reported. In fact, the average annual increase of collected pollen during the last five years is about 45% larger than that in the first five years.

It is well known that annual variations in total pollen productivity and emission from source to atmosphere are closely related to environmental conditions, especially to the thermo-pluviometric ones. In the case of olive crop previous rainfall plays a determinant role in flower production and therefore in pollen production. Our results have confirmed this fact. However, rainfall can not explain all the differences among the annual amount of collected pollen, since the pollen concentrations have increased through the years, while the rainfall shows a more or less random pattern. As the pollen source is a cultivated plant, we must consider anthropozoogenic factors as the ultimate cause for this phenomenon. From this point of view, the area of olive tree crop in Jaén has increased in the 90s at a rate of more than 5 500 hectares per year, which means about 55 000 more hectares in the producing source area. The largest part of this increase has taken place in the lowlands of the Guadalquivir Valley, where soils are very suitable for its cultivation. The homogeneous climatic conditions in the whole area significantly favour the phenological synchronization of the crop. But which has turned out significant for the flowering and pollen production increase has been the transformation of olive tree crops into irrigated cultivations. In the early 90s it was rarely found irrigated lands. whilst nowadays between 20% and 30% of the olive crops in Jaén are periodically supplied with water. This allows the trees to produce abundant flowering every year, instead of an alternated yearly pattern of lower and higher flowering and therefore crop production.

Faced with the increasingly trend in the irrigated crop areas we can expect the olive flowering and pollen production in Jaén province to maintain at extremely high levels, regardless of the previous climatic conditions. It is even possible a slight increase in the future.

Development of an Automatic Corn Pollen Monitor for environmental assessment of genetically modified crops

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With the safety and impact on the environment of transgenic crops becoming issues of concern, Losey et al. (1999) identified the possibility that pollen from Bt (*Bacillus thuringiensis*) corn could kill untargeted insects. On the other hand, there is a gene flow problem that is dispersal of artificially modified gene to the natural environment by airborne pollen. Especially for corn that is a typical wind-pollinated crop, there is a possibility that pollen diffuses considerably widely depending on meteorological conditions. The number of pollen grains decreases in exponential form according to the distance from the source field, and the extent of dispersal is controlled greatly by meteorological conditions and the state of flowering of the plant. It is necessary to develop a suitable automatic measurement technique for the pollen in order to deal with these problems appropriately.

We developed an automatic monitoring device that is easy and a continuous measurement can be taken for airborne corn pollen. The past methods, both the gravity method and the volumetric method, are done by counting the number of adhering pollens on glass slides, and require a large input of time and labour using the microscope. The automatic corn pollen monitor is constructed with semiconductor laser technology.

Experiments were carried out in the field of the National Institute of Agro-Environmental Sciences in Tsukuba city. Durham type pollen samplers were set up in the cornfield, and the meteorological observation was done at the same time. The developed corn pollen monitor was set up in the cornfields, and observation was continued through the flowering season. Two pollen monitors were used for the observation. Large conic glass (100mm diameter) was installed in the air-intake part of one monitor. A small conic glass (65mm diameter) was installed on the other monitor.

The semiconductor laser of wavelength 780nm makes a beam in the seat of about 30μm in thickness through a cylindrical lens and collimate lens. The scattered light corresponding to the particle size is caused when the particle enters from the nozzle, and the scattered light is detected with detecting element (PIN-PD). We aimed to develop a design that would select globular particles using the width of the detected pulse, and the side and forward scattered intensity of scattered light. Some of the air exhausted from the pump circulates, and the air that contains pollen is sucked in and wrapped, and it passes through an optical detector (air jacket method). This method prevents dirt from getting in to the optics, and improves the response of detector circuit to the pollen. The flowing quantity was set to be 4.1 litres per minutes, which is less than half the Burkard type sampler.

The counts of the airborne pollen grains from the corn pollen monitor were compared to the counts of pollen grains from a Durham sampler that was set up adjacent to the pollen monitor. The correlation coefficient between the counts from the pollen monitor (large intake) and the Durham method was 0.949, and the correlation coefficient between the counts from the pollen monitor (small intake) and the Durham methods was 0.928. For either combination, very high correlation coefficients were obtained. It is understood that the corn pollen monitor explains 89% of the change measured by the Durham method based on the contribution ratio (square of the correlation coefficient).

The diurnal change in the airborne corn pollen count was quite clear on both abundant pollen days and more scarce pollen days. The peaks are clearly evident. The changing pattern of the amount of airborne pollen shows a characteristic shape that peaks in daytime, and becomes almost zero at nighttime. The changing pattern has a different shape from those of the meteorological elements such as air temperature or wind speed.

There is a peak in the morning every day, which decreases to less than half of the peak density at noon. The density decrease after the peak until nighttime is gradual, although the density increase after sunrise is sudden. A large amount of pollen is emitted when the air temperature rises rapidly.

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Session c6

APPLIED AEROBIOLOGY: CULTURAL HERITAGE

Aerobiology in museums: comparison between sampling methods

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Biological aerosol can be a factor inducing biodeterioration of materials in museums and in other indoor spaces, when the environmental conditions are favourable. The estimation of microbial contaminations can vary in relation to differences in sampling methods. A comparison between data obtained with passive sedimentation methods and active impactor samplers (Andersen cascade sampler) was made in two different rooms of the Doria Pamphilj Gallery (Roma) during different seasons. The results obtained were comparatively analysed on the basis of daily and seasonal data. Two matrices of 16 taxa, with 48 and 16 relieves for the two rooms, corresponding to 12 days of sampling (3 for each season), were elaborated after a previous mathematical transformation for the statistical comparison Multivariate analysis for the presence/absence, ordinal (V abundance classes) and quantitative data was compared using the Goodall probabilistic index (Goodall et al. 1987, Goodall and Feoli 1991). The most frequent (more than 70%) isolated genera were *Aspergillus, Alternaria Cladosporium, Penicillium* and *Micelia sterilia*, with a minimum of one up to 8 different species. Differences in quantitative values of biological aerosol were observed during the seasons with highest values in spring. The different methodology for sampling does'not seem clearly to affect the biodiversity. The results can be summarised as following: the two sampling methodologies show more or less small differences, especially in the case of daily data; these differences lower in the case of average seasonal data; the transformation of data in classes of abundance is the best method for data comparison; the sampling with the Andersen method better estimates the species with smaller spores with respect to the passive sedimentation method and reduces the entity of taxa with higher spores.

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Intermuseum network for conservation of the artistic heritage: MUSA PROJECT

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MUSA project's order word is "preventive conservation". MUSA project was born from the necessity of conserve exhibits in the best possible condition into the museums, art galleries, libraries, churches and underground archaeological sites. Unfortunately objects are not "naturally" preserved but tend to deteriorate. So it's very important to survey the quality of the air "enveloping" works of art displayed in museums controlling the physical, chemical and biological parameters of the air by target analysis campaigns and the aid of microclimatic instrumentation. Also recent norms and laws establish the standards and targets of quality that museums, libraries and historical archives will have to achieve in the near future, in particular the Ministerial decree dated 10/05/2001 that stimulated the project.

MUSA project has created a network that exploits Internet and wireless communication technology to monitor buildings containing works of art using a remote-controlled system. The experimental phase, lasted about two years, is finished on 31/12/03 and has involved three pilot sites in the Emilia – Romagna region, Italy.

The network offers museum curators and technical staff a practical means of tackling preservation of the cultural heritage by automatically measuring the physical parameters of peripheral sites. The parameters measured are those fixed in the decree over cited: Temperature and Relative Humidity for physical parameters, Bacterial, Fungal and Total Microbial load for biological parameters. The aerobiological measurements are carried out with the Andersen sampler (6 stages) in different seasons and in the rooms with risk situations. The data of Bacterial load, Fungal load and Total Microbial load are expressed as Colony Forming Units per cubic meter of air (CFU /m^3). Other parameters like the concentration of chemical pollutants will also be monitored in the future. The main philosophy of MUSA project is to verify the resistance of various type of materials related to the environmental conditions.

The system will be particularly useful for those sites without conservation experts to report situations at risk or ongoing hazards. Infact all parameters monitored are transmitted in real time from the peripheral sites to a central archive (database) providing analyses and forecasts on the trend of environmental conditions.
The graphic interface of the database consists of a web site, www.isac.cnr.it/musa, a useful tool for connecting remote sites with the operation centre (CNR-ISAC).

Will come shown the results obtained in the experimental phase: the biological data in relation with the main microclimatic parameters.

In conclusion, project's next phase will be concentrated on the study of relation between materials and biological and phisical parameters and the research of threshold in which works of art must be mainteined for their optimal conservation in relation to their constituent materials.

Session c7

APPLIED AEROBIOLOGY: CLIMATIC CHANGES

The impact of recent climate changes in Europe on the start of *Betula* (birch) pollen seasons in seven countries

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*Betula spp.*pollen is an important aeroallergen over large areas of NW Europe. It is a notable cause of symptoms of hayfever and asthma. *Betula* allergens cross react with many other closely related taxa including *Alnus*, *Corylus* and *Carpinus* spp. and also with some foods such as apples. Changes in the start dates of Betula pollen seasons are significant as they have an impact on the length of the " allergy " season and have consequences for health care. The timing of Birch pollen seasons is known to depend mostly on a non linear balance between winter chilling required to break dormancy, and spring temperatures. Consequently trends in start dates can give a clear indication of a biotic response to climate changes. Previous work (Emberlin *et al.* 1997) has shown a recent trend for the seasons to begin progressively earlier in the UK by about 5 days per decade. A comparative analysis of long term records (1982 to 1999) from six sites across Europe (Emberlin *et al* . 2002) revealed marked regional differences in trends in relation to the features of temperature profiles.

The research reported in this paper extends these investigations over a wider geographical area and includes data up to 2003 in order to examine the most recent situation. The data for the start dates of pollen seasons are also compared to early spring phenophases for *Betula* and related taxa with the aim of identifying relationships that could be applied to a larger regional coverage than that available from pollen monitoring sites. In particular the work investigates relationships between the changes in pollen season start dates and changes in spring temperatures over approximately the last twenty–two years.

Daily Birch pollen counts were used from Kevo, Turku, London, Brussels, Zurich, Vienna, Paris, Lyon and Poznan for the core period 1982 to 2003. The sites represent a range of biogeographical situations from just within the Arctic Circle through to North West Maritime and Continental Europe. Pollen sampling was taken with Hirst type Volumetric spore traps. Weather data (daily mean, max and min temperature and rainfall) was obtained from the nearest sites to the pollen traps. Pollen season start dates and monthly mean temperatures for January through to May were compiled to five year running means to examine trends. The start dates for the next ten years were calculated from regression equations for each site, and information from the latest climatic predictions. The analyses show regional contrasts. For example, the most northerly site, Kevo shows a marked trend towards cooler springs and later starts. Turku exhibits cyclic patterns in start dates. A current trend towards earlier starts is expected to continue until 2007, followed by another fluctuation. London, Paris, Lyons, Brussels, Zurich, Vienna and Poznan show similar patterns in the trends towards earlier start dates but with some regional differences. If the trend continues the mean start dates at these sites will become earlier by about six days over the next ten years. The relationships with phenophases have been established where data is available. This information could assist forecasting start dates. The results of this study not only have implications for allergy sufferers and health care providers but also for the assessment of the biotic impacts of climatic changes.