

## NEW PHENOLOGICAL ANOMALIES REGARDING THE FLOWERING OF SPONTANEOUS AND CULTIVATED PLANTS FROM DIFFERENT PARTS OF ROMANIA

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### Abstract

The paper presents new observations about the phenological anomalies regarding the flowering of spontaneous and cultivated plants from different parts of Romania during the period 2010-2019. The consequences of global warming, these anomalies have become more prominent particularly in the last eight years (2013-2019) being observed in 36 species of spontaneous and cultivated plants. Flowering extension were observed, sometimes even supplementary flowerings, fecundation and even fructification, in the cold season (November-December) and are due to the positive temperatures from the cold season and the high temperatures from spring. Most phenological anomalies were observed in the following botanical families: Rosaceae (7 species, 19.44%), Lamiaceae (5 species, 13.88%), Asteraceae (4 species, 11.11%) and the least anomalies were observed in botanical families (Corylaceae, Papaveraceae, Caprifoliaceae, Hippocastanaceae, Aristolochiaceae, Brassicaceae, Geraniaceae, Primulaceae, Caryophyllaceae, Solanaceae, Vitaceae, Cannaceae, Magnoliaceae with 1 species 2.77%).

*Keywords: cultivated plants, flowering, phenological anomalies, Romania, spontaneous.*

### 1. INTRODUCTION

The climatic changes in the structure of seasons were determined by the global warming: premature and short springs, dry and sultry summers, autumns with high temperatures, mild winters, the substitution of the snows with rains.

Prematurely flowering, flowering extension, the existence of some supplementary flowerings, fecundation and fructification, in the cold season (November - December) are only some phenological aspects observed in plants, as a consequence of global warming effects. Generally, worldwide, phenological research on plants has focused on a single species or small group of species usually cultivated or forested. Studies on the phenology of a group or extended groups of plant species, especially at present, in the context of new climate change, are very few (Menzel, 2003; Wang et al., 2015).

This paper is a synthesis of the observations performed by the authors in different parts of Romania regarding the influence of global warming on the flowering of spontaneous and cultivated plants.

Data about the phenological anomalies regarding the flowering of spontaneous plants in different parts of Romania were published by some authors (Ilie et al., 2018).

## 2. MATERIALS AND METHODS

The observations were made during the period 2010-2019, in some counties, with the altitude ranging from 130 to 500 m, as follows: Tinca, Râpa, Oradea, Salonta, Miersig (Bihar county, the north-wester part of Romania), hilly areas; Maieru-Anieș (Bistrița-Năsăud county, the northern part of Romania), hilly area; Lancrăm (Alba county, central part of Romania), Căciulata, Râmnicu-Vâlcea (Vâlcea county, central part of Romania), hilly areas; Belinț (Timiș county, western part of Romania), plain area; Strehaia, Batoți, Drobeta Turnu-Severin (Mehedinți county), Craiova (Dolj county), Piscani, Mărăcineni (Argeș county) hilly areas. Research on phenological abnormalities in plants was performed spontaneously, not having a predetermined purpose in this regard, being carried out on the occasion of different excursions in different locations in Romania.

The identification of plant species was made using different books (Săvulescu, 1952-1976; Todor, 1968; Ciocârlan, 2000; Sârbu et al., 2013).

## 3. RESULTS AND DISCUSSIONS

During analyzed period, 2010–2019, phenological anomalies were observed regarding flowering in the 36 species of spontaneous and cultivated plants (table 1).

*Table 1. Phenological anomalies regarding the flowering of spontaneous and cultivated plants from two parts of Romania*

Name of the species	Data of observations in different areas (see legend)	Temperature (Celsius degrees)	Phenological anomalies of flowering	Period normal flowering, months
<i>Chrysanthemum morifolium</i> Ramat, 1763	1-5 XII 2018 A	6-7 <sup>0</sup> C	E.f.	IX-XI
<i>Nepeta cataria</i> Linnaeus, 1758	15-20 XI 2018 A	8-16 <sup>0</sup> C	S.f.	V – VII
<i>Rosa chinensis</i> Jacquard, 1800	10 XI 2018 A 1 – 29 XI 2018 T	5 – 18 <sup>0</sup> C 7 – 20 <sup>0</sup> C	E.f.	V – X
<i>Melissa officinalis</i> Linnaeus, 1758	25 X – 1 XI 2018 A	18- 23 <sup>0</sup> C	S.f.	VI – VIII
<i>Calendula officinalis</i> Linnaeus, 1758	25 X – 1 XI 2018 A	18- 23 <sup>0</sup> C	E. f.	VI- XI
<i>Taraxacum officinale</i> Weber, 1863	25 X – 3 XI 2018 A	17 – 23 <sup>0</sup> C	S.f.	IV – VI
<i>Salvia officinalis</i> Linnaeus, 1758	26 XI – 2 XII 2018 A	17 – 23 <sup>0</sup> C	S.f.	V – VII
<i>Corylus avellana</i> Linnaeus, 1758	15 X – 10 XII 2018 T 20 XI – 6 XII 2018 A	4 – 25 <sup>0</sup> C 5 – 15 <sup>0</sup> C	S.f.	II – IV
<i>Betula pendula</i> Roth, 1828	22 XI – 15 XII 2018 A 23 X – 19 XII 2018 T	4 – 23 <sup>0</sup> C 3 – 25 <sup>0</sup> C	S.f.	IV- V
<i>Symphitum officinale</i> Linnaeus, 1758	15 XI – 1 XII 2018 A	5 – 17 <sup>0</sup> C	S.f.	V – VIII
<i>Trifolium pratense</i> Linnaeus, 1758	2 XI – 4 XII 2018 A	3 – 20 <sup>0</sup> C	S.f.	V – IX
<i>Melilotus officinalis</i> Lamarck, 1753	5 XI – 27 XI 2018 A	5 – 18 <sup>0</sup> C	S.f.	VI – IX
<i>Alnus incana</i> Moench, 1786	30 X – 29 XI 2018 A	4 – 20 <sup>0</sup> C	S.f.	III – IV
<i>Robinia pseudoacacia</i> Linnaeus, 1753	10 – 15 VIII 2018 T 24 VII – 5 VIII 2018Ca 15 – 18 VIII 2018 La 29VI-25VII 2019 A, Bihar, Mehedinți counties 7-12 VII 2019 Pi 17-23VII 2019 Mă 22-27 IX Mi	26 – 30 <sup>0</sup> C 25 – 33 <sup>0</sup> C 24 – 30 <sup>0</sup> C 25-37 <sup>0</sup> C 25-27 <sup>0</sup> C 24-27 <sup>0</sup> C 22-25 <sup>0</sup> C	S.f.(second flowering) S.f. S.f. S.f. S.f.(third flowering)	V – VI
<i>Papaver rhoeas</i> Linnaeus, 1758	16 – 20 VIII 2018 T	27 – 33 <sup>0</sup> C	S.f.	V – VII
<i>Sambucus nigra</i> Linnaeus, 1758	15 – 20 VIII 2018 La	28 – 30 <sup>0</sup> C	S.f.	V – VII

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<i>Aesculus hippocastanum</i> Linnaeus, 1758	24 VIII – 10 IX 2018 O	23 – 28 <sup>0</sup> C	S.f.	V – VII
<i>Aristolochia clematitis</i> Linnaeus, 1758	27 VIII – 7 IX 2018 O	20 – 27 <sup>0</sup> C	S.f.	V – VI
<i>Brassica rapa</i> Linnaeus, 1758	19 IX 2018 Be	26 <sup>0</sup> C	E.f.	IV – VIII
<i>Prunella vulgaris</i> Linnaeus, 1758	20 X – 17 XI 2018 T	10 – 21 <sup>0</sup> C	S.f.	VI – VIII
<i>Hedera helix</i> Linnaeus, 1758	10 VIII 2018 T	34 <sup>0</sup> C	P.f.	IX - X
<i>Salvia nemorosa</i> Linnaeus, 1758	20 X – 28 XI 2018 T	4 – 25 <sup>0</sup> C	S.f.	VI - VIII
<i>Anagallis arvensis</i> Linnaeus, 1758	20 – 26 XI 2018 T	4 – 10 <sup>0</sup> C	S.f.	VI – IX
<i>Gypsophila muralis</i> Linnaeus, 1758	19 X – 27 XI 2018 T	4 – 23 <sup>0</sup> C	S.f.	VI – IX
<i>Anchusa officinalis</i> Linnaeus, 1758	14 X – 23 XI 2018 T	5 - 21 <sup>0</sup> C	S.f.	V – VII
<i>Nicotiana glauca</i> Link et Otto, 1876	26 X – 21 XI 2018 T	5 – 23 <sup>0</sup> C	E.f.	VII – X
<i>Vitis vinifera</i> Linnaeus, 1753	20 IX – 3 XI 2018 T	23 – 25 <sup>0</sup> C	S.f. Fe Fr	V – VI
<i>Canna indica</i> Linnaeus, 1753	5 VIII – 20 IX 2018 T	21 – 30 <sup>0</sup> C	E.f.	VIII – IX
<i>Rosa canina</i> Linnaeus, 1753	22 IX 2018 Sa 31X 2015 T	23 <sup>0</sup> C 15 <sup>0</sup> C	S.f.	VI – VII
<i>Prunus cerasifera</i> Linnaeus, 1753	19 IX 2018 St 20 IX – 27 X 2018 T 18 – 28 IX 2018 Dolj, Vâlcea counties	27 <sup>0</sup> C 25 – 27 <sup>0</sup> C 25-28 <sup>0</sup> C	S.f.	IV – V
<i>Cerasus avium</i> Moench, 1786	19 IX 2018 St 17 – 30 IX 2018 Ra 18 IX 2018 D 21 IX 2018 Rm V	27 <sup>0</sup> C 25 – 27 <sup>0</sup> C 24 <sup>0</sup> C 26 <sup>0</sup> C	S.f.	IV – V
<i>Prunus domestica</i> Linnaeus, 1753	20 IX - 6 X 2018 T 18 – 28IX 2018 Dolj	24 – 26 <sup>0</sup> C	S.f.	IV - V
<i>Malus pumila</i> Miller, 1768	17-30 IX 2018 Ra 17 – 30 IX 2018 T 18 – 28 IX 2018 Dolj	25 – 27 <sup>0</sup> C 25-27 <sup>0</sup> C 24 – 27 <sup>0</sup> c	S.f.	IV – V
<i>Magnolia denudata</i> Desrousses, 1792	23 VI-12 VII Cv 30 VI-158 VII O	26-34 <sup>0</sup> C	S.f.	III
<i>Crataegus monogyna</i> Linnaeus, 1753	28-31 X 2010 T	14-15 <sup>0</sup> C	S.f.	V-VI

Legend: A – Anieș (BN), T – Tinca (BH), Ca – Căciulata; Rm-Râmnicu -Vâlcea (VL), La – Lancrăm (AB), O – Oradea (BH), Be – Belinț (TM), Ra - Râpa (BH), Sa - Salonta (BH), St – Strehăia (MH), D – Dârmănești (AG), Mi-Miersig (BH), Cv - Craiova (DJ), Pi - Piscani, Mă – Mărăcineni (AG), E.f. – extension flowering, S.f. – supplementary flowering, Fe - fecundation, Fr – fructification, P.f. - prematurely flowering.

I,II,X.....XII-months of the year (January - December)

Temperatures were measured directly in nature, the data did not come from weather stations. The observed species belong to 18 families.

Three families are best represented: Rosaceae (7 species, 19.44%), Lamiaceae (5 species, 13.88%), and Asteraceae (4 species, 11.11%) being followed by Fabaceae (3 species, 8.33%), Betulaceae (2 species, 5.55%), Boraginaceae (2 species, 5.55 %), Corylaceae (1 species, 2.77%), Papaveraceae (1 species, 2.77%), Caprifoliaceae (1 species, 2.77%), Hippocastanaceae (1 species, 2.77%), Aristolochiaceae (1 species, 2.77%), Brassicaceae (1 species, 2.77%), Araliaceae (1 species, 2.77%), Primulaceae (1 species, 2.77%), Caryophyllaceae (1 species, 2.77%), Solanaceae (1 species, 2.77%), Vitaceae (1 species, 2.77%), Cannaceae (1 species, 2.77%), Magnoliaceae (1 species, 2.77%). There were observed prematurely flowering in one species of plant, supplementary

flowering in 25 species of plants, fecundation and even fructification in two species of plants, extension of flowering in seven species of plants (Fig.1-7).



*Figure 1. Crataegus monogyna L. (photo Ilie A.L.)*



*Figure 2. Crataegus monogyna L. (photo Ilie A.L.)*



Figure 3. *Robinia pseudoacacia* L. ( photo Ilie A.L.)



Figure 4. *Cerasus avium* Moench. – fructification (photo Ilie A.L.)



*Figure 5. Cerasus avium Moench. – flowering (photo Ilie A.L.)*



*Figure 6. Anagallis arvensis L. (photo Ilie A.L.)*



Figure 7. *Magnolia denudata* Des. (photo Marinescu M.)

#### 4. CONCLUSIONS

During 2010-2019, phenological anomalies were identified regarding the flowering of spontaneous and cultivated plants in 35 species from different parts of Romania. The positive temperatures from the cold season and the high temperatures from spring have determined both the premature flowering and flowering extension, sometimes even supplementary flowerings in the cold season (November - December).

#### 5. REFERENCES

- Ciocârlan, V. (2000). Flora ilustrată a României [The illustrated flora of Romania], Ed. Ceres, București.
- Ilie, A.L., Năstase, A., Cioboiu O. (2018). Phenological anomalies regarding the flowering of spontaneous and subsponaneous plants from four different parts of Romania, *Muzeul Olteniei, Craiova, Oltenia, Studii și comunicări, Științele Naturii*, 34, 1, 193-199, Craiova.
- Menzel A. (2003). Plant phenological anomalies in Germany and their relation to air temperature and NAO, *Climatic Change*, 57, 243-263.
- Wang H., Dai J., Zheng J., Ge Q. (2015). Temperature sensitivity of plant phenology in temperate and subtropical regions of China from 1850 to 2009, *International Journal of Climatology*, 35, 913-922.
- Sârbu, I., Ștefan, N., Oprea, A. (2013). Plante vasculare din România. Determinator ilustrat de teren [Vascular plants from Romania. Illustrated guide], Ed. Victor B. Victor, București.
- Săvulescu, T. (1952-1976). Flora R.P.R. – Flora R.S.R. [Romanian flora], Ed. Academiei, București.
- Todor, I. (1968). Mic atlas de plante din flora Republicii Socialiste România [Little guide of plants from Romania], Ed. Didactică și Pedagogică, București.