RESEARCH ON *CANNA INDICA* L. SEED GERMINATION

CERCETĂRI PRIVIND GERMINAREA SEMINȚELOR DE *CANNA INDICA* L.

POPESCU Liana[1]
e-mail: popescu.liana@primariabistrita.ro

Abstract. *This study aims to test the influence of constant temperature and gibberellic acid GA_3, on seed germination of five Canna indica L. cultivars. The seeds were exposed to constant temperature (30°C) for 24h and 72h. Both, variable (15-22°C) and constant temperature (30°C) provided the necessary heat to activate the embryo. In order to study the effect of gibberellic acid GA_3, the seeds were treated with GA3 solution in three levels: 150 ppm, 300 ppm, 450 ppm. The highest percentage of germination was obtained at 450 ppm concentration, on 'Tropical Bronze Scarlet' cultivar.*
Key words: *Canna indica* L., seeds, temperature, gibberellic acid

Rezumat. *Lucrarea urmăreşte influența temperaturii constante şi a acidului giberelic GA_3, asupra germinării semințelor a cinci cultivare de Canna indica L. Semințele au fost expuse la temperatură constantă (30°C) timp de 24h, respectiv 72h. Atât temperatura variabilă (15-22ºC), cât şi temperatura constantă (30ºC), au asigurat necesarul de căldură pentru activarea embrionului. Pentru studierea efectului acidului giberelic asupra germinației semințelor, acestea au fost tratate cu soluție de GA_3, în trei concentrații: 150 ppm, 300 ppm, 450 ppm. Cel mai mare procent de germinare s-a obținut la concentrația de 450ppm, pentru cultivarul 'Tropical Bronze Scarlet'.*
Cuvinte cheie: *Canna indica* L., semințe, temperatură, acid giberelic

INTRODUCTION

Herbaceous plant, decorative by leaves and flowers both and through its size, *Canna indica* L. plays an important part in public and private landscape design. It is among the few flower plants that offer color to a space for such a long period (May - October), with relatively low maintenance requirements (Șelaru, 2007).

Generative propagation of *C. indica* L. plants is a relatively simple method, but it's not widely used yet, because many cultivars don't produce seeds or they have sterile seeds. *Canna* seeds are part of large seeds category (3-10 mm), spherical, ellipsoidal or intermediate shape, brownish black color, slightly glossy, smooth and very hard coat. With no special facilities for storage, they preserve their germination for 15-20 years, requiring minimal care during storage (Cantor, 2009). Facilitating the exit from dormancy of *Canna indica* L. seeds requires mechanical or chemical degradation of the coat. The result is ease of water and oxygen ingress, leading to enzymatic germination processes initiation (Geneve,

[1] Bistrița City Hall – Public Services Department, Romania

2011). The purpose of this paper aims to establish the influence of heat and gibberellic acid treatments on *Canna indica* L. seed germination.

MATERIAL AND METHODS

Experiments were conducted in the Public Services Department's greenhouses of the Bistrița City Hall, in 2011. The biological material used in experiments, was represented by the seeds belonging to five cultivars of *Canna indica* L. (fig.1).

The seeds of 'Sémaphore' and 'Firebird' cultivars were harvested in autumn 2010, from plants used in public green spaces of Bistrița city and they were manually scarified, by rubbing on sandpaper. The seeds of 'Tropical Rose', 'Tropical Bronze Scarlet' (introduced in 2010) and 'Tropical Yellow' cultivars, were bought from TakiiSeed Company and they were scarified by the producer, with the laser (1-3 holes of 0,8mm diameter), so that they didn't require other interventions for seed coat degradation.

Experiments with seeds placed to germinate under the influence of heat treatment were conducted by exposing the batches of seeds at a constant temperature of 30ºC, the first 24 and 72 hours in a BINDER oven ED53 type, electric powered, with the temperature domain "ambient → 300ºC", temperature fluctuation of ±0,3ºC and heating time of 15 min. The material was placed on cardboard casing, on filter paper, for radicle appearance observation.

In order to study the effect of gibberellic acid on seed germination, they were treated for 24 hours with GA_3 solution, in three concentrations: 150 ppm, 300 ppm and 450 ppm. To complete the germination, the seeds were transferred to a peat substrate with pH 6-6,5 and fertilizers content (N-P_2O_5-K_2O) of 1,5 kg/mc. They were placed in plastic trays, dimpled (4x4x3 cm), and the subsequent observations on the emergence dynamics were daily made.

Statistical analysis of data was based on the variance calculation on a bifactorial experiment that allowed the significance of differences interpretation between experimental variants (Ardeleanu, 2008). Each variant was found in the experiments in three repetitions.

RESULTS AND DISCUSSIONS

Framing the experiments with heat – treated seeds, were used 54 seeds of each cultivar, meaning 18 seeds on each of the three repetitions.

From table 1 data, is shown that the differences statistically provided as very significant negative from control were recorded at V2, V7 and V12 while the very significant positive difference from control, has appeared at V4. Table 2 data shows that, between the limits of used temperatures, seed germination was not significantly influenced. Both, the ambient temperature that ranged between 15 and 22ºC, and constant 30ºC temperature provided the necessary heat for leaving the state of dormancy and activate the embryo. The results vary depending on cultivar (table 3), the differences from control being provided as very significant negative at 'Firebird' cultivar and very significant positive at 'Tropical Bronze Scarlet' cultivar.

Table 1

***Canna indica* L. seed germination, under the influence of temperature and cultivar**

Variant		Number of fully germinated seeds		± d	Significance of difference
No.	Factor combination	Absolute (no.)	Relative (%)		
V1	15-22ºC x Sémaphore	3,7	38,5	-5,9	00
V2	15-22ºC x Firebird	1,0	10,4	-8,6	000
V3	15-22ºC x Tropical Rose	14,3	149,0	4,7	**
V4	15-22ºC x Tropical Br. Scarlet	16,3	169,8	6,7	***
V5	15-22ºC x Tropical Yellow	12,7	132,3	3,1	*
V6	24h/30ºC x Sémaphore	8,0	83,3	-1,6	–
V7	24h/30ºC x Firebird	1,3	13,5	-8,3	000
V8	24h/30ºC x Tropical Rose	9,7	101,0	0,1	–
V9	24h/30ºC x Tropical Br. Scarlet	12,7	132,3	3,1	*
V10	24h/30ºC x Tropical Yellow	12,7	132,3	3,1	*
V11	72h/30ºC x Sémaphore	9,0	93,8	-0,6	–
V12	72h/30ºC x Firebird	2,7	28,1	-6,9	000
V13	72h/30ºC x Tropical Rose	13,0	135,4	3,4	*
V14	72h/30ºC x Tropical Br. Scarlet	11,7	121,9	2,1	–
V15	72h/30ºC x Tropical Yellow	14,3	149,0	4,7	**
	Average V1-V5, Control	9,6	100,0	-	-

DL 5% = 2,92 pieces DL 1% = 4,35 pieces DL 0,1% = 6,12 pieces

Table 2

***Canna indica* L. seed germination, under the influence of temperature**

Factor A graduations (temperature)	No. of fully germinated seeds		± d	Significance of difference
	Absolute (no.)	Relative (%)		
24h/30ºC	8,9	121,2	-0,7	–
72h/30ºC	10,1	117,2	0,5	–
Average V1-V5, Control	9,6	100,0	-	-

DL 5% = 1,97 pieces DL 1% = 2,69 pieces DL 0,1% = 3,60 pieces

Table 3

***Canna indica* L. seed germination, under the influence of cultivar**

Factor B graduations (cultivar)	No. of fully germinated seeds		± d	Significance of difference
	Absolute (no.)	Relative (%)		
Sémaphore	6,9	71,9	-2,7	00
Firebird	1,7	17,7	-7,9	000
Tropical Rose	12,3	128,1	2,7	**
Tropical Bronze Scarlet	13,6	141,7	4,0	***
Tropical Yellow	13,2	137,5	3,6	**(*)
Average V1-V5, Control	9,6	100,0	-	-

DL 5% = 1,92 pieces DL 1% = 2,63 pieces DL 0,1% = 3,84 pieces

Organizing the experiments with GA_3 – treated seeds, were used 36 seeds of each cultivar, meaning 12 seeds on each of the three repetitions. From table 4 data, results that the differences statistically provided as very significant negative from control were recorded at V1, V2, V7, V12 and V17, while the very significant positive differences from control, have appeared at V3, V4, V8, V9, V14, V18 and V19.

Table 4

***Canna indica* L. seed germination, under the influence of gibberellic acid GA_3 and cultivar**

Variant		No. of fully germinated seeds		± d	Significance of difference
No.	Factor combination	Absolute (no.)	Relative (%)		
V1	Untreated x Sémaphore	2,5	42,2	-3,9	000
V2	Untreated x Firebird	0,7	10,9	-5,7	000
V3	Untreated x Tropical Rose	9,5	151,6	3,1	***
V4	Untreated x Tropical Br. Scarlet	10,9	167,2	4,5	***
V5	Untreated x Tropical Yellow	8,5	129,7	2,1	**
V6	150ppmGA_3 x Sémaphore	5,3	82,8	-1,1	0
V7	150ppmGA_3 x Firebird	1,7	26,6	-4,7	000
V8	150ppmGA_3 x Tropical Rose	10,0	156,3	3,6	***
V9	150ppmGA_3 x Tropical Br. Scarlet	10,3	160,9	3,9	***
V10	150ppmGA_3 x Tropical Yellow	7,7	120,3	1,3	*
V11	300ppmGA_3 x Sémaphore	7,0	109,4	0,6	–
V12	300ppmGA_3 x Firebird	0,7	10,9	-5,7	000
V13	300ppmGA_3 x Tropical Rose	8,7	135,9	2,3	**
V14	300ppmGA_3 x Tropical Br. Scarlet	10,0	156,3	3,6	***
V15	300ppmGA_3 x Tropical Yellow	7,3	114,1	0,9	–
V16	450ppmGA_3 x Sémaphore	5,7	89,1	-0,7	–
V17	450ppmGA_3 x Firebird	0,7	10,9	-5,7	000
V18	450ppmGA_3 x Tropical Rose	9,7	151,6	3,3	***
V19	450ppmGA_3 x Tropical Br. Scarlet	11,3	176,6	4,9	***
V20	450ppmGA_3 x Tropical Yellow	7,7	120,3	1,3	*
	Average V1-V5, Control	6,4	100,0	-	-

DL 5% = 1,02 pieces DL 1% = 1,94 pieces DL 0,1% = 2,53 pieces

Analyzing the table 5 data is observed that the three GA_3 solution used concentrations, did not significantly influenced the seeds germination. The results vary depending on cultivar (table 6), the differences from control being provided as very significant negative at 'Firebird' cultivar and very significant positive at 'Tropical Bronze Scarlet' cultivar.

Table 5

***Canna indica* L. seed germination, under the influence of GA_3 treatment**

Factor A graduations (GA_3)	No. of fully germinated seeds		± d	Significance of difference
	Absolute (no.)	Relative (%)		
150ppmGA_3	7,0	109,4	0,6	–
300ppmGA_3	6,7	104,7	0,3	–
450ppmGA_3	7,0	109,4	0,6	–
Average V1-V5, Control	6,4	100,0	-	-

DL 5% = 0,98 pieces DL 1% = 1,56 pieces DL 0,1% = 2,93 pieces

Table 6

***Canna indica* L. seed germination, under the influence of cultivar**

Factor B graduations (cultivar)	No. of fully germinated seeds		± d	Significance of difference
	Absolute (no.)	Relative (%)		
Sémaphore	5,2	81,3	-1,2	–
Firebird	1,0	15,6	-5,4	000
Tropical Rose	9,5	148,4	3,1	**
Tropical Bronze Scarlet	10,6	165,6	4,2	***
Tropical Yellow	7,8	121,9	1,4	*
Average V1-V5, Control	6,4	100,0	-	-

DL 5% = 1,36 pieces DL 1% = 2,15 pieces DL 0,1% = 3,67 pieces

After analyzing the results, a comparison was made between the two types of treatment with their graduation for each cultivar. The percentage values regarding complete seed germination of the five cultivars used in the experiment are presented in table 7 and table 8 presents data regarding complete germination duration.

Table 7

Comparative germination capacity of *Canna indica* L. seeds, under the influence of seed treatments

Cultivar	Fully germinated seeds (%)					
	Untreated	24h 30°C	72h 30°C	150 ppm GA_3	300 ppm GA_3	450 ppm GA_3
Sémaphore	20,6	44,4	50,0	44,2	58,3	47,5
Firebird	5,6	7,2	15,0	14,2	5,8	5,8
Tropical Rose	79,4	53,9	72,2	83,3	72,5	80,6
Tropical Br. Scarlet	90,6	70,6	65,0	85,8	83,3	94,2
Tropical Yellow	70,6	70,6	79,4	64,2	60,8	64,2

Maximum germination values for each cultivar are presented as follows: 'Sémaphore' – 58,3% (300 ppmGA_3), 'Firebird' – 15% (72 h/30°C), 'Tropical Rose' – 83,3% (150 ppmGA_3) , 'Tropical Bronze Scarlet' – 94,2% (450 ppmGA_3), 'Tropical Yellow' – 79,4% (72 h/30°C).

Table 8

Comparative complete germination duration of *Canna indica* L. seeds, under the influence of seed treatments

Cultivarul	Complete germination time (no. of days)					
	Untreated	24h 30°C	72h 30°C	150 ppm GA_3	300 ppm GA_3	450 ppm GA_3
Sémaphore	15	28	17	22	18	19
Firebird	18	33	29	19	29	17
Tropical Rose	26	28	16	24	20	22
Tropical Br. Scarlet	20	20	25	28	14	17
Tropical Yellow	26	25	15	23	23	22

CONCLUSIONS

1. Both, heat and GA_3 treatments, significantly influenced seed germination of two cultivars, as follows: 'Sémaphore' – from 20,6% (untreated) to 50,0% (72h/30°C) and 58,3% (300 ppmGA_3); 'Firebird' – from 5,6% (untreated) to 15,0% (72h/30°C) and 14,2% (150 ppmGA_3).

2. Maximum percentages of complete germinated seeds were obtained at 'Tropical Bronze Scarlet' (94,2%), treated with 450ppmGA_3 solution.

3. Among the five used cultivars, 'Firebird' presents the lowest germination, with very significant negative difference from control, in both experiments. The opposite is 'Tropical Bronze Scarlet' cultivar, very significant positive difference from control.

4. The shortest period of time necessary to complete the seed germination was observed at 'Tropical Bronze Scarlet' cultivar (14 days), on 300 ppmGA_3 treated seeds and the longest period of time was observed at 'Firebird' cultivar (29 days), in the same experiment (300 ppmGA_3), but also under the influence of heat treatment (72h/30°C).

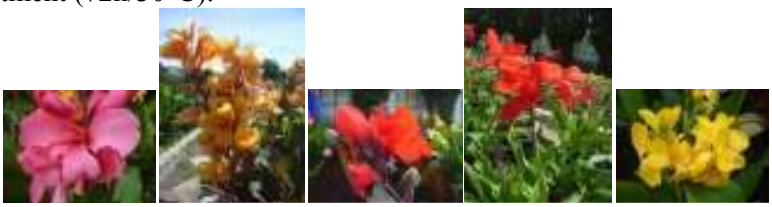

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Fig. 1 – *Canna indica* L. cultivars used in the experiments: a) 'Tropical Rose', b) 'Sémaphore', c) 'Tropical Bronze Scarlet', d) 'Firebird', e) 'Tropical Yellow'

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