Lagascalia 19(1-2): 513-520 (1997)

THE INFLUENCE OF TREE-AND SHRUB-VEGETATION COMPOSITION IN THE POLLEN SPECTRUM OF SW SPAIN

FRANCISCO JOSÉ GONZÁLEZ MINERO & PILAR CANDAU

Abstract

A research has been carried out about the pollen types of arboreal and shrubby origin identified in the airborne of Huelva (SW Spain) and its connection with the vegetation of the area. The aeropalynological sampling of the air was carried out in a four years term with the help of a Cour trap. A total amount of 35 different types have been identified representing a 65.21% of all the pollen caught. In the pollen spectrum, we can find mainly pollen of *Quercus, Pinaceae, Eucalyptus, Olea* and *Cupressaceae* that shows the huge unities of vegetation (*Eucalypus* forest, holm and cork oaks, pines, olive trees and conifers). In a smaller degree we have captured as well the pollen of the bush areas (*Ericaceae, Cistaceae, Labiatae, Papilionaceae, Pistacia, Rhamnus...*), the river communities (*Alnus, Fraxinus, Nerium* and *Tamarix*), the urban vegetation (*Casuarina, Palmae, Platanus, Acacia, Ulmus, Salicaceae...*) and the regional vegetation (*Castanea*), and interregional (*Betula*).

Introduction

Quite a few aeropalynological research papers published in the last years convering a wide range of scientific literature are to be of great help for the new applications to be sort out of those papers: they lead to a better understanding of the plants development (phenology) (BRICCHI & al., 1995), they are imperatives in order to make a reconstruction of the vegetation with the use of the fossil pollen (COUR & DUZER, 1976), they witness big changes in the vegetation due to massive trees cut down, fires etc. (WILKINSON, 1989), they are used as support mean in studies of biometeorology (MANDRIOLI, 1987), etc.

Under this basis we are presenting the outcome of a research carried out on the content of pollen of arboreal and shrubby origin identify in the airborne of Huelva (SW Spain) after a four years term of aeropalynological sampling of the atmosphere of this city. In this study, we provide a list with the different types of pollen identify, sorting out some aeropalynological conclusions of the main ones and we make some commentaries about the influence of the timber vegetation in the pollen spectrum. These results are to be found partly in some others papers published beforehand by the authors (CANDAU & GONZÁLEZ MINERO, 1992; CANDAU & al., 1993, 1994).

Area of Study

The city of Huelva it's located in the Atlantic Shore SW Spain (37º 16'N, 6º 16'W). With a maritime Mediterranean climate, the average annual temperature it's around 18º

C and the index of rainfall per year it's around 470 mm, the index of Mediterraneanity (Im3) it's of 41.9 (RIVAS MARTÍNEZ, 1987).

The vegetation with a potential influence in the pollen spectrum may be divided into native and introduced vegetation. In the first group we can find such a typical members of the Mediterranean Forest as: the holm oaks (*Quercus rotundifolia*) and cork oaks (*Quercus suber*). The holm oak are replaced by the communities of *Asparago-Rhamnion (Asparagus, Rhamnus, Daphne, Myrtus, Pistacia)* and the communities of *Ulici-Ciston ladaniferi (Ulex, Genista, Cistus, Lavandula, Thymus)*. The cork oak are replaced by the communities of *Asparago-Rhamnion, Ericion umbellatae (Cistus, Erica, Calluna)* and *Ericion arboreae (Erica, Phyllirea)*. In the seaside sandbanks there are some members of the *Cupressaceae* family (*Juniperus*) substitued in part by the *Satauracantho genistoidis-Halimion halimifolii* communities *(Corema, Pistacia, Daphne)*. At last we count as well in this area with some representants of the river communities: *Nerium, Tamarix, Alnus* and *Fraxinus*.

The introduced vegetation is formed by members of old and new forest resettlements (*Castanea, Pinaceae* and *Eucalyptus)*, evergreen agricultural cultivation *(Olea* and *Vitis)*, and by elements of the ornamental city flora *(Acacia, Cupressus, Fraxinus, Ligustrum, Moraceae, Palmae, Platanus, Salicaceae* and *Ulmaceae)* (see Figs. 1 and 2).

Material and Methods

During a four years period (1989-92) have been carried out weekly samplings of the Huelva airborne by using a Cour trap located at a height of 15 meters in the ceiling of a public building situated in the city center.

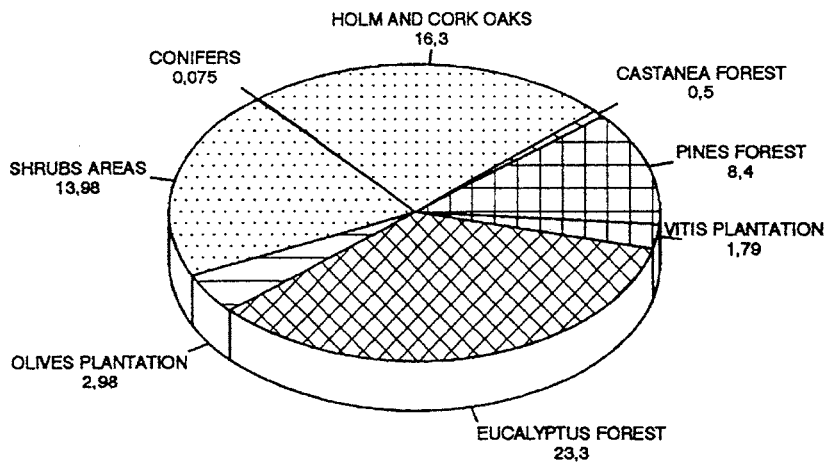

Fig. 1. Percentages of representation of the vegetation units of Huelva province.

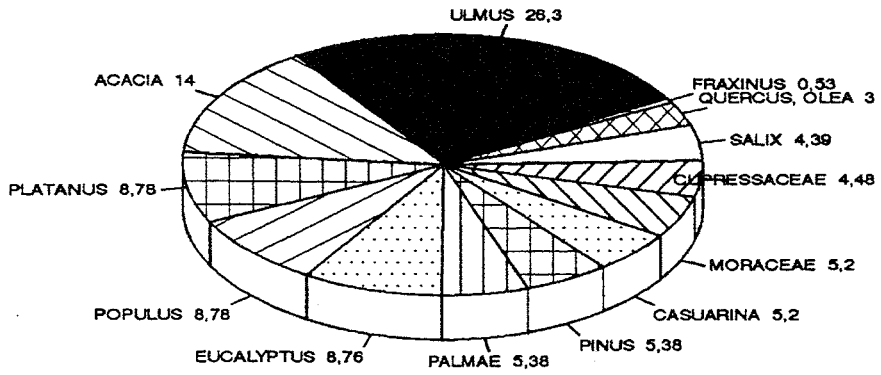

Fig. 2. Percentages of representation of the elements of the ornamental city flora.

The method employed in the processing of the samples has been described by Cour (COUR, 1974), whose particularities seem to be specially good for the study of the vegetation: the trap count with an area of impact of 400 cm^2, we esteem that the trap is able to capture with different degrees of accuracy in a geographic area within a radius of 50-100 Kms (CAMBÓN, 1981), on the other hand, we do obtain as well semifluid preparations of acetoliced pollen, what enable as to do an accurate identification of the palynomorphes intercepted.

The pollen types identified belong mostly to the ones described by VALDÉS & al. (1987a).

Results and Discussion

In the four years of sampling we have identify 82 different pollen types, 35 of them belong to the trees and shrubs (Table 1), in this table it's show, in addition, the percentage of representation of every type in the total pollen spectrum. The addition of the percentage of the different types rise to 65.21%, which means that the trees and shrubs pollen types predominate in the spectrum in spite of being smaller in quantitative terms than the pollen types of weed origin, the over-representation of the tree types is logic if we consider the biggest height of transmitting points (focus) of pollen, in an advantageous position concerning the wind exposure (FAEGRI & IVERSEN, 1975).

Figure 3 shows as follows the variation through the year of the weekly pollen concentrations of the six more abundant pollen kinds in the Huelva airborne: *Quercus, Pinaceae, Olea, Myrtaceae, Cupressaceae* and *Casuarina.* The aeropalynological curves of *Olea, Myrtaceae* and *Casuarina* show one or two maximum of concentration, as a consequence of the homogeneus blooming in the time of the short number of species forming the different types (respectively, *Olea europaea; Eucalyptus globulus* and *E. camaldulensis; Casuarina equisetifolia* and *C. cunninghgamiana);* an opposite phenomenon happens in *Cupressusaceae, Pinaceae and Quercus,* where we can see curves with saw teeth shape determined by the successive blooming of the different

Taxa	Percentage	Taxa	Percentage
ACACIA	0.23	*MYRTUS*	<0.0.1
ACER	<0.01	*OLEA*	11.79
AILANTHUS	<0.01	*PALMAE*	1.43
BETULA	0.17	*PAPILIONACEAE*	0.01
CELTIS	<0.01	*PINACEAE*	13.49
CASUARINA	1.96	*PISTCIA*	<0.01
CASTANEA	0.13	*PLATANUS*	0.87
CISTACEAE	0.13	*QUERCUS*	14.75
COREMA	<0.01	*RHAMNUS*	<0.01
CORYLUS	<0.01	*ROSACEAE*	14.75
CUPRESSACEAE	5.15	*RICINUS*	<0.01
ERICACEAE	1.19	*RUTACEAE*	<0.01
EUCALYPTUS	11.49	*SALICACEAE*	<0.01
FRAXINUS-PHYLLIREA	1.16	*TAMARIX*	<0.01
HEDERA	<0.01	*ULMACEAE*	<0.01
LABIATAE	0.15	*THYMELEACEAE*	0.09
LIGUSTRUM	0.15	*VITIS*	0.13
MORACEAE	0.26		

Table 1. Pollen types identified and percentages of representation in the total pollen captured. Mean values (1989-1992).

species forming the types respectively, *Cupressus arizonica, C. sempervirems, Juniperus oxycedrus, J. turbinata, Thuja orientalis* and *T. occidentalis; Pinus halepensis, P. pinaster,* and *Pinus pinea; Quercus coccifera, Q. rotundifolia, Q. suber, Q. pyrenaica, Q. faginea, Q. canariensis* and *Q. lusitanica)* (data appeared in VALDÉS & al., 1987 b).

Looking to the provincial vegetation census and to the urban ornamental elements (Figs. 1 and 2) and to the representation of the types identified in the global pollen spectrum (Table I) we can draw the following considerations:

1, The *Quercus* type is the more abundant with a proportion of 14.75 %, not in vain a 16.3% of the provincial area it's occupied by holm oaks and cork oaks, this panorama its been already described for the rest of the Iberian Peninsula globally analized (BELMONTE & ROURE, 1991).

2, The second type in importance it's the pollen of *Pinaceae* with a 13.49 %, figure relatively high and due at first to the strong volatility produced by the aerial vesicle and secondly to the huge extension of pine trees in the province, similar pecentages have been found in some other Mediterranean location from the South of France (BOUSQUET & al., 1984) and Israel (KEYNAN & al., 1991).

3, As in some others localities from Southern Spain, the olive pollen it's collected in huge amounts during few weeks of May and June (Fig.3). This types represents 11.79 % of the total amount of pollen, nevertheless the provincial area dedicated to the olive plantation it doesn't reach a mere 3% of the whole area, a reasoning for this situation could be the strong dispersion of the very same (as in the case of the *Pinaceae* type),

which makes possible it's transport to places located more than two hundred kms away if the wind conditions (direction and velocity) are suitable (MICHEL & al. 1979).

4, The high concentration and representation of *Eucalyptus* pollen (Fig. 3) has not been treated yet in the pollen spectrum of the Mediterranean cities, but one possible explanation to this situation could be the fact of counting with about a quarter of the whole provincial area dedicated to this plantations (Fig. 1).

5, The shrubs (*Cistaceae, Ericacea, Labiatae, Myrtus, Papilionaceae, Phyllirea, Pistacia, Rhamnus,* etc.) count with a lower proportion than the types above, motivated particularly for the entomophilous conditions of the most of the species forming this unities of vegetation.

6, We can draw out a similar commentary to the one above regarding the pollen issue of the riverside plant communities (*Alnus, Fraxinus, Nerium, Tamarix),* but in this case the low quantities collected from this group come motivated for the recession punishing this sort of areas.

7, The elms, willows, plane trees, palm trees, ash trees and acacias planted in the city are hardly represented in the pollen spectrum (percentage <5%), because the proximity of the trap become thwarted by the screen effect produced by the buildings

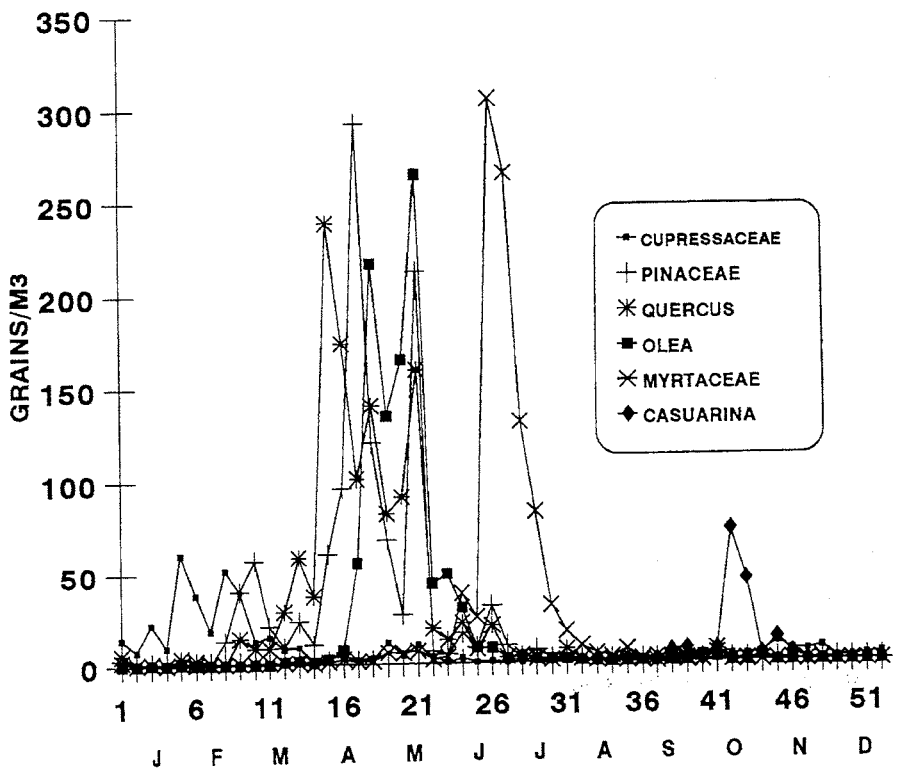

Fig. 3. Variation throught the year of the weekly pollen concentrations of the most abundant pollen types.

what makes rather hard the mobility of the pollen (DONINI & SUTRA, 1987), for this reasoning we share the opinion of NEGRINI & al. (1987) who think that the pollen traps located in the city centers collect with more facility the pollen coming from the outskirts of the city. This discussion should not be extended to the *Casuarina* pollen (1.96 %), with numerous samples next to the trap, and neither to the *Cupressaceae* pollen (5.15 %), family strongly scattered in gardens and city avenues and in the seaside.

8, Finally we have to mention the transport of the pollen from long distances (pollen marker) and the studies on the reconstruction of the vegetation starting from the pollen fossil, phenomenon considered in part in *Olea* and *Pinaceae*, and more obvious in the *Castanea* and *Betula* pollen. The collect of chestnut tree pollen it is to be considered in this case as a transport a regional scale from the chestnut area located in the mountains more than one hundred kms away. A similar case has been described in cities from the North of Italy (CARAMIELLO & SINISCALCO, 1990). More extraordinary happens to be the collect of small amount of birch tree pollen, specially considering that the nearest birch trees areas are located at about 400 kms in the provinces of Cáceres and Salamanca (MORENO & PEINADO, 1990), however researchs carried out by WALLIN & al. (1991) and HJELMROOS (1992), prove the strong disperssion capacity of this pollen type.

Conclusions

The pollen of trees and shrubs it's presented in the air almost all the year, reaching its highest concentrations by the months of April, May (*Quercus, Pinaceae* and *Olea)* and July *(Myrtaceae).*

The huge unities of vegetation censed in the province are show in the pollen spectrum, however there is not a relation area/quantity of pollen.

The elements of Mediterranean native forest *(Quercus, Cistaceae, Labiatae, Papilionaceae...)* are reflected in the spectrum, being the pollen of *Quercus* the most abundant, and all this in spite of the continuous changes in the primitives Mediterranean forests for new forest areas (*Pinaceae* and *Myrtaceae)* and agriculture land.

The high quantities of *Eucalyptus* pollen it's a specific feature of the pollen content of Huelva.

The pollen types coming from the urban vegetation, riverside communities and long distances, are scarcely represented in the spectrum.

Bibliography

BELMONTE, J. & J. M. ROURE (1991). Characteristics of the aeropollen dynamics at several localities. *Grana* **30**: 364-372.

BOUSQUET, J., COUR, P., GUERIN, B. & F.-B. MICHEl (1984). Allergy in the Mediterranean area I. Pollen counts and pollinosis of Montpellier. *Clin. Allergy* **14**: 249-258.

BRICCHI, E., FRENGUELLI, G., MINCIGRUCCI, G., FORNACIARI, M., FERRANTI, F. & B. ROMANO (1995). Time linkages between pollination onsets of different taxa over an 11-year period in Perugia, Central Italy. *Aerobiologia* **11**: 57-61.

CAMBÓN, G. (1981). *Relations entre le contenu pollinique de l'atmosphere et le couvert vegetal en Mediterranée occidental à Montpellier (France), Valencia (Espagne) et Oran (Algerie).* These doctorel. Montpellier.

CANDAU, P. & F. J. GONZÁLEZ MINERO (1992). Relationship between vegetation and pollen spectrum in southwest Spain. *Israel J. Bot.* **41**: 285-295.

——, GONZÁLEZ MINERO, F. J. & M. L. GONZÁLEZ ROMANO (1993). Relación entre la flora aeropalinológica y el espectro polínico de tres ciudades del SW de España. 1989. *Gior. Bot. Ital.* **127**: 229-241.

——, GONZÁLEZ ROMANO, M. L. & F. J. GONZÁLEZ MINERO (1994). Olivo y girasol en el espectro polínico de Andalucía Occidental. *Lagascalia* **17**: 219- 228.

CARAMIELLO, R. & C. SINISCALCO (1990). Pollen calendar in Northern Italy and its relationship to climate. *Aerobiologia* **6**: 116-121.

COUR, P. (1974) Nouvelles techniques de detection des flux polliniques: étude de la sedimentation des pollens déposés á la surface du sol. *Pollen et spores* **16**: 103-141.

—— & D. DUZER (1976). Persistance d'un climat hyperaride au Sahara Central et Meridional au cours de l'hologene. *Rev. Geogr. Phys. Geol. Dinam.* **13 (2- 3)**: 175-190.

DONINI, D. & J. P. SUTRA (1987). Recherches aéropalynologiques à Paris et dans sa banlieue: Nouveaux resultats. *Grana* 28: 37-44.

FAEGRI, K. & J. IVERSEN (1975). *Textbook of pollen analysis* **3**. Blackweel Scientific Publications. Oxford, London, Edinburgh, Melbourne.

HJELMROOS, M. (1992). Long distance transport of *Betula* pollen grains and allergic symptoms. *Aerobiologia* **8(2)**: 231-236.

KEYNAN, N., Y. WAISEL, A. SHOMER-ILAN, A. GORDEN, & S. BRENER (1991). Annual variations of airborne pollen in the Coastal Plain of Israel. *Grana* **30**: 447-480.

MANDRIOLI, P. (1987) Biometeorology and its relation to pollen count. *Adv. Aerobiol.* 37-42.

MICHEL, F. B., CH. SEIGNALET & P. COUR (1979). Contibution palynologique, allergologique, météorologique et climatologique de l'étude des flux polliniques entre la Scandinavie et l'Afrique du Nord, premiers resultats. *Le pollinoses.* Paris.

MORENO, G. & M. I. PEINADO (1990). *Betulaceae (Betula).* In CASTROVIEJO & al. (eds). Flora *Iberica* **2**. C. S. I. C. Madrid.

NEGRINI, A. C., D. AROBBA, A. EBBLI, C. TROISE & S. VOLTOLINI (1987). Le calendrier pollinique de Genes. *Rev. Fr. Allergol.* **27**: 65-70.

RIVAS MARTÍNEZ, S. (1987). *Memoria del mapa de series de vegetación de España.* Madrid.

VALDÉS, B., M. J. DÍEZ & I. FERNÁNDEZ (1987a). *Atlas polínico de Andalucía Occidental.* Instituto de Desarrollo Regional (Universidad de Sevilla). Diputación de Cádiz. Sevilla.

VALDÉS, B., S. TALAVERA & E. F. GALIANO (1987b). *Flora vascular de Andalucía Occidental.* Ed. Ketrés.Barcelona.

WALLIN, J. E., U. SEGERSTROM, L. ROSNHALL, E. BERGMANN & M. HJELMROOS (1991). Allergic symptoms caused by long- distance transported brich pollen. *Grana* **30**: 265-268.

WILKINSON, M. J. (1989). Pollen and climatic change. *Aerobiologia* **5**: 3-8.

Address of the authors:

Dr. F. J. González Minero & Dr. P. Candau, Departamento de Biología Vegetal y Ecología, Facultad de Farmacia, Universidad de Sevilla, Apartado 874, 41081 Sevilla, Spain.