which receives around 800000 of visitors per year. The geographical situation in the vast and little-monitored Region of Castilla La Mancha and the high number of tourists (overall in Spring), made this city as one of the main objectives of REA.

Air monitoring studies started in October 2002 following the REA sampling procedures. A Lanzoni volumetric spore-trap located on the roof of the Environmental Sciences Faculty is being used. It is situated in a strategic location on the Tajo river, just between the historic district (the most visited) and the "new" district (the most populated). We presented here the results obtained from October 2000 to December 2003.

32 pollen types have been identified during this sampling period. The most abundant taxa were, in decreasing order of dominance: *Cupressus*, *Quercus*, *Populus*, *Platanus*, Poaceae, Urticaceae, *Olea*, *Pinus*, *Morus* and *Ulmus*. We can also mention other minor represented taxa as *Salix*, *Alnus*, *Fraxinus* and *Tamarix*, characteristic from river areas. *Artemisia* pollen must be also mentioned due its allergenicity. It is noticeable the presence of *Castanea* pollen grains from chestnut crops so far away from the city as an example of long distance transport.

The total annual Pollen Index (PI) was 1424 in October-December 2002, and 42993 in 2003. Preliminary results for this period are shown analyzing the main pollen taxa that accounted at least 0.1% of PI. In order to a better understanding of the results we must remark that in this year a so rainy winter and an extremely hot and dry summer were registered. This factors could influence on the high quantities of Spring pollen taxa and, on the other hand on the scarce pollen grains detected during summer and early autumn.

Results reflect the diversity of urban vegetation composed of cultivated trees, *Cupressus* (22.9%), *Platanus* (9%), *Morus* (1.5%), Ulmus (1.5%) in streets and parks, spontaneous tree species associated to river which surrounds the city, Populus (12.7%), Tamarix (0.7%), Fraxinus (0.5%), Salix (0.1%) and spontaneous herbs species, Poaceae (9%), Urticaceae (8%).

The outskirts pollen vegetation is also well represented by the high concentrations of *Quercus* pollen (22.4%) from the natural areas of Mediterranean forest and "dehesas". Although Toledo is not one of the most important olive oil-producing areas of Spain, olive crops situated in the surroundings of the town released high quantities of *Olea* pollen (6%).

Aeropalynology in the sampling station of Palma de Mallorca (November 2003-May 2004)

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We report a study on the contents of airborne pollen in the city of Palma de Mallorca (Balearic Island, Spain) aimed at establishing a pollen calendar for the city during the periods of maximum pollen concentration, relating these with quantitative atmospheric variables. In addition to the orientative values of the aeropalynological analysis taken for the years 1983/84 and 1989/1994, we have began a new, more comprehensive study, starting in November 2003, with the results discussed here covering up to May 2004, inclusive. The pollen was captured with Burkard spore-traps, based on Hirst's volumetric volumetric method. Data on predicted averages and maximum airborne pollen concentrations are associated with the climatic dates of these months studied. The main pollen producers are *Cupressus*, *Urticaceae* with key producers pertaining to the genera *Parietaria*, *Platanus* and possibly *Olea* as well as other species of sporadic contributions.

Key words: Pollen calendar, Palma de Mallorca, Palynology.

Poster session c2

BASIC AEROBIOLOGY/ MONITORING/ NEW TECHNIQUES: FUNGAL SPORES

Studies on culturable air borne fungi over a tea field in North East India

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As a part of the investigation on industrial hygiene and development of HACCP for tea industry in North East India, air borne fungal popuation over a tea field located at Tocklai Experimental Station, Jorhat(Lon.94o12' E; Lat 26o47' N, Elevation 96.5 m amsl) was monitored by gravity impaction method(Paul and Scaful 1998).Rose Bengal chloramphenicol agar contained in petriplates were exposed over tea bushes at the plucking level for ten minutes. Rich diversity of fungal population were recorded (*Aspergillus, Penicillium, Cladosporium,Curvularia,Fusarium, Nigrospora, Helminthosporium, Alternaria, Colletotrichum, Pestalotia, Memnoniella, Phoma ,Pleospora, Fusarium, Verticillium etc)* belonging to different taxa. Quantitative and qualitative population of fungal flora varied during the period of observation.

Fungal Spores in Porto Atmosphere

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The seasonal distribution of fungal spores present in the atmosphere of Porto city was studied continuously throughout a year, from the 25th November 2002 to the 25th November 2003. In Portugal aerobiological studies are scarce, and to our knowledge there are no published papers on the atmospheric concentration of fungal spores in our country.

The aim of this work is to iniciate aeromicological studies in Porto.

This city is situated in the right bank of Douro River, near the mouth, in the Northwest of Portugal (41°11' N, 8°39' W). Porto is the second largest city, with around 300 thousand inhabitants being the northern regional capital.

A Burkard spore trap placed on the top of the Departamento de Botânica da Faculdade de Ciências at twenty meters above the ground was used. The counting was carried out in two longitudinal scannings using a total magnification of 400x. The number of fungal spores were scored in order to calculate the average weekly spores per cubic meter of the most abundant spore types.

In the atmosphere of Porto eighteen different fungal spore types were identified and the most frequent were *Alternaria, Cladosporium, Coprinus, Fusarium, Pleospora* and *Ustilago*.

Our future objective is to predict the principal spore types present in the atmosphere using this information for both clinicians, to prevent allergenic reactions, and farmers, to prevent plant diseases induced by these phytopathogens.

Keywords: aerobiology, aeromicology, bioaerosol, fungal spores, Porto.

Predominating fungal spores in atmospheric aerosol in the city of Caxias do Sul, Rio Grande do Sul, Brazil during 2001 and 2002

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Fungal aerosol sources of external environments are usually considered constant from year to year. As vegetables are the main substrates for the development of atmospheric fungi, it becomes clear that major changes in the ecology of plants will reflect on the aerial fungi spore concentrations which are common in different times and spaces. Climate variations are another important factor to be taken into consideration as for fungi distribution. Thus, such variations may occur between years, seasons, days and even hours.

The aim of this work was to identify and quantify the spores present in the atmosphere of Caxias do Sul (Rio Grande do Sul, Brazil) showing the frequency and profusion.

Caxias do Sul is located at 29° 10' S, 51° 12' W at 760 m above sea level. For two year in a row (2001 and 2002), daily samples of atmospheric air making use of the volumetric method non-viable Hirst-type were collected.

Forty-one taxa were identified. The fungal spores in greater number in aerosol of the city were named "dry air spores", consisting among these the *Dematiaceae*; followed by the so-called "wet air spores" including Basidiomycetes and Ascomycetes.

The most frequent fungal spores in 2001 were: *Cladosporium*, representing 32.57% of the overall spores recorded Ascospores 12.13%, *Coprinus* 7.85%, *Leptosphaeria/Fusarium* 7.35%, *Aspergillus/Penicillium* 7.30%, *Ganoderma* 6.69% and *Agaricus*-type 5.33%. In 2002, *Cladosporium* 33.16%, Ascospores 11.13%, *Coprinus* 9.96%, *Leptosphaeria/Fusarium* 8.09%, *Ganoderma* 6.29%, Phaeoamerospores 5.17%, Hyaloamerospores 4.96%, *Aspergillus/Penicillium* 3.36% were detected among others.

During the summer of 2001 and 2002, *Cladosporium*, Ascospores and *Coprinus* predominated. In the spring of 2001 and 2002, *Cladosporium*, *Coprinus* and Ascospores predominated. In the autumn of 2001 and 2002, there was greater concentration of *Cladosporium*, *Leptosphaeria/Fusarium* and Ascospores. During the winter of 2001, the greater occurrence was of *Cladosporium*, *Aspergillus/Penicillium* and *Leptosphaeria/Fusarium* and in the 2002 *Cladosporium*, *Leptosphaeria/Fusarium* and Ascospores.

Summer was the season of the year that showed the highest spore counts during the study period. Winter showed the lowest concentrations. In 2001, autumn was responsible for more quantity of fungi in relation to springtime. In 2002, during the springtime, a greater number was recorded in relation to autumn.

Intradiurnal distribution of the airborne fungal spores indoor the cave of Nerja (Málaga, Southern Spain)

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Many aerobiological works have been made indoors with the aid of viable volumetric samplers in which the airborne fungal spores are sowed on agar plates. Normally, these volumetric samplers only can be kept operational from some minutes to several hours, depending on the model, and do not allow studying intradiurnal patterns.

In the present study a volumetric sampler Hirst type (Lanzoni VPPS 2000) was used to carry out an aerobiological research indoor the Cave of Nerja (Malaga, south-eastern Spain) in which the intradiurnal distribution of fungal spores was studied. The Cave of Nerja is situated on the east coast of Malaga and it is characterized by its huge halls, excavated in calcareous rock, which are visited by 500,000 people per year as average. For the study, the sampler was removed from its peak and weathercock and situated on the ground level of the cave. It was uninterruptedly working from January 2002 to December 2003. The samples were mounted in

glycerine jelly and observed with the light microscope, according to the methodology proposed by the Spanish Aerobiology Network, the REA.

The counts were made for the total fungal spores collected and also, separately, for the more abundant spore types. The results obtained show how the spore concentrations fluctuate throughout the day, these fluctuations often being associated to human activity. Besides that, some episodes in which the spore levels reached extreme values of more than 100,000 spores/m^3 as daily average were specially analysed.

A study of airborne fungal spores at the Madrid University city campus during 2003

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Until now few studies have been published on airborne fungal spores in the city of Madrid (Sáenz Laín & Gutiérrez Bustillo, 2003). Our results represented an analysis of the atmospheric concentrations of fungal spores detected during the year 2003 at the Madrid University City campus. These results also served to fulfil the main objective of our part in the PALINOCAM Network, which is to inform the residents of Madrid of pollen and spore concentrations in their community.

Airborne spores were sampled continuously with a Hirst-type trap (Hirst, 1952) (manufacturer Burkard). The trapping instrument was placed at about 8 m. above street level on the roof of the School of Pharmacy building. The research methodology followed the recommendations of the IAA and the REA (Jäger, 1995). The relationship between the mean daily spore concentrations and the weather variables was analysed by means of the Sperman rank correlation coefficient method.

Identified in this study were 67 types of spores, the most abundant of which were: *Cladosporium*, *Alternaria*, *Drechslera* (Deuteromycetes), *Coprinus*, *Ustilago*, *Ganoderma*, *Bovista*, *Agaricales* (Basidiomycetes), *Pleospora*, *Leptosphaeria* (Ascomycetes) and Myxomycetes sp. pl. These eleven types represented more than the 82% of the total of spore elements collected. The concentrations reached by *Cladosporium* represent more of 45% of the total, of which more than 30% corresponds to the species *Cladosporium cladosporioides*. Ustilago-type spores, with concentrations in May and June that surpass 47% of monthly total, constitute the second most important group.

Spores reached their highest concentrations in the spring months (23,231 spores in April; 24,643 spores in May and 32,832 in June), and in autumn, mainly in October (48,447 spores, with daily values of 1,563 spores/m^3), when the highest daily concentration was collected (5,003 spores/m^3 on October 16). The concentrations decreased in the summer and the winter months, with daily average values of 277 spores/m^3 in January, 203 spores/m^3 in February and 307 spores/m^3 in August.

A significant relationship was found between the airborne spore counts and temperature and relative humidity, increasing with rising temperatures and decreasing at higher humidity.

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The concentration of *Alternaria* spores in the air in relation to weather variables

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Alternaria spores are considered to be one of the main aeroallergens. Their presence in the air depends on availability of growth media. This genera lives as a saprophyte or parasite on different plants. The increase of spores concentration seems to appear in areas of intensive plant production. Agricultural industry plays dominant

role in Lublin (Southern-East Poland) region. The concentration of *Alternaria* airborne spores in this area was worth examining for medical and phytopathological aspects.

The continuous sampling of *Alternaria* airborne spores were carried out in Lublin throughout two years 2002 and 2003. The investigation was based on volumetric method with use of Lanzoni VPPS 2000 spore trap, operating on about 16 metres above ground level. The comparison of concentration values in 2002 and 2003 was made. The obtained data were elaborated statistically. To estimate the relationship between *Alternaria* spore concentration and weather variables the mean correlation and regression analyses were used. Six weather parameters were taken under consideration: temperature, relative humidity, wind speed, wind direction, precipitation and cloudiness.

Airborne fungal spore concentrations inside and outside homes in the Fresno (CA) Asthmatic Children's Environment Study (FACES)

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Exposure to airborne fungal spores has been implicated as a causative factor for acute exacerbation of asthma, mainly in young adults. This investigation on indoor and outdoor concentrations of fungal spores is a part of the Fresno Asthmatic Children's Environmental Study (FACES), which is designed to characterize the health effects of air pollution on asthmatic children living in Fresno County of California, USA.

From March 2002 to February 2003, 498 daily pairs of indoor/outdoor samples were collected at 83 homes. During the one-year period, 18 of the residences were sampled during two different seasons. The samples were collected with the Burkard Continuous Recording Air Sampler (Model 9100) continuously for 24 hours in the family room and outside each home at the height of 1.5 m on 5 days during a two-week period. Homes were selected by geographic location (e.g., near highway or central area of the city) and household characteristics (e.g., pets, the number of people, and combustion source). Simultaneous fungal spore sampling was conducted with three Hirst-type Burkard Seven-day Recording Spore traps, one at 11 meters height on the U.S. Environmental Protection Agency's Supersite monitoring station located in central Fresno, two others (at 4.5 meters height each) on trailers located at different school yards in the Fresno area.

Cladosporium spp. were the most common species found indoors, followed by fungi connected to the agricultural environment (species of *Exserohilum*, *Epicoccum*, *Oidium*, *Erysiphe*, *Puccinia*, *Ustilago*, smuts and rusts), and *Alternaria* spp. The indoor concentrations of *Alternaria* spp. were very close to the outdoor concentrations. In a number of homes, *Aspergillus/Penicillium* spp. were found in high concentrations (average 2 h concentration up to 2000 spores m^{-3}) during the times for breakfast, lunch and dinner. Generally the night (8 pm–6 am) concentrations were <100 spores m^{-3}, suggesting that *Aspergillus/Penicillium* ssp. spores in these homes were liberated from surfaces because of indoor activity. The agricultural fungi showed clear seasonal and spatial variation.

Depending on the season, the indoor fungal spore concentration ranged from 4%–20% of the outdoor concentration if the windows were kept closed during the sampling period. If the windows were kept open during the whole sampling period, the indoor fungal spore concentration was 50–90% of the outdoor concentration. Keeping the windows open more than 30 minutes in the early morning (6–9 am) did not increase the total indoor spore concentration as much as having them open in the afternoon (12–6 pm) or night (8 pm–6 am). The ownership of cats or dogs did not increase the indoor spore concentration.

There was no significant difference in the total fungal spore concentrations between the 11 m and 4.5 m heights, whereas the sampling at 1.5 meters height resulted in an ~30% higher total spore counts. The biggest difference was between concentrations of *Alternaria* spp., the counts being higher at the lower sampling level.

The relationships between indoor and outdoor concentrations of fungal spores and airborne endotoxin, PM10, and PM2.5 are discussed

Aerobiological survey of basidiospores in the atmosphere of Seville

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Basidiomycetes produce a large amount of spores that are wind dispersed to long distances, some species can release billions spores in a day, many of those spores are important fungi aeroalergens that are involved in asthma and allergic rhinitis. In a survey carried out, using a Burkard spore trap, in the city of Seville during two consecutive years, we have found out that basidiospores make up the second more frequent spore group in the atmosphere of this city, with a 9% of the total fungi spores sampled. They are present throughout the year showing a certain seasonal distribution; the month with a higher concentration is November with an average concentration of 23.586 basidiospores/m^3. A total amount of 18 different types of basidiospores were identified, being *Coprinus* apd *Ustilago* the most frequent, followed by *Agaricus, Phylacteria, Boletaceae, Ganoderma, Cortinarius, Calvatia, Agrocybe, Bovista* and *Puccinia* with much more lower concentration; the rest appeared in concentrations below 1% of total basidiospores.

The statistic analysis showed that the influence of the different meteorological parameters varies according to the researched type. A temperature increase involves an increase of the greater part of basidiospores, except for *Agaricus* and *Agrocybe* type negatively affected. In general a rainfall increase does not involve a concentration decrease except for *Ganoderma, Uredospora* and *Ustilago*, however, on the contrary, concentrations of *Agaricus, Agrocybe* and *Coprinus* rise with that rainfall increase. A relative humidity increase is associated to a concentration increase of basidiospores, though concentrations of *Ustilago* and *Uredospora* decrease when relative humidity is high. At the same time as insolation increases basidiospores air concentration decreases, though concentration levels of some types as *Ganoderma, Uredospora* and *Ustilago* increase. Eventually as wind is concerned, basidiospores are more frequent on days with a calm weather.

Poster session c3

FORECASTING POLLEN

The influence of meteorological parameters and bioclimatic indices in the atmospheric pollen content of Cupressaceae in Ponferrada (León)

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The forecasting of the atmosphere pollen content is a topic of permanent investigation in the Aerobiology. In previous studies it was suggested that bioclimatic indices could be used in polinic forecastings of herbaceous taxa (FERNÁNDEZ-GONZÁLEZ et al., 2000; VALENCIA-BARRERA et al., 2000). Here, we test the two methodologies for routine pollen forecasting by comparing correlation coefficients using Cupressaceae airborne pollen, family which includes scrubs or trees, as the dependent variable and meteorological parameters and bioclimatic indices as independent variables.

Pollen grains were sampled by using a volumetric collector type Hirst seven–day-recording trap, from 1996 to 2002 in the atmosphere of the city of Ponferrada (León, N. W. Spain). Regarding the methodology and sample preparation it has been followed the proposal of the REA (DOMÍNGUEZ et al., 1991) and Andersen (1981) to determine main pollination period (MPP). In this study we have worked with the Spearman correlation analysis. For this statistical analysis we have used the MPP, the three months before the MPP and the MPP with the three months before this period. The meteorological parameters that we used in this study were: temperature