APPLICATION OF LASER TREATMENT WITH RADIATION STIMULATION IN ANNUAL SPECIES OF SEED GERMINATION *DIANTHUS CARYOPHYLLUS* - VAR CHABAUD AND *PETUNIA HYBRIDA*

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Abstract
Additional illumination with red light produced by laser diodes in continuous and different exposure times, was applied to seeds from two species of annual flowers: Garofita Dianthus caryophyllus - var. CHABAUD; FEUER KONING and romanian Petunia hybrid variety "WHITE CASCADE.
The experimental results presented in the present study are a continuation of research initiated in 2009 ((P. Niculita , S. Danaila-Guidea, O. Livadariu , M. Ristici, J. Ristici si F. Burnichi, 2009)and were aimed at testing the germination of seeds and development morphology induced by treatment effect based on laser radiation fields in the early stages of development of seeds under the effect of intensity light in the spectral range 640 nm - 660nm.
Sets of seeds were irradiated once mounted on the first day of the experiment at different energy doses by changing exposure time. Thus the experiences of dry seeds were irradiated with different doses four lots in 2009 and 2010 corresponding variants V1-V4 (5-20 minutes). The experimental results were analyzed in parallel with a control group of seeds that did not apply to treatment of red laser diodes.
In all the seeds analyzed from the two flower species studied germination capacity and that the growth of seedlings, determining germination percentages every two days for 3 weeks.
Results have shown a percentage of germination higher than control group of seeds (75%) for all repetitions of variant V4 (95%), with exposure time of 20 minutes (1.53 joules / cm ²) to treatment with red light produced by laser modulated at audio frequency.

Ke words: biostimulation, laser diodes, red light, carnation, pethunia

1. INTRODUCTION

Currently organizations in general and plants in particular are dependent on the presence of what we call light, electromagnetic radiation in the wavelength range 400 nm - 750 nm. Red field - about 660-670nm, is important because the absorption bands of chlorophylls, a 'and' b '

Absorption and laser light scattering in tissue irradiated by its spatial distribution determines subsequent biological effects. Tissue absorption properties are related to tissue biochemistry and scattering properties are related to tissue morphology.

For various applications it is necessary to know the optical properties of tissue involved, to interpret and quantify the recorded data or diagnostic imaging and to provide for the propagation of light and absorbed dose.

In addition, knowledge of laser parameters leads to the choice of suitable laser application proposed. Tissue response under laser irradiation depends on a number of variables, of which applied laser beam parameters play an important role.

2. MATERIAL AND METHOD

1. Plants from species: *Dianthus caryophyllus*-var.CHABAUD, Feuer KONING, Fam. *Caryophylaceae* is a decorative port, smell sweet, abundant red flowers, florist rigid rod, long

flowering period (from June until the fall frozen on the vine). It is used as a cut flower, and to decorate parks and gardens (Figure 1.a) .
2. Plants of *Petunia hybrida-*, variety WHITE CASCADE, Fam. *Solanaceae* are annual, glandulous hairy, herbaceous, up to sufrutescente. Growth is high, erect, funnel-shaped flowers, simple, rich and persistent bloom (Figure 1.b)

a. b.

Figure 1. The appearance of lines and varieties of crops selected for biological material (photo: original by SCDL-Buzau):
a. Dianthus caryophyllus -var.CHABAUD: FEUER KONING;
b. Petunia hybrida-, fam. Solanaceae soiul var.CASCADE ALB

DEVICE WITH LASER DIODE
Red laser radiation emitted by 19 laser diodes was used. Laser illumination was homogeneous on the all exposed surface (Petri dishes with vegetable seeds).
The front panel has a central switch, the drive, powered laser diodes in continuous and ten other switches, the overall lower corresponding generating rectangular pulses in the frequency range 5Hz-20kHz.
Functional parameters of the device used to laser irradiation of seeds of both species are: - Spectral bandwidth: 640-670nm, operating current of 20mA, operating in a rectangular pulse, the power density: 2.5 mW/cm2, power consumption <10W Power 220V/50Hz.
EXPERIMENTAL SCHEME**:** Experiments from 2010 were conducted in the form of two experimental series: S1 (2010)- seeds of the species *Dianthus caryophyllus* -var.CHABAUD: FEUER KONING *and pethunia seeds from* P*etunia hybrida-*, fam. *Solanaceae* soiul CASCADE ALB additional illuminated continuously with red laser light (exposure times: 10, 20si 30 de minute).

S2- seeds of the species *Dianthus caryophyllus* -var.CHABAUD: FEUER KONING *and pethunia seeds from* P*etunia hybrida-*, fam. *Solanaceae* soiul CASCADE ALB additional illuminated continuously with red laser light (exposure times: 5, 10, 15, 20 minutes).

For each experimental variation and repetition of series S1 were used 20 seeds and S2 were used 25 seeds respectively compared with irradiated control sample.

Seeds were then placed in numbered Petri dishes for irradiation at 23 ° C and relative humidity of 55%. After this irradiation, the two experimental series were seeded immediately with a clamp on the surface of organic potting mix. The mixture of land used for sowing seeds of pethunias and diantrus was previously sterilized and distributed in 10 cm diameter pots (Table 1, Figure 1).

Table 1. Time and the appropriate dose for the irradiation of a Petri dish with a diameter of 10 cm

T(min)	D (J/cm2)
5	0.38
10	0.75
15	1.15
20	1.53
30	2.3

a. **b.**

Figure 1 Experimental device unit attachment with diode laser irradiation (a) and seed treatments on Pethunia and Dianthus (photo: original by 4 R OPTICS)
a. laser head and b. The supply audio-frequency modulation system included.

Monitoring germination was performed daily, counting all germinated seedlings, regadless of size hypocotyls axis, or the appearance epicotyls leaf formations. The average percentage of bacteria determined on day-3 of the corresponding value was considered as germination energy (EG). On Day 14 the germination process was considered finished, the percentage of bacteria results in the period between day 3 and day 14 was being considered as estimator of germination (FG).
Additional illumination with red light produced by laser diodes under modulated laser radiation and different exposure times, according to the experimental scheme described above was performed once in the first day of installation for each version of the experiment.
All experimental variants were kept in the same controlled conditions (climatic chamber) at a temperature of approx. 23 ° C, relative humidity 85% and continuous darkness until germination triggering.
The variants used to study the ability of seedlings growth, determining the percentages of germination at 3,5,7,9,12 and 14 days and the effects rizogene, training caulinare organogenous roots and stems and leaf formation.

3. RESULTS AND DISCUSSIONS

If the petunia seed treatments applied in 2010, *Petunia hybrida*, fam. *Solanaceae* variety CASCADE WHITE were only selected three variants with duration of exposure as follows: V1 = 10 minutes, V2 = 20 minutes and V3 = 30 minutes respectively at doses of 0.75 joules / cm ², 1.53 joules / cm ² and 2.3 joules / cm ² (Table 2)

Table 2 Seed germination of Petunia hybrida-fam. Solanaceae variety CASCADE WHITE compared with control (for each variation and repetition). -experimental series S1

Var.	Media rehearsals	Periodic evaluation of the germination period of two days after sowing (%)					
		% Seeds germinated	% Seeds germinated	% Seeds germinated	% Seeds germinated	% Seeds germinated	% Seeds germinated
V1	**R_1- R_5**	**10%**	**15%**	**25%**	**35%**	**50%**	**60%**
V2	**R_1- R_5**	**20%**	**25%%**	**35%**	**50%**	**55%**	**60%**
V3	**R_1- R_5**	**10%**	**25%**	**35%**	**55%**	**60%**	**65%**
V_M	**R_1- R_5**	**0%**	**10%**	**20%**	**35%**	**50%**	**55%**

Legend:
Variants:V1= 10 minutes of exposure time and dose of 0.75 joules / cm ²; V2= 20 minutes exposure time and dose of 1.53 joules / cm and V3= 30 minutes exposure time and dose of; VM= witness/control sample

Outside the 30-minute treatment (V3) to the final amount of germination significantly exceeds that of the witness, other variations and repetitions of values were close to the irradiated seeds. This has shown us that in this case the application should be used in change because exposure times shorter intervals may lead to an incentive effect in triggering germination.
Figure 3 illustrates the petunia seedlings resulting from germination of seeds on which treatment was applied to the diode laser light variant V1-V3 (10, 20, 30 minutes of irradiation with laser light) compared with those from version control / irradiated control.
In the case of seed Garofita (*Dianthus caryophyllus*-var.CHABAUD: KONING Feuer) (Table 3), Series S1 illuminated with laser light additional continuous emission in the red following results were obtained: higher germination percentage than for all rehearsals witness of variant V1 discussed in two days of the start of experiments. Increase the maximum germination obtained after treatment with red light produced by the audio-frequency modulated laser was Registered in day-10 and was superior to control.

Figure 3: . WHITE CASCADE variety petunia seedlings 30 days after irradiation and sowing

Table 3 Seed germination of Dianthus caryophyllus –var.CHABAUD: FEUER KONING compared with control (for each variation and repetition). -experimental series S1

Var.	Media rehearsals	Periodic evaluation of the germination period of two days after sowing (%)					
		% Seeds germinated	% Seeds germinated	% Seeds germinated	% Seeds germinated	% Seeds germinated	% Seeds germinated
V1	**R1- R3**	**5 %**	**70 %**	**89 %**	**91 %**	**94%**	**94%**
V2	**R1- R3**	**13 %**	**82 %**	**83%**	**87%**	**87%**	**87%**
V3	**R1- R3**	**19 %**	**67%**	**86%**	**86%**	**86%**	**86%**
VM	**R1- R3**	**6 %**	**60 %**	**86 %**	**86 %**	**89%**	**89 %**

Legend:
Variants:V1= 10 minutes of exposure time and dose of 0.75 joules / cm ²; V2= 20 minutes exposure time and dose of 1.53 joules / cm and V3= 30 minutes exposure time and dose of; VM= witness/control sample

It can be said in this case that the V1 version, additional treated daily for 10 minutes by red laser light intensity continuous systems 0.75 joules / cm 2 and energy positively influences the faculty of Dianthus seed germination. Growth rate of germination was higher than control. Other variants and repetitions have responded differently to treatment, determining the five days, but results were below the untreated control value. Both the witness and if the values of the following evidence has been a cap from the seventh day after the initiation of experiments, the results are consistent with the witness later or slightly below its values.

Figure 4 illustrates Dianthus seedlings resulting from germination of seeds on which treatment was applied to the diode laser light variant V1-V3 (10, 20, 30 minutes of irradiation with laser light) compared with those from version control / irradiated control.

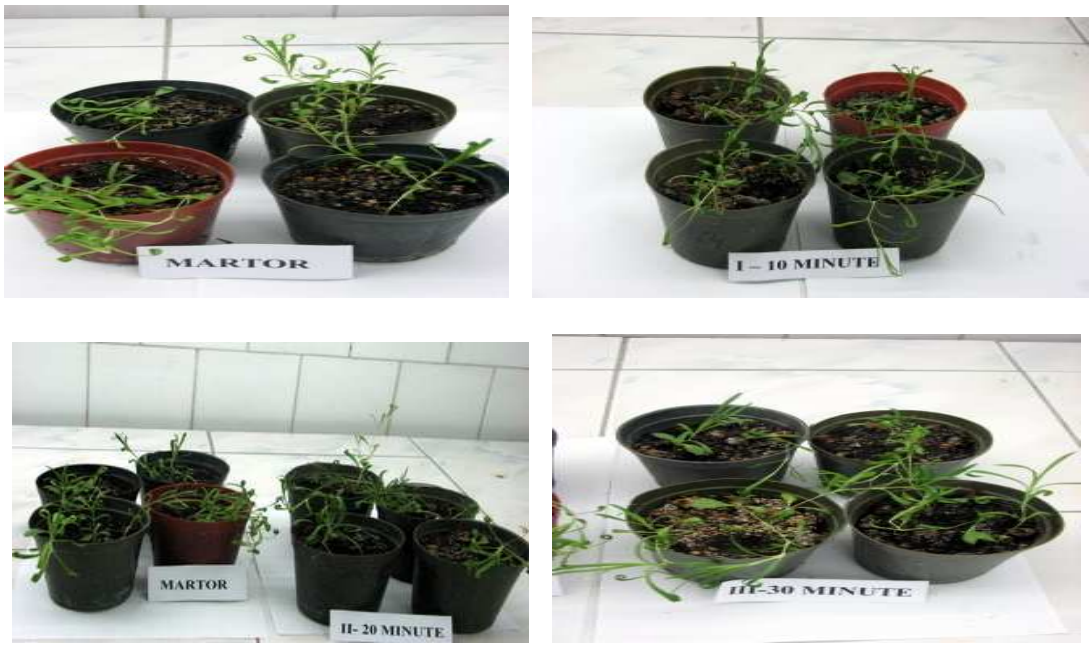

Figure 4. Variety KONING Feuer (Dianthus caryophyllus-var.CHABAUD:) seedlings 30 days after irradiation and sowing

New versions series (S2) we experimentation with durations of exposure of seeds of Petunia and Dianthus between 5-20 minutes and a dose of 0.38 joules / cm ², 0.75 joules / cm ², 1.15 joules / cm ² and 1.53 joules / cm ² caused an effect stimulating the onset of germination. All variations and

repetitions were irradiated seeds recorded higher values in the final amount of germination. (Figure 5 and Figure 6)

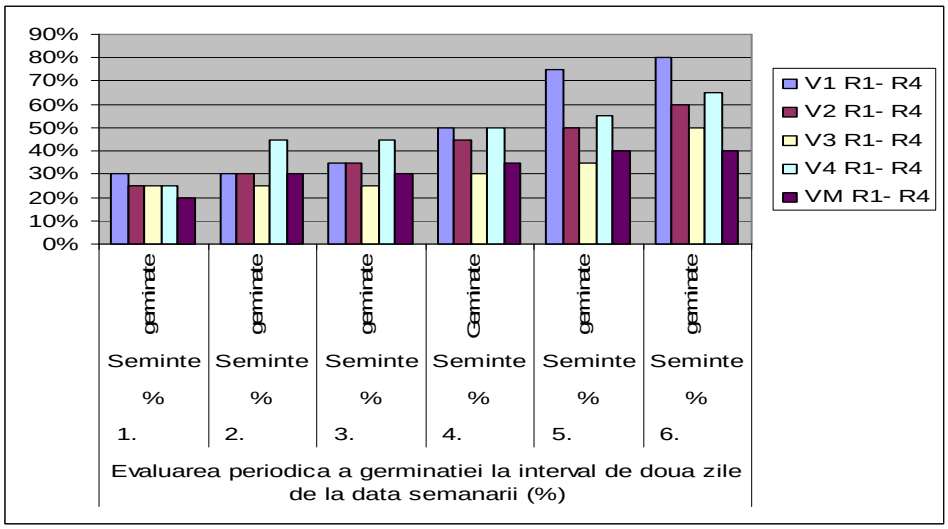

Figure 5. Petunia hybrida fam.Solanaceae, var. CASCADE ALB

Legend:

Variants:V1 = 5 minutes of exposure time and dose of 0.38 joules / cm ²; V2= 10 minutes of exposure time and dose of 0.75 joules / cm ²; V3 = 15 minutes of exposure time and dose of 1.15 joule/cm²; V4 = 20 minutes exposure time and dose of 1.53 joules / cm and VM= witness/control sample

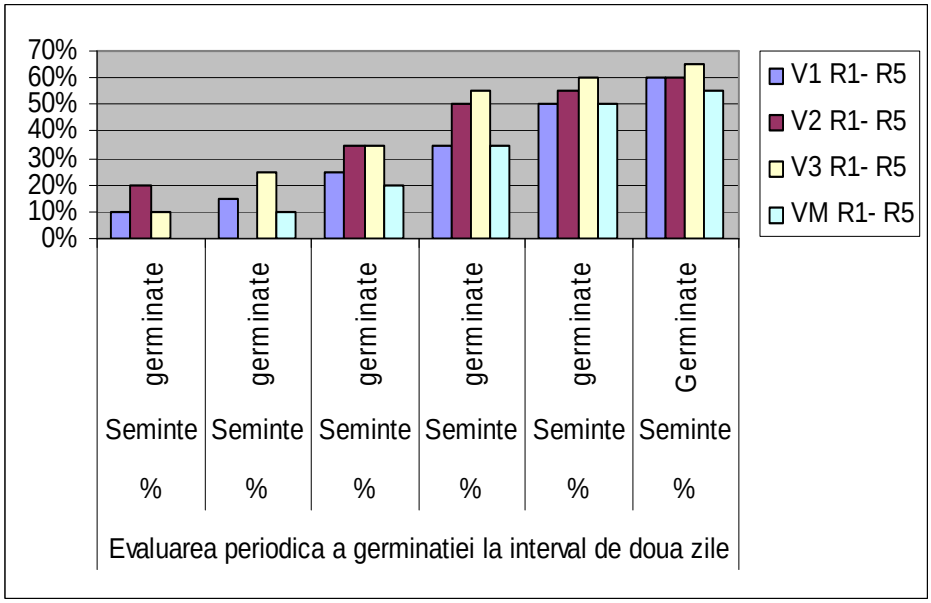

Figure 6. Dianthus caryophyllus- var. CHABAUD:FEUER KONING

Legend:

Variants:V1 = 5 minutes of exposure time and dose of 0.38 joules / cm ²; V2= 10 minutes of exposure time and dose of 0.75 joules / cm ²; V3 = 15 minutes of exposure time and dose of 1.15 joule/cm²; V4 = 20 minutes exposure time and dose of 1.53 joules / cm and VM= witness/control sample

4. CONCLUSIONS

For petunias and dianthus used varietys most effective radiation doses were found to be the 0.75 J / cm ² and 0.38 j / cmp respectively. This led to significant positive difference to very significant in terms of growth rate, number of shoots formed and number of flowers formed. Influence of laser radiation therapy is beneficial for all characteristics studied and determined.

In the first series of treatments used in 2009 we found a negative correlation between seed germination capacity and exposure to radiation treatments, the doses selected.
Of the two flower species treated with laser radiation proved petunias species that reacts fastest and most powerful irradiation, the speed and magnitude of plant response was remarkable.
In this classification petunias are followed by dianthus which also proved a material and very good study, plant response, in terms of morphological changes, biometrics is clear (Annex 1 and 2).
Since the chosen research theme is topical, we consider it necessary to repeat the experiments on the two species studied for model development and experimental validation of ecological and nestresant treatment plants based on the field.

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