

## EFFECT OF GAMMA IRRADIATION ON GROWTH AND FLOWERING OF *LATHYRUS ODORATUS*.L

BY

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### ABSTRACT

**This** experiment was carried out for two successive seasons (2005/2006 and 2006/2007) to study the possibility of inducing some variations in vegetative growth and flowering of *Lathyrus odoratus*, L. Dry seeds were subjected to gamma rays at "zero, 1, 2, 4, 8, 16, 32 and 64 Krad". Results showed that, gamma rays induced some variations in germination, vegetative growth, flowering pigments and total protein bands contents. Treated plants with gamma rays at 1&8 Krad significantly increased germination% and rate. Whereas gamma rays at 4 Krad significantly increased plant height, number of branch, fresh and dry weights of roots, Also found that 8 krad caused a significant increments in stem diameter, leaf number and area, fresh and dry weights of vegetative growth in both seasons. It was also found that treated *Lathyrus odoratus*, L with (control) hastened flowering date, while the number of flower significantly increased with 16 krad. So found that 4 krad significantly increased fresh and dry weights of grabs & dry weight of seeds. Mean whil using 4 or 8 Krad significantly increased flower age on plant. Whereas, treated plants with 2 krad significantly increased chlorophyll a and b while carotenoids increased with 4 krad. Treated plants with 1 & 4 krad of gamma rays significantly reduced protein bands from 17 (control) to 11 bands. Finally gamma rays at 4 & 8 Krad enhanced most parameter in *Lathyrus odoratus*, L.

### INTRODUCTION

The much loved sweet pea (*Lathyrus odoratus*) is a vestile plant in the garden grown up as wall fence of another plant, it reaches a height of up 2 or 3 m. It can be grown up pea sticks in the vegetable grown with –our support in mixed annual borders-dwarf varieties leaf most effective alongside traditional cartage garden plants as darkias candytuft and cornflowers. The pea like appear in early summer and provided all dead bloom are removed immediately will continue until early autumn. They come in an enormous range of colours reds pinks, salmons and white either one colour or bicoloured. Most are second, some more than others. saw the seeds in boxes or pans of seeds compost in early antumm or early spring. The most information on the effect of radiation (Gamma rays) on (*Lathyrus odoratus*) have been made of at the flowering plant to indicate that gamma irradiation at low doses was reported to stimulate plant growth. However, treatment at

high doses induce morphological variations to several ornamental plants such as *Datura metel* (Hussein *et al.*, 1995); *Hibiscus sabdariffa* "El-Sherbeny *et al.*, 1997", *chamomila recutita* (Youssef and Moussa 1998) and *Solidago altissima* (Sayed *et al.*, 2005). Moreover Gamma radiation treatments exhibited a pronounced effect on concentration of some biochemical constituents, such as pigments, indoles and phenol isolated from ornamental plants, such as carnation (El-Shafie *et al.*, 1987). *Tagets erecta*, *Zinnia elegans* and *Callistephus chinensis* (Zaharia *et al.*, 1991), gladiolus c.v. Peter Pears and Mascagni (El-Esawy 1995), *Delphinium ajacis* and *Mathiola incana* (Noby, 2002) *Calendula officinalis* and *Chrysanthemum carinatum* (Youssef 2007). This investigation aimed to study the effects of different concentrations of gamma irradiation on *Lathyrus odoratus* to induce some variations in vegetative growth and flowering.

## MATERIALS AND METHODS

This study had been carried out on *Lathyrus odoratus* L. at the Experimental Field of Ornamental Plants Research Department, Horticulture Research Institute, A.R.C., Egypt, during, 2005/2006 and 2006/ 2007 seasons to induced some variation on growth and flowering.

Seeds of *Lathyrus odoratus* were obtained from the Farm of Orman Botanical Garden. (Local variety).

### The treatments were:-

The dry seeds were irradiated before sowing, using gamma-cell "Co-60" at Middle

Eastern Regional Radioisotope Center for the Arab Countries, Dokki, Giza. The used doses were zero, 1, 2, 4, 8, 16, 32 and 64 Krad.

Seeds were sown on 12<sup>th</sup> October in pits at 35 cm, distance between each and 50 cm. between rows in both seasons. Each treatment was represented by three replicates each containing 21 seedlings.

Soil of the field was analyzed according to the method of Champan and Pratt (1978) before planting (Table A and B)

**Table (A): Particle size distribution of the investigated soil "under Giza conditions"**

Texture	Saturation (S.P)%	CaCO <sub>3</sub>	Clay%	Silt%	Coarse sand %	Fine sand %
Loamy clay	30.00	4.00	15.80	5.70	56.65	21.85

**Table (B): Chemical analysis of the investigated soil "under Giza conditions"**

Cations (meq/L)				Anions (meq/L)				
K <sup>+</sup>	Na <sup>+</sup>	Mg <sup>++</sup>	Ca <sup>++</sup>	Cl <sup>-</sup>	HCO <sub>3</sub> <sup>-</sup>	SO <sub>4</sub> <sup>-</sup>	PH	E.C ds/m
0.2%	1.30%	0.784%	3.025%	6.761%	1.16%	3.33%	7.6	0.521

Normal agricultural practices were practiced as usual in the two seasons.

### Data recorded:

The following data were recorded:

- Germination percentage and rate:** The number of germinated seeds was recorded in the different treatments at two days intervals for two weeks, then the rate and germination percentage were counted.
  - Vegetative growth:** Plant height "cm" above 10 cm. from the ground surface, stem diameter "mm", number of branches/plant, number of leaves / plant and leaf area of the 3 ed leaf "cm<sup>2</sup>" by CL-203 AREA METER, CID, INC., were recorded for nine randomly selected plants.
  - Flowering:** Flowering date (days), number of flowers /plant, age flower on plant, fresh and dry weights of grabs & seeds. These plants were dug out and the fresh and dry weights of vegetative growth and roots were determined.
- **Chemical compositions:** Chlorophyll a, b and carotenoids mg/g were determined in the fresh leaves according to Saric *et al.*, (1967).

### - Total protein in leaves:

Electrophoretic analysis was performed on leaves of the *Lathyrus odoratus* " SDS-PAGE of total protein extracts under non-reducing conditions was carried out in the discontinuous buffer system according to Laemmli (1970). Extraction was performed over-night using 0.2 mM Qtris-Hcl buffer, pH 6.8 containing 2% sodium dodecyle sulfate (SDS). After centrifugation at 10.000 rpm for 10 minutes, the supernatant was taken for loading on 12.5% polyacrylamid gel.

To determine the molecular weight of the migrated protein, the following marker proteins were used: Lysozyme (MW 14.2), Myoglobin (MW 18.4), Carbonic anhydrase (MW 35.00), Carbonic anhydrase Alkohol dehydrogenadse (MW 45.00), Bovin Serum Albumi (MW 66.2) and Galactoidase (MW 116.00).

4. **Statistical analysis:** The experiment was set in complete randomized design and data were subjected to statistical analysis

according to Sendecor and Cochran (1980).

**RESULTS AND DISCUSSION**

**Effect of gamma radiation on seed germination, growth, flowering and chemical composition of *Lathyrus odoratus* L.**

**1-Germination:**

Effect of gamma rays on the germination percentage and rate of *Lathyrus odoratus* L. Seeds is presented in Figure (1). Data show that 1 & 8 Krad of gamma rays treatment significantly increased germination percentage in the two seasons. While seeds treated with 64 Krad of gamma rays induced significantly increased of germination rate for both seasons. It was also noticed that 16, 32 and 64 Krad doses caused a significant increase in germination rate of the two plants for both seasons. These results agreed with those obtained by Zaharia *et al.* (1991) and Youssef (2007).

Generally, the increase in germination percentage and stimulating germination rate may be due to radiation action in enhancing hydrolysis of the complex compounds "carbohydrates, fats, proteins... etc.", in seeds to simpler compounds. This could be related directly or indirectly to the effect of radiation on the enzymatic reactions in seeds (EL-Esawy, 1995).

**2-Vegetative growth:**

Table (2) showed that irradiated seeds of *Lathyrus odoratus* by gamma rays at 4 or 8 krad induced significant increased on plant height, number of branches/plant, fresh and dry weights of root for both seasons. While treated seeds with gamma rays at 64 krad significantly decreased plant height, stem diameter, leaf area, number of leaves, vegetative fresh and dry weights compared with control and other treatment in both seasons.

These results of growth parameters were in agreement with those obtained by Nikolova and Vasileva (1979) and Venkatachalam and Jayabalan (1997) on *Zinnia elegans*, Youssef and Moussa (1998) on *Chamomila recutita*, Youssef *et al.* (2000) on geranium, Sayed *et al.* (2005) on *Solidago altissima*, Youssef (2007) on *Calendula officinalis* and *Chrysanthemum carinatum*, and Youssef and El-Bably (2007) on *Heli-chrysum bracteatum* and *Statice sinuate*. The stimulative effect of the low doses of gamma rays on growth, may be due to the increase of cell length or cell number and size, shifting in metabolism which promoted the stimulating effect of (photohormones) on biosynthesis of nucleic acids "Pitirmovae 1979".

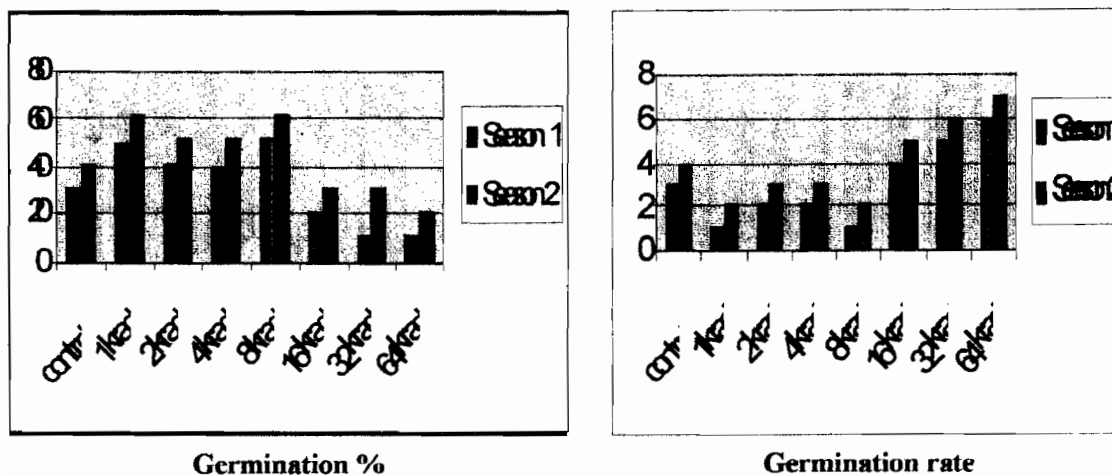


Fig (1): Effect of gamma rays on Germination % and rate of *Lathyrus odoratus*, L.

Table (1): Effect of gamma radiation on the vegetative growth of *Lathyrus odoratus*, L plants during 2005/2006 and 2006/ 2007 seasons.

Treatment	Plant height (cm.)		Stem diameter (mm.)		No. of branches/plant		No. of leaves/plant		Leafs area (cm <sup>2</sup> )		Fresh weight of plant (gm.)		Dry weight of plant (gm.)		Root fresh weight (gm.)		Root dry weight (gm.)	
	1 <sup>st</sup> Se.	2 <sup>nd</sup> Se.	1 <sup>st</sup> Se.	2 <sup>nd</sup> Se.	1 <sup>st</sup> Se.	2 <sup>nd</sup> Se.	1 <sup>st</sup> Se.	2 <sup>nd</sup> Se.	1 <sup>st</sup> Se.	2 <sup>nd</sup> Se.	1 <sup>st</sup> Se.	2 <sup>nd</sup> Se.	1 <sup>st</sup> Se.	2 <sup>nd</sup> Se.	1 <sup>st</sup> Se.	2 <sup>nd</sup> Se.	1 <sup>st</sup> Se.	2 <sup>nd</sup> Se.
Control	122.3	167.7	1.04	1.10	9.00	14.67	99.33	170.00	18.07	25.50	186.70	195.50	17.73	24.98	5.41	8.18	1.65	1.94
1.0 Krad.	140.0	173.7	0.93	1.13	10.00	17.67	122.0	251.30	22.23	25.34	213.40	199.10	20.95	27.86	7.41	8.94	1.51	2.17
2.0 Krad.	144.3	170.0	1.03	1.07	10.33	18.33	112.7	242.70	21.12	25.67	217.60	209.80	20.41	30.93	5.943	8.48	1.33	2.30
4.0 Krad.	171.3	196.3	1.10	1.23	12.67	21.00	134.0	282.00	26.55	30.08	238.20	237.40	24.29	34.36	9.067	12.22	2.93	2.73
8.0 Krad.	165.3	187.0	1.47	1.50	11.33	18.67	135.3	284.00	26.72	0.34	247.40	256.80	24.80	34.73	7.21	10.09	2.48	2.21
16.0 Krad.	148.7	174.7	1.40	1.47	10.33	20.67	117.3	288.00	23.27	28.20	241.00	241.20	23.94	31.65	6.467	9.28	1.92	2.54
32.0 Krad.	135.7	163.3	1.13	1.17	9.67	15.00	97.33	192.00	18.62	19.81	174.00	163.80	16.52	24.21	3.980	6.33	1.99	1.35
64.0 Krad.	116.0	148.3	0.967	1.00	7.00	12.67	72.67	160.70	15.57	17.40	160.30	145.70	4.55	13.41	4.457	5.34	1.08	1.24
LSD <sub>5%</sub>	7.064	8.585	1.039	.097	1.682	1.023	7.076	12.355	2.047	2.858	5.877	6.728	1.054	1.032	0.604	0.5.93	0.101	0.011

Table (2): Effect of gamma radiation on the flowering characteristics, of *Lathyrus odoratus*, L plants during 2005/2006 and 2006/2007 seasons.

Treatment	Date flowering		Number of flowers/plant		Grabs fresh weight (gm)		Grabs dry weight (gm)		Seeds dry weight (gm)		Age Flower on plant/day	
	1 <sup>st</sup> Se.	2 <sup>nd</sup> Se.	1 <sup>st</sup> Se.	2 <sup>nd</sup> Se.	1 <sup>st</sup> Se.	2 <sup>nd</sup> Se.	1 <sup>st</sup> Se.	2 <sup>nd</sup> Se.	1 <sup>st</sup> Se.	2 <sup>nd</sup> Se.	1 <sup>st</sup> Se.	2 <sup>nd</sup> Se.
Control	135.30	140.30	29.00	33.00	131.30	142.10	69.85	73.04	38.94	55.41	7.00	7.66
1.0 Krad.	139.00	143.30	34.00	44.33	151.20	160.90	123.20	132.40	51.48	66.17	7.66	8.00
2.0 Krad.	141.70	143.70	36.67	48.67	144.00	177.10	113.60	122.90	56.99	69.66	8.66	9.00
4.0 Krad.	137.30	145.70	41.33	57.67	211.50	224.90	136.40	152.20	78.60	101.16	13.00	13.66
8.0 Krad.	139.30	146.30	43.67	60.67	173.60	180.10	134.60	142.90	59.37	81.16	14.33	14.66
16.0 Krad.	142.00	148.30	46.00	66.00	177.30	187.60	99.92	140.70	69.46	86.40	10.33	9.66
32.0 Krad.	145.30	150.30	28.33	38.33	141.50	184.20	100.20	100.40	44.72	55.97	8.66	8.66
64.0 Krad.	145.70	152.70	23.67	28.00	114.30	123.90	67.05	76.33	38.15	49.66	8.00	8.00
LSD 5%	9.744	9.702	4.580	2.818	17.709	14.705	10.445	9.705	10.255	10.001	0.384	0.713

**3-Flowering:**

The period from sowing until flowering of *Lathyrus odoratus*, L. plants was markedly affected by pre-sowing gamma rays during the two growing seasons. (Table 2). In this concern, the doses of 0 (control) significantly reduced the average of flowering period of *Lathyrus odoratus*, L. compared with other treatments in both seasons, while the number of flowers were significantly increased by using 16 krad of gamma rays in both seasons. Treated plants with gamma rays at 4 krad significantly increased fresh & dry weights of grabs of seeds and dry weight of seeds. While using with 4 or 8 Krad significantly increased age flower on plant. These results were in agreement with those obtained by El-Esawy (1995) on gladiolus, De *et al.* (1997) on rose, Noby (2002) on *Delphinium ajacis* and *Mathiola incana*, Youssef (2007) on *Calendula officinalis* and *Chrysanthemum carinatum*,

and Youssef and El-Bably (2007) on *Helichrysum bracteatum* and *Statice sinuate*.

**4-Chemical composition:**

**Total chlorophyll and carotenoids mg/gm.**

Data in Table (3) cleared that gamma irradiation at 2 krad was significantly increased the total chlorophyll a & b content in fresh leaves of *Lathyrus odoratus*, L. While carotenoids content were increased by 4 krad of gamma compared with control. In this share, the earlier experiments conducted by Youssef (2003) on *Yucca elephantipes* and *Phiodendron scandens*; Youssef and El-Bably (2007) on *Helichrysum bracteatum* and *Statice sinuate* and Youssef (2007) on *Calendula officinalis* and *Chrysanthemum carinatum*, revealed that irradiation with gamma rays significantly affected the endogenous contents of pigments.

**Table (3): Effect of gamma radiation on pigments contents (mg/g.F.W.) in the leaves of *Lathyrus odoratus*,L plants during 2005/2006 and 2006/ 2007 seasons.**

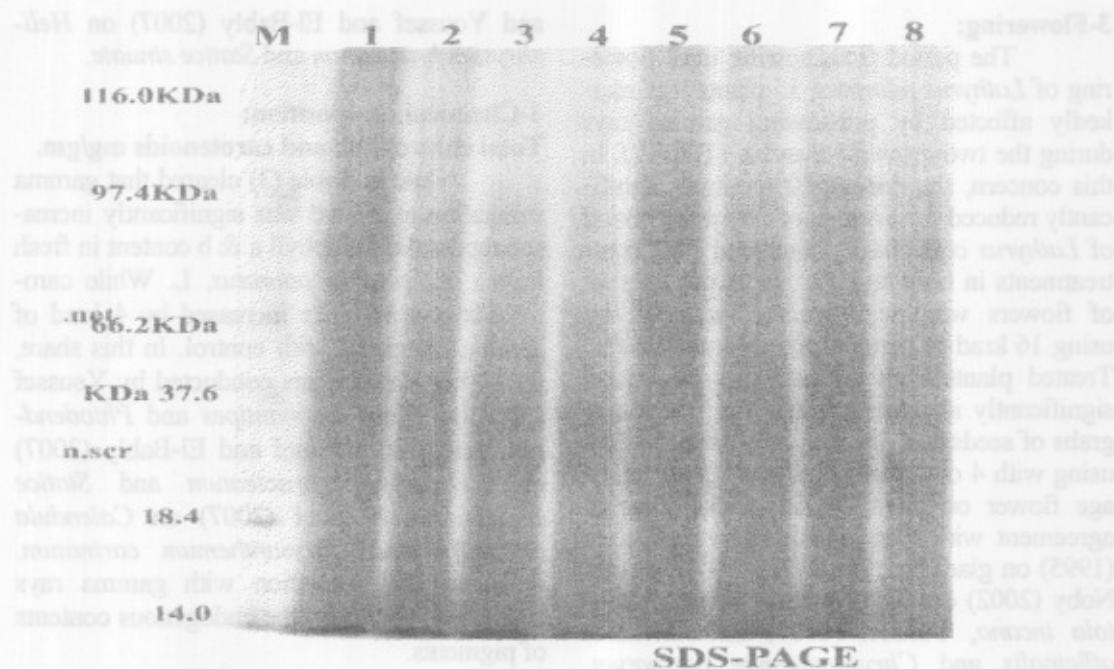
Treatment	Chlorophyll A (mg/g)	Chlorophyll B (mg/g)	Carotenoids (mg/g)
Control	0.25	0.82	0.21
1 Krad.	0.24	0.78	0.186
2 Krad.	0.32	0.85	0.195
4 Krad.	0.24	0.60	0.257
8 Krad.	0.200	0.108	0.198
16 Krad.	0.200	0.61	0.158
32 Krad.	0.189	0.60	0.152
64 Krad.	0.158	0.59	0.105

**Total protein: Effect of gamma radiation treatment on approximate molecular and intensity of protein bands.**

Protein banding patterns in *Lathyrus odoratus*, L of control, gamma rays, and gamma rays plus gibberellic acid were analysed by SDS polyacrylamide gel electrophoresis under reducing conditions. The approximate molecular weight (MW) and intensity of electrophoretic protein bands are presented in Table (4) and illustrated in Photo (1) show that protein banding patterns of the control and gamma rays, showed some differences in the number and density of the bands. The total number of the bands in the profiles of all genotypes was 17 representing MW., ranging from 137.00 to 14.50 daltons. However, the total number of bands detected

for each -was in the range of 17(for control). There are six common bands (No. 2, 3, 4, 5, 6, and 7) with MW. 131.00, 107.00, 85.00, 72.00, 66.00, and 56.00 dalton respectively) were absent in all protein profiles of gamma rays, compared to control.

Abd EL-Wahab (1994) mentioned that somaclonal banana variant plants obtained in tissue culture had a specific protein band different from that normal plants. Also Zhu and Lawes (1990) reported that different banding patterns and band intensities were obtained for several cultivars of kiwifruit and showed some promise for distinguishing between male and female veins, and Youssef (2007) on *Epipremnum aureum*.



1=control 2=1krad 3=2 krad 4= 4 krad 5=8 krad 6=16 krad 7=32 krad 8=64 krad  
 Photo (1): Approximate molecular weight and intensity Of protein bands in *Lathyrus odoratus*,L.

Chlorophyll B (mg/g)	Chlorophyll A (mg/g)	Treatment
0.21	0.25	Control

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## تأثير المعاملة بأشعة جاما على نمو أزهار بسلة الزهور

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\*\* قسم بساتين الزينة - كلية الزراعة - جامعة القاهرة - الجيزة - جمهورية مصر العربية

أجريت هذه التجربة خلال موسمين متتاليين ٢٠٠٥/٢٠٠٦، ٢٠٠٦/٢٠٠٧ بهدف محاولة استحداث تباينات في النمو الأزهار لنبات بسلة الزهور وذلك عن طريق معاملة البذور بتعريضها لجرعات مختلفة من أشعة جاما "صفر، ١، ٢، ٤، ٨، ١٦، ٣٢، ٦٤ كيلوراد" وبمتابعة قياسات الإنبات والنمو الأزهار للنبات وبعد تحليل البيانات أظهرت النتائج التالية:

أوضحت النتائج أن المعاملة بأشعة جاما أدت لاستحداث تباينات في الإنبات والنمو الخضري والزهرى ومحتوى الصبغات وكذلك البروتينات الكلية. حيث وجد أن المعاملة بـ ١ كيلوراد أدت لزيادة النسبة المئوية للإنبات وسرعة الإنبات بينما وجد أن المعاملة بـ ٤ كيلوراد أدت لزيادة كل من طول النبات، عدد الأفرع، الوزن الطازج والجاف للمجموع الجذري. والمعاملة بـ ٨ كيلوراد أدت الي زيادة سمك الساق وعدد الأوراق ومساحة الورقة معنويا وكذلك الوزن الطازج والجاف للمجموع الخضري مقارنة بالكنترول، في حين وجد أن المعاملة بالكنترول أسرعت الأزهار (تاريخ الأزهار من الزراعة حتى بداية الأزهار) في حين وجد أن المعاملة بـ ١٦ كيلوراد أدت لزيادة عدد النورات الزهرية. وكذلك وجد أن المعاملة بـ ٤ كيلوراد أدت لزيادة الوزن الطازج والجاف للقرون والوزن الجاف للبذور. ووجد أيضا أن المعاملة بـ ٤، ٨ كيلوراد أدت لزيادة عمر الأزهار على النبات.

كما أدت المعاملة بـ ٢ كيلوراد لزيادة محتوى الأوراق من الكلوروفيل أ ب -وزادت الكاروتينات بالمعاملة بـ ٤ كيلوراد. المعاملة بـ ١، ٤ كيلوراد من أشعه جاما أدت لتقليل الحزم البروتينية من ١٧ (كنترول) الي ١١ حزمة بروتينية. معاملة نبات البسلة بـ ٤ أو ٨ كيلوراد من أشعه جاما أدت لتحسين أغلبية الصفات تحت الدراسة.