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A Specific Study of Airborne Betulaceae Pollen (Vignola-Modena-Northern Italy-1990).

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Summary

This paper presents a contribution to refine the palynological recognition to the species level during monitoring of airborne pollen. A detailed study on airborne Betulaceae pollen is reported; during 1990 in the monitoring station of Vignola (Modena), we identified six pollen species of Betulaceae (four *Alnus* species and two *Betula* species). Daily mean pollen concentration, total monthly sum, total yearly sum of daily means and pollen percentages over the year are reported, as well as the relevance of empty pollen for each species. The identification of species provided a real improvement of the geobotanical and aerobiological/allergological interpretations.

1 Introduction

In air pollen analysis, as always in pollen analysis, grain identification doesn't usually reach the species level. However, specific identification of pollen in the air would be of interest for geobotanical as well as agronomic, allergological and also meteorological/climatic purposes.

In the recent CNR-strategic project "Metropolitan areas and environment" we planned out a detailed airpollen monitoring program in order to bring pollen identification towards the species level. Pollen monitoring was performed at the station of Vignola, a town in the hills of the Emilian Apennines (125 m a.s.l.), which since 1990 has been part of the "Italian Aeroallergen Network" managed by AIA= Italian Association of Aerobiology (AIA MO2 Station) (1, 2, 3).

Starting our program with the study of the main airborne tree pollen, this paper presents the first contribution, on Betulaceae pollen in the air of Vignola during 1990. The Betulaceae Family is one of the basic families recognised by the Italian Aerobiological Network(4, 5); in Italy it includes eight native growing species, four *Alnus* species, and four *Betula* species; a few exotic species of both Alder and Birch are cultivated in private and public parks. Birch Family pollen is important from the actuo- and palaeogeobotanical point of view; moreover, it is one

of the most important allergenic tree pollen in Italy (5), and a number of people suffering from related allergies are known in the very area of Vignola.

2 Materials and methods

A 7-day volumetric recording spore trap (Lanzoni VPPS 2000) was located on the roof of the n°19 Local Health Department building of Vignola. Routine preparation of slides was according to the method used by the Italian Network (6); pollen analysis was instead finer than the standard: daily slides over the entire 1990 (365 slides) were fully read for all the Betulaceae pollen types, i.e. Alder and Birch species were identified and noted separately; the deteriorated pollen types were also recognised and counted. Identification of pollen was based on the relevant bibliography (7,8,9,10,11,12,13,14,15,16); morphological observations on Italian Betulaceae pollen (reference slide collection of the Botanical Institute of Modena) was also performed with the method of the Palynological Italian Flora-Aerobiological Section (17, 18). Airpollen data were compared with meteorological data from Vignola (temperature, rainfall and humidity) and Modena-Geophysical Observatory (wind direction and speed, not available from Vignola). Vignola-airpollen data were also compared with the airpollen data of Modena, produced by the n°16 Local Health Department (AIA MO1 Station).

3 Results and discussion

Over the span of 1990, five Italian Betulaceae species plus a sixth, perhaps exotic, species were identified:

- 1 *Alnus cordata* (Loisel.) Desf. -Italian Alder
- 2 *A. glutinosa* (L.) Gaertner - black Alder, common Alder
- 3 *A. incana* (L.) Moench - grey Alder, European Alder
- 4 *A. viridis* (Chaix) DC - green Alder
- 5 *Betula pendula* Roth-common Birch, silver Birch, white Birch
- 6 *Betula* sp., a not better identified pollen type, perhaps belonging to an introduced Birch.

Four species had higher and similar concentration and percentage values (47.6-20.3 p/m³/24h - peak; 398.5-127.4 p/m³/24h -yearly sum; 34-11% of the Betulaceae yearly sum); in decreasing order they were *Betula pendula*, *Alnus glutinosa*, *Alnus incana*, *Betula* sp. The other 2 species, i.e. *Alnus viridis* and *Alnus cordata*, had a lower concentration / percentage (5.5-7.0 p/m³/24h-peak; 50.3-31.9 p/m³/yearly sum; 4-3% of the Betulaceae yearly sum). On the whole, Alder pollen was a little more abundant than Birch pollen; their total yearly sums of daily means were 658.7 p/m³ (*Alnus*) and 526.0 (*Betula*) (Figs.1,2). The total sum of daily means for the whole Birch Family was 1 184.7 p/m³ in 1990; this value represents 3% of the total amount of pollen grains (41 908.7 pollen/m³ recorded in the air of Vignola in 1990 - Fig.3).

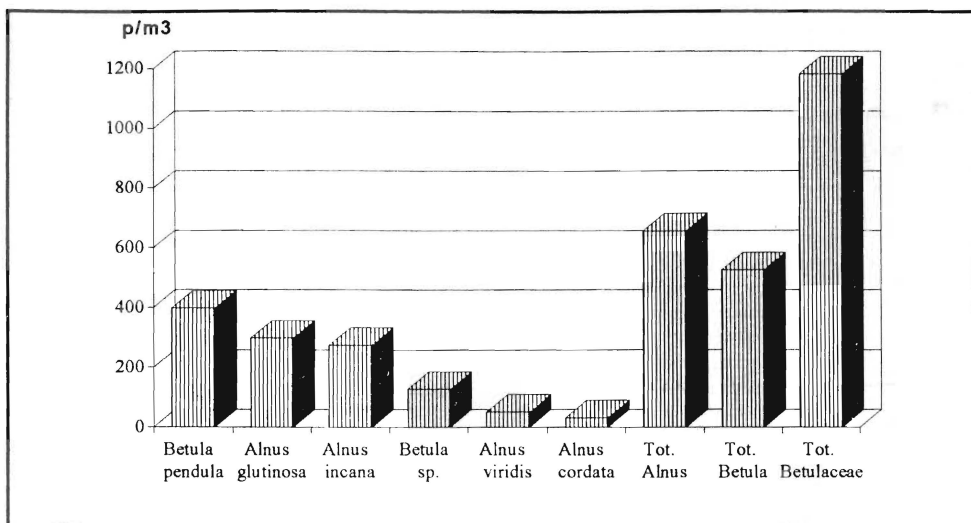


Figure 1. Yearly sums of daily mean concentrations (p/m³/24 h - yearly sums) of airborne Betulaceae pollen (Species, Genera, Family) over 1990 in Vignola (MO - Northern Italy).

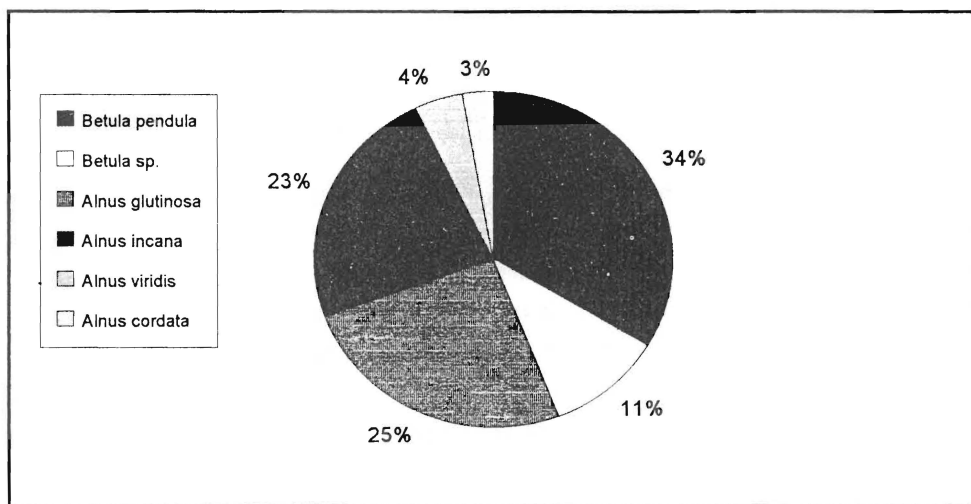


Figure 2. Percentage of Betulaceae species out of the total Betulaceae pollen over 1990 in Vignola (MO - Northern Italy).

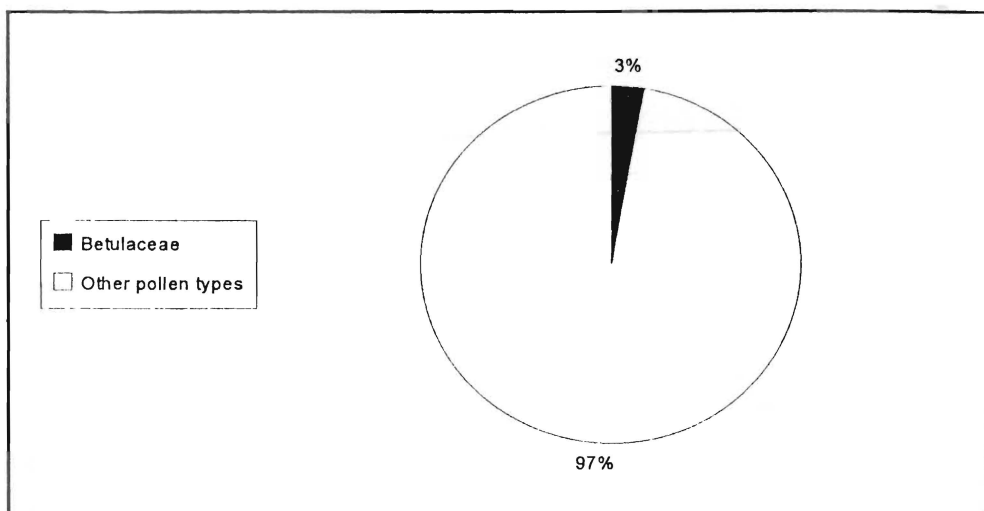


Figure 3. Percentage of Betulaceae pollen out of the total pollen recorded over 1990 in Vignola (MO - Northern Italy).

Betulaceae pollen was present in the air during a seven-month period, from January to July. During January-March, pollen from Italian Alder, grey Alder and Birches was recorded; Birches persisted until June. The green Alder arrived later during April-July (Fig.4). The grey Alder was the first to appear, the green Alder was the last. The Alders were more strongly represented in February, the Birches in March (Fig.5).

Pollen preservation was generally good, but all species showed a number of deteriorated grains among which we would like to point out the empty grains, i.e. devoid of the cytoplasmatic content; they could be related to various factors such as recycling or the diffusion of gardening cultivars (3, 19).

Black Alder, grey Alder and common Birch are native and cultivated trees in the monitoring area; the introduced *Betula* sp. may be an exotic cultivated Birch. Italian Alder, an endemic species naturally growing in the southern Apennines, from the Neapolitan to Sila area and also on the Maiella and in Corsica (20, 21,22), is cultivated occasionally in the monitoring area . These pollen types in the air of Vignola seems to be linked to a real presence of the plants in the monitoring area.

On the contrary, the Arctic-Alpine green Alder doesn't grow spontaneously (20,21,22) and is not cultivated in the area , so that its pollen must arrive by a long distance transport.

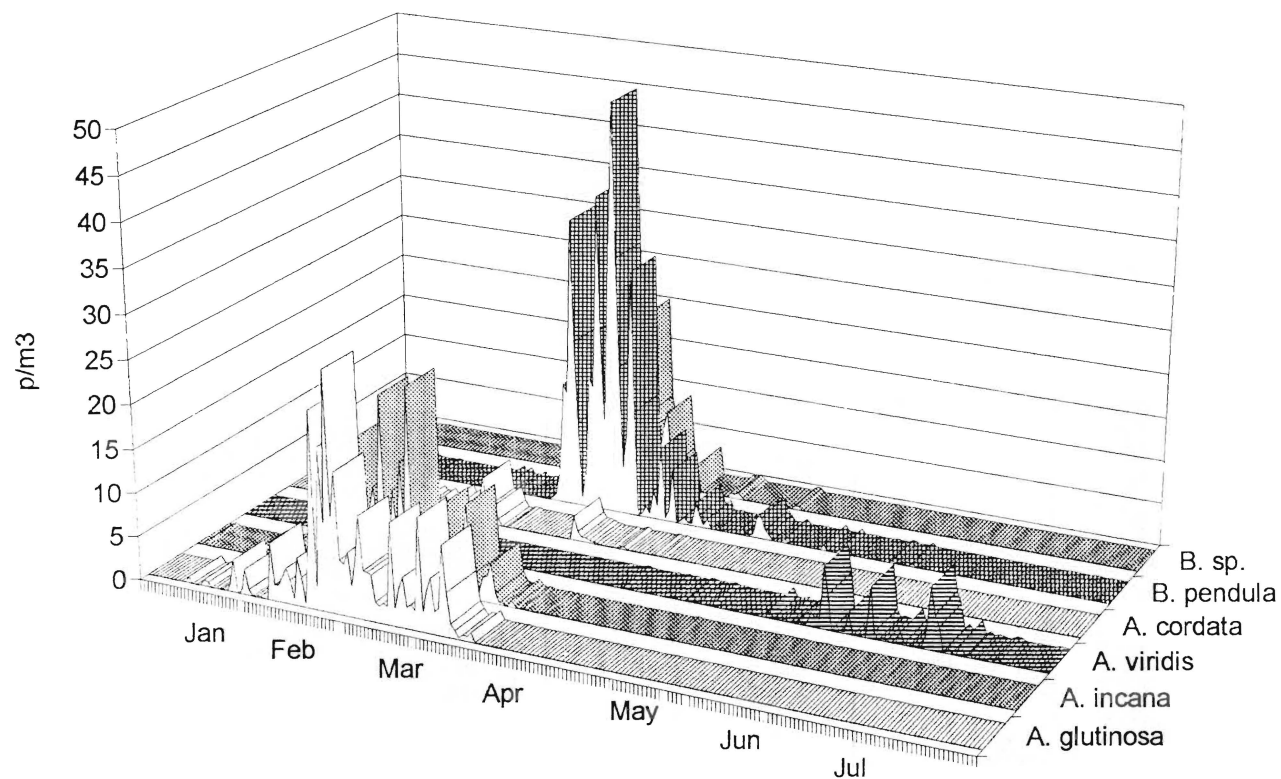


Figure 4. Daily mean airborne pollen concentrations ($\text{p/m}^3/24 \text{ h}$) of the Betulaceae species over 1990 in Vignola (MO-Northern Italy).

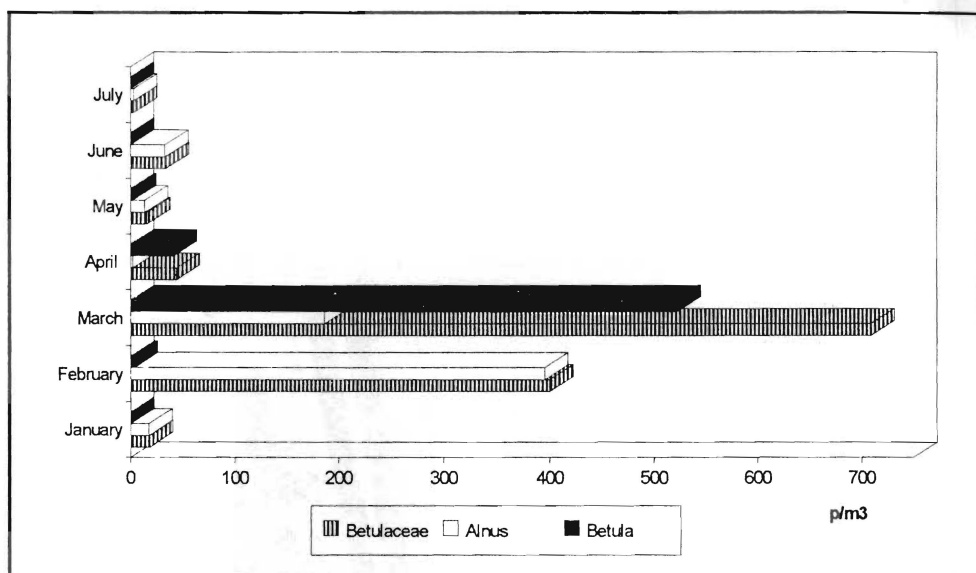


Figure 5. Monthly sums of daily mean concentrations ($\text{p/m}^3/24 \text{ h}$ - monthly sums) of airborne Betulaceae pollen (Genera, Family) over 1990 in Vignola (MO - Northern Italy).

The significant percentage of empty pollen of this species might be related to this event (Fig. 6). Moreover, by comparing pollen data with wind directions, it appeared that green Alder pollen increased in relation to prevailing East winds (Fig. 7).

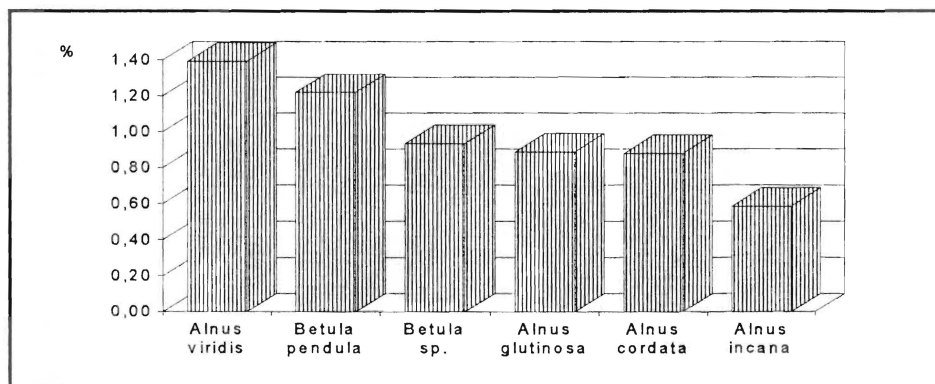


Figure 6. Percentage of empty pollen out of the yearly sum of daily mean concentration for each Betulaceae species over 1990 in Vignola (MO - Northern Italy).

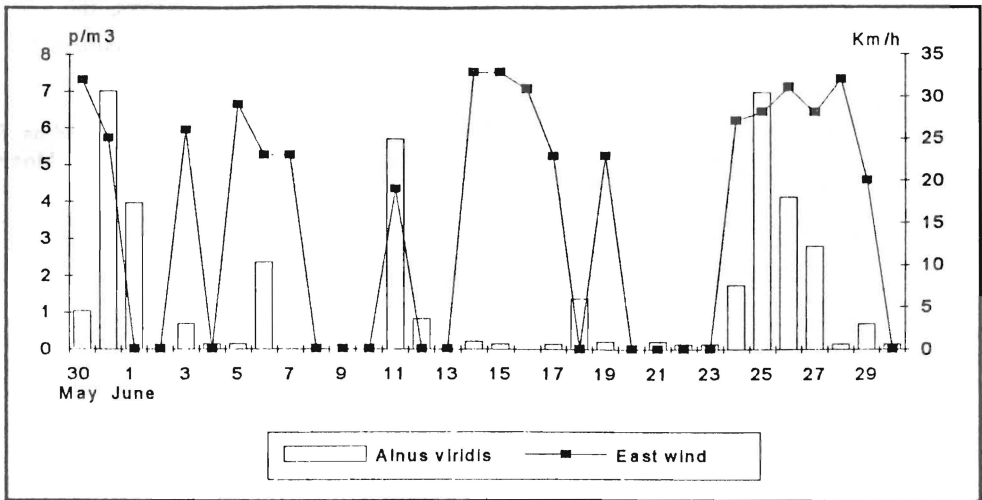


Figure 7. Comparison between East prevailing wind speed and *Alnus viridis* airborne pollen concentration in the May 30-June 30 1990 period.

4 Conclusions

The exertion of species identification points out that human activity is significantly involved in the presence of Betulaceae pollen in the air of Vignola. The bulk of airborne Betulaceae pollen appears to arrive by local dispersion from Alder and Birch trees, both naturally growing and planted by man. This is the case of the black and grey Alders, the most widespread native Alders in the area, and of the common Birch, growing in small stands in the surroundings; these are trees which man has been increasingly using for reforestation and for public and private greening. Man's action is even more involved in airborne pollen of *Betula* sp. (probably an introduced exotic Birch) and of the Italian Alder, a fine tree occasionally planted in forestry and urban landscaping; our pollen/meteorological data did not reveal a long distance transport of the latter from its natural habitats in the south. Instead, a long distance transport appears to be involved in bringing the green Alder pollen to the monitoring area, a suggestion that seems to be confirmed by the appreciable amount of its empty pollen. Green alder pollen is not abundant in the air, but its aerobiological/geobotanical interest could, nevertheless, be high, since it is rather well recognised and so could enter into the pollen pool useful for estimating alloctonous pollen transport in our region (23).

On the whole, the concentration of Birch family pollen in the monitoring area is in fact low, lower than the concentrations considered to promote reactions in people allergic to Birch trees (24, 25); notwithstanding, some people in the Vignola area do suffer from allergies to Betulaceae pollen. Our data shows the relevance of man's activity in increasing the level of this

tree pollen in the atmosphere; thus, if society is concerned about pollinosis, the use of Alders and Birches for reforestation and public and private landscaping should be curtailed.

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