

Aerobiological Information Systems and allergic respiratory disease management AIS LIFE (LIFE13 ENV/IT/001107)

**Second annual meeting
UPMC, Paris
18-19 January 2017**

**UNIFI action progress
Gianni Bedini
Department of Biology, University of Pisa, Italy**



UNIVERSITÀ
DEGLI STUDI
FIRENZE

DISPAA
DIPARTIMENTO DI SCIENZE DELLE
PRODUZIONEI AGROALIMENTARI
E DELL'AMBIENTE



DIPARTIMENTO DI BIOLOGIA
UNIVERSITÀ DI PISA



ISTITUTO DI FISILOGIA CLINICA
CONSIGLIO NAZIONALE DELLE RICERCHE



MEDICAL
UNIVERSITY
OF VIENNA



UNIPi participation in project actions

A. Preparatory actions

A.1: Set up of an Integrated Information System (IIS) in 3 countries (France, Italy, Austria).

A.2: Set up of an enhanced Personalised Pollen Information system (PPI) in France and Italy.

B. Implementation actions

B.1: Implementation of IIS and PPI in three countries (enrolment, randomisation, educational intervention).

Common to all partners

C.1: Monitoring of the long-term implementation of Aerobiological Information Systems

C.2: Validation and comparison of the effectiveness of two Aerobiological Information Systems

D.3: Stakeholder Involvement Activities

D.4: Target Audience / General Public Awareness Raising

E.1: Overall project operation

E.2: Networking with other projects (no progress to report)

E.3: After-LIFE Communication Plan (no progress to report)



ACTION A.1: Set up of an Integrated Information System (IIS) in 3 countries (France, Italy, Austria)

Beneficiary responsible for implementation: UNIFI

Beneficiaries in Pisa, Paris and Vienna are all involved in the set up of the IIS systems in their areas. UNIFI provides input to Pisa demonstration area.

Expected results

1. Installation of system for monitoring pollen - spores

Completed in Pisa, Paris, Vienna, and Lyon.

2. Setting up of data collection of conventional chemical pollutants concentrations

Completed in Pisa, Paris, Vienna, and Lyon via air quality agencies.

3. Installation and development of the non conventional air pollutants (ultrafine particles) monitoring system

Protocol developed and enabled by UPMC, spot monitoring conducted in Pisa, Paris, Vienna, and Lyon.

4. Description of the cycle of pollination and sporulation and the air pollutants concentration

Performed in Pisa, Paris, Vienna, and Lyon based on steps 1, 2.

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3. Installation and development of the non conventional air pollutants (ultrafine particles) monitoring system

Protocol developed and enabled by UPMC, spot monitoring conducted in Pisa, Paris, Vienna, and Lyon.

4. Description of the cycle of pollination and sporulation and the air pollutants concentration

Performed in Pisa, Paris, Vienna, and Lyon based on steps 1, 2.

Expected results

1. Installation of system for monitoring pollen

Completed in Pisa, Paris, Vienna, and Lyon

2. Setting up of data collection of chemical pollutants concentrations

Completed in Pisa, Paris, Vienna, and Lyon in cooperation with air quality agencies.

3. Installation and development of the non conventional air pollutants (ultrafine particles) monitoring system

Protocol developed in Paris, JPMc, spot monitoring conducted in Pisa, Paris, Vienna, and Lyon

4. Description of pollination and sporulation and the air pollutants

Performed in Pisa, Paris, Vienna, and Lyon based on steps 1, 2.

ACTION A1 completed

ACTION A.2:

Set up of an enhanced Personalised Pollen Information system (PPI) in France and Italy

Beneficiary responsible for implementation: **MUW**

UNIPi contribution:

1. collaboration to the translation of PHD texts into Italian;
2. provision of a map of biogeographical regions in Italy;
3. defining pollen and spore thresholds in Italy.

ACTION A.2:

Set up of an enhanced Personalised Information system (PPI) in France

Beneficiary responsible for the action: **MUW**

UNIPi contribution:

1. collaboration to the translation of PHD texts into Italian;
2. provision of a map of geographical regions in Italy;
3. defining policy thresholds in Italy.

ACTION A2 completed

ACTION B.1:

**Implementation of IIS and PPI in three countries
(enrolment, randomisation, educational intervention)**

Beneficiary responsible for implementation: IFC-CNR

UNIPi contribution: production of IIS forms in two languages

Concentration values and tendency
of monitored families and genera

Concentration values and tendency
of airborne chemical pollutants

Colors match concentration classes

Aerobiological forecast
Qualitative analysis
Medical recommendations

AEROPOLLEN - weekly bulletin with forecast of allergenic airborne pollens, spores, and chemical pollutants



AIS LIFE - Aerobiological Information Systems and allergic respiratory disease management - LIFE13 ENV/IT/001107

Issue for the city of Pisa - monitoring station of the Department of Biology - University of Pisa
Aerobiological monitoring of the week: 12/02/2015 to 18/02/2015

Pollen from arboreal plants:	sat	sun	mon	tue	wed	thu	fri	tendency
Birch and alder	12	19	41	146	20	50	115	↑
Hazel, european and common hophornbeam	3	0	0	0	0	0	0	→
Cypress and others	11	5	8	11	6	8	6	↑
Oak, beech and chestnut	0	0	0	0	0	0	0	→
Olive, ash and privet	0	0	0	0	0	0	0	→
Plane	0	0	0	0	0	0	0	→

Pollen from herbaceous plants:	sat	sun	mon	tue	wed	thu	fri	tendency
Ragweeds, mugwort and others	0	0	0	0	0	0	0	→
Grass and others	0	0	0	0	0	0	0	→
Pellitory and nettle	0	0	0	0	0	0	0	→

Fungal spore:	sat	sun	mon	tue	wed	thu	fri	tendency
Alternaria	0	0	1	1	0	1	1	→

Airborne pollutants	sat	sun	mon	tue	wed	thu	fri	tendency
PM 10	26	24	n.d	23	16	22	29	↑
PM 2.5	21	18	n.d	14	12	11	25	→
NO _x	30	23	33	35	35	31	29	↑
O ₃	115	129	140	111	133	143	121	→
SO ₂	N.A	N.A	N.A	N.A	N.A	N.A	N.A	→

Key:	N.A	Net available	↑: Increasing	N.A	Net available	IT	AU	FR
	Absent	→: Stationary	↓: Decreasing	High concentration PM10	daily average	50 µg/m³		
	Low concentration			High concentration PM2.5	annual average	25 µg/m³		
	Medium concentration			High concentration NO ₂	average hour	200 µg/m³		
	High concentration			High concentration O ₃	average hour	180 µg/m³		
The classification of pollen grains - spores concentration (units/ m³ of air) follows that adopted by:				Concentration thresholds for chemical pollutants in µg/m³ - monitoring station:				
IT: POLLnet - Italian aerobiological network				IT: ARPAT Pisa Passi - Reference limit for chemical pollutants (D.Lgs. 155/2010)				
AU: please insert your information				AU: please insert your information				
FR: please insert your information				FR: please insert your information				

Note: The concentration values are different in individual families and do not provide the thresholds triggering the allergic reaction

Tendency for next week: 19 to 26 February 2015
Prepared on the basis of monitoring carried out during the previous week.

Aerborne aerobiological and chemical pollutants forecast:

Insert forecast here

Qualitative analysis:

Insert qualitative analysis here

Medical recommendations:

Insert medical recommendations here

Monitoring aerobiological by VPPS 2000 or Burkard pollen trap
Data acquisition standard for Italy: UNI 11108:2004; for Austria:.....; for France:.....



ACTION C.1:

Monitoring of the long-term implementation of Aerobiological Information Systems

Beneficiary responsible for implementation: MUW

UNIPi contribution:

1. production of weekly bulletin with concentration classes and tendency of target pollen grains, fungal spores, and airborne chemical pollutants measured in Pisa;
2. update of DEX system with pollen forecast for Pisa;
3. upload to the EAN database of aerobiological, chemical, and weather data collected in Pisa

ACTION C.2:
**Validation and comparison of the effectiveness of two
Aerobiological Information Systems**

Beneficiary responsible for implementation: IFC-CNR

UNIFI contribution:

1. providing daily concentration values of target pollen grains, fungal spores, and airborne chemical pollutants measured in Pisa.



File

Visualizza

Modifica

Cella

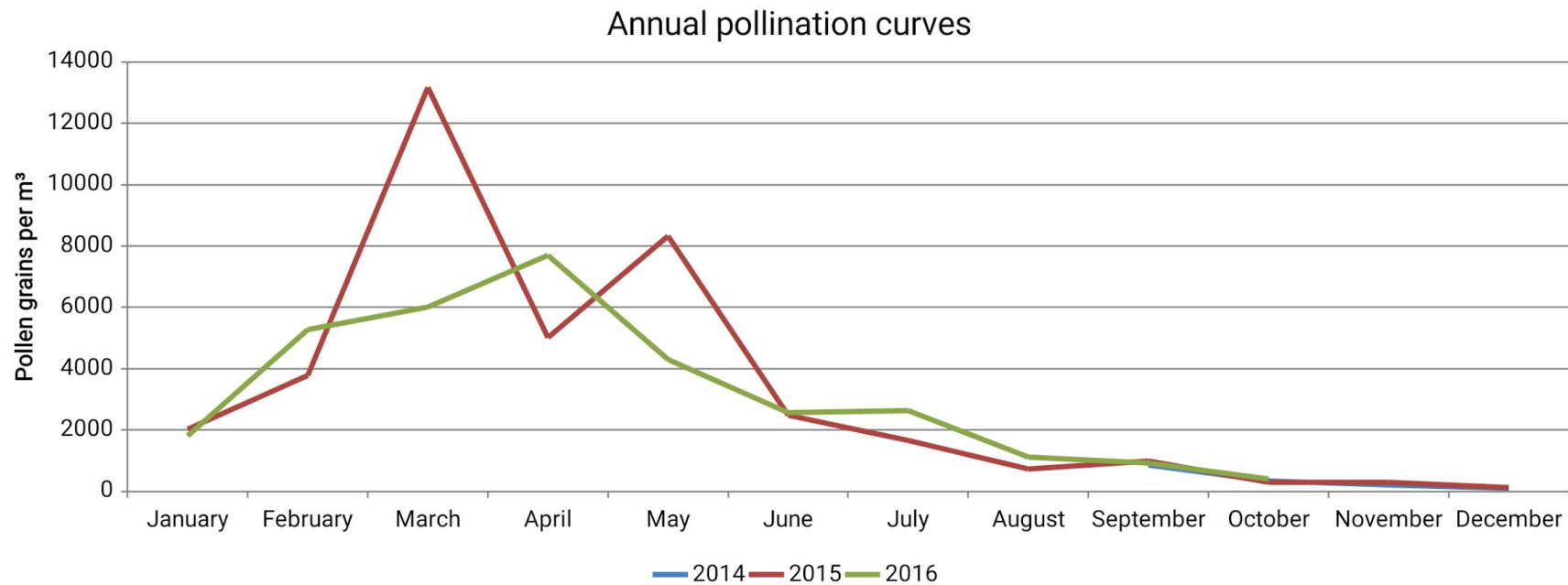
Inserisci

Dati

Penna



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Aerob

Temp - rainf

PM - chemical pollut





File

Visualizza

Modifica

Cella

In



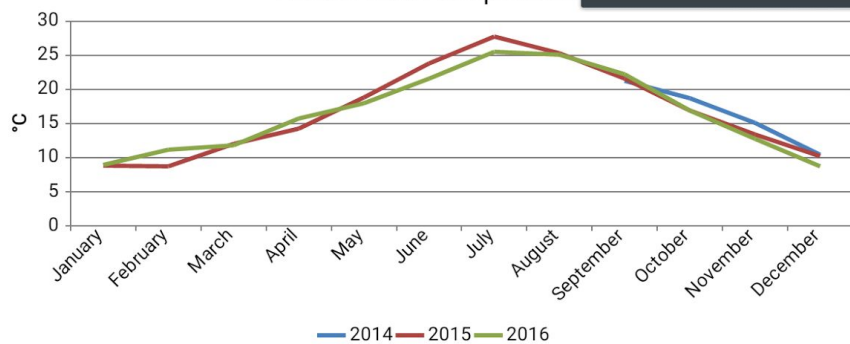
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Priorità

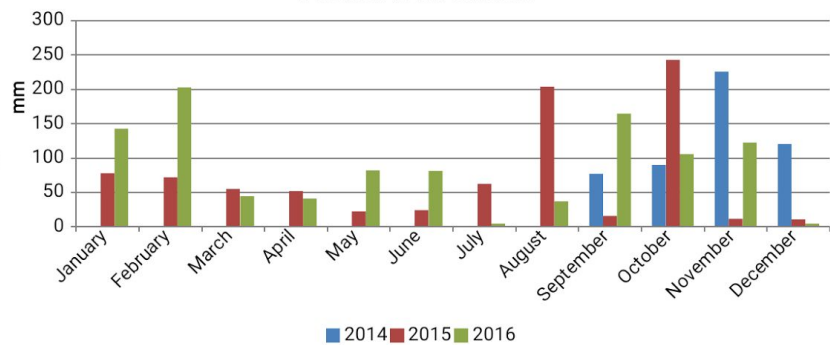
Tutte



Annual mean temperature



Annual total rainfall



Aerob

Temp - rainf

PM - chemical pollut





File

Visualizza

Modifica

Cella

Inserisci

Dati

Penna



Cella

Sposta a
destraSposta in
basso

Riga



Colonna



Grafico



Immagine



Forma



Casella di testo



Hyperlink



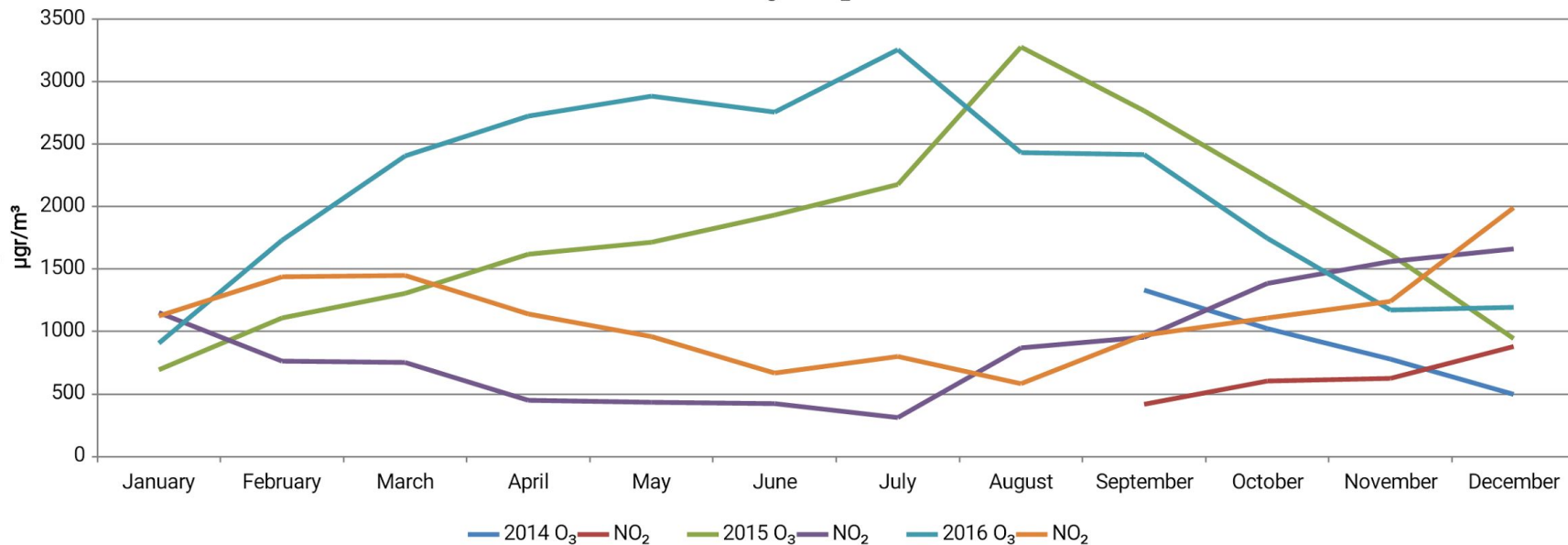
Commento



Funzione



Tabella pivot

Annual O₃ - NO₂ trend

Aerob

Temp - rainf

PM - chemical pollut



ACTION D.4:
Target audience / General public awareness raising

Beneficiary responsible for implementation:
INSERM/UPMC

UNIPi contribution:

1. poster presentation at the 110th Congress of the Italian Botanical Society, Pavia, September 2015;
2. oral presentation to the Biology doctorate students, Pisa, 5 November 2015;
3. oral presentation to master students in Conservation and Evolution, Pisa, 27 November 2015;
4. public conference in Castelnuovo Garfagnana (LU), June 2016;
5. poster presentation at the 6th European Symposium on Aerobiology, Lyon, July 2016;
6. poster presentation (two posters) at the 111th Congress of the Italian Botanical Society, Rome, September 2016.



5 = AIS LIFE – Aerobiological Information System and allergic respiratory disease management - LIFE13ENV/IT/001107

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¹Department of Biology, Pisa University, Via Luca Ghini 13, 56126 Pisa, Italy; ²Department of Applied Production and Environmental Science - University of Florence, p.le delle Cascine 18, 50144 Firenze, Italy; ³Pulmonary Environmental Epidemiology Unit, CNR Institute of Clinical Physiology, Via Tassinari 45, 56126 Pisa, Italy; ⁴Research Unit: Aerobiology and Pollen Information, Department of Otolaryngology, Medical University of Vienna, Spitalgasse 23, 1090 Vienna, Austria; ⁵UPMC, Institut Pierre Louis of Epidemiology and Public Health, UMR-S 1136 INSERM & UPMC Paris 6, Sorbonne Université, Medical School Saint-Antoine Office, rue Chaligny 75571 Paris CEDEX 12 - RNSA, Réseau National de Surveillance Aérobiologique, Le Plat du Pic, 69009, Bronville, France.

Introduction: The most important biological component of ambient air is pollen, and its allergens are the main cause of airborne allergic respiratory diseases (1). Chemical air pollutants and anthropogenic aerosols can alter the impact of allergenic pollen, while pollen production rises in higher atmospheric CO₂ concentrations (2, 3). Changes in plant flowering season due to climate change will probably result in an increase in the duration and severity of the pollen season, alongside a higher frequency of episodes of urban air pollution (1). Therefore, exacerbations of allergic respiratory diseases will have a more pronounced effect in coming decades (4).

Projects objectives: In this context, AIS LIFE project (<http://www.aislife.eu>) aims:

1. To improve pollen-related allergic respiratory disease management in the general population, through the permanent uptake of Aerobiological Information Systems in three European countries, contributing to disease control, improved quality of life and direct/indirect reductions in health system costs
 2. To assess exposure to pollen at the general population level, by considering pollen count and allergens and their interaction with particulate matter pollution.
 3. To provide a comprehensive evaluation of the use and effectiveness of Aerobiological Information Systems in different contexts, in terms of environmental, social and economic impact (including potential reduction of costs socio-economic costs of respiratory allergies in Europe)
 4. To increase awareness among target groups identified across Europe (local communities, local health agency, legislators, end-users) on the importance of integrated information on aerobiological / chemical / clinical forecasts for health improvement among people suffering from pollen allergies
 5. To increase awareness of possible lifestyle changes and preventative measures among sufferers of pollen-related allergic respiratory diseases, through the use of the Aerobiological Information Systems and supporting educational initiatives
 6. To provide input to public health policy on the environment and health, in the project areas and beyond, in line with the recommendations of the Environment and Health Action Plan
- The Project is coordinated by University of Florence and includes five more partners from Italy, France, Austria (please see authors' affiliations for partners Institutions).

Action A1:

Action A1 is now terminated. It included the installation of system for monitoring pollen - fungal spores and the description of the cycles of pollination and sporulation by pollen trap VPPS 2000 (Lanzoni) in Pisa - Paris - Lyon and by pollen trap Burkard in Vienna (please see table 1 and figure 1 - 2 - 3 - 4) to be used in subsequent actions in the Project. Aerobiological data are collected according to a common protocol.

The main cycles of pollination and sporulation of selected taxa in Pisa, Paris, and Lyon are shown in figures 5 - 6 - 7 The full dataset is available on the Project web page: <http://www.aislife.eu>



Fig. 1 - Pollen trap, VPPS 2000 (Lanzoni) on the roof of the building managed by the Department of Biology in Via Derna 4 - Pisa - Italy



Fig. 2 - Pollen trap, VPPS 2000 (Lanzoni) on the roof of the Pastore Institute in the 15th district - Paris - France



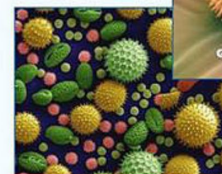
Fig. 3 - Pollen trap, VPPS 2000 (Lanzoni) on the roof of the Biomass and Isotopes Institute in the 7th district - Lyon - France



Fig. 4 - Pollen trap, Burkard on the roof of the ZAMG - Vienna - Austria

Tab. 1 - Actions in AIS - LIFE Project

Action number	Name of the action
A. Preparatory actions:	
A.1	Set up of an Integrated Information System (IIS) in 3 countries (France, Italy, Austria)
A.2	Set up of an enhanced Personalized Pollen Information System (PPIS) in France and Italy, in combination with an in-depth CO ₂ survey
B. Implementation actions:	
B.1	Implementation of IIS and PPIS in three countries (enrolment, randomisation, educational intervention)
B.2	Health assessment of Allergic Patients
B.3	Case Study Italy: Mapping of urban and rural environments through land use and allergic plants data, agroclimatic indices
B.4	Case Study France: Analysis of plant occupation of public green spaces
C. Monitoring of the impact of the project actions:	
C.1	Monitoring of the long-term implementation of Aerobiological Information Systems
C.2	Validation and comparison of the effectiveness of the two Aerobiological Information Systems
D. Communication and dissemination actions:	
D.1	Setting of procedures for reporting results and dissemination
D.2	Creation and continuous updating of web page for project activities
D.3	Stakeholder Involvement Activities
D.4	Target Audience - General Public Awareness Raising
E. Project management and monitoring of the project progress:	
E.1	Overall project operation
E.2	Networking with other projects
E.3	Air-LIFE Communication Plan
E.4	External Audit



“POLLINI E ALLERGIE:

DALLE CREDENZE POPOLARI

ALLA CONOSCENZA SCIENTIFICA

Meraviglie e aspetti inediti di un mondo microscopico e misconosciuto

SABATO 25 GIUGNO - ORE 16.00

UNIONE COMUNI GARFAGNANA

Castelnuovo Garfagnana - Via V Emanuele 9

Conferenza

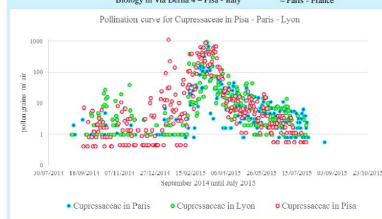


Fig. 5 - Pollination curve for Cupressaceae in Pisa - Paris - Lyon

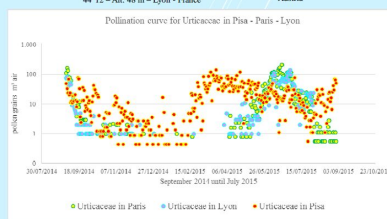


Fig. 6 - Pollination curve for Urticaceae in Pisa - Paris - Lyon

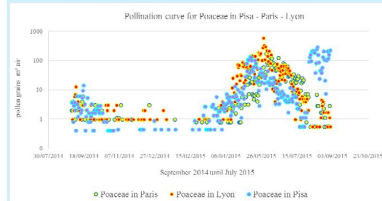


Fig. 7 - Pollination curve for Poaceae in Pisa - Paris - Lyon

Actions in progress:
Actions A1, coordinated by University of Pisa, and A2, coordinated by the Medical University of Vienna are terminated, while Actions B1, B2, B3, B4 are now starting.
Aerobiological data are integrated with meteorological data and data on air conventional chemical pollutants provided by ARPAT and Consorzio LaMMA (Italy); ZAMG and MA22 (Austria); Air Rhône-Alpes, Air Paris, Météo France and Infoclimat (France). Further more ultrafine particle spot monitoring will be performed in the three countries to investigate relationship between pollen - spores concentrations, conventional chemical pollutants, ultrafine particles, and exacerbations of allergic respiratory diseases. A newsletter service is available on the web site and a facebook account (Ais Life) and a Twitter account (Ais Life) have been set up.
Further dissemination actions will be undertaken in the next months in Italy, France, Austria.

- References:**
1. D'Amato G, Cecchi L, D'Amato M, Annesi-Maesano I, Ombrelli E, et al. (2014) Climate change and respiratory diseases. *Int J Respir Rev* June 1, 2014 vol. 23, no. 132-141-149
 2. D'Amato G, Basso-Caputo C, Cecchi L, et al. (2014) Climate change, air pollution and extreme events leading to increasing prevalence of allergic respiratory diseases. *Medicine & Biology* 2014; 2(1): 1-17
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 4. D'Amato G, Cecchi L. Effects of climate change on environmental factors in respiratory allergic diseases. *Clin Exp Allergy* 2008; 38: 1244-1274.



5 = FREE ORBICULES OF CUPRESSACEAE IN DAILY AEROBIOLOGICAL SAMPLES

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Introduction: Pollen grains of Cupressaceae are a major cause of pollinosis, especially in Mediterranean countries (1,2), and a strong risk factor for allergic asthma (2, 3). Pollen and orbicules of Cupressaceae carry a carbohydrate epitope recognised by human IgE (4). However, while airborne pollen grains of Cupressaceae are commonly observed in aerobiological monitoring, free orbicules were never reported in aerobiological samples. Within the aerobiological monitoring operated inside the AIS LIFE – Aerobiological Information System and allergic respiratory disease management – LIFE13ENV/IT/001107 project (5), we noticed fuzzy clusters of stained matter associated to pollen grains of Cupressaceae. This work was started to verify if orbicules were included in the clusters and hence visible in the aerobiological monitoring samples.

Materials and Methods: Dried microsporophylls of *Calocedrus decurrens* (Torr.) Florin, *Cupressus sempervirens* L. and *Juniperus macrocarpa* Sibth. & Sm. (Cupressaceae) were fixed to aluminum stubs with double adhesive carbon tape; the latter two species were also gently shaken on the tape, then the stubs were sputter-coated with gold, and observed and photographed with a SEM (6) (JEOL JSM 5410, Jeol Ltd, Tokyo, Japan). Daily aerobiological samples were collected in Pisa, Italy with a "Lanzoni VPPS 2000" pollen trap equipped with pre-siliconed sampling tape Silkstrap (Lanzoni) (Fig. 1). Sections corresponding to 24-hour intervals were cut from the tape, placed on microscope slides and stained with fuchsin jelly (7). The slides were then examined with optical (Leica Diaplan) and confocal microscope (Nikon A1plus) at 400x (8).

Results and discussion: We confirmed the presence of orbicules in *Calocedrus decurrens* microsporophylls (Fig. 2) and observed for the first time free orbicules on the adhesive tape of SEM samples of "shaken" *Cupressus sempervirens* and *Juniperus macrocarpa* (Fig. 3, 4). In daily aerobiological samples, we observed with the optical microscope, clusters of very small, well stained dots, around Cupressaceae pollen grains (Fig. 5). When the same samples are observed with the confocal microscope, the cluster is resolved in submicronic particles, ranging from 0.5 to 0.6 µm, with the same autofluorescence emission as the exine of the pollen grains, which leads us to identify them as orbicules (9). We were able to observe a large number of orbicules both on the exine of pollen grains of Cupressaceae and as loose bodies around them (Fig. 6). Orbicules have commonly been reported on the exine of pollen grains and on the surface of the tapetum of several species (9, 10), and some authors have inferred that they may become airborne as loose particles when pollen grains are released from pollen sacs (11). Our results confirm such hypothesis with direct observations.

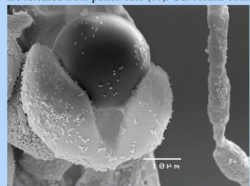
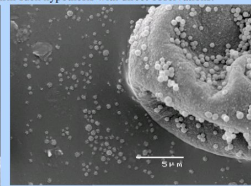
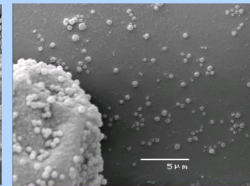
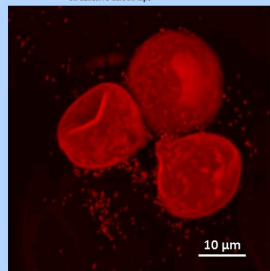
Fig. 2 - Pollen grain and orbicules of *Calocedrus decurrens* on exine and on laticFig. 3 - Pollen grain and free orbicules of *Cupressus sempervirens* on adhesive carbon tapeFig. 4 - Pollen grain and free orbicules of *Juniperus macrocarpa* on adhesive carbon tapeFig. 5 - Pollen grains and free orbicules of *Cupressus sempervirens* in daily aerobiological samples of 03/02/2016 observed with light microscope. Red outline: field observed with confocal microscope (see Fig. 6)

Fig. 6 - The same sample as Fig. 5 (inset) observed with a confocal microscope

Conclusions: For the first time, we proved that orbicules of Cupressaceae can be detected as loose particles in aerobiological samples at the same time as the "parental" pollen grains but vastly outnumbering them. On account of their smaller size, free orbicules can reach – and carry their allergenic load (4) – much deeper in respiratory systems than pollen grains. Although further cross-disciplinary research is needed, we hypothesize that free orbicules contribute to the broad circulation of pollinosis with airborne pollen grains of Cupressaceae.

Bibliographic references:

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5= FIRST AEROBIOLOGICAL MONITORING DATA IN PISA (ITALY) WITHIN AIS-LIFE PROJECT

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Introduction: One of the most important biological component of air is pollen, as its allergens are driver of airborne allergic diseases (1). Pollen allergy has a remarkable clinical impact over Europe. The aerobiological monitoring represents a unique tool to supply local real data to allergologists, enabling them to calibrate the drugs for their patients and providing immediate advantages both for patients' health and for better management of the national healthcare system (2). AIS LIFE ENV/IT001107 project – Aerobiological Information System and allergic respiratory disease management (<http://www.ais-life.eu>), launched in 2014 (3), aims to assess the clinical impact of dissemination of pollen information. In this context, aerobiological monitoring was started in Pisa (Italy) for the first time. This contribution is the first report on aerobiological data ever collected in Pisa.

Materials and Methods: The monitoring covers 21 months of operation of the pollen trap. The sampling procedure and the count of the airborne pollen grains and fungal spores is based on UNI 11108:2004 (4). Aerobiological samples were obtained with a "Lanzoni VPPS 2000" pollen trap installed on top of the Biology Department building in Pisa, via Derna 1, about 17 m above the road pavement (coordinates 43.718343° N, 10.395110° E). Pollen grains of eight families: Betulaceae, Cupressaceae – Taxaceae, Asteraceae, Fagaceae, Oleaceae, Urticaceae, Platanaceae, Pinaceae and spores of *Alternaria* spp. have been counted every day since 4 November 2014. Cycles of pollination and the main pollen seasons (MPS) for woody plants were calculated according to 5, 6. Herbaceous species and *Alternaria* were excluded from the calculations because still in active pollination/sporulation at the time of writing. Meteorological data were obtained from www.meteopisa.it and from a weather station placed next to the pollen trap.

Results and discussion: We recorded a cumulative value of 32106.65 pollen grains per m³ and 10683.45 fungal spores per m³ from 1 January to 31 August 2016; the same values for the whole 2015 are 41517.97 and 14861.02 respectively. As regards woody species, the highest value was contributed by Cupressaceae – Taxaceae families, with 8928.48 pollen grains in 2016 and 18047.5 in 2015; followed by Fagaceae with 6884.6 pollen grains in 2016 and 8792.87 pollen grains in 2015; Coryloideae subfamily with 4810.55 pollen grains in 2016 and 2881.47 in 2015; Platanaceae with 4245.15 pollen grains in 2016 and 3640.03 in 2015 and Oleaceae with 3919.55 pollen grains in 2016 and 4938.14 pollen grains in 2015. As regards start date in MPS, all plant families reported were in early for pollination in 2016, except Coryloideae subfamily. Concerning MPS, Oleaceae family lasted 153 days in 2016 and 129 in 2015. The starting date for Oleaceae family varied from 11 days in 2016 to 30 days in 2015; Betuloideae subfamily varied from 34 days in 2016 to 49 in 2015. As regards the ending date, Betuloideae varied with 94 days in 2016 and with 100 days in 2015. The average temperature of the period 1 January-30 April was 11.9°C in 2016 and 10.9°C in 2015; in the same period total rainfall was 432.2 mm and 258 mm respectively. Therefore, our data may suggest a correlation between a) temperature and start of MPS, and b) precipitation and pollen concentration of woody species, consistent with observations reported in other studies (7).



Fig. 2 - Monthly mean temperature and total rainfall from January to April 2015 – 2016 in Pisa

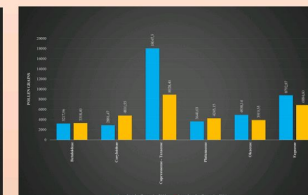


Fig. 3 - Annual total pollen grains for woody plants in Pisa 2015 – 2016

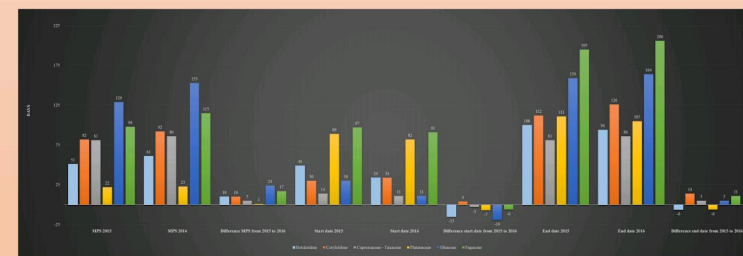


Fig. 4 - Comparison MPS 2015 – 2016 in Pisa

Conclusions: The aerobiological monitoring campaign started in Pisa in 2014 is providing scientific data in support of an on-going European project addressing the clinical impact of dissemination of airborne pollen information. Cupressaceae – Taxaceae are shown to be the most important source of airborne pollen in Pisa, consistent with reports from most Italian and European cities (8, 9, 10). The correlation between meteorological factors and pollen data may help in detecting local changes in climate factors.

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ACTION E.1:
Overall project operation

Beneficiary responsible for implementation: UNIFI

UNIFI is a member of the Steering Committee, has designated its representatives in the scientific and administrative mail lists of the project, and has participated in the kick-off meeting, in two annual meetings (Vienna, June 2015; Paris, January 2017) as well as in the monthly Skype meetings of the Steering Committee.