Pact 33 - I.a.1 : P.G. von Wahl

Emission and Distribution of Mugwort Pollen

Abstract

Some results concerning the movement of mugwort pollen (*Artemisia vulgaris* L.) at two different levels (Essen 1.8 m and 18 m above ground) established by hourly pollen analyses are presented and discussed.

Mugwort pollen movement and pollen emission is characterized by a distinct biological rhythm with emission in the early morning hours (6.00 - 11.00 a.m. CET).

Pollen traps at roof level register the daily and yearly variation in mugwort pollen movement 2 hours later than those installed 1.8 m above the ground because of the meteorological processes (influence of the daily variation in air convection) active at this level. This is why ground-level pollen traps also register greater quantities of pollen than those at roof level.

Introduction

In Central Europe the liberation and movement of mugwort pollen can be observed in July and August (Spieksma *et al.*, 1980 ; Käpylä, 1981 ; Spieksma *et al.*, 1989 ; Caramiello *et al.*, 1989). Mugwort pollen numbers among the primary allergy carriers released in the late summer (Charpin *et al.*, 1977 ; Spieksma, 1986 ; Spieksma *et al.*, 1980 ; Wallenstein *et al.*, 1985). To those allergic to herb pollen, who are frequently also sensitive to tree and grass pollen (Kersten, 1979), the emission of mugwort pollen means a third stress peak during the year.

To date, several authors have dealt with the daily variations in the dispension of pollen of allergologically relevant plants (Fuckerieder, 1976 ; Stix and Grosse-Brauckmann, 1970 ; von Wahl *et al.*, 1989a). So far, however, only Wachter and Käpylä (Wachter, 1978 ; Wachter, 1982 ; Käpylä, 1981), have described the daily variation in mugwort pollen.

This paper about the emission and movement of mugwort pollen continues the observations to be published in Aerobiologia (von Wahl *et al.*, 1989b).

Material and Methods

The pollen was recorded by means of two standard « Burkard » pollen traps. One of these traps was installed 18 m above the ground on top of the roof of the Meteorological Station of the German Weather Service in Essen. The other one was installed 1.8 m above the ground within the recording area of the same Meteorological Station. The air distance between the two traps is about 30 m.

The Meteorological Station in Essen lies 152 m above sea level and the recording area of the station is surrounded by farmland. The pollen traps are surrounded on all sides by mugwort plants which can be found at a distance of some metres from the ground level trap. For the method of hourly analysis of the pollen trap, see von Wahl *et al.*, 1989b.

Results

A comparison between the measurements of mugwort pollen in the seasons of 1989 at Essen reveals a significant qualitative and quantitative difference (Fig. 1). These differences cannot be explained in terms of a different biotope or by different phenological data. What strikes one is the temporal phase shift between the two traps. At 18 m above the ground the maximum is reached at 10.00 a.m. (Central European Time, CET), which is two hours later than in the traps 1.8 m above the ground (8.00 a.m. CET). Another result is the significant quantitative difference in the hourly average value by a factor of at least 60:1 (low level : high level).

Discussion

The figures show that mugwort pollen is apparently released according to a « biological clock », *i.e.* the emission is limited to a few hours only. Wachter (1978 and 1982) has also described daily variations in mugwort pollen emission and established daily peak concentrations of pollen in the air between 6.30 and 10.30 a.m. CET in a ground level trap.

The readiness to flower, pollen emission and pollen dispersal are basically dependent on meteorological conditions (Puls, 1987, 1988). According to Wachter (1978 and 1982) the threshold value for the emission of mugwort pollen being a temperature of 13°-14° C.

In addition to the daily temperature curve a marked daily variation in the vertical (convective) current and horizontal (advective) current also exists, which is dependant on it. This means an abatement of the wind during the night — very often to a state of windlessness — which may last until after sunrise. Such a daily variation in air convection exists particularly during weather conditions with a low pressure gradient.

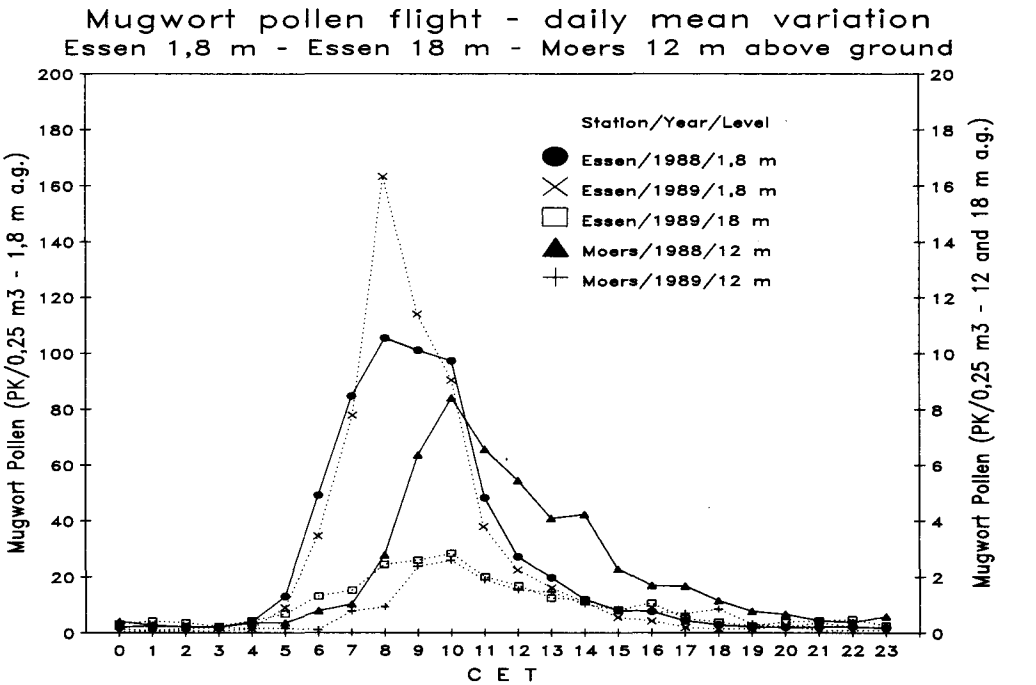

Fig. 1. Daily mean variation in mugwort pollen in two traps (Essen 1,8 m above the ground and Essen 18 m above the ground) (von Wahl, 1989).

The differences between the two pollen traps could be explained by this daily variation in air convention : after sunrise the ground warms up gradually (esp. by inversion conditions). The result is a thermal current (convection), at first at ground level and then rising hour by hour to higher layers, metres and tens of metres above the ground. As a result a ground level pollen trap (1.8 m above ground) registers the beginning of pollen liberation during the first hour and records the end of the pollen emission comensurately early. By comparison, it is up to some hours later that a high level pollen trap is reached by the convection and thus by the pollen. That is why a high level trap registers the mugwort pollen maximum considerably later than a ground level one.

From the daily variation in convection it might be assumed that a high-level trap (18 m above ground) will not record maximum pollen values before the afternoon convection maximum *i.e.* between 2.00 p.m. and 5.00 p.m. This is not, however, possible since, due to its biological rhythm mugwort pollen emission drops remarkably from 8.00 a.m. (CET) onwards and almost ceases before convection reaches its maximum in the afternoon.

This also explains why the roof top trap registers considerably smaller quantitities of pollen (factor of 60 in 1989). The ground-level liberation of pollen has almost come to an end before the convection streams of air

carrying the mugwort pollen reach the high level trap. That is why a high level trap is reached by only a very small proportion of the mugwort pollen emitted in the early morning hours.

Käpylä (1981) also demonstrated a time difference of 3 hours between a low level trap (1.5 m at Jyväskylä Airport) and a high level trap (15 m above the ground, at Turku), but without finding an explanation.

Examinations of the allergy provoking threshold values of mugwort pollen (Horak *et al.*, 1980 ; Spieksma, 1986 ; Spieksma *et al.*, 1980) indicate that even a few mugwort pollen grains in the atmosphere are apparently sufficient to cause high pollinosis rates. From this a high allergenic potential of mugwort pollen is concluded. The investigations mentioned above were made, however, without any ground-level traps. In consideration of the above-cited results which show that high level traps do not give a representative picture of ground level mugwort pollen dispersion the high aggressiveness of mugwort pollen hitherto described should be discussed anew.

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