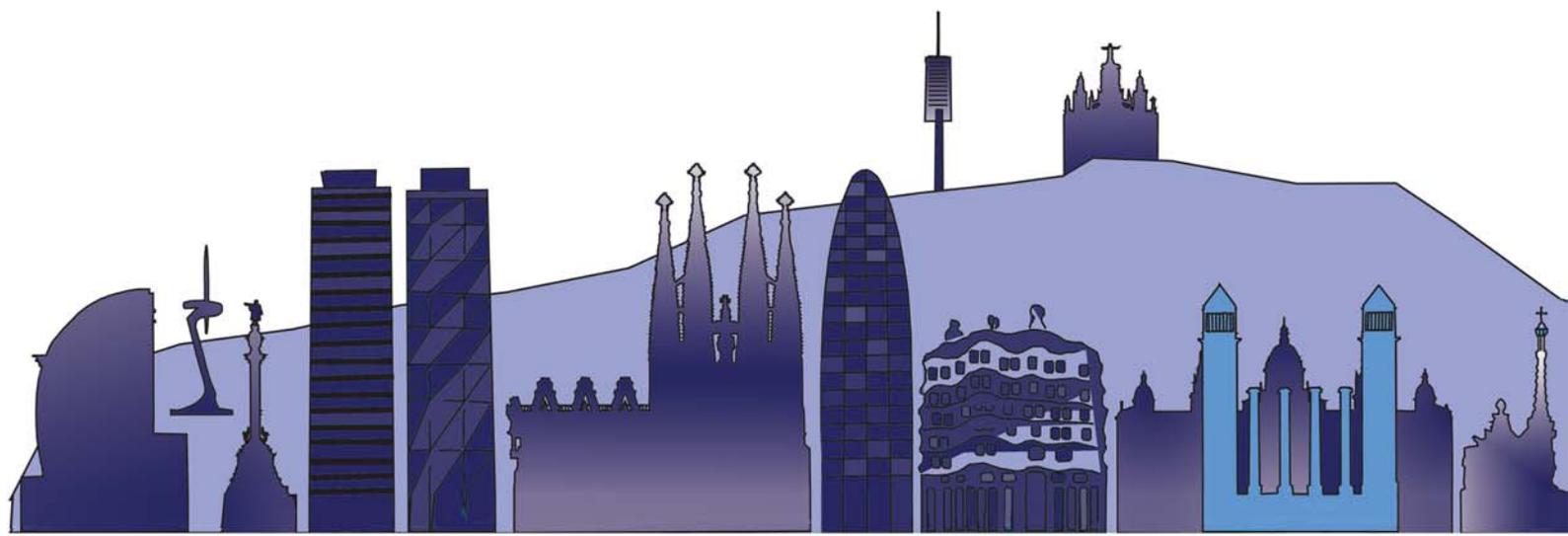


MedPalyn 2017

*Mediterranean Palynology
APLE-GPPSBI-APLF Symposium
Barcelona, 4-6 September 2017*

Abstracts Book



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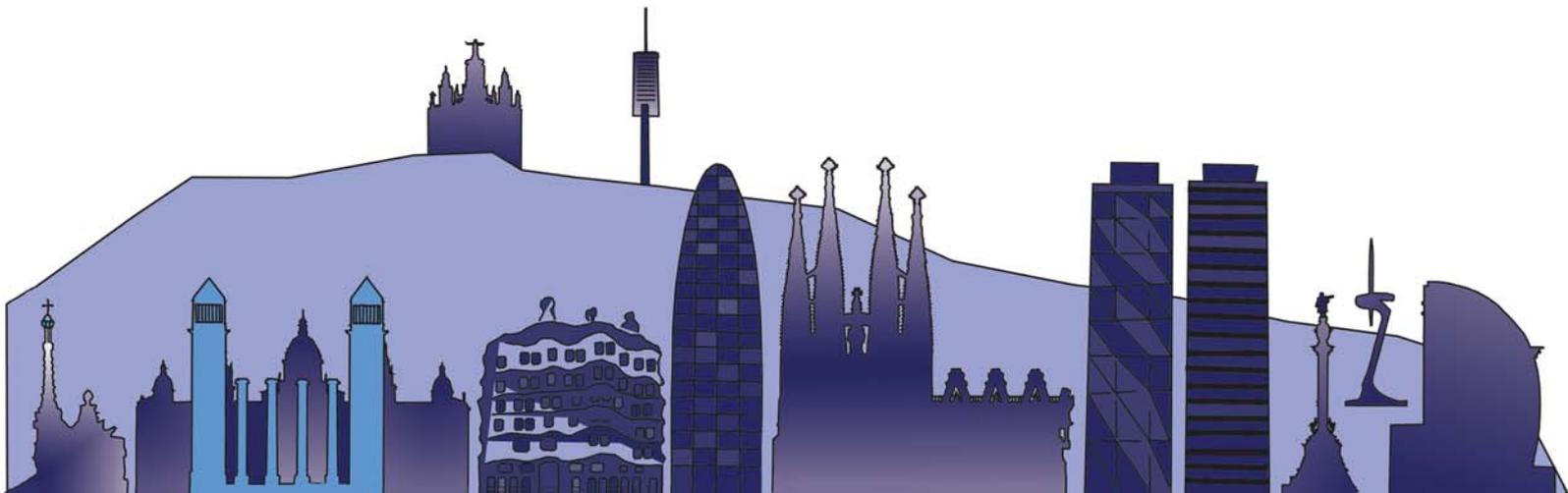
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Mediterranean Palynology Symposium 2017

Barcelona, 4-6 September 2017

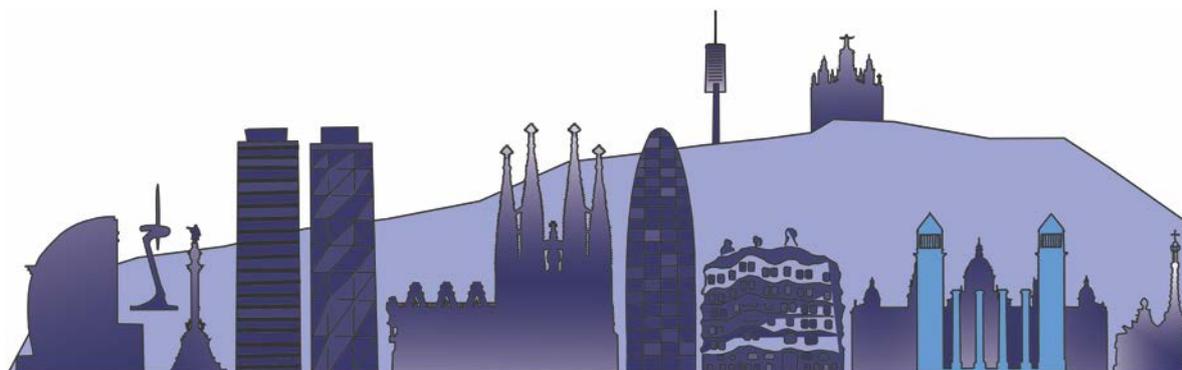
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Gruppo di Palinologia e Paleobotanica della Società Botanica Italiana (GPPSBI)

Association des Palynologues de Langue Française (APLF)

Abstracts book

Edited by Concepción De Linares and Jordina Belmonte



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On behalf of the Associations

Asociación de Palinólogos de Lengua Española (APLE)
Association des Palynologues de Langue Française (APLF)
Gruppo di Palinologia e Paleobotanica della Società Botanica Italiana (GPPSBI)
Società Botanica Italiana onlus (SBI)

Welcome to MedPalyno 2017

It is my pleasure to announce you that we are organizing MedPalyno 2017 on behalf of the Asociación de Palinólogos de Lengua Española (APLE), the Gruppo di Palinologia e Paleobotanica della Società Botanica Italiana (GPPSBI) and the Association des Palynologues de Langue Française (APLF).

The **Mediterranean Palynology Symposium 2017** will be held in Barcelona city center (UPF School of Management, Balmes 132-134), in September 4 - 6, 2017.

For the first time, three palynological societies around the Mediterranean (from Spain, Italy and France) plus palynologists from Greece, organize a joint Symposium. The diversity of pollen and spores related themes, together with the multiculturalism of the participants, will provide a forum for analysis, discussion and ideas exchange around the latest research offering great opportunities for interdisciplinary future collaborations.

Barcelona is a cosmopolitan city that promises to be a wonderful Symposium venue. It offers excellent possibilities for the development of the scientific meeting as well as a bunch of opportunities for the free time. It is an easy connected destination, has excellent hotels and restaurants for all budgets, monuments, parks, shopping, market squares and other places to visit, as well as beaches, urban and peri-urban forests and fluvial areas that surround it. The nightlife offers are non-negligible. The public transport system helps to reach everything that is not in walking distance.

I look forward to seeing you at the Symposium!

Jordina BELMONTE
MedPalyno 2017 President
medpalyno@uab.cat

Summary

Program Timetable	11
Scientific Program	13
Monday, 4th September	15
Tuesday, 5th September	18
Wednesday, 6th September.....	24
Abstracts Plenary Lectures	29
Abstracts, Monday, 4th September	33
Oral Session 1: Aerobiology	35
Oral Session 2: Pollen Morphology, Biology, Biochemistry.....	44
Poster Session A: Aerobiology	53
Abstracts, Tuesday, 5th September	65
Oral Session 3: Aerobiology	67
Oral Session 4: Paleopalynology.....	76
Oral Session 5: Aerobiology	85
Session 6: Pollen Morphology, Biology, Biochemistry.....	92
Oral presentations	92
Poster presentations	96
Oral Session 7: Aerobiology	104
Oral Session 8: Paleopalynology.....	111
Poster Session B: Aerobiology	118
Abstracts, Wednesday, 6th September	139
Oral Session 9: Paleopalynology.....	141
Session 10: Melissopalynology	148
Lecture.....	148
Oral presentations	149
Poster presentations	152
Oral Session 11: Paleopalynology.....	157
Poster Session C: Paleopalynology	163
Authors Index	185

Program Timetable

	September 4 (Monday)	September 5 (Tuesday)	September 6 (Wednesday)
10:00	Registration		
11:00	Opening Ceremony		
11:30	Plenary Lecture Ettore Pacini	3 Aerobiology	9 Paleopalynology
12:15	Plenary Lecture Mikhail Sofiev	Coffe Break + Aerobiology Poster Session B	Coffe Break + Paleopalynology Poster Session C
13:00	Lunch	5 Aerobiology	11 Oral Session Paleopalynology
14:30	Oral Sessions	6 Pollen Morphology, Biology and Biochemistry	
16:30	1 Aerobiology	Lunch	
17:00	2 Pollen Morphology, Biology and Biochemistry	7 Aerobiology	
	Coffe Break + Aerobiology Poster Session A	8 Paleopalynology	
	New palynological sampling and analyzing methods Workshop	Plenary Lecture Joel Guiot	
18:30		APLF Assembly	
19:00		APLE Assembly	
20:00	Run for fun race	AEA Assembly	
			Oral Session Melissopalynology Lecture
			10 Oral and Poster Session Melissopalynology
			11 Oral Session Paleopalynology
			Closing Ceremony
			Spanish Melissopalynology Group Workshop

Scientific Program

Monday, 4th September

11.00- 11.30	Opening Ceremony	Auditori UPF School of Management
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11.30- 12.15	Plenary Lecture	Auditori UPF School of Management
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Pollen developmental arrest and ecophysiological consequences.
Pacini E., Dept. of Life Sciences, Siena University, Italy.

12.15- 13.00	Plenary Lecture	Auditori UPF School of Management
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Natural biogenic particles in the atmosphere: current research frontiers and future needs.
Sofiev M., Finnish Meteorological Institute, Finland.

14.30- 16.30	Oral Session 1: Aerobiology Chairs: Frenguelli G. & Thibaudon M.	Auditori UPF School of Management
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01- *Allergy potency for the main urban plants.*
Thibaudon M., Sindt C., Oliver G., Monnier S.

02- *Relations between urban vegetation and airborne pollen at a local scale.*
Charalampopoulos A., Lazarina M., Tsiripidis I., Vokou D.

03- *Case Study France: Analysis of plants in public green spaces.*
Thibaudon M., Monnier S.

04- *Automatic system for simultaneous and real-time monitoring of pollen and air pollutants.*
Kiseleva S., Capela F., Crouzy B., Battaglia F., Lazzarotto B., Clot B., Kiselev D.

05- *A first assessment of aerobiological air quality in rooftop greenhouses.*
Ercilla-Montserrat M., Izquierdo R., Belmonte J., De Linares C., Montero J.I., Muñoz P., Rieradevall J.

06- *Aerobiological studies in Qatar and Sharjah: toward establishment of a network for pollen analysis and allergenicity.*
Trigo M.M., El-Keblawy A., Ali Al-Nesf M., Gharbi D., Mobayed H., Mohammed Ali R., A Sattar H., Tuffaha A., Adeli M., Blessing R., Iftikhar Hussain M., Sinoj J., Navarro T.

07- *Comparative study of airborne pollen content from northern to southern Tunisia.*
Hadj Hamda S., Ben Dhiab A., Msallem M.

08- *Preliminary study of the airborne pollen in the atmosphere of Puerto Ayora (Galapagos Islands, Ecuador).*
Picornell A., Trigo M.M., Recio M., Tapia A., Jaramillo P.

09- *Effects of air pollution exposure on allergenic power of Cypress pollen.*
Costanzi E., Ghitarrini S., Frenguelli G., Tedeschini E.

14.30- 16.30	Oral Session 2: Pollen Morphology, Biology and Biochemistry Chairs: Alché J.D. & Romero García A.T.	Amfiteatre UPF School of anagement
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- 01- *Ultrastructural changes in the pollen grain wall of the Berberidaceae family.*
Requena Ramírez M.D., Berbel M., Ben-Menni Schuler S., Suárez Santiago V.N., Pérez Gutiérrez M.A., Fernández Fernández M.C., Salinas Bonillo M.J., Romero García A.T.
- 02- *Comparative study of the pollen wall in Ranunculales families.*
Ben-Menni Schuler S., Pérez Gutiérrez M.A., Suárez Santiago V.N., Salinas Bonillo M.J., Romero García A.T., Fernández Fernández M.C.
- 03- *Beekeeping and agro-environmental benefits of some cultivated species of family Brassicaceae.*
López-Pérez J.A., González-Porto A.V., Molina-Abril J.A., García-Villarubia C., Pardo-Martín C., Higes M., Martín-Hernández R.
- 04- *Auxin progressively decreases during pollen development while its biosynthesis and transport are induced and required for microspore reprogramming to embryogenesis in Brassica napus and Hordeum vulgare.*
Pérez-Pérez Y., Solís M.T., El-Tantawy A.A., Rodríguez-Sanz H., Pitarch M., Gómez-Cadenas A., Risueño M.C., Testillano P.S.
- 05- *Programmed cell death of tapetum involves the activation of autophagy, and metacaspase and cathepsin proteases.*
Bárány I., Berenguer E., Solís M.T., Minina E., Santamaría E., Crespo J.L., Díaz I., Risueño M.C., Bozhkov P., Testillano P.S.
- 06- *AGPs as markers for Quercus suber phragmoplast assembly during pollen meiosis.*
Costa M., Amorim M.I., Coimbra S.
- 07- *Caleosins are essential for pollen performance during the progamic phase.*
Jiménez-Quesada M.I., Zienkiewicz K., Feijó J., Alché J.D., Castro A.J.
- 08- *Antioxidant activity and allergen expression of Corylus avellana L. pollen from Slovakia and Ukraine.*
Nikolaieva N., Nôžková J., Brindza J., Grigorieva O., Žirovská J.
- 09- *Comparison of Ole e 1 amount from two different Olea europaea cultivars.*
Celenk S., Vatanserver B., Malyer H.

16.30- 17.00	Poster Session A: Aerobiology Chairs: Antunes C.M. & Galán C.	Exhibition Hall UPF School of Management
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- 01p- *Aerobiological comparison between Plasencia and Cáceres (SW Spain).*
Monroy-Colín A., Tormo-Molina R., Fernández-Rodríguez S., Silva-Palacios I., Maya-Manzano J.M., Gonzalo-Garijo A.
- 02p- *Pollen diversity in the atmosphere of a semiarid region of Mexico during the dry season.*
Galván-Escobedo I.G., Ríos-Ramos B.E., Martínez-Romero L., Rosas-Pérez I.
- 03p- *24 years of aerobiology monitoring in Jaén; trends in airborne pollen.*
Aguilera E., García-Castaño G.R., Ruiz-Valenzuela L.
- 04p- *Heat and Chill requirements for the flowering period of the Albariño variety in the Ribeiro D.O. area.*
Piña-Rey A., González-Fernández E., Fernández-González M., Aira M.J., Rodríguez-Rajo F.J.

- 05p- *Prediction of grey mould periods of high infection risk for Treixadura variety.*
González-Fernández E., Piña-Rey A., Fernández-González M., Aira M.J., Rodríguez-Rajo F.J.
- 08p- *Evolution of IUGZA index in a historic park in Salamanca (1985-2016).*
Sánchez Reyes E., Rodríguez de la Cruz D., Sánchez Durán S., Vega Elices E., Sánchez Sánchez J.
- 09p- *Allergenic potential of green spaces in the city of Porto (Portugal).*
Rodríguez de la Cruz D., Lufinha M.I., Azurara C., Pereira T., Abreu I.
- 10p- *Citizen Science: Phenological observations in Rome.*
Travaglini A., Brighetti M.A., Miraglia A.R. Ricciardi L., Sigismondi C.
- 11p- *Wind dynamics' influence on airborne olive-pollen during African intrusions.*
García-Mozo H., Hernández-Ceballos M.A., Trigo M.M., Galán C.
- 12p- *Influence of the thermal requirement on the phenological development and Alternaria concentrations in a potato crop.*
Seijo-Rodríguez A., Escuredo O., Meno-Fariñas L., Rodríguez-Flores M.S., Seijo M.C.
- 13p- *Atmospheric concentrations and intradiurnal pattern of Alternaria and Cladosporium conidia in Tétouan (NW of Morocco).*
Bardei F., Bouziane H., Trigo M.M., Ajouray N., El Haskouri F., Kadiri M.

17.00- 18.30	New palynological sampling and analyzing methods Workshop Chair: Belmonte J.	Auditori UPF School of Management
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Tuesday, 5th September

09.00- 11.00	Oral Session 3: Aerobiology Chairs: Galán C. & Vokou D.	Auditori UPF School of Management
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- 01- *Ambient air- Sampling and analysis of airborne pollen grains and fungal spores for networks related to allergy- Volumetric Hirst method (CEN/TS 16868:2015).*
Thibaudon M., Galán C., Bonini M., Röseler S., Fernández-González D.
- 02- *Pollens, allergy and real time information.*
Thibaudon M., Oliver G.
- 03- *Digitalization of Samples for Evaluation and Automated Image Analysis.*
Meinardus-Hager G., Hildebrand L.
- 04- *New biomolecular tools for aerobiological monitoring: identification of major allergenic Poaceae species through fast real-time PCR.*
Ghitarrini S., Pierboni E., Albertini E., Rondini C., Tedeschini E., Tovo G.R., Frenguelli G.
- 05- *Numerical approach to compare the pollen emission from grass species.*
Romero-Morte J., Rojo J., Lara B., Rivero R., Fernández-González F., Pérez-Badía R.
- 06- *Is total protein a feasible marker of bioaerosol load in ambient air?*
Arriegas R., Alves P., Otilio M., Galveias A., Costa A.R., Antunes C.M.
- 07- *Suitability of Chemvol sampler in monitoring *Alternaria* aeroallergens.*
Grewling Ł., Bogawski P., Kostecki Ł., Szymańska A., Nowak M.
- 08- *What is the appropriate temporary extension for a representative pollen calendar?*
Elvira-Rendueles B., Moreno J.M., Negral L., García-Sánchez A., Moreno-Grau S.
- 09- *Palynological investigation of biological tissues from human volunteers.*
Pereira J.S.R., Ribeiro H., Santos A., Abreu I.

09.00- 11.00	Oral Session 4: Paleopalynology Chairs: Mercuri A.M. & Pérez R.	Amfiteatre UPF School of anagement
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- 01- *The Shackleton site, a pivotal Iberian margin climatic archive for understanding the ocean-ice-land interactions of the last 800,000 years.*
Sánchez-Goñi M.F., Desprat S., Morales-Molino C., Naughton F., Oliveira D., Rodrigues T., Polanco-Martínez J.M., Eynaud F., Daniau A.L., Hodell D.A., Sierro F.J., Martín-García G.M.
- 02- *Impact of the Mediterranean Outflow Water on the North Atlantic Ocean during past climate warming events.*
Wary M., Oliveira D., Morales Del Molino C., Naughton F., Eynaud F., Londeix L., Ducassou E., Sánchez-Goñi M.F.
- 03- *New pollen data from shallow marine sediments in Ría de Ferrol (NW Iberia).*
Muñoz Sobrino C., Cartelle V., Martínez-Carreño N., García-Moreiras I., García Gil S.
- 04- *Last Glacial-Holocene productivity reconstructions of Congo River from the revised tropical dinocyst-based modern database.*
Hardy W., Marret F., Penaud A., le Mézo P., Kageyama M., Droz L., Marsset T.
- 05- *Lago di Vico, central Italy: a detailed late Holocene pollen record.*
Sadori L., Giardini M., Masi A., Nicoletta R.

- 06- *Contributions of archaeopalynology in lakeside settlements research. The case study at La Draga (Banyoles, NE Iberia).*
Revelles J.
- 07- *Plant landscape evolution in a human-induced environment: El Sertal peatbog (Cantabria-Spain).*
Pérez Obiol R., Garcia Codron J.C., Carracedo V., Cunill R., Soriano J.M., Pèlachs A.
- 08- *Human impact in lake shore environment: a study case at Lake Chalain.*
Angeli A., Gauthier E., Richard H.
- 09- *Modern vegetation, pollen and non-pollen palynomorphs relationships in Majorca and Minorca (Balearic Islands, Spain). A tool for a better understanding of human occupation dynamics and vegetation history in Holocene Mediterranean records.*
Servera-Vives G., Mus Amezquita M., Torri P., Mercuri A.M.

11.00- 11.45	Poster Session B: Aerobiology Chairs: Moreno-Grau S. & Pérez-Badia R.	Exhibition Hall UPF School of Management
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- 01p- *Botanical families with allergenic antecedent present in the atmosphere of the city of Ibagué Tolima-Colombia.*
Ramírez-Cotes D., Bonilla-Sánchez A., Mosquera-Mosquera H.
- 02p- *Fungal spores present in the atmosphere of the city of Ibagué Tolima-Colombia.*
Ramírez-Cotes D., Mosquera-Mosquera H., Bonilla-Sánchez A.
- 03p- *Ascospores and conidia of Pleosporales in the aerospore in Barcelona during a year study.*
Rúa-Giraldo A.L., Belmonte J.
- 04p- *Mycobiota in the air and surfaces of indoor and outdoor environments in Barcelona.*
Rúa-Giraldo A.L., Belmonte J.
- 05p- *Alternaria spores behaviour in the atmosphere of Salamanca (Spain).*
Estrada Muñoz D., Sánchez Reyes E., Rodríguez de la Cruz D., Vega Elices E., Sánchez Durán S., Sánchez Sánchez J.
- 06p- *Preliminary study of the atmospheric pollen in Ronda (south Spain).*
Picornell A., Recio M., Trigo M.M., Cabezudo B.
- 07p- *Aerobiology in Alcázar de San Juan (central Spain): pollen spectrum and allergenic pollen.*
Burgos-Montero A.M., Candón-Morillo R., González-Sánchez L.A., Feo Brito F., Pérez-Badia R.
- 08p- *The aeropalynology of Oran's region Es-Senia, northwest Algeria.*
Kiared (Ould-Amara) Gh., Belmonte J., Bessedik M., Riding J.
- 09p- *Airborne Platanus pollen wall elemental analysis and adhered particulate matter.*
Ribeiro H., Guimarães F., Duque L., Lamas R., Abreu I.
- 10p- *Adjustment of the Negative Prognosis model for the incidence of late blight on a potato crop in A Limia.*
Seijo-Rodríguez A., Escuredo O., Rodríguez-Flores M.S., Seijo M.C.
- 11p- *Predictive model to determine pollen and allergen concentrations of Ligustrum lucidum in Ourense.*
Vara A., Astray G., Valencia J.A., Fernández-González M., Rodríguez-Rajo F.I.
- 12p- *Aerobiological and phenological behavior of the Godello variety in the Ribeiro DO during the 2015 and 2016 harvests.*
Cortiñas J.A., Rodríguez-Rajo F.I., Fernández-González M., Aira M.J., Ribeiro H., Abreu I.

- 13p- *Betula* allergenic load in the atmosphere of Santiago of Compostela.
Castiñeiras P., Rodríguez-Rajo F.J., Vara A., Fernández-González M., Aira M.J.
- 14p- Pollen proteins in the atmosphere: a comparative study of three methods.
Sandrini S., Aloisi I., De Nuntiis P., Facchini C., Del Duca S., Fernández-González D.
- 15p- Detection of airborne allergen in relation to pollen counts (*Olea europaea*).
Varea M., Flores E., Soriano V., Fernández J., Gil-Moltó J., Galindo N., Yubero E., Nicolás J.F., Caballero S., Castañer R., Pastor C., Crespo J.
- 16p- Case of study in the region of Paris regarding allergy symptoms, atmospheric pollution and pollen grain concentration.
Sarda Estève R., Baisnee D., Thibaudon M., Auvigne V., Guinot B.
- 17p- Long distance transport of *Olea europaea* pollen over Central Europe.
Tedeschini E., Udvardy O., Sofiev M., Palamarchuk J., Makra L., Magyar D.
- 18p- Effect of temperature and precipitation on the airborne pollen parameters in Catalonia (NE Iberian Peninsula).
Periago C., Majeed H.T., Alarcón M., Belmonte J.
- 19p- Analysis of the behavior of airborne *Artemisia* pollen in relation to precipitation and temperature in the locality of Lleida, Spain.
López D.J., Belmonte J., De Linares C.
- 20p- Forecasting the interannual variability of olive seasonal pollen load.
Ritenberga O., Sofiev M., EAN data providers

11.45- 13.15	Oral Session 5: Aerobiology Chairs: Thibaudon M. & Trigo M.M.	Auditori UPF School of Management
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- 01- Announcing the beginning of the pollen season, does the alder also announce summer?
Thibaudon M., Sindt C., Richard P.
- 02- Airborne *Ambrosia* pollen counts help to appreciate the effectiveness of the fight against ragweed? The cases of the Lyon areas: 1982-2016, 1996-2016.
Dechamp Ch., Belmonte J., Meon H.
- 03- Reproductive and aerobiological survey on natural and cultivated chestnut (*Castanea sativa* Mill.) populations in South Spain.
Hidalgo-Galvez M.D., García-Mozo H., Moreno C., Galán C.
- 04- Pollen production and geolocation of *Casuarina cunninghamiana*.
Monroy-Colín A., Silva-Palacios I., Tormo-Molina R., Maya-Manzano J.M., Fernández-Rodríguez S., Gonzalo-Garijo A.
- 05- Influence of climate on chronology and intensity of *Olea europaea* L. pollen season in Tunisia.
Ben Dhiab A., Hadj Hamda S., Ben Mimoun M., Abichou M., Msallem M.
- 06- Pollen trends in different towns of Italy.
Brighetti M.A., Gottardini E., Lucchini D., Picone R.M., Russo M., Vargiu A., Siniscalco C., Pace L., Travaglini A.
- 07- Plane tree pollination phenology and airborne pollen records.
Monroy-Colín A., Silva-Palacios I., Fernández-Rodríguez S., Tormo-Molina R., Maya-Manzano J.M., Gonzalo-Garijo A.

11.45- 13.15	Oral and Poster session 6: Pollen Morphology, Biology and Biochemistry Chairs: Alché J.D. & Testillano P.S.	Amfiteatre UPF School of anagement
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Oral Presentations

- 01- *A new allergen family involved in food pollen associated syndrome: snakin/gibberellin regulated proteins.*
 Sénéchal H., Santrucek J., Melcova M., Svoboda P., Zidkova J., Shahali Y., Guilloux L., Aizawa T., Selva M.A., Couderc R., Charpin D., Poncet P.
- 02- *Recovery and molecular analysis of olive Pollen from Sedimentary Samples.*
 González-Toral C., Alché J.D.
- 03- *Identification and functional annotation of genes differentially expressed in the reproductive tissues of the olive tree (*Olea europaea* L.) through the generation of subtractive libraries.*
Zafra A., Alché J.D.
- 04- *From inside to outside: cyto-morphological rearrangements underlying spermine involvement in the apical growth of the pollen tube.*
 Aloisi I., Cai G., Faleri C., Navazio L., Del Duca S.

Poster Presentations

- 01p- *Pollen morphology and reproductive biology of Omphalodes brassicifolia (Lag.) Sweet. an endangered Iberian endemism.*
 Vega Elices E., Rodríguez de la Cruz D., Sánchez Reyes E., Sánchez Durán S., Sánchez Sánchez J.
- 02p- *Augmented pollen superoxide dismutase activity induced by NO₂ and O₃.*
Costa A.R., Mendes S., Galveias A., Arriegas R., Ribeiro H., Antunes C.M., Abreu I.
- 03p- *Stable carbon isotope measurements on Cedrus atlantica pollen: first steps towards an independent drought stress proxy.*
 Bell B., Fletcher W., Ryan P., Grant H., Ilmen R.
- 04p- *Germination of pollen grains in the esophagus of individuals with eosinophilic esophagitis (EoE).*
 Armentia A., Martín-Armentia S., Martín-Armentia B., Santos-Fernández J., Álvarez R., Gayoso M., Fernández-González D.
- 05p- *Do cats (Felis catus domestica) suffer from environmental allergies?*
De Castro-Alfageme S., Leal-Fierro L., Rodríguez-Ramos M.A., Valencia-Barrera R., Vega-Maray A.M., Fernández-González D.
- 06p- *Pollen allergies in the dog (Canis familiaris).*
De Castro-Alfageme S., Leal-Fierro L., Rodríguez-Ramos M.A., Valencia-Barrera R., Vega-Maray A.M., Fernández-González D.
- 07p- *Allergens more frequently involved in allergy of horses (Equus caballus domesticus).*
De Castro-Alfageme S., Leal-Fierro L., Rodríguez-Ramos M.A., Valencia-Barrera R., Vega-Maray A.M., Fernández-González D.
- 08p- *Morphology and polynical viability of some genera of the Araceae family.*
 González-Gutiérrez K., Mosquera-Mosquera H., Ramírez-Cotes D.

14.30- 16.00	Oral Session 7: Aerobiology Chairs: Fernández-González D. & Trigo M.M.	Auditori UPF School of Management
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- 01- *Regression tree model to predict daily levels of airborne Urticaceae pollen.*
Vélez-Pereira A.M., De Linares C., Canela M.A., Belmonte J.
- 02- *Source-receptor exchange patterns of pollen deposition over Southern Europe.*
Sofiev M., Palamarchuk J., EAN data providers.
- 03- *Influence of wind on daily airborne pollen concentrations in Catalonia (NE Iberian Peninsula).*
Periago C., Majeed H.T., Alarcón M., Belmonte J.
- 04- *Airborne fungal spores of Abomey-Calavi (south-Benin), clinical data and meteorological parameters.*
Tossou G.M., Tchabi F.L., Akoegninou A.
- 05- *Quantitative and qualitative assessment of airborne microorganisms in the historical and modern museum depositories.*
Grabek-Lejko D., Tekiela A., Kasprzyk I.
- 06- *Fungal spores affecting vineyards across Europe, a preliminary study.*
Martínez-Bracero M., Alcázar P., Grinn-Gofroñ A., Galán C.
- 07- *Analysis of airborne fungal content in the Cathedral of Jaen (South Spain): preliminary results.*
Aguilera F., Ruiz-Valenzuela L.

14.30- 16.00	Oral Session 8: Paleopalynology Chairs: Kouli K. & Sadori L.	Amfiteatre UPF School of anagement
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- 01- *A 500 000 yrs paleoenvironmental and paleoclimatic record from the Balkans inferred from Lake Ohrid pollen data.*
Peyron O., Goring S., Combourieu-Nebout N., Sadori L., Bertini A., Donders T.H., Joannin S., Kouli K., Kousis A., Koutsodendris A., Masi A., Mercuri A.M., Panagiotopoulos K., Sinopoli G., Torri P., Wagner B.
- 02- *Centennial-scale vegetation and fire dynamics in the Middle Atlas, Morocco during the last 12,000 years.*
Fletcher W., Campbell J.F.E., Joannin S.
- 03- *Interpreting 2700 years of abrupt environmental change in central Italy by comparing pollen and climate reconstructions with historical texts.*
Mensing S., Schoolman E., Tunno I., Piovesan G.
- 04- *Warm climate could reduce trees diversity in mixed-wood boreal forest.*
Remy C.C., Senici D., Chen H.Y.H., Bergeron Y., Ali A.A., Lavoie M.
- 05- *From palaeoecology to conservation of mountain forests: Utilities and contributions in the Mediterranean Region.*
Abel-Schaad D., Alba-Sánchez F., López-Sáez J.A., Pérez-Díaz S.
- 06- *Estimating ecosystem functional changes from pollen records in Western Mediterranean.*
Alba-Sánchez F., Alcaraz-Segura D., López-Sáez J.A., Abel-Schaad D., Sabariego-Ruiz S., Pérez-Díaz S., Blanco J., Vargas G., Cabello J., Peñas J., González-Hernández A., Cheddadi R.
- 07- *Vitis representation in modern pollen spectra from Southern Europe vineyards.*
Mariotti Lippi M.M., Ciani F., Florenzano A., Torri P., Montecchi M.C., Landi Degl'Innocenti V., Ricciardo D., Rattighieri E., Mercuri A.M.

16.15- 17.00	Plenary Lecture	Auditori UPF School of Management
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Jacques Louis de Beaulieu, from the pollen grain to the European Pollen Database, a career devoted to the community of palaeoecologists.

Guiot J., Technopole de l'Environnement Arbois Mediterranee, Aix-en-Provence, France.

17.00- 18.30	APLF Assembly	Auditori UPF School of Management
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17.00- 18.15	APLE Assembly	Amfiteatre UPF School of anagement
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18.15- 19.15	AEA Assembly	Amfiteatre UPF School of anagement
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Wednesday, 6th September

09.00- 10.45	Oral Session 9: Paleopalynology Chairs: Mercuri A.M. & Sánchez-Goñi M.F.	Auditori UPF School of Management
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- 01- *Climate change since the last glacial period in Lebanon and the persistence of Mediterranean species.*
Cheddadi R., Khater R.
- 02- *Paleoproductivity changes over the last 30 ky in the NW Moroccan margin as reconstructed from palynological (dinocyst) and stable isotopic tracers.*
Penaud A., Bonin J., Eynaud F., Waelbroeck C., Blamart D.
- 03- *History of Holocene vegetation in arid and semi-arid regions of central and southern Tunisia.*
Lebreton V., Jaouadi S.
- 04- *Lateglacial to early Holocene transition in Northern Iberia. Palaeoenvironment and fuel use.*
Pérez-Díaz S., Ruiz-Alonso M., López-Sáez J.A., Alday A.
- 05- *Late Glacial and Holocene vegetation patterns of Attiki, southern Greece.*
Kyrikou S., Kouli K., Triantaphyllou M.V., Dimiza M.D., Gogou A., Karageorgis A.P.
- 06- *Environmental changes in the Middle to Late Holocene transition in Eivissa (Balearic Islands, Western Mediterranean).*
Revelles J., Burjachs F., Ghilardi M., Expósito I., Yll E., Marlasca R.
- 07- *Modern pollen-vegetation relationship and Holocene vegetation changes under arid climate (Southern Tunisia).*
Jaouadi S., Lebreton V.

09.00- 11.00	Oral and Poster Session 10 : Melissopalynology Chairs: Battesti M.J. & De Linares C.	Amfiteatre UPF School of anagement
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La méliissopalynologie et la valorisation de la qualité liée à l'origine: l'exemple de l'Appellation d'Origine Protégée «Miel de Corse – Mele di Corsica».
Battesti M.J. Laboratoire Chimie des Produits Naturels, Université de Corse, Corte, France.

Oral Presentations

- 01- *Feeding and farming practices in honey bee colonies.*
González-Porto A.V., Higes M., López-Pérez J.A., Martín-Hernández R., Molina-Abril J.A., García-Villarubia C., Pardo-Martín C.
- 02- *Characterization of Ibiza and Formentera honeys (Balearic Islands).*
Guillaumet S., Boi M., Galán C., Aguilar M.P.
- 03- *A comparison of urban and rural honey and propolis from Barcelona metropolitan area.*
Cardellach P., De Linares C., Belmonte J.

Poster Presentations

- 01p- *Pollen content of larvae of Vespa velutina collected in NW Spain.*
Seijo M.C., Rodríguez-Flores M.S., Escuredo O., Seijo-Rodríguez A.
- 02p- *Melissopalynological analysis of honey from the region of Mostaganem (Algeria).*
Homrari M., Rodríguez-Flores M.S., Dalache F., Escuredo O., Bouzouina M., Seijo M.C.

- 03p- *Characterization of Corsican blossom honey: pollen diversity and volatile variability.*
Yang Y., Costa J., Paolini L., Battesti M.J.
- 04p- *Melissopalynological origin determination and volatile analysis of honey from corsican Anthyllis hermannieae L. habitat.*
Yang Y., Costa J., Paolini J., Battesti M.J.
- 05p- *Pollen analysis of several unifloral commercial honeys.*
Navas Nieto C., Sánchez Reyes E., Sánchez Sánchez J., Rodríguez de la Cruz D.

10.45- 11.45	Poster Session C: Paleopalynology Chairs: Masi A. & Pérez R.	Exhibition Hall UPF School of Management
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- 01p- *BRAIN – cooperative network and website.*
Mercuri A.M., BRAIN members.
- 02p- *MIS 31, a globally super interglacial? Insights from a new high-resolution pollen record from the southwestern European margin.*
Oliveira D., Sánchez-Goñi M.F., Naughton F., Polanco-Martínez J.M., Jimenez-Espejo F., Grimalt J.O., Martrat B., Voelker A.H.L., Trigo R., Hodell D., Abrantes F., Desprat S.
- 03p- *Palynology of the last interglacial complex in the western Balkans.*
Sinopoli G., Masi A., Sadori L.
- 04p- *Eemian palaeoenvironmental evolution in the northern plains of France from the alluvial sequence of Waziers.*
Gauthier A., Antoine P., Auguste P., Deschodt L., Hérisson D., Limondin-Lozouet N., Lochet J.L., Virmoux C.
- 05p- *Pollen data on the Lateglacial/early Holocene transition in coastal areas from NW Iberia: the Atlantic coast vs. Mediterranean nearby areas.*
García-Moreiras I., García-Gil S., Muñoz Sobrino C.
- 06p- *Distal palaeoecological impacts of the great Bronze Age eruption of Mount Vesuvius at Femmina Morta.*
Doorenbosch M., Field M.H.
- 07p- *Paleofire dynamics in central Spain during the late Holocene: The role of climatic and anthropogenic forcing.*
López-Sáez J.A., Vargas G., Ruiz-Fernández J., Blarquez O., Alba-Sánchez F., Oliva M., Pérez-Díaz S., Robles-López S., Abel-Schaad D.
- 08p- *Fire history in Komi and Karelia Republic during the Holocene.*
Barhoumi C., Peyron O., Joannin S., Ali A.A., Subetto D., Kryshen A.
- 09p- *Asynchronous changes in the Holocene forest evolution on both sides of the Gibraltar Strait (Iberian Peninsula-Morocco).*
Alba-Sánchez F., Abel-Schaad D., López-Sáez J.A., Sabariego-Ruiz S., Pérez-Díaz S., Vargas G.
- 10p- *Last 7,000 years BP coastal archives in southern Brittany, NW France.*
Fernane A., Vidal M., Penaud A., Allan E., Combourieu-Nebout N., Goubert E., Gandouin E., VanVliet-Lanoë B.
- 11p- *Resilience, vulnerability and conservation strategies of high-mountain pine forests from the Gredos Range (central Spain).*
López-Sáez J.A., Abel-Schaad D., Luelmo-Lautenschlaeger R., Robles-López S., Pérez-Díaz S., Alba-Sánchez F., Sánchez-Mata D., Gavilán R.G.
- 12p- *The story of a survivor. The evolution of Fagus sylvatica in the Western Pyrenean Region (Northern Iberia) through palaeoenvironmental data.*
Ruiz-Alonso M., Pérez-Díaz S., López-Sáez J.A.

- 13p- *Study of Guano from New Caledonia.*
Sémah A.M., Rollin J., Wirrmann D.
- 14p- *Olea pollen from modern olive groves and archaeological sites as index of cultural landscape development in central Mediterranean.*
Florenzano A., Rattighieri E., Rinaldi R., Mercuri A.M.
- 15p- *Pollen analysis of ovicaprine coprolites and palaeoenvironmental inferences on Holocene Sahara.*
Fornaciari R., Boscaini M., Rotunno R., Mercuri A.M., di Lernia S.
- 16p- *Environmental changes during the Final Neolithic and Early Bronze Age at Palaikastro (Eastern Crete).*
Cañellas-Boltà N., Riera-Mora S., Orengo H.A., Livarda A., Knappett C.
- 17p- *Vegetation and climate dynamics in SW Iberia during MIS 14 as inferred from the multi-proxy analysis of the IODP Site 1385 (Shackleton site).*
Morales-Molino C., Rodrigues T., Desprat S., Martín-García G.M., Sierro F.J., Hodell D.A., Sánchez-Goñi M.F.
- 18p- *Anthropogenic eutrophication overlapping natural climate variability over the last 150 years: palynological evidences (Bay of Brest, NW France).*
Lambert C., Penaud A., Vidal M., Klouch K., Grégoire G., Ehrhold A., Eynaud F., Schmidt S., Ragueneau O., Siano R.
- 19p- *New data on landscape of middle Oise valley during Subboreal: study of the organic sequence of Thourotte (Oise, France).*
Leroyer Ch., Coussot C., Barracand G., Hulin G., Jude F., Leduc C., Werthe E., Allenet de Ribemont G.
- 20p- *Anthropogenic impact and environmental changes from middle Mesolithic to late Neolithic in Normandy at Cairon (Western France).*
Lemer L., Gauthier A., Lespez L., Beauchamp A., Giligny F.
- 21p- *Last Millennium vegetation patterns in Rhodopi Mt (N. Greece).*
Kouli K., Kyrikou S., Athanassa I.

11.45- 13.15	Oral Session 11: Paleopalynology Chairs: Cheddadi R. & Riera S.	Auditori UPF School of Management
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- 01- *Regional expression of the MIS9e interglacial in southwestern Europe – The Iberian margin pollen record and model-data comparison.*
Desprat S., Yin Q., Sánchez-Goñi M.F.
- 02- *Evidence of Neolithic human settlements in the High Doubs Valley (France) revealed from multi-disciplinary palaeoenvironmental studies.*
Dietre B., Bichet V., Gauthier É., Richard H.
- 03- *Environmental evolution between Late Neolithic and Late Bronze Age in the NE Iberian Peninsula. Les Madrigueres a case study.*
Val-Peón C., Morales-Hidalgo J.I., Cebrià A., Expósito I., Albalat D., Gómez M., Burjachs F.
- 04- *The Archaeobiology, Palaeoenvironment and water regime of the Rec Comtal, the “artificial” watercourse of Barcelona.*
Riera S., Miró C., Orengo H., Fàbregas M., Santos M.A., Livarda A., Bros V., Veropoulidou R., Reed J., Picornell Ll., Banks P., Julià R.

05- *Unraveling the forcings controlling the magnitude and climate variability of the best orbital analogues for the present interglacial in SW Europe.*

Oliveira D., Desprat S., Yin Q., Naughton F., Trigo R., Rodrigues T., Abrantes F., Sánchez-Goñi M.F.

06- *Palynology of the Terramare, the Middle Bronze age of the Po Plain (SUCCESSO-TERRA project).*

Mercuri A.M., Florenzano A., Torri P., Mazzanti M., Clò E., Furia E., Zerboni A., Cremaschi M.

11.45- 13.15	Spanish Melissopalynology Workshop Chair: González-Porto A.V.	Anfiteatre UPF School of anagement
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13.15- 14.00	Closing Ceremony	Auditori UPF School of Management
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Abstracts

Plenary Lectures

Pollen developmental arrest and ecophysiological consequences.

Pacini E.

Natural biogenic particles in the atmosphere: current research frontiers and future needs.

Sofiev M., SILAM team, EAN data providers.

Jacques Louis de Beaulieu, from the pollen grain to the European Pollen Database, a career devoted to the community of palaeoecologists.

Guiot J., Djamali M., Andrieu-Ponel V.

Pollen developmental arrest and ecophysiological consequences

Pacini E. Retired aggregate professor at Dept. of Life Sciences, Siena University,
Italy pacini@unisi.it

A fluid fills the cavity in which pollen develops inside the anther and it conveys substances from the mother plant via the tapetum; such fluid and that of the anther wall cells disappear by evaporation and/or resorption, promoting anther and pollen dehydration prior to pollen presentation for dispersal. The overall fluid disappearance is necessary in order to allow anther opening and pollen presentation. Vacuolization always occurs during pollen development but the extensive translucent watery vacuoles, present in early stages, are absent when ripe pollen is shed, when only small vesicles with carbohydrates and/or lipids are present. Indeed, pollen volume increases during development but decreases, because of water loss, before anther opening and immediately after pollen exposure.

The programmed pollen dehydration reduces its metabolism and allows to avoid, under certain limits, some of the eventual damages caused by environmental conditions during presentation and dispersal. Just before and during desiccation some osmolites, as well as other molecules, are formed in order to reduce the harmful effects of the environment during those periods. Therefore, dehydration facilitates pollen dormancy, analogous to seed dormancy, which is a critical condition because of the pollen-anther-environment interaction; if dehydration is anticipated, delayed or incorrect there is usually a reduction of pollen viability or longevity. However, the degree of pollen dehydration is variable across species; it defines the pollen hydration status, which is its water content, and then determines the pollen metabolic state at dispersal and pollen resistance to the environmental conditions. Two main groups of pollen grains may be distinguished according to the hydration status at dispersal: those with low water content (less than 20%), named orthodox or desiccation-resistant (OR), and those with high water content (more than 20%), named recalcitrant or desiccation-sensitive (RC). Both have advantages and disadvantages, and they differ morphologically and physiologically. OR are typically oval in shape, with furrows, pores and other mechanisms that allow big volume variations due to changes in water content (dehydration upon dispersal, rehydration on the stigma). RC are generally spherical, without pores, or with only one or many, sometimes with a reduced or discontinuous exine and thick poral and interporal intine which function as a water reserve. OR pollen is usually dispersed in a dormant state and therefore it is more resistant to the environmental conditions and long-lived, while RC pollen metabolism is highly active during presentation and dispersal, because dehydration is minimal in this case, thus pollen is less resistant and with a short life span.

In conclusion, pollen developmental arrest is strongly related to water content changes in the anther and the pollen itself, and it defines the metabolic state of pollen upon dispersal. In turn, that state will determine pollen functioning and survival in the environment, and ultimately the pollination success.

Carrizo Garcia C, Nepi M, Pacini E, 2006. Structural aspects and ecophysiology of anther opening in *Allium triquetum*. *Ann Bot* 97: 521-527.

Firon N, Nepi M, Pacini E, 2012. Water status and associated processes mark critical stages in pollen development and functioning. *Ann of Bot.* 111: 1021-1058.

Footitt S, Cohn MA, 2001. Developmental arrest: from sea urchins to seeds. *Seed Sci Res* 11: 3-16.

Pacini E, Dolferus R, 2016. The trials and tribulations of the plant male gametophyte – Understanding reproductive stage stress tolerance. In: *Abiotic and biotic stress in plants – Recent advances and future perspectives*. PP: 703-754, INTECH.

Natural biogenic particles in the atmosphere: current research frontiers and future needs

Sofiev M.¹, SILAM team¹, EAN data providers^{**}

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Mikhail.Sofiev@fmi.fi

Sources of chemical and aerosol pollutants in the atmosphere vary widely and can be classified depending relation to anthropogenic activity, primary emission regions, governing processes controlling the emission, etc. Natural biogenic particles are among the new areas in the atmospheric composition studies – but are well-known for their allergenic and biological roles. The main attention this-far was put to short-term pollen forecasting, whether local or regional, with several forecasts existing in Europe, America, and Asia.

There is an established consensus that pollen in the atmosphere is a regional-to-large-scale phenomenon and local scale is not sufficient for adequate description of the governing processes. Therefore, the modern forecasting systems are mostly based on regional approaches with a multi-factor multi-threshold flowering concept being slowly developed and accepted.

Long-term assessments are not numerous, with multi-decade regional studies only being built. The key challenges on the way towards the complex picture are: (i) highly varying flowering intensity, which model is yet to be built, (ii) severe problems with pollen data assimilation where the classical methods turned out inadequate, (iii) difficulties with the past-time mapping of the plant habitation and many others. Overcoming these difficulties is in the work plans of several on-going projects.

Among other challenges of a more generic matter, one can mention the next-step in the pollen observation and modelling technology: consideration of the allergen potential of the particles and a possibility of the allergen release by the pollen grains while in the air, with subsequent independent transport. The other frontier is the personalization of the pollen impact on sensitive individuals and mechanistic description of the interaction of pollen and chemical / aerosol pollutants in the atmosphere. Finally, the on-going climate change poses tough problems related to invasive species, habitation adjustments, plant adaptation and related changes in the model performance. Addressing these challenges forms the mid-term agenda of the pollen related research.

^{**} EAN (European Aeroallergen Network) data providers are from the national pollen monitoring stations of Croatia, Greece, France, Italy (A.I.A.-R.I.M.A.®), Spain (REA: Aerocam, AeroUEX, RAA, UO, UC and Cantabria Health Council, REDAEROCAM, Health Castilla-Leon Council, RACyL, XAC, RIAG, PalinoCAM, UPCT, Basque Government / Public Health Directory), Hungary, Israel, and Turkey.

Jacques Louis de Beaulieu, from the pollen grain to the European Pollen Database, a career devoted to the community of palaeoecologists

Guiot J., Djamali M., Andrieu-Ponel V.

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2017 is the 50-year anniversary of the I'APLF. 2017 is the year in which three European associations from Mediterranean countries will meet for the first time to stimulate scientific exchanges on our favourite microorganisms that are pollen, spores, dinokystes, acritarches, charcoals, NPP ... What better year than 2017, the 50th anniversary of the APLF, to pay a tribute to Jacques-Louis de Beaulieu.

Jacques-Louis de Beaulieu is an internationally well-known scientist who has marked our discipline and has intensively worked on sedimentary sequences from the three Mediterranean regions we come from.

To honour and recall his invaluable input, Joël Guiot, in collaboration with Morteza Djamali and Valérie Andrieu-Ponel, will give a plenary lecture at MedPalyno 2017. In this lecture Joël and collaborators will summarize the research conducted by Jacques-Louis, highlight his major contributions to Palynology and recall the perspectives he has opened during his long and fruitful career.

I wish to thank, also on the behalf of all of you, Joel, Morteza and Valérie for accepting our invitation to honour Jacques-Louis.

I am sure that their talk will stand up a benchmark in the history of our society that colleagues will recall with pleasure and proudness in years to come and, why not, at the conference that our society will organize in 2067, to celebrate the centenary of its creation!

Abstracts

Monday, 4th September

Session 1: Aerobiology

Session 2: Pollen Morphology, Biology and Biochemistry

Poster Session A: Aerobiology

Allergy potency for the main urban plants

Thibaudon M., Sindt C., Oliver G., Monnier S.

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Anemophilous species transport pollen by wind; they produce many pollen grains, so that the fertilization of female flowers has a greater chance of being effective. The majority of allergenic species are anemophilous.

Airborne pollen has a natural origin (background pollution) where climate change can change the composition of air or an anthropogenic origin (pollution of proximity) linked to pollution and vegetation in the city.

Pollen allergy depends on several parameters, such as the pollen concentration in the air, the sensitivity of people and the allergy potency of the pollen of each plant species.

The Scientific Council of RNSA was asked to update the allergy potency (AP) of plant species that can be established in urban areas.

To update the allergy potency of plant species, the RNSA used scientific work on the subject, and also the opinions of allergists and botanists.

The allergy potency of a plant species is the ability of its pollen to cause an allergy to a significant part of the population.

The allergenic potential (AP) can be:

Low or negligible: No problem to plant them in urban garden

Moderate: Only a few species can be planted in the same garden

High: This species cannot be planted in urban places.

Species or genus with a strong AP should be labeled as "Not to be planted in habitation or residence area ", those with moderate AP should be labeled as "Not to be planted in big quantities in habitation or residence area". Other species with low or negligible AP may not be affected by public information.

Relations between urban vegetation and airborne pollen at a local scale

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Aerobiological data for urban environments usually derive from one volumetric trap located centrally, at a high spot. However, people are most active at a much lower level. In addition, large differences may exist regarding vegetation from place to place, which may result into large differences of the atmospheric environment with respect to biological-particle concentrations in the different parts of the city. To examine how vegetation influences airborne pollen locally, we focused this study on the woody species that contribute pollen to the air. We recorded their abundance as well as pollen concentration of the taxa that they represent at low level, at six sampling stations in the city of Thessaloniki, Greece.

A portable volumetric air sampler was used to record airborne pollen during a period of two years at the six stations. Each sampling day, records were taken for a specified time, while in motion, within a 4 ha area (core zone). All individuals of the woody species contributing pollen to the air of the city and present in the stations were counted, separately in the core and in another four concentric zones at a distance of 50, 100, 150 and 200 m from each side of the core zone. Principal component analysis, correlation, autocorrelation (Mantel test) and similarity analyses (Bray-Curtis and Jaccard coefficients) were applied on our data to check for differences between the sampling stations with respect to pollen and vegetation. A Generalized Linear Model (GLM) was used to investigate if the vegetation composition of other stations affects the pollen spectrum of a focus station. We also used GLM to model the concentration of each pollen taxon as a function of the abundance of the woody species corresponding to that taxon, as measured at the stations' zones.

A number of taxa present in the pollen spectrum were not found in the vegetation of the six stations. The most abundantly represented taxa in both the pollen spectrum and the vegetation are Cupressaceae, Pinaceae and Platanus; they are also the ones differentiating the stations from each other. Pollen composition correlates with vegetation composition and there is no spatial autocorrelation of these two parameters. Airborne pollen is determined by the vegetation composition of the focus station and of the one nearest to it, at an average distance of 2.1 km. We found significant relationships between pollen and vegetation for the five most abundantly represented taxa in the pollen spectrum of the city. On the basis of the respective equations, we estimate that every additional individual of Cupressaceae, Pinaceae, Platanus, Ulmus, and Olea increases pollen in the air by approximately 0.7%, 0.2%, 2%, 6% and 5%, respectively.

Using the respective equations, we can make all sorts of calculations related with the above five taxa and predict changes in pollen from vegetation and vice versa. This quantification of the relationship between vegetation and airborne pollen allows us to make better forecasts, evaluate with precision impacts of vegetation on the residents of an area, especially in the urban and peri-urban environment, and provide insight on the type and magnitude of changes to be expected once pollen or vegetation changes are recorded. How these five taxa would perform under different environmental conditions and with differing species assemblages corresponding to the same pollen taxon is an issue to be explored.

Case Study France: Analysis of plants in public green spaces

Thibaudon M., Monnier S.

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RNSA is part of an AIS (Aerobiological Information Systems and allergic respiratory disease management) Life project (2014-2017) N° AIS LIFE LIFE13 ENV/IT/001107. The project's aim is to develop an information base for policy on environment and health, in terms of improved management of pollen-related allergic respiratory diseases in Europe. Within this project, a case study has been implemented in France in order to provide recommendations for plant use in public green areas. The specific objectives of this case-study are to assess pollen counts and allergen content in public gardens and on the basis of the obtained results to formulate recommendations in order to protect allergy sufferers.

Two types of pollen traps were used in this study: Hirst pollen trap and Sigma 2 like passive pollen trap (SLT). The SLT pollen traps were used for the analysis of local pollen dispersion. For the study, 7 SLT have been set up in two towns of France (Paris and Lyon) and 4 Hirst pollen traps (2 in Lyon and 2 in Paris) during the pollen season. The SLT traps were positioned at about 70 cm aboveground, in close proximity to public gardens. Every day, the slide containing biological particles was changed and sent to the laboratory to be analyzed by optical microscopy. All analyses were undertaken by RNSA in France. The first sampling period was in 2015 (March-June) and the second in 2016 (March-June). Statistical descriptive analysis was conducted to obtain the distribution of pollen grains in the gardens of the two cities, after the two sampling methods.

The results showed that there are many allergenic species in the gardens of Paris and Lyon, such as Cupressaceae, birch, plane tree, grasses, etc. This extensive use of allergenic species indicates that those responsible for the urban vegetation should be informed on the health impacts of some plants and on the species that should be avoided. In the frame of this project, information on the allergy potency of many species was compiled and made available to the public (see Table in <http://www.vegetation-en-ville.org/que-faire/le-potentiel-allergisant/>). Similarly, a guide with information on pollen and its allergenicity advising which plant species to avoid and which to plant in the green areas and parks of France was also produced (<http://www.vegetation-en-ville.org/wp-content/themes/vegetationenville/PDF/Guide-Vegetation.pdf?v=2017.03.09-17.54.48>).

Green areas of France contain many allergenic species indicating that health issues have not been taken into consideration so far, when choosing the species to be planted. This should be repaired. To enable those responsible for the urban green in France make proper choices, information is now available to everybody on the allergy potency of many plant species and a guide is produced with recommendations on which plants to avoid or prefer.

Automatic system for simultaneous and real-time monitoring of pollen and air pollutants

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According to the World Health Organization, exposure to outdoor air pollution is linked to roughly three million deaths a year. Air pollution is also known for contributing to the increasing prevalence of pollen allergy by influencing plants, pollen, and human respiratory tract and immune system. Therefore, it is particularly important to make available information on all species present in the air and affecting human health. Technological innovation makes the simultaneous detection of both pollen and air pollutants possible.

We present the first results of a project run in 2017 in Switzerland for the first simultaneous measurements of air pollutants such as fine particles, and automatic counting of pollen taxa. Three Plair Rapid-E instruments were used for this purpose. The instruments were deployed in Cadenazzo (Ticino), Payerne (Vaud) and Passeiry (Geneva) during five months. All were run in parallel with Hirst-type traps, used as reference for pollen counting, and certified optical counters (Fidas-200 from Palas GmbH and EDM #180 from GRIMM Aerosol Technik GmbH & Co) and filter samplers (DIGITEL Aerosol Sampler DHA-80) for pollution monitoring.

To obtain pollen taxa discrimination, one of the Rapid-E instruments was calibrated with 15 pollen taxa: *Alopecurus*, *Ambrosia*, *Betula*, *Corylus*, *Carpinus*, *Cupressus*, *Dactylis*, *Fraxinus*, *Pinus*, *Plantago*, *Platanus*, *Anthoxanthum*, *Quercus*, *Rumex*, *Ulmus*. Using state-of-the-art machine learning algorithms, we were able to classify all of the pollen taxa with a recall and precision higher than 80%. The comparison between measurements obtained with standard Hirst-type traps and Plair instruments shows a Pearson correlation of 95% for the total pollen count over the five months period.

The measured data of fine particles (2.5 to 10 µm) was compared between Rapid-E instruments and certified optical counters. The time series showed correlation superior to 85% to the reference.

The project was supported by the Swiss Federal Office for the Environment (Project number UTF 528.04.16) in collaboration with the Federal Office of Meteorology and Climatology MeteoSwiss and the Department of Environment, Transport and Agriculture of the Republic and Canton of Geneva.

A first assessment of aerobiological air quality in rooftop greenhouses

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Building-integrated rooftop greenhouse (i-RTG) agriculture has intensified in recent years, due to the growing interest in the development of new agricultural spaces and in the promotion of food self-sufficiency in urban areas. This is a first assessment of the indoor dynamics of pollen and fungal spores in a tomato i-RTG near Barcelona, with the aim of evaluating the greenhouse workers' exposure in order to prevent allergy problems associated with occupational tasks and to evaluate whether the quality of the hot air accumulated in the i-RTG is adequate for recirculation to heat the building.

Daily airborne pollen and fungal spore concentrations were measured simultaneously in the indoor and outdoor environments from the 10th of April 2016 to the 28th of July 2016, following the standard methods of the Spanish Aerobiology Network (Red Española de Aerobiología, REA, Galán et al. 2007).

In the i-RTG, a total of 4924 pollen grains/m³ with a daily peak of 334 pollen grains/m³ and corresponding to 33 pollen taxa together with a total of 295038 fungal/m³ spores reaching a maximum daily concentration of 26185 spores/m³ and corresponding to 29 spore taxa were observed. Regarding outdoor, the index of pollen grains registered was 17132 pollen grains/m³, the peak corresponded to 932 pollen grains/m³ and they were from 45 taxa and the fungal spore index accounted for 606,642 spores/m³, with a daily peak of 28,000 spores/m³ and 31 taxa

Following the criterion that more than 10 particles/m³ should be present indoors to study the indoor-outdoor relationship, 17 pollen taxa (*Acer*, *Alnus*, Cupressaceae, *Fraxinus*, *Morus*, *Pinus*, *Platanus*, *Populus*, *Quercus* deciduous type, *Quercus* evergreen type, *Salix*, *Ulmus*, *Coriaria*, *Corylus*, *Mercurialis*, Urticaceae and Solanaceae) and 26 fungal taxa (*Agaricus*, *Agrocybe*, *Alternaria*, *Arthrimum*, *Aspergillus/Penicillium*, *Chaetomium*, *Cladosporium*, Coprinaceae, *Drechslera/Helminthosporium*, *Epicoccum*, *Ganoderma*, *Leptosphaeria*, Myxomycota, *Oidium*, *Pithomyces*, *Pleospora*, *Polythrincium*, *Stemphyllium*, Thelephoraceae, *Torula*, *Ustilago*, Xylariaceae, other ascospores (unicellular, bicellular, pluricellular) and other basidiospores) were selected.

The most important source of pollen grains and fungal spores observed indoors was, in general, the outdoor environment. However, Solanaceae pollen and several fungal spore taxa, such as the allergenic *Aspergillus/Penicillium*, largely originated inside the greenhouse or were able to colonize the indoor environment due to more favorable growing conditions than outside.

It is possible to recirculate the air of the i-RTG to the building without posing allergy health risks for the building users if the biological air quality is monitored and the corresponding preventive measures are taken, implementing an appropriate air filter system that guarantees good air quality in the building spaces (Ercilla-Montserrat, Izquierdo et al. 2017).

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Aerobiological studies in Qatar and Sharjah: toward establishment of a network for pollen analysis and allergenicity

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Understanding pollen emission and its dynamics in the atmosphere is fundamental for the characterization of potential allergens that may be of great health relevance in both natural and inhabited areas. Aerobiological studies that assess airborne pollen and spore concentrations as well as seasonality are very common in many countries. However, few studies have been conducted in the Arab Gulf region and none in Qatar or the UAE.

Currently a project has been funded to establish a palynothèque (pollen bank), illustrated atlas and pollen calendar in Qatar and Sharjah, UAE. The project is assessing the pollen and spore contents in the atmosphere in two cities of Qatar (Doha and Al-Khor) and in Sharjah for a period of 3 years. This is important to establish seasonal and intradiurnal behaviours for pollen grains. The samplings will be carried out using Hirst type volumetric pollen traps (Hirst, 1952), situated on the roofs of buildings at Hamad Medical City (Doha), Al-Khor hospital and the University of Sharjah. The samples will be mounted and counted according to the methodology proposed by the Spanish Aerobiology Network, the REA (Galán et al., 2007).

1. To elaborate a preliminary pollen calendar for the different sampling stations.
2. Preparation of an illustrated Atlas with the most common pollen types in the atmosphere of Qatar and Sharjah Emirate, which will be the first airborne pollen atlas for the whole Arabian Peninsula.
3. To search for correlations between aeroallergen concentrations and the main meteorological parameters as well as the incidence of asthma and allergic rhinitis on local population.

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Comparative study of airborne pollen content from northern to southern Tunisia

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Aerobiology is a multidisciplinary science dealing with biological particles in the atmosphere generated by natural activities. Airborne pollen is now the main studied biological structure which is used as a reliable tool to study plant phenology, plant distribution, vegetation situation and potential crop production. Analysis of a long pollen data set provides also a future image of the climatic conditions and the reaction of species to the eventual changes. The main aims of this work is to determine the distribution of the different spring flowering species from the north to the south of Tunisia and to establish the pollen spectrum of three regions: Mornag (North), MenzelM'hiri (Centre) and Chaal (South) in 2016.

Airborne pollen data were collected using three volumetric Hirst-type spore traps placed in Mornag (36°39N; 10°16E), MenzelM'hiri (35°38N; 10°41E) and Chaal (34°34N; 10°19E) during the olive flowering season from 1st of march to 20th of May .The highest pollen index was recorded in the centre (MenzelM'hiri) corresponding to 25 different pollen types while 31 taxa were identified in the north (Mornag) and the pollen index was about 6348.03. The lowest pollen index (924.62) was recorded in the south (Chaal) and 21 pollen types were distinguished with a dominance of herbaceous species in the different studied sites presenting 48, 40 and 47 % of the identified vegetation respectively in Mornag, MenzelM'hiri and Chaal. The main common taxa were *Olea europaea*, *Cupressaceae*, *Poaceae*, *Chenopodiaceae* and *Urticaceae*. Individual pollen index showed a sharp heterogeneity among the taxa in the same region on the one hand and among the study sites on the other hand, thus they were regrouped according to their contribution to the pollen index of each site. Daily airborne pollen concentrations were shown in the pollen spectrum.

This aerobiological study showed a wide distribution of some species from the north to the south with comparable airborne pollen levels such as *Olea europaea*, *Cupressaceae*, *Poaceae*, *Chenopodiaceae* and *Urticaceae*. A dominance of herbaceous species was also noted additionally to a higher number of identified pollen types in the north. The analysis of the pollen spectrum showed important variations in the pollen concentrations of the different taxa.

Preliminary study of the airborne pollen in the atmosphere of Puerto Ayora (Galapagos Islands, Ecuador)

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Galapagos is an archipelago of volcanic islands located 972 km west from the continental Ecuador. They were declared by the UNESCO as a World Heritage Site and Biosphere Reserve due to their singular environmental value, where a third part of the native plants are endemic to this archipelago (Jaramillo *et al.*, 2011). In spite of the numerous scientific studies carried out in Galapagos, there are not any aerobiological samplings being performed currently. The main objectives of this study were to install a pollen trap for detecting the presence of pollen in the atmosphere of Puerto Ayora (Santa Cruz, Galapagos Islands) and qualitatively identify the different pollen types detected during the studied period.

A Durham (1946) gravimetric pollen trap was modified to turn it into a passive impact pollen trap based on Pla Dalmau (1957) modifications. It was placed on the roof of the Galapagos National School (Puerto Ayora, Santa Cruz Island) at a height of 15m above ground level. The samples were obtained by using silicone fluid as adhesive substance and glycerine gelatine as mounting mean. The pollen grains were counted in a surface of 14 x 48 mm in each sample. The pollen types were identified with the aid of the pollen guide of the Galapagos Island by Jaramillo & Trigo (2011) and the Charles Darwin Foundation pollen bank.

Pollen types of endemic plants such as *Darwiniothamnus* sp., *Passiflora foetida* var. *galapagensis* Killip, *Justicia galapagana* Lindau and *Castela galapageia* Hook. f. were detected together with those of other native and introduced species.

A high diversity of pollen types was detected, reflecting the particular vegetation of the island. This preliminary aerobiological information can be used as precedent for further studies on the pollination of native and introduced species of the Galapagos Islands, as well as for detecting possible allergic diseases in the population.

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Effects of air pollution exposure on allergenic power of Cypress pollen

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Air pollution is considered as one of the main causes of the increased incidence of respiratory diseases, including allergies, in industrialized countries. The present work, attended to analyze the effect of air pollutants on the allergenic power of cypress pollen, the main cause of winter allergy in the Mediterranean area, evaluating the protein profile of the pollen and the IgE-mediated reactivity in sensitized patients. The study was conducted in four areas in Umbria (Central Italy), characterized by different levels of air pollution.

The pollens from two species of *Cupressus* genus (*C. arizonica* and *C. sempervirens*) was collected in four sites, subjected to constant environmental monitoring. The pollen proteins were extracted and quantified according to the Bradford protocol. The specific IgE were quantified by ImmunoCAP test on a population of 100 patients allergic to cypress pollen and living in Umbria. Western blotting assay was followed using protein extracts of pollen grains from the four studied sites.

The present study has shown: a). in both species, a difference in IgE-binding capability among the pollens from different locations has been detected; b) a different number of allergenic proteins have been identified, between the two species of cypress as well as among the pollens from the different locations.

The effects of air pollution on cypress pollen may be the cause of an increase in the allergen contents as well as in Ig-E binding capability, intensifying clinical symptoms in the population living in urban areas.

Ultrastructural changes in the pollen grain wall of the Berberidaceae family

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The Berberidaceae family belongs to the order Ranunculales, the eudicot basal group. It is a family where there has been great controversy in clarifying the phylogenetic relationships of their genera. Today it is considered to be constituted by three sub-families Podophylloideae, Berberidoideae and Nandinoideae. The pollen of this family is generally tectate-columellate in structure, but this not found in *Berberis* and *Mahonia*. However, ultrastructural studies with non-acetolized pollen had not yet been performed. In this paper we show the ultrastructural characteristics of the pollen wall of Berberidaceae and interpret them from an evolutionary point of view in light of the molecular phylogenies of the family.

For this study we have used 17 species belonging to 10 genera of the three sub-families of Berberidaceae and as out groups we have used *Euptelea pleiosperma* (Eupteleaceae), *Hypecoum imberbe* (Papaveraceae), and *Helleborus foetidus* (Ranunculaceae). For TEM, flower buds were fixed with 3% Glutaraldehyde and 1% osmium tetroxide and dehydrated and included in Epon resin. The samples for SEM were acetolized, the critical point was reached and they were metalized before observation.

In the external groups and in the sub-families of Berberidaceae the wall of the pollen grains has layers with different thicknesses and with the characteristic ultrastructure of angiosperms, except in the sub-family Berberidoideae with the ectexine undifferentiated layer which is considered an apomorphy. In relation to the number of apertures the most common pollen type is the tricolpate pollen, but the spiriliaperturate and simpantocolpate types also appear. The latter two are considered as derived types. Regarding the ornamentation of the tectum, in the out groups *Euptelea* and *Hypecoum* the ornamentation is micro-reticulate and micro-equinate-perforate, respectively. In Podophylloideae the striate-reticulate structure predominates and is reticulate in *Bongardia chrysogonum*, changing to microreticulate-spinulate in *Podophyllum*. This last type also appears in the representative of the family Ranunculaceae. In Nandinoideae it is micro-reticulate and reticulate, it changes in Berberidoideae to psilate-perforate. The presence of orbiculs is a plesiomorphic character to Berberidaceae, but the morphology of these orbiculs varies through the different lineages of the family. We discuss the usefulness of the pollen wall ultrastructure to support the phylogenetic relationships between the different genera and close families of Ranunculales.

The type of pollen triaperturate, microreticulate and with the structured exine is considered plesiomorphic. 2. There is a tendency for a reduction in the size of the layers of infratectum and endexine.3. The morphology of the orbiculs changes from translucent to opaque core or non-core. 4. The sub-family Berberoideae presents the most apomorphic characters.

Comparative study of the pollen wall in Ranunculales families

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This research is part of a larger study on the ontogeny of pollen at the ultra-structural level in the Ranunculales order that is located between the basal clades of the eudicot. As the first objective we focused on comparing the ultrastructure of the different layers of the mature pollen wall. We compared the observations of the interapertural regions of the most representative genera of the 7 families that make up this order. We established whenever possible a wall model for each family and in families where this had not been established 2 or more models. The final objective of the work is to establish the importance of the ultrastructural characteristics of the pollen wall that supports the phylogenetic relationships between the 7 families and between the genera studied in each family.

We have studied nearly 50 genera of the 7 families of the order Ranunculales by transmission electron microscopy (TEM). The floral buds containing mature pollen were collected at 3% glutaraldehyde, buffered with 0.025 M sodium cacodylate and post-fixed in OsO₄ in the same buffer. The samples were always collected from live material from different European botanical gardens.

The main difference observed in the wall is at the ectexin level. From solidectexines with a thick tectum and short columelles as found in the genus *Ranunculusto* the absent infratectum as found in *Berberis*. We also found discontinuous tectum and very spaced columns, for example in *Cocculus*. In the basal layer of ectexine we also found a great difference from the practically non-existent as in *Stephania* to continuous as in *Nandina*. This layer appears lamellated in the representatives of the Fumaroideae family, with the non-lamellar base being the most widespread character. The endexine shows differences between the taxa of each family, and there were cases with continuous and discontinuous endexine, or absent as in *Sarcocapnos*. Although the thickness of the intine is variable in all the taxa we did not observe any differentiation in sub-layers.

The Papaveraceae and Berberidaceae families are the ones that present the two most remarkable models of wall structure. The rest of the families can be grouped into a single model.

Beekeeping and agro-environmental benefits of some cultivated species of family brassicaceae

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Plants belonging to Family Brassicaceae have taken a leading role in agriculture because of the beneficial qualities they present in many areas from the environmental and economic point of view, as occurs in the beekeeping and agricultural sectors. In the beekeeping sector, the great importance of some of these Brassicas is recognized, since they are attractive for the bee and serve as food at times of low availability of food in the environment. Also important is the nutritive value of its pollen as both, a source of protein for humans and for the bee. For the agricultural sector, they are crops that provide food throughout the year, with winter and summer crops. Among them, we find a great diversity of resources that they provide, such as horticultural species (cauliflower, broccoli, mustards, radish, etc.), species for the oil industry (such as rapeseed and mustard), species useful as green manure and biofumigants which reduces edaphic pests and the use of agrochemicals, at the same time.

To assess the importance of cultivated plants of the Family Brassicaceae in comparison with the contribution that supposes the wild ones of the same Family.

In order to assess the importance in bee nutrition of these plants, pollen balls from beehives located nearby crops of these Families was collected. The diversity of visited plants and the attraction they represent was evaluated through the proportion of pollen types present in each sampling. The representation in the harvested bee pollen and the total content of polyphenols and proteins they provide, compared to other wild plants of the same family, have been analyzed.

In this first trial, the values obtained for the total polyphenol content did not represent a significant difference between the different natures of cruciferous plants that arrived to the hive. However, the total protein content does show a significant difference, with an average of 21.77 grams of protein per 100 gr of pollen from wild plants of the family, while this value is between 27.27 and 28.76 gr per 100 gr of mustard or rapeseed pollen, respectively.

It is clear the benefits that wild plants presence confers to the bee pollen composition, but in certain cases, crops can be a pollen source for bees as good as the wild species provide. This aspect is very positive since the presence of a food source for bees could be present longer when combining the presence of wild and cultivated species. For that reason, it is necessary the characterization and knowledge of the botanic profile of the bee hives surroundings and locations in order to plan and combine blossoming of crops and wild species, to ensure the presence of food for pollinators.

The results obtained reinforce the importance of wild plants in the crop surroundings and how important is to keep as much as possible their presence. This contribute to maintain pollinators presences, such as honey bees, and also to increase the quality of hive products such as bee pollen.

Auxin progressively decreases during pollen development while its biosynthesis and transport are induced and required for microspore reprogramming to embryogenesis in *Brassica napus* and *Hordeum vulgare*

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During *in vivo* anther development, after meiosis, microspores develop and follow the gametophytic pathway to produce pollen grains. *In vitro*, isolated microspores can be reprogrammed by stress, become totipotent cells, follow embryogenesis and produce doubled-haploid embryos and plants. The involvement of the major phytohormone auxin in these two microspore developmental pathways is very limited.

We analyzed auxin concentration and cellular accumulation, expression of auxin biosynthesis gene *TAA1* and auxin efflux carrier gene *PINI-like* during the two microspore pathways, in *Brassica napus* and *Hordeum vulgare*. Effects of inhibitors of auxin biosynthesis (Kynurenin), auxin transport (NPA, N-1-naphthylphthalamic acid) and auxin action (PCIB, α -(p-Chlorophenoxy) isobutyric acid) in microspore embryogenesis were also analyzed.

During gametophytic development auxin levels, *TAA1* and *PINI-like* expression were high at early microspore development, in tetrads and tapetum, and they progressively decreased during gametogenesis in both pollen and tapetum cells. In contrast, after induction by stress of microspore reprogramming, totipotency and embryogenesis initiation *TAA1* gene was up-regulated, auxin concentration increased and accumulated in cells, from the first embryogenic divisions. Kynurenin decreased microspore embryogenesis efficiency, indicating that *de novo* auxin biosynthesis was required in this microspore pathway. *PINI-like* gene expression was also induced with microspore embryogenesis. NPA and PCIB inhibitors impaired embryogenesis initiation and development. These results indicated that polar auxin transport and auxin action were required for microspore embryo progression.

Findings showed opposite auxin dynamics along the two microspore pathways with different fates. Endogenous auxin biosynthesis, action and polar transport are required for microspore embryogenesis initiation and progression while auxin progressively diminishes during gametophytic development, in the two plant species, the monocotyledonous *Hordeum vulgare* and the dicotyledonous *Brassica napus*, suggesting.

Programmed cell death of tapetum involves the activation of autophagy, and metacaspase and cathepsin proteases

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During microsporogenesis and microgametogenesis, the innermost cell layer of the anther, tapetum, has an important nutritive function and a critical role during pollen development, being involved in the biosynthesis and secretion of pollen wall components. Developmental program of tapetum culminates in programmed cell death (PCD) whose alterations in most cases lead to male sterility. Autophagy is a degradation pathway that recycles cell materials upon stress conditions or during specific developmental processes. Together with a survival role, autophagy is also involved in developmental and stress-induced PCD. In both processes, autophagy and PCD, several proteases play key roles.

We have studied the activation of autophagy in tapetal PCD in *Brassica napus* using a multidisciplinary approach that involved protease activity assays (for metacaspases, cathepsins and enzymes with caspase 3-like activity), gene expression analysis and protein localization by immunofluorescence and immunogold labeling of Atg5, Atg8 and cathepsins, as well as ultrastructural analysis.

During early tapetal PCD, *ATG5* and *ATG8* autophagy-related genes were up-regulated, *ATG5* and *ATG8* proteins localized to autophagosome-like structures and vacuoles. Metacaspase activity was significantly enhanced at early PCD. Electron microscopy analysis revealed formation of autophagosomes and vacuoles. Cathepsin L, B, H and caspase 3-like enzymatic activities were likewise correlated with PCD.

Taken together, these results indicate that autophagy, metacaspases and cathepsins are activated during tapetal PCD and might be important for initiation of this developmental cell death process.

AGPs as markers for *Quercus suber* phragmoplast assembly during pollen meiosis

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Quercus suber L., cork oak, is an evergreen tree native to the Mediterranean basin region, its main population located in the Iberian Peninsula mostly stretching from the Estremadura regions in Spain to the Ribatejo and Alentejo regions of Portugal. Arabinogalactan proteins (AGPs) are highly glycosylated hydroxyproline rich cell membrane bound proteins, usually presenting a GPI-anchor and a secretion signal peptide. AGPs have been for long associated with several aspects of plant development including cell proliferation and survival, pattern formation, reproduction and growth, and plant microbe interaction [1]. Previous studies on the gametophytic development of *Quercus suber* have shown an intimate connection between AGPs and gametophytic cells differentiation [2, 3]. In *Quercus suber* microsporogenesis AGP epitopes recognized by JIM13 and JIM8 (John Innes Monoclonal Antibodies) were found to specifically and strongly label cells of the gametophyte germ line [3]. The labelling was restricted to the cell membrane and cell walls on all stages of the pollen development. AGPs disruption, in both *Arabidopsis thaliana* and *Nicotiana tabacum*, has shown to upset the cortical microtubular organization [4]. Zygote and proembryo cells of *N. tabacum* *in vitro* culture subjected to β -glucosyl Yariv (β GlcY) reagent, an exogenous AGPs inhibitor, showed an increase in the frequency of aberrant division related to reduction of AGPs and other cell wall components together with alteration on the endosomes distribution patterning on the cell plate [5]. AGPs were shown to integrate the formation of the newly formed cell plate during microsporogenesis, being detected after the convoluted sheets stage in *A. thaliana*, suggesting that AGPs may play a determinant role in the cell division patterning by affecting the cell plate localization and formation [6].

Anthers from *Quercus suber* in several stages of development were harvested and prepared for AGPs and pectin immunolocalization fixed as described Costa *et al.*, 2015 [3]. Immunolocalization studies were performed on anthers through the stages of pre-meiosis to microspores.

The results showed that during the short period encompassed between meiosis initiation and tetrad formation, AGP epitopes recognized by both JIM13 and JIM8 could be found labelling the cytoplasm and compacted grouped vesicular structures, as well as newly formed cell walls. This finding may be one more link connecting AGPs to cell division and microspore differentiation.

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Caleosins are essential for pollen performance during the progamic phase

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Caleosins are proteins with multiple roles in plant physiology, including storage lipid mobilization during seed germination, defense responses to abiotic stresses, protection against fungal pathogens, gibberellin-dependent floral transition, and abscisic acid sensitivity [1-3]. However, the physiological relevance of caleosins in plant reproduction remains unknown. Here, we investigated the function of two distinct caleosins located on intracellular lipid bodies of lily pollen and in the tapetum-derived coat of *Arabidopsis* pollen, respectively.

We produced recombinant caleosins to examine their molecular functions. Moreover, microinjection and controlled pollination experiments using two specific anti-caleosin Abs were carried out in order to determine their physiological significance.

Our data showed that: 1) there was neither net transcription of both caleosin genes nor net transduction of the corresponding proteins during pollen germination, 2) both recombinant proteins were able to bind Ca²⁺ ions, as well as to form homodimers through disulfide bridges, 3) pollen caleosins, either alone or on reconstituted artificial lipid bodies, catalyzed co-oxidation of aniline, a reaction that is typically fulfilled by peroxygenase enzymes, 4) disruption of caleosin function in the pollen tube caused alterations in lipid body dynamics, cytoplasmic streaming cessation and the loss of the clear zone, all this leading to permanent apical growth arrest, and 5) the blockage of the pollen coat-associated caleosin activity led to the loss of pollen adherence to the stigmatic surface.

Overall, our data suggest that caleosins are key proteins for pollen performance and, consequently, they are critical for the success of fertilization. These enzymes likely perform their functions through the synthesis of unique oxylipin compounds in the pollen grain.

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Antioxidant activity and allergen expression of *Corylus avellana* L. pollen from Slovakia and Ukraine

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Corylus species are widely distributed throughout temperate regions of the Northern Hemisphere. The European hazelnut, *Corylus avellana* L., is the species of commerce and is genetically diverse. *C. avellana* is an anemophilous plant with highly allergenic pollen. At the atmosphere, pollen mixes with different kind of pollutants. Pollution may prolong the plants pollination period and also may change pollen grain antigenic structure. It also may include morphological changes in the pollen grain and increase the amount of allergenic proteins. The aim of this study was to determine the *in vitro* antioxidant activity of hazelnut pollen and determine relative quantity of hazelnut allergens: Cor a 1 and profilin in samples from different areas of Ukraine and Slovakia by PCR in real time.

We prepared pollen extracts: 0.5 g of pollen and 12.5 ml of distilled water, methanol and ethanol. The solutions were stirred on a shaker for 24 hours. The total antioxidant activity was determined by the DPPH method. Total RNA from all analysed pollen samples was extracted using the GeneJET Plant RNA Purification Mini Kit. Reverse transcription was performed with the RevertAid™ First Strand cDNA Synthesis Kit (ThermoScientific, Slovak Republic) using 40 ng of total RNA extracted from pollen. Primers for real-time PCR were developed on the basis of the mRNA sequences Cor a 1 and profilin genes. Conserved parts of Cor a 1 mRNA accessions from the National Centre of Biotechnology Information database and conserved parts of profilin mRNA accessions were used for primer designing. All reactions were performed in a Biorad (Slovak Republic) CFX96 machine. Real-time PCR reactions were performed in the volume of 25 µl containing 2xSensiMix™ SYBR No-ROX Master mix (ThermoScientific), 0.25 mM of each primer and 135 ng of transcribed cDNA. The temperature and time conditions were as follows: initial denaturation step at 95°C for 10 min, 40 cycles at 95°C for 15 s, 58°C for 15 s and 72°C for 15 s.

The antioxidant activity of hazelnut pollen extracts was determined in the range from 75.59% for distilled water, 82.09% to 82.92% for methanol, and 39.08% to 57.86% for ethanol. The average expression for Cor a 1 was 0.84 times for profilin and the results were very variable depending on the place of growth. Expression levels were within the range of 2.957 up to the 52.936. Profilin expression was the highest in the sample from the polluted place of an industrial area with a value 52 times higher than the one of the sample from the village area.

We observed high levels of antioxidant activity in methanol and water extracts, smaller – in ethanol extracts. Differences among the levels of both analyzed allergen transcripts were found for hazelnut Cor a 1 and profilin.

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Comparison of Ole e 1 amount from two different *Olea europaea* cultivars

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Olive pollen is one of the main causes of allergic disease in the Mediterranean area [1-3]. Up to 20 proteins with allergenic activity have been described in olive pollen, with Ole e 1 as the major allergen of this pollen [4-5]. Numerous varieties of *Olea europaea* have been described in Mediterranean countries [6] and commercial olive pollen from uncertain cultivar origin is the common material used for clinical and biological studies. We aimed to assess the heterogeneity of two cultivars with regard to the presence of the major pollen allergen Ole e 1.

Pollen samples from the two olive cultivars: cv. 'Gemlik' and cv. 'Celebi' (five different trees from each cultivar) were collected for 2 years by trained personnel. Ole e 1 level of the certain amount of pollen grains collected was analyzed by allergen-specific sandwich ELISA. Comparisons were established both between individual trees and between cultivars regarding the levels of Ole e 1.

The cultivar 'Gemlik' had the higher value (mean \pm SD) of Ole e 1 content ($2,14 \pm 0,93$ and $1,55 \pm 1,13$ $\mu\text{g}/\mu\text{g}$ of freeze-dried material) when compared to 'Celebi' ($1,09 \pm 1,04$ and $0,19 \pm 0,40$ $\mu\text{g}/\mu\text{g}$ of freeze-dried material, respectively) in both years, 2013 and 2015.

The different cultivars of *O. europaea* pollen demonstrated great differences in Ole e 1 content. These differences seem to be due to genetic differences and ecological/climatological conditions.

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Aerobiological comparison between Plasencia and Cáceres (SW Spain)

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Two cities in Extremadura region (SW of Spain) as Cáceres (CC) and Plasencia (PL) have been aerobiologically monitored. Surroundings from CC were mainly cereal crops and some holm oak 'dehesas' and from PL were mainly cork oak forests, olive crops and river bank woods from a mountainous landscape. The aim of this work is to develop a first comparison between the two sites using aerobiological data.

Aerobiological sampling was performed using Hirst volumetric sampler for one whole year (2016). Samplers were located in CC on the terrace at the third floor of the School of Technology building at the University of Extremadura campus and in PL on the terrace at the second floor of the hospital Virgen del Puerto building. The two places were separated by 71 km in straight line with similar altitude a.s.l. (CC 457 m - PL 465 m). Meteorological data were provided from the government meteorological agency (AEMET).

Meteorological data for the analyzed year showed that rain was lower in CC (606 mm) than in PL (765 mm). Average temperature was 0.7°C lower in CC (16.7°C) than in PL (17.5°C). Annual average total pollen concentration was lower in CC (80 pollen grains m⁻³) than in PL (117 pollen grains m⁻³). Most of these differences were due to *Quercus* pollen, much more abundant in PL (39 pollen grains m⁻³) than in CC (18 pollen grains m⁻³). Moreover, Poaceae pollen were also more frequent in PL (40 pollen grains m⁻³) than in CC (34 pollen grains m⁻³), the same with *Olea* pollen in PL (12 pollen grains m⁻³) and in CC (8 pollen grains m⁻³). Nevertheless, *Platanus* pollen was better represented in CC (4 pollen grains m⁻³) than in PL (2 pollen grains m⁻³). Similar values were reached for the rest of the pollen types except for *Alnus* pollen, with higher concentration in PL (3 pollen grains m⁻³) than in CC (1 pollen grains m⁻³). Seasonal distributions were similar in both places, with maximum concentrations in May, with total pollen peak reached the same day, 21 May (CC 1117 pollen grains m⁻³ - PL 1581 pollen grains m⁻³).

Seasonal pollen distribution in CC and PL was similar, with differences in total pollen concentrations due to the abundance of different pollen sources. In CC the influence of ornamental trees as planes were higher than in PL. Notwithstanding, in PL pollen sources from surrounding oak forest and the olive crops close to the sampler were responsible for the higher values found.

Pollen diversity in the atmosphere of a semiarid region of Mexico during the dry season

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Pollen is one of the most important triggers of allergies. In Mexico, most of the airborne pollen studies have been conducted in Mexico City where climatic conditions and vegetation types are different from those in the semi-arid north-central region of the country. Few researches have been carried out in semi-arid zones of Mexico, such as Sonora, Nuevo Leon and Baja California, so most of the semiarid territory has not been studied. This project aims to evaluate the influence of meteorological variables on daily and hourly airborne pollen concentrations in a semi-arid city of Guadalupe, Zacatecas, Mexico.

Airborne pollen sampling was conducted from August 16th 2016 to April 2017, using a 7-day recording Burkard volumetric spore trap Hirst type, located at 1.30 kilometers from the nearest weather station belonging to Agroclimatic Monitoring Network of the INIFAP, Zacatecas. The sampling, slide preparation, pollen count and determination of the pollen concentration (pollen grain per cubic meter –pollen/m³–) were performed according to The British Aerobiology Federation guidelines. The pollen species richness and diversity index (Shannon-Wiener, H') were estimated using the absolute frequencies of pollen count. A preliminary statistical analysis between pollen concentration and meteorological data (temperature, precipitation, relative humidity, global radiation and speed wind) was carried out by a multiple regression analysis.

The preliminary results showed a pollen index during studied period of 14,039 pollen grains, which belong to 52 taxa, and a species diversity index $H' = 1.985$. The most abundant taxa were *Casuarina* (29 %), Poaceae (24 %), Asteraceae (22 %), Amaranthaceae/Chenopodiaceae (11 %) and Urticaceae (1.58 %). The lowest pollen concentrations (not detected-214 pollen/m³/h) were registered at early morning (1:00-11:00 h) and at night (21:00-24:00 h), while the highest (34-624 pollen/m³/h) were recorded at noon and afternoon (12:00-20:00 h). The multiple regression analysis between pollen concentration and meteorological data indicated that variables explaining variability of pollen concentration were temperature (12.2-23.6° C) and wind speed (0.0054-4.30 m/s). High values of temperature and wind velocity correlate with high concentrations of atmospheric pollen.

Casuarina had the highest pollen concentrations, it is an exotic tree species introduced to Mexico and widely used as an ornamental plant in the Guadalupe city; Asteraceae, Amaranthaceae/Chenopodiaceae, Poaceae and Urticaceae families, include species that are mostly herbs and usually are components of secondary vegetation. The complete data analysis of this research is under process; nevertheless, pollen concentrations along dry season in this semi-arid region of north-central Mexico, is expected to be concentrated in the same families of plants already predicted.

24 years of aerobiology monitoring in Jaén; trends in airborne pollen

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In this work we study the pollen intensity in the atmosphere of Jaén since records are started. We analyze the concentration of pollen evaluating the possible trends suffered between the majority pollen spectrums and interpreting its possible causes. This study uses 24-years database (1993-2016) of pollen records obtained according to the Hirst methodology (Hirst, 1952) and following the standardized protocols of the Spanish Network of Aerobiology (Galán et al., 2007). The total pollen index (14 pollen types) is analyzed during each season and the trend line is made. The pollen calendar (Spieskma 1991) has been reconstructed, based on all the years analyzed and it was compared to the pollen calendar by Ruiz-Valenzuela in 2001, based on 5 years of sampling (1994-1998).

The results obtained show important quantitative variations in the total amount of pollen recorded (IP) between seasons. A simple way to analyze the records in the pollen time series was to compare the average IP to the first 10 years of sampling versus the average IP to the last 10 years. Positive trends were observed for pollen types such as *Platanus* (>122%), *Cupressus* (>69%), *Pinus* (>35%), *Poaceae* (>25%), *Ulmus* (>15%) and *Olea* (>14%). In contrast pollen types such as *Plantago* (<75%), *Urticaceae* (>43%), *Rumex* (<42%), and *Chenopodiaceae* (<35%) suffer notable negative trends. Other pollen types studied do not reflect a clear trend in any direction (*Brassicaceae* (>9%), *Populus* (<7%), *Quercus* (<5%) *Artemisia* (0%)) and they show significant interannual variations during the monitoring period. Finally, the new pollen calendar resulting from total sampling period is modified for 3 pollen types: *Platanus* is increased 2 exponential classes during the month of March, *Urticaceae* decreases 1 exponential class in the same month and *Plantago* decreases 1 exponential class at the end of April.

The results obtained show a generalized increase in the pollen types of ornamental and cultivated plants while a progressive decrease of pollen types of ruderal plants take place. In this way they suggest a strong influence of the production sources in the immediate environment of the capture unit (university campus) since it is related to the process of urbanization that has been happening in the area during the last years.

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Heat and Chill requirements for the flowering period of the Albariño variety in the Ribeiro D.O. area

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The phenological behavior of a species is conditioned by anatomical, morphological and physiological factors associated with climate cycle dynamics, mainly temperature, light and humidity (Butrosse 1969; Mullins et al. 1992). The knowledge about the timing of the aerobiological and phenological processes results of great agronomical importance for the optimization of cultural practices and the establishment of the adaptive capacity of varieties to different environmental conditions.

The agrometeorological study in the Albariño variety of the Designation of Origin Ribeiro (North-West Spain) was carried out during the years 2008-2016. The phenological study was conducted during the active grapevine season following the BBCH scale (Meier, 2001). A total of 20 selected plants of the Albariño variety were monitored. We have characterized the study area by using different bioclimatic indices as Winkler index (WI) (Winkler et al. 1974) and Huglin index (HI) (Huglin 1958). In order to determine the Chill requirements to overcome the dormancy period the methods of Aron (1983) and Vegetation Activity (Jato et al., 2002) were used. For determining the heat requirements needed for the start of the different phenological stages the following methods were applied: Zalom et al. (1983), Rickman et al. (1983), Chuine et al., (1999), Galán et al. (2001) and Cessaraccio et al. (2004). Finally, *Vitis* pollen grains in the atmosphere were determined using a Lanzoni VPPS-2000 volumetric trap.

We characterized as warm temperate climate this region following the Winkler and Huglin indexes. The phenological BBCH stage with the maximum length for the Albariño variety was the stage 0 (bud development) with an average duration of 107 days, following by the stages 7 (development of fruits), 8 (ripening of berries), 5 (inflorescence emerge) and 1 (leaf development). Otherwise, the stage with the short duration was flowering (stage 6) with 13 days. It was found that following the Aron method an average amount of 793 chill units were required for the beginning of the stage 0 (bud development) with a base of temperature of 5,5°C; meanwhile with the V.A. method an average quantity of 643 chill units with a base of temperature of 6,5°C were needed. The heat requirements were calculated following five different methods, been the most accurate the proposed by Zalom et al. (1983). The start of flowering takes place when 313 GDD were registered whereas the first *Vitis* pollen grain in the atmosphere was detected when only 270 GDD were registered. The year that required a greater amount of heat hours to reach the optimal harvest data was 2016 (1510 GDD), while in 2008 the lowest thermal requirements were founded (1223 GDD).

The knowledge of the chilling and heat requirements for the grapevine phenology, contributes to the wine production increases and the improvement to the final product quality.

Prediction of grey mould periods of high infection risk for Treixadura variety

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The bioclimatological conditions of the vineyards located in North-Western Spain favor the development of fungal diseases, which have a marked impact on the grape harvest. The most common infection is grey mould, produced by *Botrytis cinerea* Pers. The knowledge of the fungal spore content in the atmosphere of a vineyard is a useful tool for the optimization of the disease prediction models, and therefore the design of an accurate application of the phytosanitary treatments only during the moment when high spores levels are detected.

The study was carried out from 2008 to 2015 in a vineyard at Cenlle, located in the Ourense Province at the Designation of Origin Ribeiro (North-West Spain). Airborne fungal spores were determined using a Lanzoni VPPS-2000 volumetric trap. The sampler was placed in the central part of the vineyard 2 m above ground level. Phenological study was carried out during the active grapevine season following the BBCH scale (Meier, 2001). A total of 22 selected plants of the Treixadura variety were monitored. In addition, we determined the periods with high infection risk during the stages 6 (flowering) and 8 (ripening of berries) following the methodology proposed by Magarey *et al.* (2005). Finally, we assessed the relationship between spores and weather variables by using a lineal regression model with the aim to predict *B. cinerea* spores concentration. The model was validated using a t-test for dependent variables.

During the study period the highest annual total *B. cinerea* spores amount was observed in 2008 (39299 spores) and the lowest in 2011 (5747 spores). The highest *Botrytis* spore counts were recorded during the stages 5 (inflorescence emerge), 6 (flowering), 7 (development of fruits) and 8 (ripening of berries) with a maximum mean daily spores concentration in 2008 (1669 spores/m³) coinciding with the stage 5 (inflorescence emerge). On the other hand the minimum mean daily spores concentration was registered in 2011 (222 spores/m³) during the beginning of the stage 7 (development of fruits). In addition, we calculated the risk infection periods for the most susceptible grapevine phenological stages (6-flowering and 8-ripening of berries). The greater number of days with potential infection risk periods were registered during the 2013 flowering stage (8 periods) and along the 2008 ripening of berries stage (21 infection risk periods). Finally, in order to forecast the *B. cinerea* spores concentration, a linear regression model was performed. The regression equation explained the 60,4% of the spores concentration variability. The accuracy of the model was tested with the data of the 2007 and 2016 harvest, and a big fit was registered between the observed and predicted data.

The use of biological sensors, such as the fitopathogenic spore concentrations in a vineyard, combined with the infection risk period calculations and the linear regression models represent an useful tool for the Integrated Pest Management protocols.

Evolution of IUGZA index in a historic park in Salamanca (1985-2016)

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Despite parks and gardens provide numerous benefits to population, the emission of pollen from ornamental flora has been identified as a major cause of pollen allergy in cities. In this sense, with the present work, we wanted to verify the evolution of the allergenic potential of one of the oldest parks in the city of Salamanca (San Francisco Park), as a consequence of variations in its botanical composition.

In order to do this, we have used the Urban Green Zone Allergenicity Index (IUGZA), which applies various formulas for the modeling of allergenicity potentiality, taking into account different biological parameters of the present taxa as well as aspects of their activity as allergen particles emitters (Cariñanos *et al.*, 2014).

For its calculation, we have based on the information obtained about the floristic composition of the park in 1985 (Costa *et al.*, 1985) and the one provided by the Park and Gardens Service of the city in relation to the botanical inventory, almost three decades later, being such documentation contrasted and revised by authors.

The total number of trees has been reduced from 240 trees in 1985 to 157 in 2016 and the number of botanical families from 15 to 14, respectively. Remarkable is the disappearance of 19 feet of elm (of a total of 20), probably due to the graphiosis disease. The decrease of the IUGZA index due to elm disappearance has been compensated with the increase in the number of Cupressaceae (taxon also with allergenic importance). The value of the index in the studied period decreases slightly (0.47 in 1985 and 0.31 in 2016), exceeding in any case the threshold value established (0.30). The vegetal composition of green zones conditions the allergenic potential that they present, being therefore the good use and management of the botanical species used as ornamental of vital importance.

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Allergenic potential of green spaces in the city of Porto (Portugal)

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The importance of green spaces in urban areas in improving the environment through better air quality and noise reduction has grown over the last few decades. However, certain factors could have a negative impact on human health. One of them is allergenic pollen emission by some higher plant species. Therefore, we aimed to evaluate the allergenic potential of some public parks and gardens in the city of Porto (Portugal) in order to contribute to the improvement of the environmental municipal management.

The allergenic potential of urban parks was calculated using the index of allergenicity of urban green zones (I_{UGZA}), which takes into account a number of biological and biometric parameters for tree and palm species growing in Green spaces (Cariñanos *et al.*, 2014). Tree composition of the parks was obtained both through visual surveys and data provided by the Parks Services of Porto City Council.

Thirteen green spaces were analysed in the city of Porto (Portugal) with areas ranging between 4805 and 96308 square metres: Praça Mouzinho de Albuquerque, Praça da República, Praça do Marquês de Pombal, Praça do Dr. Francisco Sá Carneiro, Praça de Lisboa, Parque da Pasteleira, Parque das Virtudes, Parque de São Roque, Jardim do Covelo, Jardim de São Lázaro, Jardim de Arca d'Água, Jardim da Cordoaria and Palácio de Cristal. The index values recorded varied from a minimum of .05 to a maximum of .66. Taking into account that an index value of .30 as the threshold considered sufficient to trigger allergy symptoms in the sensitive population, less than a quarter of the studied parks could cause several problems for many pollen-allergy sufferers.

The implementation of the I_{UGZA} index in different green spaces of the same city could be a useful management tool, thus allowing the adoption of corrective measures in existing green spaces, a better urban planning of future green areas and avoiding the use of allergenic pollen producer species. This information may also be helpful for pollen sensitised individuals in order to provide information about main allergenic pollen urban sources.

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Citizen Science: Phenological observations in Rome

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Aerobiological monitoring is very important in helping allergic people. We decided to support aerobiological monitoring with weekly phenological observations. Citizen science is the collaboration of not scientific people to collect data, generate results, and generally conduct science. Citizen science projects have the ability to collect large amounts of data, due to large volunteer groups, but usually require technical or scientific staff to analyse data and decipher patterns. Citizen science is a recent way to collect data especially in North Europe after the project Open Air Laboratory (OPAL) (Davies *et al.*, 2013). European Environmental Agency (Science Communication Unit, 2013) underlines the importance and the utility to involve citizens in projects on biodiversity monitoring.

Aerobiological monitoring was done following the methods adopted in Italy (Travaglini *et al.*, 2009), using a volumetric pollen and spore trap positioned in Rome. Phenological activities were carried out according to BBCH Monograph (Meier, 2001) and to Hidalgo *et al.* (2003). We sent pictures of different phenophases to volunteers. Every week we collected the phenological data originated in our group or received from citizen science and the pollen data and published them in our website.

We observed in these years, directly or indirectly, more than 60 sites in downtown and in suburbs from the end of October to the end of February. We have obtained a first map of different phenophases for *Cupressus* in Rome, in which we can see how the blooming of these trees starts before in south west of Rome and then moves towards the eastern and northern sector.

We involve citizens only using website, we want to organize a project with school and app for e-health medicine. We are testing some statistical model to forecast start flowering day for Cupressaceae.

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Wind dynamics' influence on airborne olive-pollen during African intrusions

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Given its proximity to northern Africa, southern Spain is regularly affected by high-altitude African intrusions. This influence in height determines a well-defined wind dynamics at surface levels in southern Spain. Although this weather event—mainly recorded in spring and summer—coincides with the local olive flowering season, its potential influence on olive pollen transport in this region at surface level has never been investigated in detail.

To elucidate this potential influence an analysis was made of daily and bi-hourly olive pollen concentrations recorded during 6 years, the 2010-2015 olive flowering seasons at two sampling sites 150 km apart. Málaga (coast) and Córdoba (inland) pollen data were examined together with information about 1) air masses at 300 m a.g.l., 2) surface wind direction and 3) surface wind speed over the same period. Air masses at 3000 m agl were used to identify the periods under the influence of African intrusions.

The combined analysis of these data during African wind intrusion events has enabled the identification of different pollen patterns and source contributions in each sampling site. In Málaga, hourly pollen peaks were recorded during the early morning coinciding with the arrival of north-westerly winds (developing sea-land breezes), with a minimal impact of local pollen sources; in Córdoba, by contrast, pollen concentrations reflected the joint contribution of local and long term sources, being the maximum concentrations associated with the arrival of southerly air masses in the afternoon. These results help to understand the impact of potential distant sources on pollen concentrations in each site, from west-northwest areas in the case of Malaga, and from the south in Cordoba.

These results reinforce the idea that combined studies between synoptic meteorological and aerobiological data together with different atmospheric height air masses data, offer us a better explanation and understanding of the behaviour and the potential sources of recorded airborne data in a given place.

Influence of the thermal requirement on the phenological development and *Alternaria* concentrations in a potato crop

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Early blight is a highly destructive disease of potatoes worldwide, leading to significant yield losses. The species of *Alternaria* are the cause of this disease, considered *Alternaria solani* as an aggressive species and therefore the most destructive. The characteristic symptoms of *Alternaria* infections on leaves are dark brown to black spots with concentric rings. Due to its polycyclic nature and the capacity of *Alternaria* species to produce high amounts of secondary inoculum, *Alternaria* leaf blight is difficult to manage. Cultural practices such as crop rotation, weed management, irrigation and adequate fertilization can help to reduce the impact of the disease. The aim of study was assess the phenology of a potato crop and its thermal requirements during seven cycles, in order to determine the most significantly relations with the *Alternaria* levels in the environment of this crop.

The study was carried out on a plot of A Limia (Ourense, NW Spain) during seven crop cycles. The phenology was described following the standardized BBCH scale. The aerobiological monitoring was conducted with a volumetric sampler type Hirst VPPS 2000 changed weekly. An automatic recorder and the MeteoGalicia web were used to compute the meteorological data. GDD and P-days were calculated for each crop cycle. Spearman correlation analysis was used to analyze the relationships among the variables.

Alternaria is present throughout the cycle of the potato crop in A Limia in all the studied seven cycles. The cycle of the year 2009 presented a significantly higher concentration of *Alternaria* ($P < 0.05$) with respect to the years 2007, 2008 and 2015, with a daily mean concentration of 88 spores/m³. The cycles of 2015, 2008 and 2007 were characterized with the lowest concentration of spores ($P < 0.05$), with a daily mean around 40 spores/m³. A high level of *Alternaria* spores were recorded during the development of leaves (E1) while the maximum concentrations were registered during the senescence of the crop. In order to verify the relationship between the *Alternaria* concentrations and the main meteorological parameters, a Spearman linear correlation analysis was performed. The results showed positive correlation coefficients with mean, minimum and maximum temperatures ($p < 0.01$), with GDD ($P < 0.01$) and with P-days ($P < 0.05$). However, correlation coefficients were negative ($p < 0.01$) with mean relative humidity and rainfall.

The phase of leaf development (E1) is the most sensitive to an attack of early blight. Statistical methods may be useful for predicting the concentration of phytopathogens in the field and initiating the timing of fungicide applications.

Atmospheric concentrations and intradiurnal pattern of *Alternaria* and *Cladosporium* conidia in Tétouan (NW of Morocco)

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Fungal spores of *Alternaria* and *Cladosporium* are ubiquitous components of both indoor and outdoor air samples and are the main causes of human respiratory allergies.

Monitoring these airborne fungal spores during 2009–2014 was carried out by means of Hirst-type spore trap to investigate their airborne spore concentrations with respect to annual load, seasonality and overall intradiurnal pattern.

Alternaria and *Cladosporium* spores are present throughout the year in the atmosphere of Tétouan, although they show seasonal variations. Despite important differences between years, their highest levels presented a first peak during spring and a higher second peak in summer or autumn depending on the year. The spore concentrations were homogeneously distributed throughout the day with slight increase of 7.6 and 3.7% on average between 12–14 and 14–16 h for *Alternaria* and *Cladosporium*, respectively. The borderline of 3000 sp/m³ of *Cladosporium* linked to the occurrence of allergic diseases was exceeded between 13 and 31 days.

Airborne spores of *Alternaria* overcame the threshold value of 100 sp/m³ up to 95 days, suggesting that *Cladosporium* and *Alternaria* could be clinically significant aeroallergens for atopic patients.

Abstracts

Tuesday, 5th September

Session 3: Aerobiology

Session 4: Paleopalynology

Session 5: Aerobiology

Session 6: Pollen Morphology, Biology and Biochemistry

Session 7: Aerobiology

Session 8: Paleopalynology

Poster Session B: Aerobiology

Ambient air - Sampling and analysis of airborne pollen grains and fungal spores for networks related to allergy - Volumetric Hirst method (CEN/TS 16868:2015)

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Biological particles are present in the air, causing health impacts at various levels. In Europe, nearly 18 % to 20 % of people suffer from pollinosis due to pollen and/or fungal spores. Both are considered in some Member States as an air pollutant as well as particles suspended in the air (PM10, PM2.5). In Europe, European Aerobiology Society (EAS) in coordination with International Association for Aerobiology (IAA) manage problems of sampling, analysis, quality control, development and information.

Persons and institutions involved in pollen forecasting have a scientific and public health responsibility. The health state of pollen allergy sufferers must never be risked due to inadequate forecasts, financial interests or deficient working routines applied in the fundamental work such as pollen data evaluation and all involved processes (maintenance of the device, preparation, evaluation, handling and processing of data)

For the sampling and analysis of biological particles different methodology and operating procedures are used. Sampling equipment is diversified. Analysis is based on optical light microscopy for identification and counting pollen grains and fungal spores. Elements and reagents used during sampling and analysis have very specific properties and require to be handled carefully

Information on airborne pollen and spore concentration (counts and analyses) plays an important role in aerobiology, as well as in other disciplines and fields of application, such as biodiversity, agriculture, forestry, phytopathology, meteorology, climatology, paleoecology/-climatology, forensic science, bioterrorism and health (sensitization and allergy).

A European Standard (EN) has been proposed at the initiative of the previous President of EAS, Michel Thibaudon, with the help of AFNOR, which specifies the procedure to be followed for the sampling and continuous analysis of the concentration of pollen and fungal spores in the air, using a Hirst volumetric sampler (or some method comparable data). The method described in the Technical Specification (TS) is aimed for the purposes of networks related to allergy.

The document has been prepared by Technical Committee CEN/TC 264 WG39 "Air quality" and approved by CEN on 15 September 2015 for provisional application (prEN 16868). The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

Pollens, allergy and real time information

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Biological particles like pollens are causing pollinosis to nearly 18 to 20% of the population in Europe. Currently, the main method to determine pollen concentrations is based on a Hirst pollen trap system and microscopy analysis. The methodology is robust and efficient to provide reliable information but the results are available only a week after the sampling. The analysis need very performed technicians and is long time consuming. Since a few years, lots of efforts have been done by the scientific community to build new automated instruments for pollen detection and identification.

Two different ways are used for this development: automatic image analysis, and laser w/wo fluorescence. The interest of the second type of equipment is to provide, in a same device, the collection and the analysis, but they are still less effective for the taxa discrimination. Some years ago, a lot of European aerobiology teams worked on immunochemical methods during the European project MONALISA and HIALINE. These works, if they permit to measure some allergen data, shows that immunological methods are not available for real time analysis. Some teams are working on new methods using molecular biology and sequencing to analyze and discriminate some main allergenic data.

This study will permit to present a synthesis of the different classical and alternative methods with their characteristic, advantages and disadvantages.

Since a few years with the development of the new electronic information technique, health authorities, doctors and allergic patient want to receive alert and/or information in real time, on their smartphone.

Among the equipment tried these last years in France by RNSA, there are:

- a KH 3000. It is a device with an algorithm for monitoring airborne pollen automatically by using laser optics. The scattered light induced by each particle passing in the beam of a semiconductor laser (780 nm, 3 mW) is detected. The forward- and sideward-scattered pulses are measured and the peak intensities of them are recorded.
- a FIDAS 200 of Palas. It is a size segregated optical particle counter. It has been certified by the TÜV for the measurement of particulate matter below 10, 2.5 (PM10, PM2.5), and calibrated for pollen in a range from 10 to 60µm;
- a Rapid E from Plair which is a laser and fluorescence measurement which permit to measure and to discriminate the airborne biological particles in real time.

Some developments are made using Coriolis delta and Hirst pollen trap to purchase material for molecular biology.

In the next decade, these new methods, with modeling, will complete Hirst trap networks in France and in Europe.

Digitalization of Samples for Evaluation and Automated Image Analysis

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Standard method in aerobiology and related fields is sampling particles and making of a slide from a diluted sample. Light Microscopic inspection may yield detailed information on occurrence, number, size and shape of pollen, spores and other particles of biological or non-biological origin.

Objective of our Microscope Image Analysis System (MIAS) is to introduce modern but non-expensive techniques. This means to combine the advantages of the standard collection method with the automation of microscopic inspection and image analysis in this field of investigation. The MIAS relies on Standard methods for the sampling and staining of samples to have a clear contrast and recognisable features of the particles.

Our automatic scanning light microscope is designed to simulate the routine particle counting: The aeroIScope[®] has a free programmable scanning pattern in a 24 x 72 mm area applicable to 10 standard slides to obtain a series of images fitting by 0.2 µm. The optical magnification is chosen to have best resolution available at greatest image size. To capture the relevant details of the appropriate grains an Intelligent Automatic Focussing accounts for variations in sample properties. Particles of different size can be combined into one image from different focus levels. Detailed structures may be documented by images of close-by focus levels at each frame.

To make 3x100 pictures per slide takes about 60 min and needs 75 Mb storage capacities.

A software tool named PCS Marker supports eye inspection of the images on a screen far from microscope and laboratory. It enables labelling and image-related listing of structures.

The image analysis program PCS performs the automated image analysis: The images are transformed to a fixed format and grey values. An analysing routine scans these images for segments, which correspond to that of particles searched for. Values of numerous parameters of these segments related to the size, average brightness and distribution of intensity are used for classification of distinct pollen grains by comparing them to values typical for distinct pollen.

This way it takes five minutes to select as much as 18000 pollen of one kind from 300 images.

The MIAS[®] was validated for two aspects: The match of the number of pollen depicted from the images made by the aeroIScope[®] to the eye counts at the microscope revealed that counting few pollen is no problem, but at high pollen density microscopic inspection overestimates the number by up to 50%.

Comparing evaluation of pictures using the Marker to results of Image Analysis demonstrates that the later are sensible to quality of sample, also kind, constitution and number of grains.

MIAS[®] makes the analysis of pollen objective and effective: The technical specification of the aeroIScope[®] provides automatically series of fitting images which

- provides photographic documentation including clear relation to position on the slide
- enables comfortable evaluation on a screen by eye inspection far from lab
- has a quality suitable for digital analysis to detect, and classify distinct pollen from these images.
- aeroIScope[®] is a modular system open to possible adaptations in software, but also in magnification of the optical system with appropriate alterations in mechanics.

New biomolecular tools for aerobiological monitoring: identification of major allergenic Poaceae species through fast real-time PCR

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Poaceae are very common plants which are extremely diffused in all environments and urban areas. Although their economical importance, they can represent a problem to humans due to their abundant production of allergenic pollen. Detailed information about the pollen season for these species is needed in order to plan adequate therapies and to warn allergic people about the risks they take in certain areas at certain times. Moreover, precise identification of the causative species and their allergens is necessary when the patient is treated with allergen-specific immunotherapy (SIT).

While classic aerobiological monitoring (that employs optical microscopy techniques) works good for most of the plants that produce allergenic airborne pollen, the intra-family morphological similarity of grasses pollen grains makes it impossible to distinguish which particular species are present in the atmosphere in a given moment. This study aims at developing new, biomolecular tools to analyze aerobiological samples and identify major allergenic Poaceae *taxa* at subfamily or species level, exploiting fast real-time PCR.

Protocols were optimized for the extraction of DNA from pollen sampled with volumetric and gravimetric methods. A fragment of the *matK* plastidial gene was amplified and sequenced in Poaceae species known to have high allergological impact (*Dactylis glomerata*, *Phleum pratense*, *Lolium perenne*, *Festuca arundinacea*, *Poa pratensis*). Species- and subfamily (Pooideae)- specific primer-probe systems were designed and tested in fast real-time PCR to evaluate the presence of these *taxa* in environmental pollen samples.

Species-specific primer-probe systems, with different levels of sensitivity, were developed for four out of five species analyzed. A Pooideae-directed primer-probe system was also assessed.

Different pollen sampling methods were coupled with adequate DNA extraction and analysis protocols in order to gain integrative information on Poaceae pollination. In particular, sensitive systems were obtained to identify the presence in the atmosphere of pollen grains from *D. glomerata* and *P. pratense*, probably the two most allergenic grass species in Europe. A primer-probe set was also proposed for the detection of Pooideae in aerobiological samples, since this subfamily gathers species carrying both grass allergens from groups 1 and 5, considered responsible for the most frequent and severe allergic manifestations in the same area.

Numerical approach to compare the pollen emission from grass species

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Pollen from grasses represents one of the main causes of respiratory allergies in Europe. For this reason, Poaceae pollen is very well studied from the aerobiological point of view. The identification of the species that provide the highest concentrations of pollen in the atmosphere is an important subject to consider. In this sense, the aim of this study was to analyze the pollen contribution of the different species of grasses to the atmosphere and to identify which species are mainly responsible for the episodes of pollinosis.

A total of 28 grass species, representatives of the flora and vegetation of the central Iberian Peninsula, were studied. To evaluate the potential contribution of these species to overall airborne pollen concentrations, the Pollen Contribution Index was developed, standardized in a scale from 0 to 1, and based on the following variables: flowering phenology, pollen grain size, abundance of the species in the area and pollen production.

The flowering period of the grass species in the study area generally begins in late March and ends in early July. The highest airborne pollen concentrations coincided with the flowering-period of later-flowering species (between May and June). Thus, the species that contributed remarkably to the pollen curve, according to the values of the Pollen Contribution Index, were *Dactylis glomerata* subsp. *hispanica* with 0.9, followed by a few other species, including *Arrhenatherum album*, *Trisetum paniceum*, *Piptatherum miliaceum* and *Lolium rigidum*, whose index score was higher than 0.4. All these species share certain characteristics related to pollen emission and dispersal, such as a small size of the pollen grain (and thus greater buoyancy in air), high pollen production and considerable abundance.

The Pollen Contribution Index shows that a small number of grass species account for most of the airborne grass pollen concentrations. This index provides important information, on which recommendations for allergy sufferers could be based. This is because it enables identification of the species that cause pollinosis and, in consequence, avoidance as far as possible, of exposure to the main sources of pollen emission. Besides, the Pollen Contribution Index could also be applied to other pollen types, especially those involving species whose flowering-periods overlap, such as *Plantago* and Amaranthaceae, which also comprise numerous and highly-diverse species.

Is total protein a feasible marker of bioaerosol load in ambient air?

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The burden of pollen allergies is increasing worldwide. Due to its environmental etiologic nature, disease management in a changing environment has proven to be challenging. Pollen counts are widely used by health professionals as markers for allergenic loads (EAN). Other strategies like direct allergen monitoring have also been attempted with reliable results (Butters *et al.*, 2015; Galan *et al.*, 2013). While the first strategy requires highly trained professionals and is tedious, the second is still expensive. Inexpensive and uncomplicated ways to follow allergenic loads are still missing.

The aim of this work was to evaluate the validity of the measurement of total protein in ambient air samples as a marker for bioaerosol loads and therefore as a risk predictor for allergen exposure.

The air samples were collected from 2009 and 2011 with a high-volume cascade impactor (ChemVol, Butracco Inc., Son, Netherlands), with two stages to capture two fractions of particulate matter (PM): M-stage for small particles ($2.5\mu\text{m} < \text{PM} < 10\mu\text{m}$); XL-stage for $\text{PM} > 10\mu\text{m}$. The filters were extracted using phosphate buffer (10mM, pH=7,4) supplemented with 0.01% Triton X-100 for four hours protected from light. Supernatants were collected after centrifugation (10000g; 10min) and protein content was measured by a Bradford method.

Quantification of total protein in the extracts was possible within the range 2-20 $\mu\text{g}/\text{mL}$. Protein content in ambient air showed a daily variation and varied between 10-500 $\mu\text{g}/\text{day}$. Protein content was 2-3 fold higher in the $\text{PM} > 10\mu\text{m}$ compared to $2.5\mu\text{m} < \text{PM} < 10\mu\text{m}$ fraction. Since, it is expected that pollen will constitute the major component of the bioaerosol during the spring time. Preliminary results indicate a correlation of protein content and grass and olive major allergens.

This method, inexpensive, quick and easy to perform, proved to be effective in determine the protein load present in the atmosphere, a potential marker for bioaerosol, including allergen loads and account for air quality control thus for improving risk management strategies and reducing impacts on populations.

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Suitability of Chemvol sampler in monitoring *Alternaria* aeroallergens

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Recently, Chemvol sampler has been broadly used in the collection of airborne allergens. To estimate the relationship between the daily pattern of allergens and their carriers (pollen or fungal spores) the additional sampler - Hirst type volumetric trap, had to be used. Both samplers differ however dramatically in flow rates (800 and 10 liters/min, respectively), what raise a question about the comparativeness of data obtained from both impactors. The main aim of this study was to evaluate the suitability of Chemvol sampler in fungal allergen monitoring and develop a method that allows resigning from Hirst-type spore trap in allergens analysis.

Alternaria spores have been collected by three-stage Chemvol impactor (stage I $PM_{10} > 10 \mu m$; stage II $2.5 > PM_{10} > 10 \mu m$, and stage III $0.12 > PM_{10} > 2.5 \mu m$) and Hirst-type volumetric spore trap. The airborne spores collected on the filters (impactor medium of Chemvol) were extracted in buffer over 4-h periods. The sediment was investigated under the light microscope in order to calculate the number of impacted spores, while the supernatant was used in the immunoenzymatic analysis (ELISA) to quantify the amount of the main *Alternaria* spore allergen (Alt a 1). Alt a 1 levels were compared with fungal spores data collected by both samplers.

Daily concentration of spores collected by Hirst-type spore trap and Chemvol impactor were statistically significant ($r^2 > 0.9$; $p < 0.05$). The highest number of spores was observed in stage II and was around 80% higher than in stage I. The number of spores found in stage III was very low (<5% of total spores sum). Daily levels of Alt a 1 significantly correlated with airborne spores collected by both samplers. The highest amount of Alt a 1 was collected in stage II and corresponded with the number of spores found in that stage.

The preliminary results showed that proposed method of spores' extraction from filters gave comparative results to the spores counts using a traditional Hirst-type trap. Therefore, we suggest that fungal aeroallergen monitoring by Chemvol impactor does not require additional second sampler. The significant correlation between fungal spores and Alt a 1 found in three stages of Chemvol impactor call into question the hypothesis of presence of fungal allergens in sub-spore fragments, i.e. in hyphal parts.

What is the appropriate temporary extension for a representative pollen calendar?

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Pollen calendars provide information about the variety of pollen types and seasonality in a locale. The accuracy and robustness of a calendar will increase with longer time series. On 03/07/2017, the topic “pollen calendar” was searched in Web of Science resulting in 108 outputs, of which 84 were research papers and 3 reviews. Focusing on the 84 articles published between 1975 and 2016, 7 manuscripts tackled other topics related to palynology and 5 documents could not be accessed. The remaining 79 articles presented the following frequency in terms of years of duration in the calendar: 1 year, 18 articles; 2 years, 29; 3 years, 5; 4 years, 4; 5 years, 3; 6 years, 2; 7 years, 3; 8 years, 2; 9 years, 1; 11 years, 1; 15 years, 2; and 20 years, 1. Rodríguez-Rajo et al. (2004) stated that 7 years should be the minimum duration to achieve a representative estimate of the behavior of the pollen of any area. In the current work, we discuss and highlight the differences caused by modifying the duration of the pollen calendar.

The aerobiological data were obtained from Cartagena (37° 36' N 0° 58' W) by means of a Hirst-type volumetric sampler, following the methodology approved by the Spanish Aerobiology Network (Galán et al., 2007). The database was compounded by the pollen counts between 03/19/1993-12/31/2014. The average weekly values were calculated for three periods: 1993-1999, 1993-2014 and 2009-2014. For plotting purposes, the pollen calendars followed these scales: 0, <1,00; 1, between 1,1-2,9; 2, 3-5,9; 3, 6-11,9; 4, 12-23,9; 5, 24-47,9; 6, 48-95,9; 7, 96-191,9; and 8 > 192.

The three pollen calendars presented relevant differences for Urticaceae, the summer-autumn flowering of Amaranthaceae, the autumn-winter flowering of Cupressaceae, the occurrence of *Morus* in the pollen calendar 2009-2014, and the decrease of Palmae throughout the latter period.

A prolonged time series allows the extreme values to be minimized so the central tendency statistics can properly describe time series. This is how the climatic data are managed, with a minimum of 30 years. Nevertheless, main topics related to anthropogenic activities and short-lasting environmental events can be blurred. We consider that pollen calendars should be made with prolonged time series and periodically updated. This information should be necessarily completed with current daily pollen counts, because these pollen counts provide the main information for clinical physicians and patients.

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Palynological investigation of biological tissues from human volunteers

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Palynology has already proved capable of providing evidence of contact between individual with objects, individual with locals and/or objects and locals. Since the pollen profile may allow inferring on the existing flora composition, it is possible to locate pollen origin (Mildenhall *et al.* 2006). The aim of this work was to evaluate the efficiency of human body as pollinic trap, through the palynological analysis of different samples from human volunteers.

Sampling was performed in hair, nasal cavities and subungual tissue from human volunteers. The sampling of hair and subungual tissue was accomplished by washing with diluted antimicrobial detergent and distilled water. The nasal cavities were sampled using swabs (Wiltshire 2016). Concentration of the pollen content in the samples was estimated by destructive methods. Tablets of lycopodium spores were added to samples to enable calculation of the palynomorphs. Concentration of pollen grains was determined using an optical microscope at a magnification of 400x along the total area of the microscope slide. Pollen counts were expressed as pollen grains per gram of the sampled material.

We found pollen grains in the samples from hair and subungual tissue, but not in those from nasal cavities. The types of pollen found in hair and subungual tissues are usually the same, although, in hair samples, there is a higher quantity and in some case a higher diversity. Furthermore, percent contribution of each of the types of pollen found in these two tissues is roughly equal, indicating a common origin. The pollen found could be related with the time of the year.

Human tissues retain different pollen assemblages, working efficiently as pollinic traps, with hair samples having the highest pollen diversity and quantity. Surprisingly, we did not find pollen in samples collected from nasal cavities. There are three probable causes (or their combinations) for this: (i) small concentration of atmospheric pollen at the time of sampling, (ii) inefficient sampling method and/or (iii) incapability of nasal cavities to as pollinic traps.

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The Shackleton site, a pivotal Iberian margin climatic archive for understanding the ocean-ice-land interactions of the last 800,000 years

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The Shackleton site, IODP Site 1385, is a unique palaeoclimatic sequence that records marine and terrestrial climate changes and ice dynamics over the last 1.5 million years in the southwestern Iberian margin. This region is located below 40°N and therefore particularly affected by precession and directly influenced by the westerlies and the subtropical ocean water currents. The position of this site is ideally suited to investigate the origin of the millennial scale variability and the interactions between the low and high latitude regions of the North Atlantic explaining the orbitally-driven deglaciations and entering in glaciations. We present here an array of new land-sea paleoclimatic data (pollen, foraminifera, dinocysts, microcharcoals, $\delta^{18}\text{O}$ of benthic and planktic foraminifera, alkenone derived sea surface temperatures, $\text{C}_{37:4}$ -based freshwater pulses) covering the last 800,000 years. These data, and particularly those for interglacial periods, will be discussed in the light of changes in baseline conditions, i.e. the distribution of incoming solar radiation, greenhouse gas (GHG) concentrations and ice volume. For instance, MIS 19, an interglacial centered at 800,000 years ago, was marked by 5000-year cyclicity in the North Atlantic westerlies suggesting a low-latitude origin of this cyclicity related to the fourth harmonic of precession. This cyclicity led to repeated air-sea thermal contrast during MIS 19c in Iberia enhancing moisture production and leading to ice growth. Our results also reveal a different cyclicity of the Holocene and MIS 19c challenging their similar duration.

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Impact of the Mediterranean Outflow Water on the North Atlantic Ocean during past climate warming events

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The Atlantic Meridional Overturning Circulation (AMOC) is a key component of the climate system, yet some uncertainties remain regarding its past variability. AMOC variability and climate changes have a non-linear relationship which suggests important feedback mechanisms. The nature of these feedbacks is poorly constrained, but as the North Atlantic salinity budget strongly impacts the AMOC vigor, such feedbacks are likely to be related to processes able to affect the salinity of this basin. The Mediterranean Outflow Water (MOW), i.e. the warm and salty intermediate-depth water-mass overflowing from the Mediterranean Sea to the North Atlantic Ocean, appears as a good candidate. Such a hypothesis is indeed supported by modeling experiments which suggest that a stronger MOW could boost the AMOC strength.

Here we analyze the impact of the MOW on the North Atlantic climate and Ocean circulation during past climate warmings. The studied marine site (U1385, IODP Expedition 339), located on the southwestern Iberian margin (the well-known “Shackleton Site”), has been the subject of many paleostudies which have shown its strong potential to record 1) AMOC strength changes (using benthic $\delta^{13}\text{C}$), 2) North Atlantic – Mediterranean Sea water-mass exchange variations through their impact on surface hydrographical conditions (dinocyst assemblages), and 3) precipitation changes over the western Mediterranean Sea which are likely to affect the MOW intensity (pollen assemblages). The study site is also located close to Gulf of Cadiz cores where past MOW strength variations have been directly assessed. Here we present data for MIS16-15 (635-610 ka BP) and MIS12-11 (440-405 ka BP) transitions, which are characterized by different insolation conditions, ie. one factor known to influence the MOW intensity. We present new dinocyst data which were obtained at unprecedented high temporal resolution (around 600 years for both time periods). The population shifts observed in the record provide new insights on oceanic circulation changes characterizing the abrupt and gradual climate warmings of these two glacial-interglacial transitions.

New pollen data from shallow marine sediments in Ría de Ferrol (NW Iberia)

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Ría de Ferrol is a semidiurnal mesotidal embayment at the passive Atlantic margin of NW Iberia, with tides ranging from 1.5 to 4 m. Bedrock consists of granites and Paleozoic sedimentary rocks. The whole ria (21 km²), NE-SW orientated, may be divided in: 1) an outer sector NE-SW orientated, 2.2 km-wide and less than 33 m deep; 2) a 2 km-long 0.5 km-wide narrow channel (until 20 m deep) that connects the inner and outer sectors; and 3) a shallow inner area (15 m deep on average), where most of the freshwater inputs in the ria occur and several gas-related features exist. Detailed multiproxy analyses were performed in the sedimentary infill of this basin in order to contextualize the gas-related features found in the area.

Several surveys were performed on board R/V *Mytilus* to obtain high-resolution seismic records. Besides, 3 gravity-cores and 7 vibracores were recovered for geochemical and pollen analyses. Several shells found inside sediment were used for radiocarbon dating (Beta Analytic, Florida; USA). Palynological analyses (pollen, NPP and dinocysts) were performed on core GC2X to characterize the facies of sediment, but also for the reconstruction of the main environmental changes affecting the shallowest part of the ria during the last 10 kyr.

The sedimentary infill in the inner part of Ría de Ferrol consists of three main seismic units separated by two main erosive surfaces (D1 and D2). Unit U1 is interpreted as deposited during the Lateglacial. Gas-related features were only identified in the two younger units (U2 and U3). The aggrading unit U2 appears mainly in the margins of the ria, with a central axis of non-deposition or erosion. It is characterized by onlap terminations against its basal surface (D1). Internally, it shows channel incisions and infills, developed in several phases of erosion and deposition. Palynological analyses, together with XRF elemental data obtained on core GC2X, enable a detailed study of units U2 and U3. Our results denote an increasing marine influence from the base to the top of the sequence. Particularly, dinocyst concentrations and D/P ratios show rapid increases above surface D2 (unit U3), together with higher values of Ca and Sr. Nevertheless, at the sampled point, we have recognized a sedimentary hiatus that extends from the Mid-Holocene to ca. 1 kyr BP, delimiting the two upper units, units U2 and U3.

Acoustic turbidity was identified in two seismic units of Holocene age: the unit U2 deposited between the early Holocene and ca. 5.9 kyr BP, and the unit U3 placed above. The limit between both units is an erosive surface (D2), denoting a hiatus that extends from Mid-Holocene to last millennium. In spite of the dredging activities affecting the ria during the historical period, these major erosive events might be linked to natural causes (erosion, bypassing) related to climatic shifts, changes in the relative sea-level and conspicuous runoff episodes.

Last Glacial-Holocene productivity reconstructions of Congo River from the revised tropical dinocyst-based modern database

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In order to refine the relevance of quantitative reconstructions of net primary productivity conditions through the dinocyst-based transfer function method, we deeply revised the tropical Atlantic modern database n=208 (Marret et al., 2008).

84 new surface sediment samples have been added to provide a better geographical coverage of the South Atlantic Ocean, while 55 have been removed due to low dinocyst concentrations and/or ages older than 1,000 years BP. We also have updated the environmental dataset, using the World Ocean Atlas 2013v2 for SST and SSS data as well as for 1978-2015 mean values of net primary productivity recorded during CZCS, SeaWiFS and Modis spatial programs, and calculated with chlorophyll-based VGPM and Eppley models, as well as carbon-based CBPM model. We also have experimented new environmental datasets in order to track past upwelling activity, using SST/SSS-based water density and SST anomalies regarding mean latitudinal SST. Finally, preindustrial net primary productivity values, simulated with IPSL-CM5A-LR model developed at the IPSL (le Mézo et al., 2016), have also been added in the dinocyst transfer function so as to provide more relevant modern values for each modern analogue available in the dinocyst database. We then have applied the revised dinocyst and environmental datasets to fossil dinocyst assemblages of core KZAI-01 (retrieved off the Congo River mouth) recently acquired at high resolution over the last 44 ky BP (Hardy et al., 2016).

Our results argue for an obvious orbital forcing, with higher net primary productivity values reconstructed during minima of precession (MIS 3 and the last deglaciation), and especially during a combination minimum of precession-maximum of obliquity that occurred during the last deglaciation and the Holocene. Higher productivities appear mainly led by the Congo River activity, with maximal terrigenous inputs also occurring during these periods, and probably generating powerful river-induced upwelling cells during the last deglaciation. Finally, a gradual increase of net primary productivity values begun at around 4 ka BP and is still recorded today in remote-sensing instrumental data in the study area. Also, a data-model comparison was performed on three snapshots: 20, 9.5, and 6 ka BP. First reconstructed seasonal dinocyst-based net primary productivity values are here presented and appear greatly consistent with IPSL model results. Also, during the Last Glacial Maximum, lower seasonal contrasts are evidenced in comparison with today.

Lago di Vico, central Italy: a detailed late Holocene pollen record

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Lago di Vico is a volcanic lake located 50 km northwest of Rome, 40 km from the Tyrrhenian Sea, in central Italy. It has a max. depth of 50 m, an elevation of 510 m a.s.l., a diameter of ca. 5 km, a surface of ca. 12 km², and a catchment area of ca. 40 km². It is located in the central collapse caldera of the Vico volcanic district. The catchment, exclusively formed by volcanic rocks, is delimited by the edge of the caldera, peaking 965 m a.s.l. at Monte Fogliano where an estimate of the rainfall provided a value of about 2000 mm. Outside the caldera, at the closest meteorological station of Ronciglione (441 m a.s.l.), the mean annual precipitation (over 40 years) is about 1400 mm and the mean annual temperature is 13.6°C.

The forest vegetation of the caldera is organized in belts: on the top of Monte Fogliano beech woods are found, while mixed forest of beech and deciduous oaks mainly lie on the southern and western slopes and on Monte Venere; on the northern slopes of the caldera mixed oak woods dominated by *Quercus cerris* is found; chestnut and hazel coppices are found respectively on the eastern slopes and on the flat areas surrounding the lake; extrazonal populations of *Q. ilex* and other Mediterranean elements are found on rocky and sunny slopes.

Human activity in the caldera is archaeologically documented by a votive cave on Monte Venere where a series of ten radiocarbon dates from 8000±160 B.P. to 4390±50 B.P. indicates a long-lasting frequentation of the cave. Evidence of Bronze Age occupations is found on the northern slope of Monte Venere and on Monte Fogliano. Remnants of Etruscan and Roman cultures are widespread in the area. Three pollen records from Lago di Vico have been published, the longest one spanning the last 90,000 years (1), two others covering shorter periods (2, 3; None of them has a complete pollen record for the Holocene).

With the aim of reconstructing the vegetation, the climate and the fire history of the last millennia, we present integrated pollen, microcharcoal and NPP (non pollen palynomorphs) analyses of the top 5.60 m of a new 12 m long sediment record. The core was drilled in the north-western sector of the lake, at a water depth of ca. 19 m. The diagram spans the last ca. 4500 years, the chronology was established using four radiocarbon dates and the characterization of one tephra level. Deciduous oaks, beech, hornbeams characterized the environment around the lake. Even if clear signs of human presence are detected before, a strong human impact on vegetation is recorded around 2800 years ago, at the beginning of the Iron Age, with forest clearance and cultivation of olive, chestnut and walnut. Intensive cultivation of hazel, which today characterizes the landscape around the lake, is quite recent, dating back to the Modern Age.

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Contributions of archaeopalynology in lakeside settlements research. The case study at La Draga (Banyoles, NE Iberia)

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Anthropogenic sediments from lakeside settlements are not ideal archives for reliable palaeoenvironmental reconstructions given the overrepresentation of taxa introduced by humans. However, these archives offer the possibility to obtain evidence of socioeconomic practices, due to the fact that human activities cause changes in the configuration of the pollen record. In addition, the study of pollen and NPP in archaeological sediments provides relevant data to comprehend processes of site formation. In that sense, different taphonomic processes occur in aerial/subaerial mineral deposits such as archaeological sites, which can alter the original deposition of pollen and NPP.

In this study, pollen and NPP data from La Draga (Banyoles, NE Iberian Peninsula), a Neolithic settlement, are presented. The sampling of the archaeological site of La Draga (Sector D) followed two different strategies: a vertical sampling in order to obtain a diachronic record of the successive layers and phases; and an horizontal sampling of the 1st occupation phase (Level VII) in order to carry out an spatial analysis of pollen and non-pollen palynomorphs (NPP).

The application of integrated pollen, NPP, macrofossil and sedimentological analyses enabled understanding site formation processes, the reconstruction of palaeo-environmental evolution and provided new data about socioeconomic practices during the Early Neolithic as well as about the use of space within a pile dwelling site. In addition, the integration of bioarchaeological data from La Draga and from off-site pollen records in Lake Banyoles provided significant data for the comprehension of human-environment interactions and the scale of human impact during the Early Neolithic.

The differential preservation of pollen grains documented at La Draga can be explained in terms of the existence of different environments within the site. While the first occupation phase occurred in a wet environment, at least seasonally flooded, the second phase is characterized by the occurrence of soil erosion processes in relation with deforestation carried out by former Neolithic communities. In addition, during the first phase, sub-aerial outside spaces and humid organic environments beneath pile dwellings were identified.

In conclusion, this work evidences the need to carry out spatial analysis in palynological studies in archaeological sites, owing to the spatial heterogeneity of results reflecting human impact in terms of input of plants to the settlement (gathering, cultivation, storage, foddering), in arrangement of structures and in soil erosion. Additionally, spatial analysis in archaeopalynology has proved to be an extremely valuable and necessary method in open-air pile dwelling sites, where the reconstruction of domestic structures and spaces becomes especially difficult.

Plant landscape evolution in a human-induced environment: El Sertal peatbog (Cantabria- Spain)

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Based on the results previously obtained by Mariscal (1986), a pollen analysis has been done in order to supplement certain aspects and obtain a higher resolution of analyses. The study of pollen data and sedimentary charcoals obtained at El Sertal peatbog (Cantabria-Northern Spain) allows us to discuss the evolution of the vegetation cover and its relation to human activity in an area where human presence has been widespread and well known since the Prehistory.

The bottom of the diagram (ca. 6500 cal yr BP) corresponds to the beginning of the Neolithic period. Despite the highest values for arboreal pollen and a significant presence of *Corylus*, high percentages of Poaceae and *Pteridium* indicate a wide extension of clearances. In this period, also pine (probably *Pinus sylvestris*) has higher relative importance, although its pollen values, around 15%, would not indicate the permanence of pine forests in the vicinity. Cereal pollens begin to appear between 6000 and 5000 cal years BP.

About 4500 years BP, an increase of *Alnus* occurred, a fact that could indicate a change in climate, geomorphology, or human management of the territory. Therefore, a change in the hydric distribution of the peat bog would be noted increasing small, much more superficial, rivulets of water, facilitating colonization of its margins by *Alnus*. *Fagus sylvatica* appears at about 3000 years ago but it remains with low percentage values for more than 2000 years. During all this period, arboreal pollen percentages continue to decrease and there is a continuous curve of cereals and significant *Plantago* values which provide evidence of an intensification of anthropic activity. Simultaneously, from 2800-3000 cal years BP, the percentage of Ericaceae pollen increased. In the last millennium, there was a strong expansion of beech that coincides with a period of intense human pressure in the Cantabrian Mountains. In this period, the most intense fire episodes are recorded at El Sertal. During the most recent centuries, large deforested areas have dominated, with highest values of Ericaceae, cereals, and *Plantago*.

The work has fulfilled its objectives: the pollen diagram for El Sertal shows the main vegetation changes since Neolithic times and the existence of dissimilar chronological patterns with other peat bogs which can only be interpreted as a consequence of human actions. Through them, we also prove that human control has been a major factor in the region's fires since the Neolithic period.

Human impact in lake shore environment: a study case at Lake Chalain

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Lake Chalain is a middle mountain lake (about 540m) located on the first plateau of the Jura Massif. Known since the beginning of the 20th century for its well preserved Neolithic dwellings, it was excavated for many years under the direction of Pierre Pétrequin. These archaeological sites are today listed at the UNESCO World Heritage. Research lead on lakeside sites has provided an important amount of archaeological and paleoenvironmental data evidencing settlements on the western shore of the lake, from the Middle Neolithic and the end of the Bronze Age (-4000 to -800 cal. BP). The impact on local environment of this occupation is well-known for the Neolithic period but very misled for later period, when settlements moved away from the shore. Furthermore, despite the numerous palaeoenvironmental studies carried out, very few palynological analysis were conducted outside the archaeological context. If these studies documents what man brought on sites, they do not really inform vegetation evolution around these sites. The main objective of this research is to realize a high temporal resolution study in order to comprehend environmental changes related human settlements and land use around the lake. To reach this objective, two cores were performed in the deep part of the lake in 2015 (one at the center of lake and one near the archaeological sites). The well-preserved state of sediments enables the detailed study of human impact on local and regional environment during the last seven millennia.

Modern vegetation, pollen and non-pollen palynomorphs relationships in Majorca and Minorca (Balearic Islands, Spain). A tool for a better understanding of human occupation dynamics and vegetation history in Holocene Mediterranean records

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Palynological works carried out in the Balearics since the 90's have revealed a deep vegetation change in the mid-Holocene and late-Holocene transition from a mesic-dominated vegetation to maquis garrigue formations more adapted to drier conditions [1-3]. Nevertheless, the comprehension of the vegetation composition and the role of human activities in this vegetation change are not well understood. This work have been carried out in the frame of the project HAR2015 67211-P (ArqueoUIB, Dir. M. Calvo) and the postdoctoral stage in the LPP (Modena, Dir. A.M. Mercuri) with the José Castillejo program.

We present the study of modern pollen and non-pollen palynomorphs carried out in 41 samples (moss a sediment samples) from different vegetation formations including maquis, garrigue, littoral vegetation, wetland vegetation, crop fields, box formations, pastures, etc. This research aims to analyse pollen and NPPs in relation to vegetation, grazing and agriculture to characterize main vegetation formations and human activities. Multivariate analysis and indices of plant-pollen fidelity and dispersibility are used to characterize the vegetation and pollen of the Gymnesics (Northern Balearic Islands) and evaluate their local and regional value.

The ongoing pollen counting shows a wide diversity of pollen taxa in all the studied samples, with a widespread *Pinus* pollen overrepresentation. For this reason, we have decided to attain a minimum pollen sum of 300 pollen grains excluding pine pollen. Other common taxa recorded in most of the samples are *Olea*, *Quercus* and *Pistacia*.

This study give us new insights on the pollen and NPP representation on the main vegetation communities and land uses of the northern Balearic Islands, allowing us to go deeper in the past cultural landscape interpretations.

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Announcing the beginning of the pollen season, does the alder also announce summer?

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During the year 2016, significant quantities of alder pollen were recorded at the station of Annecy in June. Many questions then arose: was it really alder pollens? Only this year? Only on this station? Only in France?

After verification, the pollen grains recorded were indeed alder pollens and peaks of various intensities were present over the last 5 years. Alder pollen, although present in the surrounding stations during this period, remain mainly in significant quantities for the pollen traps in Haute-Savoie area.

To compare with more Alpine stations, data from traps from Switzerland distributed across the country were analyzed (Geneva, Neuchâtel, Visp and Buchs). Each site showed a presence of alder pollen during June, but more surprisingly, the Buchs site showed significant quantities of alder pollen before the typical season of these trees. Alder pollens appear at the end of December for this trap.

The presence of this pollen type out of season was explained by other species of alder. The common alder present in France, *Alnus glutinosa* extends its pollination period from February to March. In the Alps, another species must wait for the snowmelt to begin its reproductive cycle. *Alnus viridis* prefers rocky environments in pre-alpine areas, its period of pollination lasts according to its location in April, but also in June and July. Humans play a decisive role in the implantation of vegetation in the city; stemming from a cross between Caucasian and Siberian species, the *Alnus spaethii* presents nice foliage and is resistant to pollution. But due to the appearance of a significant symptom on late December and January due to alder pollen¹, these trees were identified as the culprits and monitored to identify their early pollination period.

In the French Alpine territory, monitoring in June of pollens and symptomatology to alder pollens must intensify, but also a census of the presence of *Alnus spaethii* must be carried out.

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Airborne *Ambrosia* pollen counts help to appreciate the effectiveness of the fight against ragweed? The cases of the Lyon areas: 1982-2016, 1996-2016

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The East area of Lyon is the cradle of the *Ambrosia* spread in France. AFEDA settled in 1982 a network of aerobiological samplers (Cour, 1974) to obtain the *Ambrosia* pollen concentrations and help patients to take preventive care and have a good treatment. At the same time results should help to follow-up if the different methods implemented for fighting ragweed expansion are working well. The network is working yearly, between the weeks 31 and 39 (August-September), when the pollination takes place.

In this case we present the results obtained in the Lyon-Bron meteorological station, a semi-urbanized area representative for the Rhône department and running since 1982 and in the Lyon-Saint-Exupéry meteorological station, a rural place at 15km east (as the crow flies) of the previous one, representative for the Nord-Isère area and running since 1996.

The parameters under study are:

- Mean weekly pollen concentration (P/m^3), weeks 31 to 39, each year under study,
- Pollination Period Index (PPI), defined as the sum of the mean weekly *Ambrosia* pollen concentrations of the weeks 31 to 39,
- Number of weeks with Allergy Risk (NwAR, defined as weeks with *Ambrosia* pollen concentration higher than $5 P/m^3$),
- Number of weeks of the Debilitating Allergy Risk (NwDAR, defined as weeks with *Ambrosia* pollen concentrations higher than $100 P/m^3$).

In the past, Lyon-Saint-Exupéry was always more infested than the semi-urbanized Lyon-Bron, because ragweed is more frequent in the rural places than in the urbanized one, with values two or three times higher.

Results show that in Lyon-Bron (35 years period), PPI and NwDAR decrease significantly, while NwAR decrease non-significantly and that in Lyon-Saint-Exupéry (21 years period), PPI, NwDAR and NwAR decrease significantly

In conclusion, *Ambrosia* pollen counting technique used in Lyon-Bron(1982-2016) and in Lyon-Saint-Exupéry (1996-2016), shows, at the moment, a decrease in this kind of pollen greater in the rural site than in the semi-urbanized one, thus suggesting that the different methods used to fight ragweed seem to be better implemented in the rural site.

Allergy sufferers benefit in the two cases from the decrease in PPI and NwDAR and in NwAR, only in the rural site, *Ambrosia* fighting policies are well implemented but improving is still necessary.

Reproductive and aerobiological survey on natural and cultivated chestnut (*Castanea sativa* Mill.) populations in South Spain

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Chestnut (*Castanea sativa* Mill.) is a deciduous, monoecious species, abundant in forests and cultivated areas of Central and North Europe. This species is less frequent in South Europe, although some natural and cultivated populations can be found. Due to the partial anemophily of this species, it could be thought that the genetic selection of the cultivated varieties would favor pollen production, although there are no actual data in bibliography. To test this hypothesis, we performed a combined aerobiological, palynological and phenological study including natural and cultivated populations of a pilot area of Southern Spain.

8 sampling points have been monitored in the Sierra of Córdoba since 2015. Pollen grains were collected by an impact not volumetric sampler located in the forest and were compared with those obtained with the Hirst volumetric-type trap in the city of Cordoba (20 km far away). Phenophases analysis was defined in detail for this species within the framework of the general BBCH scale.

In average, chestnut populations presented the budburst in early April and leaf unfolding in mid-April. Flowering takes place in late May, and fruit ripening lasts until October. Leaf fall occurs in December. Airborne pollen data recorded at the field was 4709 pollen grains/cm² in 2015 (1st June week); in 2016 the peak of pollen was 18416 pg/cm², one week later. These results were in relation with temperature and rainfall. Comparing the two samplers, it was noticed that pollen season appeared longer at the field sampling point. Nevertheless field phenological data do not fully match with the urban sampler season, which would indicate that pollen records at Cordoba city included long and medium range transport.

Regarding pollen production per flower, it was twofold higher in the cultivated trees for both 2015 and 2016. Nevertheless, pollen production per individual was higher in the natural population than in cultivated trees, due to the bigger size of the first. A yearly difference was also detected: in 2015, natural chestnuts produced an average of 1,592,838,071 pollen grains/tree, whereas cultivated individuals 882,649,515 pollen grains/tree; however, in 2016, natural chestnut produced 3,183,650,800 pollen grains/tree and cultivated individuals 1,997,052,805 pollen grains/tree. These results would explain the aerobiological yearly differences.

Finally, fruit production estimation was carried out to compare it between years and areas. Although the highest pollen production took place in 2016, the number of fruits was lower in that year compared to 2015. This phenomenon occurred in both cultivated and natural populations. The percentage of fertilized flowers that reached the ripening stage was on average 73% in 2015 and 90% in 2016. For most of the individuals, the southern orientation coincided with the highest fruit production.

Our results show that cultivated varieties produce more pollen per flower. However, this was not expressed at the level of individual, due to the bigger size of trees in the natural population. Higher pollen production was not associated with higher fruit production.

Pollen production and geolocation of *Casuarina cunninghamiana*

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Casuarina cunninghamiana is a monoecious and wind pollinated tree often used as ornamental in urban green spaces. Pollination takes place in autumn and high amount of airborne pollen are shed close the trees. The aim of this work is to assess total pollen production per tree and to analyze source location in relation to airborne pollen records.

Aerobiological sampling was carried out in Badajoz (SW Spain) from 1993-2016 using a Hirst volumetric sampler. Trees were geo-localized in an area of 1 km around the spore trap. Pollen production was studied in three male trees. On each tree, main branches were counted, 10 of this primary branches were selected to count number of secondary branches, the same with the tertiary and quaternary branches. Quaternary branches bear the flowers at the tip, they are green and included eight, on average, verticillated flower, each one with one stamen. In 25 quaternary branches the male inflorescence was measured and the number of verticils per cm were calculated. 10 stamens for each tree were selected and the number of pollen grains counted.

Only 4 trees were located in the studied area, 2 male and 2 female, 200-250 m close to the spore trap and West forward. Average daily airborne pollen recorded for the period studied was always below 8 pollen grains m⁻³, maximum daily concentration was 68 pollen grains m⁻³ (2/10/2015). Pollen appeared from early August up to early December, mainly concentrated in October. Table 1 includes the values obtained per tree regarding height, total main or primary branches, average number of branches of second, third and fourth order. In the fourth order branches the average number of verticils of flowers along the inflorescences per cm was 12.7, 12.5, 11.5, respectively, in the three trees. The number of pollen grains per stamens (male flower) was on average 6684.5.

Total pollen production per tree in *Casuarina cunninghamiana* was 2.6-9.8x10¹³, range that seems to be related to the height of the tree. Those values represent ones of the highest found in angiosperms. Nevertheless, the amount of airborne pollen recorded was low, this is because pollen sources are few and they are far away from the pollen station.

Table 1. Pollen production in *Casuarina cunninghamiana* (SD Standar Deviation)

Tree	height	branch 1		branch 2		branch 3		branch 4		verticils		Total	Total pollen
	meters	total	mean	SD	mean	SD	mean	SD	mean	SD	stamens	per tree	
1	4.9	65.0	10.1	3.0	47.5	39.3	195.4	44.5	42.3	7.1	1.5x10 ¹⁰	9.8x10 ¹³	
2	4.4	50.0	9.1	3.1	49.2	10.6	186.2	111.5	26.0	8.0	7.0 x10 ⁰⁹	4.7x10 ¹³	
3	3.3	18.0	6.9	2.1	43.3	19.1	154.2	53.0	50.4	11.7	3.9 x10 ⁰⁹	2.6x10 ¹³	

Influence of climate on chronology and intensity of *Olea europaea* L. pollen season in Tunisia

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The olive (*Olea europaea* L.) is one of the most widely grown tree-crop species in the Mediterranean basin, being well adapted to its mild climate. Tunisia is the world's third largest olive producer, with the second largest surface area after the European Union. Knowledge of the main biological and climate factors influencing the Pollen Index (PI) is becoming increasingly necessary by the fact that several previous studies have shown the strong correlation between the final olive harvest and the PI and thus ensures optimized, effective, private crop management. It is also of great value to public agricultural institutions for planning government subsidies. The aim of the present study was to focus on the effect of phenol-climatic factors on the pollen season in terms of intensity (PI) and chronology of the main olive flowering phenological phases (start and pollinic peak) within the five olive growing regions of Tunisia, which covered the different bioclimatic stages of the country from the extreme South with arid and dry climate to the extreme North with humid and sub-humid climate. The effect of studied parameters was evaluated using partial least-squares regression (PLs), considering both the flowering start and full-flowering dates as dependent variables. Mornag, Jemmel, Menzel Mhiri, Chaal, and Zarzis airborne pollen concentrations were monitored over the period 1993–2016 using a Cour trap. The percentages of variance explained by the full-flowering parameter were greater than this explained by the flowering start parameter. Moreover, given the time lag from the five olive growing areas in the main olive flowering dates, the regional full-flowering parameters are proposed as the most useful to improve the knowledge of the influence of climate on the olive tree floral phenology and pollen intensity. The meteorological parameters related to the previous autumn (rainfall in terms of intensity and frequency) and both the winter (rainfall and Chilling hours or units) and the early spring seasons (rainfall and Heat accumulation), and above all the temperatures, regulate the reproductive phenology and the pollinic season of olive trees in the Tunisian area.

The phenol-climatic data can be used to know the reproductive response of the olive tree in a given climatic context through its phenological and pollination behavior, which are faithful reflections of the climatic conditions of such olive growing area.

Pollen trends in different towns of Italy

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Recent studies show how global climate changes influence the phenology of plants (Albertine *et al.* 2014, Ziello *et al.* 2012). Using the data from 8 Italian aerobiological monitoring stations, over the period 1985-2010, we examine whether they show any trend and if this is related with temperature.

Pollen data (pollen grains/m³) were obtained from the stations L'Aquila-AQ, Bologna-BO, Messina-ME, Napoli-NA, Roma-RM, Sassari-SS, San Michele a/A-TN, Torino-TO and were analysed using standard methods. We considered 8 taxa (*Carpinus/Ostrya*, *Castanea*, *Corylus*, Cupressaceae/Taxaceae, *Olea*, Poaceae, *Quercus*, Urticaceae) and explored pollen trends on the basis of phenological (pollen season start date and length) and production indicators (API - annual pollen index) (Jäger *et al.* 1996). For the winter taxa (Cupressaceae/Taxaceae and *Corylus*), we examined the period from 1st November to 31th October of the following year. For the meteorological data, we used the monthly average temperature (Tmed °C). The normality of distribution of all data was examined using the Shapiro-Wilk test. To evaluate the significance of trends, the linear regression analysis Reduced Major Axis (RMA) was applied. Moreover, to determine the degree of correlation between two variables, the Spearman correlation test was used (PAST and 21.0 IBM-SPSS Statistics Software).

Significance (p=0,05) of the linear regression is found for all indicators: (i) for the start day of the pollen season (early for *Carpinus/Ostrya* in AQ, *Castanea* in NA, *Corylus* in ME and RM, *Olea* in BO, Poaceae in RM, *Quercus* in NA and TO; late for *Carpinus/Ostrya* in RM, *Corylus* in AQ, NA, SS and TO, *Olea* in RM and SS, *Quercus* in RM), (ii) for the season length (increasing for *Corylus* in RM, Cupressaceae/Taxaceae in AQ and SS, Poaceae in BO and TN, *Quercus* in TO, Urticaceae in BO; decreasing for *Castanea* in ME and SS, *Quercus* in SS), and (iii) for API (rising for Cupressaceae/Taxaceae in SS and TN, Poaceae in SS; decreasing for *Castanea* in SS, *Corylus* in TO, Cupressaceae/Taxaceae in TO, *Olea* in AQ, Poaceae in ME, NA, RM, TN, and TO, Urticaceae in NA). The linear regression for temperature is significant (p=0,05) only in Napoli (decreasing). The correlation between pollen indicators and temperature is significant for the start day of the pollen season (for *Castanea* in BO and ME, *Corylus* in BO, Cupressaceae/Taxaceae in TN) and for API (for *Corylus* in SS, Poaceae in NA).

In general, significant relationships for the API show decreasing trends, while the starting day of the pollen season occurs earlier or later without presenting significant correlations with temperature: there are no significant increases in temperature or in the pollen load. The API decline of arboreal taxa may be attributed to the different distribution of precipitation.

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Plane tree pollination phenology and airborne pollen records

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Plane trees (*Platanus* species) are one of the more frequent ornamental trees used in urban environments. Airborne pollen records should reflect pollination phenology and pollen source distribution in relation with the wind. This work aims to assess the relationship between the airborne pollen sampled from plane trees with its flowering phenology and tree location around pollen sampler.

Aerobiological sampling was carried out in Badajoz (SW Spain) in 2016 using Hirst volumetric spore trap. Meteorological station close to the spore trap (2 m) was used. Trees were geo-localized in the urban area. Pollination phenology was studied in 10 specimens, five in the surrounding of pollen station and five 3 km apart, with a frequency of 3-4 days on average. The period studied was March-June. For phenology BBCH methodology was used, branches around the tree top up to 2 m height were tested if pollen was shedding.

Only 5 plane trees were located in a circular area of 1 km around spore trap, all of them south forwards within 150 m. Plane trees from the rest of the urban area were located between W and SE. Pollen grains were recorded along 55 days (15/3-8/5), with an average pollen concentration of 16 pollen grains m⁻³ (pollen index of 894). Pollen peak was reached 30/3 with 142 pollen grains m⁻³, only four days overcome 50 pollen grains m⁻³. Rain was present in 22 days with a total of 51.2 mm. Winds from the SW were predominant during the days with higher pollen concentrations. Phenology observation showed a peak of pollination 9 days after pollen peak from the 5 trees studied in the close area of the pollen trap and a peak of 12 days after from the trees studied 3 km apart. Winds from the NW were predominant when phenological pollination peaks were observed. Only a 5.5% of pollen recorded was outside of the phenological period observed, along over 3 days before and 16 days after.

Peaks of phenological observations from plane pollination at the two areas studied were of 3 days. That result showed a high homogeneity in the pollination behaviour of plane trees, mainly as a consequence of their homogeneous genetic background. Results showed a great correspondence between phenological period and airborne pollen record period. Nevertheless, peaks of pollen were reached in advance with respect to phenological peaks. We suggest two causes to explain this difference. Close pollen sources and opposite wind direction decreased pollen records and phenological observation performed at the bottom branches of the trees masked that top branches were shedding pollen in advance.

A new allergen family involved in food pollen associated syndrome: snakin/gibberellin regulated proteins

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The cypress pollinosis affects nearly 40% of Mediterranean allergic people. Several species of cypress are responsible and especially the Italian cypress, *Cupressus sempervirens* (Cups). Four groups of allergens are described and listed in the IUIS allergen databank. The group 1 is a major allergen and corresponds to a pectate lyase; the group 2 is a polygalacturonase, group 3, a thaumatin-like protein and group 4 a calcium binding protein. Other allergens were reported and especially in Cups pollen where a basic 14kDa unidentified allergen (BP14) is recognized by 25 to 40% of cypress pollen allergic patients.

BP14 characterization was performed by immunoproteomics analysis, i.e. IgE western blotting using cypress pollen allergic patient's sera followed by mass spectrometry (LC/MS/MS).

MS analysis using chymotrypsin identified in BP14 a peptide also found in the family of protein snakin/gibberellin-regulated protein (GRP). The snakin-1, an anti-microbial peptide of potato, produced as a 63 amino-acid recombinant protein (homologous to the C-terminal part of GRP), is recognized by IgE from cypress pollen allergic patients with IgE to BP14. This IgE reactivity disappears after reduction of disulfide bridges and is inhibited by a cypress pollen extract. IgE reactivity to BP14 is however barely inhibited by the recombinant potato snakin-1

BP14 exhibits a molecular mass closer to GRP than to snakin and the absence or very low inhibition of the IgE reactivity to BP14 with snakin may be explained by peptidic IgE epitopes on the N-terminal part of BP14. The potato snakin-1 share 83% sequence identity with peamaclein, the peach allergen Pru p 7. These results might explain the peach/cypress and citrus/cypress syndromes described and point out BP14 as the cross reactive allergen. This is the first description of snakin/GRP protein allergenic in pollen grains.

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Recovery and Molecular Analysis of Olive Pollen from Sedimentary Samples

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Since its appearance, archeopalynology has applied methods based on physic-chemical attacks and differential floating coefficients in order to separate and concentrate sedimentary pollen grains. Despite its potential, molecular techniques have not become a common use tool in this area yet. Olive tree (*O. europaea* L.) has gathered enough attention for its commercial, nutritional and allergenic interests to generate the identification of protein markers like the Ole e 1 allergen, and a wide molecular database of SSR markers that would allow us to detect its presence in sedimentary samples. The main goal of the present work is the optimization of pollen recuperation procedures based on size discrimination, enabling the extraction of well-preserved molecules that could be analysed by molecular techniques such as immunoassays and PCR amplifications..

1) Filtrations of simulated sedimentary samples through sieves. Detection of protein markers by means of ELISA, Western blotting and Coomassie staining. Extraction of DNA from sedimentary samples and PCR amplifications using species-specific microsatellite flanking primers. 2) Finally, micromanipulation has been assayed as an alternative to filtration.

Oppositely to the ability of ELISA methods to detect protein markers, Western blotting and Coomassie staining lack enough sensibility to achieve this detection. We have been able to extract DNA from the sedimentary filtrates, and use such DNA for PCR amplifications of microsatellite markers. Remarkably, successful amplification of pollen DNA occurs in the 100µm sieve extract, and not in the most pollen-retaining sieves. Finally, we have successfully accomplished pollen grain isolation from a suspension by means of micromanipulation at light microscopy.

At least two methods for isolation and purification of pollen grains from sedimentary sources have been established. Pollen fractions obtained are prone to further analysis in order to detect and quantify biomolecules of interest for physiological and systematic purposes. Putative applications of these methods and future developments are widely discussed in this work.

Identification and functional annotation of genes differentially expressed in the reproductive tissues of the olive tree (*Olea europaea* L.) through the generation of subtractive libraries

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The olive tree represents a crop of high socio-economical importance in the Mediterranean area. Sexual reproduction in this plant is an essential process, which determines the yield. Successful fertilization is mainly favored and sometimes needed of the presence of pollen grains from a different cultivar as the olive seizes a self-incompatibility system, likely of the gametophytic type [1]. The purpose of the present study was to identify key gene products involved in the function of olive pollen and pistil, in order to help elucidating the events and signaling processes, which happen during the courtship, pollen grain germination, and fertilization in olive.

The use of subtractive SSH libraries constructed using one specific stage of the pistil development with germinating pollen grains on the one hand, and on the other hand mature pollen grains, may help to reveal the specific transcripts involved in the cited events. Such libraries have also been created by subtracting vegetative mRNAs (from leaves), in order to identify reproductive sequences only.

A variety of transcripts have been identified in the mature pollen grains and in the pistil at the receptive stage. Among them, those related to defense, transport and oxidative metabolism are highlighted mainly in the pistil libraries, where transcripts related to stress, and response to biotic and abiotic stimulus have a prominent position. Extensive lists containing information as regard to the specific transcripts determined for each stage and tissue are provided, as well as functional classifications of these gene products. Moreover, the unique presence of these transcripts has been validated by means of PCR approaches.

The construction of SSH libraries using pistil and pollen allowed the identification of transcripts with important roles in stigma physiology, considering the high interaction between male-female counterparts. The functions of many of the transcripts obtained are intimately related, and most of them are of pivotal importance in defense, pollen-stigma interaction and signaling.

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From inside to outside: cyto-morphological rearrangements underlying spermine involvement in the apical growth of the pollen tube

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Pollen tube growth is matter of study because of its enormous importance to food production and because it is a useful system for elucidating issues of growth and development. Moreover, it can be considered as a single growing cell and it is extremely sensitive to external stimuli. All these features make pollen grains very useful models in plant biology and physiology.

Pollen tube growth is a rapid process restricted to the only tip region. Many factors cooperate to allow this apical growth, creating an intricate signalling network. The continuous rebuilding of the cell wall and apical migration of the cytoplasm sustained by cytoskeleton re-organization are the most important driving forces needed for growth, but many other factors are involved in this process, among which emerge polyamines (PAs). PAs are small polycations that are essential during pollen tube emergence and that support the apical growth at physiological concentration.

The aim of the study was to investigate factors affecting apical growth, among which the effect of the natural PA spermine (Spm) on *Pyrus communis* pollen tube; PAs effect was researched in order to shed light about how several factors and processes are interconnected in the apical growth of the pollen tube.

A broad panel of techniques was used in order to investigate the involvement of Spm during pollen tube growth. We mostly used microscopy techniques but also biochemical assays. Moreover, we report here, for the first time in germinating pollen, the application of the TAT-aequorin technique to accurately measure intracellular calcium fluxes in germinating pollen.

The effects of Spm concerned, at least in part, its ability to modulate ROS concentration by modulating the activity of ROS producing and scavenging enzymes. The tip-focused cytosolic Ca²⁺-gradient, which is essential for tip growth and orientation, was also altered by Spm supply in the germination medium and this caused drastic reorganizations in the actin cytoskeleton leading to the formation of thicker bundles, causing also alteration in the vesicles trafficking. These alterations in the vesicles trafficking had as consequence a targeting of newly synthesized cell wall material in a zone not delimited only at the extreme apex and led to a swelling of the apex that grew giving rise to a pollen tube with enlarged diameter.

The cyto-morphological effects induced by Spm not only highlighted the plausible involvement of Spm during the tip growth process of pollen tube, but ultimately also shed light on the relationships among several factors essential for tip growth.

Pollen morphology and reproductive biology of *Omphalodes brassicifolia* (Lag.) Sweet., an endangered Iberian endemism

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Omphalodes brassicifolia (Lag.) Sweet., belonging to the Boraginaceae family, is an endemic species of the Iberian Central System, which can be found in two Spanish regions: Castilla y León and Extremadura. The following work aims to provide information on the pollen grain morphology and the strategies of reproductive biology presented by the species.

The samples of dry pollen coming from 4 populations (2 from Castilla y León, 2 from Extremadura) were acetolysed according to Erdtman's method (1960) and observed by light microscope. Pollen grains were prepared in glycerine jelly and measured (polar axis length -P-, equatorial diameter -E-, P/E ratio) using a Leica software LAS V 3.8). These results were analysed making a one-way analysis of variance (ANOVA) among the populations. The reproductive biology was studied by means of hand pollination techniques and four mating systems: agamospermy, spontaneous autogamy, obligated autogamy and hand cross-pollination. Differences between treatments were analysed by Generalized Linear Models (GLM) using a Logit function as link function. All analyses were performed using PASW Statistics version 22.

The size and shape of the 6-zono-heterocolpate pollen grains in the studied populations (Extremadura: P= 6.87 – 10.16; E= 3.59 – 5.02; P: E= 1.55 – 2.64; Castilla y León: P= 7.53 – 9.75; E= 3.32 – 4.90; P:E= 1.75 – 2.71) revealed no significant differences using one-way ANOVA. These results coincide with those obtained by Coutinho *et al.* (2010). The reproductive biology assay displayed lower fecundation percentages with agamospermy and autogamy treatments than the results appeared in hand pollination flowers. The GLM analysis showed significant differences between all the treatments (p values < .05) with hand cross-pollination and no differences (p value = 1) between agamospermy and autogamy used systems.

There were no significant differences in their pollen grains measurements. Hand pollination was the most effective mating treatment, what could indicate that cross-pollination should be the preferred mating system of this species. This fact may be reinforced with the limited viable seeds produced by agamospermy and unforced autogamy indicating a lack of spontaneous self-pollination as reported in other endangered Iberian species (Amat *et al.*, 2011).

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Augmented pollen superoxide dismutase activity induced by NO₂ and O₃

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Superoxide dismutase (SOD), a known enzyme in several species and recently described as candidate grass allergen, that catalyzes the dismutation of toxic superoxide radicals to molecular oxygen and hydrogen peroxide, working against oxidative stress in plants. Airborne pollen during its transport becomes in contact with a variety of atmospheric chemicals, including common air pollutants O₃ and NO₂. Besides, their direct deleterious action in respiratory air ways, exposure to these pollutants, either independently or in combination, may change the pollen biochemical properties thus its allergenicity. Nonetheless, species-specific action of these pollutants or their synergic effects in pollen is essentially unknown.

The aim of this research was to study the effects of O₃, NO₂ and the mixture of both pollutants on SOD activity of *Dactylis glomerata* pollen, a proposed grass allergen.

Pollen samples were *in vitro* exposed to O₃, NO₂ and O₃+NO₂ in an environmental chamber system during 6 hrs and concentrations around the ambient levels. A blank pollen sample, subjected to the same procedure but not exposed to the gases was used as control.

Pollen extracts from unexposed (Control) or exposed to pollutants were prepared in phosphate buffered saline (PBS) and frozen until analyses. Total SOD activity was measured following riboflavin-induced reduction of nitro blue tetrazolium (NBT) for 40 min, and the absorbance (A) was measured at 560 nm every 5 min (Beauchamp & Fridovich, 1971), triggered with cool white fluorescent light (30 μmol m⁻² s⁻¹). Enzymatic activity (U/mg protein) was determined according to Asada et al. (Asada, Takahashi, & Nagate, 1974).

Pollen exposure to O₃ alone did not significantly affect SOD activity while exposure to NO₂ induced a 50% SOD activity increase (150±25%). When mixed together (O₃+NO₂) the SOD activity was higher (200±40%) compared to control and slightly but not significantly higher when compared to NO₂ alone. These results show that exposure to NO₂ induced a significant increase on SOD activity and suggest that, although O₃ alone did not induce any change, it may exert a synergic action on the effect of NO₂, contributing to amplify the response.

These results suggest that NO₂ stimulates pollen antioxidant defenses while O₃ does not, characterized at least by an augmented SOD activity, an allergen.

Consequently, pollen exposure to NO₂ can induce an increase in the allergenicity and directly correlated with the enhancement of respiratory diseases.

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Stable carbon isotope measurements on *Cedrus atlantica* pollen: first steps towards an independent drought stress proxy

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The measurement of stable isotopes in pollen remains an under-exploited approach in Quaternary palynology. In Mediterranean regions, carbon isotopic composition ($\delta^{13}\text{C}$) of plant tissues may be strongly influenced by physiological responses to drought stress and may therefore provide a record of past hydroclimate impacts. Here, we evaluate the relationship between the $\delta^{13}\text{C}$ of pollen, leaf and stem tissue for the Atlas cedar (*Cedrus atlantica*), an autumn-pollinating conifer species endemic to Northwest Africa that is well represented in fossil pollen records from the Maghreb. We aim to determine whether the $\delta^{13}\text{C}$ of *C. atlantica* pollen is a reliable indicator of moisture availability, and thus could be used as a palaeoenvironmental proxy.

Pollen, leaf and stem tissue was collected from *C. atlantica* trees from the native distribution range in Morocco, as well as arboretum specimens, representing a long environmental aridity gradient. Measurements of $\delta^{13}\text{C}$ were made for paired measurements on leaf, stem and pollen tissue (n=30) and a large dataset of pollen samples (n=93). Values of $\delta^{13}\text{C}$ were converted to carbon isotope discrimination ($\Delta^{13}\text{C}$) to reflect fractionation effects at the plant level, taking into account the isotopic composition of the atmosphere.

Values of $\delta^{13}\text{C}$ for *C. atlantica* pollen range from -23‰ to -30‰ (average -25.1‰), with significant intra- and inter-site variability. Paired samples confirm that the isotopic composition of pollen is strongly related to leaf and stem tissues. We show significant relationships between $\Delta^{13}\text{C}$ and mean annual precipitation ($R^2 = 0.50$, $p < 0.001$), summer precipitation ($R^2 = 0.63$, $p < 0.001$) and scPDSI (self-calibrating Palmer Drought Severity Index) ($R^2 = 0.86$, $p < 0.001$).

Our findings support the use of pollen as a reliable material for carbon isotopic study. For *C. atlantica*, our findings emphasize a combined role of precipitation and temperature on moisture availability signals captured in pollen $\Delta^{13}\text{C}$, biased towards the summer season during which the pollen is formed. In common with tree-ring studies on *Pinus halepensis* and *Quercus ilex*, our study indicates that drought stress signals are reflected in patterns of carbon isotope discrimination in several major Mediterranean forest trees. In Mediterranean environments, this signal can provide an important way to test for past climatic impacts on physiological processes that can help resolve debates about sensitive vs. buffered environmental responses and climate vs. human impact in past vegetation changes. Application of the approach to a fossil case-study from lake sediments in the Middle Atlas, Morocco, is in progress.

Germination of pollen grains in the esophagus of individuals with eosinophilic esophagitis (EoE)

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Eosinophilic esophagitis (EoE) is an emerging, severe inflammatory pathology of immunological origin. EoE is characterized by esophageal dysfunction and, histologically, by eosinophilic inflammation. About 85% of patients with EoE present seasonal exacerbations, as well as symptoms of rhino-conjunctivitis, atopic dermatitis and asthma. The esophageal and bronchial mucosa share the same embryonic origin, therefore, they could present similar inflammatory mechanisms against environmental and food allergenic stimuli. The aim of this work is to demonstrate the possible pathogenic role of environmental allergens in eosinophilic esophagitis, through anatomo-pathological studies.

Microscopic analyzes of esophageal biopsies of 129 patients with EoE and controls were performed in order to verify the presence of callose (very abundant in pollen tubes) and eosinophils in the esophagus. For callose detection, histological sections were stained with sirofluor fluorochrome. Esophageal mucosal sections were also analyzed by SEM, in order to detect the presence of pollen or spores. Finally, allergens involved in EoE were identified through Component Resolved Diagnosis (CRD)

After clinical and anatomo-pathological diagnosis of the patients, comorbidity between eosinophilic esophagitis (EoE) and pollen hypersensitivity was evident. Pollen allergens were detected in 87.6% of patients with EoE. The predominant allergens were grasses group 1 (55%), followed by Art v 3 (11.3%) and other lipid transfer proteins of peach and mugwort, hazelnuts and walnuts.

Callose was found in 65.6% of the biopsies of patients positive for pollen allergens and not in the controls. We observed pollen tubes surrounded by eosinophils in the proximal and middle esophageal mucosa, resulting in microabscesses. Eosinophils act as if they are responding to parasitic infections, drug reactions, or neoplasms.

In patients with eosinophilic esophagitis (EoE) we have been able to demonstrate a high incidence of sensitization to pollen found in the nasopharyngeal mucosa and that could be swallowed. Alteration of the mucosal barrier due to desmoglein or a weakness of the innate immune response could be the cause of the penetration of pollen grains into the tissues of the esophagus. Subsequent germination of pollen and release of highly allergenic molecules resistant to digestion such as LTPs and expansins of group 1 of grasses could be responsible for the increase of the symptoms in these patients during the periods of greater pollination.

Do cats (*Felis catus domestica*) suffer from environmental allergies

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The symptoms of feline asthma are an increasingly frequent reason for consultation in daily practice. In USA, one percent or so of the domestic feline population suffer from acute or chronic asthma. Environmental allergens in human allergic patients are mainly responsible for rhinitis and asthma, whereas in cats they predominantly cause rhinitis, asthma and dermatitis. Cats have been used as animal models for human asthma.

The purpose of this study is to review the prevalence of environmental allergies in cats.

During the years 2015 and 2016, 87 serological samples of cats with allergy symptoms from Spain and Portugal were analyzed.

We use a serological assay for the detection of environmental allergen-specific IgE in cat serum using the recombinant alpha chain of the high affinity mast cell receptor of IgE (Fc-ε-R1-α chain) (ALLERCEPT[®], Mediterranean panel, by HESKA). The ALLERCEPT assay is an ELISA based test. A score of 150 Espectrofotometry Absorbance units tells with 99% confidence that there is specific IgE in the sample.

96% of the samples were positive, of which 74% were polysensitized cats. Most cats (90%) were sensitized to dust mites and storage mites. 23% were sensitized to weed pollen (*Rumex crispus*, *Plantago lanceolata*, *Artemisia vulgaris*, *Chenopodium album*, *Parietaria officinalis*, *Taraxacum vulgare*, *Urtica dioica*, *Ambrosia artemisifolia* and *Ambrosia elatior*).

Almost 21% were sensitized to tree pollen, mainly pollen of *Platanus* (15%), *Olea europaea* (14%) and *Ligustrum vulgare* (11%).

Grasses (*Phleum pretense*, *Lolium perenne* and *Cynodon dactylon*) account for 19.5% of the positive.

No cat tested positive for fungal allergens (*Aspergillus fumigatus*, *Alternaria alternata* and *Penicillium notatum*).

Environmental allergens that cause human disease are relevant for our domestic cats.

The treatment of choice is to avoid contact with allergens.

The only etiologic treatment is specific immunotherapy according to the levels of IgE detected.

Pollen allergies in the dog (*Canis familiaris*)

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The number of allergic dogs has grown dramatically over the past few years.

Both humans and their most important domestic animals, their dogs, harbor IgE and a similar IgE receptor repertoire and expression pattern. The same cell types are also involved in the triggering or regulation of allergies, such as mast cells, eosinophils or T-regulatory cells.

Pollen of various species most often causes allergic rhinitis in human patients, whereas in dogs it elicits predominantly dermatological lesions (canine atopic dermatitis), a disease associated with high specific IgE against environmental allergens.

We aim to know the specific IgE in allergic dogs for the etiologic treatment.

1363 serological samples of dogs with allergy symptoms from Spain (including the Balearic Islands and the Canary Islands) and Portugal were analyzed during the years 2014, 2015 and 2016.

We use a serological assay for the detection of environmental allergen-specific IgE in dog serum using the recombinant alpha chain of the high affinity mast cell receptor of IgE (Fc-ε-R1-α chain) (ALLERCEPT[®], Mediterranean panel, by HESKA). The ALLERCEPT assay is an ELISA based test, where the cut-off point is 150 EA units.

98% of the samples were positive, of which 90% were polysensitized dogs, the majority of which were dust mites and storage mites (predominantly *Dermatophagoides farinae* and *Tyrophagus putrescentiae*).

27% of dogs are sensitized to grasses (*Phleum pratense*, *Lolium perenne* or *Cynodon dactylon*).

In the pollen group of the weeds stand out *Rumex crispus* (28%), *Plantago lanceolata* (23%), *Chenopodium album* (20%) and *Ambrosia sp.* (11%), whereas in the pollen group of the trees predominate *Olea europaea* (15%), *Ligustrum vulgare* (11%), *Platanus sp.* (10%) and *Betula sp.* (10%).

Allergenic pollens that cause human disease are relevant for our domestic dogs.

As in humans, the avoidance of pollen allergens using the information from the Aerobiological Networks, would decrease the symptoms of allergic dogs.

In view of the positive results obtained, the administration of a specific immunotherapy, the only etiologic treatment, is recommended.

Allergens more frequently involved in allergy of horses

(*Equus caballus domesticus*)

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Horses do develop respiratory and skin diseases (urticaria, atopic eczema) due to allergens.

Pollen allergens are mainly responsible in horse recurrent urticaria, pruritic dermatitis and recurrent airway obstruction (not called asthma).

Diagnosis of hypersensitivity in horses can be made based on clinical symptoms, ruling out other differential diagnoses and by serology with specific IgE diagnosis and intradermal testing.

The aim of this study is to know the prevalence of environmental allergies in horses.

20 serological samples of horses with allergy symptoms from Spain and Portugal were analyzed, during the years 2015 and 2016. We use a serological assay for the detection of environmental allergen-specific IgE in horse serum using the recombinant alpha chain of the high affinity mast cell receptor of IgE (Fc-ε-R1-α chain) (ALLERCEPT® by HESKA). The antigens used were extracts from 24 sources of allergens (Equine mediterranean panel).

ALLERCEPT is based on ELISA. A score of 150 Espectrofotometry Absorbance units tells with 99% confidence that there is specific IgE in the sample.

65% of the samples were positive, of which only 25% were monosensitized horses.

Most horses (45%) were sensitized to storage mites (*Tyrophagus putrescentiae*). Dust mites (*Dermatophagoides farinae* y *Dermatophagoides pteronyssimus*) account for 25% of the positive, while *Rumex crispus* account for 35%; 25% were sensitized to grasses (*Dactylis glomerata*, *Phleum pratense* or *Secale cereale*); and 15% of the horses were sensitized to Birch (*Betula spp.*).

No horse tested positive for fungal allergens (*Alternaria alternata*, *Cladosporium herbarum*, *Aspergillus fumigatus*, *Penicillium notatum*, *Helminthosporium halodes*, *Epicoccum nigrum*, *Epicoccum purpurascens*, *Fusarium culmorum*, *Ustilago tritici* and *Rhizopus nigricans*).

Environmental allergens that cause human disease are relevant for our domestic horses.

The treatment of choice is to avoid contact with allergens.

Allergen immunotherapy is a reliable instrument to reduce clinical symptoms in horses.

Morphology and polynical viability of some generes of the araceae family

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Araceae is one of the basal families of Angiosperms (including the subfamilies Aroideae, Lasoideae, Monsteroideae and Pothoideae among others), its pollen is mostly aperturate and in monads, shows a great diversity in the morphology, ornamentation and stratification of exine. Some genera have a thick layer on the ektexine that seems to be a unique feature in some members of Aroideae. It has been verified that the modifications of the wall of exine observed in these taxa is due to the adaptations to the environment and to the mechanisms of pollination, although they do not influence the germination of the pollen, apparently do not favor the fossilization of the same. For this reason, the objective of this research was to characterize the pollen grain and determine the viability of the genus *Anthurium*, *Dieffenbachia*, *Dracontium*, *Monstera*, *Spathiphyllum* and *Xanthosoma*.

The pollinic material was examined and photographed at 40X with a Primostar + ERL 5 Carl Zeiss clear field microscope, to determine the pollen characteristics: shape, size, number and position of apertures, exine stratification and ornamentation. For the viability analysis, the 2% acetocarmin glycerol technique was used, determining as viable pollen those that presented intense red coloration due to their protoplasmic content and not feasible the translucent ones.

The results indicate that *Anthurium*, *Dieffenbachia*, *Monstera* have pollen grains (10 -15 µm) apolar, spheroidal, apertured, porous, with psilate, foveolate or reticulate ornamentation; *Dracontium*, has a heteropolar pollen of 10 -15 µm, monosulcate and *Spathiphyllum* possesses pollen inaperturate and polypllicated monade, only the genus *Xanthosoma* has pollen in tetrad tetrahedral, inaperturate of 10 -15 µm, with psilate ornamentation and with a transparent and thick layer on ektexine. The genera with the lowest percentages of viability were: *Dracontium* (23%), *Xanthosoma* (46%), *Anthurium* and *Spathiphyllum* (49%); however, *Dieffenbachia* (with 90% viable pollen) and *Monstera* (96%), evidenced an intense red coloration in the protoplasmatic content in almost all pollen grains.

In the family primitive characters persist (pollen sulcate in *Dracontium*) but also derived characters as the transparent layer on ektexine, observed *Xanthosoma*. On the other hand, in genera that exhibit a greater viability potential, they should be complemented with studies that evaluate the germination capacity of the species, in order to confirm if this favorable percentage persists, and is beneficial for the reproduction of the species, many they are of ornamental and/or food importance in Colombia.

Regression tree model to predict daily levels of airborne Urticaceae pollen

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Urticaceae family comprises herbs and small shrubs mostly represented in Spain by two genera: *Urtica* and *Parietaria*. Both taxa are wind-pollinated, commonly found in the countryside and urban areas, and grow on walls and soils rich in nitrogen. Urticaceae pollen is present in the air throughout the year, with the highest concentrations between March and November¹. This taxon is causing about 16% of the pollinosis in Spain; 23% in the Mediterranean Spanish region². Our aim is to establish regression tree models to predict the presence of airborne Urticaceae pollen and the exceedance of concentration thresholds.

Our study is based on data from years 1995-2014 of eight aerobiological monitoring stations in Catalonia (NE Spain). Daily maximum and minimum temperatures and their squares; precipitation and the occurrence of rainfall in the previous one, two and three days; and the relative humidity are used as predictors. The period 1995-2011 are used to establish four regression trees applied to predict the exceedance of thresholds 1, 4, 8 and 12 pollen grains/m³ and data from 2012-2014 are used to validate the models through specificity and sensibility parameters.

Maximum temperature was the most influencing parameter on Urticaceae pollen concentration, with an average critical value of 17°C, followed by the minimum temperature (11°C) and relative humidity (70%). The validation shows satisfactory results, with specificity values between 42 and 88% and sensitivity ranging between 49 and 87%. The first model (exceedance of 1 pollen/m³) shows the highest sensitivity value, while the exceedance of 12 pollen/m³ shows the highest specificity value.

Regression trees show reliable results to model the presence or absence of airborne Urticaceae pollen, as well as the exceedance of the concentrations of 4, 8 and 12 pollen/m³, thus it is a good mechanism to establish alerts of this pollen type in the air.

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Source-receptor exchange patterns of pollen deposition over Southern Europe

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A multi-decadal modelling study highlights the stable patterns in olive and grass pollen dispersion over Mediterranean region and adjacent countries, for the period 1980-2016. The simulations are performed with the chemical transport model SILAM. The phenological part of the model includes the descriptions of biological processes of the pollen initiation, maturation and release. The emitted pollen grains are transported in the atmosphere with the wind, mixed by turbulence and removed via sedimentation and scavenging with precipitation. As a result of these processes, the deposition of the released pollen can take place far away from the source areas, subjected to favourable transport conditions. The importance of such long-range transport events, recognised in the health-related applications, is not unequivocal for the deposition patterns. The current study aims at a quantitative assessment of the mutual contribution of the local, regional- and long-range transport events to the deposition patterns.

The simulations were arranged independently for a collection of pre-defined taxon areas. The deposition from each source region was then analysed for each year and stable statistical relationships were computed for the main receptor areas. Apart from the mean source-receptor relationships, its inter-annual variability was estimated as well. The source term formulations and habitation maps were kept constant, which allowed attributing the obtained variability exclusively to the pollen release and transport conditions during the flowering seasons. It has been previously shown, using birch and grass European SILAM simulations, that the effect is substantial: meteorology-induced variability contributes 10-20% (grass) and 20-40% (birch) to the observed year-to-year changes of the seasonal pollen index reported in literature. The phenomenon has well-pronounced spatial and species-specific patterns. We extend the analysis to the large-scale source-receptor deposition relationships in Mediterranean and include olive as the new taxon.

** EAN (European Aeroallergen Network) data providers are from the national pollen monitoring stations of Croatia, Greece, France, Italy (A.I.A.-R.I.M.A.®), Spain (REA: Aerocam, AeroUEx, RAA, UO, UC and Cantabria Health Council, REDAEROCAM, Health Castilla-Leon Council, RACyL, XAC, RIAG, PalinoCAM, UPCT, Basque Government / Public Health Directory), Hungary, Israel, and Turkey.

Influence of wind on daily airborne pollen concentrations in Catalonia (NE Iberian Peninsula)

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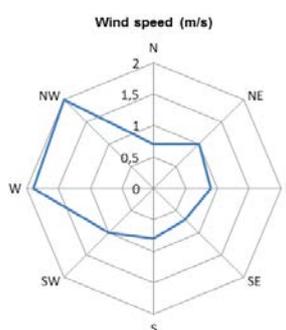
Airborne pollen grains constitute part of the biological component of the atmospheric aerosol and their concentration varies depending on the pollen taxa, the meteorological conditions and the characteristics of the sampling stations. Here we explore the influence of wind (speed and direction) on the daily airborne pollen concentrations of 12 taxa recorded at 6 aerobiological stations in Catalonia (NE Iberian Peninsula): Barcelona, Bellaterra, Girona, Lleida, Manresa and Tarragona, for the period 2004-2014.

In order to analyse the effect of wind, its direction was divided into 8 sectors: N, NE, E, SE, S, SW, W and NW. For each sector, the correlation between the daily pollen concentration and the daily mean wind speed was computed using Spearman's rank correlation coefficient. We limited our study to days without precipitation during the pollination period of each taxon.

As expected, the results show a high variability depending on the pollen taxa and the sampling station. We have focused on the pollen types of which the sources are situated near the station and those which have a major representation in the atmosphere. As an example we present the results for *Artemisia* in Tarragona.

<i>Artemisia</i> (Tarragona)							
N	NE	E	SE	S	SW	W	NW
			-0,212		-0,223	0,219	0,244

The significant positive correlations between the daily pollen concentration of *Artemisia* and wind speed from W and NW sectors shown in the table might be interpreted as a contribution of pollen from a localized source in the west of the city and inland of Catalonia. On the other hand, the negative correlations with the wind coming from SE and SW sectors might be interpreted as a cleaning and dispersion effect over the station due to fluxes coming from the sea. These significant correlations are supported by the radar chart shown in the figure. The stronger winds in Tarragona, coming from the W and NW sectors, contribute to increase the levels of pollen grains of *Artemisia*.



Airborne fungal spores of Abomey-Calavi (south-Benin), clinical data and meteorological parameters

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Pollen grains and fungal spores are the main microscopic elements found in abundance in the atmosphere. The former are often the source of respiratory allergies called pollinosis, mainly asthma in children and susceptible adults. Indeed, according to the consultations and hospitalizations of the year 2015-2016 at the hospital of Abomey-Calavi (Benin), there were registered 3792 cases of pollinosis of which 1708 asthma cases. In addition, in agriculture, fungal spores are pathogenic to many plants. The objective of this work is to know the load of fungal spores at the atmosphere of the municipality of Abomey-Calavi and to make the link with the clinical data and the meteorological parameters.

The sampling was carried out by means of a Hirst type volumetric trap (Hirst, 1952) located about 15 m above ground level on the slab of the National Herbarium of Benin. The spores were captured from April 15, 2015 to March 31, 2016. The counts were carried out according to the methodology of the Spanish Aerobiological Network, REA (Galán *et al.*, 2007). The different taxa were identified in the laboratory by the using of floras and plant guides.

A total of 12633 annual fungal spores were counted under a light microscope. The average number of daily spores estimated per cubic meter of air is 21. Seasonal variation of airborne fungal spores was observed. Thus, during the dry season the most dominant taxa are: *Aspergillus*, *Cladosporium* and *Alternaria*, whereas during the rainy season, *Aspergillus* and *Cladosporium* spores predominate.

Analysis of the fungal content of the Abomey-Calavi municipality during one year revealed a variety of spores distributed unevenly over the months and during the different seasons of the year. The correlation between the clinical data, meteorological parameters, and the amount of spores recorded shows that the spores have a large part in the manifestations of allergies.

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Quantitative and qualitative assessment of airborne microorganisms in the historical and modern museum depositories

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Most of museum artefacts are of organic origin, what favours colonization by bacteria and fungi. They are generally stored for a long period of time in repositories and are prone to biodeterioration. It is important that aerosanitary conditions in repository rooms meet required standards to protect exhibits. The goal of this research was to assess the risk of microbiological colonization of cultural heritage objects stored in the museum repositories that are located both in the historic and the modern parts of the Regional Museum in Rzeszow. It allows us to verify the working hypothesis of the diverse composition of bacteria and fungi depending on the age of the depots and examine the effect of various parameters on their concentration.

The research was carried out in the Regional Museum in Rzeszow, SE Poland. Its main part (exhibition areas, several depositories) is housed in a 17th century monastery complex. In the 1960's, a new building was built. To collect airborne microorganisms, the volumetric method was applied using AESAP 1075 Sampl'air Lite sampler. The air was sucked onto Petri dishes with a diameter of 90 mm containing appropriate media - PDA for fungi, and TAS, Mannitol Salt Agar for bacteria. Results were expressed as colony forming units per 1 m³ (CFU/m³).

The concentrations of microorganisms (fungi and bacteria) in the studied rooms varied from 80 CFU/m³ to 440 CFU/m³. The average concentration of fungal spores in 1 m³ of indoor air was 30 CFU/m³, but the number of bacteria colonies in indoor air was about four times higher. We demonstrated that for all types of artefacts in the depots located in the historic part of the museum, the number of bacteria in the air was significantly higher. The highest differences concerned the depots with books. This did not hold true for fungal spores. In all repositories, 10 fungal taxa including yeasts were distinguished. The most common was *Penicilium expansum*. In total, 19 bacteria taxa were identified and only two were Gram-negative. In all rooms as well as outdoor, *Micrococcus luteus/lylae* occurred, and its concentrations were the highest. We found a linear relationship between bacteria concentrations and temperature, but relationships between microclimate parameters and concentrations of particular bacteria and fungi were not linear. In general, temperature favoured microorganisms' colonization, whereas humidity had reverse effect. The impact of the area of depots had no great effect.

In the museum under the study, artefacts are not exposed to too high concentrations of bacterial and fungal spores and are stored properly. *P. expansum* and *M. luteus/lylae* were the prominent representatives of fungi and bacteria, respectively, in the air of the museum. We detected the effect of 'historical building air' for bacteria but not for fungi.

Fungal spores affecting vineyards across Europe, a preliminary study

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Vineyards are one of the most important crops in Europe. Fungal spores are microscopic biological particles that possess a great capacity to colonize several kinds of substrates, being ubiquitous in nature. One of the interesting points of studding fungal spores is their effect as plant pathogens. *Botrytis cinerea*, *Uncinula necator* and *Plasmopara viticola* are those which mostly affect the vineyards. The knowledge of the behaviour of these particles in distinct weather conditions will help in the crop management. The main goal of this study is to know the airborne spore concentrations of *Botrytis cinerea*, *Uncinula necator* and *Plasmopara viticola* in three different study zones.

The airborne spores monitoring was conducted using a Hirst-type volumetric spore trap (Hirst, 1952) from April to August 2015 in 3 towns of Europe: Montilla (south Spain), Nuremberg (South Germany) and Szczecin (northwest Poland). Samplers location was performed in accordance with the standard protocol proposed by the Spanish Aerobiology Network (REA) (Galán et al. 2007), and the minimum recommendations proposed by the European Aerobiology Society (EAS) (Galán et al. 2014). Data analysis was performed as counting more than 5% of the total surface of the slide. Data were expressed as a daily average of spores/m³ of air. Correlation analysis has been done between the spore concentrations and meteorological parameters with the R program.

2015 was drier and hotter in Montilla than in the other study zones with a total rainfall of 63.2 mm, compared with 169.14 mm in Szczecin and 195 mm in Nuremberg from April to August, and an average temperature of 23.67°C, compared with 16.47 °C of Szczecin and 16.80 °C of Nuremberg. Higher concentrations of fungal spores during the studied period have been found in Szczecin (2958) than in Montilla (909) and Nuremberg (478). *Botrytis* is the most abundant spore in the air of Szczecin meanwhile *Uncinula* represents higher percentage of the total spores detected in Montilla and Nuremberg. Temperature and sunshine are positively correlated in all places with *Botrytis* spores while relative humidity and temperature correlated with *Uncinula* spores. In the case of *Plasmopara* spores positive correlations have been observed with the temperature, but only in Nuremberg and Szczecin.

The main phytopathogenic spores affecting vineyards were detected in the three study zones. *Uncinula* is more representative in Montilla and Nuremberg meanwhile in the case of Szczecin the most representative is *Botrytis*.

Analysis of airborne fungal content in the Cathedral of Jaen (South Spain): preliminary results

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The air of indoor and outdoor environments contains biological particles in suspension that come from various sources. Most of them are fungal spores, bacteria, viruses, algae, lichen propagules and pollen grains that form the atmospheric aerosol. Many of these biological particles, particularly from heterotrophic organisms such as fungi, can promote biodeterioration of an extensive range of materials and have a negative effect on the preservation of artistic-historical heritage. Aerobiological studies evidence the important role that outdoor and indoor environments assume and may be used for the evaluation of degradation causes and the potential risk of airborne biological material present in the atmosphere. These investigations not only allow us to define the original sources or means of access of the biological particles, but also determine the levels and the main accumulation areas of airborne biodeteriogen organisms. The aim of this preliminary study was to identify and quantify the aeromycological content in the Cathedral of Jaen.

The Cathedral of Jaen in South Spain is considered the best conserved and the most representative example of Spanish Renaissance art and has been listed as National Historic and Artistic Heritage since 1931. Airborne fungal spores were recorded in various parts of the Cathedral from March to June, 2016, by using a volumetric sampler, and were compared with those in the outdoor air.

The overall mean fungal spore levels recorded in the outdoor air were higher than those recorded in the indoor, but differences among the sampling points within the Cathedral were not detected. The highest mean airborne fungal spore concentrations were recorded in May (48.5%). Outdoor spore levels had a significant influence on indoor concentrations, but not the outdoor fungal diversity, which showed significant and positive correlation only with the airborne fungal spore diversity (number of taxa) recorded in the Choir, an area close to the entry and exit of visitors. A total of 27 taxa were identified, with *Aspergillus/Penicillium* and *Cladosporium* being the taxa most frequently present in the air; they were recorded in all measurements regardless of the indoor/outdoor study point and the seasonal trend. Of the airborne fungal spores recorded in the Cathedral environment, 81.1% belong to biodeteriogen fungi that, under suitable conditions for their germination, could have a negative effect on the preservation of artistic-historical heritage.

The indoor environment of the Cathedral is more loaded than the outdoor environment with fungal spores. There are no parts inside the Cathedral with less or higher airborne spore concentration. The participation of biodeteriogens in the indoor fungal community is a risk to be assessed.

A 500.000 yrs paleoenvironmental and paleoclimatic record from the Balkans inferred from Lake Ohrid pollen data

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Lake Ohrid is considered as one of the deepest and oldest tectonic lake in Europe. A drilling campaign was carried out in 2013 as part of the International Continental Scientific Drilling Program (ICDP), within the scope of the Scientific Collaboration on Past Speciation Conditions in Lake Ohrid (SCOPSCO) project. This lake is located at middle altitudes in a rift basin (693 m) surrounded by high mountain ranges and provides an excellent opportunity to study the impact of past climate changes on mid- to high-altitude forests. At the confluence of temperate and Mediterranean climate influences it is an exceptional site to record climate changes over several glacial-interglacial periods. First investigations show that the DEEP site sediment sequence covers the entire lake history and an age model was established for the upper 500 kyr. Thus, the last 12 marine isotope stages have been analysed at a millennial-scale resolution by a European team of palynologists.

Our aim is now to propose a robust and precise quantitative estimates of the climate from the DEEP pollen record with three objectives: (1) to explore climate change on the Balkan Peninsula at the confluence of temperate and Mediterranean climate influences, (2) to identify the major patterns of climate change during the last 500 kyr in this region with a focus on the seasonality of the reconstructed climate parameters, and (3) to reconstruct the climatic change during the glacial and interglacial periods to better understand the variability of these glacial–interglacial cycles in south Europe. based on a multi-method approach (including the Modern Analogues Technique, and Weighted Averages regression). The originality of our approach is to better assess the error of the climate reconstruction by integrating all the errors calculated by each method in an “optimal” temperature and precipitation reconstruction.

The so far existing DEEP pollen sequence records the major vegetation and climate changes. Results show that there is a general good correspondence between forested/non-forested periods and glacial–interglacial cycles of the marine isotope stratigraphy, suggesting a regionally relevant vegetation and climate record.

We have reconstructed the annual precipitation and the annual temperature, summer precipitation and temperature, alpha index and GDD5 with the different methods. All the methods give roughly the same pattern, even if the MAT show more variability; the different glacials and interglacial periods are well reconstructed. Our reconstruction shows 2 distinct periods:-from 500 to 200 ka, colder and wetter than today conditions;-from 200 ka to now, more warm and dry conditions, particularly during glacials MIS6 and MIS2. The interglacial complex MIS5 is also dryer than interglacials 7, 9, 11. To improve these results, tests without pine and more methods are still in progress to better assess the uncertainties in the predictions and the error of reconstruction.

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Centennial-scale vegetation and fire dynamics in the Middle Atlas, Morocco during the last 12,000 years

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Lakes and wetlands of the Middle Atlas represent important palaeoenvironmental archives for vegetation history and climate change in Northwest Africa. Despite a growing wealth of pollen data, there is so far little information available about the role of wildfire in Holocene environments of the Middle Atlas, particularly on centennial or shorter timescales. There is a need, therefore, to understand better the role of fire in ecological processes across the different boundary conditions of the Holocene in this setting.

Two sites in the southern Middle Atlas have been studied, which are a large permanent lake (Lake Sidi Ali, 2080 m.a.s.l.) and a small seasonal wetland (Col du Zad, 2150 m.a.s.l.). Multiproxy analysis including pollen and microcharcoal analyses was undertaken at both sites, while at Col du Zad, contiguous sampling for macrocharcoal was also undertaken at 1cm intervals specifically for the characterization of Holocene local fire events. Both site chronologies span the entire Holocene and are based on AMS ¹⁴C dating of charcoal and pollen concentrates, yielding sub-centennial-scale information on charcoal accumulation rates.

The Sidi Ali and Col du Zad pollen records document a long-term transition from (a) steppic landscapes at the onset of the Holocene, to (b) open sclerophyll vegetation with evergreen *Quercus* in the early Holocene, (c) colonization by montane forest with *Cedrus atlantica* from the mid-Holocene, and (d) *matorralization* and finally degradation of the forest cover during the Late Holocene. At both sites, we observe a significant Mid-Holocene shift in fire regime associated with the development of the *Cedrus* forest, with subsequent intense fire episodes occurring on multi-centennial to millennial-scale timescales. Fire episodes generally promote shifts in vegetation composition, specifically declines in *Cedrus*, and increases in Cupressaceae and spiny xerophytes.

Our approach allows the first robust characterization of centennial-scale fire regime in this high elevation sector of the Middle Atlas. Our findings document a mid-Holocene shift towards higher fire frequency and intensity linked primarily to increased forest biomass, despite a shift in long-term climate from warm and summer-dry towards cooler and more humid conditions. Short-term (millennial- and centennial-scale) climate variations nevertheless appear to condition high fire episodes. Although anthropogenic fire-lighting may contribute to the Late Holocene decline of the forest cover, the emergence of high intensity fire episodes occurred in the context of maximum Holocene forest development and appears as a natural part of the forest ecosystem dynamics.

Interpreting 2700 years of abrupt environmental change in central Italy by comparing pollen and climate reconstructions with historical texts

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We analyze climatic and societal causes for abrupt environmental change during the last 2700 years in central Italy by examining a high-resolution sedimentary paleopalynology record and historical documents of local land use and compare these with annually resolved independent climate reconstructions of temperature and precipitation. Our site, the Rieti Basin 80 km north of Rome is an intermontane depression in the Central Apennines.

Proxy data from sediment cores are used to interpret the environmental history of vegetation (pollen), erosion and livestock (non-pollen palynomorphs – NPP), and sedimentation (geochemistry). ¹⁴C dates on different materials (macrofossils, pollen, charcoal, bulk sediments) produced dates up to 1000 years too old, therefore paleomagnetic secular variation (PSV) was measured and correlated to available PSV curves and models for Europe to create a robust age model. Historical texts were primarily from the Abbey of Farfa, near the Rieti Basin.

A 14.6 m core spanning 2700 years was recovered from Lago Lungo, one of four remnant lakes within the basin. Rapid sedimentation rates (3 – 12 mm yr⁻¹) produced a high-resolution record that could be compared with historical events. Five pollen zones identified from temporally constrained cluster analysis coincide with historic periods developed from well-established archaeological sequences. Non-metric multidimensional scaling ordination analysis identified distinct community changes between historic periods; each temporal period occupied nearly unique ecologic space.

The Imperial Roman period (until ~AD 400), during a mild climate phase, saw an increase in pasture but no large decline in forest cover or taxonomic biodiversity. Following the Gothic Wars (AD 535 – 554) during the subsequent Lombard period (AD 570 – 750) historical texts suggest widespread depopulation and reforestation, however the pollen record has evidence for forest decline, loss of biodiversity, particularly hardwoods such as maple, elm and beech, although independent climate reconstructions show trends of warmer wetter climate that should have supported increased tree growth. A period of reforestation, primarily oaks, begins after AD 750 coinciding with the beginning of the Carolingian period. Significant forest loss began ~AD 850 associated with increased land ownership of the church and agricultural intensification. While this is at the beginning of the Medieval Warm Period the rapidity and scale of deforestation are better explained by changes in rural land management. Cooling and increased precipitation with initiation of the Little Ice Age (LIA) ~ AD 1250 followed by plague in AD 1348 was a catalyst in abandonment of upland settlements and rapid reforestation. Despite cool climate and increased precipitation, improved hydrologic technology allowed for land drainage and forest clearance in AD 1600 at the height of LIA cooling, providing an example of early successful technological response to climate change.

Warm climate could reduce trees diversity in mixed-wood boreal forest

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In the global change context, understanding the role of climate and wildfires on the boreal forest composition is crucial to predict vegetation trajectories. We investigated the incidence of fire regime and climate conditions on multi-millennial vegetation diversity in two mixed-wood boreal forest sites in northeastern Canada (Ontario). We hypothesized that potential positive feedbacks between fires, climate and early successional taxa may increase the vegetation diversity during warm periods.

We performed charcoal (>160 µm) analyses using CharAnalysis to reconstruct fire regime from 6 lacustrine cores and pollen analyses (identifications and counting) to reconstruct vegetation and vascular species diversity histories from 2 of these lacustrine cores, since the last deglaciation (*ca.* 9,000 years cal. BP). Lakes are situated in two near zones. Due to their spatial proximity, we assumed that these zones were under the same climate conditions and with the same potential vegetation during Holocene period. However, these two zones differ by their degree of landscape connectivity and drainage.

Preliminary results show that vascular trees diversity was higher during the colder periods (Neoglacial period). This period was marked by an increase of coniferous trees abundance in detriment of deciduous trees until then dominant in poorly connected and drained zone. In contrary, in the highly connected and drained zone, this cold period coincided with a decrease of coniferous trees abundance in favor of deciduous trees until then under-represented in landscape.

The best conditions to optimized the mixed-wood forest diversity seems thus to be a cold and/or moist climate rather than warm and/or dry. While mesic zones embody what might be called 'diversity's refuges', xeric zones could be the most fragile areas in these forests and deserve a high watchfulness in the context of the global warming. Future research should focus on understanding the complex dynamics behind vegetation trajectories in order to preserve high diversity level through a maximum equity between conifers and broadleaf trees proportion in mixed-wood boreal forests.

From palaeoecology to conservation of mountain forests: Utilities and contributions in the Mediterranean Region

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Current strategic conservation priorities (e.g. Natura 2000 network) include the assessment of the habitat vulnerability against climate change, as well as improving the adaptation abilities of ecosystems by enhancing their conservation state and resilience. In this sense, long-term studies have been traditionally applied to the identification of top priority areas, the localization of “refugia” or the formulation of hypotheses subsequently checked by other disciplines. Moreover, they are mainly concerned with the response of plant species to past environmental variability and thus can provide a qualitative insight to support future conservation strategies and initiatives. Recent advances in palaeoecological studies have allowed a higher visibility and their application to biodiversity management and conservation policies

A revision of recent studies performed in Mediterranean mountain areas (e.g. Iberian Central System, Baetic ranges and Rif mountains) show a set of techniques and palaeoproxies required for a better understanding of vegetation dynamics and further application to conservation strategies: (i) High-resolution (<50 yr/cm) studies, magnetic susceptibility, charcoal, fungal spores, geochemical elements, together with fossil and modern pollen; (ii) Rarefaction, correspondence, principal component, correlation and fire frequency analyses; (iii) A wide archaeological and historical dataset. They are all essential to an accurate approach.

Palaeoecological works have demonstrated the natural origin of high-mountain pine forests, both in the Iberian Central System and in the Baetic ranges, and also of sweet chesnut ones in central Spain. Human activities seem to have been the main driver of the overall decline of Mediterranean montane conifers, the drop of treeline and the widespread extension of grasslands and broom communities. Most of these habitats are currently considered as priority areas for conservation policies. Both fire and grazing have been long used for land clearance, indeed favoured by climatic conditions at these altitudes. Distinct erosion and deforestation phases are likewise coeval with historical events.

Long-term studies allow us to evaluate the response of plant species to diverse disturbances, an essential background for elaborating more appropriate measures for policy and management strategies. Current high-mountain landscapes which harbor ancient forests are the result of a long-term influence of human activities through burning and grazing. Consequently, a certain degree of management is needed to maintain these high-value habitats. The thresholds for such handling measures could be suggested by palaeoecological works. The more accurate the analyses, the better measures will be taken.

Estimating ecosystem functional changes from pollen records in Western Mediterranean

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In a world facing rapid environmental changes, exploring the expected effects of habitat changes on biodiversity is a critical issue to guide climate change policy, conservation and management actions. Understanding how vegetation structure and dynamics responded to past climate changes will help to improve our conservation efforts. In this sense, the fossil pollen record has proven to be a pertinent proxy for exploring the interactions between past climates and species dynamics. Our goal is to understand the extent to which taxa assemblages comprise relationships between vegetation functioning and structure and climate. We hypothesize that based on the relationship between pollen records and current vegetation functioning, we can reconstruct past vegetation structure and functioning.

The study area covers the Western Mediterranean. First, we extracted raw pollen data from EPD and EMPD using EPD-r package. The raw pollen data were classified into Plant Functional Types (PFTs) according to life form, phenology, leaf shape, and climatic tolerance. Then, the functional categories were used to find functional similarities in the fossil-pollen samples using Hierarchical Analog Technique (HAT). For vegetation structure we used CORINE Land Cover. Descriptions of vegetation functioning and identifications of Ecosystem Functional Types (EFTs) were based on MODIS (Moderate Resolution Imaging Spectroradiometer) satellite images of the Enhanced Vegetation Index, albedo and land surface temperature.

From the original raw pollen, we used 77 taxa, including trees, shrubs, and herbs, that were assigned to 22 PFTs. These selected pollen taxa were optimized to be more sensitive for detecting changes in vegetation composition throughout the Western Mediterranean. HAT analysis allowed us to draw a clear picture of vegetation structure and composition by incorporating a greater number of taxa into our analysis and by blending many taxa from disparate regions. We characterized ecosystem functioning in terms of annual amounts (annual mean), seasonality (annual standard deviation) and phenology (date of the maximum) of carbon dynamics, radiative balance and sensible heat. Based on these descriptors, we identified EFTs that were then compared to the pollen-derived PFTs.

Knowing how ecosystem functions responded to past environmental changes can serve as a sentinel to anticipate expected effects of current, and ongoing, climate change on biodiversity and ecosystem functions and services. The successful combination of pollen data and satellite-based vegetation descriptions is a powerful tool, enabling the extrapolation of vegetation dynamics beyond the limited domain of direct observations.

***Vitis* representation in modern pollen spectra from Southern Europe vineyards**

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Vitis vinifera is an important food plant in the Mediterranean area and one of the key fruit species in the economy of modern Europe. In spite of the wide diffusion of *Vitis* pips in archaeological layers, *Vitis* pollen is generally found in a very low amount in the same sediments, and has low values in past pollen spectra. With the aim of understanding the significance of these low values, an interesting research on *Vitis* pollen dispersal was carried out by Turner and Brown (2003) in England. Their results stated that pollen percentages over 0.2% on total pollen possibly indicate the on-site presence of a vineyard. Our study presents the current *Vitis* pollen found in surface soils and moss cushions taken from vineyards located inside the distribution area of the wild species. Indeed, studies on the present-day pollen rain are useful tools to assess the relationship between plant presence and pollen spectra, furnishing an interpretative key for understanding the significance of the past pollen records. In the case of *Vitis*, the different pollen production of the wild and domesticated subspecies has to be taken into consideration.

Samples of soils and moss cushions were collected on the edge and inside vineyards in several regions of Italy (Emilia Romagna, Tuscany, Sicily), and in Greece (Micene, Corfù). Isolated vineyards were selected for studying the pollen dispersal outside the edges. The samples were processed according to the routine procedures (HF, HCl, KOH, acetolysis). *Vitis* absolute pollen frequencies and percentages on TLP were calculated.

A notable variability in *Vitis* pollen representation is evident from the different investigated areas. In some cases, this pollen is absent. In Tuscany, values < 1.5% were recorded in the surface soil while 10-20% were observed in moss cushions; hundreds of pollen grains occurred in the former, thousands were in the latter ones; moving away from the vineyard edge, the values dropped down below 0.2% at 50m of distance and below 50 grains/gram.

Vitis pollen resulted in different amount in the moss cushions and surface soils inside the vineyards, suggesting a better preservation in the moss. At the distance of 50m, very low amounts of *Vitis* pollen were recorded in the moss samples too, indicating a short distance diffusion of the grains. The results of the present study are in agreement with the data from literature. However, some cultivars exist that can be invisible to the pollen record.

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Botanical families with allergenic antecedent present in the atmosphere of the city of Ibagué Tolima-Colombia

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Pollen is characterized by its morphological variation these characters being influential for its taxonomic determination and type of pollination. The anemophilous pollen grains present adaptations that discard their displacement and/or suspension in the atmosphere thanks to convulsions of the wind. Some of these pollen units report allergenic potential, due to the presence of glycoproteins, lipoproteins and soluble proteins of low molecular weight; provoking pollinosis, which are expressed with symptoms of allergenicity (rhinoconjunctivitis, dermatitis, and/or asthma). Studies in countries such as Spain, France, Mexico and Brazil, analyze the airborne material, reporting pollinics types with the allergological characteristics and their relation with the environmental conditions. In Colombia, especially the city of Ibagué due to the diversity of thermal floors and average climatic conditions: annual precipitation 1,993 mm, prevailing annual wind 1.4 m³ / s, temperature annual average 24 ° C, altitude 1,220 m.s.n.m. and relative humidity 81% is possible that the presence of pollen types with reports of allergenicity is favored in their proliferation in different ecosystems. The objective of this work determined the plants families with major abundance of airborne pollen in the atmosphere of the city of Ibagué, captured during a month of sampling. The collection of the aerobiological material was used a volumetric pollen trap-Hirst, located 12 meters high at the University of Tolima (city center), for a period corresponding to 31 days of sampling in March, 2017. The samples were observed on a 40X Optical Microscope, Primostar + ERL 5 Carl Zeiss model for the analysis and identification of the pollinic types, later the software ZEN 2.3 Lite was used for the taking of images. The families with allergenic antecedents with greater abundance of pollen types in the atmosphere were Betulaceae (6941 pollen grains), Poaceae (6844), Cyperaceae (3601), Myrtaceae (1571), Asteraceae (537), Plantaginaceae (163) and Cupressaceae (15); For a total of 19672 pollen grains a day, 137704 a week and 550816 a month counted for these families. The seven families with allergenic antecedents, Betulaceae is the one of major presence with 35% and Cupressaceae the minor with 0.07%. This aeropalynological study of the city of Ibagué is of great importance because it is the first report showing airborne pollinic types with allergenic antecedents. That allows facing the results palynological with the claims of allergic reported in the local health centers, in order to generate etiological tests-allergy to the affected population. Also, the generation of pollen calendars for allergenic species and finally, the search for strategies to mitigate the affections by pollen allergies in the population.

Fungal spores present in the atmosphere of the city of Ibagué Tolima-Colombia

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Fungi are multicellular or unicellular structures which act as decomposers in the biosphere, some of them can grow at temperatures of up to minus 6 ° C and others at over 50 ° C. It has been estimated that there are about 300,000 species, of which more than 100,000 have been identified. The fungi reproduce by means of spores that in their great majority are transported by the wind thanks to their morphological characteristics (size, weight, form and ornamentation), achieving their displacement and / or suspension in the atmosphere; these structures have been reported with allergenic antecedents in countries as Spain, France and Portugal propitiating their allergic reaction called pollinosis. In Colombia, especially the city of Ibagué (Colombia center) due to the variability of thermal floors and annual average weather conditions (temperature 24 °C, annual rainfall of 1,993 mm, relative humidity of 81%, annual wind predominant of 1.4 m / s and approximate altitude of 1220 msnm) is possible that the proliferation of fungi is favored in the different ecosystems. The objective of this work was to determine the occurrence of fungal spores in the atmosphere of the city of Ibagué during the sampling period of one week.

For the collect of airborne material, was used the Hirst type volumetric sampler, which are located in a structure 12 meters high at the University of Tolima (Ibagué city center), for a period corresponding to 31 days of sampling in March, 2017. The observation was made with the aid of the optical microscope, under the objective of 40X, then the ZEN 2.3 Lite software was used for the taking of images.

In one week sampling were collected fungal spores of the genus *Agrocybe*, *Alternaria*, *Arthrinium*, *Beltrania*, *Cladosporium*, *Curvularia*, *Drechslera*, *Epicoccum*, *Fusarium*, *Nigrospora*, *Leptosphaeria*, *Pithomyces*, *Pleospora*, *Puccinia*, *Tetraploa*, *Torula* and *Ustilago*; was obtained 16,066 spores per day and 112,462 spores per week. It is evident that exists a high diversity of spores in the atmosphere of the city, with major abundance of the genus *Nigrospora*, which represents 18% of the total airborne particles analyzed; while of the genus *Tetraploa*, only 0.2% is reported.

The results of this study are the first report on fungal spores in the atmosphere of Ibagué, information that will serve to correlate it with the dates of affections of allergic presented in the population of the city.

Ascospores and conidia of Pleosporales in the aerospore in Barcelona during a year of study

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Pleosporales is the most important order of Ascomycota. Because of the wide distribution of their host plants and their easy environmental adaptation, they are found at any latitude and they are a common component of the aerospora around the world. Some genera of *Pleosporales* are pathogens of grasses and cereals; others are allergens or pathogens for humans and animals, in addition they produce mycotoxins. Studies have shown the presence of orthologous genes related to virulence and allergenicity (as Alt a 1) within different genera and species of *Pleosporales*. Therefore, the knowledge of the *Pleosporales* taxa frequently present in the atmosphere of a region and the study of their aerobiological behavior, will allow to establish their local importance and to estimate the real risk to which the population is exposed. With this purpose, the present study was carried out in Barcelona (Spain) during a year (2010) determining the hourly behavior of these spores and the effects of the atmospheric parameters on their concentration and distribution in the air.

The samples were obtained from January 1st to December 31st in 2010, using the trap Hirst-type of the Aerobiological Catalan Network (Xarxa Aerobiològica de Catalunya, XAC), located in a central place of the city. The slides were examined with light microscopy with 600X magnification; the total longitudinal area was divided into 24 equidistant vertical areas corresponding to each hour of the day. The spores were identified and counted following a continuous transverse scanning in the central zone of each time band. The results were expressed as mean hourly spore concentration/m³, total daily averages of *Pleosporales*/m³, and seasonal averages of total *Pleosporales* and for each individual taxon. The GMT system was used to designate the hours of the day. Identification of the spores was done following the available morphological atlas. Correlations were established between identified taxa and environmental parameters such as temperature, relative humidity, rainfall and wind speed (data provided by the Meteorological Service of Catalonia - Meteocat).

Among the results it is highlighted that *Pleosporales* spores were a common component of the atmosphere throughout the year, with seasonal and time-varying patterns according to the taxon the mode of spore production. The conidia and ascospores had representative taxa in the air during all the analyzed days, with predominance of the mitosporic ones, which duplicated in concentration to the meiosporic practically all the year. In summer and beginning of autumn they even surpassed them until ten times. In total, 15 taxa of mitosporic *Pleosporales* and 17 meiosporic were identified. The highest daily concentrations of conidia were obtained from late spring, whole summer and advanced autumn with a higher peak (9752.6 spores/m³) at the beginning of autumn due to *Alternaria* conidia (8171.6 conidia/m³). The highest release of these conidia during warmer times was around noon (13 to 14 hours in spring and 10 to 15 hours in summer), but with later displacement during the cold periods (autumn and winter, from 13 to 24 hours). Ascospores had a greater presence in the air during the early hours of the day in spring (from 22 to 14 hours) and a significant decrease after midday (from 15 to 21 hours), reversing this pattern in winter. The highest peak (around 5000 spores/m³) occurred at the beginning of autumn thanks to *Leptosphaeria* ascospores (4238.2 spores/m³), coinciding with an increase in temperature and a decrease in relative humidity.

Mycobiota in the air and surfaces of indoor and outdoor environments in Barcelona

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Allergic diseases, affecting around 40% of the world's population, have shown a steady increase in the number of cases. Several studies have associated high levels of conidia of *Alternaria*, *Penicillium*, *Cladosporium* and *Aspergillus* with the exacerbation of asthma. This study aimed to identify the fungi present in the air and surfaces in indoor (In) and outdoor (Out) environments of dwellings in rural (R), semi-urban (S-U) and urban (U) areas in Barcelona, Spain, for a year, and its relation with environmental parameters and characteristics of the building.

We analyzed 50 U, 9 S-U and 1 R dwellings. Air In data were obtained using a portable Hirst device (VPPS 1000, a non-viable method, NVM) and the results were compared with the Air Out data provided by the Xarxa Aerobiològica de Catalunya for the closest station to the dwelling studied. Air, In and Out data using a viable method (VM) were obtained by means of a Microflow 60 sampler with a malt extract culture medium. Surfaces were analyzed by the tape method (NVM) and cotton swab (VM). Temperature and relative humidity were measured with a thermohygrometer (Testo) and the other meteorological parameters were obtained from the Servei Meteorològic de Catalunya (Meteocat). SPSS v 17 software (SPSS Inc., Chicago) was used.

Main findings are:

- Greater diversity of taxa and a higher count (up to 10 times) in NVM versus VM, both in air and surfaces.
- Regarding the number of taxa, In and Out, NVM and VM: U>S-U>R, both in air and surfaces.
- Regarding average concentrations, In and Out: NVM: S-U>R>U; VM: R>S-U>U. And counts Out were twice those In, both in air and surfaces.
- Air and Surfaces, regarding diversity, In and Out, VM & NVM, U, S-U & R: *Cladosporium* was the most common taxa, except for Air, In, NVM, S-U where *Penicillium/Aspergillus* conidia were the most frequent.
- Air, regarding diversity other important genus, In, NVM: *Penicillium/Aspergillus* and hyphae fragments; VM: *Penicillium* and *Alternaria*; In and Out: Dematiaceous ascospores and Agaricales basidiospores.
- Surfaces, regarding diversity other important genus, In and Out, VM & NVM, U, S-U & R: dematiaceous hyphae fragments (NVM) and *Alternaria*.
- Regarding seasonal highest levels, Air, Out, VM&NVM, U & R: spring (S-U summer).
- Regarding seasonal lowest levels, Air, Out, VM&NVM, U, S-U & R: winter.

***Alternaria* spores behaviour in the atmosphere of Salamanca (Spain)**

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Due to its importance as an aeroallergen, the atmospheric content of *Alternaria* spores was monitored in 2014 in the city of Salamanca and the results compared with those obtained more than 15 years before, in 1995 and 2000).

The methods and materials used in this research are set out in the manual of the Spanish Aerobiology Network (Galán *et al.*, 2007), being samples obtained by a Hirst type volumetric spore trap (Lanzoni), located on the roof of the Faculty of Pharmacy of the University of Salamanca, at a height of 25 meters above ground level.

Data analysis was carried out from three different approaches, studying the seasonal behaviour of atmospheric spore concentrations, intra-daily variations according to three different models (Sánchez Reyes *et al.*, 2009), as well as correlations with the main meteorological parameters by means of Spearman's correlation analysis.

The total number of spores detected was 5246 from early summer (1st of June) to late autumn (31th of October) (Pérez Gorjón *et al.*, 2003). Maximum daily peaks were detected on 9th and 22nd of July with 202 and 271 spores/m³, respectively. No significant differences were found in the three models of intra-daily variation with hourly maximums mainly in the morning. Significant positive correlation coefficients were obtained with temperature, total insolation and winds blowing from the first quadrant but they were negative with rainfalls, relative humidity and winds blowing from the third quadrant.

Alternaria maintained a distribution pattern positively related with the increase of temperature and the absence of precipitations, with a maximum in the summer months.

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Preliminary study of the atmospheric pollen in Ronda (south Spain)

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Since 1991, the aerobiology research team of the University of Malaga has been sampling and studying the atmospheric pollen content in different localities of Malaga province (SW Spain) (Recio *et al.* 1998, 2006). Nevertheless, the northwest part of the province had not been studied yet. In order to complete this missing information, a pollen trap was installed in Ronda in December 2016. This locality, the biggest city in the northwest of Malaga province, is located in a rural area close to the natural Parks Sierra de las Nieves and Sierra de Grazalema, surrounded by crops, natural and semi-natural vegetation. The objectives of this preliminary study were to determinate the atmospheric pollen behaviour of the main taxa registered during winter and spring months in Ronda, as well as compare them with the data obtained by Malaga city sampling station during the same period in order to search for significant differences.

The samplings were made by means of two Hirst-type volumetric pollen traps (Hirst 1952). One of them was placed on the roof of the Perez de Guzman High School (Ronda) and the other was located on the roof of the Faculty of Sciences building (Malaga). Samples obtained were mounted and counted according to the methodology proposed by the Spanish Aerobiology Network, the REA (Galán *et al.* 2007).

Significant differences ($\alpha = 0.05$) between Ronda and Malaga were found regarding the daily concentration of pollen. These differences were particularly detected for some pollen types such as *Mercurialis*, *Fraxinus*, Urticaceae and Cupressaceae. In general, we found higher pollen concentration levels in Ronda. We can see a delay for some taxa in Ronda.

The higher concentrations of pollen detected in Ronda can be justified by the abundant surrounding vegetation. The differences in concentration and seasonal behaviour detected for some taxa can be explained by the different thermotype and ombrotype of the two sampling sites and the natural distribution and abundance of these taxa in the province.

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Aerobiology in Alcázar de San Juan (central Spain): pollen spectrum and allergenic pollen

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Pollen grain is one the main causes of allergic respiratory diseases. In fact, pollen is the most frequently involved aeroallergen (51%), followed by mites (42%). In Spain, between 10% and 25% of the population has rhinitis. In addition, 28% of the allergic people present asthma so that is a significant socio-economic impact. Thus, for the allergist, it is essential to know the aerobiology of the area where the patients live and their pollen periods to be able to make a correct diagnosis and treatment. Grasses, olive, saltwort, plane tree, and cypress trees pollen are the most frequently implicated. The aim of this study is to know the pollen spectrum from the atmosphere of Alcázar de San Juan (central Spain) as well as the main pollen types that cause allergies in this area.

Alcázar de San Juan (Ciudad Real) with 31.650 habitants is located in Castilla La Mancha region. Biogeographically, Alcazar de San Juan is situated in the Mediterranean Central Iberian Province and regarding the bioclimatology lies in the Mesomediterranean belt.

The sampling method complies with recommendations of the Spanish AerobiologyNetwork and the study period was carried out from 2013 to 2016.

During the study period, the sum of the average daily concentrations of airborne pollen (Pollen Index) was 91,901, of which 20,409 were recorded in 2013 and 28,041 in 2016. The highest monthly pollen counts were concentrated between April to June and the greater registries were reached in June due to grasses and olive flowering (day of maximum concentration: June 11, 2013 with 1,800 grass pollen grains/m³, 1,658 olive pollen grains/m³). Allergenic pollen types were Cupressaceae (10% of total annual pollen, late winter), *Platanus* (10%, early spring), Poaceae (10%), *Olea* (28%) in spring, and Amaranthaceae (3%, late summer). Regarding non-allergic pollen, the most important was *Quercus* 23% of the total pollen. According to the allergy thresholds established by the Spanish Aerobiology Network, the number of days on which pollen counts reached allergy-risk levels varied as a function of pollen type. Cupressaceae exceeds 46 days at least moderately allergenic levels, *Platanus* 35 and *Olea* 84. Amaranthaceae (moderate levels >15 g/m³) exceed 27 days and Poaceae (moderate levels >25 g/m³) exceed 84 days.

In Alcázar de San Juan, there is an annual average Pollen Index of 22,975. This average is lower than other cities in central Spain, probably due to the orography, the vineyards and olive trees cultivars that surround the city. The most important allergenic pollen types are Cupressaceae, *Platanus*, Poaceae (grasses), *Olea* and Amaranthaceae.

The aeropalynology of Oran's region Es-Senia, northwest Algeria

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A continuous study of atmospheric pollen at Oran Es-Senia airport, near Oran city in northwest Algeria was undertaken with the aim to establish the diversity of airborne pollen, the pollination periods of the major taxa, the intensity of pollen emissions and the relationship between airborne pollen calendar and the autochthonous and allochthonous vegetation in the region.

A Cour device, placed in the meteorological station at Es-Sénia airport, was used to collect airborne pollen on a weekly basis, between April 2004 and April 2006. Physic-Chemical treatments and pollen analysis followed the methodology described by Cour (1974).

The mean annual index (sum of the mean weekly concentrations on a year) was 3246 pollen grains/m³, 99.7% of which were identified and 0.3% remained unknown. The pollen harvest during the first year was 4230 grains/m³, which is significantly higher than that in the second year (2258 grains/m³). Pollen from herbaceous plants (69.5%) was significantly more abundant than arboreal and shrub pollen (27.9% and 2.3%, respectively). The pollen types identified, cited in decreasing order of abundance, were: Chenopodiaceae/Amaranthaceae (41.4%), *Plantago*, *Olea*, Poaceae wild type, *Lygeum*, Cupressaceae, Urticaceae, *Quercus*, *Pinus*, total Asteraceae, *Eucalyptus*, Brassicaceae, *Casuarina*, *Pistacia*, Arecaceae, Apiaceae, Thymeleaceae and *Rumex* (0.6%).

The winter pollen spectrum largely comprised Arecaceae and Cupressaceae pollen. Pollination during spring included most taxa: total Asteraceae, Brassicaceae, Chenopodiaceae/Amaranthaceae, *Lygeum*, *Olea*, *Pinus*, *Pistacia*, *Plantago*, Poaceae wild type, *Quercus*, *Rumex* and Urticaceae. During summer Apiaceae and *Eucalyptus* pollinated, and in autumn *Casuarina* pollen was largely produced.

The relative importance of allochthonous pollen at Oran is low; most pollen is from autochthonous vegetation. Specifically, in spring, the abundance of Chenopodiaceae/Amaranthaceae from Sebkhia reflects dense and large populations of goosefoots. This is followed by *Plantago* and Poaceae wild type which have the most sustained high concentrations, i.e. 12 consecutive weeks from early April to late June. Pollen from allochthonous vegetation includes Arecaceae (winter), *Pinus* and *Quercus* (spring).

The study showed an important inter-annual variability in the airborne pollen content at Oran region, the predominance of pollen from herbs (Chenopodiaceae/Amaranthaceae, *Plantago*, Poaceae wild type and Asteraceae), the pollen richness during spring and the importance of the autochthonous vegetation in the airborne pollen calendar.

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Airborne *Platanus* pollen wall elemental analysis and adhered particulate matter

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In the aerosol we can distinguish a gaseous and a solid phase composed of biological particles (such as pollen), minerals and particulate of anthropogenic origin. The aim of this study was to characterize the elemental differences in the composition of the airborne *Platanus* pollen wall and to describe the particulate matter (PM) found adhered to this pollen in the coastal city of Porto, Portugal.

A Field Emission Electron Probe Microanalyser (EPMA) was used for the elemental characterization of the airborne *Platanus* pollen surface as well as to investigate the characteristics of the PM attached to its surface. Analyses were performed both to airborne *Platanus* pollen and to control pollen directly collected from trees in public gardens. Airborne pollen sampling was performed using a 7-day Hirst-type volumetric spore sampler, where the Melinex tape was coated with a double-sided adhesive carbon tape.

Airborne *Platanus* pollen samples showed significant differences in elemental composition when compared to the control pollen, particularly in the amounts of Cl, Na, Mg and Si, which significantly increased on airborne samples. Concerning the PM attached to the airborne pollen surface, a total of 659 particles were analysed, most of them presented an equivalent diameter in the fine particles fraction, with the highest distribution between 0.1 and 1.0 μm . The dominant particulates identified were Si-rich (Si-O, aluminosilicates, Fe-Si), Organic (rich in elemental and in organic carbon components), SO-rich (SO-Ca, SO-Ca-K, SO-Ca-Na), Metals & Oxides (Fe-O) and Cl-rich (particularly combined with K, Mg, Na). Our results showed significant daily differences in the physical-chemical characteristics of the airborne pollen surface and PM attached to it. These differences were correlated with the meteorological parameters.

Airborne pollen has the ability to adsorb other materials that can contribute to change its characteristics.

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Adjustment of the Negative Prognosis model for the incidence of late blight on a potato crop in A Limia

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Late blight on potato crops is considered the most economically important disease to potato crops. *Phytophthora infestans* (Mont.) de Bary, which causes the disease of late blight, causing the death of leaves, stem and even tubers of the plant. In most cases fungicide applications during the growing season is essential to avoid significant yield losses. The management decision for the control of late blight has been covered in several areas, such as obtaining resistant varieties, the use of more effective fungicides and the development of prediction models (such as Cook's system, Hyre model, Smith's system or Negative Prognosis model, among other). In any case, the control of the disease is based mainly on the application of fungicide treatments, often with a schedule calendar that marks the onset of the first application and the frequency of the consecutive ones, applied independently of the risk of infection and the need of to do them. These systems allow farmers an inadequate control of the disease with great weaknesses. Effective prediction of the risk of infection by a pathogen let save production costs and a sustainable use of the agricultural systems. In order to predict the behavior of *P. infestans* in potato crop in A Limia and to improve the control of the disease, Negative Prognosis model have been adjusted with the aim of guiding the first treatment dates.

Negative Prognosis model have been used to test the *P. infestans* forecasting during seven crop cycles on a plot of A Limia (Galicia, NW Spain). This model establishes various multiplication factors according to the hourly values of temperature, relative humidity and rainfall (Ullrich and Schrodter, 1966). Temperature and relative humidity were obtained by an automatic recorder HOBO PROSERIES HO8-032-08, and rainfall was provided by MeteoGalicia. For aerobiological monitoring a volumetric sensor type Hirst VPPS 2000 model change weekly was used.

P. infestans concentrations usually were higher in the vigorous stages of the plants. Mean concentration of sporangia's in the year 2007 showed the significantly higher concentrations compared to the other years ($P < 0.05$), with a daily mean of 36 spores/m³. The years 2010 and 2015 had the lower mean levels ($P < 0.05$), 5 and 3 spores/m³, respectively. The accumulated risk values (130-150 units) used in the Negative Prognosis model by Ullrich and Schrodter (1966) are not very effective in A Limia. Considering a relative humidity higher than 75% and an accumulated risk value of 15 units was possible to improve the fit of the model. The forecast for the first peak was of 1 day (2008), some days (2009), 14 days (2010), 12 days (2014), 11 days (2015) and 2 days (2016). However, in the year 2007 it was not possible to predict the first peak.

Negative Prognosis model was better adapted to crop cycles with lower levels of *P. infestans* in the air. However, more years of studies are needed to improve the fit of the model.

Predictive model to determine pollen and allergen concentrations of *Ligustrum lucidum* in Ourense

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Privet (*Ligustrum lucidum* Aiton) is a well-represented tree across the South Europe, commonly used as ornamental plant in urban gardens and streets. This genus could be considered an important source of airborne pollen allergens during the months of June and July in spite the amount of its pollen grains registered in conventional samplers is very low due to the large size of the grains, which impedes its long-distance dispersion (Cariñanos et al., 2002). The aim of this research was to forecast the pollen and allergens of *Ligustrum* concentrations in order to determine in advance the periods of exposure to prevent the allergic symptomatology duration and intensity.

The study was carried out in Ourense city (North-West Spain) during the years 1999-2015. The airborne pollen sampling was conducted by using a Hirst volumetric trap (Hirst, 1952). For counting the pollen grains, the methodology proposed by the Spanish Aerobiology Network (REA) was considered (Galán et al., 2007). For allergen detection, a Burkard Cyclone sampler was used. The air samples were collected into a 1,5 mL Eppendorf vials and analyzed by means Ole e 1 antibodies following the method proposed by Takahashi et al. (2001) with some modifications (Moreno- Grau et al., 2006). Prediction models have been carried out considering two methodologies: Linear Regression Analysis and Artificial Neural Networks (ANN).

Privet trees flowers from July to August. The total annual pollen index of *Ligustrum* pollen was 48 grains as average during the period of study. The highest total annual pollen index of pollen was observed in 2015 (69 grains) as well as the maximum daily pollen peak with 23 grains/m³. Likewise, the total annual average of airborne allergen was 0,09 ng. The highest annual total allergen amount was observed in 2015 with 0,137 ng. The peak allergen concentration was registered during the same year with 0,035 ng/m³.

In order to forecast the pollen and allergen concentrations a Linear Regression model was conducted but non-significant determination coefficients were found. On the contrary, significant models were obtained by means the ANN methodology. The model obtained for the pollen prediction explained the 72,6% of pollen concentration variability with an (Root Mean Square Error, RMSE) of 1,529 grains·m⁻³ in the training phase. The ANN's power prediction was determined using the 2016 as validation year, registering a R² of 0,198 and a RMSE of 4,797 grains·m⁻³. The best neural model to predict allergen concentration presents a R² of 0,636 % (RMSE=0.002 ng·m⁻³) for the training phase. During the validation phase with the year 2016 the neural model showed a R² of 0,24 (RMSE = 0.019 ng·m⁻³).

ANN methodology represents a good tool to predict airborne pollen concentrations in the case of pollen types with scarce presence in the atmosphere.

Aerobiological and phenological behavior of the Godello variety in the Ribeiro DO during the 2015 and 2016 harvest

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Knowledge about the estimated wine production for a Designation Origin Area is essential in order to develop regulatory systems to attenuate annual harvest variation effects and, therefore, to coordinate supply and demand requirements (Cunha et al., 2003). Furthermore, this information is required for an accurate harvest and post-harvest planning as well as a precise estimation of the supplies in terms of crop insurance, grape-picking workforce and post-harvest and cellar processes.

The study was carried out in a vineyard located in Cenlle (Ourense) (North-West Spain), belonging to the Ribeiro Designation of Origin during the years 2015-2016. The airborne pollen sampling was conducted over the study years by using both, a Hirst (Hirst 1952) and a Cour trap. Following the protocol proposed by Cour (1974), pollen grains were trapped on vertical gauze filters (400 cm²) exposed for 3 or 4 days during the flowering period. To determine the pollen, flower and bunch quantity produced per plant, ten Godello variety vines were selected. In order to calculate the number of pollen grains per anther, the model proposed by Cruden (1977) was applied. The quantity of pollen per anther was calculated in three bunches of each vine by selecting three flowers of each bunch and three anthers of each flower. The pollen production per flower was determined based on five anthers from each grapevine flower as a mean. To obtain the number of flowers per vine, the average value of tertiary ramification of each bunch (considering that each tertiary ramification presents a group of 25 flowers) was calculated.

Along the study period, the highest annual total pollen amount was observed during 2016 with 2057402 pollen grains using the Cour methodology. Lower quantity of *Vitis* pollen in the air was registered by means the Hirst methodology: an annual total amount of 102 pollen grains during the year 2015 and 315 during 2016. The largest number of bunches per vine was observed in 2016 (average 24 per vine). The highest average value for pollen production per anther (2953 grains) was also recorded in this year. Pollen production per vine was also highest in 2016 (38773450 pollen grains).

The knowledge of the grape vine phenology and aerobiology, mainly during the flowering stage, contributes to the optimization of the harvest and the improvement of the final product quality.

***Betula* allergenic load in the atmosphere of Santiago of Compostela**

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Type I pollen allergy episodes caused by airborne pollen proteins have a high clinical impact around the world. *Betula* pollen contains at least eight identified allergens with a recognized major allergen, Bet v 1. The protein belongs to the pathogenesis related protein group (PR 10), representing the primary sensitizer in regions with high birch pollen exposure as consequence of the high *Betula* pollen production per plant. Birch pollen is a frequent cause of allergic rhino conjunctivitis within northern America and Europe, with around 100 million people sensitized to the major allergen Bet v 1 (Breiteneder et al., 1988).

The study was conducted in Santiago de Compostela, placed in the North West Spain, from 2012 to 2015. Pollen sampling was carried out using a Lanzoni VPPS-2000 volumetric trap, and for allergen quantification a Multi-Vial Cyclone Sampler was used. Allergen content in the samples was detected using a specific 2-site ELISA and Bet v 1 antibodies. Meteorological data were provided by the Agencia Estatal de Meteorología (AEMET). The Principal Component Analysis (PCFA) was applied to determine the relationship between pollen, allergen and weather variables. Finally a lineal regression model was performed with the aim to predict pollen and allergen concentrations.

Betula pollen grains and Bet v1 allergen were detected from the second half of March to the end of the month of April or the beginning of May in the Santiago atmosphere. The higher annual total pollen concentrations were registered during the year 2014 with 1697 pollen grains. The maximum pollen daily peak was observed in same year, on April 10th with 330 pollen/m³. Furthermore, the higher total annual amount of allergen concentration was recorded in 2014 with 32,01 nanograms. During the same year the maximum allergen peak was detected with 6,27 ng/m³ the April 11th. The PCFA analysis performed extracted 4 principal components, since they had eigenvalues greater equal or than to 1.0. The components account for together around of 87,7% of the data set variability. The predictive capacity of the main variables was evaluated in order to obtain a linear regression model to predict the pollen an allergen concentrations in the study area. The most accurate forecasting model to *Betula* pollen obtained explained a R² value of 0,54, whereas for the Bet v1 allergen concentrations explained a R² value of 0,52. The accuracy of the equations was verified by the good fit obtained in the comparison between the predicted and observed data of the year 2011 (which it has not been include in the study).

The combination of the pollen counts and the quantification to the allergenic proteins can be used as a tool for predict the allergy risk periods to *Betula* and thus alert to sensitize people to this pollen type.

Pollen proteins in the atmosphere: a comparative study of three methods

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In recent years, different methods and instruments have been used for the analysis of allergens in the atmosphere. The quantitative results have been very diverse, possibly due to the different efficiency of the instruments and/or the different sampling substrate, together with the difficulty of making comparisons between localities. The aim of this work was to compare three sampling systems to see which factors (extrinsic or in the apparatus itself) influence the quantification of airborne allergens.

Airborne concentrations of total proteins and of two families of grass allergens, Phl p 1 and Phl p 5, were monitored in Bologna from March to June 2015. Three samplers were employed: a Burkard cyclone sampler (flow 16.5 L/min) collecting total suspended particulate matter, a five stages Berner impactor (flow 80 L/min) loaded with Tedlar supports for particles collection from 0.05 to 10 µm and a dichotomous Universal Air sampler (flow 300 L/min), which allows the simultaneous collection of fine (< 1 µm) and coarse (from 1 to 10 µm) particulate matter on quartz fiber filters.

Prior to allergens quantification by a double antibody sandwich ELISA, proteins were quantified by BCA assay. Results were compared with pollen concentrations monitored using a Hirst-type volumetric spore trap over the same study period.

The results obtained for total protein concentration displayed significant differences among the three methods. High concentrations have been obtained with the Burkard cyclone. But we found significant differences for the two PM10 samplers; in this case, while data for the fine fraction were correlated, though with a low correlation coefficient ($R^2 = 0.4$), no correlation was observed for the coarse fraction. For what concerns the analysis of Phl p 1 and Phl p 5, the collection flow of the Berner impactor was not sufficient to quantify the selected allergens above the detection limit over a 24 hours sampling period, hence only data collected by cyclone and dichotomous sampler were compared. It was interesting to find significant concentrations of Phl p 5 (min = 10 pg m⁻³; max 284 pg m⁻³; avg 130 pg m⁻³) also in the fine fraction (< 1 µm), which is a carrier of pollutants and allergens to the deep airways.

The lack of correlation for proteins concentration between the dichotomous sampler and the Berner impactor in the coarse fraction is probably to be ascribed to the occasional capture of pollen grains or their fragments in this fraction of air, because of incomplete separation, which eventually doesn't occur simultaneously for the two samplers.

The presence of allergens in the fine and coarse fractions of particulate matter should be analysed according to the meteorological data and chemical composition of particulate matter to shed light on the factors which most influence the allergens release by pollen and their absorption and interaction with them.

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Detection of airborne allergen in relation to pollen counts (*Olea europaea*)

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Different studies have confirmed the presence of allergenic activity outside the pollination period, suggesting that the pollen counts do not include the total allergen exposure. This also points to that there are other sources of allergens, such as atmospheric aerosol, in addition to the pollen grain, that may constitute a relevant allergenic load.

The aim of this study is to quantify the presence of Oleaceae allergenic activity in the atmosphere, establishing its relationship with the respective atmospheric pollen grain counts and assessing the influence of weather variables on Oleaceae allergens.

During the flowering season (April and July 2010), daily airborne pollen sampling was carried out using a Hirst-type volumetric trap at an aerobiological station located in Elche (Alicante), on the southeastern Spanish Mediterranean coast. Meanwhile, for the aeroallergens load (Ole e1), twenty-four hours samples of PM₁₀ were collected on quartz fiber filters by means of low-volume samplers Derenda LVS 3.1. Pollen analysis followed the norms of the Spanish Aerobiology Network, and allergen concentrations were quantified by ELISA after extraction of the samples.

Meteorological parameters were obtained from a station of the air quality surveillance network of the regional government. The back-trajectories were computed using the HYSPLIT model for days with maximum concentrations of pollen, allergen or both.

The olive pollen season comprised from mid-April to the beginning of June. Peak daily concentrations occurred during the first half of May, reaching pollen concentrations between 50 and 161 grains m⁻³. The highest concentration was reached on May 26, with 280 grains m⁻³. However, the greatest presence of allergen was from mid-May to mid-June, with concentrations higher than 0.65 ng m⁻³, in particular on June 8 and May 26, with 1.55 and 1.54 ng m⁻³, respectively. Thus, during the beginning of the main pollination period (PPP), *Olea* and Ole e1 had a similar behavior, coinciding with air masses coming mainly from Andalusia, the region with the greatest cultivated extension of olive tree in Spain. On the other hand, during the second half of the PPP, when the highest concentrations of Ole e1 were recorded, *Olea* did not exceed 50 grains m⁻³. This was particularly evident on June 3 and 8 reaching allergen concentrations of 0.714 and 1.554 ng m⁻³. Peculiarly, these days were preceded by rains (the accumulated precipitations were 4.2 and 8.9 l/m², respectively). In addition, the levels of both decreased on May 15, coinciding with air masses coming from the north of Spain (> 2 m/s).

The study of olive pollen grains and Ole e1 allergen levels showed that light rainfall reduces the presence of pollen in the air. In contrast, a substantial increase in the concentrations of allergen was observed due to the pollen rupture by rehydration. On the other hand, the influence of air masses coming from Andalusia (in southern Spain) on the increase in both the pollen counts and allergen concentration was confirmed.

Case of study in the region of Paris regarding allergy symptoms, atmospheric pollution and pollen grain concentration

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The French Network of Survey for Airborne contaminants (Réseau National de Surveillance Aérobiologique, RNSA) monitors pollen concentrations for all the identifiable species since 1985. This monitoring is based on a dense network of 400 Hirst pollen and spores traps spread all over France. The technic used in the network allows getting a concentration of pollen grains every two hours. These data have been since the beginning associated with records from a panel of doctors to give a second level of information on allergic symptoms.

In addition to that, OpenHealth.fr designed and is publishing a health indicator aiming to monitor allergic rhinitis using drug sales data (mainly antihistamines) from over 4600 pharmacies. Data are available since 2010.

The relationship between allergy symptoms and the presence of pollens in the atmosphere has been well established by combining all these data. The concept is based on the comparison of the day mean of pollen concentration and the health indicator.

But up to date, the relationship between pollution events, meteorological parameters and the allergic rhinitis has not been achieved. Our study aims to understand their respective relevance according three distinct pollution events in the search of new triggers to prevent sanitary risks. We present here preliminary results on the relationship between allergic rhinitis, pollen concentration and pollution events.

Long distance transport of *Olea europaea* pollen over Central Europe

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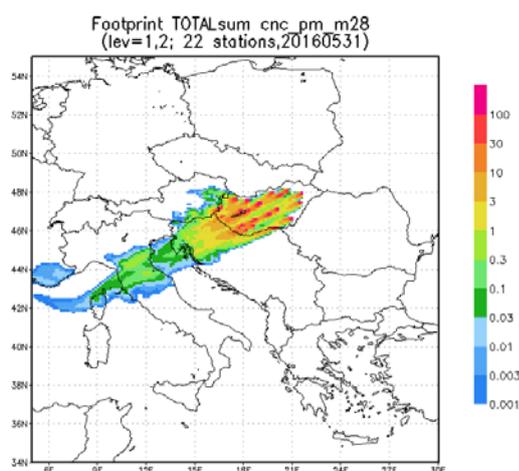
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The olive tree (*Olea europaea* L.) is extensively cultivated for its oil in the Mediterranean Basin. Its pollen is one of the most important causes of respiratory allergies in that region.

Air samples were collected using Hirst-type pollen traps (Burkard design) at 18 monitoring stations in Hungary.

High pollen concentrations of airborne *O. europaea* pollen was observed in all Hungarian monitoring stations in 2016, during two periods, between 29 May - 01 June and 15 - 17 June. The maximum pollen concentration in the first period was 20 pollen/m³ in Pécs (31 May) while in the second period the pollen level reached its maximum, 36 pollen/m³ in Veszprém (16 June). The large-scale pollen transport towards Hungary was predicted by the SILAM model within the scope of the Copernicus operational pollen forecasts for Europe and HYSPLIT model. The first model is run on a daily basis with 10 km spatial resolution over the whole Europe predicting the emission and transport of pollen for five days ahead. For the above episodes, we also ran the adjoint computations revealing the probable source areas for the observed pollen – and comparing these footprints with the map of olive flowering during the corresponding times. In the Hungarian air samples pollen grains of another mediterranean species, *Quercus ilex* were also detected. The detection period of pollen grains in the Hungarian air samples corresponds to the pollination period of *O. europaea* and *Q. ilex* in Italy. The computations have shown that the main source of pollen grains is North part of the Italian Peninsula. To our knowledge, this is the first report of long distance transport of olive pollen to Central Europe.

Pollen grains of the highly allergenic plants could be transported by air currents to Hungary from the mediterranean area.



Effect of temperature and precipitation on the airborne pollen parameters in Catalonia (NE Iberian Peninsula)

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Here we explore the correlation between temperatures and precipitation and the main standardized airborne pollen parameters of 22 taxa collected at 6 localities in Catalonia, in order to determine the effect of meteorological variability on their pollen dynamics.

Airborne pollen data were recorded by the Aerobiological Network of Catalonia (XAC) at six stations located in Barcelona (BCN) and Bellaterra (BTU) over an 18-year period from 1994 to 2011, and in Girona (GIC), Lleida (LLE), Manresa (MAN) and Tarragona (TAU) over a 16-year period from 1996 to 2011. Samples were obtained daily from Hirst samplers, the standardized method in European aerobiological networks, and analysed following the standardized Spanish method. 22 pollen taxa were considered of high interest: *Alnus*, *Ambrosia*, *Artemisia*, *Betula*, *Castanea*, Chenopodiaceae/Amaranthaceae, *Corylus*, Cupressaceae, *Fagus*, *Fraxinus*, *Olea*, *Pinus*, *Pistacia*, *Plantago*, *Platanus*, Poaceae, Polygonaceae, total *Quercus*, *Quercus* deciduous type, *Quercus* evergreen type, *Ulmus* and Urticaceae.

The pollen parameters included in the study are: Annual Pollen Index (API) and the start (SPP), the end (EPP) and the length (LPP) of the Pollination Period (PP). The PP has been established as the period beginning the date in which the sum of the daily mean pollen concentrations reaches 2.5% of the annual sum until the date in which the sum reaches 97.5%.

Considering that the PP of most of the taxa in Catalonia begins in spring, correlations between pollen parameters and winter (from previous December to March) and annual mean values of meteorological variables have been calculated.

Temperature was the meteorological variable that showed a greater influence in the pollen production (API) and in the timing of the pollen season (SPP, EPP and LPP).

Winter temperatures, especially maximum and mean values, are responsible for the advance or delay in the SPP, while annual temperatures, especially minimum and mean values, explain an advance or delay of the EPP.

API was primarily influenced by winter precipitation and winter maximum temperature.

Analysis of the behavior of airborne *Artemisia* pollen in relation to precipitation and temperature in the locality of Lleida, Spain

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Artemisia (mugwort) is a common herb/shrub growing in nitrophilous and ruderal weedy-lands and wastelands with arid, salted, gypseous and/or dry soils, as well as on wet cultures and rocky mountains. They flower mainly in autumn and winter, except mountain species which flower in summer. Airborne mugwort pollen dynamics shows variable patterns and intensity from year to year. The aim of this work is to understand the variability shown by daily airborne *Artemisia* pollen in Lleida, the Catalan locality with the highest concentrations.

Artemisia pollen data obtained by the Point of Information on Aerobiology (PIA) of the Universitat Autònoma de Barcelona and the meteorological precipitation and temperature data provided by the Catalan Service of Meteorology (Meteocat) were used. Pollen data analyzed were the Annual and Monthly Pollen Index (API, MPI), the dates of start, end and duration of the pollination and meteorological data were considered daily, monthly and for seasonal periods (winter, spring, summer and autumn). Analyses were performed with IBM SPSS Statistics and Microsoft Excel.

The following behavior of *Artemisia* can be evidenced in relation to the precipitations and temperatures.

- Winter precipitation increases the *Artemisia* API and the pollen peak intensity.
- Spring precipitation increases the API advances the start of the pollination and increases the length of the pollination period.
- No relationship in autumn, neither all the year period and the peak date.
- High temperatures in winter have a positive influence of API and on the intensity of the pollen peak.
- High temperatures in spring decrease the API, shorten the length of the pollination period and delay the start of the pollination.
- High temperatures in summer delay the start of the pollination.
- High mean annual temperatures coincide with a decrease in API, in the intensity of the pollen peak and on the number of days with pollination.

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Forecasting the interannual variability of olive seasonal pollen load

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Forecasting of the airborne pollen concentrations using numerical models is becoming a useful tool in many practical and research-oriented areas. However, to-date there is no unified approach for predicting the overall season severity that could be applied at European scale. Recent studies on Northern Europe confirmed the possibility of predicting the birch SPI based on the meteorology and the SPI of the previous year. The current study aims at development of a similar-type model for to predict the interannual variability of olive pollen load in Mediterranean region.

Pollen data from European Aeroallergen Network was used together with daily meteorological and environmental data (CO₂, temperature of air, precipitation, short wave solar radiation) taken from European Re-analysis ERA-Interim dataset. Steps performed to identify the most influencing factors are: (i) Censuring the annual dataset by length and continuity; (ii) normalization of the SPI for all years; (iii) clusterization; (iv) analysis of correlation matrix of data; (v) identification of a single main site as a base for spatial analysis; (vi) change of temporal axes to heat axes (i.e. days are expressed as a amount of accumulated heat); (vii) splitting previous year to periods based on heat accumulation; (viii) calculation of mean meteorological parameters for each heat-sum period; (ix) testing the influencing parameters for each period by using bootstrap and MLR. The constructed model is evaluated using withheld subset of data.

Mediterranean cluster consists of French (FRAIXP, FRCHAL, FRDIJO, FRGAP1, FRGREN, FRLYON, FRMONP, FRNIME, FRPAU1, FRPERI, FRPERP, FRTOUN, FRTOUS) and Spanish (ESBAR2, ESBARC, ESCART, ESCORU, ESGIRO, ESGRAU, ESJAEN, ESLLLEI, ESMADR, ESMALA, ESTOLE) aerobiological stations whose data are available from the year 1991 to 2016. As the main influencing factors of the next-year SPI, CO₂, temperature before and during the current season, precipitation before the season, and short wave radiation during the pollen season were identified.

Accuracy of model is significantly controlled by the length of the data set, i.e. the number of years available for each monitoring station. Unexpected message came from the previous-year SPI – the parameter is not important on regional level, probably because of the difference between the natural and controlled olive tree plantations in Spain and France.

Abstracts

Wednesday, 6th September

Session 9: Paleopalynology

Session 10: Melissopalynology

Session 11: Paleopalynology

Poster Session C: Paleopalynology

Climate change since the last glacial period in Lebanon and the persistence of Mediterranean species

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The Near East, including Lebanon territory, is considered as a hotspot of biodiversity as well as a refugial area in the Mediterranean. Lebanon is a territory which represents the southernmost edge of the range of some valuable plant species such as firs and cedars. Genetic studies suggest that it is crucial to evaluate the climate changes and their impacts at the rear edge of relict populations of species such as those found in Lebanon.

Three fossil pollen records, encompassing the Holocene and partially the last post-glacial period, were collected in Lebanon. Temperature and precipitation variables were reconstructed using the modern ranges of the Eastern Mediterranean plant taxa identified in the fossil pollen records and their related modern climate. We quantified the mean January temperature (Tjan) and both winter (Pw) and summer (Ps) precipitation.

Tjan shows a strong correlation with the global temperature changes retrieved in the NGRIP Greenland ice core. The amplitude of ca. 8°C between the Younger Dryas (YD) period and the Holocene is coherent with climate reconstructions from the Eastern Mediterranean. The overall amount of precipitation was lower during the YD than during the Holocene but the contrast between Pw and Ps was much more reduced (less than 2 times) during the YD than during the Holocene (up to 8 times). Such different seasonal contrast compare to the present day is coherent with other climate proxies from the Levant that tend to indicate the presence of moisture during the last glacial period. In effect, the low Pw during the YD reflects the replacement of the forest ecosystem by a more shrubby or herbaceous vegetation.

During the last glacial period, Lebanon was not under a typical Mediterranean climate such as the one we know today, i.e. with a strong precipitation and temperature contrast between summer and winter seasons, but rather under a less contrasted climate. Mediterranean species persisted in this area due to the low amplitude of temperature change between the last glacial period and the Holocene as well as to an availability of moisture throughout the year instead of an occurrence mainly during the winter season as is the case today.

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Paleoproductivity changes over the last 30ky in the NW Moroccan margin as reconstructed from palynological (dinocyst) and stable isotopic tracers

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Past hydrological and primary productivity regimes, on the basis of dinocyst and planktonic foraminiferal fossil assemblages as well as on planktonic (*G. bulloides*) and benthic (*U. mediterranea*) stable isotopes (O, C) together with alkenones, were investigated over the last 30 kyr BP at upwelling site MD04-2805 CQ off NW Morocco. These data previously published and compiled in regional synthesis for the NE subtropical Atlantic Ocean (Penaud *et al.*, 2010, 2011, 2016) have been implemented by new recently ones (acquired on this core) especially including benthic foraminiferal assemblages and related new isotopic data (*C. wuellerstorfi*) together with unpublished dinocyst-based quantitative reconstructions of sea surface productivity. This multiproxy data set enables to deepen the discussion about paleoproductivity changes across rapid climate events such as Heinrich Stadials (HS2 and 1) or the Younger Dryas (YD).

Over the last 30 kyr BP, our previous published results showed higher upwelling intensity during HS1 and the YD and lower upwelling cells during the LGM and HS2. We also presented coherent regional reconstructions of paleo-sea-surface temperatures (SSTs) modulated by well-known Northern Hemisphere climatic fluctuations using three independent proxies: dinocyst and foraminiferal transfer functions as well as alkenones. Specific occurrences of the dinocyst *Spiniferites lazus* and of the foraminifer *Turborotalita quinqueloba* were noted during HS2, HS1, and the YD, whereas in the Alboran Sea and in peri-Iberian waters these cold events were commonly accompanied by the occurrence of the dinocyst *Bitectatodinium tepikiense* and of the subpolar foraminifer *Neogloboquadrina pachyderma* s. This very pronounced shift between the planktonic communities was interpreted as indicating the presence of a distinct hydrological structure in the vicinity of the strait of Gibraltar which separated at that time African (north of Morocco) from European (southern Iberia) water masses. In parallel with the well discussed southward shift in planktonic population in response to the migration of polar water masses (Eynaud *et al.*, 2009; Penaud *et al.*, 2011), we here focus on productivity regime changes reconstructed thanks to an enlarged isotopic dataset and to new dinocyst-based quantitative reconstructions obtained with the same Modern Analog Technique as recently tested in the central Gulf of Cadiz (MD99-2339 core; Penaud *et al.*, 2016).

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History of Holocene vegetation in arid and semi-arid regions of central and southern Tunisia

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The north-south increasing aridity is a key climate factor for the latitudinal extension of the semi-arid and arid bioclimate in central and southern Tunisia. In this area, the spread of the Mediterranean forests and steppes is approximately limited between the 400 mm/yr and 200 mm/yr isohyets. The transition towards the desert vegetation is gradually recorded between 200 mm/yr and 100 mm/yr isohyets. During the Holocene, rainfall variation related to global climate change and rapid climate events has affected the vegetation distribution. In North Africa, the onset of increasing aridity since the Middle Holocene is correlated with the end of the African Humid Period in the Sahara at ca. 5.5 kyr and results in a major aridification of the southern Mediterranean. Thus a northward shift of the isohyets may have impacted the vegetation structure in southern and central Tunisia.

In arid and semi-arid areas, sediments from lagoons and sebkhas are suitable archives to study the vegetation dynamic related to climate variability. Pollen analyses undertaken in the Kasserine palaeo-sebkha, the sekha-lagoon Halk-el-Menjel in central Tunisia and the sebkha Boujmel in Southern Tunisia document the semi-arid, arid and desert vegetation changes under increasing aridity during the Holocene. Pollen data attest to the presence of forested taxa during the Early Holocene, and their later decrease since the Middle Holocene while the steppe vegetation extended in central Tunisia. In southern Tunisia at the beginning of the Middle Holocene, steppe lands dominated the Jeffara coastal plain and Mediterranean woody taxa are limited to the slopes of the Matmata Mountains. Thereafter when aridity increase, desert taxa are recorded in the Jeffara Plain and the woody vegetation remains confined [restricted] to the Matmata Mountains area. However, the vegetation sensitivity to aridity is attenuated by the persistence of local moisture in coastal and mountainous areas.

Lateglacial to early Holocene transition in Northern Iberia. Palaeoenvironment and fuel use

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The relationship between landscape evolution and human activities is currently an issue of great interest in the palaeoenvironmental scientific literature. The study of this connection was of particular interest during the Lateglacial to the early Holocene transition, when the climate variability could have influenced the hunter-gatherers way of life of the Magdalenian and Mesolithic groups. Here we present the two only archaeobotanical sequences in Northern Iberia documenting the end of the Pleistocene and the beginnings of the Holocene.

Archaeobotanical data from two archaeological sites have been analyzed, including the rock shelters of Martinharri (Treviño, Burgos) and Socuevas (Pobes, Álava), both located in the transition between Atlantic-Mediterranean biogeographical regions. The chronological frame of these sites expands between ca. 14000 cal yr. BP and 9000 cal yr. BP. Both archaeological sites have been object of palynological analysis of pollen, spores and non-pollen palynomorphs in order to reconstruct the palaeoenvironmental conditions. In addition, we have studied the fuel uses through the analysis of wood charcoal, with the aim of evaluate the main preferences in the catchment wood resources and its relationships with local forests.

Results indicate the predominance of *Pinus sylvestris* during the Lateglacial and their progressive replacement during the early Holocene by deciduous *Quercus*. We have also detected the presence of other deciduous taxa as *Corylus*, *Alnus*, *Salix*, *Fraxinus*, *Fagus* and *Ulmus*, with scattered presence during the Lateglacial and more abundant during the early Holocene.

The archaeobotanical analysis of those sites shows the main features of the environmental evolution of Northern Iberia. From ca. 14000-9000 cal yr. BP, climate changed from colder and dryer conditions during the end of the Pleistocene, with a landscape dominated by pines with scarce presence of deciduous forests, to the development of more humid and temperate conditions during the early Holocene, when the landscape was dominated by deciduous forests. These local forests were the main source of wood resources for the human communities of Magdalenian and Mesolithic technocomplexes in this region.

Late Glacial and Holocene vegetation patterns of Attiki, southern Greece

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Late Glacial and Holocene vegetation supersessions of Greece exhibit significant dissimilarities attributed heterogeneity local geological, environmental and climatic factors. So far, vegetation patterns of Northern Greece are generally in-detail studied as a result of the well preserved pollen record. Nevertheless, in south Greece a deficiency of long continuous, accurate dated and well preserved pollen records exist. Under that perspective the shallow marine core originated from the landlocked shallow bay of Elefsis offers a unique opportunity to study in detail the Lateglacial and Holocene vegetation patterns of Attiki (S. Greece) and feature the passage from the climate controlled vegetation of Late Holocene to the human disturbed and shaped modern landscape.

Retrieved from the deepest part of Elefsis bay by the Hellenic Centre for Marine Research (HCMR), core S2P, covering the last 14,000 years, has been the subject of joint palynological, micropalaeontological, sedimentological and geochemical analyses.

High resolution palynological analysis of the top 300 cm of core S2P records the plant landscape development during the last 14,000 BP in response to climatic variability and to human impact. In Attiki open woodland Mediterranean communities, already established around 13,000 BP, were temporally replaced by low vegetation with steppe elements like *Chenopodiaceae* around 11,000 BP, indicative of the Late Glacial climatic oscillations. The onset of the Holocene is characterized by a major boost of mixed deciduous oaks, as well as the spread of *Pistacia* in response to the climatic amelioration. During Early Holocene evergreen Mediterranean woodlands are expanding, while deciduous oak woodland composition is becoming more diversified following the significant occurrence of *Carpinus/Ostrya* type. After around 6000 BP pine trees become the dominant feature in the landscape. The signs of human activities in the area are evident around 6000 BP. Olive and cereal cultivation as well as the gradual occurrence of several anthropogenic and soil erosion indicators signal human activities in the broader area of Elefsis, such as cultivation, wood clearance and pastoralism. The several oscillations of anthropogenic indicators recorded are linked to historical events in Elefsis area.

Environmental changes in the Middle to Late Holocene transition in Eivissa (Balearic Islands, Western Mediterranean)

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The study of palaeo-environmental evolution in island ecosystems is of great importance due to their high sensitivity to climatic and anthropic factors. The particularity of Balearic Islands is the late human colonization, occurring in the Late Holocene, during the Chalcolithic/Bronze Age. Therefore, environmental changes during Middle Holocene are apparently exclusively influenced by natural processes. Palaeoecological research in Balearic Islands has been mainly focused in the Gymnesian islands (Majorca and Minorca) and the palaeo-environmental evolution of Pityusic islands (Eivissa and Formentera) remains less known. In this paper, a study of three cores (Prat de Vila 1 and 2 and Prat de Ses Monges 1) from Eivissa is presented. The main objective is to obtain a well-defined chronostratigraphy of the southern islands of the Balearic archipelago, an essential step in order to understand the palaeo-environmental evolution and the sedimentary processes that originated the current landscape. This work is focused in the transition from Middle to Late Holocene, evaluating vegetation and sedimentation changes to climate oscillations during Middle and Late Holocene. Besides, one important aim of the study is to assess human-environment interactions along the first settlement of the island, during the Bronze Age.

This study represents the first interdisciplinary analysis in a core from Eivissa, combining sedimentological (Loss On Ignition, Laser Grain Size), macrofossils (malacology) and palaeobotanical (pollen) analyses. The pollen record in Prat de Vila 1 shows the dominance of *Quercus ilex-coccifera* and *Pinus* during the Middle Holocene. Around 4000 cal BP, vegetation changes occur, with *Pinus* reaching highest values and a noticeable decrease in values of both deciduous trees and in *Quercus ilex-coccifera*. Sedimentological analysis in Prat de Vila 2 shows significant changes during the second half of the 5th millennium cal BP, a transition from peatlands to an open lagoon in ca. 4500-4200 cal BP followed by episodes of terrestrial inputs. These environmental changes occurred just in the period when first settlers arrived to Balearic Islands during the Bronze Age, conferring probably an anthropic component to the process of environmental change. However, the transition to the Late Holocene in the context of a cooling event in 4200 cal BP, detected at global (Bond et al., 1997) and local (Frigola et al., 2007) scales, would have also had a significant role in these changes.

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Modern pollen-vegetation relationship and Holocene vegetation changes under arid climate (Southern Tunisia)

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The desert margins and arid ecosystems of northern Africa are particularly sensitive and vulnerable to climate change and increasing human pressure. However, pollen records from these areas are still scarce and reconstructions of Holocene climate changes and biogeographical history of the modern landscape remain a challenging issue. Taking into account the scarcity of suitable deposits for pollen conservation in the arid regions of southern Tunisia, pollen analyses are undertaken on surface samples and Holocene sediments from sebkhas.

The pollen/vegetation/climate relationship is based on soil surface samples collected along the hydrographic network and the surrounding of Sebkha Boujmel. The modern data are consistent and document the pollen transport and sedimentation on the surface of the sebkha, with a coherent representation of the regional ecosystems.

Paleoecological data are recovered from core BJM2 in Sebkha Boujmel spanning the last 8 millennium, supplemented by clay mineralogical analysis and by the integration of the data in an age-depth model based on 11 ¹⁴C AMS dates. Regional biogeography highlights the presence of Mediterranean vegetation on the mountains and a grassy steppe on the piedmonts and the plain during the humid periods of the Middle Holocene. Changes in vegetation up to 3ka are mainly modulated by climatic aridification while the anthropogenic impact remains limited. During the Middle and Upper Holocene, the millennial climate trend in southern Tunisia indicates increasing aridity from 5.7 ka, and correlates with changes in orbital and insolation parameters and global increasing aridity recorded in the southern Mediterranean after the African Humid Period. This aridity trend ends at ca 3 ka with the establishment of pre-desert plant ecosystems and Rapid Climate Changes henceforth synchronous of North Atlantic cooling. From the 3rd century BC, the record of *Olea* and *Vitis* indicates an intensification of the anthropogenic impact through agriculture. Agricultural activities are superimposed on that of the pastoral societies during the Punic and Roman periods. The anthropogenic impact thus marks phases of intensification. Human pressure is responsible for changes in plant landscapes, especially between 850 AD and 1150 AD with an increase in wormwood, and during the 20th century. Indeed the latter period shows a significant degradation of local environments reflecting major socio-economic changes in the local societies with sedentism and intensive pastoralism and agriculture.

La méliissopalynologie et la valorisation de la qualité liée à l'origine: l'exemple de l'Appellation d'Origine Protégée «Miel de Corse – Mele di Corsica»

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Contexte. L'activité apicole en Corse référencée dans les textes anciens depuis l'Antiquité connaît un regain d'intérêt dans les années 1975-1980. Une filière se structure et revendique le statut d'activité agricole à part entière pour favoriser les installations et l'augmentation de la production. Elle fait le choix de la valorisation de la qualité liée à l'origine de ses miels et obtient, en 1998, l'Appellation d'Origine Contrôlée (A.O.C) " Miel de Corse-Mele di Corsica", puis son équivalent européen l'Appellation d'Origine Contrôlée (A.O.P), en 2000. Cette dynamique place au nombre de ses priorités l'accompagnement scientifique pour caractériser et faire reconnaître les spécificités de son cheptel et de ses productions. Le grain de pollen est utilisé comme biomarqueur des relations abeille-végétation et bio indicateur de la qualité lié à l'origine des miels.

Objectif. Cette présentation vise à démontrer comment le questionnement du terrain et celui de la recherche se sont enrichis mutuellement pour présenter des résultats scientifiques reconnus comme novateurs et contribuant aux avancées de la méliissopalynologie [1-3] mais aussi utiles aux différentes étapes : dossier de revendication, expertise délimitation [4] et mise en place du cahier de charges et du contrôle des productions [5] de l'AOC et de l'AOP.

Principaux résultats exposés

- ✓ La synergie entre la recherche et le développement : bref historique des acquis scientifiques et professionnels.
- ✓ La définition du terroir des miels de Corse et de ses spécificités: une résultante des interactions entre une abeille particulière, un milieu naturel original et une conduite apicole adaptée.
- ✓ Le grain de pollen au centre de la connaissance de ces interactions : rappel des fondements de la méliissopalynologie et constitution des référentiels : palynothèque et « banque de miels ».
- ✓ La proposition d'une nouvelle méthode de traitement informatisé des données de la méliissopalynologie qui prend en compte l'ensemble du spectre pollinique pour certifier l'origine géographique et contribuer à la définition de l'origine botanique des miels.
- ✓ L'intérêt de la pluridisciplinarité et la place de l'analyse sensorielle pour qualifier, présenter et valoriser la diversité des productions, présentée sous forme d'une gamme variétale à déclinaison spatio-temporelle au fil des paysages végétaux insulaires et de leurs principales floraisons mellifères.

Conclusions – perspectives. Ces travaux intéressent d'autres régions ou pays et sont actuellement à l'origine de collaborations de recherche avec notamment : la Guadeloupe, la Martinique, la Guyane et le Sénégal. Ils ont été également utilisés pour développer une méthode innovante d'étude de la fraction volatile des miels par une approche de qualification pluridisciplinaire : méliissopalynologie et chimie [6].

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Feeding and farming practices in honey bee colonies

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Lately, there is a lot of alarming news about the consequences of the use of pesticides on the pollinators health and on the bee products quality (Greenpeace, 2014; Kessler et al, 2015, among others). On the other hand, it is important to highlight the different situation of European countries, from climatic and socio-economic point of view. Factors such as the extension of each crop, types of cultivations or treatments applied, are very different in each country and their influence may affect bees differently.

To know the preference of honey bee colonies over different feeding sources in a crop field. A pilot trial was carried out in the experimental fields of the Centro Agrario de Marchamalo along 2013. Two cultivation areas were chosen: the first one with thiamethoxam coated maize (systemic insecticide of the neonicotinoids family), irrigated by sprinkling at dawn, trying not to interrupt the foraging; the second one with the four most commonly grown sunflower varieties in Spain, MOWGLI, PR65A40 and TRANSOL, treated with thiamethoxam and LG5543CL (Clearfield) without treatment. Beehives were placed within the crop areas. Pollen spectrum of honey and bee pollen of hives placed in both crops, as well as the nutritive value of pollen (sugars, total protein and polyphenols content) were analyzed.

Maize results: Pollen spectrum of honey indicates that maize pollen practically does not appear in honey and, if it appears, never exceeds 2% of frequency. Among honeys obtained from each beehive, two are multifloral and the other two are Lotus monofloral. From the total bee pollen harvested, maize represents a range between 0 and 29.02%. The nutritive values obtained were: 0.59-0.76 g gallic ac. / 100g pollen of total content of polyphenols, 13-14.45% of proteins, 17.57-19.68% fructose and 22.11-25.54% glucose.

Sunflower results: Pollen spectrum of honey indicates that, with the exception of one hive located inside the crop (monofloral sunflower honey), bees preferred to collect nectar of wild plants around the crop, producing 3 Lotus monofloral honeys and one Retama monofloral honey. However, bees show high attraction towards sunflower pollen, especially during the blooming season, over 80% in the composition of the total pollen harvested. The nutritive values obtained were: 0.64-0.76 g gallic ac. / 100 g pollen of total content of polyphenols, 13.33-14.40% of proteins, 17.55-20.45% fructose and 21.79-27.37% glucose.

Pollen and maize nectar are not attractive for honey bees. However, honey bees are moderately attracted by sunflower nectar and very attracted by sunflower pollen. In general, nutritional bee pollen values are lower than those of other families.

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Characterization of Ibiza and Formentera honeys (Balearic Islands)

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Ibiza Island has a very important history for the beekeeping; there exists in all the territory stone-beehives, dated from Phoenician and Roman domination, which were used to collect rare and appreciated Mediterranean honey like that of thyme. The aim of this study is to identify and characterize the honey types of Ibiza and Formentera Islands (Balearic Islands) through melissopalynology as well as perform chemical analysis.

Samples of 55 honeys were collected from different geographical areas, representative of the Mediterranean vegetation in different typical season of collection (spring, summer and autumn), where beekeepers informed us about the predominant vegetation types surrounding the beehives. The characterization will involve the analysis of pollen types (qualitative and quantitative studies), trying to elucidate the exact nectar botanical origin of all the honey samples to know whether honey is mono- or multifloral with the help also of others parameters such as colour and sensorial characteristics. The total polyphenolic content, as well as some antioxidant properties, are measured by the Folin-Ciocalteu and the ORAC methods, respectively.

The monofloral honey of Ibiza in autumn came from *Ceratonia siliqua* and *Erica multiflora*, *Prunus* spp. and representant of Fabaceae during the early spring. During the rest of the year it is possible to collect particular monofloral honeys with different pollen types. Fabaceae honeys are very common in summer (such as those of *Lotus* spp. and *Genista* spp.) or that of *Echium* spp., or the original of *Asparagus acutifolius* and *Rhamnus* spp. It also exists important species of Lamiaceae, especially *Thymus* spp. and *Rosmarinus officinalis* which gives the particular taste of thyme honey (Mel de frigola), known and appreciate by beekeepers and customers. Honey colour, as well as the total phenolic content and antioxidant activity of each honey sample has been compared with the floral and geographical origin to describe the entire characteristic of Pityusic honeys.

It is the first time that Ibiza and Formentera honeys have been analysed according to its pollen and chemical composition. In this context, it was possible to classify honey samples according the islands vegetation as well as the different parameters in order to authenticate and provide a better valorization of honeys based on the combination of different assays.

A comparison of urban and rural honey and propolis from Barcelona metropolitan area

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Bees produce and store several products (honey, propolis, wax, pollen bread, royal jelly and venom) for different purposes. Although most of them contain pollen due to their plant origins, the most studied ones in melissopalynology are honey and propolis. Honey is a transformation of plant nectars by bees processed and stocked in honeycombs, and propolis is the resinous hive product made with a mixture of plant resins (from floral buds and bark exudates) and wax (from bee gland). The pollen content of these products can be isolated and identified, thus determining their botanical and geographical origin. On the other hand, the establishment of urban beekeeping in Catalonia is increasing and this makes necessary to know the viability of apiaries in the city and the influence of ornamental vegetation in the products of the bees. We compare, for the first time, the pollen spectra and botanical origin of urban and rural honeys and propolis from Barcelona metropolitan area.

Honey and propolis were obtained from 3 apiaries from two urban locations (Viladecans and Barcelona) and a rural one (Viladecans district) during the years 2015 and 2016. The honey samples were prepared according to acetolysis method (Louveaux *et al.*, 1978) and the propolis samples according to Barth (1998). The qualitative and quantitative results were interpreted following Louveaux *et al.* (1978).

Differences between honey and propolis and between urban and rural areas have been observed. Honey and propolis from urban locations show lower pollen diversity than the rural ones. At the same time, honey has lower pollen diversity than propolis. Regarding the botanical origin of these products, the Mediterranean vegetation is well represented even inside the cities. The ornamental plants do not have an important influence on the urban honeys, but they are represented by species like *Citrus* sp., *Aesculus hippocastanum* and some tree Fabaceae plants with a tricolporate and reticulated pollen (i.e. *Cercis siliquastrum*, *Gleditsia triacanthos*). Propolis samples contained pollen from resinous species such as *Pinus* sp., not usually present in honeys, and also *Hedera helix* or *Schinus molle*.

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Pollen content of larvae of *Vespa velutina* collected in NW Spain

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The yellow-legged hornet *Vespa velutina* is an invasive pest proceeding from Asia that causes a high economic impact in the biodiversity of the natural and suburban areas that occupies. The hornet was introduced, probably in 2004, near Burdeos and from this area was spreading along the Atlantic and Mediterranean coast to Spain (Castro & Pagola-Carte, 2010), Portugal and to other countries as Belgium, Germany or Italy (Bertolino et al., 2106). The adults of this hornet are predators of other insect including honeybees, but they also feed on plants. The larvae of *Vespa velutina* need a protein resources that frequent obtain from the thorax of the honeybee, but a great number of pollen grains are present in the digestive tracts of this larvae. This work provides information of these pollen types.

During the autumn and winter of year 2016, secondary nests of *Vespa velutina* were retired of their emplacement and studied. The nests were destroyed to obtain information about their structure: number of combs, size and number of individuals of the colony. From each comb, larvae have been extracted and subsequently dissected, to obtain the digestive tract. The obtained sediment was observed under light microscopy in order to identify the pollen grains that contain. The frequency of the different pollen types in samples was calculated counting a minimum of 300 pollen grains in each one.

The results indicate that the presence of pollen grains is common in all studied individuals, so the larvae of *Vespa velutina* used pollen as protein resource. The number of pollen types identified in the larvae varies between 5 and 12. *Eucalyptus* was common in all the samples being the most important resource in the studied nests. Other important pollen types present in the samples were from *Eriobotrya japonica*, *Hedera helix* and Asteraceae as *Calendula* type or *Taraxacum* type, coinciding with plants of winter flowering. No differences in pollen content were found between larvae of each comb of the nests.

Pollen grains are present in the digestive tract of the larvae of yellow-legged hornet. Under the conditions of this study the most common pollen were *Eucalyptus* and *Eriobotrya japonica*.

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Melissopalynological analysis of honey from the region of Mostaganem (Algeria)

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Algeria is considered a country traditionally consumer of honey but not achieve self-sufficiency in honey production, so important quantities of honey are imported from other countries as China, India and Saudi Arabia. Beekeeping in Algeria is practice mainly in the littoral area and is poorly development with a yield of 4 to 8 kg / hive. The lack of national legislation contributes to minimize the commercialization of Algerian honey. Some interesting unifloral honeys could be produced as: citrus, lavender, wild carrot, rosemary, jujube, heather and honeydew honey. The study of the pollen spectra of the honeys produced by the beekeepers contributes to its valorization, relates this product with the territory, facilitates the recognition of the botanical origin and allows differentiating it from other imported honeys. For this reason the pollen spectrum of honey produced in the region of Mostaganem, one of the main area for honey production, has been studied.

A melissopalynology study of 15 honey Samples collected during 2015 and 2016 harvest were performed. The samples were prepared using a melissopalynological method (Louveaux *et al.*, 1978). 10 g of honey was weighted and dissolved in bidistilled water and then centrifugated at 4500 rpm (3383 g). Quantitative and qualitative analysis was realized in order to know the pollen content of the samples and determinate the characteristics of pollen spectra.

The honeys studied present a medium-high content of pollen so are rich in pollen (Class III and IV). An important number of taxa were identified corresponding mainly to the families: Asteraceae, Apiaceae, Leguminosae, Rhamnaceae, Myrtaceae, Anacardiaceae, Caryophyllaceae, Brassicaceae, Rhamnaceae or Oleaceae, among others. Some pollen types as *Anthemis* type, *Centaurea*, *Brassica* type, *Pimpinella* type, *Foeniculum* type, *Daucus carota* type, *Acacia*, *Chamaerops*, *Sonchus* type, *Ceratonia*, *Hedysarum*, *Eucalyptus*, *Ziziphus lotus* or *Genista* type are present in more than 80% of the samples. The presence of considered non-nectariferous species as *Olea europaea* is frequently high being in some samples the principal type in the pollen spectrum of the honeys. Also non frequent taxa as *Opuntia ficus-indica*, *Muscari comosum* or *Paronychia* were identified. Unifloral honeys of *Citrus*, *Eucalyptus*, Apiaceae and honeydew honey were typified.

The pollen spectra of honeys from Mostaganem correspond to samples produced in semiarid areas of Mediterranean vegetation.

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Characterization of Corsican blossom honey: pollen diversity and volatile variability

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The Corsican honey was certified by the European “Protected Designation of Origin (P.D.O): Miel de Corse-Mele di Corsica” and was classified in six varietal categories: “spring”, “spring maquis”, “honeydew”, “summer maquis”, “chestnut grove” and “automne maquis”. The quality assessment of Corsican honey was essentially based on melissopalynological data taking into account the entire pollen spectrum and completed by physico-chemical parameters [1-3]. The aim of this work was to characterize the volatile composition of Corsica blossom honey and to develop an interdisciplinary approach to complete the characterization of Corsican honey and the qualification of the botanical and/or geographical origin.

In this work, botanical origin of 195 nectar honeys, including the five Corsican blossom honey ranges commercialized under P.D.O, were certified by melissopalynological analyses. The volatile composition of samples was established using Headspace-solid phase microextraction (HS-SPME) followed by GC-FID and GC-MS analyses.

Pollen analysis allowed the certification of Corsican origin and highlights the main nectariferous species and/or characteristic plant associations of each varietal range. The analysis of volatile fraction allowed the identification of 80 compounds amounting to 60.7 – 99.7 % of the total composition [4]. The volatile fraction of Corsican honeys was dominated by oxygenated compound (68.7 – 96.5 %) especially the aromatic compounds (32.9 – 56.4 %), except for “autumn maquis” honeys with isophorone derivatives (42.5 %) as major components class. Otherwise, some chemical markers of botanical origins were identified as 2-aminoacetophenone (“chestnut grove”); p-anisaldehyde and 4-n-propylanisole (“spring maquis”); isophorone and 3,4,5-trimethylphenol (“automne maquis”); isomers of lilac aldehydes and p-menth-1-en-9-al (“spring clementine”) [4]. Finally, the “spring non-clementine” and “summer maquis” honeys were both dominated by phenylacetaldehyde and benzaldehyde.

Finally, this study was helpful to develop an innovative approach based on the statistical analysis of the volatile fractions, which allowed obtaining discriminant chemical markers for the determination of the botanical origin of honeys.

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Melissopalynological origin determination and volatile analysis of honey from corsican *Anthyllis hermanniae* L. habitat

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Anthyllis hermanniae L. grows wild in the eastern mediterranean basin especially in the Balkan and Turkey, but also in the south of Italy (Salentina peninsula) in Sardinia and Corsica. In Corsica, it is very attractive and thus visited by honeybees, essentially for nectar in May and June [1]. The production areas of honeys with the contribution of *A. hermanniae* nectar were in the characteristic landscape of the corsican mountains (> 600 m altitude) dominated by associations of endemic subshrub plants (<1 m high). Since obtaining “Appellation d’Origine Contrôlée” designation [2-3], these light honeys derived from these typical taxa associations are named summer maquis honeys.

In the current study, 29 Corsican “summer maquis” honeys were characterized by melissopalynological and volatile analysis. The aim of this work was to characterize the volatile composition of corsican “summer maquis” honey certified by melissopalynological analysis in order to obtain an overview of the diversity of “summer maquis” honeys.

Melissopalynological analysis allows the identification of 83 taxa. The originality of pollen directory was founded on the presence of *Anthyllis hermanniae* associated with *Rubus* sp., associated with endemic taxa such as *Thymus herba-barona*, *Teucrium* sp., *Genista* sp. (essentially represented by *G.salzmannii* and *G.corsica*). In all samples *Castanea sativa* is present with variable proportions. The volatile composition of honey was characterized by 37 compounds amounting to 80.0 – 98.5% of the total composition. The volatile fraction was rich in phenolic compounds, especially in phenolic aldehydes. The contents of phenolic ketones and linear acids also showed great variability and statistical analysis suggests the existence of two groups. Indeed, 18 samples were characterized by a high content of phenolic aldehydes, which might be related to the high total amount of *A. hermanniae* and *Rubus* sp pollen grains. On the other hand, 11 samples showed a higher concentration of phenolic ketones and linear acids, which might be due to the nectar contribution of *C. sativa* and *T. herba-barona*, respectively.

Finally, the results showed that the volatile fraction combined with melissopalynological data could be useful for detecting the nectar contribution of plant species in honeys with complex melliferous origins.

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Pollen analysis of several unifloral commercial honeys

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The increase in the consumption of natural products in the last decades requires the development of methods to assess their quality. Microscopical analysis, especially the identification and counting of pollen grains in honey sediment, is widely used to ascertain the botanical origin of honeys. The purpose of this work was to evaluate the botanical origin of some commercial honeys labelled as single-flower honeys.

Five single-honeys labelled as Eucalyptus honey (4) and Chesnut honey (1) were bought in different establishments during November 2016. All of them were also marked as Spanish honeys. The qualitative analyses were done following Gadbin (1979), whereas the quantitative studies were carried out according the procedures described by Louveaux *et al.* (1978).

The quantitative analysis enabled the honeys to be placed in the Class III established by Maurizio (1975), except one honey labelled as “Eucalyptus honey” that was included in Class II. The qualitative studies showed that analysed honeys containing percentages in relation to pollen content upper to 90% of *Eucalyptus* sp. and *Castanea sativa* pollen types, respectively.

The qualitative analysis displayed that pollen content of *Eucalyptus* sp. and *Castanea sativa* in studied honeys were sufficient to be considered Eucalyptus and Chestnut monofloral honeys, respectively (Seijo *et al.*, 1997; Rodríguez *et al.*, 2013).

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Regional expression of the MIS9e interglacial in southwestern Europe – The Iberian margin pollen record and model-data comparison

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Intensity and regional expression of past interglacial periods are among the challenging questions on natural interglacial variability. Model experiments show that some interglacials of the last 800 kyr, such as MIS 9 and 5 interglacials, stand out by the strongest warming at high latitudes resulting from important insolation and greenhouse gas forcing while weak or no temperature difference with other interglacials is simulated at mid-latitudes. Millennial-scale climate variability during ice volume minima was proposed to play a predominant role in prescribing interglacial duration. A major evidence of that process was given by the pollen record from the SW Iberian margin MD01-2443 showing an early collapse of the Mediterranean forest in SW Europe during MIS 9e likely due to an abrupt climate change. This terrestrial interglacial appears however anomalously short-lasting as compared to other records from the southern Europe and North Atlantic.

The IODP site U1385 from the SW Iberian margin enables to revisit the regional signature of the MIS 9 interglacial in southwestern Europe. We will present new pollen data from this site to characterize the Iberian vegetation and climate changes during MIS9e. We will compare these data to MIS 5e pollen data from the Iberian margin and to simulations performed with the LOVECLIM climate model, in order to determine the factors controlling interglacial climate in SW Europe when high latitudes are particularly warm.

- 1) Our results display a short-lasting maximal forest expansion during the early MIS9e, in agreement with the MD01-2443 pollen record, but a persisting forest over the entire MIS9e.
- 2) Comparison with MIS 5 pollen data from the Iberian margin shows marked difference in Mediterranean forest expansion suggesting lower winter/annual precipitation during MIS 9 than during MIS 5.
- 3) Model simulations agree on lower SW Iberian tree fraction during MIS 9e and confirm that the vegetation cover difference between MIS 5e and 9e is mainly driven by lower winter precipitation during MIS 9e.
- 4) Model simulations show that the observed differences in vegetation and climate between MIS9e and MIS5e in SW Europe are mainly caused by insolation change while CO₂ plays a negligible role.

Data and model simulations show a strong regional expression of interglacial climate in SW Europe. The hydroclimate response in this region was mainly dependent on insolation forcing during past interglacial periods and followed different trends from high latitude warming which is highly sensitive to CO₂.

Evidence of Neolithic human settlements in the High Doubs Valley (France) revealed from multi-disciplinary palaeoenvironmental studies

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Neolithic pile-dwelling settlements are known in the Jura Mountains at Neuchâtel (Switzerland) and Chalain (France) Lakes. However, the Saint-Point and Remoray Lakes – in the High Doubs Valley (France) – have received little attention in this respect so far. Since 2015, a renewed interest allows for under-water archaeological surveys, aiming at finding such structures in the area. To further investigate the question of Neolithic occupation in this part of Jura Mountains and its frequency and intensity, we carried out multi-disciplinary analyses on several sites of the Haute Chaîne (850–1200 m a.s.l.). To this aim, we used palynological (including the identification of non-pollen palynomorphs) and sedimentological proxies combined with high temporal resolution. Palynological studies from the Saint-Point Lake (12.5-m long sediment core) reveal first evidence of agro-pastoral activities around 7400 cal. yr BP, as well as phases of cultivation of cereals (6800–6600 cal. yr BP, ca. 6250 and 6000 cal. yr BP, 5700–5500 and ca. 5200, 4900 and 4400 cal. yr BP; Murgia 2011). These phases correspond to periods of favourable climatic conditions (Magny, 2004). They are often followed by an increase of pollen of *Juniperus* and *Acer* as well as important variations of the main tree taxa (*Abies*, *Fagus* and *Picea*), that reflect temporary but recurrent human activities in the area during the Neolithic Period (Gauthier *et al.* 2014). Silicates and detrital carbonate fractions increased at Saint-Point Lake from 6800 to 5000 cal. yr BP, but they are mainly attributed to a climatic origin (Leroux *et al.* 2008). From Remoray Lake (13.2-m long sediment core), also, anthropogenic pollen indicators and spores of coprophilous fungi suggest the onset of human occupation and agro-pastoral activities during the Neolithic Period.

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Environmental evolution between Late Neolithic and Late Bronze Age in the NE Iberian Peninsula. Les Madrigueres a case study

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Studies concerning the Holocene climatic variability in Western Mediterranean showed those bioclimatic conditions have not been stable during this period. Pollen sequences along the North-Eastern coast of the Iberian Peninsula indicated an aridification trend from the Mid-Holocene. In this context, pollen and Non Pollen Palynomorphs (NPP) of a new palynological record from a core drilled in wetland delta Riera de la Bisbal (Les Madrigueres, El Vendrell, Tarragona) were studied with the aim of completing the knowledge about Holocene climatic variability during Late Neolithic-Late Bronze Age.

The 36 m-depth core obtained is formed by different sediments corresponding with Pre-Quaternary chronologies, Pleistocene and 4.5 m of diverse Holocene sediments in a discontinuous chronological sequence. The pollen and NPP record allowed us to identify the existence of a lagoon *ca.* 4000 cal BP, coinciding with the RSL stabilization model proposed by Vacchi *et al.* (2016). The vegetal landscape was denser than in the present, it was dominated by pine forests with some holm oak areas and an important role of the coastal maquis. A posterior transformation in an ephemeral lagoon was characterized by water fluctuation, showing a transitional phase in which, due to the bad pollen preservation, only local vegetation is recorded. However, in a regional context, it matches with the Minorca event 3, after which the lagoon progressively disappears from *ca.* 3000 cal BP.

A regional update of archaeological sites has been made in order to demonstrate the occupation (or not) of the territory during the transition from Middle to Late Holocene, which has showed an overlap between arid climate events and a minimum land use. Integration of both palaeoenvironmental and archaeological data of this region contribute to a better understanding of how sea-level changes and climatic turnovers (4.2 and M3 events) shaped the coastal landscape over the last few millennia, shedding light on the role of climate as a factor that has been influencing human activity between the Late Neolithic and Late Bronze Age.

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The Archaeobiology, Palaeoenvironment and water regime of the Rec Comtal, the “artificial” watercourse of Barcelona

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For centuries, one of the main challenges faced by the inhabitants of Barcelona was to ensure the provision of water to the city. Indeed, historical Bàrcino does not stand near a river although the historic core was bordered by seasonal streams. For this reason, during Roman period, a long aqueduct was built to transfer drinking water from the Besòs River, 11.3 km to the North. In Medieval times, at the end of the 10th century, this channel was repaired and used as a watercourse although it had other purposes. The latter mainly included industrial ones, such as powering mills and supplying artisan activities as well as irrigating deltaic lands. This long water channel was named the Rec Comtal and it crossed the upper limit of the Besòs delta, a plain which extends north from the city. This watercourse became the artificial river of Barcelona for a thousand years. In the 19th century, water for the Rec Comtal was obtained from wells and it was assigned to supply drinking water and for irrigation.

Since 2013, the Archaeology, Urban-planning and Garden Services of the Barcelona City Council have undertaken a far-reaching program for the study and recovery of the Rec Comtal, which has included the excavation of several sections. These are located inside and outside the medieval defences, in urban and farming environments respectively. The City Council is especially interested in developing archaeobotanical and palaeoenvironmental studies of the channel in order to use these data in urban planning, which includes urbanization, urban farming and extensive gardening works.

Archaeological excavations revealed stratigraphies reaching 180 cm in depth and historical phases of the channel use and repair. The sediments contained in the channel are highly variable, formed by organic silts and clays in some cases, by laminated levels and by sands and gravels. This stratigraphy has been radiocarbon dated to the second half of the 10th century, a date that accords with written sources. For each section of this structure, a multiproxy study has been carried out, including sedimentology, geochemistry, pollen analyses, NPP analyses, in addition to studies of charcoal, seeds, egg parasites, diatoms, ostracods and continental gastropods. These types of evidences have been compared with written sources.

The results indicate a high oscillation of water flow over different time scales, seasonally, annually and decadal, probably due to human water use and climate variability. The channel even dried up, as it is indicated by sedimentology and several bioindicators. In addition, bioindicators have furnished data about the quality of waters in relation to climate oscillations.

Pollen analyses suggest that in Medieval times the channel crossed a largely open landscape with few trees, while in the 18th century, the channel banks were occupied by coppiced riverbank forests and planted plane trees. Irrigated plots are also evidenced by high values of Cannabaceae pollen, while dryland agriculture was mainly concentrated on cereal crops and vineyards, as abundant grape seeds have been recovered.

All these data will be used by architects and urban planners to promote the reconstruction of this significant structure and to define a future Management Urban Plan for the Northern quarters of Barcelona.

Unraveling the forcings controlling the magnitude and climate variability of the best orbital analogues for the present interglacial in SW Europe

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The suitability of MIS 11c and MIS 19c as analogues of our present interglacial and its natural evolution is still debated. Here we examine the regional expression of the Holocene and its orbital analogues over SW Iberia using a model–data comparison approach. Regional climate based on snapshot and transient experiments using the LOVECLIM model is evaluated against the atmospheric and oceanic climatic records from IODP Site U1385. The pollen-based reconstructions show a larger forest optimum during the Holocene compared to MIS 11c and MIS 19c, putting into question their analogy in SW Europe. Snapshot experiments indicate reduced MIS 11c forest cover compared to the Holocene, primarily driven by lower winter precipitation which is critical for Mediterranean forest development. Decreased precipitation was possibly induced by the amplified MIS 11c latitudinal insolation and temperature gradient. In contrast, the reconstructed lower forest optimum at MIS 19c is not reproduced by the simulations probably due to the lack of Eurasian ice sheets and its related feedbacks in the model.

Transient experiments with time-varying insolation and CO₂ reveal that the SW Iberian forest dynamics over the interglacials are closely coupled to changes in summer temperature and winter precipitation mainly controlled by precession, CO₂ playing a negligible role. Model simulations reproduce the observed persistent suborbital atmospherically-driven vegetation changes in SW Iberia and the dramatic forest reductions marking the end of the interglacial “optimum”. This observation highlights the potential role of the interactions between long-term and millennial-scale climate dynamics in amplifying the climate and vegetation response.

Palynology of the Terramare, the Middle Bronze age of the Po Plain (SUCCESSO-TERRA project)

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In the framework of the national-funded project SUCCESSO-TERRA (*Human societies, climate-environment changes and resource exploitation/sustainability in the Po Plain at the Mid-Holocene times: the Terramara*), an interdisciplinary geoarchaeological and archaeobotanical (pollen and macroremains) investigation has been carried out, aiming at reconstructing the land transformations that occurred at the onset, duration, and end of the Terramare culture in the southern-central Po Plain (Emilia Romagna region). The Terramare are archaeological vestiges of banked and moated villages that developed in the central sector of Po River alluvial plain during the Middle and Late Holocene. The project expressively focuses on the Terramara Santa Rosa di Poviglio and on the Vasca Grande di Noceto. The relationships between the Late Holocene regional environmental and land-use changes have been investigated to obtain a detailed comprehension of adaptive strategies of the Terramare people during the Middle/Recent Bronze ages (1550–1170 years BC; Cremaschi *et al.* 2016).

Pollen samples were collected from trenches excavated within the main structures of the archaeological sites (the moat and ditch surrounding the Santa Rosa di Poviglio site, and the infilling of the Vasca Grande di Noceto site). Pollen extraction also includes sieving and heavy liquid floatation to concentrate pollen and non pollen palynomorphs.

Pollen was common and well preserved. A set of anthropogenic pollen indicators, common in the spectra (and in the spectra from other Italian archaeological sites; Mercuri *et al.* 2013), was considered especially useful to reconstruct agricultural dynamics besides the distribution of wild vegetation (wood and wetland plant associations).

The palynological research showed a transformation in flora composition and plant communities, suggesting a dynamic agricultural economy. The latter was possibly practiced on the basis of wood management and crop fields. At the top of the sequence of Santa Rosa di Poviglio, in correspondence with the drying of the moat system, a dramatic decrease of woods may had a twofold causation: increased aridity (natural factor) and intensive land-use (anthropic factor) might have played a fairly synchronous action on vegetation.

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BRAIN – cooperative network and website

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In 2015, a paper on the archaeobotany as a key tool ‘for the understanding of the bio-cultural diversity of the Italian landscape’ gave rise to a new initiative, the realization of the first cooperative network of archaeobotanists and palynologists working on archaeological sites located in Italy. The Botanical Record of Archaeobotany Italian Network has been introduced at MedPalyno2015 in Rome. Now the BRAIN database is ready as a website at <https://brainplants.unimore.it>

The website (programmed by Matteo di Lena, and Federico Camerini) consists of 6 pages, two of which are dedicated to the database including "Sites" and "References". Site position and density are immediately visible in a map while three graphs show updated statistics on the number of sites per Region, or per Cultural period, or per type of Record studied (e.g., pollen, seeds or charcoals). References may be sorted in alphabetical order, or by specific (first) letter or name of authors.

The first set of archaeological or human-related sites studied in Italy is available as an interactive sheet, and > than 1160 visits have been recorded in the first year of activity. The number of included sites is increasing, and the website is a user-friendly instrument, easy to navigate and to be implemented.

The BRAIN network lies in this database which is a useful instrument for both the research of one single group or for joint researches that will be planned to produce synthesis. The website is also a good way to publicize the impressive work that has been carried out, and will continue, in the field of archaeobotany in the Italian on-sites (archaeological) or near-sites (human-related environmental sites).

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MIS 31, a globally super interglacial? Insights from a new high-resolution pollen record from the southwestern European margin

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Marine Isotope Stage 31 (MIS 31) is an important analogue for ongoing and projected global warming, yet key questions remain about the regional signature of its extreme orbital forcing and intra-interglacial variability. Based on a new direct land-sea comparison in SW Iberian margin IODP Site U1385 we examine the climatic variability between 1100 and 1050 ka including the “super interglacial” MIS 31, a period dominated by the 41-ky obliquity periodicity. Pollen and biomarker analyses at centennial-scale-resolution provide new insights into the regional vegetation, precipitation regime and atmospheric and oceanic temperature variability on orbital and suborbital timescales. Our study reveals that atmospheric and SST warmth during MIS 31 was not exceptional in this region highly sensitive to precession. Unexpectedly, this warm stage stands out as a prolonged interval of a temperate and humid climate regime with reduced seasonality, despite the high insolation (minima precession values) forcing. We find that the dominant forcing on the long-term temperate forest development was obliquity, which may have induced a decrease in summer dryness and associated reduction in seasonal precipitation contrast. Moreover, this study provides first-time evidence for persistent atmospheric millennial-scale variability with multiple forest decline events reflecting repeated cooling and drying episodes in SW Iberia. Our direct land-sea comparison shows that the expression of the suborbital cooling events on SW Iberian ecosystems is modulated by the predominance of high or low-latitude forcing depending on the glacial/interglacial baseline climate states. Severe dryness and air-sea cooling is detected under the larger ice volume during glacial MIS 32 and MIS 30. The extreme episodes, which in their climatic imprint are similar to the Heinrich events, are likely related to northern latitude ice-sheet instability and a disruption of the Atlantic Meridional Overturning Circulation (AMOC). In contrast, forest declines during MIS 31 are associated to neither SST cooling nor high-latitude freshwater forcing. Time-series analysis reveals a dominant cyclicity of about 6 ky in the temperate forest record, which points to a potential link with the fourth harmonic of precession and thus low-latitude insolation forcing.

Palynology of the last interglacial complex in the western Balkans

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Lake Ohrid (Albania/FYROM) is the oldest continuously existing lake in Europe. It is located in a graben formed during the last phases of Alpine orogenesis the north-eastern Mediterranean region at 693 m a.s.l. It is included in the UNESCO “World Heritage Site” list since 1979 and represents an important hotspot of biodiversity, as it hosts over two hundred endemic species. A recent drilling campaign realized in spring 2013, mostly financed by the ICDP (International Continental Scientific Drilling Program) was carried out in the frame of the project SCOPSCO (Scientific Collaboration On Past Speciation Conditions in Lake Ohrid).

Palynological analyses were carried out in a composite sequence (DEEP) 569 m long and more than 1.2 million years old drilled in the depocenter of the lake. Pollen analysis (one sample every ca. 1600 years) of the top 200 m of the sequence and covering the last 500,000 years (at least five glacial/interglacial cycles), shows alternations between forested and non-forested periods in conjunction with a progressive change from cooler/wetter to warmer/drier conditions during interglacial and glacial periods [1]. Here we present the high resolution (roughly one sample every 400 years) pollen results of sediments ascribed to the last interglacial complex (LIG, 130-70 ka) the terrestrial equivalent of MIS5. The LIG, including the Eemian, the Last Interglacial (LI, MIS5e) and the early Glacial (MIS5d-a) is investigate to reconstruct past climate parameters and hypothesize future scenarios and risks. The Eemian (MIS5e) has been multidisciplinary investigated and its chronology carefully tuned using tephra layers and synchronization with other proxies [2]. The so far obtained results indicate a fairly good conservation of pollen and resulting in a certain taxonomic variety (95 different taxa). Pollen concentration is between 13,000 and 395,000 grains/ g. The average counts are over 500 pollen grains per sample. The AP (arboreal pollen) % curves from Ohrid are similar to those of two other lakes [3]. There are, however, minor differences. In all three diagrams we can distinguish the Eemian and its beginning around 130 ka. Also interstadials and stadials included in MIS 5 and defined in La Gran Pile (France) record since 1978 [4] are clear in the Ohrid record: Mélisey I, St. Germain I (divided in Ia and Ic), the Mélisey II and St. Germain II. This last appears to be tripartite at Ohrid, similarly to what happens at Ioannina [5], and in Italy at Lago di Vico [6] and at Lagaccione [7].

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Eemian palaeoenvironmental evolution in the northern plains of France from the alluvial sequence of Waziers

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In northern Europe, only few Eemian sedimentary sequences showing the Neanderthal's presence are attested. Therefore, the discovery at Waziers, in the Scarpe River valley, of a lot of flint artefacts within an alluvial sequence is remarkable.

The aim of the poster is to present the main results from the palynological analysis.

The thick alluvial sequence presents from the base to the top: 1) coarse fluvial deposits (lithological unit III); 2) organic silts (lithological unit IV); 3) peaty sediment (lithological unit V) with two archaeological levels (flint artefacts); 4) sand and loess sequence (lithological units VI and VII). The organic silts and peat units IV and V are correlated to the Eemian on the basis of a U/Th date on oogons of Characeae (minimum age: 103 +3.5/-3.4 ka), and the occurrence of the typical Last Glacial (Weichselian) loess sequence overlying fluvial organic deposits. The pollen record, from a 250 cm sedimentary sequence covering organic silts and peat units, documents palaeoecological changes in northern France from the MIS 6/5 transition to the end of the Eemian. Based on pollen data, three palaeoecological phases have been identified. The first phase corresponds to an open dry grassland driven by a cold climate. The second phase starts with an important expansion of trees indicative of a *Betula-Pinus* boreal forest development. The third phase is characterized by a warm temperate forest with the successive development of *Ulmus*, deciduous *Quercus*, *Corylus* and finally *Carpinus betulus*. Palynological data also show changes in the local vegetation, such as aquatic and wetland communities. A nutrient-poor oligotrophic environment with a slow water flow allows aquatic plants to develop. Following the water flow stop, the peat bog is set up then evolves towards an acid peat bog (rise of *Sphagnum*). Finally, the end of the pollen record shows the colonization by a dominant *Alnus* swamp forest.

Pollen data on the Lateglacial/early Holocene transition in coastal areas from NW Iberia: the Atlantic coast vs. Mediterranean nearby areas

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NW Iberia is situated at a transitional area between typically Atlantic and Mediterranean territories, and it is very sensitive to climate variations. Currently it presents a strong NW to SE climatic gradient, with rainfall and oceanic influence decreasing towards the SE. In this region, the climate oscillations of the Lateglacial/Holocene Transition (LGHT) have been reconstructed from several palaeorecords from inland areas. Particularly, the high-resolution multiproxy record from the small lake of La Roya provides a detailed reconstruction of the environmental changes experienced in the highlands. However, to date no comparable high-resolution palaeorecords for the LGHT exist from shallow marine environments of NW Iberia (*Rías Baixas*). Here, we present new pollen data for the LGHT, obtained from fluviomarine sediments at the Atlantic margin of NW Iberia. We compare the obtained biostratigraphy with others obtained from NW Iberia uplands and other Mediterranean areas to contribute to a better understanding of the vegetation responses to LGHT climatic changes in SW Europe.

Pollen analyses were carried out on two sediment cores from the *Rías Baixas*. Radiocarbon data and correlation with other climatic records allowed establishing a precise chronology for the two sequences, which jointly cover the period ~14.5-8.0 ka BP.

New evidence indicates that during the Lateglacial period cool and relatively humid conditions prevailed at the *Rías Baixas*, with local development of *Betula* and *Pinus* but also *Quercus* and other cool temperate mesophilous trees (*e.g. Carpinus betulus*) persisting on coastal valleys (*e.g. Ría de Vigo*) and the subhumid highlands of NW Iberia (*e.g. La Roya*). Precipitation and temperatures increased after the Holocene transgression, when heaths and wetlands spread on the coastal lowlands. Here, *Quercus* expansion started around 11.4 ka BP, whereas other deciduous trees (*e.g. Carpinus* and *Betula*) significantly declined. Sequences obtained in coastal and mountainous areas from NW Iberia were more sensitive to Early Holocene abrupt climatic events (*i.e.* 11.4 ka, 9.3 ka and 8.2 ka) than others described in nearby Mediterranean areas.

Local effects of the 10.5 ka event (Bond cycle-8) has been identified for the first time in sequences from NW Iberia. Higher representation of mesothermophilous and hygrophilous species on Atlantic areas of NW Iberia evidences relatively warm and moist conditions even during regional arid/cold events, in comparison with other inland sites and other Mediterranean territories of Iberia.

Distal palaeoecological impacts of the great Bronze Age eruption of Mount Vesuvius at Femmina Morta

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The major Early Bronze Age eruption of the Monte Somma Vesuvius (1995±10 BC) must have had an enormous impact on the landscape and inhabitants of the Campania region. The population may have fled the area and possibly some of the refugees might have resettled in the Pontine Plain and the Fondi Basin of South Lazio, north from Campania. Environmental impacts brought about by the influx of immigrants from Campania should be detected when reconstructing the vegetation in this area before and after the Avellino (AV) eruption. The distal ash from the AV has been found in the sediments of the Pontine plain and the Fondi basin (Sevink *et al.* 2011) and this lithological horizon acts as a stratigraphic marker. In this paper the results from pollen and macrobotanical analyses from samples taken at the site Femmina Morta 197 (FM 197), in which two tephra layers were present, including the AV tephra, will be discussed.

Palynological research of FM 197 was undertaken to reconstruct the regional vegetation development in the area. Changes in the vegetation might be the result of an increase in local population density and associated landscape change. Plant macrofossil analysis of samples around the tephra layers give an insight into the local vegetation and environment immediately before and after the tephra was deposited basin. In addition, plant macrofossils from terrestrial plants were extracted to obtain accurate radiocarbon dates allowing the construction of an precise chronology for the profile.

1. The AV tephra fallout seems to have affected the local vegetation, the regional vegetation seems unaffected
2. There are no clear indications for human activity in the region, during the entire investigated period. Only possible local effects seem to have taken place.
3. These results show no effect of a possible increase in population after the AV eruption of the Vesuvius in the hinterland of the sites.
4. This is in accordance with previous work in the Agro Pontino basin, Ricci and Mezzaluna (Bakels *et al.* 2015), where also only some local vegetation fluctuations seem to have taken place. It is not clear whether these are human induced or natural.

The tephra fallout seems to have had an effect on the local vegetation, as is represented by the plant macrofossil analysis. The regional vegetation seems not to have been notably affected. Small populations were most likely already present in the area before the AV eruption and had affected the natural vegetation. Effects of a possible increase in inhabitants and their activities after the AV eruption are not visible in the botanical research of FM 197.

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Paleofire dynamics in central Spain during the late Holocene: The role of climatic and anthropogenic forcing

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There has been an increase in the scale, intensity and level of destruction caused by fires in the Mediterranean region during the late Holocene. This matter can be verified in the central mountains of the Iberian Peninsula where significant changes in vegetation, land use, agriculture and policy have promoted such increase in fires frequency in mountain landscapes. Understanding the complex interactions between fire, climate and human impact is important, in order to establish measures of protection against landscape degradation.

Three continuous high-resolution macrocharcoal records (> 150 µm) were selected in order to document the last 3000 cal. yr BP of fire regime history. The charcoal series were analyzed using the method of charcoal signal decomposition with the CharAnalysis 1.1 software. These analyses were complemented with an ensemble member procedure in order to assess the sensitivity of fire event reconstruction to varying statistical methods

Charcoal influx was low between 3140 and 1800 cal. yr BP when forests were relatively dense both in high and mid-mountain areas. Fire frequency increases synchronously between 1800 and 1240 cal. yr BP suggesting antropogenic fire control between the Late Roman and the Visigothic periods that can be related to the cultivation of olive trees in the valleys and greater human impact in high-mountain areas. Independent fire response occurs between 1240 and 850 cal. yr BP during the Muslim period. Fires after 850 cal. yr BP (Christian period) are often synchronous and corroborate with inferred droughts during the warmth of the Late Medieval Warm Episode. Subsequently, fire records suggest that fire activity has varied continuously during the late Holocene in response to long- and short-term global and regional climate, vegetation, and human land use changes.

Paleofire histories demonstrate coeval changes in fire frequency, similar FRI distributions and millennia-scale synchrony during the late Holocene. Differences in the fire signal recorded suggest that fires are sensitive to the environmental gradient separating warmer southern (Lanzahíta) from cooler sites to the north (Tiemblo), and both from the one located at higher altitude (Serranillos). Resilience to fire is determined by the interaction between fire severity and plant traits involved in the postfire response, but also by the particular human history. Our study shows that the most fire-resilient forests are those that quickly recover from high fire frequency and fire events, i.e. *Pinus pinaster*, while those associated to low flammability environments (*Castanea sativa*) display lower magnitude in fire behavior and effects when compared with conifers. In this sense, human-induced land use changes in high-mountain environments interacted with topography and fire in the last three hundred years, supporting the spatio-temporal dynamic of *Pinus sylvestris* forests extinction when a susceptible threshold was reached.

Fire history in Komi and Karelia Republic during the Holocene

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In the frame of the four-year PREREAL project (Improving PREdictability of circumboREAL forest fire activity and its ecological and socio-economic impacts through multi-proxy data comparisons: <http://www.prereal.org/index.htm>), we developed a study aiming to highlight the impact of fire disturbances on boreal forest ecosystems of Russia (Republic of Komi, Karelia and Yakutia). Fire history is based on the analysis of charcoal particles (greater than 160 µm) sequestered in lacustrine and peat deposits, and dendrochronological analysis. Preliminary results show distinct charcoal peaks in peat sequences while in lacustrine deposits the fire signal is more complex with an important background component.

To analyze the fire history, a coring fieldwork has been realized in September 2016 in the Komi Republic where four cores have been studied and cover a period of 9500 years. In this area, the climatic influence is European and there were no glacier since 20 000 years (Kultti et al., 2003). A second fieldwork has been done in March 2017 where two cores have been studied. This place is also under European climatic influence but with the presence of a glacier during the last glacial crisis (Bakhmutov & Grigori, 1990). A last fieldwork is planned in Siberia (Eastern climatic influence) for July 2017. The method consists in cutting cores each 0.5 cm; then we count and measure macrocharcoals in each 1 cm³ of the samples with the program WinSeedle (WinSeedle 2009, Regent Instruments Canada Inc.; Oris et al. 2014). A statistical analysis will be then applied to the samples with the program CharAnalysis and related to the datations of the cores to determine the detailed fire history of these places.

For now we have just counted and measured charcoals but analysis will be ready in September. In Komi Republic, periods of intense fires (more than 300 charcoals counted for one sample), occur with periods having very few charcoals (many samples with 0 charcoals). In Karelia, charcoal peaks are also present but less intense and it is to note that periods with no charcoals are more frequent than in samples from Komi Republic. This is very preliminary results, statistics analysis will be done to determine a reliable fire history during the Holocene (Nowadays up to 10,000 years ago) in these two areas.

In a second step, palynological analyzes will be carried out in order to relate the fire activities to the vegetation.

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Asynchronous changes in the Holocene forest evolution on both sides of the Gibraltar Strait (Iberian Peninsula-Morocco)

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We aim to elucidate the role of climate and human activities in the decline of Western Mediterranean ecosystems on both sides of the Gibraltar Strait (Betic mountains in the Iberian Peninsula, and Rif and Atlas mountains in Morocco) focusing on *Abies pinsapo* Boiss. and *Cedrus atlantica* (Endl.) Manetti ex Carrière populations. *A. pinsapo* (Spanish fir) is a Tertiary relict tree extending along few coastal mountain ranges of southern Spain (West Betic Range) and northern Morocco (Rif Mountains). *C. atlantica* forests are distributed in Morocco (Rif, Middle Atlas and north-east of the High Atlas) and Algeria. To understand the factors involved in this decline, a long-term approach on climate change and anthropogenic disturbances is needed. But few well-dated environmental and pollen records are currently available for this area to draw significant conclusions.

In this study we present various high-resolution pollen sequences sampled in Morocco mountains (Fifi, Targuist), as well as in Southern Iberia: Sierra Nevada (Cañar and Dehesa del Camarate), Sierra Tejada (Praillos de Boissier) and Sierra de las Nieves (Ánimas). To complete the analysis, fossil records included in the European Pollen Database were extracted using EPD-r package.

The scarce number of well-dated fossil sequences in Morocco prevents from analyzing the spatial patterns and contrasts them with Iberian forests evolution. Despite this obstacle, two different scenarios are observed on both continents. The asynchronous human histories could explain, at least in part, the divergent trends in the forest evolution observed on each side of the Mediterranean. In North Africa the late persistence of forested landscapes is perceptible over Rif Mountains (Targuist) as well as in the Middle Atlas, where human-induced changes occurred for less than 2,000 years ago. Exceptionally, some cedar forests (Fifi in the Rif Mountains) went extinct as a result of high human impact (e.g. timber for construction, crop intensification, livestock activities from 2200 cal BP to 500 cal BP). As opposed, Southern Iberian forests have experienced human-induced forest loss and xerophytization, from sea level to high altitudes, for the last four millennia (Dehesa del Camarate, Ánimas). Additionally the Spanish forests were subject to major human pressures (intensive grazing, shipbuilding, charcoal making, etc.) during the last centuries. The *A. pinsapo* forest is an example of a dramatic decline during the Late Holocene (Ánimas).

Iberian forests are now recovering after centuries of intensive anthropogenic impact. However, these relict forests face the new threats of climate change, arson and the appearance of pests. In Moroccan forests it seems that the human impact has been more moderate during the last centuries. Looking forward, not only climate change will be the only threat but unsustainable forestry practices and expanding cannabis cultivation in North Africa (Rif), lead to deforestation and soil erosion of these fragile ecosystems.

Last 7,000 years BP coastal archives in southern Brittany, NW France

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In Brittany, major storm surges combined with the regional sea level rise (Goslin *et al.*, 2013) induced important coastal geomorphological changes and modifications of tidal and river channels (Fernane *et al.*, 2014). On the historical and Holocene period, some studies suggested that storminess is promoted during moister climate contexts in Brittany (van Vliet-Lanoë *et al.*, 2014) and concomitant with the retreat of Neolithic societies from the coastline in exposed areas (Fernane *et al.*, 2015).

Pollen analysis and foraminiferal assemblages conducted along a Holocene sequence retrieved at Kerzine (Morbihan, East of the Blavet river) enable to describe the vegetation evolution on the surrounding territory and to highlight changes in coastal environments related to climate/storm events and/or sea level rise, in addition to human impacts. Besides this local history, the results obtained at Kerzine are compared to those previously acquired in Guidel (Fernane *et al.* 2015), on the other side of the Blavet estuary, displaying common events presumed to have therefore a regional signature.

1) Numerous Chenopodiaceae and agglutinated foraminifera observed throughout the Kerzine sequence, except at the top, attest of a schorre environment. Punctually, synchronous occurrences of dinocysts and calcareous foraminifera (with typical infralittoral species) suggest a connection to the marine domain discussed in the light of storm events.

2) Pollen tree oscillations (mainly *Quercus* and *Corylus*) between 7,000 cal BP and the Bronze age (included) are synchronous on both sequences and discussed in parallel with Holocene rapid climate shifts. Regarding the anthropogenic forcing on landscape evolution, each side of the Blavet river however reveal a diachronous history (crops, grazing) recording local footprint of Neolithic human societies, that intensified during the Bronze age on both sites. 3) Surprisingly, anthropogenic evidences are missing between about 5,000 to 4,000 cal BP on both sites. In the light of the palaeoenvironmental analysis discussed above, this palynological retreat may be concomitant with coastline geomorphological changes related to storm events.

The few distance (20 km) between the two well dated coastal Holocene sequences allows us to distinguish diachronous *versus* synchronous changes in vegetation and palaeoenvironments, tentatively related to anthropogenic *versus* climatic changes, before the generalization of human footprint (gallo-romain period). Our conclusions however deserve other paleoenvironmental studies along the Brittany coast and will be soon confronted with archaeological data.

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Resilience, vulnerability and conservation strategies of high-mountain pine forests from the Gredos Range (central Spain)

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Cultural landscape and human impact studies are peculiar in regions that have featured extremely high environmental biodiversity as well as extraordinarily rich and complex cultural diversity in both the past and the present. In this sense, Circum-Mediterranean countries are ideal locations for investigating past environmental changes. This presentation introduces the use of fossil pollen analysis in order to identify the origin of broom communities (*Cytisus oromediterraneus* and *Echinopartum barnadesii*) in a mountain system (Gredos Range, Iberian Central System), as well as the construction of a cultural landscape during the last two thousand years. Two origins have been proposed to explain this deforested landscape (1600-1800 m. a. s. l.): natural vs anthropogenic.

In the context of an integrated research to study the dynamics of the upper forest line in the Gredos Range, several palynological studies are being undertaken to examine the history of the forest-broom communities during the last three millennia. The fossil record of the Gredos Range (central Spain) provides an opportunity to analyse the relationships among taxa and their millennial-scale role at structuring communities. To test our hypothesis, four basic questions have been addressed: (i) is the historic evolution of broom communities in the Gredos Range highlands the result of 'random walk' or human-mediated?; (ii) to what extent are high-mountain pine forests resilient to environmental and anthropogenic disturbance?; (iii) what was the dynamics of forest communities on the oromediterranean belt of the Gredos Range in terms of resilience and/or vulnerability trends; and, (iv) according to predicted climate scenarios, what future holds for the high-mountain forests of the Gredos Range?

The documentation of high percentages of *Pinus sylvestris* s.l. and *P. nigra* s.l. in fossil pollen records as well as the identification and radiocarbon dating of macroremains of these species, in all of the sites located in the current broom area, demonstrate that high-mountain pine forests have been present on the orosubmediterranean bioclimatic belt of the Gredos Range since the mid-Holocene. To explain the occurrence of fire events from the Visigothic to the Modern periods, agro-pastoral clearings have been postulated. Such high human impact may have enhanced by climatic conditions.

Our study demonstrates that broom communities have not a natural origin, they replaced an ancient forested system that was intensively used and transformed by societies since 700 cal yr BP, which led it to the extinction ca. 500 cal yr BP. Nowadays these communities, consisting of brooms and grasslands, with scattered stands of high-mountain pines, show a high resilience and provide suitable refugia for mountain biodiversity. The aim of this research is to promote this cultural heritage in order to protect its future.

The story of a survivor. The evolution of *Fagus sylvatica* in the Western Pyrenean Region (Northern Iberia) through palaeoenvironmental data

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Global palaeoenvironmental reconstructions have increased markedly in recent years, focusing on the evolution of the landscape, climatic variability and increasing human influence on ecosystems. However, only a few studies pay attention to the particular evolution of certain species. In this case we focus in the evolution of *Fagus sylvatica* in the Western Pyrenean Region (Northern Iberian Peninsula).

We have considered all the published palaeoenvironmental analyses from the Western Pyrenean Region in which any beech remain have been identified. We have taken into account both charcoal and pollen from natural deposits and archaeological sites. In sum, a total of 79 deposits located in the selected area have been considered, with the recalibration of all radiocarbon dates to provide a reliable chronological frame.

We can highlight that the presence of beech is documented in very ancient chronologies in the studied region, at least from the Upper Pleistocene to the middle Holocene, although in general they reflect punctual and discontinuous appearances. In the late Holocene, there is a significant increase in the number and density of findings, both in macrorremain and microrremain records, linked with the expansion of the beech and the intensification of their exploitation. From that moment (*ca.* 4500-3500 cal yr. BP) the beech is one of the most abundant trees in this territory. This expansion took place probably from native populations that survived in northern Iberia in refuge areas. Among the factors that could favor the expansion of the beech forests we can mention both climatic variations of the late Holocene and anthropogenic disturbances on the landscape. During the last two millennia an increase in the exploitation of the beech wood takes place, which is reflected in all paleoenvironmental sequences. The combination of historical, archaeological and palaeobotanical data show the importance of the management/exploitation of beech wood for the diverse economic activities that developed over the last centuries.

A general overview of the available data suggests the ancient presence of *Fagus sylvatica* in the Western Pyrenean Region, with a clear expansion *ca.* *ca.* 4500-3500 cal yr. BP. From that moment, beech became one of the main actors of the mountain forests, used for diverse anthropogenic activities.

Study of Guano from New Caledonia

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Following palaeoenvironmental studies in New Caledonia and Vanuatu carried out on lacustrine sediments (Combettes *et al.*, 2016a, Combettes *et al.*, 2016b, Sémah *et al.* 2016), our choice was concerned with a proxy allowing a higher resolution.

First, with speleothems then, recently, with guano. Indeed, we observe numerous records of guano in the 'Grande Terre' and Loyalty Islands in New Caledonia. First results underlined, in pluridisciplinary studies with pollen, $\delta^{13}\text{C}$, dD and $n\text{-C}_{29}$, (Sémah *et al.* 2015, Wirmann *et al.* 2016, Wirmann *et al.* 2017), that it is possible to correlate the guano content with strict environmental parameters.

Two kinds of guano are studied: from salanganes, *Collocalia spodiopygia*, diurnal and insectivorous and from a bat, *Micropterus robustior*, nocturnal and insectivorous as well.

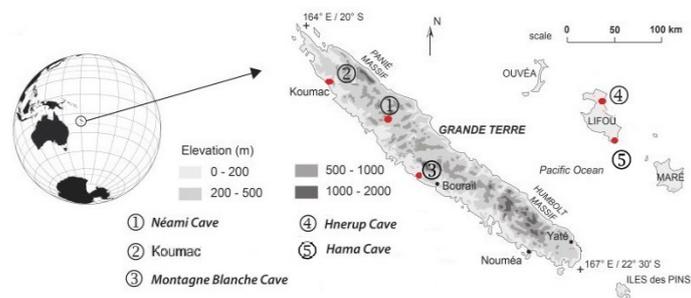
Therefore, we associate now the pollen content and the remains of insects included in the guano. The determination of insects and their analysis will allowed us to refine the climatic parameters being during the guano formation.

Currently we carry out a surface samples calibration based, in the guano of Hama cave (Loyalty Islands), on the pollen content and then the periods of flowering, the insect's remains content with their environmental characters and the measured meteorological data. This pluridisciplinary study allows us to strictly link climatic parameters with the guano content and to use them to reconstruct palaeoclimate and palaeoenvironment during the past.

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Localization map.



***Olea* pollen from modern olive groves and archaeological sites as index of cultural landscape development in central Mediterranean**

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Olive trees are key elements of the cultural landscape of Mediterranean regions. The spread of these trees, which have been gathered or cultivated since ancient times with *Juglans* and *Castanea* ('OJC group'; Mercuri *et al.* 2013), could be an indicator of increasing human activity ('anthropization') in the Mediterranean area. Despite some problems in the interpretation of its pollen signature (e.g., cultivated and wild *Olea* subspecies are virtually undistinguishable), olive pollen is among the best indicator to investigate transformations of natural into human-influenced environments. The aim of this research is to furnish new data for the interpretation of the pollen of *Olea* in past pollen spectra helping to reconstruct the history of cultural landscapes in central Mediterranean.

Surface soils have been collected from 12 olive groves located in two Italian regions (Tuscany and Basilicata), immediately before or at the beginning of the season of olive flowering. For each olive grove, sampling consist on 2 samples Central (IN), and 4 peripheral (OUT) at a distance of 500 m and of 1000 m from the center, respectively, to the north and to the west. A total amount of 30 samples were treated for pollen extraction (laboratory treatments included heavy liquid separation). *Olea* pollen percentages were compared to olive data from pollen spectra of 12 archaeological sites located in close proximity of the analyzed olive groves.

Olea pollen was found in good amount in all samples but its percentages were very variable depending on several factors, e.g. olive grove extension, the presence of overrepresented pollen in the pollen rain (*Pinus*), interference of the olive grove with other groves in a study area, or presence of wild olive specimens in the same area. As expected, the highest percentages of *Olea* pollen are found at the centre of the olive groves (> 50% on average), and then dramatically fall at 500 m (< 5%), and remained fairly constant at 1000 m. The average percentage of *Olea* pollen found in samples from the archaeological sites (< 3%) is fairly similar to those found in the modern ones at 500-1000 m far from the centre of the grove.

The comparison between the percentage of *Olea* pollen recorded in surface soil samples and in the archaeological layers help to assess the significance of this crop pollen in palaeoenvironmental reconstructions. Based on our data, it can be argued that not high values are expected far from the exact point of growing of past cultivations. The olive trees were significant elements of the landscape in the central Mediterranean. From our study, we argue that olive groves were present but not always extended in the farming lands of Tuscany and Basilicata regions.

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Pollen analysis of ovicaprine coprolites and palaeoenvironmental inferences on Holocene Sahara

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Pollen analysis of coprolites provides useful information on palaeoenvironment. Animal coprolites preserve evidence of the plants eaten by animals, and therefore they are indirect witnesses of both main plant food sources and their ecosystems in the grazing area. Coprolites are important especially in the arid to semi-arid regions where lakes and peat bogs are scarce [1]. They are largely part of the Saharan archaeological deposits, also incorporated in layers, or isolated and measurable pellets [2, 3]. In this research, we report on hundreds of coprolites collected at Takarkori (SW Libya), a rock shelter which chronology ranges from c. 10,200 to c. 4,600 cal yr BP [4].

Coprolites were isolated by dry sieving in the field (10, 0.5 and 0.2 meshes). Based on their chronology, nine samples (ten coprolites per sample) were selected to perform pollen extraction. The chemical treatment includes boiling with NaOH 10% and acetolysis. Pollen concentrations and percentages were calculated.

Pollen concentrations are medium-high (up to about 15,000,000 p/g). A minimum of 2 to a maximum of 32 taxa per coprolite are recorded, with high percentages of Asteraceae, Cyperaceae, Moraceae and Poaceae in most of the samples.

The pollen spectra give information about the diet of the animals grazing wild plants. The plant associations from the samples match well the savannah-like gradually drying environment. Pollen data from the coprolites collected in Libya confirm that the Early-Middle Holocene flora of central Sahara was formed by a rather humid grassland.

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Environmental changes during the Final Neolithic and Early Bronze Age at Palaikastro (Eastern Crete)

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The Bronze Age on Crete evidenced the growth of urban society centred around palatial complexes. The management of agricultural production (particularly Mediterranean polyculture) by a centralised authority has been proposed as a key basis for the emergence of palatial power and stratified society. However, archaeological data do not show clear evidence of an intensification of olive and vine production until the second palace period (Late Minoan). Landscape, archaeobotanical and palaeoenvironmental data have the potential to furnish new evidence that can contribute to this debate.

In particular, the history of landscape and vegetation of Crete, specifically eastern Crete, remains largely unknown because continuous sediment records with well-preserved pollen, multiproxy analyses and reliable chronologies are very rare in the island. With the aim of elucidating vegetation and landscape changes during the Neolithic and Bronze Age, a palaeoenvironmental study of a sedimentary core recovered from Kouremenos wetland (35° 12' 14" N, 26° 16' 21" E), near the village and the archaeological site of Palaikastro (Eastern Crete), has been conducted. In this core, a multiproxy analysis, including pollen, non pollen palynomorphs and macrocharcoal particles, has been carried out. An age-depth model has been constructed using four radiocarbon AMS dates obtained from macroremains found along the core. According to this, the studied period covers the timespan between 4300 and 2500 cal BC.

Pollen data suggest that a shrubby landscape dominated by Ericaceae, and with the presence of olive trees, prevailed during the Final Neolithic (4300 cal yr BC), while the occurrence of coprophilous fungal spores indicates grazing practices in the littoral plain. Significant vegetation changes occurred during the Final Neolithic and Early Bronze Age. At c. 3600 cal BC a decline of Ericaceae was accompanied by the expansion of low shrubs (phrygana plant community). This was coeval with a period of olive tree expansion and high frequency of wildfires between 3600 and 2800 cal BC. At c. 2800 cal BC, grasslands expanded together with a new decline of Ericaceae and a further spread of olive trees. A rise in grazing activities is also recorded. The results show how the shaping of this cultural landscape resulted from agricultural and pastoral practices and the use of fire. The data suggest the expansion of olive trees in the Palaikastro region since the Final Neolithic as a result of human management of this tree.

Vegetation and climate dynamics in SW Iberia during MIS 14 as inferred from the multi-proxy analysis of the IODP Site 1385 (Shackleton site)

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The Shackleton site (IODP Site 1385, SW Iberian margin) constitutes a unique palaeoclimatic archive providing a continuous record of marine and terrestrial climate proxies for the last 1.5 million years. In this area, below 40°N, the influence of westerlies and subtropical ocean water currents is notable, and the impact of precession is especially significant. Therefore, the site is particularly well suited to study millennial scale climatic variability. Here we focus on the marine isotopic stage (MIS) 14 (ca. 530-560 ka), the globally warmest glacial period of the last 800,000 years and almost unknown with respect to vegetation and climate dynamics. Here we present the first reconstruction of vegetation dynamics in the Iberian Peninsula for the MIS 14 based on pollen data. Additionally, we make inferences about the terrestrial palaeoclimate and directly correlate our terrestrial signal with the record of marine palaeoclimatic proxies from the same core to better understand the functioning of the climatic system during MIS 14.

We took sediment samples every 4 cm from the cores recovered at the Shackleton site during the IODP Expedition 339 “Mediterranean Outflow”. Then, we treated them according to the protocol of the EPHE Department of Palaeoclimatology and Marine Palaeoenvironments (www.ephe-paleoclimat.com) to concentrate their pollen content. The chronology of the core is based on oxygen isotopic measurements on benthic foraminifera.

Our preliminary results suggest that during MIS 14 the landscape of central-western Iberia was steppic but with larger refugial tree populations than during other glacial periods. This is in agreement with the relatively warm sea surface temperatures and the low ice volume. Marked and short-lived oscillations in the forest and steppic taxa curves point to the existence of significant millennial climatic variability during MIS 14.

Anthropogenic eutrophication overlapping natural climate variability over the last 150 years: palynological evidences (Bay of Brest, NW France)

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The Bay of Brest is an estuarine system open to the North Atlantic and connected with the Aulne, Elorn and Daoulas rivers. Palynological analysis conducted on sedimentary archives allows discussing in parallel marine (dinocysts) and continental (pollen/spore) influences affecting the Bay and its watersheds.

These data are integrated within the framework of a French CNRS project INSU-EC2CO/LEFE (“CAMOMI”) that aims at comparing micropaleontological and molecular analysis to calibrate paleoecological tools and to decipher the complexity of recent paleoecological changes affecting coastal environments.

Here, we present coastal palaeoecological changes that occurred over the last century (1870-2013 AD) thanks to the study of a sediment core (Daoulas estuary: inner/western Bay).

Previous studies demonstrated that the occurrence of the toxic dinoflagellate species *Alexandrium minutum* has increased in the estuary since the 1970s. The palynological study, conducted on the same core, allows us discussing the eutrophication forcing responsible for such toxic blooms. The rise in fluvial runoff is suggested by both the increase of *Alnus* percentages and the Ti/Ca XRF ratio with a decrease in marine microalgae concentrations. The trend in increasing discharge of the Daoulas River may have also brought fertilizers (industrialized agriculture) that promoted the increase of toxic planktonic species.

Moreover, significant changes of arboreal taxa percentages appear correlated with the Atlantic Multidecadal Oscillation. We suggest a link between North Atlantic Ocean sea-surface temperatures/climate in western France and pollination rates of arboreal species. This study will allow us to understand climatic/anthropogenic mechanisms responsible for paleoenvironmental changes in the region over the Holocene.

New data on landscape of middle Oise valley during Subboreal: study of the organic sequence of Thourotte (Oise, France)

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The INRAP rescue excavation campaign at Thourotte "La Motte" (Oise, France), associated to the landscape development of the "Seine-Nord Europe" channel, revealed new archaeological and palaeoenvironmental information on the poorly-explored area of the Middle Oise valley, upstream of Compiègne. Geophysical and morpho-sedimentary survey of a palaeochannel that scraped a mound led to the implementation of a multidisciplinary approach (archaeology, sedimentology, pollen and wood analyses, dendrochronology, zooarchaeology, radiocarbon dating). While sediment analyses unveiled the evolution of the alluvial plain since the last glaciation, the other studies mainly dealt with the channel organic matter filling. This filling dates back to the Early Subboreal, between *c.* 3600 and 2700 BC. The local environment seems to be mainly composed of alder forest around which oaks tend to grow. Organic sedimentation starts during a period of forest surface recovery leading to a densification of tree cover. Around 3000 BC, the riverside vegetation is cleared and crops are cultivated. The presence of ruderal species indicates the practice of arable and pastoral farming. These agro-pastoral activities might originate from Late Neolithic populations that left some scarce remains on the mound and in the channel.

Anthropogenic impact and environmental changes from middle Mesolithic to late Neolithic in Normandy at Cairon (Western France)

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The site of Cairon is located in the Vey valley in Normandy, at about 250 meters from the Middle Neolithic settlement of « la Pierre Tourneresse ». Archaeological data provide evidence of agropastoral practices around the settlement. Previous pollen analysis (Lespez, *et al.*, 2005) covers partly the Mesolithic and the Neolithic periods. Nevertheless, it supplies limited information about those practices and the spatial extent of the forest clearing needed for the development of agropastoral activities. Valley bottom could have been used to cattle breeding, but former paleoenvironmental data doesn't bring evidence to support this hypothesis. On the opposite, according to the previous studies, during the Neolithic the marshy valley bottom doesn't have to encourage agricultural practices in this area.

A new pollen investigation using pollen, non-pollen palynomorphs and macroscopic charcoal analyses has been carried out on a new core (Cairon 2016). Chronology of Cairon 2016 is based on 3 radiocarbon dates and a stratigraphic correlation between Cairon 2016 and the former cores. According to the age depth model, this sequence covers the Mesolithic and the Neolithic periods approximately between 7300 - 6800 BC and 3500 – 3300 BC.

The aim of this poster is to present the main results obtained by multi-proxy analyses. This study provides new data: 1) to study environmental consequences of the rapid climate changes occurred during the Mid-Holocene; 2) to characterize agricultural practices; 3) to study agrarian landscape structure during the Neolithic period. This work refines previous results and brings new results, in particular about the evolution of the local environment. At the local scale a wet meadow dominated by *Sparganium* grows at the beginning of the Neolithic period. The wet meadow is gradually replaced by a *Corylus* forest that declines around the Middle Neolithic period for the benefit of an *Alnus* forest. The transition between the *Corylus* forest and the *Alnus* forest corresponds to a phase of arboreal pollens decreasing and of *Poaceae* and ruderal plants increases. During this phase, anthropogenic evidences suggest the development of pastoral practices in the valley bottom.

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Last Millennium vegetation patterns in Rhodopi Mt (N. Greece)

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The Rhodopi Mountain Range (Greece-Bulgaria) is the natural border between Greece and Bulgaria. It is a region with high ecological significance in Southern Balkan hosting a rich variety of ecosystems and being the southern border of expansion and a resort for many species from central and northern Europe. It's southern part, characterized as "National Park" (Natura 2000), hosts the biggest and most productive forests of Greece and is considered as the least degraded natural ecosystems of Europe. In addition, as Rhodope Mt is located on the borderlands of the plain of Macedonia (N. Greece), human activities, habitation, land use and related impact on natural vegetation during the last millennium are closely connected with the history of Byzantine and Ottoman Empires.

The aim of the present study is to investigate the vegetation successions in the high biodiversity area south Rhodopi Mountains. The first results of the comparative study of two mires located at an altitude of ca. 1400 m above sea level. Leivaditis and Lepidas mires are located in the southeast and in the central part of Rhodopi Mt respectively and their deposits cover approximately the last 1000 years of vegetation history of the area.

Palynological investigation, microcharcoal analysis and absolute dating were performed on the deposits. Both pollen archives record an original occurrence of dense conifer forests around both sites, dominated by pines in Leivaditis and firs in Lepidas, while a temporal expansion of beech forest was evidenced around 1200 AD in the latter. The occurrence of several anthropogenic pollen indicators feature the impact of human activities, mainly pastoralism, in the vegetation of Leivaditis weak in the bottom and more intense towards the top, especially between 1500 AD and 1700 AD. In Lepidas signs of pastoral activities are evidenced only after 1400 AD, though human pressure is not as significant as in the area of Leivaditis.

Authors Index

A

A Sattar H. · 15, 40
Abel-Schaad D. · 22, 25, 115, 116, 169, 171, 173
Abichou M. · 20, 89
Abrantes F. · 25, 26, 161, 164
Abreu I. · 17, 18, 19, 21, 59, 75, 97, 126, 129
Adeli M. · 15, 40
Aguilar M.P. · 24, 150
Aguilera F. · 16, 22, 55, 110
Aira M.J. · 16, 19, 56, 57, 129, 130
Aizawa T. · 21, 92
Ajouray N. · 17, 63
Akoegninou A. · 22, 107
Alarcón M. · 20, 22, 106, 135
Albalat D. · 26, 159
Alba-Sánchez F. · 22, 25, 115, 116, 169, 171, 173
Albertini E. · 18, 70
Alcaraz-Segura D. · 22, 116
Alcázar P. · 22, 109
Alché J.D. · 16, 21, 50, 93, 94
Alday A. · 24, 144
Ali A.A. · 22, 25, 114, 170
Ali Al-Nesf M. · 15, 40
Allan E. · 25, 172
Allenet de Ribemont G. · 26, 181
Allevato E. · 163
Aloisi I. · 20, 21, 95, 131
Álvarez R. · 21, 99
Alves P. · 18, 72
Amorim M.I. · 16, 49
Andrieu-Ponel V. · 29, 32
Angeli A. · 19, 83
Antoine P. · 25, 166
Antunes C.M. · 18, 21, 72, 97
Armentia A. · 21, 99
Arobba D. · 163
Arriegas R. · 18, 21, 72, 97
Astray G. · 19, 128
Athanassa I. · 26, 183
Auguste P. · 25, 166
Auvigne V. · 20, 133
Azurara C. · 17, 59

B

Bacchetta G. · 163
Baisnee D. · 20, 133
Bal M.C. · 163
Banks P. · 26, 160
Bárány I. · 16, 48
Bardei F. · 17, 63

Barhoumi C. · 25, 170
Barracand G. · 26, 181
Battaglia F. · 15, 38
Battesti M.J. · 24, 25, 148, 154, 155
Beauchamp A. · 26, 182
Bell B. · 21, 98
Belmonte J. · 15, 19, 20, 22, 24, 39, 86, 104, 106, 120, 121, 125, 135, 136, 151
Ben Dhiab A. · 15, 20, 41, 89
Ben Mimoun M. · 20, 89
Beneš J. · 163
Ben-Menni Schuler S. · 16, 44, 45
Berbel M. · 16, 44
Berenguer E. · 16, 48
Bergeron Y. · 22, 114
Bertini A. · 22, 111
Bessedik M. · 19, 125
Bichet V. · 26, 158
Blamart D. · 24, 142
Blanco J. · 22, 116
Blázquez O. · 169
Blessing R. · 15, 40
Bogawski P. · 18, 73
Boi M. · 24, 150
Bonilla-Sánchez A. · 19, 118, 119
Bonin J. · 24, 142
Bonini M. · 18, 67
Boscaini M. · 26, 177
Bosi G. · 163
Bouziane H. · 17, 63
Bouzouina M. · 24, 153
Bozhkov P. · 16, 48
Brighetti M.A. · 17, 20, 60, 90
Brindza J. · 16, 51
Bros V. · 26, 160
Buonincontri M. · 163
Burgos-Montero A.M. · 19, 124
Burjachs F. · 24, 26, 146, 159

C

Caballero S. · 20, 132
Cabello J. · 22, 116
Cabezudo B. · 19, 123
Cai G. · 21, 95
Campbell J.F.E. · 22, 112
Candón-Morillo R. · 19, 124
Canela M.A. · 22, 104
Cañellas-Boltà N. · 26, 178
Capela F. · 15, 38
Caramiello R. · 163
Cardellach P. · 24, 151
Carracedo V. · 19, 82

Cartelle V. · 18, 78
Castañer R. · 20, 132
Castelletti L. · 163
Castiglioni E. · 163
Castiñeiras P. · 19, 130
Castro A.J. · 16, 50
Cebrià A. · 26, 159
Celant A. · 163
Celenk S. · 16, 52
Charalampopoulos A. · 15, 36
Charpin D. · 21, 92
Cheddadi R. · 22, 24, 116, 141
Chen H.Y.H. · 22, 114
Ciani F. · 22, 117
Clò E. · 26, 162
Clot B. · 15, 38
Coimbra S. · 16, 49
Combourieu-Nebout N. · 22, 25, 111, 172
Cortiñas J.A. · 19, 129
Costa A.R. · 18, 21, 72, 97
Costa J. · 25, 154, 155
Costa M. · 16, 49
Costantini L. · 163
Costanzi E. · 15, 43
Couderc R. · 21, 92
Coussot C. · 26, 181
Cremaschi M. · 26, 162
Crespo J. · 20, 132
Crespo J.L. · 16, 48
Crouzy B. · 15, 38
Cunill R. · 19, 82

D

Dalache F. · 24, 153
Daniau A.L. · 18, 76
De Castro-Alfageme S. · 21, 100, 101, 102
De Linares C. · 15, 20, 22, 24, 39, 104, 136, 151
De Nuntis P. · 20, 131
Dechamp Ch. · 20, 86
Del Duca S. · 20, 21, 95, 131
Deschodt L. · 25, 166
Desprat S. · 18, 25, 26, 76, 157, 161, 164, 179 di
Lernia S. · 26, 177
Di Pasquale G. · 163
Díaz I. · 16, 48
Dietre B. · 26, 158
Dimiza M.D. · 24, 145
Djamali M. · 29, 32
Donders T.H. · 22, 111
Doorenbosch M. · 25, 168
Droz L. · 18, 79
Ducassou E. · 18, 77
Duque L. · 19, 126

E

EAN data providers · 20, 137
Ehrhold A. · 26, 180
El Haskouri F. · 17, 63
El-Keblawy A. · 15, 40
El-Tantawy A.A. · 16, 47
Elvira-Rendueles B. · 18, 74
Ercilla-Montserrat M. · 15, 39
Escuredo O. · 17, 19, 24, 62, 127, 152, 153
Estrada Muñoz D. · 19, 122
Expósito I. · 24, 26, 146, 159
Eynaud F. · 18, 24, 26, 76, 77, 142, 180

F

Fàbregas M. · 26, 160
Facchini C. · 20, 131
Faleri C. · 21, 95
Feijó J. · 16, 50
Feo Brito F. · 19, 124
Fernández Fernández M.C. · 16, 44, 45
Fernández J. · 20, 132
Fernández-González D. · 18, 20, 21, 67, 99, 100, 101, 102, 131
Fernández-González F. · 18, 71
Fernández-González M. · 16, 19, 56, 57, 128, 129, 130
Fernández-Rodríguez S. · 16, 20, 53, 88, 91
Fernane A. · 25, 172
Field M.H. · 25, 168
Fiorentino G. · 163
Fletcher W. · 21, 22, 98, 112
Florenzano A. · 22, 26, 117, 162, 163, 176
Flores E. · 20, 132
Fornaciari R. · 26, 177
Frenguelli G. · 15, 18, 43, 70
Furia E. · 26, 162
Furlanetto G. · 163

G

Galán C. · 17, 18, 20, 22, 24, 61, 67, 87, 109, 150
Galindo N. · 20, 132
Galván-Escobedo I.G. · 16, 54
Galveias A. · 18, 21, 72, 97
Gandouin E. · 25, 172
Garcia Codron J.C. · 19, 82
García Gil S. · 18, 78
García-Castaño G.R. · 16, 55
García-Gil S. · 25, 167
García-Moreiras I. · 18, 25, 78, 167
García-Mozo H. · 17, 20, 61, 87
García-Sánchez A. · 18, 74
García-Villarubia C. · 16, 24, 46, 149

Gauthier A. · 25, 26, 166, 182
Gauthier E. · 19, 83
Gauthier É. · 26, 158
Gavilán R.G. · 25, 173
Gayoso M. · 21, 99
Gharbi D. · 15, 40
Ghilardi M. · 24, 146
Ghitarrini S. · 15, 18, 43, 70
Giardini M. · 18, 80, 163
Giligny F. · 26, 182
Gil-Moltó J. · 20, 132
Gogou A. · 24, 145
Gómez M. · 26, 159
Gómez-Cadenas A. · 16, 47
González-Fernández E. · 16, 56, 57
González-Gutiérrez K. · 21, 103
González-Hernández A. · 22, 116
González-Porto A.V. · 16, 24, 46, 149
González-Sánchez L.A. · 19, 124
González-Toral C. · 21, 93
Gonzalo-Garijo A. · 16, 20, 53, 88, 91
Goring S. · 22, 111
Gottardini E. · 20, 90
Goubert E. · 25, 172
Grabek-Lejko D. · 22, 108
Grant H. · 21, 98
Grégoire G. · 26, 180
Grewling Ł. · 18, 73
Grigorieva O. · 16, 51
Grillo O. · 163
Grimalt J.O. · 25, 164
Grinn-Gofroń A. · 22, 109
Guido M. · 163
Guillaumet S. · 24, 150
Guilloux L. · 21, 92
Guimarães F. · 19, 126
Guinot B. · 20, 133
Guiot J. · 23, 29, 32

H

Hadj Hamda S. · 15, 20, 41, 89
Hardy W. · 18, 79
Herchenbach M. · 163
Hérisson D. · 25, 166
Hernández-Ceballos M.A. · 17, 61
Hidalgo-Galvez M.D. · 20, 87
Higes M. · 16, 24, 46, 149
Hildebrand L. · 18, 69
Hodell D. · 25, 164
Hodell D.A. · 18, 26, 76, 179
Homrari M. · 24, 153
Hulin G. · 26, 181

I

Iftikhar Hussain M. · 15, 40
Ilmen R. · 21, 98
Izquierdo R. · 15, 39

J

Jaouadi S. · 24, 143, 147
Jaramillo P. · 15, 42
Jimenez-Espejo F. · 25, 164
Jiménez-Quesada M.J. · 16, 50
Joannin S. · 22, 25, 111, 112, 170
Jude F. · 26, 181
Julià R. · 26, 160

K

Kadiri M. · 17, 63
Kageyama M. · 18, 79
Karageorgis A.P. · 24, 145
Kasprzyk I. · 22, 108
Khater R. · 24, 141
Kiared (Ould-Amara) Gh. · 19, 125
Kiselev D. · 15, 38
Kiseleva S. · 15, 38
Klouch K. · 26, 180
Knappett C. · 26, 178
Kostecki Ł. · 18, 73
Kouli K. · 22, 24, 26, 111, 145, 183
Kousis A. · 22, 111
Koutsodendris A. · 22, 111
Kryshen A. · 25, 170
Kyrikou S. · 24, 26, 145, 183

L

Lamas R. · 19, 126
Lambert C. · 26, 180
Landi Degl'Innocenti V. · 22, 117
Lara B. · 18, 71
Lavoie M. · 22, 114
Lazarina M. · 15, 36
Lazzarotto B. · 15, 38
le Mézo P. · 18, 79
Leal-Fierro L. · 21, 100, 101, 102
Lebreton V. · 24, 143, 147
Leduc C. · 26, 181
Lemer L. · 26, 182
Leroyer Ch. · 26, 181
Lespez L. · 26, 182
Limondin-Lozouet N. · 25, 166

Livarda A. · 26, 160, 178
Locht J.L. · 25, 166
Londeix L. · 18, 77
López D.J. · 20, 136
López-Pérez J.A. · 16, 24, 46, 149
López-Sáez J.A. · 22, 24, 25, 115, 116, 144, 169, 171, 173
Lucchini D. · 20, 90
Luelmo-Lautenschlaeger R. · 25, 173
Lufinha M.I. · 17, 59

M

Magyar D. · 20, 134
Majeed H.T. · 20, 22, 106, 135
Makra L. · 20, 134
Malyer H. · 16, 52
Marchesini M. · 163
Mariotti Lippi M. · 22, 117, 163
Maritan M. · 163
Marlasca R. · 24, 146
Marret F. · 18, 79
Marsset T. · 18, 79
Martín-Armentia B. · 21, 99
Martín-Armentia S. · 21, 99
Martínez-Bracero M. · 22, 109
Martínez-Carreño N. · 18, 78
Martínez-Romero L. · 16, 54
Martín-García G.M. · 18, 26, 76, 179
Martín-Hernández R. · 16, 24, 46, 149
Martrat B. · 25, 164
Marvelli S. · 163
Masi A. · 18, 22, 25, 80, 111, 163, 165
Maya-Manzano J.M. · 16, 20, 53, 88, 91
Mazzanti M. · 26, 162, 163
Meinardus-Hager G. · 18, 69
Melcova M. · 21, 92
Mendes S. · 21, 97
Meno-Fariñas L. · 17, 62
Mensing S. · 22, 113
Meon H. · 20, 86
Mercuri A.M. · 19, 22, 25, 26, 84, 111, 117, 162, 163, 176, 177
Minina E. · 16, 48
Miola A. · 163
Miraglia A.R. · 17, 60
Miró C. · 26, 160
Mobayed H. · 15, 40
Mohammed Ali R. · 15, 40
Molina-Abril J.A. · 16, 24, 46, 149
Monnier S. · 15, 35, 37
Monroy-Colín A. · 16, 20, 53, 88, 91
Montanari C. · 163
Montecchi M.C. · 22, 117, 163
Montero J.I. · 15, 39

Morales Del Molino C. · 18, 77
Morales-Hidalgo J.I. · 26, 159
Morales-Molino C. · 18, 26, 76, 179
Moreno C. · 20, 87
Moreno J.M. · 18, 74
Moreno-Grau S. · 18, 74
Mosquera-Mosquera H. · 19, 21, 103, 118, 119
Motella S. · 163
Msallem M. · 15, 20, 41, 89
Muñoz P. · 15, 39
Muñoz Sobrino C. · 18, 25, 78, 167
Mus Amezquita M. · 19, 84

N

Naughton F. · 18, 25, 26, 76, 77, 161, 164
Navarro T. · 15, 40
Navas Nieto C. · 25, 156
Navazio L. · 21, 95
Negral L. · 18, 74
Nicolás J.F. · 20, 132
Nicoletta R. · 18, 80
Nikolaieva N. · 16, 51
Nisbet R. · 163
Nowak M. · 18, 73
Nôžková J. · 16, 51

O

Oliva M. · 25, 169
Oliveira D. · 18, 25, 26, 76, 77, 161, 164
Oliver G. · 15, 18, 35, 68
Orengo H. · 26, 160
Orengo H.A. · 26, 178
Orrù M. · 163
Otilio M. · 18, 72

P

Pace L. · 20, 90
Pacini E. · 15, 29, 30
Palamarchuk J. · 20, 22, 105, 134
Panagiotopoulos K. · 22, 111
Paolini J. · 25, 154, 155
Pardo-Martín C. · 16, 24, 46, 149
Pastor C. · 20, 132
Pèlachs A. · 19, 82
Penaud A. · 18, 24, 25, 26, 79, 142, 172, 180
Peña-Chocarro L. · 163
Peñas J. · 22, 116
Pepe C. · 163
Perego R. · 163
Pereira J.S.R. · 18, 75

Pereira T. · 17, 59
Pérez Gutiérrez M.A. · 16, 44, 45
Pérez Obiol R. · 19, 82
Pérez-Badía R. · 18, 19, 71, 124
Pérez-Díaz S. · 22, 24, 25, 115, 116, 144, 169, 171, 173, 174
Pérez-Pérez Y. · 16, 47
Periago C. · 20, 22, 106, 135
Peyron O. · 22, 25, 111, 170
Picone R.M. · 20, 90
Picornell A. · 15, 19, 42, 123
Picornell Ll. · 26, 160
Pierboni E. · 18, 70
Piña-Rey A. · 16, 56, 57
Piovesan G. · 22, 113
Pitarch M. · 16, 47
Polanco-Martínez J.M. · 18, 25, 76, 164
Poncet P. · 21, 92

R

Ragueneau O. · 26, 180
Ramírez-Cotes D. · 19, 21, 103, 118, 119
Rattighieri E. · 22, 26, 117, 163, 176
Ravazzi C. · 163
Recio M. · 15, 19, 42, 123
Reed J. · 26, 160
Remy C.C. · 22, 114
Requena Ramírez M.D. · 16, 44
Revelles J. · 19, 24, 81, 146
Ribeiro H. · 18, 19, 21, 75, 97, 126, 129
Ricciardi L. · 17, 60
Ricciardo D. · 22, 117
Richard H. · 19, 26, 83, 158
Richard P. · 20, 85
Riding J. · 19, 125
Riera S. · 26, 160
Rieradevall J. · 15, 39
Riera-Mora S. · 26, 178
Rinaldi R. · 26, 163, 176
Ríos-Ramos B.E. · 16, 54
Risueño M.C. · 16, 47, 48
Ritenberga O. · 20, 137
Rivero R. · 18, 71
Robles-López S. · 25, 169, 173
Rodrigues T. · 18, 26, 76, 161, 179
Rodríguez de la Cruz D. · 17, 19, 21, 25, 58, 59, 96, 122, 156
Rodríguez-Flores M.S. · 17, 19, 24, 62, 127, 152, 153
Rodríguez-Rajo F.J. · 16, 19, 56, 57, 128, 129, 130
Rodríguez-Ramos M.A. · 21, 100, 101, 102
Rodríguez-Sanz H. · 16, 47
Rojo J. · 18, 71
Rollin J. · 25, 175
Romero García A.T. · 16, 44, 45

Romero-Morte J. · 18, 71
Rondini C. · 18, 70
Rosas-Pérez I. · 16, 54
Röseler S. · 18, 67
Rottoli M. · 163
Rotunno R. · 26, 177
Rúa-Giraldo A.L. · 19, 120, 121
Ruiz-Alonso M. · 24, 25, 144, 174
Ruiz-Fernández J. · 25, 169
Ruiz-Valenzuela L. · 16, 22, 55, 110
Russo M. · 20, 90
Ryan P. · 21, 98

S

Sabariego-Ruiz S. · 22, 25, 116, 171
Sabato D. · 163
Sadori L. · 18, 22, 25, 80, 111, 163, 165
Salinas Bonillo M.J. · 16, 44, 45
Sánchez Durán S. · 17, 19, 21, 58, 96, 122
Sánchez Reyes E. · 17, 19, 21, 25, 58, 96, 122, 156
Sánchez Sánchez J. · 17, 19, 21, 25, 58, 96, 122, 156
Sánchez-Goñi M.F. · 18, 25, 26, 76, 77, 157, 161, 164, 179
Sánchez-Mata D. · 25, 173
Sandrini S. · 20, 131
Santamaría E. · 16, 48
Santos A. · 18, 75
Santos M.A. · 26, 160
Santos-Fernández J. · 21, 99
Santrucek J. · 21, 92
Sarda Estève R. · 20, 133
Sarigu M. · 163
Schmidt S. · 26, 180
Schoolman E. · 22, 113
Seijo M.C. · 17, 19, 24, 62, 127, 152, 153
Seijo-Rodríguez A. · 17, 19, 24, 62, 127, 152
Selva M.A. · 21, 92
Sémah A.M. · 25, 175
Sénéchal H. · 21, 92
Senici D. · 22, 114
Servera-Vives G. · 19, 84
Shahali Y. · 21, 92
Siano R. · 26, 180
Sierro F.J. · 18, 26, 76, 179
Sigismondi C. · 17, 60
Silva-Palacios I. · 16, 20, 53, 88, 91
Sindt C. · 15, 20, 35, 85
Siniscalco C. · 20, 90
Sinoj J. · 15, 40
Sinopoli G. · 22, 25, 111, 165
Sofiev M. · 15, 20, 22, 29, 31, 105, 134, 137
Solís M.T. · 16, 47, 48
Soriano J.M. · 19, 82
Soriano V. · 20, 132

Suárez Santiago V.N. · 16, 44, 45
Subetto D. · 25, 170
Svoboda P. · 21, 92
Szymańska A. · 18, 73

T

Tapia A. · 15, 42
Tchabi F.L. · 22, 107
Tedeschini E. · 15, 18, 20, 43, 70, 134
Tekiel A. · 22, 108
Testillano P.S. · 16, 47, 48
Thibaudon M. · 15, 18, 20, 35, 37, 67, 68, 85, 133
Tormo-Molina R. · 16, 20, 53, 88, 91
Torri P. · 19, 22, 26, 84, 111, 117, 162, 163
Tossou G.M. · 22, 107
Tovo G.R. · 18, 70
Travaglini A. · 17, 20, 60, 90
Triantaphyllou M.V. · 24, 145
Trigo M.M. · 15, 17, 19, 40, 42, 61, 63, 123
Trigo R. · 25, 26, 161, 164
Tsiripidis I. · 15, 36
Tuffaha A. · 15, 40
Tunno I. · 22, 113

U

Udvardy O. · 20, 134

V

Valencia J.A. · 128
Valencia J.A., · 19
Valencia-Barrera R. · 21, 100, 101, 102
Val-Peón C. · 26, 159
VanVliet-Lanoë B. · 25, 172
Vara A. · 19, 128, 130

Varea M. · 20, 132
Vargas G. · 22, 25, 116, 169, 171
Vargiu A. · 20, 90
Vatanserver B. · 16
Vatanserver B. · 52
Vega Elices E. · 17, 19, 21, 58, 96, 122
Vega-Maray A.M. · 15, 21, 100, 101, 102
Vélez-Pereira A.M. · 22, 104
Veropoulidou R. · 26, 160
Vidal M. · 25, 26, 172, 180
Virmoux C. · 25, 166
Voelker A.H.L. · 25, 164
Vokou D. · 15, 36

W

Waelbroeck C. · 24, 142
Wagner B. · 22, 111
Wary M. · 18, 77
Werthe E. · 26, 181
Wirmann D. · 25, 175

Y

Yang Y. · 25, 154, 155
Yin Q. · 26, 157, 161
Yll E. · 24, 146
Yubero E. · 20, 132

Z

Zafra A. · 21, 94
Zerboni A. · 26, 162
Zidkova J. · 21, 92
Zienkiewicz K. · 16, 50
Žirovská J. · 16, 51

