

EVALUATION OF „POACEAE“ ALLERGENS PHENOLOGICAL ONSETS IN DEPENDENCE ON WEATHER CONDITIONS WITHIN THE PERIOD 1991 - 2010

Věra Kožnarová¹, Soňa Sulovská¹, Dáša Richterová², Lenka Hájková²

¹Czech University of Life Sciences Prague, Dept. of Agroecology and Biometeorology, Kamýcká 129, 165 21 Prague 6 – Suchbát, Czech Republic, ² Czech Hydrometeorological Institute Prague, regional branch Ústí nad Labem, Kočkovská 18, 400 11 Ústí nad Labem, Czech Republic

Abstract. Periodicity in the life of plants and animals is considered to be an indirect indicator for the periodicity in the climate. The Czech Hydrometeorological Institute operates phenological observing network with 45 wild plants. The programme includes *Poaceae* important allergens - the Meadow Foxtail (*Alopecurus pratensis* L.) and the Cocks Foot (*Dactylis glomerata* L.). We have statistically evaluated the phenological stages closely connected with the pollen release into the air (the beginning of flowering - BBCH 61 and the end of flowering - BBCH 69), and determinate by weather conditions within the twenty year period. Number of days from the beginning of flowering till the end of flowering, sum of air temperature and sum of precipitation were chosen as analysed parameters in the same phenological periods during 1991 - 2010. Relations between characteristics were described by deviation of mean. Relations between temperature and precipitation during phenological period represent phenothermopluviograms.

Introduction

In this article we have evaluated the phenological stages closely connected with the pollen release into the air, because many people suffering from allergy are those with allergy to pollen. An important source of airborne pollen is wind pollinated plants. The extension of pollen grain is determinate by onset and duration of flowering influenced by weather conditions. Hájková et al. (2011) studied phenology season onsets in relation to synoptic situations (weather condition) in the Czechia within 1991 to 2010.

Data and methods

The onsets of the selected phenological phases are monitored in the phenological station network according to the methodological regulations for the activity of phenological stations (Methodological regulation no. 10, 2009). The method Clidata–DEM was used for the depiction of maps with a horizontal differentiation of 500 m and of regressive semi-diameter 40 km. The maps are processed from the observed data from the phenological stations; in the territory above the boundaries of the present occurrence, the map expresses expectation values. Technical rows for geographical coordinates of phenological stations were assessed for the calculation of complementing meteorological characteristics; using the software ProClimDB (Stepanek, 2009).

In stripe graph is presented the variability of the onsets and duration of flowering of important allergens *Poaceae* family the Meadow Foxtail and the Cocks Foot. Phenothermopluviograms represent relations between temperature and precipitation within the interval of

flowering on locations Lednice and Pernink. On axis x is the deviation of temperature total, on axis y is deviation of precipitation total. The long-term mean of both characteristics is placed in the centre of this diagram. Scaling of boundaries is based on probability of occurrence for a given phenomenon (Kožnarová et al., 1997).

Results and discussion

The results of the average onset of selected phenological phases the beginning of flowering and the end of flowering are described in the graph (Fig. 1.).

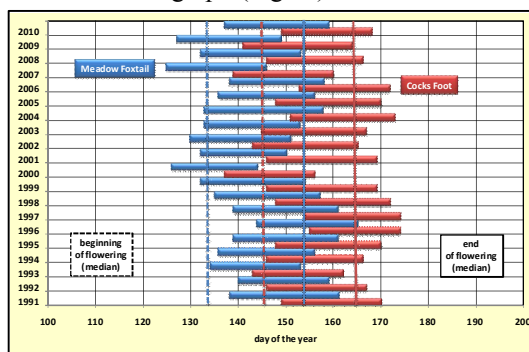


Fig. 1. Temporal variability of flowering. Map of the beginning of flowering of Cocks Foot (Fig. 2.) and end of flowering (Fig. 3.) show nine areas with five-day intervals.

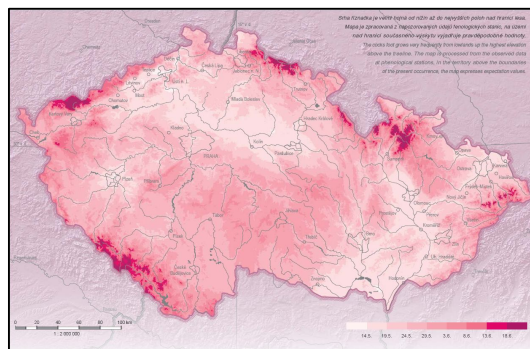


Fig. 2. Average date of beginning of flowering 10%.

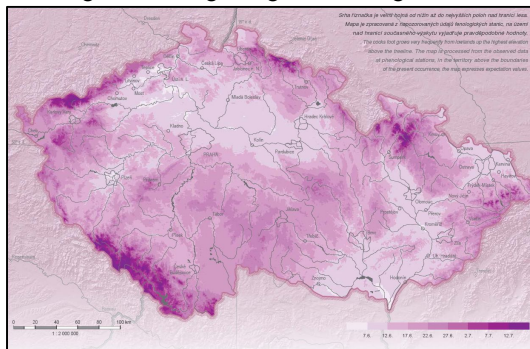


Fig. 3. Average date of end of flowering.

The flowering of the Cocks Foot lasts on average 20 to 22 days in the selected elevation zones, with sum of air temperature between 295 and 348 DD, the duration of sunshine ranges between 149 and 158 hours and number of days with precipitation total ≥ 1 mm is between 7.4 and 7.7 days. Similarly the map of Meadow Foxtail – beginning of flowering (Fig. 4.) shows six areas and the map of the end of flowering (Fig. 5.) has eight areas.

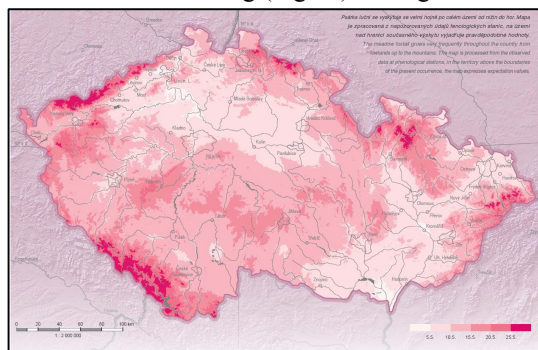


Fig. 4. Average date of beginning of flowering 10 %.

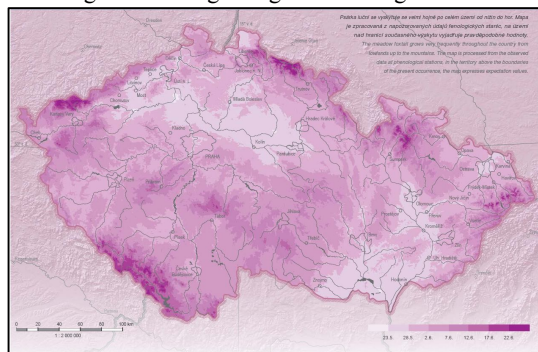


Fig. 5. Average date of end of flowering.

The flowering of the Meadow Foxtail starts between 5th and 23th May in the selected elevation zones, with sum of air temperature between 282 and 338 DD, the duration of sunshine ranges between 130 and 161 hours and number of days with precipitation total ≥ 1 mm is between 6.3 and 7.4 days. The phenothermoplviograms on Fig. 6. and 7. represent relations between air temperature and precipitation total in period of flowering on location Lednice and Pernink.

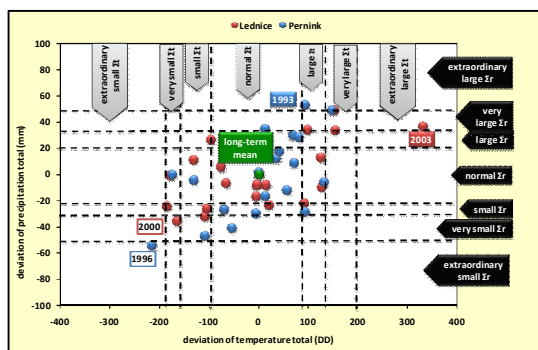


Fig. 6. Phenothermoplviogram of flowering of Cocks Foot. The longest period of Cocks Foot on location Lednice was 36 days (2003), with sum of temperature (Σt) 700.3 DD and precipitation total (Σr) 77.4 mm, on location Pernink 32 days (1993), $\Sigma t = 356.4$ DD and $\Sigma r = 107.3$ mm. The shortest interval of flowering was in location Lednice

11 days (2000); $\Sigma t = 205.3$ DD and $\Sigma r = 5$ mm, and in Pernink 6 days (1996), $\Sigma t = 49$ DD and $\Sigma r = 0$ mm.

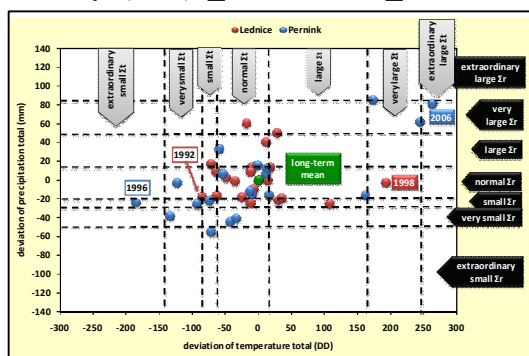


Fig. 7. Phenothermoplviogram of flowering of Meadow Foxtail. Meadow Foxtail has the longest period on location Lednice 33 days (1998), with $\Sigma t = 478.4$ DD, $\Sigma r = 27.9$ mm, on location Pernink 44 days (2006), $\Sigma t = 554.1$ DD and $\Sigma r = 146.3$ mm. The shortest interval of flowering was in location Lednice 14 days (1992); $\Sigma t = 199.2$ DD and $\Sigma r = 12.2$ mm, and in location Pernink 12 days (1996), $\Sigma t = 106$ DD and $\Sigma r = 41.3$ mm.

Conclusions

Generative phenological phases (the beginning of flowering; the end of flowering) of the most allergologically important species of family *Poaceae* were evaluated in this paper. Analyzed data of Meadow Foxtail and Cocks Foot were from the CHMI phenological stations (wild plants) situated at elevations from 155 m to 1,102 m. The flowering of these both species showed a great variability within the twenty year period. The average time of flowering at elevation zones is subsequent: 20 days with standard deviation 1.0–2.7 days (Meadow Foxtail) and 20–22 days with standard deviation 1.3–4.0 days (Cocks Foot). The phenological phases were most accelerated in the years 2000, 2007 and 2009; on the contrary the onsets were most delayed in the years 1991 and 1996.

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References

- Cesky hydrometeorologický ústav, Methodical instructions for phenological stations – forest plants. Metodický předpis. 10, Praha: CHMU, 2009.
- Hájková, L., Kožnarová, V., Sulovská, S., Phenology season onset in relation to synoptic situations in the Czech Republic within 1991–2010. Book of Abstracts, 3rd–6th May, 2011. Topolčianky, Slovakia, p. 129, 2011.
- Kožnarová, V., Klabzuba, J., Bures, R., The use of thermoplviogram to evaluate agrometeorological year, season and month. Pametnik Pulawski 110, Pulawy, ISSN 0552-9778, pp. 71 – 78. 1997.
- Stepanek, P., ProClimDB – software for processing climatological datasets. CHMI, regional office Brno. <http://www.climahom.eu/ProcData.html>, 2009.

