Cork oak (Quercus suber L.) threatened by the introduced acacias
in the National Park of El-Kala (North-east Algeria)
Beddiar, A, Adouane, M., Merabet, A., Boudiaf, I. .................................................. 1-4
Abstract: The National Park of El Kala (PNEK) located in North-eastern of Algeria is one of the most significant reserves of biodiversity in the Mediterranean region. It includes the cork oak, a dominant tree species, as well as mixed stands of eucalyptus and acacias planted in 1970. However, during this last decade, it was noted that Acacia decurrens Willd. invaded the park and threatened the cork oak ecosystem. The principal objective of our research was thus to evaluate the transformations induced by this acacia on the cork oak symbiotical microflora and on the plant biodiversity. The first results show the negative effect of acacia on cork oak growth, its mycorrhizal statute as well as on the morphotypic diversity of its ectomycorrhizes. The plant and fungal biodiversity fall significantly in the sites invaded by this acacia species.

Quercus suber L. «dehesas» in Sardinia
Carta, L. ........................................................................................... 5-8
Abstract: The aim of the present work is to assess the distribution in Sardinia of Quercus suber dehesa through the map of habitat made by using aerial and satellite images. That habitat includes several sintaxa of Quercetea ilicis, Cisto-Lavanduletea, Thero-Brachypodietea, Helianthemetea guttati classes. The thematic map (1:25,000 scale) was obtained by the following steps: unsupervised classification of satellite images (Landsat TM) and supervised classification by using the ERDAS software (O.S. Erdas Imagine 8.6, Leica); analysis of combined data from orthophoto and ground control points in order to verify the supervised map (O.S. Arc Map, ESRI, GPS). The dehesa system typical species of Quercus suber, from 20 to 50% canopy, rises from agrosilvopastoral practice aimed at extensive livestock, and it is characterized by the scarcity or total absence of plant regeneration. They represented the 5% of regional land surface most of all widespread in the central-northern area and become almost absent in the South. This kind of geographic distribution comes from different factors as ecological (climate, geomorphology, geologic and soil) and anthropogene factors (pastures, fires, deforestation, ploughing, overgrazing). The distribution is open to strong changes because the human activity and the environment decay that can play a major role in the cork-oak forests, but it is also an important stage in the wood recovery.

Shrub specific diversity and spatial distribution in the cork oak forest
of Ain Snoussi, Tunisia
Boutheina Stiti., Mannai, Y., Khaldi, A., HENCHI, B. ................................................... 9-16
Abstract: Given the current degradation state of the cork oak forest ecosystem, plant cover restoration must be ensured by an appropriate space management. This requires a database on natural resources potential, which has been hardly evaluated in Tunisia. This study focused on the spatial distribution and biodiversity of shrubs in the Ain Snoussi forest, located in northwestern Tunisia. Transects combined with the nearest-neighbour-distance method was used. Indeed, six representative plots were selected and two orthogonal transects of 50m installed in each one. In
each transect, 50 observation points were fit, all 1m apart. From each observation point, distance to the nearest shrub was measured as well as morphologic parameters of the plant. In overall the forest, maximum species richness was 5. Shannon index (1.44) and Pielou’index (~1) indicated a low species diversity with similar relative abundance, and Berger-Parker index (0.36) a slight dominance of Erica arborea. Mean plant density was equal to 8692 plants/ha and shrub phytovolume reached 8277, 52m$^3$/ha.

The problematics of coppice conversion to high forest;
Quercus pyrenaica Willd. forest management at a turning point
Valbuena-Clará, M., Zaida, L., Gil, L. ........................................................... 17-20

Abstract: Quercus pyrenaica Willd. is widely distributed in siliceous sub-Mediterranean mountains from south-western France to northern Morocco. The species presents a high re-sprouting capability, mainly from the whole root system, which has determined the intense coppice management to which the species have been historically subjected. Nowadays, a great number of traditionally-managed coppices have been abandoned and the need to find out new uses for these stands has been widely recognized. The conversion of coppice to high forests is an accepted recommendation by managers on the bases of productivity and environmental services. Notwithstanding, stand coppice degradation and the scanty of acorn production have hindered attempts to coppice conversion by thinning. In this framework, much more scientific knowledge on the ecological, physiological and genetic factors modulating the natural regeneration processes of coppice systems is needed. The present work aims to describe the preliminary results of two ongoing research projects focused on the genetic characterization of clonal structure and the different factors limiting the natural regeneration of these woods. It also attempts to highlight the importance of multidisciplinary perspectives to successfully face the big challenges of forest management conversion and changes in the use of the land that are taking place in Mediterranean ecosystems.

Recovery and exploitation of a cork oak forest covered by fire
Pintus, A., Ruiu, P. A. ............................................................................. 21-26

Abstract: In Sardinia, the fire problem has historically been the main factor of oak forest degradation, particular for cork oak forests. Large cork areas crossed by fire are always in a bad vegetative state, subject to phenomena of decline accompanied by attacks of pathogenic fungi and insects, without any form of forest management and economically idle. This paper describes a method of recovery of a cork oak forest of about three hectares burned in summer 1993, that’s to say one year after last extraction. The intervention of recovery was conducted in two different phases, one in spring 1994, the other during the following autumn, mainly with the clear cutting of damaged trees. The sprouts obtained were then selected, subject to pruning, recording regularly the growth in diameter and height. The results show the possibility to obtain in short time, the full economic and environmental recovery of cork oak forests damaged by fire also contributing to improved plant forests of Sardinia.

Quality grading of cork planks with image analysis based on sanitary state of trees: the case of oak forests of M’Sila and Zarieffet (North-West of Algeria)
Dehane, B., Bouhraoua, R. T., Gonzalez-Adrados, J. R. ................................. 27-34

Abstract: The classification of the quality of cork by image analysis was studied in summer 2009 in two production areas, one coastal (M’Sila) and one mountainous (Zarieffet). The cork sampling was randomly performed in each area from 40 trees belonging to three health categories: healthy (defoliation <25%), weak (defoliation 25-60%) dying (defoliation >= 60%). The results show that the thickness of boards and their average annual increases (all state of health combined) were respectively about 25mm (2.3mm/yr) in coastal versus 21mm (1.9mm/yr) in mountain forests. The average coefficients of porosity (all health status combined) calculated from image analysis techniques vary between 4.90% and 4.50% in tangential section. In the oak forests of M’Sila, prone to an advanced decline, superimposed on a large genetic variation of trees, variable porosity (total area of pores, pore density, % CP) vary significantly across the
three health situations. In Zarieffet, limited decline and slow growth of cork seem to have no effect. The classification of cork planks according to their increasing quality, and thus to the decreasing abundance of defects, does not seem to be dependent on the health status of the trees. The physiological changes of the tree do not necessarily induce a complete eradication of the cork of good quality but rather provoke a gradual reduction of its surface in relation to decay intensity. This phenomenon is much more pronounced in coastal stands than in mountain stands.

Water-Nitrogen use efficiency in cork oak seedlings (Quercus suber L.)


Abstract: The effect of water shortage and nitrogen deficiency on physiology behaviour has been studied in cork oak (Quercus suber L.). Two years old seedlings have been submitted to different water and nitrogen treatments. Two water-nitrogen regimes were adopted (W: well watered plant, S: water-stressed plant, N1: plant receiving 3g of nitrogen, N0: plant without nitrogen) corresponding to the four following combinations: WN1, WN0, SN1, SN0. We assessed morphological parameters (seedlings size, leaves number and diameter of the collar) and physiological parameters (stomata conductance (g), photosynthesis (A) and chlorophyll content). Morphological parameters did not show a significant difference between the different treatments. Low stomata conductance and photosynthesis level were closely related to water-stressed seedlings compared to well watered ones. The average of water use efficiency (A/g) increased by 25% in water-stressed seedlings. Chlorophyll content, assessed with CCM-200 chlorophyll content meter, decreased in seedlings deprived from nitrogen treatment. Further ecophysiological studies are in progress including assessment of the effect of increasing CO2 on water use efficiency through A/Ci curves.

Seasonal variations of evapotranspiration and net carbon assimilation in a cork oak forest of North Tunisia


Abstract: In the Mediterranean region, water and carbon balances are important factors to understand cork oak forest decline. The objective of this investigation is to know the seasonal variations of cork oak transpiration and net photosynthesis in the North of Tunisia. The experimental design was carried out during the 2009 vegetative season. It consisted in following-up the sap flow densities (4 trees) and in monthly measurements of photosynthesis rates (6 trees). Usual climatic parameters, such as soil moisture, radiation, temperature, wind velocity and humidity were measured using an automatic weather station. Tree transpiration (Tr) indicates a similar evolution to climatic demand (ETo Penman) with a weak slowing down during July-August. Tree transpiration accounts for 40% of ETo and 30% of annual rainfall and has reached a maximum value of 2.8mm/j when ETo is almost 7mm/j. Average photosynthesis marked a clear growth from March to June, reaching a maximum value of Pn = 13µmol/m² s⁻¹, and dropped appreciably during August and July (Pn = 4µmol/m² s⁻¹).

Estimating above-ground biomass of natural stands of Mirbeck’s oak (Quercus canariensis Willd.) in Kroumirie, North West of Tunisia

El Mokni, R., Riadh Mahmoudi, M., Sebei, H., Hédi El Aouni, M. ......................... 47-50

Abstract: Today, facing climatic changes, monitoring forests to promote their productive potentialities and develop adequate improvement and development strategies, is of great importance. Forest change characterization resorts to measure various biometric and/or weight parameters such as: density, terrestrial area, diameter or circumference at breast height (DBH), leaf area index, biomass, etc. In the mountain forests of Kroumirie, where natural Mirbeck's oak (Quercus canariensis) grows, ten study plots of 1ha each were selected in 4 different stations, and the DBH of all the trees measured. Ten trees representative of the main diameter classes were then harvested and their dry-biomass measured. Their diameter ranged from 4.8 to 48.4cm, total height from 4.5 to 18.3m and dry-weight from 5.9 to 1989.1kg. Equations between the different compartmental biomasses and the other tree parameters were developed and tested statistically.
Non-linear models based on trunk diameter (DBH) alone explained more than 98% of the biomass variation. Coefficients of determination ($R^2$) ranged from 0.89 to 0.98. Equations for wood trunk and foliage biomasses showed higher $R^2$ than did that of bark trunk, branches, twigs and buds or total branch biomasses of this deciduous tree species.

**Soil restitution of organic carbon under cork oak forest in the north of Tunisia**

*Abstract:* Degradation of soil properties, including the reduction of organic matter content, basically induces ecosystem imbalance. The present study was undertaken to characterize the surface organic carbon content in soils of cork oak (*Quercus suber*) forest areas in the Mogods region, North of Tunisia. In total, 36 sites were studied and 108 samples analyzed (representing 11,000ha of cork oak forest). The analyses showed that the restoration of organic carbon (fibric, hemic and sapric organic soil materials) varies from 6.2 to 22.1 tons per hectare with an average of 15.1 t/ha. The surface water erosion largely affected the distribution of the surface organic matter (39%), especially in the slope direction. The capacity of the cork oak forest system to request soil organic matter is considered to be weak. Appropriate management actions, such as soil erosion protection measures and external input of organic matter in new and young plantations have to be seriously considered to improve the soil restitution of organic carbon under cork oak forest.

**Influence of different management strategies of a cork oak forest on chemical and microbiological characters of soils**

*Abstract:* This study was performed in the framework of an international research program financed by NATO (ESP.MD.SFPP 981674). The experimental cork oak forest area of Cusseddu-Miali-Parapinta, managed by AGRIS Sardegna – Dipartimento della Ricerca per il Sughero e la Silvicoltura, has been selected for the environmental soil study. Soil samples were collected from three stations undergoing different management strategies: Station 1 was damaged by fire in 1983 and recovered in the following years. Station 2 has been managed since 1958; Station 3 remained as a spontaneous growing stand since the 1960’s. The samples collected at two depths (0-10cm and 10-20cm) and in two periods (summer and winter) were analysed to determine some chemical parameters (pH, total organic carbon, heavy metals) and fungi diversity. Among the three stations some differences were pointed out concerning the pH values, lower in the damaged station, and the heavy metal content, higher in the same station. Moreover, the highest fungi biodiversity was observed in this last station while the *Penicillium* genus dominated in the non-managed station. These results could be partially correlated with the management strategies.

**Decline of *Quercus robur* forests in northwestern Italy: current situation and tentative aetiology**

*Abstract:* *Quercus robur* decline is a widespread phenomenon in northwestern Italy. In order to determine the incidence, the severity and the evolution of the decline, *Q. robur* crown transparency was assessed starting from 2007 in 11 study sites. In 2007, the mean crown transparency ranged from 35% to 74% depending on sites. No significant variation was observed among crown transparency levels in the 3 sampling periods (2007-2008-2009) at any sites. Soil and climate conditions of study sites were investigated in order to find possible correlations with crown transparency. Drought in spring may be the main factor triggering off oak decline in northwestern Italy. Ongoing experiments indicate that the availability of water and light may have effect only in the medium and long time period.
Pedunculate oak decline: thinning effects on the ectomycorrhizal exploration groups

Mosca, E., Scattolin, L., Garbaye, J., Mutto Accordi, S., Montecchio, L. 71-78

Abstract: The research was performed in a declining pedunculate oak (Q. robur L.) stand, selecting sixteen trees belonging to two declining classes and reducing the competition exerted by the neighbouring trees by thinning half of them. Their ectomycorrhizal (EM) community was monitored over a two-year period, with regard to species abundance and soil exploration ability. Sixty-four EM species were measured, with relative abundances changing over time with respect to both the degree of decline and the thinning treatment. EMs able to explore larger soil volumes were more abundant after thinning in both decline classes. Since oak decline was often associated with water and nutritional stresses, this cause-effect relationship suggests that thinning could slow decline.

Isolation and growth temperature requirements of oomycetes and Botryosphaeriaceae from the same oak hosts: evidence for a vicariant pathogenic action?

Moricca, S., Uccello, A., Ginetti, B., Ragazzi, A. 79-84

Abstract: “Oak decline” is a complex syndrome affecting oak stands worldwide. The phenomenon, reported early in the 1900’s, became a serious ecological problem starting from the 70’s. In recent years, it has become more and more evident that oak decline is the result of a complex interaction between a plurality of disease agents and environmental stresses (e.g. prolonged drought). In Mediterranean climates, hot and dry summers predispose trees to water deficit, a condition that is sufficient to shift the behaviour of some endophytes towards pathogenicity. The cold season, on the contrary, during which time rainfall is concentrated, is more favourable to oomycetes for their attack and dispersal. Here we report on the isolation of fungal endophytes and oomycetes from the same trees in declining stands and on some laboratory tests carried out to individuate optimal growth conditions for these agents. Our preliminary findings suggest a possible synergistic action between endophytes and oomycetes in inciting disease and inducing plant dieback.

New outbreaks of charcoal canker on young cork oak trees in Portugal


Abstract: Biscogniauxia mediterranea, the causal agent of charcoal canker, is widely spread in Mediterranean region affecting mainly Quercus suber. It has been considered a secondary pathogen that only attacks weakened hosts but, in the last years, we have been witnessing an increasing number of young vigorous trees exhibiting charcoal canker symptoms in Portugal. Beyond the fungus teleomorphic stage usually present in the infected hosts, it has been frequently observed in young trees its anamorphic stage. The impact of climatic changes on fungal development and forest vulnerability is discussed, particularly in the Mediterranean scenario.

Ophiostomatoid fungi associated with cork oak mortality in Portugal

Inácio, M. L., Henrique, J., Lima, A., Sousa, E. 89-92

Abstract: Two Ophiostomatoid fungi consistently isolated from declining cork oaks attacked by the ambrosia beetle Platypus cylindrus in Portugal are described as Raffaelea canadensis and R. montetyi. A molecular analysis based on DNA sequences classified these species within the Ophiostomatales. The investigation of conidiogenesis of R. canadensis and R. montetyi by SEM supported this taxonomic placement and showed the formation of conidia by sympodial and annellidic percurrent proliferation, respectively. Also, their pathogenicity was proven through inoculations experiments. The fungi have been isolated both from wood and the body surface and mycangia of the beetle. It is certain that the pathogens were transferred to cork oak by P. cylindrus, consequently, the previous hypothesis of a species-specific association of a single ambrosia fungus with a single beetle species is questioned.
**Phytophthora root disease: a new threat for cork oaks**
at Doñana National Park (south-western Spain)
De Vita, P., Serrano, M. S., Caliér, F., Ramo, C., García, L. V., Sánchez, M. E. ................................................................. 93-96

*Abstract:* The cork oak is an emblematic species of great ecological value in the ecosystem ‘stabilized sands’ at Doñana National Park (south-western Spain). The current oak population mainly consists of big scattered individuals representing only a 10% of the forest that occupied the area three centuries ago and which was devastated by massive cutting. After the protection of the area as Biological Reserve forty years ago, all silvicultural practices such as cutting, pruning and cork extraction ceased. However, the population of mature trees is suffering a quick decline that threatens their survival. The main menace to the survival of cork oaks comes from the high density of herbivores (deer, wild boar, cattle, horse) which eat almost all of the acorns and prevent young plants to grow and replace old trees. Additionally, a significant number of oaks are frequently occupied by a nesting colony of wading birds (storks, herons, spoonbills). These trees show signs of stress (defoliation), and eventually die much faster than trees not occupied. Finally, we detected a new problem: the sudden decline of trees, which may die within a few months independently to the presence of nesting birds. *Phytophthora cinnamomi* has been consistently isolated from roots and rhizosphere of these trees and an important increment in the number and size of these foci is expected. In this way, proposals to monitoring the affected trees and preventive application of phosphonates by trunk injection have been exposed to the Park authorities.

**Phytophthora cinnamomi and Pythium spiculum as main agents of* Quercus* decline in southern Spain and Portugal**
Serrano, M. D., De Vita, P., Fernández-Rebollo, P., Coelho, A. C., Belbahri, L., Sánchez, M. E. ................................................................. 97-100

*Abstract:* A severe decline affecting Iberian *Quercus* species has been reported since the early 1990s in southern Spain and Portugal, leading to a widespread mortality of the evergreen Iberian oaks, *Quercus suber* and *Q. ilex ssp. ballota* (synonym: *Q. rotundifolia*). This work summarizes the results obtained through several research projects carried out in southern Spain since 1997 dealing with Iberian oak decline in managed forests and natural oak ecosystems, and the role played by *Phytophthora cinnamomi* and *Pythium spiculum* as the main biotic factors associated.

**Serious outbreak of Holm oak decline on Caprera Island, Italy**
Franceschini, A., Linaldeddu, B. T., Scanu, B. ..................................................... 101-108

*Abstract:* Since 2009 a severe decline of Holm oak trees has been observed on Caprera Island, Italy. In summer 2010, a survey was carried out to study the pathogens involved in the aetiology of this decline event. Fungal isolates obtained from living twigs and branches of affected trees, showing sunken necrotic bark lesions and blackish exudates were identified as *Botryosphaeria corticola* on the basis of morphological features and internal transcribed spacer region (ITS1-5.8S-ITS2) rDNA sequence. The occurrence of signs and symptoms caused by this pathogen was detected in all Holm oak stands investigated. Moreover, *Phytophthora cinnamomi* and other root-infecting *Phytophthora* spp. were isolated from Holm oak trees showing sudden death, severe branch dieback, bleeding cankers and root rot. The results obtained suggest that invasive pathogens such as *Botryosphaeria* and *Phytophthora* species, as well as causing sudden oak death, could also be important contributing factors in the onset of long-term oak decline and in the loss of biodiversity of natural and semi-natural ecosystems in the Mediterranean area.

**Fungi associated with* Platypus cylindrus* (Col., Platypodidae) in a cork oak stand of north western Algeria: the case of harmful fungi**

*Abstract:* The study of the mycoflora associated with *Platypus cylindrus* in a cork oak forest of the coastal north-western Algeria let to isolate 42 fungal species from intestinal contents of old larvae and both sexes of the insect, as well as mycangia and wood galleries; these fungi include
17 species potentially pathogenic to plants. Their identification was based on morphological and molecular (rDNA) characteristics. Some of them are already known to be pathogenic to cork oak: *Ophiostoma quercus*, *O. stenoceras*, *Biscogniauxia mediterranea* and *Botryosphaeria corticola*. Others as *Phaeoacremonium inflatipes*, *Ulocladium botrytis* and *Gnomonia petiolorum* have already proved their pathogenicity on other plants. Among the isolated fungi, some are for the first time recorded in association with this insect.

**Soil fertilization as a control strategy against Quercus root rot in agroforestry systems**

Serrano, M. S., Fernández-Rebollo, P., De Vita, P., Carbonero, M. D., Sánchez, M. E.  .............................................................. 117-120

**Abstract:** We studied the effect of various calcium (CaO, CaCO$_3$ and CaSO$_4$) and potassium products (KIO$_3$ and KOH) on the inoculum density in the soil and infectivity of *Phytophthora cinnamomi*, the main biological agent causing root rot on Quercus species in oak-rangelands ecosystems in southern Spain. Products were chosen by their known effectiveness on inhibition of *P. cinnamomi* sporangial production. The chemicals were added separately to soil infested with *P. cinnamomi* at the usual doses used in rangelands. Two weeks after chemicals addition, only potassium products produced a significant decrease on inoculum densities. At that time, soils were transferred to plastic pots and holm oak seedlings were planted. Eight weeks later, plants growing in infested and untreated soil showed high levels of foliar and root symptoms, whereas plants growing in soil treated with fertilizers (exception made with KIO$_3$) showed a significant reduction of symptom severities. These results suggest that, together with other control strategies, the regular application of Ca and K fertilization in oak rangelands should be considered for reduction of the incidence of this severe disease.

**Effectiveness of environmental friendly control strategies against powdery mildews on oak seedlings in natural forests**

Lione, G., Nicolotti, G. and Gonthier, P.  ........................................................... 121-127

**Abstract:** Powdery mildew caused by *Microsphaera alphitoides* Griff. et Maubl. is a major threat affecting the survival and growth of oak regeneration. An experiment was performed in a *Quercus robur* L. naturally regenerated forest in northwestern Italy in order to assess the effectiveness of sulphur and potassium dihydrogen phosphate against powdery mildew. Both treatments reduced significantly disease severity on seedlings compared to controls (p < 0.05). The best result was obtained with sulphur. An additional experiment was conducted by using potassium phosphite. Results suggest that these treatments may be suitable to control powdery mildew in natural forests.

**Mycoflora of oak trees in Turkey**

Eken, Cæfer  ......................................................................................... 129-132

**Abstract:** Turkey is a rich country in terms of plant diversity. There are 9000 plant species, 3000 of them are endemic. Oaks (*Quercus* spp.) are common trees of deciduous forests in Turkey. Oaks are one of the most diverse groups of tree species in Turkey. There are 18 different species of oaks. The oak trees have a number of pathological problems, especially fungi. The objective of this paper is to summarize data on the mycoflora of oak trees. According to the relevant literature, 63 fungus species belonging to 45 genera are reported in Turkey.

**eMyCo – Ectomycorrhizal Community Database**


**Abstract:** “Ectomycorrhizal Community Database” (EMyCo) is a tool planned for gathering data concerning the structure and characters of ectomycorrhizal communities, in order to study and compare those present in different environments, particularly in the Mediterranean area. The project is made up by independent surveys, each one describing a community and its growth habitat. The base components of survey are elementary taxonomical units, each described by a simplified set of morphological data relative to mycorrhizas, and by ITS sequences of the
symbiotic fungus. Values of abundance and frequency of each unit belonging to the community are calculated. eMyCo presents a data search system suitable to compare different surveys investigations sharing one or more parameters. This approach makes easy to obtain in-depth information about the ecological preferences of any ectomycorrhizal fungal species, as well as the relationships established with other species in the community. Moreover, eMyCo allows calculating some ecological indices of a community and comparing those of different communities. Finally, eMyCo may be used also for studying space-temporal variations of such communities, so providing a useful tool to recognize bio-indicators of the forest health state.

Methodological approach in monitoring ectomycorrhizal communities of cork oak woods in Sardinia (Italy)
Seddaiu, S., Lancellotti, E., Corda, P., Franceschini, A. ........................................... 139-142

Abstract: The high sensitivity of ectomycorrhizal fungi to the changes in the vegetative condition of the plants makes them suitable to be used as bio-indicators in healthy monitoring programs of forest ecosystems. For this purpose, general predictive models concerning the relationship between tree health and ectomycorrhizal fungi are need. The building of suitable models requires large-scale studies in order to explore the different situations were forest species grow. Considering such aim this research on the cork oak ectomycorrhizal communities is carried out in Sardinia. In addition to health state of trees two key factors (soil type and forest structure) influencing the qualitative-quantitative composition of the ectomycorrhizal community are also considered. In this note the experimental approach and its effectiveness in revealing the richness of species of cork oak ectomycorrhizal fungal community is discussed.

First field tests with an American strain of the Nucleopolyhedrosis Virus for the control of Lymantria dispar L. in Sardinia
Cerboneschi, A. ................................................................................................. 143-146

Abstract: Small scale field tests with an American strain of the Nucleopolyhedrosis Virus, the active ingredient of Gypchek®, were conducted for the first time in Sardinia during 2006-2007 on Lymantria dispar larvae. Promising results were obtained by spraying the entomopathogenic formulation at different dosages on the cork-oaks trees infested by 2
nd instar larvae of the gypsy moth. The mortality and the incubation period varied with the concentration of the viral polyhedra. The Virus markedly affected the rate of development of lethally infected larvae.

Susceptibility of third instar larvae of Lymantria dispar L. to an American isolate of the Nuclear Polyhedrosis Virus
Cerboneschi, A. ................................................................................................. 147-150

Abstract: Some tests have been carried out in order to estimate the susceptibility of a gypsy moth population from North Sardinia to an American isolate of the nuclear polyhedrosis virus. Third-instar larvae were infected by contaminating the artificial diet with variable concentrations of different viral suspensions. The analysis of larval mortality and development data reveals considerable susceptibility of the Sardinian populations of Lymantria dispar to the American isolate of the virus.

Electrophysiological and behavioural analysis on the use of a (+)-disparlure analogue for biological control of Lymantria dispar L.

Abstract: The female gypsy moth Lymantria dispar produces a single-component sex pheromone, called (+)-disparlure (2-methyl-7,8-epoxy-octadecane), for upwind attraction of conspecific males for mating. It was recently shown that a (+)-disparlure analogue, the 2-decyl-1-oxaspiro[2.2]pentane (OXP-01) is neither stimulatory nor attractive by itself, but strongly decreases the male response to the pheromone and also inhibits its attractiveness when the two compounds are blended at a 1:1 ratio. Aim of the present work is to study the temporal decay patterns of the attractive effect of the 1:1 blend as compared to those of the single components,
OXP-01 and (+)D. We counted the number of males trapped from field trap with (+)D and traps with the blend and with OXP-01 within a time interval of 1-16 days. Our electrophysiological results show that OXP-01 always decreases the excitatory effect of pheromone on the male antennae. Present behavioural results suggest that the analogue may interact with the natural gypsy moth pheromone, by modifying its attractiveness on male moths.

Geostatistical analysis of gypsy moth outbreaks in Sardinian oak forests using a geographical information system
Cocco, A., Luciano, P. ................................................................. 155-162
Abstract: Populations of the gypsy moth Lymantria dispar (L.) (Lepidoptera: Lymantriidae) in Sardinia were studied with a geostatistical model. A geographical information system was created by joining the gypsy moth egg mass counts recorded at 282 permanent monitoring sites from 1980 to 2004 and the climatic, vegetational, geomorphological and pedological features of the sites. The frequency of gypsy moth outbreaks during the study years was affected by the predominant host tree, slope, elevation and temperature of the monitoring sites, while no correlation was found between the outbreak frequency and exposure, rainfall and soil type. Spatial distribution of the gypsy moth was analyzed with geostatistical methods. Cokriging with outbreak frequency as a covariate was found to be the most suitable technique to estimate the gypsy moth egg mass abundance, showing a spatial correlation within a range of 18.5-53km. Distribution maps of the gypsy moth in Sardinia were created to show the outbreak foci and the spread of gypsy moth infestations in each monitoring area. Our findings provide a technical tool to predict gypsy moth distribution and define the treatment areas, thus helping to develop rational gypsy moth management programs.

Analysis and modelling of Lymantria dispar (L.) metapopulation dynamics in Sardinia
Gilioli, G., Bodini, A., Cocco, A., Lentini, A., Luciano, P. .......................... 163-170
Abstract: Sustainable forest management could take advantage from knowing the ecological mechanisms underlying provisioning and regulating ecosystem services. The gypsy moth, Lymantria dispar (L.) (Lepidoptera: Lymantriidae), is one of the main oak forest defoliators in the Holarctic Region, and its outbreaks may disrupt ecosystem mechanisms at the basis of forest productivity and regulation. Most of the analysis and modelling approaches on gypsy moth population dynamics have been applied to a continuous spatial dimension. These approaches do not account for the possible role of highly fragmented forest stands on pest dynamics. The objective of this contribution is to analyse the influence of the fragmented landscape structure in Sardinian forest areas on gypsy moth spatio-temporal dynamics. The performed analysis is based on: a) the evaluation of spatial synchrony of population dynamics to account for connectiveness among local populations in single patches, b) the parameterization of spatially explicit metapopulation models to describe the forest pest metapopulation dynamics. The estimated metapopulation models display interesting properties that could be useful in defining the specific metapopulation dynamics pattern at forest district level. The proposed approach could be further developed and applied to the evaluation of management strategies of the forest pest.

Effects of Bacillus thuringiensis kurstaki treatments on gypsy moth population dynamics
Lentini, A., Cocco, A., Luciano, P. .......................................................... 171-174
Abstract: The present study investigates whether treatments with Bacillus thuringiensis kurstaki (Btk) at the beginning of the progradation phase affect the natural oscillation in Lymantria dispar (L.) populations, by decreasing their abundance to the levels of the latency phase, thus avoiding outbreaks. During the spring of 2005, a bioinsecticide based on Btk was applied on 3500 hectares of cork oak wood in north-eastern Sardinia where infestation foci of the gypsy moth had been recorded. Spray applications reduced the population abundance and interrupted the progradation phase. However, from the third generation after the treatments, the gypsy moth population
abundance increased, reaching a peak in 2009. Our findings indicate that treatments applied at the beginning of the progradation phase postpone the outbreak by 2 years.

Ten years of microbiological control program against lepidopterous defoliators in Sardinian cork oak forests

Luciano, P., Lentini, A. .................................................. 175-178

Abstract: Severe infestations of Lymantria dispar (Linnaeus) and Malacosoma neustria (Linnaeus) have become increasingly frequent in Sardinian cork oak forests. The consequent progressive decay of the health conditions of oak trees has threatened the conservation of oak forests and the amount and quality of cork production. To limit the damage caused by L. dispar and M. neustria in Sardinia, a microbiological control program using Bacillus thuringiensis subsp kurstaki have involved approximately 100,000 hectares of cork oak forests in the period 2001-2010. Here we report the main results achieved and problems faced during the control program.

Persistence of Bacillus thuringiensis subsp. kurstaki after an aerial application

Petrucci, C., Marchi, G., Panzavolta, T., Tiberi, R., Surico, G., Filindassi, M., Ruiu, L. .................................................. 179-183

Abstract: On May 7th 2007 a commercial preparation of Bacillus thuringiensis subsp. kurstaki strain HD1 (Btk-HD1) was applied by aircraft in an oak forest near Florence (Italy) to control Oak processory moth (Thaumetopoea processionea L.). The persistence of Btk-HD1 in the oak forest was assessed by collecting leaf, litter and soil samples 24h before and 24h after the treatment. Further soil samples were collected 36, 84 and 122 days after the Btk-HD1 application. The presence of Btk-HD1 was detected by morphotyping analysis followed by a high throughput staining methodology and PCR analysis. Btk-HD1 was isolated both from leaves and litter collected 24h after treatment, but never from soil of the oak forest.

Comparative applications of Bacillus thuringiensis formulations against Lymantria dispar in Sardinian forests

Ruiu, L., Lentini, A., Coinu, M., Loi, A., Serra, G., Luciano, P. .................. 185-190

Abstract: During 2007 and 2009, aerial spray trials were carried out in order to evaluate the effectiveness of four Bacillus thuringiensis kurstaki (Btk) formulations against gypsy moth infestations in North Sardinian cork oak forests. Based on randomized-blocks, the experimental design involved three replicates on 25-50ha-plots for each of the following thesis: 1. Untreated Control; 2. Foray 48B(S), flowable concentrate formulation used for standard application, containing 12.7 BIU/L; 3. Foray 48B(N), flowable concentrate formulation including new safety ingredients, containing 12.7 BIU/L; 4. Foray 76B, flowable concentrate formulation containing 20 BIU/L; 5. VBC-60074, dry flowable formulation containing 64 BIU/kg. A good efficacy was recorded in trials with Foray 48B(S), Foray 48B(N) and Foray 76B. These formulations caused mortality rates greater than 80% and adequately protected trees from defoliation. The dry flowable formulation, VBC-60074, produced the lowest efficacy probably in relation to a higher evaporation of spray droplets resulting in less overall coverage of target foliage.

Successful insect spraying operations in Mediterranean climates

Fusco, R. A. ................................................................. 191-195

Abstract: In the Mediterranean climate, weather is one of the most important factors which determine whether a spray operation is a success or a failure. Other factors include the spray formulation, the spray equipment, aircraft type, phenological conditions, characteristics of the forest canopy, and the pilot skills/attitude. In this presentation, I will discuss some of the meteorological factors that affect aerial spraying operations and the guidelines that should be followed to achieve high levels of control of forest insect pests. Comments on how to organize and carry-out a successful aerial spray operation will also be made.
Egg development and diapause in Sardinian populations of *Tortrix viridana* L.

*Serra, G., Lentini, A.* ................................................................. 197-200

**Abstract:** A three-years study was carried out on egg development by several Sardinian populations of green oak leaf roller moth. In Spring 2005 coincidence between budburst and egg hatching was analyzed in two mixed oak stands of *Quercus pubescens* and the evergreen oaks *Q. ilex* and *Q. suber*. In each stand the time of budburst was the same for the different oak species and egg hatching did not differ in the *Tortrix viridana* populations associated with each oak. During 2005/06 and 2006/07, trends of diapause completion and egg hatching of thirteen *T. viridana* populations collected in some Sardinian forestry districts and associated with *Q. pubescens*, *Q. suber*, or *Q. ilex* were compared in two semi-field trials. In both years *T. viridana* populations showed differences in cold requirement for diapause completion and displayed non synchronous egg hatching.

Spatio-temporal evolution of *Platypus cylindrus* (Col., Platypodidae) attacks in a young cork oak stand after debarking: case study of the M’ Sila cork-oak forest (North Western Algeria)

*Belhoucine, L., Bouhraoua, R. T.* ....................................................... 201-204

**Abstract:** Two young plantations of the M’Sila cork oak forest (north-west Algeria) debarked in summer 2007 were selected to follow the rate and intensity of *Platypus cylindrus* infestation. The colonization of the 216 sample-trees was assessed monthly by counting the insect penetration holes. After eight months of survey (December 2007-July 2008), the results showed an increasing rate of trees infestation, that varied from 26% in winter to 44% in July, with an average density varying during this period from 22 to 130 holes/m². Insect population distribution insect on the trees is not at random but corresponds to a strategy depending on the following tree characteristics: size (height < 6m, circumference < 70cm; exploitation (debarking coefficient > 2.5, debarking height > 1.5m); sanitary conditions (weak and declining trees).

Larval densities, behaviour and life cycle of *Sphodroxia maroccana* (Coleoptera, Melolonthidae), an endemic pest of cork oak in the Mamora forest, Morocco


**Abstract:** The reproduction biology of *Sphodroxia maroccana* Ley was studied from adults collected in 2009 in the Mamora forest (North of Rabat), and with adults issued from larvae reared in the laboratory. Pairs were bred separately in plastic boxes containing sand from the Mamora and they were followed for their biology until death. In 50% of pairs, mating was immediate without any preliminary. In the other cases, mating occurred 24 to 48 hours after the pairs were formed. This delay was necessary until the two partners attained sexual maturity. Females oviposited quickly after mating, usually in the next three days. Oviposition occurred at the surface of boxes in case of a thin layer of sand. When sand was enough, females oviposited at the bottom of boxes. Fertility of females collected in the field varied from 60 to 120 eggs, 82 eggs on average. Fertility was less for females obtained from larvae reared in the laboratory (10-70 eggs). Oviposition was sporadic, with breaks lasting up to 24 hours. Under laboratory conditions, females were slowly moving round, allowing eggs dispersal. At a temperature of 28°C, egg development lasted for 22 days on average. Adult longevity was short after sexual maturity, 13 and 15 days on average for males and females, respectively. Development from egg to adult was 3 and 4-5 years on average for males and females, respectively, with three larvae instars and a marked sexual dimorphism. A study on the density of *S. maroccana* larvae during two seasons (2008 and 2009) for all the Mamora districts showed that the density depended both on the depth of the clay floor and on annual rains, and thus indirectly on the water holding capacity of sand. The highest densities (up to 3500 larvae / ha) were observed in the northern districts, where the soil depth was greatest, particularly during wet years.
Subterranean mobility of *Sphodroxia maroccana* larvae (Coleoptera, Melolonthidae), a pest the young cork oaks plantations in the Mamora forest, Morocco


Abstract: The larvae of *Sphodroxia maroccana* Ley (Coleoptera, Melolonthidae) attack roots of cork oak plants in the young plantations of the Mamora forest (North-East of Rabat, Morocco). Factors inferring larvae movements in the soil (sand) were analysed to improve the techniques of fighting against this pest. Laboratory experiment was performed by creating a horizontal and vertical humidity gradient in the sand, with or without food. Larvae moved to reach optimal humidity. Larvae showed low moving, with crossing distances ranging from 5.68 to 5.93cm per day under 40 to 60% humidity, and approximately 0.48cm a day when sand was dry (humidity <10%). The roots of young cork oak seedlings seemed to exert a positive attraction towards larvae. Sand humidity can explain the seasonality of the damages observed in the field. Damages were substantial in the wet season (late autumn to early spring), or during summer in case of excessive watering.

Contribution to the identification of gall wasps (Insecta; Hymenoptera; Cynipidae) in the Mirbeck’s oak forests (*Quercus canariensis* Willd.) of Kroumiria, North West of Tunisia

El Mokni, R., Riadh Mahmoudi, M.et El Aouni, M. H. ........................................... 221-224

Abstract: The forest stands of Mirbeck’s oak (*Quercus canariensis* Willd.) (pure or mixed with cork oak) extends in the North West of Tunisia over approximately 20,000ha. The altitude, heavy rainfall, and high humidity favor a high biodiversity, notably in gall wasps, a group of micro-wasp inducing galls on various organs (leaves, buds, fruit, etc.) of the plant. The ecological study undertaken in the oak forests of Kroumiria since 2004, allowed to identify ten species of gall wasps representing 3 genera, among which *Andricus* (4 species) is the richest. We presented here the different Cynipidae species identified for the first time on Mirbeck’s oaks in Tunisia and the morphological characteristics of their galls. These galls may affect the trees’ health and contribute to their lower productivity. This calls for a more serious health surveillance to stem their potential overgrowth.

The oak gall-wasps in North Africa: interesting and dangerous species (Hym.: Cynipidae)


Abstract: This paper presents a provisional list of North African oak gall-wasps collected during several years by different research teams. Collects were carried out on different oak species (*Quercus suber*, *Q. coccifera*, *Q. ilex*, *Q. canariensis* et *Q. faginea*, and on two hybrids: *Q. afares* (*Q. suber* x *Q. canariensis*) and *Q. kabylica* (*Q. suber* x *Q. afares*). Several species of Cynipidae belonging to *Andricus*, *Biorhiza*, *Callirhytis*, *Cynips*, *Neuroterus*, *Plagiotrochus* and *Synophus* genera were found. Data concerning the main species are examined and specific diversity of each country is displayed. We underline the presence of *Neuroterus minutulus* on a host different from *Q. cerris* and the presence of *Neuroterus saltans* on *Q. afares* and *Q. kabylica*. We note the occurrence of two dangerous species (*Callirhytis rufescens* on *Q. suber* and *Q. faginea*, and *Plagiotrochus amenti* on *Q. suber*), and that of three potentially dangerous species (*Andricus grassulariae*, *A. pseudo-inflator / inflator* and *A. pictus*). Finally, new data are given on the host of *Synophus* species.

Charipins (Hym.: Figitidae: Charipinae) and aphid mummies: knowledge review about these secondary parasitoids of aphids populations (Hemiptera: Aphididae) on oaks

Pujade-Villar, J., Ferrer-Suay, Mª Mar, Selfa, J., Pérez-Hidalgo, N. ..................... 233-240

Abstract: Charipins are small wasps that develop in other secondary parasitoid wasp parasitoids. Two genera, *Allosxysta* and *Phaenoglyphis*, attack aphid mummies. Based on the example of
human mummies, we present the mummies of aphids and the importance of Charipidae in food chains that control aphids’ populations. We summarize the data on the diversity of aphids that make damages on oaks in the Circummediterranean region, especially the cork oak, as well as the historical knowledge on charipins in this region and results of recent studies on their taxonomy and phylogeny.

Gall-wasps of oaks (*Quercus* spp.) in Tunisia with a special attention to *Synophorus olivieri* Kieffer (Hymenoptera: Cynipidae)

**Ben Jamâa, M. L., Grami, M., Selmi, H. & Pujade-Villar, J.** ........................................... 241-244

**Abstract:** Cynipid galls were collected between February-March and October 2009 in the Khroumirie Mountain in Northwestern Tunisia on *Quercus suber*, *Q. faginea*, *Q. afares* and *Q. coccifera*. Twenty of the 24 known Tunisian Cynipids species were recorded during this study with 10 reported for the first time from Tunisia: *Andricus burgundus*, *A. curvator*, *A. quercusradicis*, *Cynips disticha*, *C. quercus*, *Neuroterus anhracinus*, *N. minutulus*, *Plagiotrochus amenti*, *P. coriaceus* and *P. gallaeramulorum*. A particular attention must be given to two species: *N. minutulus*, whose very peculiar gall was known in central Europe on *Quercus cerris*, is mentioned here for the first time on *Quercus suber* in Tunisia and North Africa. On another hand, *P. amenti* could be considered as a potential pest for oak trees as its expansion should induce economical losses for Tunisian cork industry. Finally, we identified for the first time in Tunisia several parasitoid Chalcidoidea obtained from *Synophorus olivieri* galls.

Buprestids populations sampling in Spanish cork oak forests

**Soto, A., Martínez Gonzalvo, M., Miravet, A., Duart, M.** ........................................... 245-248

**Abstract:** Abiotic factors, diseases and pests have an important effect on the health of cork tree and a significant impact on the losses in the production of the cork. Among these factors is the presence of buprestid beetles. Buprestidae family is a coleopteran group that produces important damage in cork oak because they are borer insects of trunks or branches. *Coroebus undatus* is one of the most important pests of the cork oak. The aim of this work was to study the composition, diversity and seasonal trend of buprestids community present in Espadan mountain in Spain. We used several types of traps to catch the buprestid insects to carry out this study. From 2004 to 2005, studies were carried out with a vacuum machine in seven plots and with Malaise traps in four plots. From June to September in the 2008 and 2010, sticky traps were employed. All samples were collected periodically every 7-10 days. Differences among the caught species were dependent on the kind of sampling used. *Agrilus* spp, *Acmaeodera* spp and *Chrysobothris affinis* were the most numerous. 13 different species with malaise traps and only 4 with vacuum machine were found. In the present study we also compared the population dynamics of the most abundant species.

Ant species noxious to cork oak in Sardinia

**Verdinelli, M., Loi, A., Luciano, P.** ................................................................. 249-252

**Abstract:** During the biennium 2009-2010, a survey on the pest status of some ant species was conducted in some cork-oak stands of the North of Sardinia. In the first year, 5 species of arboricolous ants were collected by direct sampling from a number of trees randomly chosen. Although they are not very common species, workers of *Camponotus fallax* (Nylander, 1856) and *Camponotus truncatus* (Spinola, 1808) were collected inside little twigs and in other refuges. *Crematogaster scutellaris* (Olivier, 1792) was the most common species as its presence was detected in every tree. *Camponotus vagus* (Scopoli, 1763) was observed primarily in old trees and in rotten wood among roots and its pest status has not been seen yet as it rarely builds its nest in productive trees. Serious damages caused by *Lasius brunneus* (Latreille, 1798) were observed on cork bark of young plants. The ant activity degrades cork, diminishing its market value and makes the extraction of the cork very difficult. As a consequence, in the second year the survey of ant fauna was replicated in the same site by using also pitfall traps and carried out in three other plots. The infestation percentage caused by *L. brunneus* was estimated as well as the damage on each plant.
Survey of entomopathogenic nematodes and fungi in the oak woods of Sardinia (Italy)

Tarasco, E., Lentini, A., Triggiani, O. ............................................................. 253-255

Abstract: The natural occurrence of entomopathogenic nematodes and fungi in different oak woods of Sardinia was investigated during a survey carried out in April-May 2009; in the centre and in the north-east of the island 33 sampling areas were investigated from Giara di Gesturi and Barumini (Medio Campidano Province), Laconi, Orotelli, Desulo, Bolotana, Aritzo and Fonni (Nuoro Province) Tempio Pausania and Calangianus (Gallura Province) and Abbasanta (Oristano Province). Nematodes were isolated from 1 soil sample and identified as Steinernema ichnusae, while fungi were isolated from 6 soil samples (18%) and were all represented by Beauveria bassiana strains. Sardinian EPN and EPF strains are at the moment under study for their biological characterization and in particular one strain of B. bassiana (ItBb-Sar22) has just shown to be able to produce conidia in liquid medium, a very interesting characteristic related to the mass production potential of this biological control agent.

Infection of Curculio elephas Gyll. and Cydia splendana Hb. larvae with the entomopathogenic fungus Beauveria bassiana (Balsamo) Vuill.

Cerboneschi, A. ..................................................................................... 257-261

Abstract: The entomopathogenic fungus Beauveria bassiana (Balsamo) Vuill. (Deuteromycotina, Hyphomycetes) was tested in laboratory experiments against larvae of Curculio elephas and Cydia splendana. The larvae were treated by a direct immersion method involving two suspensions with different concentrations of conidia. The data regarding the mortality of infected larvae and the low average time-to-death values showed that the Sardinian populations of Curculio elephas and Cydia splendana were highly susceptible to Beauveria bassiana.

Bioecology of oak Phylloxera and its natural enemies on urban and peri-urban holm oaks

Croci, F., Bracalini, M., Bonuomo, L., Tiberi, R., Niccoli, A. ............................................ 263-270

Abstract: Phylloxera quercus B.d.F is one of the most well-known holm oak aphids and can cause serious damage, mostly on urban and peri-urban ornamental oaks. From 2005 to 2007 and again in 2010, samplings were carried out regularly in order to survey Phylloxera and other aphid infestations. Samples were collected from early spring to summer on holm oaks from 4 areas: a public garden in the centre of Florence, a peri-urban green area near Florence, a tree row in Barberino Val d’Elsa and a mixed woodland in Montepaldi near the town of San Casciano Val di Pesa (Florence). The investigations permitted comparisons of the life cycle and the degree of infestation of the various aphid species in the different typologies of green spaces considered. Over the last year particular attention was paid to the aphid entomophagous insects, already detected in previous years, considering their activity in relation to the level and the evolvement of the phylloxerid infestation. In the course of samplings, natural enemies were identified and their occurrence was ascertained. Results showed several groups of generalist predators, such as Antochoridae (Rhynchota), Chrysopidae (Neuroptera), Cecidomyiidae (Diptera), Syrphidae (Diptera), Coccinellidae (Coleoptera). Coccinellids were often observed and among them Adalia decempunctata L. and Oenopia conglobata L. were recurrent. Trials were carried out to assess the trophic requirement of the most common predators during their preimaginal development.

Relationships between the polyphagous Orgyia trigotephras (Lepidoptera, Lymantriidae) larvae, a cork oak pest, and its host plants in Tunisia

Ezzine, O., Dahmouni, M., Ben Jamâa, M. L., Mabrouk, G., Nouira, S. ............... 271-278

Abstract: Orgyia trigotephra is one of the main defoliator insects of shrubs in Tunisian cork oak forests. This work aims to study the interaction between the pest larvae and their host plants. A choice test was conducted on five bush species (Quercus coccifera, Erica multiflora, Erica arborea, Pistacia lentiscus and Cistus crispus) defoliated by the pest larvae and three other undefoliated species (Phillyrea media, Daphne gnidium et Myrtus communis). Total polyphenols, flavonoids and flavonols from three types of leaves (non-attacked old leaves, attacked old leaves
and newly flushed foliage) of each bush species were determined. No differences have been
evidenced between the three types of leaves. However, significant differences appeared between
the different bush species.

Insect pests of oak trees in Turkey
Hayat, R., Villemant, C. .......................................................... 279-282
Abstract: Turkish forests cover 20,703,122ha, among which oak (Quercus spp.) trees occupy
5,696,005ha. Oak forests suffer a wide range of antagonist factors that induce various levels of
damage. Basing on bibliography, we listed here for the first time the 100 insect pests (5 orders
and 23 families) attacking leafs, buds, branches, trunks or roots of oak trees in Turkey.

Conclusion and recommendations ............................................................. 283-284