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Influence of wind velocity on pollen concentration in urban canopy layer

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POLLEN RELEASE

Temperature is the basic parameter for prediction of the beginning of the pollen season and identification days with good potential for pollen release. Different approaches are used for determination of the start of the pollen season: i) the sum of daily pollen counts = [U+F0E5]x criterion (Arnold 2002), ii) the mean temperature method during pre–defined period (Sparks, 2000), iii) the temperature sum method (Jones 1992). Another parameters influencing pollen release are: day light length, morning temperature gradient, relative humidity. The mentioned parameters enable to create the “statistical” model for determination of timing of pollen potential release. But, the correct determination of pollen release timing is only the first step to correct prediction of pollen concentration in air. The above mentioned collection of parameters isn’t complete for correct pollen production prediction without inclusion of the actual wind velocity. The wind velocity directly influences the pollen release rate from mother plant and subsequently transport of pollen grains. From this reason, influence of wind conditions has to be considered as exactly as possible in complex prediction models.

WIND VELOCITY AND POLLEN CONCENTRATION

Results of in-situ measurements were used for carried out analysis of the relation between wind velocity and pollen concentration in an urban canopy layer. The mean daily wind velocities and the mean daily pollen concentrations were used as the input data describing the pollen season 2005 in an inner part of the city of Brno (pop. 400 000). The mean daily pollen concentrations were matched to corresponding mean daily wind velocity and depicted in graphs. This procedure was done for all locally monitored aeroallergens, namely Alnus, Ambrosia, Betula, Artemis, Corylus, Fraxinus, Poaceae and Quercus. Only days with significant pollen concentration (above 10% of maximal pollen season concentration) were considered for detail analysis. Clear evidence of the wind threshold velocity of pollination appears in the carried out graphical expression of in-situ measurement. The threshold velocity of pollination is the lowest wind velocity with significant concentration of pollen grains in the air. Wind velocity increase above the wind threshold velocity of pollination causes another increase in pollen maximal concentration until reaching the highest concentration of the pollen season. This trend reflects increase in the total pollen release rate due to increase of the air velocity in deeper layers of vegetation and branch bundles. Another increase of wind velocity causes decrease of the maximal air pollen concentration due to “dilution” of the canopy layer by vast quantity of fresh air. The described "triangle" trend was confirmed for majority of considered species. The particularly determined values of the wind threshold velocity of pollination in urban area are: Alnus 0,66 m/s, Ambrosia 0,4 m/s, Betula 0,59 m/s, Artemis 0,62 m/s, Corylus 0,75 m/s, Fraxinus 0,5 m/s, Poaceae 0,45 m/s and Quercus 0,66 m/s. The wind velocities corresponding to the highest pollen concentration values are: Alnus 0,95 m/s, Ambrosia 1,01 m/s, Betula 1,1 m/s, Artemis 0,8 m/s, Corylus 0,95 m/s, Fraxinus 1,1 m/s, Poaceae 1,29 m/s and Quercus 0,96 m/s.