitoid *Avetianella longoi* in Israel

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Abstract: Eucalypts are the backbone of the Israeli forestry in dry lower areas. Two longed-horn beetles were studied; *Phoracantha semipunctata* (=PS) and *P. recurva* (=PR) (Cerambycidae). Both borers known to develop on different *Eucalyptus* spp. PS was accidently introduced to Israel from South Africa in 1941; while PR was first recorded in Israel less than two decade ago. We studied the abundance and seasonal activity of these borers with the emphasis on the effect of their interspecific competition and their host preference. The parasitic wasp *Avetianella longoi* Siscaro (Hymenoptera; Encyrtidae) which has probably accompanied PR on its spread to Israel from Africa was also studied. Four *Eucalyptus* spp. were used as trap- trees to study the abundance of the borers; two tree species with typical smooth bark, *E. camaldulensis* and *E. spathulata*, and two others with typical rough bark: *E. gomphocephala* and *E. loxophleba*. The trap trees were exposed in 11 sampling sites in the major eucalypt forest areas of Israel. We have recorded the density of the emerging beetles out of trap- trees; monitored the density of beetles congregated on the trap trees during major daily flight period, and, we determined the egg clusters density and A*. longoi* parasitism rates. Adults of both borers emerged from all four tested *Eucalyptus* spp. *E. camaldulensis* trap- trees produced up to 3 times more PR than PS. Monitoring of adult borers landing on the trap trees after dusk showed a slightly larger numbers of PS over PR. PR tended to appear in greater numbers than PS in spring time. When given the choice of different *Eucalyptus* spp. in the field, PR preferred to land on *E. camaldulensis* and PS showed preference to *E. gomphocephala*. PS was more abundant on sites whereas the stand consists of mostly *E. gomphocephala*. Smaller egg-clutches were associated with rough bark in comparison to those from smooth barks. On the average, only about 5% of eggs per cluster (of 1433 sampled clusters) collected from smooth bark *Eucalyptus* spp were parasitized by *A. longoi*. While among the egg cluster found on rough bark *Eucalyptus* spp. (of 671 sampled clusters) 15-24% were parasitized. It seems that few years after the establishment of PR in Israel, equilibrium between the two borers was achieved in most of the country, excluding the Golan height. Remarkably, PR tends to be more common in *E. camaldulensis* stands. *A. longoi* occurs inconsistently in most study sites. We suggest that more moderate microclimatic conditions in the typical planting areas of *E. gomphocephala* and on its rough stem of the tree, may allow the survival of *A. longoi* the episodes of extreme heat and dryness. However, the overall impact of *A. longoi* on the density of the borers, as reflected from the low rates of parasitism, is rather low. In this study we have also found a specific larvae parasitoid of *Phoracantha* spp; *Liodoryctes sp*. (Braconidae) which has been released in Israel in 1980s; it is the first record of this wasp outside Australia.

Performance of *Phoracantha recurva* larvae on four *Eucalyptus* species in Tunisia

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Abstract: To determine the performance and capacity of *Phoracantha* larvae to colonize their host Eucalyptus healthy trees, a study was carried out in August 2013 in two Tunisian arboretums: arboretum Choucha belonging to lower humid bioclimate and arboretum Jebel Mansour belonging to the higher semi arid bioclimate. Four Eucalyptus species aged of 50 years and common to the two arboreta, were selected: *E. camaldulensis*, *E. gomphocephala*, *E. astringens* and *E. sideroxylon*. On each of three healthy trees, 60 young *Phoracantha recurva* larvae were inoculated in three incisions made in the bark surface (20 larvae per incision). 15 days after inoculation, debarking was performed to determine the number of larvae penetrating through the bark. After 45 days, a second debarking was performed to determine the number of larvae reaching the sapwood and measure the length of their galleries. Preliminary results showed that all inoculated larvae on *E. astringens* and *E. sideroxylon* within the two arboretums were dead due to the Kino exudation. However, for *E. camaldulensis* and *E. gomphocephala*, inoculations succeed but the penetration rate of young larvae did not differ significantly between the two arboretums and between the two species in the same arboretum. For larval survival under the bark we recorded no significant difference for *E. camaldulensis* between the two arboretums, whereas for *E. gomphocephala* the rates differ significantly (24.44 % ± 1.54 and 14.44% ± 2.81 for Choucha and Jebel Mansour respectively). In the arboretum of Jebel Mansour, larval survival under bark varies significantly between the two *Eucalyptus* species, it was more important for *E. camaldulensis* (33.33%±6.5) than for *E. gomphocephala* (14.44% ± 2.81).

When feeding, larvae make galleries under the bark. The mean length of these galleries in the arboretum of Choucha was similar on the two *Eucalyptus* species *E. camaldulensis* and *E. gomphocephala*. In the arboretum of Jebel Mansour galleries mean length showed a significant difference, where it was more longer on *E. camaldulensis* (14.70 ± 0.64 cm) than on *E. gomphocephala* (11.65 ± 0.51 cm). Comparing the galleries lengths between the two arboretums no significant differences was showed for the two *Eucalyptus* species.

Healthy trees of *E. astringens* and *E. sideroxylon* have the ability to inhibit the penetration of young larvae through the bark by Kino exudation while young larvae can penetrate through the bark of *E. camaldulensis* and *E. gomphocephala* and dig their feeding tunnels.

***Keywords*:** *Phoracantha recurva*, Larva, *Eucalyptus*, Performance, Tunisia

New data about biotic factors that affect stone pine production in Portugal

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Abstract: The stone pine (*Pinus pinea*) is one of the most important forest species in Portuguese forestry context, generating economic benefits for entities exploiting the species, particularly the production of cones. It occupies an area of 175 742 ha in Portugal and the production of cones is between 60 and 70 million Kg, corresponding to 600-700 tones of pinion.

In the latest years there has been an increasing incidence of one disease and three pests on the cones of the Stone Pine: *Diplodia pinea* (disease), *Pissodes validirostris* (Coleoptera), *Dioryctria mendacella* (Lepidoptera) and *Leptoglossus occidentalis L. occidentalis* is an exotic species native to North America that was recently introduced in Portugal (2010). Currently seems distributed from north to south and feeds on seeds of various species of the genus *Pinus*. The species has a sucking mouthpart (stylet) that allows it to suck the content of seeds and has five nymphal stages before reaching adult. Various methods have been tested to control the specie but no truly effective methods are available for this purpose. Due to gaps in knowledge some bioecological studies were initiated (2012-2013), especially concerning *L. occidentalis* (natural and lab conditions). By comparing the phenology of Stone Pine with the biotic agents´ life cycles (in particular *L. occidentalis*), it's possible to verify that these species are active during the flowering/pollination and late summer periods. At the same time, for the quantification of the damages and factors involved several plots were implemented in the terrain during 2013, for testing the long-term effect of different forest management techniques (fertilization). It was also possible to verify that the biological cycle of *L. occidentalis* is strongly correlated with the phenological cycle of the reproductive structures of *P. pinea*, and that this insect needs about 2 months to complete its life cycle during the favorable summer months, resulting in probably two generations and a half per year**.** Measurements were made to determine the length of the body and stylet on the five nymphal stages and adult. Increases of 2,5x more on the stylet length were found on the second instar, indicating that at this stage the insect needs a greater amount of food. If *L. occidentalis* is confirmed to feed on the flowers and cones and if we add the effects of the others biotic agents, there is a strong likelihood of these pests and diseases having an important role in the decrease of nut production currently observed.

We also comment on preliminary observations on the factors associated with damages induced by these pests and diseases in Portugal, and on some strategies of forest management to reduce their potential impact.

Keywords: Stone pine, cone production, pests, diseases, *Leptoglossus occidentalis*, forest management.

Intra-specific niche divergence within North American *Dendroctonus* bark beetles: implications for biological invasion risk

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Abstract: Past geologic and climatic events are important drivers of geographically structured intra- specific diversity. Such phylogeographic histories may – or may not – have led to actual realized niche divergences between sister lineages. Species distribution models (SDMs) are widely used tools to depict the niche dimensions of species and predict their potential distributions in new space and/or time. SDMs usually do not include evolutionary information about species and are fitted without prior investigation of differences of ecological requirements between intra-specific entities. However, this issue can be relevant when designing pest management and assessing biological invasion risk and quarantine status. We explored this question by considering 5 American bark beetles belonging to the genus *Dendroctonus*, which are highly damaging pests of conifers forests within their native range (America). All these species are indiscriminately listed as quarantine organisms in Europe. We modelled all the intra-specific lineages distributions and compared the results with the models fitted at the species scale. Multivariate analysis ant tests of niche equivalency and similarity were performed to investigate the existence and the magnitude of niche divergence between sister lineages. We additionally predicted their potential geographic range in Europe.

We found evidences of realized niche conservatism as well as divergence between sister lineages depending on the species considered. The lineages of *D. brevicomis* and *D. ponderosae* ranging from the South-western Pacific coast of United States to Canada exhibited relatively low niche divergence with their sister clades occurring across southern Rocky Mountains. For these species, SDM predictions largely overlapped among sister lineages. On the other hand, we observed significant realized climatic niche divergence between lineages of *D. valens* and *D. pseudotsugae*. The populations occurring in mountainous ranges of Mexico and Central America experience relatively milder winters and different seasonal structures than populations occurring in United States and Canada. For these species, the geographic area considered as climatically suitable in Europe differed significantly among lineages.

These results highlight the importance of considering lower taxonomic resolutions when assessing risk of biological invasions.

European invasion of the Western conifer seed bug: So what happened?

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Abstract: The Western conifer seed bug, *Leptoglossus occidentalis* Heidemann (Heteroptera, Coreidae), is considered as a major pest of cones and seeds in conifer seed orchards of its native western North American range. This insect was unintentionally introduced in the Eastern part of the USA during the 1950s and then spread eastwards to reach the Atlantic coast in the 1990s. Then, *L. occidentalis* was introduced in Europe during the late 1990s and was first reported in Italy in 1999. The bug expanded its range very quickly and it colonized most of Europe within just a decade. Recent studies indicated that the bug can be considered as a serious threat for seed production not only in seed orchards but also in natural stands.

In order to implement successful management program and understand the reasons underlying the invasive success of *L. occidentalis* in Europe, it is important to characterize the routes of its fast spatial expansion, assessing if it has proceeded from a unique or several different introductions. We used mitochondrial gene sequence data (Cytochrome b) and a set of microsatellites loci on bugs sampled across the three main areas, i.e. western North America, eastern North America and Europe. Both mitochondrial and microsatellites results indicate that *L. occidentalis* presents a largely homogeneous population through its entire native area. The invasive samples (European and eastern North American ones) compared to the native ones showed a lower genetic diversity, traducing a bottleneck often characteristic of invasive populations. Moreover, all of our analyses showed a stronger genetic affinity of European invasive samples with the eastern North American populations than with those of native range, which demonstrates that European populations share a common origin with eastern North America. This suggests that the populations having invaded eastern North America may have acted as a bridgehead for the European invasion. Moreover, as suggested by the historical and biological data, the molecular data confirmed multiple introductions in different parts of Europe.

Evolutionnary history and ongoing gene flow of *Monochamus galloprovincialis* (Coleoptera, Cerambycidae), vector of the Pine Wood Nematode

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Abstract: *Monochamus galloprovincialis* (Coleoptera, Cerambycidae) is the main factor involved in the natural spread of the Pine Wood Nematode (PWN), a serious pest for pine forests. Since its introduction in Portugal, the PWN has rapidly expanded its range to a large part of the country and entered into Spain. The estimation of dispersal abilities of *M. galloprovincialis* in various landscapes and across mountains is one of the key points to predict the invasion of the PWN in Europe and to provide accurate management procedures for this pest.

Highly polymorphic genetic markers have proven their utility to provide estimations of population genetic structure and gene flow at both broad and fine scales. Using 13 microsatellites loci, we reconstructed the phylogeography of *M. galloprovincialis* across its whole distribution range. Our objective was to uncover the historical patterns involved in the establishment of current genetic structure and to define the main barriers to dispersal of this species at the scale of Europe.

First results show that distribution of the genetic structure is consistent with post-glacial recolonization of some other temperate species associated with pines. *M. galloprovincialis* displayed four main lineages occurring in Eastern and Western part of the Iberian Peninsula, in Central and Eastern Europe. Maximum allelic diversity was observed in Spain, suggesting that *M. galloprovincialis* might have had one major refugium in the Iberian Peninsula. We also found contrasting results regarding insular populations.

A focus on Pyrenean chain shows that this relief has acted as a barrier to the dispersal of *M. galloprovincialis*, although a signature of migration was detected along the Atlantic cost of this chain, where altitude is lower. This observation provides evidence of the potential role of altitudinal barriers to limit the natural dissemination of the PWN in Europe.

Preliminary genetic analysis of the bacteria associated with *Monochamus galloprovincialis* from Turkey

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Introduction

Pine wilt disease (PWD) is a serious threat to susceptible pine forests worldwide, particularly in Eastern Asia and Europe. The disease has become particularly important to European pine forests after being reported in Portugal for the first time in 1999 (Mota et al.,). The causative agent of PWD is the pinewood nematode (PWN), *Bursaphelenchus xylophilus*, which is transmitted to susceptible pine trees by beetles, mainly *Monochamus* species (Coleoptera: Cerambycidae). The disease has been causing extensive damage in susceptible pine forests of Eastern Asian countries (Japan, China, Korea and Taiwan) and Portugal (Europe). The PWN has been recently detected in Spain which indicates that the nematode tends to expand its geographical distributions into different regions.

Turkey is located in a very important transitional area between Asia and Europe thus increasing the possibility of invasive pest organisms into forested areas. Therefore, studies have started to investigate the three components of PWD since 2002 in Turkey. The presence of susceptible pine species, such as *Pinus sylvestris, P. pinaster*, insect vectors and suitable climatic conditions increases the importance of these studies in Turkey. In the current study, adults of *M. galloprovincialis*, a vector species of *Bursaphelenchus* sp., were collected and the bacterial community associated with the beetles was studied for the first time in Turkey.

Methods

1. Insect collection and dissection

In 2013, adults of *M. galloprovincialis* (female and male) were collected from *Pinus pinaster* Ait. stands in Düzce city, in the western Black Sea region of Turkey, by using multi-funnel pheromone traps containing Galloprotect-2. The collected insects were brought into the laboratory in the same day. In Portugal, the surface of the insects (n = 18) was sterilized with a 70% ethanol solution for one minute, rinsed with sterile distilled water and dissected under a binocular microscope for trachea extraction from the insect thorax. Tracheae were placed in 40µl of sterile 1X phosphate-buffered saline (PBS) for total genomic DNA extraction.

2. DNA extraction and 16S rDNA amplification

Total genomic DNA was isolated from tracheae of insects using Purelink Genomic DNA kit according to the manufacturer's instructions. The V3 region of bacterial 16S rRNA gene was amplified using the primers 338F (5'–GACTCCTACGGGAGGCAGCAG-3') and 518R (5'-ATTACCGCGGCTGCTGG-3'). A GC clamp was attached to the 5' end of the forward primers in order to prevent complete melting of the PCR products during subsequent DGGE analysis (Muyzer et al. 1993). The mixture of the PCR reaction was 25 µL of 6.25 µL NZYTaq, 2× Green Master Mix (2.5 mM MgCl2; 200 µM dNTPs; 0.2 U/µL DNA polymerase), 16.25 µL of ultrapure water and 0.75 µL of each 1µM forward and

reverse primers. The amplification conditions consisted of an initial denaturation step (95 ºC for 5 min.), followed by 35 amplification cycles including the following steps: denaturation (92 ºC for 30 sec.), annealing (55 ºC for 30 sec.) and extension (72ºC for 30 sec.), and a final extension step (72 ºC for 30 min.). Re-amplification approach was required to obtain sufficient PCR product for subsequent analysis. For this, a second PCR was conducted using 1µL of the first PCR product as template, the same primers and conditions.

3. Denaturing Gradient Gel Electrophoresis (DGGE)

The PCR products were directly applied onto 40% polyacrylamide gels (37.5:1, acrylamide/bisacrylamide) in 50x TAE buffer (20 mmol/L Tris–acetate, pH 7.4, 10 mmol/L sodium acetate, 0.5 mmol/L Na_2 EDTA) with urea and formamide as denaturants. Linear denaturing gradients ranged from 30 to 65% (100% corresponds to 7 M Urea and 40% formamide). Electrophoresis was performed on a D-Code Universal Mutation Detection System at 60 ºC; initially a constant voltage of

20 V was applied for 15 min followed by 75 V during 16 h. After electrophoresis, the gels were stained for 5 min. with ethidium bromide and then rinsed for 20 min in distilled water. Every DGGE gel contained two lanes, with a standard of eight bands for internal and external normalization and as an indication of the quality of the analysis. Cluster analysis of DGGE profiles was performed using the UPGMA method (group average method) applying Pearson correlation measures.

Results

DGGE fingerprints were obtained from all samples (Figure 1). The number of DGGE bands detected in each profile ranged from 16 to 20. The obtained profiles were grouped by clustering analysis (Figure 2) in two main clusters with around 20% of similarity among them. The smaller cluster constituted by samples 2, 5 and 7 was separated mainly due to the phylotype with high melting temperature common to all three of them as seen in Fig. 1 corresponding to the strong band in the bottom of the DGGE gel. This phylotype is not exactly in the same position in each lane once it is perceptible some inconsistence in the polymerization in this gel area. There is a division in the main group in two clusters. The profiles of both clusters have an approximate 45% similarity. In each cluster, the profiles share a high degree of similarity (>70%) except for profile number.

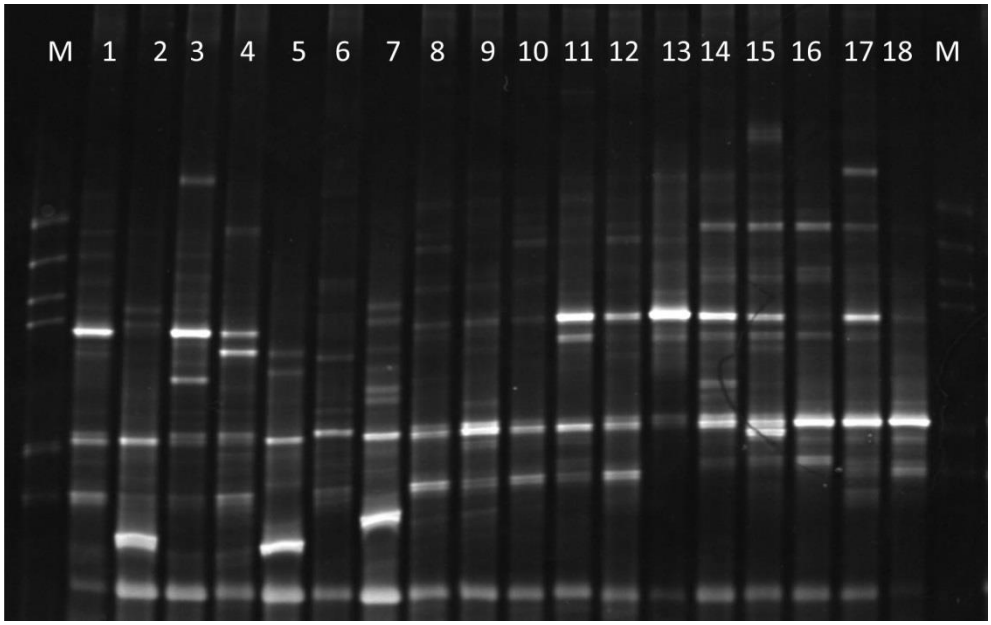

Figure 1 – DGGE gel showing PCR-amplified bacterial 16S rDNA fragments for the 18 trachea of the insects sampled (indicated on top of the lanes). Lane M: DGGE marker constructed using previously characterized 16S rDNA clones from environmental libraries (Henriques et al., 2004).

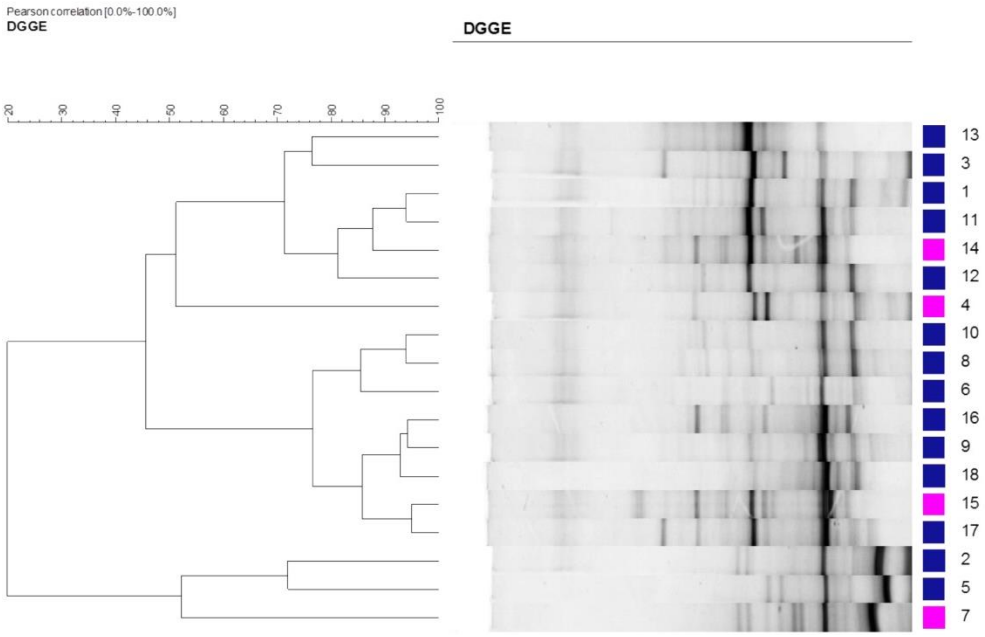

Figure 2 - Dendrograms of DGGE patterns created using UPGMA method (group average method) applying Pearson correlation analysis. Blue boxes correspond to male *M. galloprovincialis*; pink boxes correspond to female *M. galloprovincialis.*

Conclusion

In this study, the preliminary results of bacteria community associated with *M. galloprovincialis* collected from Turkey are presented. New studies have to be carried out to understand the role of bacteria on PWNs survival and population dynamics inside *M. galloprovincialis* during transmission from one host to another. Studies on identification of bacteria at species level are still ongoing by using sequencing techniques.

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Characterization of bacterial communities associated with the pine sawyer beetle *Monochamus galloprovincialis*, the insect vector of the pinewood nematode *Bursaphelenchus xylophilus*. *FEMS Microbiology Letters* DOI: 10.1111/1574-6968.12232.

SESSION 3

INSECT BIOLOGY, RELATION WITH HOST TREES AND WITH OTHER ORGANISMS

Host plant specialization influences the spread of endosymbiotic parthenogenesis in seed wasps (Hymenoptera: Torymidae)

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Abstract: Wasps of the *Megastigmus* genus are highly specialized on seeds of gymnosperms (Pinaceae and Cupressaceae) or angiosperms (Rosaceae and Anacardiaceae), which strongly shaped their evolutionary history and influences many processes of their population dynamics. When several wasp species exploit the same host, they strictly require the same ecological niche, which is then particularly propitious to direct intra- or interspecific interactions.

In this study, we investigated how such host-mediated interactions can drive the epidemiology of thelytokous parthenogenesis within the *Megastigmus* genus. In Hymenopterans, thelytokous parthenogenesis is a form of spontaneous loss of sexuality leading to strong distortion of sex ratio towards females and resulting from mutation, hybridization or infection by bacterial endosymbionts. In the genus *Megastigmus*, the dominant and ancestral form of parthenogenesis is by far arrhenotoky (a form of sexuality) as thelytoky characterizes only a minority of species, but both arrhenotokous and thelytokous species can occur in sympatry on gymnosperm or on angiosperm hosts. In this context, we address specifically the potential for phylogeny, ecology and infection by parthenogenesis-inducing endosymbionts to drive the spread of thelytoky within this group of seed wasps.

We first performed a large literature survey to examine the distribution of thelytoky in these wasps across their respective obligate host plant families. Second, we tested for thelytoky caused by endosymbionts by screening in 15 arrhenotokous and 10 thelytokous species for *Wolbachia*, *Cardinium*, *Arsenophonus* and *Rickettsia* endosymbionts and by performing antibiotic treatments. Finally, we performed phylogenetic reconstructions to examine the evolution of thelytoky in *Megastigmus* and its possible connections to both endosymbiont infection and host plant specialization.

We demonstrate that thelytoky evolved from ancestral arrhenotoky through the horizontal transmission and the fixation of the parthenogenesis-inducing *Wolbachia*. We find that ecological specialization in *Wolbachia*'s hosts was probably a critical driving force for *Wolbachia* infection and spread of thelytoky, but also a constraint. Sharing a narrow ecological niche opens an encounter filter between species, but also restricts the host spectrum to the few species exploiting a particular resource. Niche overlap opportunity being closely related to phylogenetic proximity between species, a compatibility filter can be open and facilitates symbiont infection. Our work shows that community structure of insects is a major driver of the epidemiology of endosymbionts and that competitive interaction among closely related species may facilitate their horizontal transmission.

Keywords: Ecological specialization, epidemiology, parthenogenesis, *Megastigmus*, phylogeny, thelytoky, *Wolbachia*

Exploring a possible preference in *Megastigmus spermotrophus* infestation of Douglas-fir

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Abstract: Intercontinental movement of Douglas-fir (*Pseudotsuga menziesii*) seed from its native range in North America has resulted in the establishment of invasive, parasitic seed insects, in particular, *Megastigmus spermotrophus*. This seed pest is able to manipulate Douglas-fir physiology and redirect the trees resources for its own larval development. The high infestation rates in Europe cause major economic losses for seed orchard production.

From previous field experiments we noticed that highly infested seed came from trees that were induced with gibberellic acid. These trees had an abundance of cones that were noticeably smaller compared to other trees from the same genotype. In addition, we noted that infested seeds tended to be smaller than healthy seed when investigating seed lots from previous years' collections. Thus, we hypothesized that *M. spermotrophus* infestation rates may be related to seed size.

In order to test this hypothesis we collected thirty cones from five trees located on the University of Victoria campus. Cones were dissected scale by scale, seeds were x-rayed to determine infestation status, and x-ray images were used to measure seed length. Seed images, and visual observation revealed the presence of a competing seed pest, *Contarinia oregonesis* (Douglas-fir cone gall midge), which forms galls at the base of scales adjacent to the seed and is known to compete with *Megastigmus*; the infestation status of each seed for *Contarinia* was also scored.

GLM (logistic regression/ logit function) analyses show that position of the seed within the cone, seed length, and their interaction are strong predictors of infestation ($p = 3.65E-02$, $p = 0.02022$, and $p = 7.02E-03$ respectively). For a given cone, seed size gradually increases then decreases from the base of the cone toward the apex; the smallest seeds occurring at the distal and proximal ends. Our results show that *Megastigmus* infestation tends to occur in smaller seed and in the seeds from both ends of the cone. Surprisingly, we noted that *Megastigmus* is infesting seed above and below the region in the cone where viable seed are possible. In highly infested cones, infestation is more uniform along the cone; obscuring the proximal-distal infestation pattern seen in less infested cones. Seed length and position do not predict infestation by *Contarinia*. In addition, there is no discrete pattern in infestation by *Contarinia,* suggesting that the midge is not directly displacing nor competing with *Megastigmus*.

Previous work searching for clone-based infestation prevalence showed more uniform infestation of cones from France (a pattern similar to our smaller and highly infested cones) versus the bimodal infestation (similar to our results for lightly infested cones) for cones from northern California. These differing patterns were hypothesized to be the result of the presence of additional cone parasites in the North American system versus the introduced stands in France, which lack many of these pests. However, our results suggest that cone morphology may be a more parsimonious explanation for these patterns, suggesting that larger, healthier cones are more difficult for *Megastigmus* to attack.

Putative venom discovery in the Douglas-fir seed chalcid, *Megastigmus spermotrophus*

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Abstract: *Megastigmus spermotrophus* (Hymenoptera: Torymidae) is a seed parasite of Douglas fir, *Pseudotsuga menziesii*. This parasite has the ability to manipulate host seed development for its own reproductive success, preventing the abortion of unfertilized ovules and feeding on nutrient rich megagametophyte tissue in the absence of a viable plant embryo. The mechanism of host manipulation is not known. A transcriptomic approach was used to identify putative venoms expressed by *M. spermotrophus* that may play a role in early host manipulation. *M. spermotrophus* was found to share several homologous venom sequences with the model parasitoid wasp, *Nasonia vitripennis*. Three of these putative venom transcripts were found to be highly expressed in adult females. One of these putative venoms, aspartylglucosaminidase, has also been identified as a major venom component of two divergent parasitoid wasps. There is evidence that venomous aspartylglucosaminidase may have arisen through a gene duplication event within the Hymenoptera.

Influence of attacks by Carpophagous on metabolism of cork oak acorns (*Quercus suber*)

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Abstract: Natural regeneration of cork oak remains a major concern of forest in Algeria. Faced with the deterioration of the health status of the Algerian forests, it is urgent to think otherwise. Acorn is also affected by this degradation by the low yield and vulnerability to carpophagous attack that disrupt the regularity and abundance of acorns.

For our study we collected 200 acorns from different forests, we conducted a follow-up of infestation in the laboratory to determine the extent of the carpophagous attack. We measured metabolites (proteins, carbohydrates and lipids) on the different categories of acorns. This assay is completed by a chemical analysis of different extracts acorns by gas chromatography / mass spectrometry. After 11 weeks of evolution of the attack, the acorns harvested healthy have an attack rate of 50%. The attack is also changing at the acorns harvested achieved. This infestation key content metabolites acorns more at the almond at the level of the pericarp.

Chemical analysis of different extracts acorns by gas chromatography / mass spectrometry allowed us to identify 18 major compounds belonging to different chemical classes (aldehyds, alcohols, ketones, acids, saturated or unsaturated hydrocarbon, terpen, sesquiterpen, etc ....) . Nonvolatile heavy fraction includes many sesquiterpen and saturated hydrocarbons (C22 to C29) and C28 and C29 polyphenols.

Keywords: *Quercus suber,* acorns, Carpophagous, metabolites, GC / MS

Beauty or the Beast? An association between oak and oak gall wasps with special emphasis on Turkish Cynipid Richness

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Abstract: Oak gallwasps, obligate parasite of oaks, show one of the most amazing relationships with their host. Providing nutrients, shelter and protection to the inducer, gall morphological traits are important characteristics to distinguish galls of a species from those of others since each gall forming taxon induces species- and even generation specific galls. Oak gall wasps with nearly 1300 defined species classified under 40 genera distributed world-wide are grouped under the tribe Cynipini. Many aspects of the trophical relationships between gall wasps and their hosts are still unknown; however studies have shown that the abundance and richness of gall wasps are strongly correlated with the richness and abundance of host plants. Many western Palearctic oak species are mostly found in Eastern Europe, Turkey and the Caucuses, and Iran. In Turkey there are 23 oak taxa and hybrids, which might also affect the richness of oak gall wasp diversity in Turkey.

Until recent works studies on the Turkish oak gall wasp fauna was very poor, only 89 species of oak gall wasps have been reported from Anatolia. Nonetheless our latest works on oak gall wasps revealed that there are 113 species from 11 genera of oak gall wasps in Turkey. Eighty two gall wasp species have been reported from oak forests of Iran, with the richest cynipid species diversity in Europe 95 species are known from Hungary, 70 from the Iberian Peninsula, 39 from the Scandinavian countries and 87 from Croatia. Compared to the oak gall wasp species diversity of those countries Turkey has conspicuously higher gall wasp diversity and we believe that the true number might be much higher than this. Dispersed with their partners oak gallwasp diversity in Turkey requires more attention since Turkey is accepted as a center of diversity and a hotspot area for species diversity and further studies and protection of the oak forestry areas are necessary for conserving not only forest diversity but also the obligate species to those oak species.

Keywords: Cynipidae, oaks, oak gall wasps, species diversity

Monoterpenes say against insects: “unus pro omnibus, omnes pro uno” (one for all, all for one)

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Abtract: Monoterpenes are known as secondary compounds implicated in direct plant defense. Secondary compounds can negatively affect herbivores’ performances by reducing food intake; and once ingested by reducing the efficiency of food utilization and through their direct toxic effects. Mortality is frequently used to assess negative impact of secondary compounds on insect biological performance. We studied the spruce budworm (*Choristoneura fumiferana* (Clem.))-its host plants monoterpenes system, especially balsam fir (*Abies balsamea* (L.) Miller) and white spruce (*Picea glauca* (Moench)). Firstly the foliage monoterpenes and their concentrations were determined according to tree age and the larval development period. A mixture of ten synthetic monoterpenes (tricyclene, α-pinene, camphene, β-pinene, myrcene, δ-3-carene, limonene, δ-phellandrene, terpinolene and bornyl acetate) at two concentrations (3.13% and 2.66%, monoterpenes per dry weight found in 30- and 70-year old balsam fir trees respectively) was incorporated into artificial diet by hexane solubilization. In this first experiment, higher monoterpene concentration representing young trees caused a higher mortality of spruce budworm larvae. High concentration of δ-3-carene, terpinolene and bornyl acetate in the young trees can explain the higher mortality rate. This study shows that spruce budworm mortality and feeding behavior are affected by monoterpenes, but it does not provide enough information on the individual effect of these compounds. A second experiment was performed using artificial diet to determine the individual dosage effects of six monoterpenes (α-pinene, bornyl acetate, camphene, δ-3- carene, terpinolene, tricyclene). α-pinene and δ-3-carene exerted significant mortality on spruce budworm larvae at the maximum concentration found in the foliage. Bornyl acetate and camphene caused significant mortality when their concentrations were twice of those encountered in the foliage. Any mortality effect of terpinolene and tricyclene was not observed. In previous studies α-pinene has been reported as budworm oviposition stimulant, but our results showed that α-pinene at concentrations found in the foliage proved toxic to larvae. Similarly bornyl acetate, δ-3-carene, camphene and terpinolene are considered as being toxic to spruce budworm. Our second experiment showed that these monoterpenes are individually not very effective in terms of their toxicity against spruce budworm larvae. This low protection capacity can be explained by the absence of other monoterpenes or by the provision of sufficient energy for detoxification by soluble sugars. These two experiments showed that the defensive role of monoterpenes is higher when they are together and spruce budworm host plants produce these molecules at concentrations that provide optimal protection.

Biotic investigation on *Acacia* species in Kordofan Region Sudan against climate change

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Abstract: Climate change poses serious challenges to Sudan's overriding development priorities in agriculture, forestry, water resource management, and health. *Acacia species* producing gum Arabic are of great (socio)-economic, and ecological importance in Sudan. The *Acacia senegal* tree, producing gum Arabic provides an important source of cash income to the farmer population in the Northern Kordofan State in Sudan. *Acacia seyal* var. *seyal* (talh) is a gum-yielding tree found in the savannah belt of the Sudan. The ecological knowledge of insect pest species of *Acacia* trees is still scarce. Thus, the study aimed at the identification and characterization of a pest insect group of worldwide importance: the longhorned beetles, among factors interfere with the health of *Acacia* trees; focuses on the assessment of tree characteristics that may trigger the infestation, overall aimed is managing of deteriorating biotic factors that stand against tolerating drought by *Acacia* species in a way to stand against climate change. This study was conducted in Kordofan region in a six of study sites three for *Acacia senegal* (gum Arabic producing tree), namely El Himaira, El Demokeya and Acacia Agricultural project study sites and two study sites for each of *Acacia mellifera* and *Acacia seyal*. Research was held in the 2007-2008 season. Temporary sample plots technique was conducted in all of study sites in this study to investigate on *Acacia* tree species. Logistic regression was used to analyses the data. The results of logistic regressions verified predictions about long-horned infestation, using all independent variables recorded (tree age, dbh, crown size, crown diameter, tree height and tree temperature) for each *Acacia* species, separately. *A. senegal*, *A.mellifra* and *A, seyal* indicate that even a single variable significantly affects the probability of infestation (response variable) with tree age as a predictor variable of 89.2% for *A. mellifera*, by 91.7% for *A. seyal,* and 91.1% for *A. senegal*. All other independent variables were excluded from the model classification table and were not considered as variables for the equation. It is recommended to consider tree age as factor enhances biotic activity on management activity to sustain *Acacia* trees.

Keywords: *Acacia mellifera*, *Acacia senegal*, *Acacia seyal,* Climate change, Kordofan region, Logistic regression, Long-horned Beetles, Sudan

Contribution to the bio-ecological study of *Anacampsis scintillela* Fischer von Röslerstamm, 1841 (Lepidoptera: Gelechiidae Anacampsinae) in Tunisia

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Abstract: Larvae of *A. scintillella* are polyfagous. It feeds on *Helianthemum vulgare*, *Cistus psilosepalus*, *C. crispus* and *C. salvifolius*; on *Halimium halimifolium*, on *H. lasianthum*. In Tunisia , larvae of *A. scintillella* were observed for the first time in 2010 on *H. halimifolium* in the defoliated shrub-forest (*H. halimifolium*, *Quercus coccifera*, *Pistacia lentiscus*, *Erica arborea* and *E. multiflora* and also *Q. suber*). The severe defoliation were caused by *Orgyia trigotephras* (Lepidoptera: Lymantriidae) where about 2500 ha from 3200 ha of the totality of the forest were defoliated. In 2013, *O. trigotephras* was substituted by *A. scintillella* and it was observed only on *Q. coccifera*. Preliminary investigations of bioecology of *A. scintillella* were carried out in three different regions: Nefza (Jebel Ediss), Bizerte (Séjnane) and Cap Bon (Ftahiz and Guitoun). To estimate host plant infestations', a direct counting was carried out on the host plant. Between 20 and 60 egg-masses were counted on *Q. coccifera*. About 30 Shelters from *Q. coccifera* were collected to be analyzed in the lab. Each shelter holds in 2 or 3 larvae. Results show that larvae and pupae of *A. scintillella* are protected between two or three leaves of the host plant. Larval development's condensed in time; it takes only one month to become adult. Larvae were observed in March, and adult was observed in April.

Biological study of *A. scintillela* is poorly studied, so far. In this paper, we present a contribution of its biological life, however, further investigation must be done to deepen bio- ecological study of this pest.

Keywords: *Anacampsis scintillella, Quercus coccifera,* Nefza, Bizerte and Cap Bon

Tomicus piniperda, main insect vector of pitch canker disease in *Pinus radiata* in northern Spain

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Abstract: *Fusarium circinatum* is the causal agent of pitch canker disease which is currently affecting *Pinus radiata* plantations in northern Spain. The main symptom of the disease is the presence of pitch soaked cankers in trunks and big branches. The pathogen needs a wound to infect the tree, as those caused by insects. Bark beetles (Coleoptera; Scolytinae) have been reported as vectors of this pathogen. The aim of this study is to know the role of *Tomicus piniperda* as a main vector of this fungus in *P. radiata* plantations in Cantabria (Spain). For this purpose, ethanol and α-pinene baited funnel traps were displayed and also affected shoots with *T. piniperda* feeding gallery were collected from the affected plots. Moreover, an experiment was set in the laboratory for testing the capability of *T. piniperda* in transmitting the disease as they had been previously inoculated with the pathogen and after fed in healthy shoots. Shoot feeding gallery and necrosis reaction length were measured. Morover, vegetal tissues and insects were cultured in Potato Dextrose Agar media. *Fusarium circinatum* was isolated from both field (11.42%) and lab shoots feeding galleries whereas lower rates of the fungus presence were isolated from insects collected in funnel traps. *Tomicus piniperda* becomes the most important insect candidate for transmitting the disease, since it is a primary pest as it feeds on *P. radiata* healthy crowns.

The biologic course of *Ips sexdentatus* (Boern.) on *Pinus pinaster* Ait. and *Pinus radiata* D. Don. plantations and the relations with the factors of site

Fazıl Selek

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Abstract: Bark beetles (Scolytidae) are one of the most important threats in our country's forests to place at risk the sustainibility of our forests. *Ips sexdentatus* (Boern.) (Six- spined engraver beetle) attack to *Picea* sp., *Pinus* sp. and *Abies* sp. in Blacksea, Mediterranean, Aegean and Marmara regions in our country. The insect killed 1.684.390 m³ *Picea orientalis* between 1928-1999. The life cycle of this dangerous insect is important to be known to control. This study was done for this reason.

To determine the biology of the insect 14 *Pinus pinaster* Ait. trap trees were prepared in İzmit and Adapazarı regions. 3 *Pinus radiata* D. Don. trap trees were prepared in İzmit region. First trap trees prepared in April, to determine the biology of the insects the second trap trees were prepared in July. The trap trees were observed 15 days periods the life stages of the insects were recorded. The regression analyze were done between the number of insects and tree age, diameter, slope, elevation, exposition, canopy closure. Between the number of insects and tree age, slope and exposition relations were nonsignificant. Between the number of insects and diameter and elevation relations were increasing, canopy closure were decreasing. To determine the adult flight of insects 14 pheromone traps were established in İzmit regions. The first generations of the insect were May-June and the second generations end of July and the first week of August.

Keywords: *Ips sexdentatus*, Bark beetles, Biology

Fungal symbionts of polyphagous shot hole borer (*Euwallacea* sp.) an ambrosia beetle (Coleoptera: Scolitiana) causing branch dieback and tree mortality on avocado and other host plants in California

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Abstract: The polyphagous shot hole borer (PSHB) is an invasive ambrosia beetle that forms a symbiosis with *Fusarium euwallaceae*. Together, they cause fusarium dieback (FD), a pathogen/insect complex that affects trees in agriculture, ornamental landscapes, and native forests in California. PSHB was first reported on black locust in California in 2003 but there were no records of fungal damage until 2012, when *Fusarium* euwallaceae was recovered from the tissues of several backyard avocado trees infested with PSHB in Los Angeles County. Since early 2012, FD has been confirmed on more than 120 species of tree in landscape and urban forest in Los Angeles, Orange, San Bernardino and San Diego counties. The objective of this study was to identify, characterize fungal species associated with the PSHB in California. Beetles and larvae from infested trunks were collected from eight different tree species including *Acer buergerianum*, *A. negundo*, *Acacia floribunda*, *Erythrina atitlanensis*, *Persea americana*, *Quercus agrifolia*, *Ricinus communis*, and *Salix* sp. in Los Angeles county. Beetles and larvae samples were collected from galleries and put directly into 1.5 ml tube containing 90% ethanol. All samples were brought to the laboratory (University of California, Riverside). Isolation from beetle and larvae, tubes with 70% ethanol containing beetles or larvae were vortexed for 10 s followed by three serial washings with sterilized distilled water. The beetles were aseptically dissected. The head and the abdomen of the beetle or larva were individually macerated in 1.5 ml tube containing 200 µl of sterile water with a sterile blue pestle. Tubes were vortexed a suspension of 50 µl was spread onto potato dextrose agar (Difco) amended with 0.01% tetracycline hydrochloride (PDA-tet). The relative abundance of fungal species associated with the Polyphagous shot hole borer (PSHB) in different hosts was determined by counting colony-forming units (CFUs) of each fungal species identified within the head and abdomen of ten beetles each from eight different hosts. *F.euwallaceae* and *Graphium* sp. were most frequently recovered form the head and abdomen (respectively) of the female beetles. Both fungi were recovered from the abdomen of the males at very low frequency, and were never recovered from the male heads. *Graphium* sp. was recovered at higher frequencies than *F. euwallaceae* from the larvae. These data suggest the beetle carries more than one fungal species, and this beetle–disease complex potentially may establish in a variety of plant communities locally and worldwide.

Identification, Occurrence, Incidence, and Associations of New Fungal Pathogens Associated with the Goldspotted Oak Borer (*Agrilus auroguttatus*) Affecting Coast Live Oak (*Quercus agrifolia*) in Southern California

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Abstract: California has experienced a significant decline in its native populations of oak species, with the loss of over 20 thousand oaks (*Quercus agrifolia, Quercus kelloggii,* and *Quercus chrysolepis*) in southern California alone. This report presents a 2-year assessment of the role of pathogens and their associations with the goldspotted oak borer (GSOB, *Agrilus auroguttatus*) in coast live oak (*Q. agrifolia*) woodlands in southern California where oak mortality is occurring. The objectives of this study were to (i) identify fungal pathogens associated with canker symptoms on coast live oak at GSOB- infested and -uninfested sites in southern California; (ii) assess the occurrence and incidence of GSOB and pathogens throughout these regions; (iii) identify factors that determine distribution of pathogens and their establishment in relation to GSOB occurrence; (iv) assess how these agents influence mortality of *Q. agrifolia*. To meet these objectives, a network of 45 plots were established throughout GSOB-infested and - uninfested locations. Tissues were sampled from all symptomatic trees per plot, of which six trees were more intensively sampled from two positions on the trunk. Compositional and environmental variables explaining mortality and incidence of pathogens and GSOB in plots were determined using multiple linear regression analysis; sets of variables predicting pathogen and GSOB presence on trees were determined using multiple logistic regression analysis; probabilities of agents co-occurring in a plot were determined using association analysis; and how agents colonized trees at positions and plant tissues of the intensively sampled trees was determined using Fisher's exact tests. Seven fungal species were newly identified as pathogens of coast live oak and two (*Diplodia agrifolia* and *Cryptosporiopsis querciphila*) were newly described. Multiple logistic regression models explained that GSOB, *D. corticola, Fusarium solani, Dothiorella iberica, Diatrypella verrucaeformis*, and *C. querciphila* may precisely be predicted by an assemblage of many variables for each agent, not only trunk staining. Fisher's exact test analysis determined that *F. solani* was recovered at significantly greater proportions from the trunk compared to the crown. All other fungi were recovered at significantly greater proportions from the crown; *D. iberica* was the only fungus that was recovered at greater proportions from the upper bole. Multiple linear regression models showed high correlation between environmental variables and plot-level incidence of both GSOB and *D. corticola*. Disease incidence for *D. corticola* was highest in GSOB-uninfested locations. Jaccard index of association showed that *D. corticola* was negatively associated with the presence of GSOB, *F. solani* and *C. querciphila*. *Cryptosporiopsis querciphila* was most prevalent at GSOB-infested sites, and was recovered at significantly greater proportions from GSOB exit holes on the trunk compared to tissues sampled from symptoms of staining and non-GSOB exit holes. Cumulative coast live oak mortality was not significantly different between sites and was correlated with GSOB and *Diplodia corticola* incidence and negatively correlated with annual relative humidity. Results suggest a potential association

between GSOB and *C. querciphila*, and that oak decline in southern California is an example of a complex syndrome involving strong intra-regional differences in factors that are associated with the problem.

SESSION 4

POPULATION DYNAMICS AND INVASION PROCESSES

Spatial Synchrony in Forest Insect Outbreaks: Why is it so Ubiquitous?

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Abstract: Spatial synchrony refers to the coincident temporal variability in the abundance of geographically disjunct populations and is a characteristic shared by virtually all species of insects. For insect species that occasionally reach outbreak densities, it is the characteristic of spatial synchrony that determines their pest status because outbreaks occurring synchronously over large areas are likely to result in more substantial ecosystem and sociological impacts. Despite the ubiquity and importance of spatial synchrony, its causes are often not clear. Spatial synchrony can result from 1) dispersal of individuals among populations, 2) synchronous trophic (e.g., parasitism) effects and 3) synchronous stochastic (e.g., weather) effects. Unfortunately it is often difficult to identify the relative contribution of these mechanisms and synchrony observed in real populations is likely the result of several mechanisms. Temporal variability in weather is universally synchronous and this is a plausible explanation of the ultimate ubiquity of synchronous population dynamics. However, understanding synchronous dynamics requires identifying both the factors contributing to synchrony as well as those processes that desynchronize populations. Recent work indicates that spatial synchrony among populations can vary among different geographic regions and through time. Such analyses provide some novel insight into the causes of spatial synchrony and may also provide information about how climate change affects forest insect population dynamics.

The pinewood nematode, *Bursaphelenchus xylophilus*, and pine wilt disease: a serious forest threat to Turkey and Europe

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Abstract: *Bursaphelenchus xylophilus*, the pinewood nematode (PWN), and the causal agent of pine wilt disease (PWD), was detected for the first time in 1999, in Europe, in Portugal. The PWN has been detected in new forest areas in the center of the country, in 2008, despite efforts developed by the national forestry and quarantine authorities to control the nematode and its insect vector (Monochamus galloprovincialis). The nematode has also recently been reported to be present from Madeira Island and Spain. Circulation of non-treated wood and wood products may explain the spread of the nematode. Control strategies have been focused on the vector by using chemical traps, by cutting down symptomatic trees, heat-treatment of lumber, and monitoring of main roads and ports through which lumber and wood products are transported, by the Portuguese authorities. The nematode constitutes a threat to the rest of Europe, if proper measures are not taken by European governments. The same applies to Turkey which displays a particularly sensitive geographical location. Study topics on this issue include nematode and insect bioecology, pathogenicity, use of molecular biology in diagnostics and detection, histopathology, etc. Many gaps in the knowledge of this complex biological system persist. The involvement of bacteria, associated with the PWN in causing pine wilt, has been claimed. Results on the bioecological role of bacterial associates (of pine, nematode and insect) will be presented, including preliminary results from Turkish insects. New quick detection methods and the understanding of the nematode population dynamics are being developed. Nematode genomics may provide some insight to better understand the pathogenic effects caused inside the plant. Pathogenicity testing of susceptible pine species is imperative. A review of the progress is hereby presented.

Evolutionary responses to a highly variable resource: comparison of life history strategies in forest seed insects and consequences for management

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Abstract (in an order of introduction, methods, results, and conclusion): Masting, i.e. a highly variable and synchronous production of seeds by plants, has been reported in a broad group of forest trees. This particular pattern of reproduction is thought to have adaptive significance. One of the most popular hypotheses of an evolutionary advantage of masting is the predator satiation theory. It postulates that years of low seed production keep the populations of seed predators at low levels so they are unable to consume all the seeds in years of high seed production. In parallel, specialist forest seed insects have evolved various life history strategies to track a highly fluctuating resource including dispersal, asexual reproduction and extended diapause. Using field observations and population dynamics models, we assess some of these strategies in terms of their: (1) intrinsic ability to sustain seed insect populations, (2) comparative advantages in situations of interspecific competition, (3) implications in the invasive capacity of individual species. We discuss how these results provide support for the predator satiation theory and potential applications in seed insect pest management in natural stands and seed orchards.

An outbreak of *Thaumetopoea pinivora* at the northern edge of its distribution range

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Abstract: The northern pine processionary moth *Thaumetopoea pinivora* has a peculiar global distribution, occurring in isolated populations at high-altitude locations in southern Europe while primarily residing close to sea level in northern Europe. Outbreaks of *T. pinivora* have been documented from central and northern Europe but never over large areas. There are no outbreaks recorded from southern Europe. The largest outbreak documented so far (3,000 ha) started in 2004 in south Sweden on the island of Gotland in the Baltic Sea. The density slowly declined, but spots with high density still occur. In the talk I will present details about *T. pinivora* life history, and discuss the present outbreak in Sweden in relation to general patterns in insect biogeography and population dynamics of defoliating insects.

Identifying contrasted processes in the invasion history of the maritime pine bast scale *Matsucoccus feytaudi* across Southern Europe

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Abstract: Deciphering the colonization processes by which introduced pests invade new areas is essential to limit the risk of further expansion and/or multiple introductions. We studied the invasion history of the maritime pine bast scale *Matsucoccus feytaudi* using molecular markers to trace the origins of the invasive populations, and to understand the demographic processes involved in the successive steps of its colonization history.

M. feytaudi is a specific pest of the maritime pine *Pinus pinaster*. It is naturally present in the western part of the Mediterranean basin, i.e. in South-Western France, the Iberian Peninsula and Morocco, where its impact on the host tree is negligible. On the contrary, the scale caused severe outbreaks responsible for the decline of 120 000 ha of maritime pine in South-Eastern France where it was detected in the 1960s. It reached Italy in the late 1970s where it is still expanding southwards. Moreover, in the island of Corsica, its range has been continuously growing since its first detection in 1994, rapidly causing heavy tree mortality.

We used population genetics approaches to infer the populations' recent evolutionary history from seven microsatellite markers, and Approximate Bayesian Computation to explicitly test various colonization scenarios to determine the most likely origins of the main colonized areas and to estimate the intensity of the founder effect at each step. Consistent with previous mitochondrial data, we showed that the native range is geographically strongly structured, which is probably due to the patchy distribution of the obligate host and the limited dispersal capacity of the scale. Our results showed that the invasion history can be described in three successive steps involving different colonization and dispersal processes. During the mid- XXth century, massive man-aided introductions occurred from the Landes planted forest in South-Western France to South-Eastern France, probably due to transportation of infested wood material during or after World War II. Stepping-stone expansion, consistent with natural dispersal of winged males and aerial transport of larvae, then allowed *M. feytaudi* to reach the maritime pine forests of Liguria and Tuscany in Italy. The island of Corsica was accidentally colonized in the 1990s, and the most plausible scenario involves the introduction of a limited number of migrants both from the forests of South-Eastern France and from Liguria. Such a scenario is consistent with a long-distance aerial dispersal of larvae due to the locally dominant winds, namely strong Mistral events associated to outflows blowing from Liguria and the Gulf of Genoa (the "Genoa cyclone"), that occur in spring in this region, i.e. when the larvae are developing.

Modelling the effects of climate change on the distribution of pine processionary moth populations in Turkey

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Abstract. Anthropogenic climate change is one of the most popular scientific topics of the last decades due to its significant consequences in ecosystems. However, organismic studies, especially those focusing on specific forest pests are limited.

Larvae of the two pine processionary moth (PPM) species, *Thaumetopoea pityocampa* and *T. wilkinsoni*, cause severe allergies in mammals and are dangerous defoliators of Mediterranean pines. While *T. pityocampa* occurs mainly in Europe, *T. wilkinsoni* occurs in Turkey and the Middle East. Recent studies showed that ranges of the two species contact in Turkey. PPM has been known as one of the organisms that respond climate warming by expanding its range both latitudinally and altitudinally. However, all studies on this issue have been conducted on *T. pityocampa* in Europe; and response of *T. wilkinsoni* populations is completely unknown. Furthermore, despite to the significant amount of budget created for their management in Turkey, it is not known whether these two species' ranges will change in this part of the Mediterranean Basin.

In this study, we aimed to model PPM's future distribution through Turkey and surrounding countries by using Maximum Entropy Modeling (MAXENT) software. Our results indicated that southeastern and northeastern Turkey, and Black Sea coasts of Georgia and Russia, where PPM does not exist today, might be suitable places for PPM invasion by 2080.

We suggest to create a risk map for PPM invasion under different climate change scenarios with a resolution high enough to indicate local scale predictions. Such a map would provide valuable insight for afforestation and forest management practices.

Monochamus galloprovincialis distribution in Aleppo pine forests in Tunisia

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Abstract: The pine sawyer *Monochamus galloprovincialis* is one of the main vectors of the pathogenic pine wood nematode (PWN) *Bursaphelenchus xylophilus*, the causal agent of pine wilt disease. Although not present in northern Africa, it is feared that the PWN may cause significant damage if introduced into the Maghreb region, where it will have various pine species which can serve as hosts and insects of the *Monochamus* genus, which can act as vectors of *B. xylophilus*.

In order to assess the risk of wilt disease, we studied the presence of the pine sawyer beetle in Tunisia, characterizing its distribution and emergence pattern. Studies were carried out in nine Aleppo pine (*Pinus halepensis*) forests, belonging to the humid (Azib and Dar fatma forests), subhumid (Darchichou and Oued bir forests), semi arid (Sidi aouidet, Sidi said and Kebouche forests) and arid bioclimate (Samama and Ain amara forests), and covering the main pine forests of Tunisia. Survey of *Monochamus* relied on the trap tree technique, in which two pine trees were cut in each site from july 2011 to august 2011 during three occasions, and kept in the field for 43± 2,7 days to allow for pine sawyer oviposition. Three logs were cut from the basal, medium and the upper part of each tree (N= 54 logs), and taken to the INRGREF Entomological Laboratory in Tunis, where they were kept separately in insect-proof bags under natural conditions, being weekly monitored until september 2012. Emerging adult insects were collected, counted, identified and conserved in alcohol (95%).

We confirmed the presence of *Monochamus* beetles in Tunisia, with *M. galloprovincialis* found to be widespread in the Aleppo pine forests of the nine locations surveyed. Nevertheless, the number of beetles reared from the various locations differed significantly, being higher in Sammama, Oued bir and Kebouche forests, while lowest emergencies were reported from the Azib and Sidi Said forests, which could results from variations in the population abundance between forests, related to the availability of suitable hosts for oviposition or bioclimatic influences. Overall, a total of 1,838 adults emerged from 94% of the trap-tree logs, with an average of 19,72± 3,8 adults from each log. Our results shows that this specie can develop and emerge from the basal, median and the upper part of the Aleppo pine tree with similar success. Larval development took nearly one year, and adult emergences occurred from May to August, 2012. Results are discussed in view of similar biological studies conducted in other Mediterranean countries, and the implications for the risk assessment of pine wilt disease in Tunisia.

Keywords: Pine sawyer, *Pinus halepensis*, Emergence, Xylophagous beetle, Pine wilt disease

SESSION 5

FOREST DECLINE, INSECT SURVEY AND CONTROL, FORESTRY PRACTICES

Tree species composition rather than diversity triggers associational resistance to the pine processionary moth

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Abstract: The reduction of insect herbivory is one of the services provided by tree diversity in forest ecosystems. If it is increasingly acknowledged that the compositional characteristics of tree species assemblages play a major role in triggering associational resistance to herbivores, underlying mechanisms are less well known.

We addressed this question in the ORPHEE experiment in which a total of 25600 trees of 5 native species (European birch, *Betula pendula*; pedunculate oak, *Quercus robur*; Pyrenean oak, *Quercus pyrenaica*, holm oak, *Quercus ilex*; and maritime pine, *Pinus pinaster*) were planted in 2008 within a 12 ha area. Eight blocks were established, with 32 plots in every block, corresponding to the 31 possible combinations of 1 to 5 species, with an additional replicate of the combination of 5 species. In particular, 17 species combinations contained pines.

We assessed pine processionary moth infestations (*Thaumetopoea pityocampa*) across the whole tree diversity gradient, from pine monocultures to five species mixtures. We showed that tree species richness *per se* had no effect on the probability of attack by this pest. By contrast, the infestation rate was strongly dependent on plot composition.

Mixtures of pines (*Pinus pinaster*) and birches (*Betula pendula*) were less prone to *T. pityocampa* infestations, whereas mixtures of pines and oaks (*Quercus* spp.) were more often attacked than pine monocultures. By taking into account the relative height of pines and associated broadleaved species, this effect could be explained by pine apparency. Birches, as fast growing trees, were on average taller than pines, while oak trees were significantly smaller. Host trees of *T. pityocampa* were then partly hidden in mixtures of pines and birches but more apparent in mixtures with oaks. We suggest that reduced pine apparency disrupted visual cues used by female moths to select host trees prior oviposition.

This study highlights the need to take into account tree traits such as growth rate when selecting the tree species that have to be associated in order to improve forest resistance to pest insects.

Keywords: Associational resistance, Biodiversity, Forest, Herbivory, ORPHEE, *Thaumetopoea pityocampa,* Tree apparency

Results from the FORRISK project show that tree density and apparency explain the probability of attack by the pine processionary moth

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Abstract: The pine processionary moth (*Thaumetopoea pityocampa*) is the main pine defoliator in the Mediterranean area, requiring constant survey and regular pest management. For that a better knowledge of the spatial distribution of infested trees both among and within stands is important. In the FORRISK project (Interreg Sudoe), we hypothesized that the probability of PPM infestation depends on two main mechanisms operating at two different spatial scales: host tree density at the stand scale and host tree apparency at the individual tree scale. To test these assumptions we sampled 171 maritime pine stands in the Landes de Gascogne, the largest plantation forest in Europe. We showed that PPM infestation (percentage of infested trees) significantly decreased with stand density, being higher in older stands. The probability of a pine tree to be attacked significantly increased with tree height and proximity to stand edge. The exposure of sentinel egg batches at increasing distance from stand edge showed no difference in mortality rate. These results are consistent with previous observations of active host tree selection by adult female moths based on visual cues, in particular the shape of tree crown silhouette against a clear background. Our findings suggest that stand management can modify the risk of damage by the pine processionary moth, advocating the development of predictive tools based on forest growth models.

Silvicultural assessment based on some factor that causes oak decline

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Abstract: Turkey is one of the world's leading oak site in terms of species richness and covered land. The term of Oak Death (oak decline) is expressed as a collection of events ultimately killed and destroying trees violently including a series of biotic and abiotic factors other that is triggered typically by abiotic stres. Each factor distorting the normal physiological functions of any tree prepare a suitable environment for Phytophthora species and Armillaria Factors such as low pH, lack of water retention capacity in the soil effects in a negative way the stand health.Oak afforestation or reducing the strength of stand around will not be the right approach in southern slopes having shallow soil conditions having burning and drying effects of sun exposed. Oak seeds is eaten largely by pigs, mice, birds, insects and pests.It is a species damaged from frost, drought and high temperature when young.Therefore, it is necessary to be decide considering these features of oak for natural and artificial regeneration.The highest compression values were found in damaged oak stands.Therefore, tillage is very important, especially in oak plantations and need to be implemented methods of tillage tools ventilating the soil. Research shows that leaves benefit cause lack of nutritional ingredients. Protection measures should be increased in coppice forest and should continue to be regularly coppice management or should be continued improvement works. In case of proper maintenance procedures, it should be remembered that easy to obtain youth from seed consequent and seed yield. Local seed sources should be used to improve the local environment in terms of resistance.It is remarkable that are more disease factors in b development period of oak species and in the third closure. Dead organic matter in the field of healthy cover ratio is higher than in the dry areas. Spacing should reduce disease. Remain under pressure and the continued lack of light leads the deformation of the hill in youth.Healthy body can be achieved with stimulus segments sections stimulus in this type of areas. It is used mostly outside the limits of their optimum distribution species as *Q. robur* and this is one of the possible causes of death.Therefore, species not should be taken out of habitat through sowing and planting. Disease agents in oak species is seen at least in Cupped oak (*Q. cerris*) and maximum in Pedunciek oak (*Q. robur*). It is important monitoring of changes in health status and Consideration of the data in those applications.Habitat surveys should be very good in oak candidate afforestation area and should be examined well factors of climatic and edaphic and biology of the species. It should be cautious against pests to avoid unnecessary costs in the oak sowing field and should be preferred planting the scuba saplings instead of sowing in this area, if possible.

Keywords: Oak, Disease, Afforestation, Planting

Cedar forests under the threat of new pests

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Abstract: Insects can have negative impacts on the cedar forests and even hinder its productivity both in its natural range but more in its artificial area. The insects collected on cedar trees can be categorized into phytophagous, xylophagous, saproxylophagous and entomophagous. If this last category is beneficial to the tree, other species belonging to the first two categories, often cause damages to the cedar. In addition, other phytophagous and xylophagous insects living on the cedar are known as simple parasites or considered as potential pests may become harmful as well to the tree when they reach outbreak populations. Most of those insects are monophagous and feed only on cedars. This host plant - insect relationship seems to be so strong that some selectivity is established between insects and their host plants that make insects living on any tree are in general absent on the other. Currently this relationship is challenged to find some insects affiliated to other trees are able to feed on the cedar and even jeopardize the tree.

During our investigations on the cedar insects that include field observations, samplings, breeding ... we have often identified known or new monophagous or polyphagous pests on the tree. In the same time we have noticed the sporadic presence of some phytophagous or xylophagous insects, feed only on the cedar, but their damage was insignificant because of the low level of their populations. It is known that in a natural complex forest system insect populations are kept in balance simultaneously by the action of a series of non biotic (climate, etc ...) and biotic (natural enemies) factors. We currently have noticed that these insects can outbreak to harm the tree. Examples are numerous including a xylophagous insect whose presence was rare but nowadays it occurs in all cedar forests that are in the process of dying back, for instance, in North Africa. In addition, we remarked the apparition of some phytophagous or xylophagous insects, living on other trees, on the cedar and constitute currently a threat to the cedar forest. This seems to be a new phenomenon that concerns artificial cedar forests more than the natural ones.

We intend to review the cedar pests and focus mainly on the emergence of new pests and their threats to the tree in Western and Easter Mediterranean forest cedars. Phytophagous or xylophagous insects, hosted by the cedar or come from other trees, will be considered. Their symptoms on the cedar and the possible causes of their outbreaks will be presented. The need for closer cooperation between Mediterranean countries, where the cedar exists, will be discussed to monitor the pest populations of the tree.

Cork-oak stand protection in Portugal trapping *Platypus cylindrus*

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Abstract: Cork oaks (*Quercus suber* L.) are currently the second most widespread tree species in Portugal, covering 737.000 hectares and corresponding to 23% of the total forest area in continental Portugal. The cork oak stands are an environmental unique production system with multiple activities, along with the cork production, such as livestock, hunting, mushroom production, aromatic herbs, among others. Cork is the main product of exploitation, representing over 800 M Euros income only in 2005 (2,73% of Portuguese Gross Product) and ensures its economic sustainability. Over time several diseases and pest outbreaks have caused significant tree mortality and for the last decade the Oak pinhole borer *Platypus cylindrus* Fabr. an ambrosia beetle is the most serious damaging pest in Portugal. Until recently the only existing control managing technique was the cut and disposal of infested trees, but now the use of pheromone lured slit traps is a useful tool for monitoring and control of the beetle's populations. The placement of these traps with pheromones in Herdade dos Leitões cork oak stand near Montargil (Portugal) during three years allowed the capture of over 200.000 beetles. Over the years the total number of beetles continuously decreased to such extend that during 2013 less than half was captured than in 2011. In this presentation we intend to discuss the results obtained with this control method during three years and the factors affecting its efficiency.

Testing of traps baited with semiochemical attractant to capture cork oak borer, *Coraebus undatus*, in southern Portugal

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Abstract: The cork oak borer, *Coraebus undatus*, is a beetle of the family Buprestidae which can be found in Europe and north of Africa. In the Iberian Peninsula it is commonly found in cork oak (*Quercus suber*), where the larvae built galleries that damage the cork and decrease its quality. Currently there are no effective strategies to manage or control this pest, although there are reports of a response to a semiochemical attractant which is used in southern Spain to capture insects. Based on these studies, a similar experiment was initiated in southern Portugal to test the same attractant, with the objective of evaluating its use for monitoring or control and to study the local flight curve of *C. undatus*. Purple prism traps of polypropylene (100 x 53cm^2) were placed in selected cork-oak stands during 2012 (eight stands from July to September) and 2013 (six stands from May to October). Stands were chosen because of historical high levels of attack by *C. undatus*, and therefore were assumed to have high populations of this insect pest.

Captures of the cork oak borer were very low and only during July and August in both years: In 2012 two beetles were caught, while in 2013 a total of 11 individuals were caught, corresponding to just 1.7% of the total captures of buprestids. A total of 14 species of others buprestids were captured in a total of 1.421 individuals. Variations between plots are probably related to local differences. In both years captures were largely dominated by the species *Chrysobothris affinis*, (80% of the captures in 2012 and 76% in 2013). Overall, results suggest that this trap model is effective in capturing diverse buprestid species, and is recommended for studies of biodiversity assessment or evaluation of population abundance. Although baited traps caught more buprestids of all species, the attractant does appear to be specific or effective against the cork oak borer. The low captures observed in southern Portugal contrast with much higher captures reported for Catalonia (Spain), using the same traps and attractants. Several reasons may explain these pronounced differences, such as variations in the population levels between the two places, or variations on the response of the two populations to the same attractant, and are discussed in this presentation.

Pheromone trap height for cone insects in *Picea abies* seed orchards

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Abstract: *Dioryctria abietella* (Lepidoptera: Pyralidae) and *Cydia strobilella* (Lepidoptera: Tortircidae) lower seed production in Norway spruce seed orchards. The infestation rates of the two species vary from 10 or 80 percent from year to year. A monitoring method would be a beneficial tool in orchard management.

In Finland white delta traps baited with synthetic female pheromones (Wang *et al*. 2010, Löfstedt *et al*. 2012) were set at height of 1.5 m but the trap captures were low despite the high damage rate observed in the cones. As the flowers and cones grow in the upper part of the tree crowns, different trap heights (1.5 m, 3 m, 6 m, 9 m and 14 m) for both *D. abietella* and *C. strobilella* were tested in high (16 – 19 m) and low (7 – 9 m) seed orchards.

In the high orchard comparison of trap heights of 1.5 m and 14 m revealed that *D. abietella* was not attracted to 1.5 m traps and all the specimens were caught at 14 m. *C. strobilella* males were equally attracted to traps at 1.5 m and 14 m. When the trap height of 9 m was added to the design *D. abietella* males were still caught mostly at 14 m, only some at 9 m and none at 15 m. For *C. strobilella* the catch at 9 m was more than double the catch at 1.5m and 14 m.

In the low orchard some *D. abietella* was caught above the canopy but the highest catch was at 9 m and almost zero at 1.5m. No *C. strobilella* was caught above canopies at 14 m. Also the catch at 9 m was low and four times more were caught at 1.5 m. Finally, comparisons among trap heights of 1.5 m, 3 m, 6 m and 9 m revealed that highest trap captures for both species were at 6 m that approximates 2/3 of the canopy height.

For now, no rule of thumb for monitoring height exists. More knowledge is needed on the correlation of the damage rates and trap captures in space and time. In conclusion, *D. abietella* tend to fly and be attracted to pheromones higher than *C. strobilella*.

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Egg masses analysis of pine processionary *Thaumetopoea pityocampa* (Denis and Schiffermüller 1775) (Lepidoptera: Notodontidae) in cedar forests of Algeria

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Abstract: In Mediterranean countries spectacular defoliation of pine and cedar forests are caused by the pine processionary moth. In Atlas cedar forests egg masses of *T.pityocampa* are deposited as plates on thick twigs wrapped around branches of small dimensions. These ooplaques are covered by small scales that match the colour of selected branches. Eggs are laid in 9 to 20 parallel rows. Batches of 78 clutches were collected at about a 2 meters height from trees across a transect of about 200 meters in the cedar forests of (1) Chrea, (2) a sub-humid area of Chelia, and (3) a semi arid area in Theniet-El-Had. Before packaging the biological material the length of each egg was recorded. Measured samples were then stored in a tube closed with cotton to ensure aeration. Biological material thus prepared was daily checked to monitor outbreaks of caterpillars in relation to daily temperatures. Careful counting of hatched and unhatched eggs parasitized was performed on harvested clutches. Biometry of egg masses showed similar lengths among the three sites, ranking from 25 to 29 mm. Number of eggs per clutch was similar in Chelia (54-314 eggs) and Theniet-El-Had (48-286 eggs), but was higher in cedar forests from Chrea (110-380 eggs). In this last place hatching rate was 51.3%, whereas in cedar forests of Theniet-El-Had the rate lowered to 44.6 % and to 12.8% in Chelia. This reduction proportion can be explained by late flights of the population that takes place after July. Examination of protective scales eggs provided information about their size and shape, and their role in protecting eggs. Shape and size of scales allowed to characterize the species or the type of processionary population in its biotope.

Examination of biological material showed a diversity of three Chalcididae egg parasitoids: *Baryscapus servadeii, Ooencyrtus pityocampae* and *Trichogramma embryoph agum*. Parasitism rate varied from one batch to another and from one station to another. In Theniet El-Had and Chrea the calculated rates were 14.4% and 13%, respectively. In forests of Chelia this rate decreased to 7%. A presentation and discussion of these results follows.

Analyse des pontes de la processionnaire du pin *Thaumetopoea pityocampa* (Denis et Schiffermüller 1775) (*Lepidoptera*: *Notodontidae*) dans quelques cédraies (Algérie)

Résumé: Dans les pays méditerranéens, des défoliations spectaculaires de forêts de pins et de cèdres sont occasionnées par la processionnaire du pin: *Thaumetopoea pityocampa.* Sur le cèdre de l'Atlas, les pontes de *T. pityocampa* sont déposées sous forme d'ooplaque sur des rameaux épais, où enroulées autour des rameaux de petites dimensions. Elles sont recouvertes par des écailles de taille réduite et de couleur variable en parfaite homochromie avec les rameaux choisis. Les œufs sont déposés en rangées parallèles, variables de 9 à 20. Des lots de 78 pontes ont été récoltés à hauteur d'homme à partir des arbres répartis

sur un transect de l'ordre de 200 mètres dans les cédraies de Chréa en zone sub-humide, de Chelia et de Theniet- El-Had localisées en zone semi-aride. Avant le conditionnement du matériel biologique, la longueur de chaque ponte est notée. Les échantillons mesurés ont été conserves individuellement dans des tubes à essai fermés à l'aide du coton pour assurer une aération. Le matériel biologique ainsi préparé est contrôlé quotidiennement pour suivre les éclosions des chenilles en relation avec les températures journalières. Un comptage minutieux des œufs éclos, non éclos et parasités a été effectué sur les pontes récoltées.

La biométrie des pontes de la processionnaire, *T.pityocampa* en provenance des cédraies prospectées a révélé des longueurs significativement comparables, allant de 25 à 29mm. L'analyse des effectifs des œufs par ponte reste comparable dans les sites de Chelia (54 à 314 œufs) et de Theniet-El-Had (48 à 286 œufs). Les pontes en provenance du cèdre de l'Atlas de Chréa se caractérisent par des nombres plus significatifs (110 à 380 œufs) par ponte avec un taux d'éclosion de 51,3% de l'effectif global. Dans la cédraie de Theniet-El-Had on note une réduction à 44,6% et dans la cédraie de Chelia, le taux d'éclosion se limite à 12,8%. Ce faible taux enregistré peut s'expliquer par les vols tardifs de la population qui s'effectuent après le mois de juillet en relation avec les variations des températures et ne donne généralement pas de descendance.

L'examen des écailles protectrices des œufs a permis de tirer des informations sur leur dimension, leur forme et leur rôle dans la protection des œufs. Un critère taxonomique basé sur la forme et la taille des écailles caractérise la population ou le clade de la population de la processionnaire dans son biotope.

L'examen du matériel biologique a mis en évidence une diversité de trois *Chalcididae* parasitoïdes embryonnaires actifs: *Baryscapus servadeii, Ooencyrtus pityocampae* et *Trichogramma embryophagum.* Le taux de parasitisme varie d'une ponte à une autre et d'une station à l'autre, dans les sites de Theniet El-Had et de Chréa les taux sont respectivement de 14,4% et de 13%, dans la cédraie de Chelia il se limite à 7%. Nous nous proposons de présenter et de discuter les résultats obtenus sur les pontes en provenance du cèdre de l'Atlas localisé dans les deux étages bioclimatiques prospectés.

Host alternation by egg parasitoids, the role of the variegated caper bug *Stenozygum coloratum* in seasonal activity of *Ooencyrtus pityocampae*

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Abstract: Many parasitoid species are thought to switch between different host species. However, the increasing use of molecular tools during the last decades revealed that many parasitoids which were considered as rather generalists, are actually an ensemble of closely related and morphologically similar species (known as cryptic/sibling species), each occurring on a single host, or having a narrow host range. The present study focused on *Ooencyrtus pityocampae* (OP), a well known egg parasitoid of the pine processionary moth (PPM, *Thaumetopoea wilkinsoni/pityocampa* complex), which also naturally occurs in the eggs of the variegated caper bug (CB). These two hosts frequently share the same habitat in the Eastern Mediterranean, but their eggs are laid in different seasons – CB in spring and summer, PPM in autumn. Emergence of OP adults from the eggs of PPM throughout the spring and summer led us to hypothesize that the OP population alternates seasonally between these two hosts. If indeed CB serves as a summer springboard for OP, it may play a significant role in enhancing the biological control of PPM. However, the distinctly different sex ratio of OP population emerging from PPM eggs (~ 0.5% males) as compared to that of OP obtained from the CB eggs (25% males), and the fact that unlike the OP population in autumn, OP summer population is apparently not attracted to the PPM sex pheromone, have led us to suspect that the two populations might be disparate. As a result, the occurrence of host alternation was questioned. Our study focused on the genetic similarity between the two OP populations found on the respective hosts, and on the biology and ecology of the CB, whose life and seasonal histories are practically unknown.

Molecular data revealed five *Ooencyrtus* spp. emerging from the CB eggs. Only one of them, OP, is obtained from PPM eggs, and most likely alternates seasonally between the two hosts. The distinction between the species is difficult and they are not yet fully identified. They vary in habitat preferences and probably also in their ecological requirements.

It was found that CB reproduces on several *Capparis* spp.; many other plant species, unrelated to the Capparaceae family, served for feeding only, usually at summer end when caper fresh foliage becomes rare. Large CB aggregations, which often occur, result in fast defoliation of the infested caper plants, and many become completely dry as early as mid summer, and resume growth in the following year. Non-colonized plants, however, continue to grow until late autumn. Other pentatomid species develop on the caper plants and on some occasions they were found to be more common than CB. Most of them were also parasitized by the same studied guild of *Ooencyrtus* spp. This further emphasizes the importance of the caper plant as a refuge for several egg parasitoids including OP, a major natural enemy of PPM. This case study put forward an example of the importance of multi- trophic interactions, and the role of biodiversity on the regulatory mechanisms, which often remains hidden and not easily revealed.

Diversity and importance predators and parasitoids of the gypsy moth, *Lymantria dispar* L. (Lepidoptera, Lymantriidae) in outbreaks phases (Blida, Algeria)

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Abstract: The density of ovo-larval stages and pupae of *Lymantria dispar* in the National Park of Chrea (Blida, Algeria) is affected by a number of natural predators, which much help to regulate its population outbreaks. A study carried out between 2006 and 2009 along an altitudinal gradient of the Park, revealed the presence of these natural enemies, which showed different strategies with regard to population density of the moth. Among the most active parasitoids, *Ooencyrtus kuvanae* was mostly found parasiting the eggs mass of gypsy moth. In 2007, the estimated rate of parasitism was 29% and this figure increased to 46.29% during the following year. The Braconidae *Aponteles* sp. parasited the moth at lower rates, 2% (2006) and 10% (2007). Infestation by pupae of the chalcidid wasp *Brachymeria intermedia* is highly variable from site and from year, ranging from 0 (chestnut, 2006) to 63% (holm oak, 2006) at an altitude of 1100 m. During 2007 the rate varied between 4% (holm oak with cedar at 1400 m of altitude) to 15% (cork oak, 600 m of altitude). The tachinid fly *Exorista segregata* predated on *Lymantria dispar* pupal stage in both chestnut and holm oak trees (14% and 20%, respectively). Analysis of spawning has revealed the presence of four species of egg-feeders: *Trogoderma versicolor*, *Anthrenus* sp*., Anthrenus exilis*, and *Attagenus* sp*.*

The ground-beetle *Calosoma sycophanta* was also an active predator, thus much reducing the density of *L. dispar*. During preimaginal stages *C. sycophanta* preferably eats nymphal stages, whereas adults eat about ten larvae per day.

Outbreaks of gypsy moth are cyclical and dependent upon both biological and environmental factors. Natural predators act as a whole making up an effective biological control, as they are seasonally diversified and vary with regard to the different host plants of *L. dispar.* Despite their effectiveness, the biopesticides used in forests disrupt the action of these natural enemies and make it difficult the maintaining of their populations over time.

Impact of egg parasitoids on the control of pine processionary populations in stage infestation in the Chrea National Park (Algeria)

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Abstract: The sustainable protection of the cedar forest against of pests is particularly linked to the knowledge and the role of complex of natural enemies. Among the Parasitoids, eggs antagonists of *T. pityocampa* exert a crucial role in regulating pine processionary population levels during its development. The investigations carried during 2010 showed a severe pine processionary moth outbreak in the cedar forest of Chrea National Park (Blida, Algeria). To assess the impact of eggs parasitoids on the biological control of the processionary, 200 egg masses were collected from this forest during the summer. Egg masses were individually placed in rearing tubes and controlled daily in the laboratory. After hatching, an enumeration of the different categories of eggs has been carried. Emerged parasitoids were separated and identified. The results obtained showed that the emergence rate is 89. 6%. The rate of parasite individuals is 4.2%. Three egg parasitoids have been identified: *Trichogramma embryophagum, Baryscapus servadeii* and *Ooencyrtus pityocampa.* The effect of these species of parasitoids was compared. A significant difference in their efficiency was confirmed. The obtained results showed a high parasitic performance by *T. embryophagum.* Eggs masses infested by this species are significant destroyed compared with other parasitoids. The rates have also shown a high density of pine processionary populations. This significantly reduces the incidence of eggs parasitoids. The control strategy of pests in protected sites must focus on all of the interactions among parasites. Natural antagonists will have impact if their action is synchronized. In this context it appears essential to further investigate the different interactions that govern the mode of parasitoids action in their natural site.

Keywords: Cedar, pine processionary, egg parasitoid, biological control, interaction

Importance of the predation and parasitism of *Orgyia trigotephras* (Boisduval 1829) (Lepidoptera, Lymantridae) in Tunisia

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Abstract: Phytophagous insects may select plants or plant parts not only based upon nutritional content, but also on the intensity of predation and parasitism. This observation lead to the enemy free space hypothesis, which suggests that herbivores will select host plants for which the mortality from natural enemies will be minimized, by preferring host plants on which the herbivores would be less vulnerable to their natural enemies. In Tunisia, *Orgyia trigotephras* is a polyphagous moth, bivoltine with a spring generation (SG) and an autumnal generation (AG). This work was carried out in tow sites: Jebel Abderrahmane (Ftahiz, Delhiza and Guitoun) and Bizerte (Sejnane). A total of 30 egg masses were collected from 2 host species: *Quercus coccifera* and *Pistacia lentiscus*, in each site. In the laboratory, egg masses were placed in plastic boxes (8 cm length x 3cm diameter) at 25 °C, until parasitoids and predator emergence. The egg masses collected from the field were found to be predated by one species, *Coccidiphila rungsella* and parasitized by one unique species of the genus *Aprostecetus.*

C. rungsella was observed in Jebel Abderrahmane and in Sejnane, on *Q. coccifera* and *P. lentiscus. Aprostecetus* sp. was observed only in Jebel Abderrahmane, on the two host species. Parasitism (SG) and predation (AG) are higher in Jebel Abderrahmane on *P. lentiscus*. In fact, in the AG, significantly higher predation was observed in Jebel Abderrahmane, on *P. lentiscus* (12%) and on *Q. Coccifera* (10%). In Sejnane Predation is very low (2%).

In the spring generation, predation was observed in Delhiza (11%) and Ftahiz (4%), on *P. lentiscus*. Nevertheless, predation is very low in Sejnane: only one predator was observed on *Q. Coccifera*, but in Guitoun no predation was signaled on both host plants.

In automnal generation, in Ftahiz, parasitism is higher, on *P. lentiscus* (64%) than on *Q. coccifera* (20%). Although, in Delhiza and Guitoun, parasitism is lower, on *P. lentiscus* with respectively 15% and 23%, also lower on *Q. coccifera* with respectively 9% and 1%.

In spring generation, in Delhiza and Ftahiz parasitism is higher, on *P. lentiscus* with respectivly 90% and 47% than on *Q. coccifera* (4% and 0%). In Guitoun, parasitism is lower on *P. lentiscus* (31%), but the emergence period of *Aprostecetus. sp* is longer than in the other stations. In this paper, we study the importance of predation (*C. rungsella*) and parasitism (*Aprostecetus*) of *Orgyia trigotephras* in Tunisia.

Keywords: *Orgyia trigotephras, Aprostecetus* sp*., Coccidiphila rungsella, Quercus coccifera, Pistacia lentiscus,* Tunisia

Insecticidal effect of halofenozide and methoxyfenozide in different stages of *Lymantria dispar*, an important cork oak defoliator

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Abstract: The gypsy moth *Lymantria dispar* (Lepidoptera, Lymantriidae) is one of the most notorious pests of hardwood trees. It appears in cyclic way and provokes serious defoliations of the cork oak. In Algeria, *L. dispar* is reported since 1925 and the control of this defoliator consists of chemical insecticides and/or biological control tools.

In this project we evaluated halofenozide and methoxyfenozide against larvae of *L. dispar.* These two molecules are member of a new generation of insect growth regulators that mimic the natural insect moulting hormones or ecdysteroids. Halofenozide is active against Lepidoptera and Coleoptera, while methoxyfenozide is more specific for Lepidoptera.

We determined the toxicity and mode of action of these two insecticides by treatment of the larvae of *L.dispar*. In intoxicated larvae typical morphological aberrations during moulting/ metamorphosis were observed leading to death. In addition, we noted in the surviving adults a strong negative effect on the fecundity and fertility. The results are discussed in relation to the susceptibility of the different stages of *L.dispar*.

Keywords: *Lymantria dispar,* Algeria, Halofenozide, Methoxyfenozide, Toxicity, Development

Evaluation du pouvoir insecticide de deux mimétiques de l'hormone de mue (Halofénozide et Méthoxyfénozide) sur les stades immatures de *Lymantria dispar*, principal défoliateur du chêne-liège

Résumé: La spongieuse *Lymantria dispar* (Lepidoptera, Lymantriidae) est l'un des plus importants ravageurs des subéraies. Il apparaît de manière cyclique et provoque de graves défoliations du chêne-liège. En Algérie, *L. dispar* a été signalé depuis 1925 et la lutte contre ce défoliateur majeur s'appuie essentiellement sur des insecticides chimiques.

Dans cette étude, nous avons évalué l'effet insecticide du halofenozide et du methoxyfenozide contre les larves de *L. dispar*. Ces deux molécules appartiennent à une nouvelle génération de régulateurs de croissance des insectes qui imitent les hormones de mue ou ecdystéroïdes. Le Halofenozide est actif contre les Lépidoptères et les Coléoptères, le méthoxyfénozide est spécifique aux Lépidoptères.

Le traitement des larves de *L.dispar* nous a permis de déterminer la toxicité et le mode d'action de ces deux insecticides et d'examiner son action différée sur la fécondité des adultes issus du traitement des larves. Nous avons calculé aussi

les paramètres toxicologiques, comme on a mis en évidence un effet différé sur la fécondité et la fertilité, avec apparition de formes aberrantes de larve et d'adulte.

Mots-clés: *Lymantria dispar,* Algérie, Halofenozide, Methoxyfenozide, Toxicité, Développement.

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Kazdağı National Park revealing its entomological treasures

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Introduction

Turkey is one of the important diversity center of oaks e.g. *Quercus* L. genus according to species number and geographical distribution of the genus. The oaks are represented by at least 18 species in Turkey. Old oaks have a very species-rich insect fauna in Europe and Turkey, but the habitat has declined substantially and many species are threatened. The reason is lack of suitable trees from wrong management or habitat conversion. Kazdağı National Park near Edremit in the district of Balıkesir is situated in northwest Turkey near the Aegean Sea. The aim with the study is to describe the diversity of the old oaks in the national park. But later also compare with studies in similar habitats in different parts of Turkey.

Methods

The saproxylic beetle fauna were studied by using window traps in the canopy and pitfall traps inside the hollow trunks of 11 hollow oaks (*Quercus frainetto*). The study was conducted between 20 March and 10 September 2011.

Results

Up to now more than 100 species from 11 families have been identified. In the material five species on the European Redlist have been found (*Lucanus cervus, Protaetia mirifica, Elater ferrugineus, Ischnodes sanguinicollis* and *Ectamonogonus montandoni*) and four species new to science have been identified: *Hister arboricavus* from the family Histeridae, *Mycetochara* n. sp. (darkling beetles, Tenebrionidae) and *Melanotus* n. sp. and *Elathous* n. sp. (klick beetles, Elateridae).

Conclusions

The oaks in Kazdağı National Park has a high number of saproxylic beetle species threatened in Europe and in need of wood structures uncommon to find in a forest landscape with high silvicultural activities. This result, together with the new and endemic species point out the high value of the protected forest in Kazdağı National Park.

Dung beetles (Coleoptera: Scarabaeoideae) between a natural Forest and a reforested steppe (Djelfa, Algeria)

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Abstract: Steppe ecosystems are characterized by significant biological diversity, and this is the result of a long adaptation process to difficult agro-climatic conditions. These ecosystems are experiencing a significant decline in the canopy and a reduced pastoral productivity; they are also subject to a serious deterioration spreading through a process of desertification. In grazed ecosystems, forage production is closely dependent on the dynamics of recycling of the organic matter produced and the amount of minerals available. Feces of large or small herbivorous animals must be destroyed to be recycled. This process is involving the activity of various soil organisms such as fungi, worms and insects. Among the most active insects are dung beetles (Scarabaeoidea), that have been used as bioindicators of habitat quality due to their sensitivity to environmental changes. Our study was conducted in two grazed ecosystems in djelfa pasture, with a Mediterranean climate and situated in the semi-arid region; the first one is a pinewood forest, located in the Senalba, a scrub with some formation of green oak, Juniper, Cistus and Rosemary. The second one is an Aleppo pine reforested stand located in Moudjbara, and part of the Green Dam that was launched decades ago to stop desertification. This stand spans from the Eastern border to the Western border of Algeria, with over 1,400 km long and 20km width, covering an area of about 3 million hectares. Dung beetle was captured using baited pitfall traps during the period 2009-2010. 1435 beetles belonging to 42 species were trapped. The faunas of senalba and of Moudjbara were compared. The fauna in the reforested stand is poorer than the one of the natural forest. The natural forest might provide favorable microclimatic conditions for some species such as *Chironitis furcifer*, *Aphodius fimetarius* and *A. felscheanus*. two species *Bubas bison* and *B. bubaloides* that rarely coexist were recorded in Senalba forest. Results showed a significant seasonal variation in the composition, and diversity. There were four periods of activity during the course of the year. Temporal turnover was highest in September and in February, Dung beetle dominates during summer and autumn in Moudjbara while in the Sénalba it dominates during autumn and winter. This study reveals that natural forest is the most suitable habitat to the installation Scarabaeidae unlike reforestation, this could be the result of a limited grazing in the reforested steppe.

Taxonomic investigations on oribatulid mites (acari, oribatida, oribatulidae) from the southwestern region of the Amanos Mountains

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Introduction: Oribatulid mites inhabiting in a southwestern region of Amanos Mountains were evaluated from the taxonomic point of view, based on samples collected in 2012.

Methods: The extraction of mites from materials collected from the investigation area was made by using a Berlese-Tullgren funnel extractor. Mites were killed, fixed and stored in 75% ethanol. The light and scanning electron microscopes were used to examine mites. The compound microscopic examinations of specimens were made in lactic acid, mounted in temporary cavity slides.

Results: Seven species belonging to the family Oribatulidae Thor, 1929 were determined. Of these, *Zygoribatula exarata* Berlese, 1916, *Zygoribatula excavata* Berlese, 1916, *Zygoribatula propinqua* (Oudemans, 1900), *Oribatula amblyptera* Berlese, 1916 and *Oribatula interrupta* (Willmann, 1939) are new records for the Turkish fauna; *Zygoribatula lanceolata* (Grobler, Bayram & Cobanoglu, 2004) and *Zygoribatula undulata* Berlese, 1916 have already been determined in Turkey.

Conclusion: Electron microscope photos of all determined taxa were taken. Their morphological features were reviewed on the basis of our samples, and their taxonomic problems were discussed. Furthermore, the identification keys to the genera and species were arranged.

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Preliminary results of forest cockroaches inventoried: Decomposers of litter in Northeast Algerian forests

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Abstract: Cockroaches are species that live at night and shelter in places that provide a suitable microclimate and allow them to have easy access to food. The inventory of African species is far from complete. In North Africa, little research has been conducted on wildlife Orthopteroid and more particularly on the Dictyoptera.

To identify different species of cockroaches existing forest in northeastern Algeria, we made an inventory of species that live in various areas: cork oak forests [cork forests of El- Kala National Park (Tarf), of Edough (Annaba) and Souk-Ahras], eucalyptus forests (Annaba).

Four species of cockroaches were collected from different sites: *Loboptera decipiens*, *Loboptera angulata*, *Ectobius kervillei* and some yet unidentified specimens *Ectobius*. All these insects are present in the litter, mainly from February to June, and their numbers are fluctuating. More than 2000 individuals of all stages were captured including 86% of the genus *L. decipiens* and 14% of such *Ectobius.*

Keywords: Forest Cockroaches, Inventory, Algerian forests, *Loboptera*, *Ectobius*

Résultats préliminaires d'un inventaire des Blattes forestières: Décomposeurs de la litière des forêts du Nord Est Algérien

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Résumé: Les blattes sont des espèces qui vivent la nuit et qui s'abritent dans les endroits qui leur fournissent un microclimat convenable et qui leur permettent d'avoir un accès facile à la nourriture. L'inventaire des espèces africaines est loin d'être complet. En Afrique du Nord, peu de recherches ont été effectuées sur la faune des Orthoptéroïdes et plus particulièrement sur les Dictyoptères.

Afin de recenser les différentes espèces de blattes forestières existant dans le Nord Est Algérien, nous avons réalisé un inventaire des espèces qui vivent dans des zones variées: forêts de chêne-liège [subéraies du Parc National d'El-Kala (Tarf), de l'Edough (Annaba) et de Souk-Ahras], forêts d'eucalyptus (Annaba).

Quatre espèces de blattes ont été récoltées dans les différents sites: *Loboptera decipiens*, *Loboptera angulata*, *Ectobius kervillei* et quelques spécimens d'*Ectobius* non identifiés pour l'instant. Tous ces insectes sont présents dans la litière, principalement de Février à Juin, et leurs effectifs sont fluctuants. Plus de 2000 individus de tous stades ont été capturés parmi lesquels 86% sont du genre *L. decipiens* et 14% du genre *Ectobius*.

Mots clés: Blattes forestières; Inventaire; Forêts Algériennes, *Loboptera*, *Ectobius*

Major pests and diseases determined in pine cones in Turkey

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Abstract: Seed orchards obtained from healthy and high-quality seeds are of great importance during cultivating seedlings from the seeds, seedlings and saplings cultivation and establishing a forest. The quantity and quality of seeds have significant losses due to various reasons every year. Pine species are among main tree species and have a wide distribution in Turkey. We have to give importance to the seeds to ensure the continuity of forests and we need to know the factors that cause losses in the number of high-quality seeds and germination rates. Therefore, major pests and diseases causing damage on pine cones in Turkey are investigated in this study. Researches, articles, theses, books published so far, and internet resources have been reviewed and examined. It was found that the diversity and amount of damage caused by harmful insects on pine cones are higher than any other pests. These harmful insects mainly belong to the following Orders; Lepidoptera, Coleoptera and Diptera. Fungal diseases and other harmful animal species are in the groups causing damage. Especially *Diplodia pinea* (Desm.) Kickx. disease and *Sciurus vulgaris* L. (Red Squirrel) are noteworthy, due to the damage caused by them and their distributions in pine forests in Turkey.

Keywords: Cone, Pine, Seed, Pests, Diseases

Study of the arthropodofaune in an olive grove to Sefiane (W Batna - East of Alegria)

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Abstract. The olive tree (*Olea europea* L.) is the characteristic tree of the region of the Mediterranean Basin, it is one of the major elements of the agricultural economics of certain countries of which Algeria is a part of it. In spite of its big rustic character, this culture is sensitive to the attacks of several devastating. Indeed, it shelters a fauna (crowd) rather rich and diversified with in particular notorious plant-eating species. This present study is guided by two objectives, the first one of which is to make a contribution on the knowledge of the arthropodologiques species met in an olive grove situated in the region of Sefiane (Wilaya de Batna) during period going from January, 2011 till June, 2011, by employing for it several techniques of sampling, worth knowing the hunting at sight classic, The visual control, the beating, the trapping and the reaping. The second is to be able to explain the distribution and the distributionof these species in their biotope and it according to several studied ecological parameters. A total of 134 species of arthropods distributed in 6 classes is inventoried. Among them, class of the insects is the most dominant with 124 species distributed between 67 families and 10 orders, among which that of the Beetles is quantitatively the best represented. The frequency of abundance, the frequency of constancy and the diversity are studied.

Inventory of galls in oaks (*Quercus suber, Quercus faginea*) in the Northeast Algerian's forests

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Abstract: The Algerian forests are essentially constituted of *Quercus suber* and Quercus faginea, they shelter a much diversified entomofaune among which the species gall. We were interested in the collection and identification of the various galls which settle down on the different organs of the *Quercus suber* and of the *Quercus faginea*.

We have chosen four eastern Algerian forests to realize our work, the forest of the National Park of El Kala, the national forest of Ouled Bechih in Souk-Ahras, the forest of Edough in Annaba and the forest of Collo (Skikda). The harvests were led at sight and concern leaves, buds, flowers, twigs and acorns of the trees of *Quercus suber* and *Quercus faginea*.

We have highlighted 12 species of galls. We included those distributed on leaves (*Neuroterus minutulus*, *Neuroterus saltans* and *Neuroterus quercusbaccarum*), buds (*Andricus hispanicus*, *Andricus pseudoinflator*, *Biorhiza pallida*), flowers (*Andricus grossulariae*, *Andricus quercusramuli*), twigs (*Callirhytis glandium*, *Synophrus olivieri* and *Synophrus politus*) and acorns (*Callirhytis glandium*).

Shape analysis of scales of pine processionary moths in Turkey

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Abstract. Larvae of the two pine processionary moth (PPM) sister species, *Thaumetopoea pityocampa* and *T. wilkinsoni*, causes severe allergies in mammals and are dangerous defoliators of Mediterranean pines. While *T. pityocampa* occurs mainly in Europe, *T. wilkinsoni* occurs in Turkey and the Middle East. Recent studies showed that ranges of the two species are in contact in Turkey.

Female moths of the two species cover their eggs with scales on their abdomens. These scales are believed to protect eggs from parasitism. Although *T. pityocampa* and *T. wilkinsoni* exhibit highly similar morphologies, few studies have suggested that scale morphology could be used for species identification. On the contrary, our field observations in Turkey do not confirm this suggestion. However, statistical approaches have never been used on this issue.

In this study, we aimed to solve this contradiction by digitizing PPM scale shape photographs taken standardly from 60 individuals collected from different locations in Turkey and by subjecting them to geometric morphometry approaches. We conducted shape analysis by using TPS software and Elliptic Fourier Outline Analysis which is a sensitive method for morphometric computations.

Results did not reveal any correlation between scale morphology and species taxonomy. This result could be interpreted as an insufficiency of scale morphology being able to be used as a taxonomic character to seperate *T. pityocampa* and *T. wilkinsoni* in Turkey. However, it should be kept in mind that these two species have a contact zone in Turkey, which might cause hybridization. This phenomenon could completely change morphological patterns. In order to reach more accurate results, this study should be repeated with samples from the entire ranges of the two species.

Megastigmus spermotrophus in Europe: Where does this invasive Douglas-fir seed pest really come from?

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Abstract: Cone and seed insects are considered the most important predators of tree seeds during the pre- dispersal phase of development. Among them, exotic seed chalcids in the genus *Megastigmus* invaded Europe as a result of the rapidly-increasing and mostly unregulated seed trade for afforestation and ornamental plantations.

Megastigmus spermotrophus, associated with Douglas fir (*Pseudotsuga menziesii*) and highly specialized, was accidentally introduced together with its host seeds during the last part of 19th century from North America to Europe where it became the major pest in Douglas-fir seed orchards and stands. In the native area, the host tree populations are genetically structured, and two varieties of Douglas-fir (coastal and Rocky Mountain) co-exist but diverged about 2Ma. The evolutionary history of the host tree influenced the current distribution of *M. spermotrophus*. Molecular analysis realized using two molecular markers (one mitochondrial and one nuclear) showed that the insects' populations are geographically and genetically well structured, reflecting the host structuration (Auger-Rozenberg, in prep). Among the insects attacking coastal Douglas firs, populations are also structured, and in the south of native area, those from California don't share any haplotypes with populations from the rest of the American coastal range, further north. Historical data pointed out Oregon and Washington states as the probable origin of introduced populations in Europe.

The aim of the preliminary study presented here was to verify the North American sources of the invasive European populations with the help of one mitochondrial marker. In the introduction areas, we detected a significant loss of diversity and structure, and haplotypes unknown in North America. These results suggest that multiple populations of *M. spermotrophus* were introduced a long time ago from multiple source areas, but inconsistencies between the historical sources of seeds and genetic data demonstrate that the traceability of seed lots has not always been reliable over time. Polymorphic markers such as microsatellites, which are now available, will allow us to reconstruct and clarify the invasion history of these damaging Chalcids in Europe.

Climate niche of the summer pine processionary moth: potential distribution in Portugal and across the Mediterranean basin

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Abstract: The pine processionary moth, *Thaumetopoea pityocampa*, is a Mediterranean insect that typically reproduces in the summer while larvae develop in the winter. A phenologically atypical population, hereafter named "summer population" (SPPM), was detected in 1997 in the region of Leiria, Portugal. For this peculiar population, reproduction occurs in May and larval development in the summer. It co-exists in the large Leiria pinewood with a population exhibiting the typical life cycle. The objectives of the present study were: i) to determine the climatic niche of the SPPM by means of species distribution modelling; ii) to predict the potential range of the SPPM across the Mediterranean basin and iii) to analyse the patterns of dispersion since 1997 and simulate potential expansion in Portugal.

We first analysed the climate features prevailing in Leiria and showed that this region, as well as the northern coastal areas of Portugal experience peculiar climatic conditions characterized by mild winters and cool summers. Since its discovery, the SPPM has been monitored and its spatial expansion documented. Based on this existing set of data, we modelled the climatic niche of the SPPM and mapped the potential distribution of this population across the Mediterranean basin, using the MaxEnt algorithm. The potential range of the SPPM appeared very limited, essentially including the northern coastal region of Portugal *plus* a localized spot of 150 km by 30 km between the cities of Arhoud and Zaouiat el Kourati, in Morocco. We further implemented dispersal and landscape information into our SPPM distribution model and simulated the population expansion since its first observation back in 1997. Our results showed that, while the present range roughly comprises 80 km along the coastline, between the villages of Leirosa in the North and Campelos in the south, the potential distribution extends southwards as far as Lisbon. The future expansion of the population may be hampered by the scarcity of pine plantations in the area of Lisbon, although it is known that scattered trees outside forests are potentially important elements of habitat connectivity for forest organisms that may compensate the absence of pine stands.

We conclude that the SPPM appears to be distributed in areas characterized by peculiar climatic conditions. Under the assumption of no ecological shift, the population can be expected to remain localized within its present area of distribution and thus the risk of a large-scale biological invasion is not high. Nevertheless, the expansion of the SPPM will, most probably, reach the Lisbon area within the next decade, invading highly inhabited and touristic areas, where the occurrence of urticating larvae in the summer would lead to serious public health problems.

Contribution à l'étude des insectes ravageurs des semences et des gousses de quelques espèces d'acacias au Maroc et en Tunisie

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Abstract: Aujourd'hui, les écosystèmes naturels des zones arides et sahariennes notamment à bases des acacias, sont soumis aux différentes formes d'agressions et de menaces qui mettent en péril leurs pérennités. Le facteur anthropique s'avère le plus déterminant dans cette dégradation et sous lequel se déclenche et s'accélère l'effet destructeurs d'autres facteurs abiotiques (sécheresse, changements climatiques) et biotiques notamment les insectes. Ces derniers constituent une menace réelle à tous les stades du développement et de l'entreposage des semences des essences du genre Acacias. Toutefois, surtout au Maroc, ces insectes ravageurs des semences et des gousses n'ont guère fait l'objet de beaucoup d'attention jusqu'à présent et on manque de renseignements précis. Et même lorsque certains renseignements existent, ils sont souvent épars et difficiles à acquérir. L'objet de cette communication est de donner la liste des principaux ravageurs ainsi que leurs spécificités d'attaque en vue de mettre en place un système de lutte efficace pour la conservation de ces écosystèmes menacés.

Mot-clés: Zones arides, Acacias, Insectes ravageurs, Semences, gousses.

Phoresy of Mites by Beetles (Coleoptera) in South Forest of Turkey

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Abstract: Some mite groups of Acarina carried by insect. As a group of insects family Aphodida, Cerambycidae, Curculionidae, Geotrupidae, Hydrophilida and Scarabaeidae (Coleoptera) of the members are known.

In this study, in south of Turkey, located in the Mediterranean region as foretic mites in forest insect species to determine which are discussed. End of this study are collected as a vector *Ips sexdentatus* (Börner 1776), *Orthotomicus tridentatus* Eggers 1921, *Tomicus minor* (Hartig 1834), *Tomicus piniperda* (Linnaeus 1758) (Col.: Curculionidae, Scolytinae), *Arhopalus ferus* (Mulsant 1839), *Arhopalus syriacus* (Reitter 1895) (Col.: Cerambycidae), *Lacon punctatus* (Herbst 1779) (Col.: Elateridae) and an unidentified staphylinid (~2 mm) (Col.: Staphylinidae). Determination of the all vector species is recorded from Turkey for the first time. But mites which are found Tarsonemidae, Crptostigmata, Uropodidae ve Acaridae have not been identified. In addition to mites which found with insects have been discussed with pictures.

Keywords: Mite, Phoretic, Mites-transmitting, Turkey, Coleopteran

Türkiye'nin Güney Ormanlarında Akar Taşıyan Bazı Coleopterler

Özet: Bazı akar grupları bir canlı organizmadan bir diğer canlı organizmaya taşınmasında (foretik) böcekleri aracı olarak kullanırlar. Bu böcek grupları Aphodidae, Cerambycidae, Curculionidae, Geotrupidae, Hydrophilidae ve Scarabaeidae (Coleoptera) familyaları olarak bilinmektedir.

Bu çalışmada, Türkiye'nin güneyinde, Akdeniz bölgesinde bulunan ormanlarda akarları foretik olarak taşıyan böcek türlerini belirlemek üzere ele alınmıştır. Araştırma sonunda vector olarak *Ips sexdentatus* (Börner 1776), *Orthotomicus tridentatus* Eggers 1921, *Tomicus minor* (Hartig 1834), *Tomicus piniperda* (Linnaeus 1758) (Col.: Curculionidae, Scolytinae), *Arhopalus ferus* (Mulsant 1839), *Arhopalus syriacus* (Reitter 1895) (Col.: Cerambycidae), *Lacon punctatus* (Herbst 1779) (Col.: Elateridae) ve tanımlanmamış bir staphylinid (~2 mm) (Col.: Staphylinidae) türleri elde edilmiştir. Saptanan akar-vektörü türlerin tamamı Türkiye'den ilk kez kaydedilmiştir. Fakat elde edilen Tarsonemidae, Crptostigmata, Uropodidae ve Acaridae familyalarına ait akarların tür teşhisleri henüz yapılmamıştır. Bu yayında ayrıca vektör türlerin akarları taşıma yöntemleri resimlerle tartışılmıştır.

Keywords: Akar, Foretik, Akar taşınması, Türkiye, Coleopter

Oviposition pattern and realized fecundity of the processionary moth, *Thaumetopoea pityocampa* (Denis & Schiffermüller 1775) (Lepidoptera: Thaumetopoeidae) in natural and artificial Aleppo pines forests in Djelfa (Algeria)

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Abstract: The pine needles on which the egg batches of pine processionary moth, *T. pityocampa*, laid in naturals and plantations forests of the semi-arid region of Djelfa (Algeria) were analyzed for a total of 358 samples. The results highlighted the importance of needle length on the distribution of the egg batches. The shortest needles are preferentially sought by the females. The needles collected from plantations forests were between 32 and 73 mm long, with an average of 55.47 $\pm$ 11.29 mm. In natural forests, the needles were between 24 and 69 mm long, with an average of 45.47 $\pm$ 9.02 mm. ANOVA test analysis conducted on the two forest types showed significant differences in needle length. The relationship between the length of the needles and that of the egg batched was also significant (R^2 = 0.105, p = 0.0007). In Aleppo pine plantations, the central part of the needle is preferred by ovipositing female to basal and apical parts, with a ratio base without eggs / apex without eggs = 1. The needles which received eggs in natural forests showed a ratio of 3.35, indicating that eggs are laid more at the top of the needle. The egg batches of the natural forests are significantly shorter (22 mm) than those of plantation forests (25 mm) (p = 0.002).The mean numbers of eggs per batch varied accordingly, with 94 and 128 eggs per batch, respectively. There was a greater fecundity in plantations. This may be explained by different environmental conditions and may have consequences on the population dynamics which should be considered in future studies.

Keywords: Needles, Egg batches, Processionary, Aleppo pine, Algeria

Stratégie et distribution des pontes de la processionnaire, *Thaumetopoea pityocampa* (Denis & Schiffermüller 1775) (Lepidoptera: Thaumetopoeidae) sur les aiguilles de pins dans les reboisements et les pinèdes naturelles de la région de Djelfa (Algérie)

Résumé: L'examen de 358 aiguilles, support des pontes de la processionnaire, *T. pityocampa* de deux milieux, naturels et reboisés a mis en évidence une stratégie dans la distribution des pontes. La longueur de l'aiguille rentre dans le choix des femelles pondeuses. Parmi le matériel biologique examiné, les aiguilles les plus réduites en longueur sont préférentiellement recherchées par les femelles.

Les aiguilles récoltées dans reboisements mesurent entre 32 et 73mm de longueur avec une moyenne de 55,47$\pm$ 11,29mm. En forêts naturelles, les longueurs des aiguilles se limitent entre 24 et 69mm avec une moyenne de 45,47$\pm$ 9,02mm. L'analyse par ANOVA conduite sur les deux populations a mis en évidence une

signification entre les mesures en longueur des aiguilles considérées. La relation entre les longueurs des aiguilles et des pontes a mis une corrélation très hautement significative (R^2 = 0,105 ; p=0,0007). Dans les reboisements de pin d'Alep, la partie centrale de l'aiguille reste le support idéal de ponte pour les femelles avec un rapport A/C= 1 (A : partie basale de l'aiguille sans œuf; C: partie supérieure allant de l'extrémité de la ponte à la limite de l'aiguille). L'examen et les mensurations des aiguilles en provenance des forêts naturelles ont mis en évidence un rapport de A/C= 3,35 confirmant la position de la ponte plus à l'extrémité de l'aiguille, support de ponte.

Les lots des pontes en provenance des deux milieux prospectés ont mis en évidence une moyenne de 25mm pour le site reboisé et de 22mm pour le milieu naturel. La comparaison des moyennes des longueurs des pontes dans les deux milieux prospectés montre une différence hautement significative (p=0,002). En moyennes, 128 et 94 œufs par ponte ont été dénombrés respectivement dans les reboisements et les forêts naturelles.

Les femelles sont sous la dépendance de plusieurs variables environnementales et acquièrent une plus grande capacité de fécondité dans les reboisements.

Mots clés: Aiguilles, Ponte, Processionnaire, Pin d'Alep, Algérie

Some biological aspects of *Virachola livia* on *Acacia farnesiana* in the South of Tunisia

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Abstract: The pomegranate butterfly *Virachola livia* constitutes a severe pest to the pomegranate in Tunisia, since its record in 2006. However, *V. livia* was found to breed not only in the pomegranate but also in the pods of *Acacia farnesiana* which is a very common plant in Gabes region (South-East of Tunisia).

This study which was carried out in Metwia (the most infested area in Gabes) from April to July 2013, aims to clarify some biological aspects of *V. livia* on *A. farnesiana* such as: fly of adults, egg laying, larva development, pupae and number of generation.

Randomized samples of green Acacia pods were collected weekly from different trees of *A. farnesiana*. In the lab, pods were examined under a binocular to detect eggs, after pods were desiccated to count larva stage and pupae. The monitoring of adults activity and emergence were made by experimental apparatus both in the field and the laboratory.

The preliminary results show that *A. farnesiana* is the main and primary host plant of *V. livia* in South Tunisia. On *A. farnesiana* this pest develops three annual generations, each one lasts about four weeks. The first generation starts late in April and finished in the end of May. The second one is from the end of May to about the twenty five of the next month; the third is from the last one to the middle of July.

Due to the absence of green pods on the tree from July, the butterfly migrates to its alternative host the pomegranate.

Keywords: *Virachola livia*, *Acacia farnesiana*, Bioecology, Tunisia

Trees outside forest as a critical component of landscape connectivity with regards to forest insects

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Abstract: Various species of forest trees are commonly used for ornamental purposes and are therefore frequent in non-forest ecosystems. They constitute an important component of the so-called trees outside forests (TOF). Beyond their beneficial role in biodiversity conservation or their recreational value in urban and peri-urban landscapes, TOFs may also act as elements of ecological continuities and promote pest dissemination, expansion and invasion. This point is essential since urban areas constitute major points of entry for invasive species while both urban forests and the ecological corridors constituted by TOFs tend to favor their expansion. Not much is known, however, about the drivers of TOFs spatial distribution either in urbanized or in agricultural landscapes and only few data are available regarding their role in forest pests dispersion. TOFs are generally absent from forest inventories.

The present study focused on the spatial distribution of TOFs across agricultural landscapes and its role in the dispersal of a forest pest insect, the pine processionary moth, *Thaumetopoea pityocampa* (PPM). This species is a common defoliator occurring on various native and exotic conifer species throughout southern Europe and Mediterranean countries, where it is the most important pine and cedar defoliator. All the TOFs belonging to the genera *Pinus*, *Cedrus* and *Pseudotsuga* were considered as potential hosts. Our first aim was to identify landscape drivers of TOFs distribution and fit a point process model to empirical tree distribution data in a sampling window of 22 × 22 km. We then used the model to simulate TOFs distribution at the scale of a whole ecoregion (100 × 120 km) which facilitated the evaluation of the potential contribution of TOFs to landscape connectivity with regards to PPM dispersal. Various landscape metrics were used to quantify TOF contribution to landscape connectivity.

We fitted a non-stationary Poisson process to the empirical data. Ornamental TOFs distribution appeared to be largely driven by the presence of buildings and the “distance to the nearest building” proved to be an accurate covariate in the model. Both empirical and simulated data indicated that TOFs constitute the main source of landscape connectivity in the open-fields under study. Because they do not account for TOFs, forest inventories dramatically underestimated landscape connectivity hence providing an erroneous picture of the PPM habitat distribution. We conclude that TOFs must be taken into account when it comes to understand forest insects landscape dynamics or genetics. TOFs omnipresence also suggests a potentially huge role in pest dispersal and invasive species expansion.

Study of an infestation of carpophagous cork oak acorns in the cork forests of Edough (Annaba)

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Abstract: The cork oak multiple of two way, natural and artificial, natural regeneration makes or by sowing or by refusals of tree stumps. The regeneration bay natural sowing depends strictly on several factors especially of the abundance and the faculty of germination of acorns and their sanitary state.

The objective of this work is to identify the various destructive insects of the acorns (Carpophagous insect) of the cork oak and their rate of infestation. On acorns harvested with the cork oak forest of Edough, we determined nature and levels of infestation inside acorns.

We put in evidence an infestation of the acorns of all the cork oak forest, this infestation is a function of canvassed sites, it is represented essentially with Beetles of the family of *Cydia fagiglandana* and *Cydia splandena*, and one other space which remains to determine.

Notes on the distribution of *Corythucha arcuata* (Say, 1832) (Heteroptera, Tingidae) in Turkey

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Abstract: *Corythucha arcuata* (Heteroptera, Tingidae) is native to North America. Firstly, the American Oak Lace Bug was introduced to Europe in northern Italy in spring 2000. Then, it was reported from Switzerland, Turkey, Bulgaria and Hungary respectively.

C. arcuata was first recorded from Bolu province, northwestern Turkey in 2003. Later on, the specimens of this species were recorded from Düzce, Zonguldak, Sakarya, Kocaeli, Eskişehir, Ankara, Çankırı and Bilecik provinces in 2009 and Eastern Black Sea region of Turkey in 2010-2011.

The presence of *C. arcuata* in the oak stands located in different regions of Turkey were investigated in this study. As a result of this study, *C. arcuate* was found to extend to the oak forests in Amasya, Bursa, Istanbul, Mersin, Niğde, Samsun and Tokat provinces of Turkey. The American Oak Lace, according to the point it was firstly identified, was seen to spread to four main aspects and also it is expected to further spread in Turkey, where host plants occur.

Keywords: Alien species, Turkey, Spring, Oak lace bug

Türkiye'de *Corythucha arcuata* (Say, 1832) (Heteroptera, Tingidae)'nın Yayılışı

Özet: *Corythucha arcuata* (Heteroptera, Tingidae), Kuzey Amerika'nın doğal türüdür. Amerikan meşe dantel tahtakurusu Avrupa'ya ilk kez 2000 yılı ilkbaharında kuzey İtalya'dan girdi. Daha sonra sırasıyla İsviçre, Türkiye, Bulgaristan ve Macaristan'dan rapor edildi.

C. arcuata Türkiye'de ilk kez 2003 yılında ülkenin kuzey-batısında yer alan Bolu'dan kaydedildi. Bunu 2009 yılında Düzce, Zonguldak, Sakarya, Kocaeli, Eskişehir, Ankara, Çankırı ve Bilecik ile 2010-2011 yılında Doğu Karadeniz bölgesinde kayıtlar izledi.

Bu çalışmada Türkiye'nin farklı bölgelerinde bulunan meşe meşcerelerinde varlığı araştırılmıştır. Çalışma sonunda, *C. arcuata* Türkiye ormanlarında Amasya, Bursa, İstanbul, Mersin, Niğde, Samsun ve Tokat meşe ormanlarına kadar ulaştığı tespit edilmiştir. Amerikan meşe dantel tahtakurusu ilk tespit edildiği noktaya göre dört ana yönde yayıldığı ve yakın gelecekte Türkiye'deki yayılışı genişleteceği tahmin edilmektedir.

Anahtar kelimeler: Yabancı tür, Türkiye, Yayılış, Amerikan meşe dantel tahtakurusu

Répartition et impact de la processionnaire du Pin (*Thaumetopoea pityocampa* Den. & Schiff.) au Maroc

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Résumé: Au Maroc, la processionnaire du pin (*Thaumetopoea pityocampa* Den & Schiff.)**,** connue depuis longtemps, demeure l'un des fléaux le plus important des peuplements forestiers à base de pins et du cèdre. En effet, les archives montrent que le Maroc a connu des pullulations depuis le début du dernier siècle et jusqu'à présent, les dégâts de ce raveur n'ont pas cessé et son aire de distribution s'étend conjointement à l'extension des périmètres de reboisement qui s'étend sur environ 200.000 ha. Le présent travail consiste à l'analyse des fiches d'infestations élaborées par les gestionnaires forestiers régionaux entre 2006 et 2010. L'examen de ces fiches a révélé que i) l'infestation concernent neuf régions de l'ensemble du territoire marocain, ii) les attaques varient d'une région forestière à une autre, et iii) la région du Moyen Atlas et celle du Nord-Ouest présentent une augmentation de l'impact de la processionnaire du pin.

Mot-clés: Processionnaire du Pin, Regions, Fiches d'infestation, Impact

The Cedar processionary moth, *Thaumetopoea bonjeani* Powell (Lepidoptera - Thaumetopoeidae) in the National Park of Djurdjura (Algeria)

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Abstract: In outbreak phase, the summer processionary moth, *Thaumetopoea bonjeani* causes severe damage to *Cedrus atlantica*, a tree species endemic to Algeria and Morocco. Since 2007, populations of this pest are multiplying significantly in Djurdjura Atlas cedar forests, where nearly 200 hectares were affected.

The aim of this study was to investigate the biology, behavior, and natural enemies of the pest in Djurdjura Atlas cedar, during 2012 and 2013. In addition, biometric tests were performed on a total of 318 adults and 182 egg-masses collected in two transects 400 m long. *Thaumetopoea bonjeani* has a one-year development cycle. Adults emerge from the cocoons in the soil from the beginning of August to mid-September. The wingspan of the males and females is 25-32 mm and 32-39 mm, respectively. The males are 10-16 mm in length and the females 15-20 mm. The males live 4 days, while females only 2 days.

Females lay eggs only on the underside of *C. atlantica* twigs. All eggs are covered by grayish scales, similar to the color of the bark. The length of the egg-batches varies from 16 to 55 mm. The number of eggs per batch varies between 67 and 280. Unlike the pine processionary moth *T. pityocampa*, which inhabits the same *C. atlantica* stands, oviposition by the female of *T. bonjeani* occurs from the tip to the base of the twigs. Eggs hibernate almost for 8 months and hatch in spring of the following year, between the last decade of April and the beginning of May, which is well synchronized with *Cedrus atlantica* budburst. The larval development occurs from April to mid-June. During the day, larvae live in colonies combined in a form of ball, without weaving a structured tent. Feeding and movements of larvae occur during the night and in the morning. Between mid-June and the second decade of July, larvae leave the trees for pupation in a long procession. Cocoons are woven after three days of burying and pupae are formed during the following week. The sex ratio is about 1.3 in favor of males.

The eggs parasitoids are the most significant factor for reducing density of *T. bonjeani*, with variables rates (9.3% and 33.8%). Three species of parasitoids were identified: *Ooencyrtus pityocampae* (Mercet) was observed as the most abundant egg parasitoid, followed by *Baryscapus servadeii* (Domenichini) and *Trichogramma embryophagum* (Htg.). Eggs destroyed by predators Ensifera, *Ephippiger ephippiger* and *Tettigonia viridissima* were approximately 6%.

Keywords: *Thaumetopoea bonjeani*, Life cycle, Egg parasitoids, Algeria

La processionnaire du cèdre de l'Atlas, *Thaumetopoea bonjeani* Powell (Lep., Thaumetopoeidae) dans le Parc National du Djurdjura (Algérie)

Résumé: En phase de gradation, la processionnaire d'été, *Thaumetopoea*

bonjeani provoque d'importantes défoliations sur *Cedrus atlantica*, essence endémique de l'Algérie et du Maroc. Depuis l'année 2007, les populations de ce déprédateur se multiplient significativement dans la cédraie du Djurdjura, où prés de 200 hectares ont été concernés par ces infestations. L'objectif de la présente étude est d'élucider les écophases du cycle biologique de *T. bonjeani* ainsi que les facteurs de régulations de ces populations au stade embryonnaire dans son biotope naturel, par des observations conduites directement au terrain et au laboratoire durant les années 2012 et 2013. De même, des tests biométriques ont été réalisés sur une population de 318 adultes et sur un lot de 182 pontes collectées sur deux transects de 400 mètres.

Dans les plantations de cèdre prospectées, les adultes de *T. bonjeani* émergent dès la fin de la première décade d'août et s'échelonne jusqu'à la mi-septembre. Les mensurations effectuées sur la longueur et l'envergure des adultes mâles sont respectivement, de 10 à 17mm et 25 à 32mm. Les adultes femelles se caractérisent par des longueurs de l'ordre de 15 à 20mm, et des envergures de 32 à 39mm. Dans les élevages contrôlés, la longévité moyenne des adultes se limite à 2 jours pour les femelles et 4 jours pour les mâles. Les pontes sont déposées en forme d'ooplaque uniquement à la face inférieure des jeunes rameaux de cèdre. La biométrie conduite sur les pontes récoltées a mis en évidence des longueurs variables de 16 à 55 mm. La quantification des d'œufs sur le matériel biologique récolté, a mis en évidence une moyenne de 140 œufs par ponte avec des valeurs extrêmes de 67 et de 280 œufs. La femelle dépose ses œufs en progressant vers la base du rameau, contrairement à la processionnaire d'hiver, *T. pityocampa* qui cohabite sympathiquement sur *C. atlantica,* qui progresse vers l'extrémité des rameaux.

Le contrôle des éclosions des pontes de *Thaumetopoea bonjeani* au laboratoire, a permis d'évaluer la durée de la diapause embryonnaire à 8 mois. Les éclosions ont lieu au printemps de l'année suivante, à partir de la dernière décade du mois d'avril, période synchronisée avec le débourrement de cèdre de l'Atlas. Les observations menées périodiquement au terrain ont permis de caractériser la durée de développement larvaire entre le mois d'avril et la mi-juin. Au cours de leur développement, les chenilles ont un comportement grégaire et se déplacent en procession à la recherche de leur alimentation pendant la nuit. Pour leur protection, la journée elles se regroupent en pelote. Les processions de nymphose, ont été décelées entre la mi-juin et la deuxième décade du mois de juillet. Pour leur enfouissement, les chenilles du dernier stade, recherchent des sites ombragés favorables. Les cocons de *T.bonjeani* sont tissés après trois jours d'enfouissement et les chrysalides se forment au cours de la semaine qui suit. Le sexage des adultes émergés a mis en évidence un sex-ratio de 1,29 en faveur des mâles. Les parasitoïdes embryonnaires, principaux régulateurs des populations de *T. bonjeani* au stade œufs, ont un impact variable de 9,3% à 33,8%. Trois espèces de *Chalcididae* ont été répertoriées: *Ooencyrtus pityocampae* (Mercet) été le parasitoïde le plus abondant, suivie par *Baryscapus servadeii* (Domenichini) et *Trichogramma embryophagum* (Htg.). Parmi les prédateurs, les Ensifères du genre, *Ephippiger ephippiger* et *Tettigonia viridissima* détruisent jusqu'à 6% des œufs.

Mots clés: *Thaumetopoea bonjeani*, cycle de développement, parasitoïdes embryonnaires, Algérie.

Influence of host plant and climatic constraints on larval activity of the pine processionary moth in pine forests of the west coast of Algeria

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Abstract: The winter pine processionary moth, *Thaumetopoea pityocampa* Den. & Schifft (Lepidoptera: Notodontidae) is one of the most destructive species of pines and cedars in the Mediterranean basin area. The caterpillars feed on the foliage of host trees causing significant defoliation damage resulting in growth loss and tree mortality. During gradation from 2010 to 2011, we estimated larval development times with respect to each stage on three host species: Aleppo Pine, Maritime Pine and stone Pine on both South and North exposures in the western coastal fringe in Tipaza region, from September 2010 until the beginning of April of the following year. A total of 15 to 16 outputs were performed in each respective station, on a 30 trees observed randomly each time. The fourth instar larvae were the longest: its duration can vary between one month and one month and a half in the studied pine forests. Durations between sites of L4 and L5 stages are relatively similar: between 57 and 60 days for the L4 stage and between 30 and 46 days for the L5 stage. The differences are not significant in the average duration of each instar for each category of pine forest site (south and north) including the altitude. Thus, according to our observations in the western coast of Tipaza forests area, the larval development of the pine processionary moth took place during rainy periods characterized by large amounts of rain: in October and November with the development of young larvae (L1, L2 and L3), and in January and February with the oldest stages ones (L4 and L5). The longer duration of the L4 stage could be explained by maintaining very low temperatures between 5°C and 6°C in January and February which could decrease the development and the activity of caterpillars outside their nest for searching their food.

Keywords: pine processionary moth, life cycle, host plant, climate, Algerian coast.

Study of the sanitary state of the sheets of the Cork oak collected in the subéraies of the National park of El Kala (PNEK) - Inventory of the entomofauna

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Abstract: Seen the importance of the cok oak forest which occupies consequent surfaces east of the country, we led an inventory of the entomofauna of the oak cork in three places of El-Kala's national park, Brabtia, El-Mellah and Sanaoubari, what allowed us to raise a list of sorts living in these two places. We put in evidence 44 spaces on 5 orders: (Beetles, Lepidoptera, Hyménoptères, Hétéroptères and Odonates) distributed on 14 families (Cetoniidae, Scarabaeidae, Geotrupidae, Tenebrionidae, Carabidae, Curculionidae, Chrysomelidae, Oedemeridae, Chantharidae, Histeridae, Coccinelidae, Elateridae, Ichnenmonidae, Miridae) One studied the effect of the attacks of insects in sheets and results show an important activity of défoliators in the studied forest.

Three forms of galls were identified which are due to an insect piquor and sucking of sap which lays the eggs in exgrowths of the sheet.

Very frequent to the oak, galls can become a problem if they are too big number on the tree.

First year interim results of traps developed for catching pine processionary moth (*Thaumetopoea pityocampa* (Schiff.) caterpillars

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Abstract: The pine processionary moth cause damage in all Mediterranean basin and economical losses by decreasing annual increment in conifers and human health problems.

In control of this pestilent, various methods are being used mechanical by collecting egg-batches and bags, biological using birds and *Calasoma sycophanta,* chemical using chemical poisons and psychic using pheromones. In control, none of methods are sufficient alone. In mechanical control, gathering of egg-batches and bags on top high trees is not possible. In chemical control, it is necessary applying over wide areas and in a effective way. In biological control, islet in a pond for using parasites and parasitoids of larvae and rear and release of *Calosoma sycophanta* L. (Col., Carabidae) are used. In additon a bacterium *Bacillus thuringiensis* var. *Kurstaki* is used as a biological preparation. Because currently used pheromone traps are expensive and susceptible for external conditions have low efficay in control. None of these metods is effective in control of population, they are either expensive or not effective or has some inconvenience for human health and environment.

With this study that is being carried out it is aimed to develop a new trap and determine its efficacy and cost. Mature larvae have to move down by marching through tree trunk and become a pupa entering into the ground at early summer after finishing feeding. During this marching by putting a cone shaped trap on tree trunk larvae have been captured and accumulated in the trap.

Trap trials have been carried out in 2013 and first year results have been obtained and evaluated. Besides other pest management methods, it has been found effective for controlling population.

Keywords:

The pine processionary moth, *Thaumetopoea pityocampa* (Den. & Schiff.), catch trap

Thanks

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Çam keseböcekleri (*Thaumetopoea pityocampa* (Schiff.) ile mücadele amaçlı geliştirilen tırtıl yakalama tuzağının ilk deneme sonuçlari

Özet: Çam keseböceği bütün Akdeniz havzasında zarar yapmakta, iğne yapraklı

ağaçlarda artım ve büyümeyi azaltarak ekonomik değer kayıplarına ve sağlık sorunlarına neden olmaktadır.

Bu zararlı ile mücadelede; yumurta koçanı ve yuvaların toplanması şeklinde mekanik, böcekçil kuşlarla ve *Calasoma sycophanta* ile biyolojik ve kimyasal ilaçlarla ve feromonlarla da kimyasal ve biyoteknik mücadele yöntemleri kullanılmaktadır. Bu yöntemlerden hiç biri tek başına mücadelede yeterli olmamaktadır: Mekanik mücadelede boylu ağaçlarda yumurta koçanlarının ve keselerin toplanması mümkün olmamakta, kimyasal mücadelede büyük alanlarda ve etkili şekilde ilaçlama yapılmasını zorunlu kılmakta ve çevre sağlığını olumsuz etkilemektedir. Biyolojik mücadelede larva parazit ve parazitoitlerinden yararlanmak amacıyla adacık yöntemi ve sınırlı alanlarda kullanılmak üzere de *Calosoma sycophanta* L. (Col., Carabidae) üretimi yapılmaktadır. Ayrıca bir bakteri olan *Bacillus thuringiensis* var. *kurstaki* biyolojik preparat olarak kullanılmaktadır. Halihazırda kullanılan feromon tuzakları pahalı ve dış çevre şartlarından çok kolay etkilendiklerinden mücadelede etkileri düşük kalmaktadır. Tüm bu mücadele yöntemlerinin her biri populasyonu kontrol altına almada etkili şekilde kullanılamamakta, ya çok maliyetli ve etkisi düşük yada çevre ve insan sağlığı ile ilgili sakıncalar oluşturmaktadır.

Gerçekleştirilen çalışma ile çam keseböcekleri ile mücadelede yeni bir tuzağın geliştirilmesi, etkinliğinin ve maliyetinin belirlenmesi amaçlanmıştır. Olgun larvalar beslenmelerini tamamladıktan sonra yaz başında katar halinde ağaç gövdesinden toprağa inerek pupa olmaktadırlar. Bu inişleri sırasında ağaç gövdesine huni şeklinde tasarlanan bir yakalama tuzağı takılarak olgun larvaların tuzak içinde birikerek yakalanmaları sağlanmıştır.

Tuzak denemeleri 2013 yılı içerisinde gerçekleştirilmiş ve ilk sonuçlar alınarak değerlendirmeler yapılmıştır. Diğer mücadele metotlarının yanında populasyonun kontrol altına alınmasını sağlamada etkili olduğu belirlenmiştir.

Anahtar Kelimeler: Çam keseböceği, *Thaumetopoea pityocampa* (Den. & Schiff.), yakalama tuzağı

Teşekkür

Bu proje Tübitak tarafından desteklenmektedir. Proje No: 112 O 250

Mass production in laboratory of *Calosoma sycophanta* L. used for biological control against Lymantria dispar L.

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Abstract: Last years in Albania the insect pest Lymantria dispar L. have had a vast spread on oak forest (Quercus cerris, Q. frainetto, Q. petraea) in districts of Mirdita, Kukesi and Lushnja. The attacked degree has been very high in these districts, where the tree defoliation has been about 80-90% of tree crowns. In this situation during the last year in period of May-June were produced in mass on laboratory the Calosoma sycophanta L. used for biological control against Lymantria dispar.

In this case the reproductive imagos was taken in district of Lushnja, where they were in mass. After production work on the biological laboratory of Forestry Faculty (laboratory established with help of Turkish Cooperation and Coordination Agency and General Directorate of Forest in Turkiye) the fifteen days larvas were released in oak forest of Mirdita district.

During the production work of Calosoma sycophanta used for biological control against Lymantria dispar were drawed respective conclusions about the biology of Calosoma sycophanta in climatic conditions of Albania. Concretely the first eggs of Calosoma in laboratory conditions were observed on 17 may 2013 and have continued intensively until 5 June 2013, while the first larvaes were observed on 20 may 2013 and were released in the forest on 5 June 2013.

Biological control of Winter Moth

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Abstract: Biological control of Operophtra Brumata with entomopathogenic fungi *Beauveria bassiana* and *Metharisium anisopliae* are given in this article. The series of investigations have been carried out on the effect of different concentration of the entomopathogenic fungi. The results reported that *B. bassiana* and *M.* anisopliae are effective pathogens for the biological control of Winter moth. *B. bassiana* was more effective (30-60 %) at 5, 10, 15 days post treatment, than *M. anisopliae.*

Introduction

Winter Moth *(Operophtera Brumata)* is important pest of Apples, Blueberries and other deciduous plants, especially in Eastern part of Georgia. They can severely reduce yields and/or defoliate bushes. Caterpillars feed within both flower and foliar buds. Once a bud has been devoured from within, the caterpillar will migrate to other buds and repeat the process (1). Destruction of the flower buds leads to greatly diminished harvest on fruit crops. Older larvae feed in expanding leaf clusters and are capable of defoliating trees and other plants, when abundant (2).

Because of the severe damage to control of Winter Moth in Georgia where used chemical methods. However, the use of pesticides proved to be less than ideal as a means of controlling this pest, which continued to proliferate. Consequently biological control was considered according to the classical bio control theory.

Microbial control aims at biological suppression of insect pests by the use of entomopathogens like viruses, fungi, bacteria, protozoa (3).

Entomopathogenic fungi *Beauveria bassiana* and *Metarhizium anisopliae* are fungi that grow naturally in soils throughout the world and causes disease in various insects, resulting in their mortality by acting as a parasite (4,5).

The present work was carried out to study affectivity of this entomopathogenic fungi for biological control of Winter Moth.

Materials and Methods

Field collected larvae of Winter Moth were fed with nut leaves, dipped with *B. bassiana* and *M. anisopliae.* Leaves were air dried before use. Disposable petri dishes, each containing a wet filter disk on the inside covers, were used as test chambers. Filter discs were periodically wetted to insure turgid leaves. Mortality of larvae was recorded at 3, 5,7,10 days post treatment. 20 larvae were used for each treatment and each treatment was triplicate.

Result and Discussion

The results reported that *B. bassiana* and *M. anisopliae* are effective pathogens for the biological control of Winter moth. At the highest concentration of fungi mortality of winter moths larvae was higher. *B. bassiana* was more effective (30-60 %) at 5, 10, 15 days post treatment, than *M*. *anisopliae* (Table 1).

Average percent of larval mortality

The use of natural enemies such as predators, parasites, and pathogens to control insect is very important for the biological control. Strategies for the use of pathogenic organisms for insect control are basically the same as that for other biological control agents.

Present study agrees with the reports where higher doses produced the highest Percentage of mortality.

Based on the findings of these studies, it is recommended that this fungi could be used in Winter Moth management.

Table 1

Stock dilution	Days post treatment	Mortality %	
		B. bassiana	***M. anisopliae***
1:1000	5	93	90
	10	95	93
	15	98	98
1:5000	5	81	79
	10	83	82
	15	87	89
1:10000	5	69	65
	10	72	70
	15	75	75
1:50000	5	29	27
	10	42	40
	15	45	45
Control	5	8	7
	10	15	14
	15	17	17

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Comparative study of the effectiveness of the essential oils formulated of Thyme and Origan on the black poplar (*Chaitophorus leucomelas*)

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Abstract: The use of the chemicals for the control of the insects raises several concerns connected to the environment, human health, the nontarget species, and with the development of the resistant populations. Actually, aromatic plants have a considerable asset thanks to the progressive discovery of the applications of their essential oils in the biological fight against the pest of the culture. The present study related to the evaluation of the effectiveness of the essential oils formulated containing Thym and Origan compared with a product of synthesis (Methomyl) on the abundance of the black poplar (*Chaitophorus leucomelas*).

The results of this study showed that all the molecules tested had a repressive effect on the pests targeted with supremacy of effectiveness of essential oil containing thymol compared to the others biopesticides applied. On the other hand the thymol remains less effective than the chemical which posts the weakest rate of abundance of the aphid's populations. These same results allowed, to highlight a shock effect and a temporal toxicity of all the molecules tested. The estimate of the effectiveness of the amounts applied, revealed that all the amounts had a repression on the abundance of the populations of the plant louses concerned but the complete amounts (D) appear definitely more effective than half-amounts (DD).

Keywords: Abundance, Biopesticides, Carvacrol, Essential oils, Methomyl, Origan, Thymol, Toxicity

Spatial analysis of forest regeneration after fire in Algeria by using high spatial images resolution and GIS

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Abstract: The use of remote sensing data multidates, combined with other types of data of various kinds on the environment and forest burned, opens up interesting perspectives for the management of post-fire regeneration. Indeed, development of remote sensing and geographic information systems (GIS) occurred in recent years has offered both environmentalists as managers, an opportunity for evaluation, monitoring and analysis of vegetation. The vegetation indices derived from radiometric data of remote sensing are widely used in programs to monitor the dynamics of vegetation around the globe. The forest environment has benefited greatly from this approach. In this study the use of multitemporal remote sensing image Alsat-1 combined with other types of data concerning both background and burned down forest appears to be promising in evaluating and spatial and temporal effects of post fire regeneration. A spatial analysis taking into consideration the characteristics of the burned down site of Sebdou in the South Tlemcen in Algeria, allowed to better account new factors to explain the regeneration and its temporal and spatial variation. We intended to show the potential use of remote sensing data from satellite ALSAT-1, spatial resolution of 32m, and derived index Normal Difference Vegetation Index (NDVI) and normalized regeneration inde (NRI), in the assessment and quantification of regeneration post fire in a context of Algerian forest. These data were analyzed in a system of informatiuon Geographic, the results obtained allow us to identify the rate of regeneration witc infuenced by climatic and ecological conditions.

Monitoring *Anoxia arenbergeri* Petr. (Col.: Melolonthidae) outbreaks on Taurus cedar forest

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Anoxia arenbergeri Petr. (Col.: Melolonthidae) is a new species of pest insects in Taurus cedar forests. Defoliation of Taurus cedars caused by *A. arenbergeri* was investigated by multi-temporal Landsat imagery and tree ring analysis. The infestation area is approximately 4 km away south from Isparta city center in West Mediterranean Region of Turkey. *A. arenbergeri* larvae feed on roots, while adults are harmful to needles. The damage on roots can cause death of many young cedars in plantation areas. The insect has a life cycle of four years. Outbreaks have been determined every one-in-four-year period between 1997 and 2009. Years of outbreaks are characterized with dramatic increase in adult population size. Flight period starts at the end of June and continues until July. Damage increases at the edge of stands, in sparse stands, and on single trees. As a result of adult feeding, trees completely lose their leaves and this causes negative effects on increment and growth of the trees.

We monitored the population dynamics of *A. arenbergeri* since 1997. Landsat data was processed for four years, from 2005 to 2008. The findings were evaluated to determine of the defoliation damage and compared to annual ring widths. Increment cores were sampled from 50 trees growing at heavily damaged stands. Differences in annual ring widths in different years during the defoliation period (1997-2011) were tested using ANOVA. Duncan's multiple range test was applied to determine whether or not there were significant difference in annual tree-ring width between defoliation and non-defoliation years. The mean annual tree-ring width in defoliation and following non-defoliation years were 3.95, 3.51, 4.57, and 4.69 mm respectively. As a result, there was a significant difference in annual tree-ring width between defoliation and non-defoliation years. Multiple comparisons indicated that difference between defoliation years and the first non-defoliation years were not statistically significant, whereas these two years and last two years (third and fourth non-defoliation years) were significantly different. Negative impact on increment increased slightly in the first non-defoliation years and then decreased in following non-defoliation years.

Keywords: *Anoxia arenbergeri*, *Cedrus libani*, insect outbreak, Landsat, tree-ring analysis

Evaluation of the effect of plant protection bioferilisants made on *Chaitophorus leucomelas* (Homoptera, Aphididae) of black poplar (Populus nigra) in the region of Boumedefâa

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Abstract: Severity caused by aphids (Hemiptera: Aphididae), especially makes necessary the development of alternatives based on the role of natural biofertilsants as elicitors in stimulating the natural defenses of plants. With the introduction of new formulations to deal with pests.

The study compared the effect of two formulated fertilizers (vermicompost juice and a deficiency corrector based on trace elements) with a certified fertilizer (seaweed extracts) on the expansion of the surface leaf of *Populus nigra* and population structure of black poplar aphid *Chaitophorus leucomelas*, at a young poplar in the region Boumedefâa (Wilaya de Ain Defla).

The results of this study showed that all fertilizers tested had a mixed effect on the expansion of leaf area and density of different life forms (adults and larvae) of *Chaitophorus leucomelas.* Improved efficiency of densities is reported for *Chaitophorus leucomelas* juice vermicompost and correcting deficiency tracking algasmar.

The results suggest that appear effective treatment of leaf expansion is certainly a better effect for correcting deficiency and algasmar from the juice of vermicompost. On the combined effect, the juice of vermicompost madea better display effect by developing a SDN effect and increasing the leaf surface**.**

Keywords:

Algasmar, *Chaitophorus leucomelas*, correction of deficiency, density, fertilizer, vermicompost juice, *Populus nigra*, leaf surface.