EFFECT OF BIOREGULATORS TREATMENTS ON *ALLIUM SAXATILE* M. Bieb.

EFECTUL BIOREGULATORILOR LA *ALLIUM SAXATILE* M. Bieb.

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Abstract. *This research was conducted to investigate the influence of the bioregulators on the Allium saxatile M.Bieb. vegetative growth and flowering period. There were used two bioregulators, represented by a growth retardant, Cycocel (CCC) and a growth stimulant, Gibberellic Acid (GA_3), applied by foliar sprayng, in three concentrations (250, 500 and 1000 ppm). The plants were evaluated with reference to the vegetative growth, like leaves length, leaves number, flowering stem height, inflorescence diameter and with reference to the flowering period. The analysed results, highlighted that aplication of GA_3 promote the vegetatives growth. The treatments with CCC had a noticeable influence in the flowering period delay. Therefore, treated with CCC, the plants bloomed ealier with about 10-20 days than the other variants.*
Key words: *Allium saxatile* M. Bieb., plant bioregulators, vegetative growth

Rezumat. *Acest studiu a fost realizat în scopul investigării influenței substanțelor bioregulatoare asupra creşterii vegetative şi perioadei de înflorire la Allium saxatile M.Bieb. Au fost utilizate două sunstanțe regulatoare de creştere, un retardant de creştere (CCC) şi un stimulator de creştere (GA_3), aplicate prin pulverizare foliară, în trei concentrații (250, 500 şi 1000 ppm). Plantele au fost evaluate din punct de vedere al creşterilor vegetative,la nivelul lungimii frunzelor, numărului de frunze, lungimea tijei florifere, diametrul inflorescenței şi din punct de vedere al perioadei de înflorire. Rezultatele analizate, au evidențiat faptul că administrarea de GA_3 îmbunătățește creşterile vegetative. Tratamentele cu CCC au avut o influență notabilă asupra extinderii perioadei de înflorire. Prin urmare, tratate cu CCC, plantele au înflorit mai devreme cu aproximativ 10-20 de zile decât celelalte variante.*
Cuvinte cheie: *Allium saxatile* M. Bieb., substanțe bioregulatoare, creştere vegetativă

INTRODUCTION

Allium saxatile M. Bieb. (syn. *Allium globosum* M. Bieb.) is one of the plentiful number of the *Allium* genus species (about 750-860 species of perennial, monocots plants), wildly growing in Europe, from Italy to NW China. In the spontaneous flora of Romania it has the position of a rare species, found on

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craggy highlands, calcareous alpine areas (Oprea, 2005; Zahariadi, 1966; cited by Draghia *et al.*, 2013; Harding, 2004).

In the last years, the ornamental plants of the genus *Allium* became more and more popular, getting in the same time an important economical place like ornamental crop. These species can be used worldwide like garden plant, due to their disease and climate resistance and to the great variety of species and cultivars. They also entered to the cut flowers market because of their resistance as cut flowers, the hardness of flower stems and the wide range of colours and shapes (Harding, 2004; Szot et al., 2009).

The bioregulators substances are widely used in floriculture area. The gibberellic acid (GA_3) and cycocel (CCC) were extensively studied in the last years, due to their effects over the vegetative growing and generative processes (Zheng *et al.*, 2012).

Nidhish *et al.* (2014) discovered that the CCC treatment in 1000 ppm concentration, can increase the leaves number of plants.

The exogenic gibberellins can promote flowering for a very wide range of long day flowering plants. In case of *Allium karataviense* 'Ivory Queen' it was observed the inflorescence shoot elongation and the increased number of flowers in inflorescence (Pogroszewska, 2007).

MATERIAL AND METHOD

The research was carried out in the period 2014–2016, during two experimental years, in the field of Floriculture discipline, from the University of Agricultural Sciences and Veterinary Medicine of Iaș i, Romania.

The biological material was represented by the *Allium saxatile* M. Bieb. species. This *Allium* species has a great ornamental potential. The flowers are grouped in spherical umbels, light purplish-pink, the leaves are simple, thin, light green. It grows in the areas with plenty of sun, in well drained, sandy or craggy soils. It blooms in the summer months, from June to August. The plants persist at the crop place all over the year, in the winter they stay in a latent vegetation rest.

The experiment was organized in randomized blocs design, with three replications. A plot has a surface of 3.00 m^2 and it was planted with 45 plants. Before planting, the bulbs were disinfected with Kaptan (1%) and Topsin (0.7%) solutions and during the frosty season the plots were mulched with dried vegetal material (straw). The experimental factors were represented by two growth regulators, a growth stimulant (gibberellic acid - GA_3) and a growth retardant (cycocel CCC) in 250, 500 and 1000 ppm concentrations (table 1).

The treatments were made by foliar application, in the vegetative growth period, twice per season, repeated at two weeks. Thus, in 2014-2015, the first treatment was made on 6th May and the second on 20th May and in the year 2015-2016, the first treatment was made on 4th May and the second on 18th May.

The plants were investigated thru the biometric measurements and determinations, for the vegetative growth, like leaves length, leaves number, flower stem height, umbel diameter and regarding the flowering period. The experimental data was processed using analysis of variance, which established limits of probability for each planting times, compared with the control (untreated variant). The

significance of the differences was assessed by taking into account the LSD test (Săulescu and Săulescu, 1967).

Table 1

Experimental variants

Experimental factors	Specification	Variant/Graduations
Control	Untreated	V_1
Growth Stimulant	Gibberellic Acid - GA_3	V_2 - 250 ppm
		V_3 - 500 ppm
		V_4 - 1000 ppm
Growth Retardant	Cycocel - CCC	V_5 - 250 ppm
		V_6 - 500 ppm
		V_7 - 1000 ppm

RESULTS AND DISCUSSIONS

For many species of the genus *Allium*, the foliage is very perishable, getting dry before the plant are getting flowers. This character has a bad influence over the aesthetic aspect of the *Alliums*, for many species and cultivars, being necessarily a combination with a leaves resistant plant. So, the studies shown that the bioregulators can have good influence over the *Alliums* foliage, regarding the vegetative growing (leaves number, leaves length, plant height) (Maji et al., 2015).

The analysis of the *Allium saxatile* foliage shows that the plants answered most for the leaves length and less for the leaves number, under the bioregulators influence. The leaves length varied between 18.3 and 26.5 cm, the untreated variant registering around 18.6 cm (tab. 2).

Table 2

The bioregulators influence of over the *Allium saxatile* foliage characters

Variant	Leaves length (cm)	±d (cm)	Leaves number/ plant	±d (no.)
V_1 –control	18,60	-	5.77	-
V_2 – GA_3 250 ppm	26,30***	-	5.77 ^{ns}	0,0
V_3 – GA_3 500 ppm	26,50***	7,70	5.83 ^{ns}	0,07
V_4 –GA_3 1000 ppm	21,50*	7,90	5.80 ^{ns}	0,03
V_5 –CCC 250 ppm	19,50 ^{ns}	2,90	5.50 ^{ns}	-0,27
V_6 –CCC 500 ppm	18,87 ^{ns}	0,90	5.83 ^{ns}	0,07
V_7–CCC 1000 ppm	18,33 ^{ns}	0,27	5.50 ^{ns}	-0,27
	LSD 5%	2.33		0.55
	LSD 1%	3.27		0.77
	LSD 0.1%	4.61		1.09

The GA_3 treatment have led to increase the leaves length, in the higher proportion for the 250 and 500 ppm doses, with around 41-42% toward the control and very significant positive differences. The influence was less for the 1000 ppm, with 15% toward the control. The CCC treatment determined the inhibition of the leaves growing for *Allium saxatile* (tab. 2).

The number of leaves/plant was relatively closed between the variants and had not been influenced by any of the two products used into the experiment. This is indicated by the insignificant differences between the treated variants and control (tab. 2).

For *Allium saxatile*, it has been demonstrated that the bioregulators may have a much higher influence over the flower stem height. From the presented data, in the table 3, it should be noted that the flower stem vary between 18.5 and 43.3 cm.

Table 3

The bioregulators influence over the *Allium saxatile* flower stem and inflorescence

Variant	Flower stem length (cm)	±d (cm)	Inflorescence diameter (cm)	±d (cm)
V_1 –control	23.00***	-	2.77	-
V_2 – GA_3 250 ppm	36.07***	13,7	2.80 ^{ns}	0,03
V_3 – GA_3 500 ppm	40.10***	17,10	3.00 ^{ns}	0,23
V_4 –GA_3 1000 ppm	43.33***	20,33	3.00 ^{ns}	0,23
V_5 –CCC 250 ppm	22.80 ^{ns}	-0,20	2.57 ^{ns}	-0,20
V_6 –CCC 500 ppm	20.40 ^{ns}	-2,60	3.10 ^{ns}	0,33
V_7–CCC 1000 ppm	18.50 ^{o}	-4,50	3.27 ^{ns}	0,50
	LSD 5%	4.37		0.69
	LSD 1%	6.13		0.97
	L SD 0.1%	8.66		1.37

The gibberellic acid has the most powerful action at 1000 ppm doses, causing the stem increase with about 88% towards the control (untreated plants). For all the three GA_3 doses, the differences 13.7 and 20.3 cm were very significant.

Under the cycocel influence the flower stem length has been reduced from 22.8 cm at the 250 ppm to 18.5 cm at the 1000 ppm doses.

As regards the diameter of the inflorescences, the bioregulators treatments did not indicated notable differences. The very small differences are insignificant as compared with the control, but it can be noticed a positive effect under the GA_3 treatments and also under CCC, on the inflorescences sizes compared to control, excepting the 250 ppm dose of CCC (tab. 3).

From the phenological diagram (fig.1) regarding on the treatment influence over the *Allium saxatile* are represented the monthly period of the phenophases.

As it can be seen, for the CCC treated plants, the full flowering got earlier with around 20 days than the control and with around 10 days earlier than the GA_2 treated plants (GA_3 also extended the flowering period, but less than CCC).

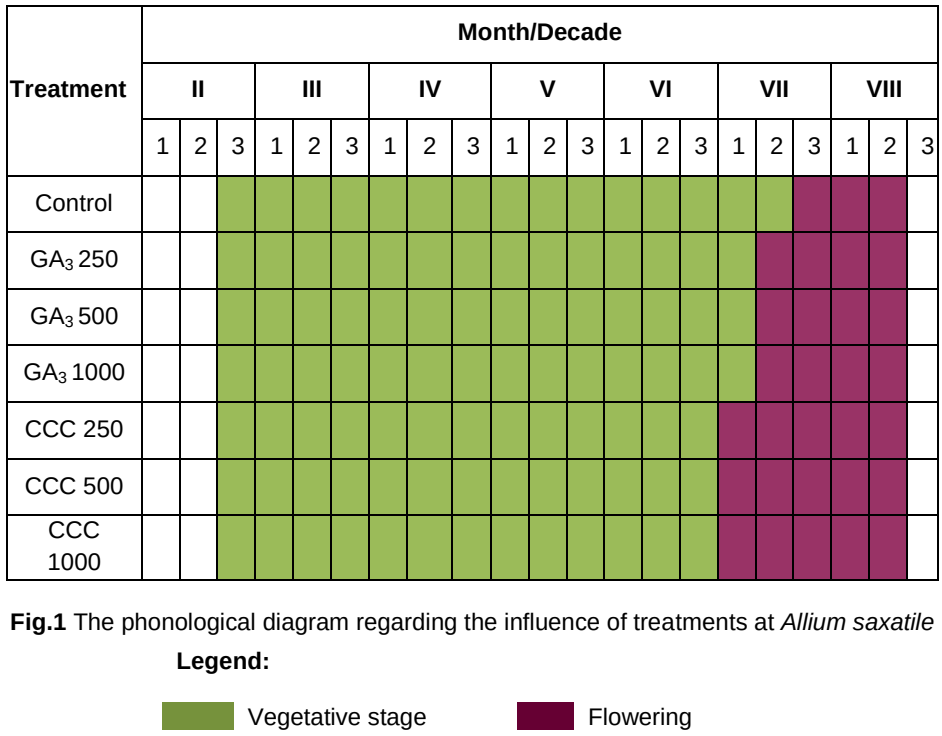

Fig.1 The phonological diagram regarding the influence of treatments at *Allium saxatile*

The flowering period ended, for all the variant in the same time, around the middle of the august month (fig. 1).

CONCLUSIONS

1. The bioregulators can improve the quality of *Allium saxatile* specie, having different influence. The gibberellic acid stimulates the vegetative growing and CCC over delay flowering period.

2. By applying GA_3 in 250 and 500 ppm doses, the *Allium saxatile* foliage can be improved, regarding the leaves length. For the flower stem and inflorescence diameter increasing, there were necessary higher doses (500 and 1000 ppm).

3. The CCC treatment have influence more over the flowering period, by extended it, than over the morphologic characters. Thus, the plants which were treated with CCC, flourished earlier with around 20 days than the control and 10 days than the GA_3 treated plants.

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