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EVALUATION OF MORPHOLOGICAL PARAMETERS OF FLOWERING BUDS AND FLOWERING ON *ASIMINA TRILOBA* (L.) DUNAL IN THE CONTEXT OF CLIMATE CHANGE IN ROMANIA

Beatrice Agneta Szilagyi [1,] *, Florin Stănică [2], Silvana Mihaela Dănăilă-Guidea [2]

[1] S.C. Garden Design S.R.L., Hortensiei st. no. 7/34, 430294, Baia Mare, Romania,
[2] University of Agronomic Sciences and Veterinary Medicine Bucureşti,
Blvd. Mărăşti. no. 59, 011464, Bucureşti, Romania

Abstract
In the context of climate change in Romania, we proposed to study the improvement of the country's flora by introducing an ornamental and beneficial species of temperate climate. Studies undertaken in spring 2017 indicate that Asimina triloba (L.) Dunal flowers under conditions in Romania similar to those in the area of origin. Thus, we found that the beginning of vegetation in flowering buds took place in the first tenth of April and continued in stages until the start of the third trimester of April, when the flowering bud dimensions were over 15 mm in diameter, while the entire period of flowing took place from 24.04-20.05. One influence on the start of vegetation in flowing buds was the average daytime temperature recorded in the planting zone of Asimina triloba (L.) Dunal studied, which compared with historical averages was twice as high.

Keywords: Asimina, climate change, flowering buds monitoring

1. INTRODUCTION

Climate change is a global challenge that requires a realistic response. At present, this response focuses on actions for protecting plants. At the global level, research indicates that it is the main factor influencing plant growth, abundance and geographic distribution of plants and animals, the chemical composition of the oceans and the polar ice. Thus, climate change remains an important intellectual and academic subject (Răileanu, 2014).

Climate change has become a political priority for the European Council and European Parliament (Miroiu, 2012).

Romania has a high level of biodiversity, in terms of both ecosystems and species. In recent decades, natural conditions in our country were particularly influenced by industrial activity, along with recent economic growth that often led to excess exploitation of natural resources. Hence, many plant species are threatened, while changes in the landscape portend a degradation of the surrounding environment. Thus, the problem of conservation, at the level of ecosystems, species, populations and genera, is becoming ever more acute due to the intensification of man's impact on the biosphere. Flora are a dynamic element that periodically change under environmental influence (Buta et al., 2010).

*Corresponding author, E-mail address: beatrisce16@yahoo.com

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The location of the critical areas characterized by low precipitations and/or high temperature according to the 2100 prediction for Romania suggests that mountain regions will be most affected, with the methodological limitations related to their delineation based only on the altitude and the intrinsic limitations of the clime scenario (Petrişor et al., 2011).
The negative influence of atmospheric pollutants on vegetation has been noted through total or partial defoliation, leaf chloroses or necroses, various teratological causes, particularly noticeable in species located near sources of impurities (Zamfirache et al., 2006).
Marinelli (2004) observes that among the main factors that cause the disappearance of native and imported plants are: climate change, irreversible habitat destruction, commercial exploitation of endangered species, the invasion of new species and environmental pollution.
Certain varieties and hybrids lost some of their resistance to disease and pests and suffered a biological degradation, due to abrupt climate change, which means that the current array of ornamental plants should be improved (Buta et al., 2010).
In Romania, we should improve the current array of ornamental plants. *Asimina triloba* is a species of temperate climate, and research undertaken so far demonstrates its utility in physically cleaning the atmosphere as well as its resistance to diseases and pests (Szilagyi et al, 2015).
The diversity of ornamental plants, a fundamental element of landscape arrangements, is the main component of urban green spaces. Landscaping of urban green spaces in our country requires constant improvements. In this context, we recommend both a renewal of landscaping among extant displays of decorative species, as well as the introduction of new ornamental species. The ornamental value of the *Asimina triloba* plant is creating an ever-increasing interest among scientists as well as landscape architects (Szilagyi, 2015).
In our country, the interest shown in *Asimina triloba* is increasingly apparent, and studies are more and more detailed. *Asimina triloba* is the only decorative tree species of the *Annonaceae* Family in North America. Its area of cultivation is constantly expanding, from temperate-subtropical zones to those with a more severe climate, as well as from North America to Europe, Asia and South America. This plant, exotic in origin, is little known in Europe, particularly so in Romania. Its ornamental value comes from its shape and the decorative nature of its bronze flowers, which appear in early spring (Szilagyi, 2015).

2. MATERIALS AND METHODS

According to data published by *http://www.accuweather.com*, for the values recorded in April 2017 in the Romanian location at the beginning of flowering bud vegetation, the daytime temperature was recorded as having values between 23°-25˚C, while the night temperatures were at 5˚-9˚C. Starting on 10.04 and until 24.04, the daytime temperatures as well as the night-time ones fell, so that values of 8-18˚C were recorded during the day, and 0-6˚C at night (Figure 1).
For determining the phenological aspects of *Asimina triloba* plants grown in Romania, we continued the observations started in 2016 (Szilagyi et al., 2016), with a new series of observations and conclusions. Thus, in spring 2017, we monitored 15 trees aged 6 on a plantation exposed to the urban climate conditions of Transylvania. The plants are in their second year of flowering. In order to determine the moment when the onset of vegetation occurred, we took minute observations of the flowering buds, measuring the diameter of 50 buds/tree at the onset of vegetation as well as at the end of their development. One in every 10 flowers were monitored in order to establish the stages of flowering under the climate conditions of Romania. We took observations and measurements based on trees´ exposure to direct sunlight, diffused sunlight and shade. To estabilish the influence of light on *Asimina triloba* plants, we organized a single-factor experiment involving five plants with one

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variation, namely: V_1- plants exposed to direct suntlight (Mt.); V_2 - plants exposed to shade; V_3 - plants exposed to diffuse sunlight. The results are shown in table form.

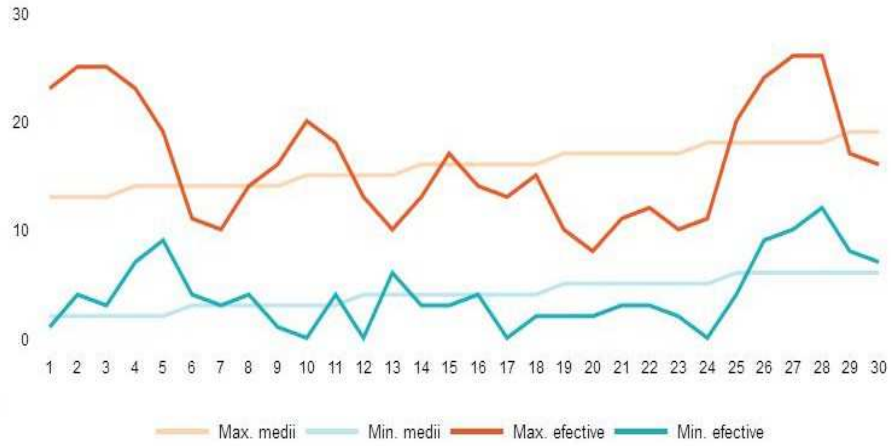

Figure 1. Temperature values recorded in April 2017 (*http://www.accuweather.com*)

3. RESULTS AND DISCUSSIONS

In 2017, vegetation onset in flowering buds of Romania was correlated with the changes in their length. The results recorded in this study, done in spring 2017, show a growth in diameter of buds between 1.04-21.04. We observed that during the vegetation period, not all flowering buds reached the point of ending vegetable evolution; thus, the number of flowering branches, as well as of flowering buds, was in decline. Likewise, we observed large variations between the number of flowering buds formed per tree between varieties, varying between 23 (V_1–Mt.) and 211 (V_3). Thus, climate conditions are a key factor; plants exposed to direct light grow and develop the best as to flowering buds.

Table1. Results regarding flowering buds on *Asimina triloba* in Transylvania (2017)

Variant	Number of branches with flowering buds/tree			Number of flowering buds/tree		
	(1.04)	(21.04)	Difference of extreme value	(1.04)	(21.04)	Difference of extreme value
V_1- plants exposed to direct suntlight (Mt.)	7	19	12	23	44	21
V_2 - plants exposed to shade	19	21	2	110	118	8
V_3 - plants exposed to diffuse sunlight	33	29	-2	211	161	-50
Average	18	23	4	115	108	-7

Regarding the dimensions of flowering buds, we noted that in 2017, under conditions in Romania, we recorded values at the beginning of vegetation encompassed between 3.20 mm (V_1-Mt.) and 8.87 mm (V_2), and at the end of vegetative evolution we recorded values of between 7.02 mm (V_1-Mt.) and 15.31 mm (V_3) (Table 2).

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Table2. Morphological characteristics of flowering bud dimensions on *Asimina triloba* in Transylvania (2017)

Variant	Flowering bud dimensions (mm)						Difference in average growth (mm)	% growth compared to control
	at the onset of vegetation (1.04)			at the conclusion of vegetative evolution (21.04)				
	Min	Max	Med	Min	Max	Med		
V_1- plants exposed to direct suntlight (Mt.)	3.20	7.90	5.73	7.02	13.73	9.50	3.77	-
V_2 - plants exposed to shade	5.83	8.87	7.13	7.46	11.20	9.63	2.50	66.3
V_3 - plants exposed to diffuse sunlight	6.28	8.43	7.61	8.98	15.31	12.87	5.26	139.5
Average	5.10	8.4	6.82	7.82	13.41	10.66	3.84	101.8

In its area of origin (North America), the flowering process of *Asimina triloba* begins with budding. This continues with flowering and ends with the formation of the stigma. This interval takes place in spring and lasts 5-19 days, while mass flowering takes place 15-16 days from the appearance of flowers (Peterson, 1991).

Analyzing the data recorded in Table 3, we can observe that in Romania in 2017, floral decor lasts 1-15 days, while the total period of flowering takes place in the period 24.04-20.05.

Table3. Flowering of *Asimina triloba* in Transylvania (2017)

Phenological observations of flowering stages	Period
Beginning of flowering	24.04
Petal formation	26.04-1.05
Petal coloring	28.04-3.05
Floral decor	1.05-15.05
End of flowering	20.05
Total dudation of flowering	24.04-20.05

After monitoring, (http://www.tutiempo.net/en/Climate/Baia_Mare/04-2009/150140.htm) environmental factors (temperature, atmospheric humidity, atmospheric precipitation and wind speed) we determined the climate conditions under which the flowering buds developed (Table 4).

Table 4. Climate conditions recorded during the period of *Asimina triloba* flowering bud development

Period (days)	Average temperature (^{0}C)	Atmospheric humidity (%)	Atmospheric precipitation (mm)	Wind speed (km/h)
1.04	13.3	48	0	8.1
2.04	15.6	41	0	7.0
3.04	15.5	46	0	7.4
4.04	15.2	49	0	9.1
5.04	13.3	61	0	7.2
6.04	7.9	91	0.51	9.8
7.04	5.7	80	8.13	14.8
8.04	8.4	73	0.76	11.9
9.04	8.3	61	0.25	9.6

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10.04	11.5	54	0	7.6
11.04	10.6	76	0	10.2
12.04	8.1	60	1.02	10.0
13.04	8.1	87	1.27	8.7
14.04	8.6	81	8.13	7.4
15.04	10.3	66	0	6.9
16.04	10.2	72	2.03	10.2
17.04	6.4	64	3.3	9.1
18.04	8.6	61	0	10.2
19.04	6.8	66	0	14.6
20.04	5.1	69	12.19	10.0
21.04	6.3	52	0.25	14.1
Average	9,7	65	3.44	8.8

Figure 2. Flowering of *Asimina triloba* in different stages (Transilvania, 2017)

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4. CONCLUSIONS

After analyzing the results obtained during the study, which aimed the evaluate the morphological parameters for flowering buds and flowering of *Asimina triloba* in the context of climate change in Romania, we can state the influence of local climate in spring 2017 upon the development of flowering buds. Thus, in Romania, *Asimina triloba* trees exposed to diffuse light (V_3-plants exposed to diffuse light) form more and more of the flowering buds (161 buds), with the largest dimensions 15.31 mm (21.04), while the total duration of flowering takes place in spring before leaves emerge (24.04-20.05).

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*Corresponding author, E-mail address: beatrisce16@yahoo.com