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First Plant Phenological Records in the Carpathians and their Possible Use

M. Tekusova, V. Horecká, and K. Mikulová
SHMI, Climatological Service Department, Bratislava, Slovakia (maria.tekusova@shmu.sk)

Phenological observations have a long history. The long time series come from Korea and some other parts of Asia, while wine harvest dates form the oldest phenological data sets in Europe. One of them started as early as 1457 year in Vienna, i.e. on the border of the Carpathian region. However, the first systematic phenological observations started in the south Carpathians almost four hundred years later following the establishment of the phenological network in Austria and later in the Hungarian Kingdom. A medical doctor P. Wierbitzky did first phenological observations in the Carpathian region in the beginning of thirties of the nineteenth century in Orawicza.
The first systematic observations and records of plant development in this region are connected with the establishment of Austrian Institute for Meteorology and Geomagnetism since 1851. Although the historical significance of these observations is high, the data recorded are of lower quality, frequently interrupted and fragmented. Further development of phenological observations came with the introduction of the methodology of the observations introduced by Karl Fritsch in the beginning of the sixties of the nineteenth century mainly with the establishment of Hungarian Meteorological Service in 1871. These historical data were recorded and published in the yearbooks and, despite of the fragmentary character of the records, they are usable for some evaluations. This article brings the description of the data sets of systematic phenological network in the Carpathian region and considers some possible phenological evaluations.
The phenological observations were done in some cases at the same localities as the climatologic observations but the number of phenological stations was quite lower in several years.
The historical plant phenological records were based in many cases on the observation of four phenological phases: leafing, flowering, ripening and fall of leaves. Both the volume and the quality of the records vary from station to station. In some cases records were given in details including geographical details regarding the position of observed individual plant (orientation of the slopes) and the damages caused by frosts but this was not a general feature. All phenological observations were done on a voluntary basis.
Moreover, even the stations that performed the observations for more than ten years changed the observed species from year to year. This makes the data sets quite fragmented with many gaps and the standard statistical characteristics of any station can be hardly obtained and their statistical significance is very low.
As the standard statistical processing of the data sets was not possible, we tried to elaborate some descriptions that can characterize the distribution of phenological manifestation in space and time. Climatologic records available in the yearbooks were expressed as monthly mean values and totals. There are also gaps and missing data in the climatologic records. Nevertheless, these data sets enable us to get general characteristics of months and seasons.
Next possible evaluation can follow the local phenological calendar. This was done also in 1874. As only three phenological phases were recorded, it was difficult to follow the development and growth of a particular plant. That is why only flowering of the plants characterizing start of early spring /Corylus Avellana/, full spring /Cornus mas, Salix alba and Prunus spinosa/, late spring /Syringa vulgaris, Aesculus Hippocastanum and Crataegus laevigata/ and early summer /Robinia Pseudoacacia and Sambucus nigra/ were considered. The full start of summer is indicated usually by flowering of Tilia platyphyllos. Three stations from the lowlands in northern region with relatively good data sets were selected in order to get this course of flowering. The northern most positioned station showed the delay in the beginning of flowering at the plants which flower in full spring and early summer while the plants flowering in early spring show data comparable with other localities. Selected data were compared with the averages of flowering from 1993 to 2008 at the localities close to the stations. The differences showed flowering of plants 1 - 3 weeks sooner. This corresponds to the higher temperature from February to June by 1.0 -1.5 ?C.

The inventory of phenological records from the period of 1871-1885 from Carpathian region showed pretty fragmented data set that are not suitable for standard statistical evaluation.
Some possibilities of phenological evaluations are in spatial and time analysis of the development of different plants in particular years/seasons that either represent the average climatic conditions or include also some climatic extremes. Deeper analysis of such phenological events will require daily climatologic/temperature data. The advantage of above discussed data sets is the fact that one methodology of observations was applied and that they cover big area of Central Europe and a part of Balkan.
Further development of phenological observations in the region after the break-down of the Austro-Hungarian Empire was based on the conditions in a particular country. It means changes in the methods of observations and the number of stations. The recent cooperation in creating phenological databases brought considerable difficulties as some networks were cancelled and re-established again in the 20th century.