PHENOLOGICAL ANOMALIES REGARDING THE FLOWERING OF SPONTANEOUS, SUB-SPONTANEOUS AND CULTIVATED PLANTS OF ROMANIA DURING 2021 - APRIL 1, 2023

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Abstract. The paper presents observations about the phenological anomalies regarding the flowering of spontaneous, sub-spontaneous and cultivated plants from different parts of Romania during 2021-April 1, 2023. These anomalies have become more prominent particularly in the last years (2010-2022), being observed in species of spontaneous, sub-spontaneous and cultivated plants. Flowering extension was observed, sometimes even supplementary flowerings, in the cold season (November-February) and is due to the positive temperatures in the cold season. Most phenological anomalies were observed in the following botanical families: Asteraceae (30 species), Lamiaceae (11 species), Rosaceae (10 species), Fabaceae (9 species) and the least anomalies were observed in the following botanical families: Brassicaceae (6 species), Polygonaceae (5 species), Solanaceae, Caryophyllaceae, Ranunculaceae (4 species), Scrophulariaceae, Convolvulaceae (3 species), Geraniaceae, Violaceae, Boraginaceae, Plantaginaceae, Chenopodiaceae (2 species) , Papaveraceae, Primulaceae, Malvaceae, Oleaceae, Cornaceae, Sapindaceae, Alismataceae, Onagraceae, Urticaceae, Hypericaceae, Iridaceae, Cannaceae, Amaryllidaceae, Poaceae, Euphorbiaceae (1 species). If these climatic anomalies are maintained and accentuated in the future, then successive flowerings are likely to be observed over the course of a year.

Keywords: phenological anomalies, flowering, Romania.

Rezumat. Anomalii fenologice privind înflorirea speciilor de plante spontane, sub-spontane şi cultivate ale României în perioada 2021 - 1 aprilie 2023. Lucrarea prezintă observaţiile despre anomaliile privind înflorirea speciilor de plante spontane, sub-spontane şi cultivate din diferite părţi ale României în perioada 2021-1 aprilie 2023. Aceste anomalii au devenit mai evidente în special în ultimii ani (2010-2022), fiind observate la plantele spontane, sub-spontane şi cultivate. Au fost observate prelungiri ale înfloritului, uneori chiar înfloriri suplimentare în sezonul rece (noiembrie-februarie), şi sunt datorate temperaturilor pozitive din sezonul rece. Cele mai multe anomalii fenologice au fost observate la următoarele familii botanice: Asteraceae (30 specii), Lamiaceae (11 specii), Rosaceae (10 specii), Fabaceae (9 specii) şi cele mai puţine anomalii au fost observate la familiile botanice: Brasicaceae (6 specii), Polygonaceae (5 specii), Solanaceae, Caryophyllaceae, Ranunculaceae (4 specii), Scrophulariaceae, Convolvulaceae (3 specii), Geraniaceae, Violaceae, Boraginaceae, Plantaginaceae, Chenopodiaceae (2 specii) , Papaveraceae, Primulaceae, Malvaceae, Oleaceae, Cornaceae, Sapindaceae, Alismataceae, Onagraceae, Urticaceae, Hypericaceae, Iridaceae, Cannaceae, Amaryllidaceae, Poaceae, Euphorbiaceae (1 specie). Dacă aceste anomalii climatice se vor menţine şi se vor accentua în viitor atunci probabil se vor observa înfloriri succesive pe durata unui an.

Cuvinte cheie: anomalii fenologice, înflorire, România.

INTRODUCTION

In the last years (2010 – 2022), many climate changes were seen in the structure of seasons: premature and short springs, dry and sultry summers, autumns with high temperatures, mild winters, the predominance of rains at the expense of snows. All these climate changes determined the appearance of phenological anomalies regarding flowering in plants: prematurely flowering, flowering extension, the existence of supplementary flowerings, fecundation and fructification in the cold season (November – December). Studies on the phenology of a group or extended groups of plant species, especially nowadays, in the context of new climate change, are very scarce (MENZEL, 2003; WANG et al., 2015).

Data about the phenological anomalies regarding the flowering of spontaneous, sub-spontaneous and cultivated plants in different areas of Romania were published by some authors (ILIE et al., 2018; 2020). The paper is a synthesis of the observations performed by authors in different areas of Romania regarding the influence of global warming on the flowering of spontaneous, sub-spontaneous and cultivated plants.

MATERIAL AND METHODS

The observations were made during 2021 – April 1, 2023, in five counties, with the altitude ranging from 100 to 538 m, as follows: Tinca, Râpa, Girișu- Negru, Cociuba Mare, Husasău de Tinca, Miersig, Talpoș, Tăut, Măgești, Oradea (Bihor county, the north – western part of Romania), hilly areas; Baia-Mare (Maramureș county, the northern part of Romania), hilly area; Rodna village, Anieș (Bistrița-Năsăud county, the northern part of Romania), hilly area; Craiova (Dolj county, the south-western part of Romania), plain area; Bala (Mehedinți county, the south-western part of Romania), hilly area. Research on phenological anomalies regarding the flowering in plants was performed spontaneously, without a predetermined purpose in this regard, and was carried out on the occasion of different excursions in different areas in Romania.

The identification of plant species was made using different books (SĂVULESCU, 1952 – 1976; TODOR, 1968; CIOCÂRLAN, 2000; SÂRBU et al., 2013).

RESULTS AND DISSCUSIONS

During the analyzed period, phenological anomalies regarding flowering were observed in the 121 species of spontaneous, sub-spontaneous and cultivated plants (Table 1).

Table 1. Phenological anomalies regarding the flowering of spontaneous, sub-spontaneous and cultivated plants from three areas of Romania (original).

Names of the species	Data of observations in different areas	Phenological anomalies of flowering	Period normal of flowering (months)
Medicago sativa Linnaeus, 1753	20 XI 2021, O	E.f.	V – X
Carduus acanthoides Linnaeus, 1753	23 XII 2021, O 12 XII 2021, 5 XII 2022, T	S.f.	VI – IX
Viola tricolor Linnaeus, 1753	4 I 2022, T	P.f.	V – VIII
Centaurea jacea Linnaeus, 1753 *Centaurea jacea ssp. angustifolia* Linnaeus, 1753	3 XI 2021, T 15XI 2022, T 20 XII 2021, 27 XII 2022, O	S.f. S.f.	VI – IX
Berteroa incana Linnaeus, 1753	13 XI 2021, T 31 XII 2022, 1-23 I, 2023, O	S.f. P.f.	V – X
Cirsium vulgare Savi, 1798	4 XII 2021, T 6 XII 2022, O 3 XII 2022, Ba	E.f.	VII – X
Anchusa officinalis Linnaeus, 1753	12 XI 2021, 10 XII 2022, O	S.f.	V – I X
Calendula officinalis Linnaeus, 1753	9 I 2022, 31 XII 2022, 1 I – 20 II 2023, T 30X 14 XI 2022, Cv	P.f. S.f.	VI – IX
Medicago lupulina Linnaeus, 1753	12 XI 2021, 11XII 2022, T	S.f.	VI – I X
Symphitum officinale Linnaeus, 1753	5 XI 2021, 17 XI, 2022, T 20 XI-1 XII 2022, A	S.f. S.f,	V – VII
Tanacetum vulgare Linnaeus, 1753	4 I 2022, 1 XI – 31 XII 2022,T, O	P.f.	VII – IX
Ranunculus auricomus Linnaeus, 1753	20 XII 2021, T	S.f.	V – VI
Achillea millefolium Linnaeus, 1753	3 I 2022, 1 X – 31 XII 2022, T, O 3 XII 2022, B.M. 5X 2022, Ba 1 I – 7 II 2023, T 10 I 2023, Cv	P.f. S.f. P.f.	VI – VIII
Ranunculus arvensis Linnaeus, 1753	10 XII 2021, T	S.f.	V – VII
Polygonum persicaria Linnaeus, 1753	15 XII 2021, T 2 XI 2021 B.M. 13 XII 2022, O	S.f.	VII – IX
Polygonum aviculare Linnaeus, 1753	25 XII 2021, 15 XII 2022,T 9 XII 2022, O	S.f.	VI – X
Forsythia viridissima Lindl, 1840	15 -20 XII 2021, (one flower); 7 I – 1 III 2023, T 6XI – 17 XI 2022, R (many flowers)	S.f. P.f.	IV – V
Melilotus alba Medik, 1787	25 XI 2021, R	S.f.	VI – IX
Capsella bursa – pastoris Linnaeus, 1753	20 XI – 6 XII 2021, G.N. 12 II 2022, 31 XII 2022, T, 1 I – 1 III 2023, T 15 II 2022, 31 XII 2022, O 15XII 2022, Ba 1-16 XII 2022, A 3-8 I 2023, B.M.	E.f. P.f. P.f. S.f. P.f.	IV – VII X – XI
Draba verna Linnaeus, 1753	4 II – 1 III 2023, T	P.f.	III-IV
Potentilla argentea Linnaeus, 1753	7 XII 2021, 4 XI – 31 XII, 2022, T 2 XI 2021 B.M. 31 XII 2022, O	S.f.	VI – X
Potentilla reptans Linnaeus, 1753	26 XI 2021,11 XII 2022, T	S.f.	VI – VIII
Leontodon hispidus Linnaeus, 1753	18 XI 2021, T	E.f.	V – X
Verbascum phlomoides Linnaeus, 1753	25 XI 2021, O 10X – 10 XII 2022, O 27 XI 2022, Tau	S.f.	VI – VIII
Malva silvestris Linnaeus, 1753	25 XI 2021, 31 XII 2022, 3-25 I 2023, O 7 XII 2022, T	E.f. P.f.	V – X
Silene latifolia Poiret, 1789	25 XI 2021, 31 XII 2022,1-23 I 2023, O	S.f. P.f.	VI – IX

Trogopogon pratensis ssp. orientalis Linnaeus, 1753	25 XI 2021, O 20 X 2022, A	S.f.	V – IX
Picris hieracioides Linnaeus, 1753	26 XI 2021, T 12 X – 26 XII 2022, T	S.f.	VII – IX
Veronica persica Poiret, 1789	10 – 14 I 2022, T 12 II – 17 II 2022, T 1 X 2022, 31 XII 2022, 1 I -1 III,2023,T	P.f. S.f.	III – VI
Senecio vulgaris Linnaeus, 1753	15XII 2021, 31 XII 2022, T 8 XII 2021, 3 XII 2022, B.M. 31 XII 2022, O	E.f.	III – XI
Matricaria chamomilla Linnaeus, 1753	1 XII 2021, T	S.f.	V – VI
Stellaria media Vill, 1789	7 XII 2021, 31 XII 2022,3 I – 1 III 2023, T 18 II 2022, T (flower buds) 25 XI 2022, B.M. 10XII 2022, Cv 3 I 2023, B.M.	S.f. P.f. S.f. P.f.	III – X
Bellis perennis Linnaeus, 1753	2 XII 2021, 8 XII 2022,O 20 XI – 15 XII 2021, Rod. 13 XI – 18 XII 2022, Cv 6 XII 2021, B.M. 31 XII 2022, 1 I – 1 III, 2023, T	S.f. P.f.	II – X
Rudbeckia triloba Linnaeus, 1753	23 XII 2021, 22XII 2022, T	S.f.	VII – X
Chelidonum majus Linnaeus, 1753	5 XII 2021, T 6X – 20 XI 2022, T (two succesive flowerings) 23 XI – 5 XII, Rod 2 XI 2021, 9 XI 2022, B.M. 5I 2023, B.M. 31 XII 2022, 1-20 I 2023, O 20-25 XI 2022, A	S.f. P.f. P.f.	V – IX
Trifolium pratense Linnaeus, 1753	4 XII 2021, 11 XII 2022, T 25 XI 2021, Rod 17 XII 2021, B.M.	S.f.	V – IX
Wisteria sinensis (Sims) DC, 1825	12 VII – 22VII 2022, T (the second flowering) 6 VIII – 16 IX (three succesive flowerings)	S.f.	V – VI
Solanum tuberosum Linnaeus, 1753	20 XI – 1 XII 2021 Rod (one single plant)	S.f.	VII – VIII
Lamium album Linnaeus, 1753	20 XI 2021 Rod	S.f.	IV – VI
Lamium purpureum Linnaeus, 1753	20 XI 2021 Rod 6 XII 2022 B.M. 31 XII 2022, T 8 XII 2022, O 1 I- 1 III 2023, T	S.f. P.f.	III – IX
Trifolium repens Linnaeus, 1753	25 XI 2021, Rod 6 XII 2021 B.M.	S.f.	V – IX
Glechoma hederacea Linnaeus, 1753	20 – 25 XI 2021 Rod	S.f.	IV – VI
Fragaria vesca Linnaeus, 1753	20 XI 2021 Rod	S.f.	V – VI
Primula acaulis Linnaeus, 1753	23 XI – 6 XII 2021 B.M. 31 XII 2022, 10 II -1 III 2023,T	S.f. P.f.	III – IV
Erigeron annuus Person, 1807	29 XI 2021, B.M. 10 XII 2022, O 31 XII 2022, 1-23 I 2023, T	S.f. P.f.	VII – VIII
Solanum nigrum Linnaeus, 1753	25 XI 2021 B.M. 13 XII 2022 T	E.f.	VI – X
Galinsoga parviflora Gardens, 1796	25 XI 2021 B.M. 11 XII 2022, T 13 XII 2022, O	S..f.	VI – X
Solidago canadensis Linnaeus, 1753	2 XI 2021 B.M.	E.f.	VII – X
Pilosella officinarum Vaill, 1832	17 XII 2021 B.M.	S.f.	V – VIII
Viola odorata Linnaeus, 1753	26 XI 2021 B.M. 31 XII 2022, 1 I – 1 III 2023, T	S.f. P.f.	III – IV
Cirsium arvense Scopoli, 1753	2 XI 2021, B.M. 8 XII 2022, O	S.f.	VI – VIII
Aesculus hippocastanum Linnaeus, 1753	13 VIII – 9 IX 2022, O; 12 IX – 25 X,O; 25 VIII – 21 IX 2022 and F, T	S.f., F	V – VII

Robinia pseudoacacia Linnaeus, 1753	27 VIII – 12 IX 2022, T 30 VII-20 VIII 2022, A	S.f. S.f.	V – VI
Malus domestica Borkhausen, 1803	25 VIII – 19 IX 2022, C.M.	S.f., F	IV – V
Ononis spinosa Linnaeus, 1753	1-12 IX 2022, T	S.f.	VI-VII
Alisma plantago-aquatica Linnaeus, 1753	2 X – 10XI 2022 , T	S.f.	VI-VIII
Cornus sanguinea Linnaeus, 1753	7 X – 10 XII 2022, T 10X-12XII 2022, O	S.f.	V-VI
Helianthus annuus Linnaeus, 1753	15 X- 17 XI 2022,T 18 X – 27 XI, 2022, Bat 15 XII 2022, Mi	S.f.	VII – IX
Verbascum phoenicerum Linnaeus, 1753	14 X – 3XI 2022, H.T.	S.f.	V-VII
Rumex acetosa Linnaeus, 1753	10 X – 12XI 2022, O	S.f.	VI – VII
Sisymbrium loeselii Linnaeus, 1753	10X- 4XI 2022, O	S.f.	VI-VIII
Scutellaria galericulata Linnaeus, 1753	16 X – 3XI 2022, O	S.f.	VII-VIII
Hypericum perforatum Linnaeus, 1753	5X – 29X 2022, O	S.f.	VI-IX
Calystegia sepium Linnaeus, 1753	17X – 4XI 2022, O	S.f.	VI-IX
Bidens cernuus Linnaeus, 1753	20X – 2XI 2022, O	S.f.	VII-IX
Commelina communis Linnaeus, 1753	12X – 5XI 2022,O	S.f.	VI-IX
Mentha aquatica Linnaeus, 1753	5X – 3XI 2022, O	S.f.	VI -IX
Lycopus europaeus Linnaeus, 1753	13X – 3XI 2022, O	S.f.	VI-VIII
Anagallis arvensis Linnaeus, 1753	23X – 6XI 2022, O	S.f.	VI -IX
Agrimonia eupatoria Linnaeus, 1753	2X – 4XI 2022, T	S.f..	VI-IX
Rubus caesius Linnaeus, 1753	6X – 7Xii 2022, T 7 X – 25 X 2022, O and some fruits	S.f., F	V – IX
Ipomoea purpurea Linnaeus, 1753	10 IX – 12 XI 2022, T	E.f.	V – IX
Clematis viticella Linnaeus, 1753	2X – 15XI 2022, T	S.f.	V – IX
Ambrosia artemisiifolia Linnaeus, 1753	5 XII 2022, O	S.f.	VIII – IX
Urtica dioica Linnaeus, 1753	20 XI 2022, 11 XII 2022, 10 - 15 XII (floral buds),T 5 XII 2022, O 25 XI 2022, B.M.	S.f.	VI – IX
Erodium cicutarium Linnaeus, 1753	5-31 XII 2022, O (floral buds and flowers) 8 I 2023, B.M.	S.f. P.f.	IV – X
Oenothera biennis Linnaeus, 1753	16 XI 2022, T	S.f.	VI – IX
Polygonum mite Schrank, 1839	9XII 2022, O	S.f.	VII-IX
Coronilla varia Linnaeus, 1753	7 XII 2022, O	S.f.	VI – VIII
Sonchus oleraceus Linnaeus, 1753	25 XI 2022 Tal 10 XII 2022, A	S.f. S.f.	VI -VIII
Datura stramonium Linnaeus, 1753	20 XI 2022 Tau (floral buds and flowers)	S,f,	VI -IX
Ballota nigra Linnaeus, 1753	31 XII 2022, T	S.f.	VI – VIII
Aster novi – belgii Linnaeus, 1753	2 XII 2022, T (floral buds)	S.f.	IX -XI
Pilosella caespitosa Sell et West. 1836	8 XII 2022, O (floral buds and flowers)	S.f.	V-VII
Tripleurospermum inodorum Linnaeus, 1753	7 XII 2022, T 12 XII 2022, O	S.f.	VI -IX
Prunella vulgaris Linnaeus, 1753	21 XII 2022, T 20-30 XI 2022, A	S.f. S.f.	VI -VIII
Pelargonium zonale Lher, 1873 *Pelargonium peltatum* Lher, 1873 *Pelargonium grandiflorum* Willd, 1854	2 XI – 15 XII 2022, T	S.f.	IV-X
Nicotiana alata Link et Otto, 1876	20 XII 2022, T	S.f.	VII-X
Lapsana communis Linnaeus, 1753	15 XI 2022, B.M.	S.f.	VI-VIII
Polygonum convolvulus Linnaeus, 1753	25XI 2022, B.M.	S.f.	VI-IX
Veronica hederifolia Linnaeus, 1753	6 XII 2022, B.M.	S.f.	V-VI
Rosa chinensis Jacquard, 1800	31 XII 2022, 1-20 I, 2023, T 15 XI 2022, A	S.f. P.f. S.f.	V-X
Cana indica Linnaeus, 1753	20 XI 2022 Mi 25 XI 2022, T	S.f.	VIII-IX
Iris germanica Linnaeus, 1753	3 – 10 XII 2022, Rod	S.f.	V – VI
Lychnis viscaria Linnaeus, 1753	27 X – 17 XI 2022, Mag	S.f.	V – VIII
Galanthus nivalis Linnaeus, 1753	30 – 31 XII 2022 – 20 I 2023 T (floral buds, flowers) 3 I 2023, B.M.	S.f. P.f. P.f.	II – III
Chrysanthemum morifolium Ramat, 1763	10-15 XII, A	E.f.	IX-XI
Nepeta cataria Linnaeus, 1753	15-20 XI, A	S.f.	V-VII
Crataegus monogyna Linnaeus, 1753	20-25 XI 2022, A	S.f.	V-VI

Antirrhinum majus Linnaeus, 1753	5 – 17 XI 2022, A	E.f.	V-X
Cichorium intybus Linnaeus, 1753	20-30 X 2022, A	S.f.	VI-IX
Pilosella aurantiaca Linnaeus, 1753	5-10 X 2022, A	S.f.	VI-VIII
Atriplex patula Linnaeus, 1753	1-5 XI 2022, A	E.f.	VI-X
Chenopodium album Linnaeus, 1753	1-5 XI 2022, A	E.f.	VI-X
Melissa officinalis Linnaeus, 1753	1-5 XI 2022, A	S.f.	VI-VIII
Taraxacum officinalis Linnaeus, 1753	5-10 XI 2022, A 5 IX-7XII 2022, Ba 31 XII 2022, 1 I – 1 III 2023, T 2I-10 II 2023, Cv	S.f. P.f.	IV-VI
Salvia officinalis Linnaeus, 1753	30 XI-5 XII 2022, A	S.f.	V-VII
Prunus domestica Linnaeus, 1753	10 IX -20IX 2022, A	S.f.	IV-V
Rosa canina Linnaeus, 1753	2 – 10 IX 2022, A	S.f.	VI-VII
Brassica rapa Linnaeus, 1753	10-15 X 2022, A	E.f.	IV-VIII
Cerastium glomeratum Thuill, 1763	8 I 2023, B.M.	P.f.	II-V
Salvia nemorosa Linnaeus, 1753	25 X 2022, A	S.f.	VI-VIII
Bromus sterilis Linnaeus, 1753	3-20 I 2023, O (green immature ear)	S.f.	V-VI
Tussilago farfara Linnaeus, 1753	13-20 I, A	P.f.	II-IV
Ranunculus repens Linnaeus, 1753	16 I – 8 II, T	P.f.	V-VIII
Ranunculus bulbosus Linnaeus, 1753	15 I – 10 II, T	P.f.	V – VII
Euphorbia helioscopia Linnaeus, 1753	17 I – 7 II, T	P.f.	IV -X
Eruca vesicaria Linnaeus, 1753	27 III, T	P.f.	V - VII

Legend: T – Tinca; O – Oradea; B.M. – Baia – Mare; R-Râpa; Rod – Rodna; G.N. – Girişu Negru; C.M. – Cociuba Mare; H.T. – Husasău de Tinca; Mi – Miersig;Tal – Talpoș; Tau – Tăut; Mag – Măgești; A -Anieș; Ba -Bala; Cv – Craiova; S.f. – supplementary flowering; E.f. – extension flowering; P.f. – prematurely flowering; F – fructification; I, II, ...XII – months of the year (January – December).

The observed species belong to 31 families. Most phenological anomalies were observed in the following botanical families: Asteraceae (30 species), Fabaceae (9 species), Lamiaceae (8 species), Rosaceae (6 species), Brasicaceae (6 species), Polygonaceae (5 species) and the least anomalies were observed in botanical families: Solanaceae, Caryophyllaceae, Ranunculaceae (4 species), Violaceae, Polygonaceae, Scrophulariaceae, Convolvulaceae (3 species), Geraniaceae, Violaceae, Boraginaceae (2 species), Papaveraceae, Primulaceae, Malvaceae, Oleaceae, Sapindaceae, Plantaginaceae, Alismataceae, Cornaceae, Onagraceae, Urticaceae, Hypericaceae, Iridaceae, Cannaceae, Plantaginaceae, Amaryllidaceae, Poaceae, Euphorbiaceae (1 species). Premature flowering was seen in 11 species, extension of flowering in 9 species and supplementary flowering in 77 species.

Some species presented two flowering anomalies: *Stellaria media* Vill., *Forsythia viridissima* Ram., *Galanthus nivalis* L.; *Rosa chinensis* Jacq., *Berteroa incana* L., *Calendula officinalis* L.*, Achillea millefolium* L.*, Chelidonium majus* L.*, Viola odorata* L.*, Erigeron annuus* Per.*, Silene latifolium* Poir., *Taraxacum officinalis* L., *Primula acaulis* L.*, Lamium purpureum* L. – supplementary flowering and premature flowering; *Veronica persica* Poir. And *Capsella bursa-pastoris* L., *Malva silvestris* L. – extension of flowering and premature flowering; *Malus domestica* Bork. (Fig. 3) and *Rubus caesius* L. – supplementary flowering and fructification. In *Aesculus hippocastanum* L., the following flowering anomalies were observed: supplementary flowering after all the fruits have fallen from the tree (Oradea, 3 trees; Tinca, 1 tree); supplementary flowering followed by fructification, the new fruit existing concurrently with the old fruit (Tinca, 1 tree).

Three and two successive flowerings were observed in *Wisteria sinensis* Sims. (Fig. 1) and *Chelidonum majus* L. at Tinca, these flowers existing concurrently with the old fruits. Three species showed two successive additional flowerings: *Stellaria media* Vill. and *Lamium purpureum* L. and *Veronica persica* Poir. Consulting the bibliography regarding the flowering anomalies in Romania in recent years (ILIE et al., 2018; 2020), it is found that some plant species show a constancy regarding these anomalies: *Bellis perennis* L., *Erigeron annuus* L., *Galinsoga ciliata* Blake, *Achillea millefolium* L., *Tanacetum vulgare* L., *Carduus acanthoides* L., *Picris hieracioides* L., *Rudbeckia triloba* L., *Tragopogon pratensis* L., *Taraxacum officinale* Web., *Calendula officinalis* L., *Symphytum officinale* L., *Trifolium pratense* L., *Chelidonium majus* L., *Polygonum aviculare* L., *Stellaria media* L., *Fragaria vesca* L., *Potentilla reptans* L., *Medicago lupulina* L., *Trifolium repens* L., *Robinia pseudoacacia* L., *Aesculus hipocastanum* L., *Primula acaulis* L., *Syringa vulgaris* L., *Solanum nigrum* L., *Lamium album* L., *Viola tricolor* L. (Fig. 2), *Sambucus nigra* L., *Nicotiana alata* Link., *Rosa chinensis* Jack., *Cana indica* L, *Galanthus nivalis* L. *Eruca vesicaria* L. (Fig. 4) is a relict species from old cultures in the flora of Romania, sporadic in the plains and the hilly area (SÂRBU et al., 2013).

Since the climatic changes that have determined these anomalies seem to remain constant or to increase, we propose that, in the future botanical guides that will be printed, the months in which these anomalies may appear should be mentioned in parentheses.

CONCLUSIONS

During 2021 – April 1, 2023, phenological anomalies were identified regarding the flowering of spontaneous, sub-spontaneous and cultivated plants in 121 species from different parts of Romania. Premature flowering, supplementary flowering and the extension of flowering due to positive temperatures in the cold season and high temperatures in spring and sometimes extremely high in summer were identified. Three species presented two flowering

anomalies and three species presented one flowering anomaly and fructification. If these climatic anomalies are maintained and accentuated in the future then successive flowerings are likely to be observed over the course of a year. One species is a relic from old cultures in the flora of Romania.

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Phenological anomalies regarding the flowering of the plants of Romania (photos: ILIE A. L.)

Figure 1. *Wisteria sinensis* Sims.

Figure 2. *Viola tricolor* L.

Figure 3 *Malus domestica* Borkh.

Figure 4. *Eruca vesicaria* L.

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