Session 2

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Meteorological conditions and the hazel flowering at the beginning of 2018 – typical or unusual?

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Meteorological conditions at the winter-spring transition period have an impact on the vegetation development and affect the course of the whole pollen season in the year. Large temporal, spatial and qualitative differentiation of the pollen spreading particularly characterizes the trees flowering at the early spring period, e.g the hazel (*Corylus* L.). The aim of the paper is to present the daily course of mean, maximum and minimum air temperature and precipitation observed in the period of January-April 2018 as well as the reports of the hazel flowering at the chosen sites in Poland. The data from 2018 will be assessed due to regional multiannual climatological and phenological norms provided from the Institute of Meteorology and Water Management of Poland (IMGW).

Weather conditions in early 2018 were diverse in Poland. From January to April the warmer periods were followed by frosts periods. In Cracow, days with mean air temperature about or above 5°C were noted in the first and third decades of January as well as in the second and third decades of March. Maximum air temperature above 10°C appeared at the end of January and in the middle and at the end of March. In prevailed areas January 2018 was thermally above the norm (SD > +2.5°C), while February and March 2018 were below the norm (SD < -2°C).

The first phenological reports of the hazel flowering was sent at 6th and 12th of January 2018 from Bielsko-Biala and Opole respectively. Next reports occurred at the end of January and in the first days of February, mainly from stations located in south-western areas. The beginning of the hazel flowering was not observed at any station from the second decade of February till the beginning of March, when a single report from the central region was submitted. Subsequent reports began to come in the second decade of March from various sites located in central, north-western and western regions of Poland. Until the beginning of April, 60% of phenological stations in the IMGW network have documented the blossoming of hazel. It seems that 2018 will be different in terms of the hazel flowering in relation to the previous 10 years. In past years, the earliest blossoming of hazel, has been recorded in the western part of Poland, in the third decade of January. Typically a significant delay in the flowering is observed in the eastern part of the country in relation to western regions. In 2018 spatial and temporal differentiation have occurred. It seems that the vegetation of the hazel has slowed down or even stopped in February, which coincides with the period of lower air temperature compared to January.

Increased pollen concentrations during rainfall and storms – an attempt to explain this phenomenon

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Introduction: Precipitation of high intensity has been shown to wash out pollen grains from the air, which results in decreased concentrations during and shortly after rainfall. However, few study indicated on increased pollen concentrations during the first two hours of precipitation. Moreover, the increase in fungal spore concentration just before and during summer storms were stated to be responsible for asthma symptoms. The current study was focused on the phenomenon of increased pollen concentrations during rainfall and storms in the air of Rzeszów. We assumed that this phenomenon is rare in comparison with decreased concentrations during rainfall and is conditioned by the specific synoptic situations. We also hypothesized that the phenomenon concerns different types of pollen and is associated mainly with rainfall and storms which are convective in origin.

Methods: The study was performed in Rzeszów (SE Poland) in 2014-2017. Pollen grains were collected using two Hirst volumetric traps situated in the city centre and in the city suburbs, both at 12 m a.g.l. The pollen grains were counted in hourly intervals. The meteorological and synoptic records were obtained from IMGW-PIB and from a Synop numerical code at hourly intervals for the station Rzeszów-Jasionka located approximately 10 km from the city centre, and from one another station located a few meters from the pollen trap in the suburbs.

Results: The episodes of increased concentrations during precipitation and/or storms involved the pollen of *Ambrosia*, *Betula, Pinus,* Poaceae and *Urtica*. This phenomenon occurred from April to September on the days or after a day of high mean temperature and of high sum of actual sunshine duration. The rain had usually character of showers and in the most of cases was associated with thunderstorms. The increase in pollen concentrations occurred shortly before and in the first or the first two hours of the precipitation and then the concentrations markedly decreased. In two cases the increasing pollen concentration occurred simultaneously with the thunderstorms and the concentrations decreased when the heavy rain began. However, during one episode concentrations increased back as rapidly as one-two hours after heavy rain. Each situation was similar in terms of the cloud type, with creeping *Cumulonimbus* clouds observed just before and during precipitation. The synoptic maps indicated that the cool air masses were passing over SE Poland during the majority of the episodes.

Conclusions: The increased pollen concentrations during rainfall and storms seem to be associated with the strong air convection. This was confirmed by the appearance of *Cumulonimbus* clouds which were formed as an effect of convection and the cool air masses usually accompanied convective rainfall and convective storms. Although, this phenomenon occurred occasionally, it is important for people suffering from allergy as they could be exposed to high concentrations of allergenic pollen not only on sunny and warm days but also on cloudy days just before or during the first hours of rainfall and/or storms. The study of *Betula* pollen also revealed that the efficiency of the wash-out effect of rain might be weak and high concentrations occur again in one or two hours after heavy rain.

Airborne *Alnus* pollen during snowfall – aerobiological anomaly?

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Introduction: The annual variability in dates of *Alnus* Main Pollen Seasons in Poland is a result of, inter alia, the unstable weather pattern during the pollination period. The returns of coolness, snowfall and rainfall usually interrupt shedding of pollen which has already begun. The greater variability in the weather pattern, the more fluctuations in the course of *Alnus* MPS are registered. In spite of the fact that on the days with snowfall and temperature below zero, the pollen grains rarely occur in the air, the opposite relationship was observed in Rzeszów in March 2018. The current study was focused on the relation between the course of *Alnus* MPS and the weather parameters in 2018 with the emphasis on the increasing concentrations of pollen grains during coolness and snowfall.

Methods: The study was conducted between January and March 2018 in Rzeszów using two volumetric pollen traps situated at 12 m a.g.l. Daily concentrations of *Alnus* pollen grains were compared to weather parameters obtained in the meteorological station located a few meters from one of the pollen traps. Detailed information about the snowfall were obtained from Synop records.

Results: In 2018 one two-day peak (approximately 2000 pg·m^{-3}) of *Alnus* MPS was registered in the middle of March, soon after warming. Then the pollen concentrations markedly decreased and increased again to approximately 700-900 pg·m^{-3} in two days with maximum daily temperature below zero, actual sunshine duration equal with zero and continuous snowfall or snow mixed with rain.

Conclusions: The investigation revealed that high concentrations of *Alnus* pollen grains might occur when weather conditions are unfavourable to shed and disperse the pollen.

Phenological observations run by the Institute of Meteorology and Water Management – National Research Institute

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Introduction: Phenology is an interdisciplinary study of dynamic seasonal life processes of organisms which are mainly driven by changes of weather and climate conditions. It comprises of phytophenology and zoophenology, but because changes in meteorological conditions have stronger impact on plants than on animals, observations of plants are more frequent and the term "phenology" is generally used for this kind of research. The results of phenological observations play an important role in the climate change investigation since, plants exhibit complex response to weather conditions and climate change i.e. plant reaction is set off

by all components of a climate as a system. Therefore, phenological data are applied in climatology, ecology, biology, allergology, forestry, agrometeorology etc.

Materials and methods: In the 1940's, the Institute of Meteorology and Water Management – National Research Institute (IMGW-PIB) created a network of over 600 phenological observatories. Their observations were published up to 1960. In later years, the network was systematically reduced and in 1992, the observations were suspended. In 2007 IMGW-PIB renewed the phenological network and presently the observations are conducted at 51 synoptic stations in the whole country. Ten different wild plants are observed (common hazel, coltsfoot, bird cherry, common dandelium, silver birch, common lilac, horse chestnut, black locust, small-leaved lime, common heather) and the following phenophases are registered: flowering, leaf unfolding, fruit ripening, leaf coloring and falling. On the base of a 10 year data (2007-2016) in chosen 11 stations located in different parts of Poland, the earliest and latest dates of the beginning of all phenophases were indicated and the mean date of each phenophase was calculated. Afterwards, the years in which very early and very late beginning of phenophases were determined and compared to the thermal conditions.

Results: The biggest diversity of the dates of the phenophases beginning was observed in the common hazel flowering. Generally, bigger differences were noted during spring and early summer and smallest during autumn. Dates of the beginning of spring and summer phenophases were mainly correlated with temperature of the preceding 1-2 months. There were no clear correlations between the dates and the thermal conditions of previous 3, 4, …, 9 decades. Analysis showed also that the earliest beginning of all phenophases was observed mainly in 2014 and the latest in 2010.

Conclusions:

- The big differences in dates of the beginning of early phenophases result from the slow progress of the early thermal seasons from the west to the east of Poland (app. 40 days). In the second part of the year the range of the beginning of the thermal seasons is much smaller (app. 10 days).
- The relationship between temperature and the beginning of autumn phenophases is not so clear because of the influence of such factors as strong wind and rain, single frost etc.
- The very early beginning of all phenophases in 2016 and very late in 2010 were caused by the crucial departure of mean monthly temperature from the norm.