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EFFECT OF RADIATION ON THE INHERITANCE OF ECONOMICALTRAITS IN SNAKE CUCUMBER (*Cucumis melo* , L.)

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ABSTRACT

The present investigation was conducted to study the effect of different doses of gamma-rays on four varieties and all hybrids among them of snake cucumber. In this respect, variation, the magnitudes of genetic parameters correlation coefficient between traits were also studied. Seeds of all genotypes were exposed to three doses of gamma-radiation emitted from cobalt 60 source. The doses used were : zero (control), 6 , 12 and 18 kr. The sensitivity of genetic material were measured for the studied traits : (P.L cms), (No.L/p) , (E.Y/P gms) , (A.F.W gms) , (Th.F cm) , (F. L cm) , (F.D cm) and (T.Y/P kgs) .

The results showed that the dose of 6 kr. treatment exhibited the highest value of means for most studied traits. The obtained values of heterosis, genetic parameters and heritability also showed that 6 kr. treatment was the best. Coefficient of correlation showed that genotypic and phenotypic correlations were positive for all studied traits. Consequently selection for increasing one trait would increase the other related traits.

INTRODUCTION

The damaging effect of ionizing radiation on living cells is an established fact, and is of a common occurrence in both animal and plant cells. Although, sometimes it is possible to obtain some useful mutants, the rays penetrate living cells, cause chromosomal breaks at different loci. Induced mutants by radiation are usually <u>deterious</u> and unpredictable, although plant breeder used it frequently on many field crops hopping to to recover useful mutations. Many investigators used radiation emitted from several sources on different plants to study the genetical and cytogenetical effects of these radioactive materials.

Many investigators studied the direct effect of gamma-rays on snake cucumber traits. Sen and Datta (1976) irradiated dry seeds of the variety, Cv. Long Green with 25-55 Krad. of gamma-rays. They recorded that the high doses reduced seed germination percentage. At the same time,Bader *et al* (1978) stated that irradiation of dry seeds of two varieties of tomato with 250 , 500 , 1000 , 2000 and 4000 rad, induced some stimulating effect on plant height, specially 500 and 1000 rad, doses.

Smetanina and Kodaneva (1982) treated seeds of cucumber with gamma irradiation. They found that the irradiation increased the early yield by 4.1-14.9%. On the other hand, Nath and Madan (1986) evaluated of the effects of low doses of gamma irradiation on cucumber traits, where the variety Cv.Long Green was irradiated with 0.5 - 2.5 Kr. The 1.5 and 2 Kr .these low doses were effective in enhancing femaleness and increased number of fruits per plant when compared with the control.

EL-Sharkawy (1993) treated dry seeds of tomato hybrids with 0 , 5 and 10 Kr. He mentioned that 5 Kr. was the best treatment to obtain high values of heterosis than the other treatments for all studied traits.

Al-Oudat *et al.* (1994) tested the effects of treating cucumber seeds with different doses of gamma irradiation (2, 3, 4, 5, 7.5, 10 and 15 Gy [where GY=100 rad]) on plant characters. They found that gamma irradiation doses of 3 – 7.5 Gy led to an increases in number of leaves and plant length.

El – Adl *et al.* (1996) revealed that both additive and non additive genetic variances showed similar importance. They obtained high estimates of heritability in F_1 hybrids of Agoor for all studied traits. Similarly, Munshi and Verman (1999) recorded that additive and non additive genetic variances showed similar trend for all studied traits. On the other hand, Inmuskmelon EL-Mighawry *et al.* (2001) calculated heritability values and heterosis for six traits (No. Fruit per plant, fruit weight, total yield per plant, T.s.s, flesh fruit thickness and fruit firmness). They found high values of heritability for all studied traits.

Abd EL-Hadi *et al.* (2001) noticed that total yield per plant in sweet melon was positively correlated with number of fruit per plant and flesh thickness was positively correlated with weight of fruit . Similar results were also reported by Kosba *et al.* (1993) and EL-Sharkawy (1993).

MATERIALS AND METHODS

I- The Genetic Materials :

The genetic materials used in this investigation included four different varieties of snake cucumber. All these varieties belong to the species [*cucumis melo*,L.]. Seeds of all varieties were obtained from the vegetable Research Institute, Agriculture Research Center, Ministry of Agriculture in Giza. These varieties were 1- Flexuasus, 2- Elongotus, 3- Pubescence 4- Balady variety. The seeds of varieties were treated by these gamma-rays doses (6,12,18 kr.) emitted from Co^{60} at th Middle Eastern Regional Radioisotope Center for the Arab Countries at Doky, Giza, Egypt. All the agriculture treatment were done as recommended to snake cucumber cultivares.

II- Experimental design :

The treated seeds were planted using a randomized complete blocks design (R.C.B.D) with three replications. Irradiation and non-irradiation seeds were grown in the field trail experiments at the Agriculture Experimental Station Farm, Vegetable Research Dept., El-Baramoon, Dakahlia Governorate, during the two growing seasons at 1999 and 2000. Experimental plots consisted of three ridges. Each ridge was 5.0 meter in length and 1.5 meter at width. Four to six dry seeds were sown in every hill at 50 cm apart on the northern side of ridges. After building the fourth true leaf on the plant, the hills were thinned to single plant in each hill.

In the growing season of 1999, all crosses were made among these varieties according to a partial diallel crosses mating design. Data were recorded on the following traits :

1- Plant Length (P.L.cm)
2- Number of leaves per plant (No. L/P)
3- Early yield per plant in grams (E.Y/P gms)
4- Average Fruit weight in grams (A.F.W gms)
5- Thickness of flesh (Th.F cm)
6- Fruit Length (F.L cm)
7- Fruit Diameter (F.D cm)
8- Total Yield per plant (T.Y/P kgs)

III- Statistical Analyses :

A - Analysis of variance :

Several analysis of variance were made in order to test the significance of the differences among the four parental varieties and the six hybrids among them . In addition, a combined analysis of variance over the used doses was also made according to the form of analysis of variance presented in Tables 1 and 2

Table1: The form of the analyses of variance and the expectation of mean squares.

S.V	d.f	M.S	E.M.S
Replications	r-1		$\sigma^2 e + g\sigma^2 r$
Genotypes	g-1	M_2	$\sigma^2 e + r\sigma^2 g$
Errors	(r-1)(g -1)	M_1	$\sigma^2 e$

Table 2: The form of the analysis of variance and the expectations of mean square for combined analysis over doses.

S.O.V	D.F	M.S	E.M.S
Doses	(d-1)		
Doses X Rep	d(r-1)		
Genotypes	(g-1)		$\sigma^2 e + r\sigma^2 gd + rd\sigma^2 g$
Gnotypes X Doses	(d-1)(g-1)		$\sigma^2 e + r\sigma^2 gd$
Error	d(r-1)(g-1)		$\sigma^2 e$
Total	rgd - 1		

Where :

r : is number of replication. g : is number of genotypes d : is doses of gamma-rays

Tests of significance between the means for each trait were made according to the Least significant difference value (L.S.D) at both 5% and 1% level of significance.

The values for L.S.D were calculated as outlined by Snedecor and Cochran (1967) as follows :

$$L.S.D\ (5\%) = t_{0.05\ ,\ Edf} \times s^{-}d \qquad L.S.D\ (1\%) = t_{0.01\ ,Edf} \times s^{-}d$$

$$S^{-}d = \sqrt{\frac{E.M.S}{r} \times \frac{n_1 + n_2}{n_1 n_2}}$$

Where:

Edf : is the number of error degree of freedom.

E.M.S : is the error mean squares from the analysis of variance table.

r : is the number of replications.

n_1 : is the number of genotypes involved in the first means.

n_2 : is the number of genotypes involved in the second means.

B- Estimation of Heterosis :

The amount of heterosis was determined as the percentage deviations of the F_1 hybrids over all the average of parents (M.P) or above the better- parent (B.P). Therefore, the value of heterosis could be estimated as follows :

1- The mid-parents heterosis :

$$H\ (M.P)\ \% = \frac{F_1 - M.P}{M.P} \times 100$$

2- The better parent heterosis :

$$H(B.P)\% = \frac{F1 - B.P}{B.P} \times 100$$

The significance of the observed differences of these comparisons were determined by comparing the differences with respect to the (L.S.D)

C- The diallel cross analysis :

General Combining ability (G.C.A) of a line is the average value of the line in all other combinations, and it is a measure of additive gene action.

Specific Combining ability (S.C.A) is the ability of a line to do better or worse than the average value in a specific cross and it is a measure of the deviations from additivity. Both G.C.A and S.C.A could be obtained through the evaluation of the diallel cross. In this study four parental varieties were utilized in the diallel crosses mating design to produce six F_1 hybrids. The diallel crosses analysis of variance for the F_1 hybrids for each dose was used to estimate General Combining ability (G.C.A) and specific Combining ability (S.C.A) using the procedures described by Matzinger and kempthorne (1956) which is shown in Table 3.

Table 3 : the form of analysis of variance the diallel cross and the expectations of mean squares :

S.V	d.f	M.S	E.M.S
Replications	r-1		
Crosses	c-1		
G.C.A	p-1	M_3	$\sigma^2 e + r\sigma^2 s + r(p-2)\sigma^2 g$
S.C.A	p(p-3) / 2	M_2	$\sigma^2 e + r\sigma^2 s$
Error	(r-1)(c-1)	M_1	$\sigma^2 e$

Where : r, c and p are numbers of replications, crosses and parents respectively.
$\sigma^2 g$ is the variance of general combining ability.
$\sigma^2 s$ is the variance of specific combining ability.

Estimates of Heritability :

The estimates of heritability were determined according to the following equations :

a - h_b^2 (broad) sense heritability = $$\frac{2\sigma^2 g + \sigma^2 s}{2\sigma^2 g + \sigma^2 s + \sigma^2 e / r}$$

b - h_n^2 (narrow) sense heritability = $$\frac{2\sigma^2 g}{2\sigma^2 g + \sigma^2 s + \sigma^2 e / r}$$

Genotypic and phenotypic correlation :

In order to estimate the genotypic and phynotypic correlations between pairs of traits, acovariance analysis between selected pairs of traits were also made.

The procedures used for analysis of covariance and analysis of variance were as outlined by steel and Torrie (1960) and presented in table 4 therefore ,the genotypic correlation (r_g) and phenotypic correlation (r ph) for any pair of traits could be obtain as follows :

$\sigma\, g_{1}.g_{2}$ $\sigma ph_{1}.ph_{2}$

$$(rg) = \frac{\quad}{\sigma^2 g_1 . \sigma^2 g_2} , \quad (r\,ph) = \frac{\quad}{\sigma^2 ph_1 . \sigma^2 ph_2}$$

Table 4 : Form of analysis of variance and covariance and expectation of mean squares and mean products:

s.v	D.F	M.S	Analysis of variance	M.P	Analysis of covariance
Replication	(r-1)				
Genotypes	(g-1)	M2	σ 2 e + r σ 2 g	MP2	σ e1 e2 + r σ g1 g2
Error	(r-1) (g-1)	M1	σ 2 e	MP1	σ e1 e2

The significance of the (rg) and (rph) was tested by using the " t " test at 5% and 1% levels of significances as described by Cochran and Cox (1957) as follows :

$$\text{Calculated (t) for rph} = \frac{r_{ph}}{\sqrt{\frac{1-(r_{ph})^2}{n-2}}} \qquad \text{Calculated (t) for rg} = \frac{r_g}{\sqrt{\frac{1-(r_g)^2}{n-2}}}$$

RESULTS AND DISCUSSION

This research work was conducted to determine the radiation effects on means , variations, heterosis, genetic parameters and heritability on some traits of snake cucumber.

The interaction effects between varieties and radiation doses were also studied. In addition the effect of radiation on coefficient of correlation between selected traits were also studied. These traits were : (P.L cm), (No.L/p), (E.Y/p gms) ,(A.F.Wgms ,( )Th.F cm) ,(F.L cm) ,(F.D cm) and (T.y/pkgs).

I: Effect of Radiation on Means:

The means of all varieties and the hybrids among Them for all doses of radiation were estimated and the results are presented in table 5:

The results indicated that the means ranged from 158.96 (1 x 3) to 212.35 (1 x 4) for (p.L cm) at 18 kr.and 6kr. ,respectively .The results also showed that the means of (NO.L/P) ranged from 149.33 (2 x 3) to 193.67 (1 x 4) for 18kr. And 6 kr.,respectively. The means of (E.y/pgms) ranged from 0.290 (1 x 3) to 0.632 (1 x 4) for 18kr. and 6kr. ,respectively.

The results indicated that the means of (A.F.Wgms) ranged from 170.25 (1 x 3) to 312.57 (1 x 4) for 18kr. and 6kr. ,respectively .On the other hand, the means of (F.L cm) trait ranged from 24.47 (2 x 4) to 40.61(1 x 2) for 18kr. and 6kr. ,respectively .The means of F.D cm ranged from 4.57 (2 x 3) to 6.73 (2 x 4) for 18kr. and the control ,respectively.

The results also indicated that the hybrid (1 x4) showed the highest mean for (Th.F cm) (1.94) at 6kr, while the means of (T.Y/P kgs) ranged from 1.22 (1 x 3) to 2.52 (1 x 4) for 18kr. and 6kr. respectively.

Generally, it appeared that the means of hybrids exceeded the means of all varieties. Similarly, dose of 6kr. treatment always showed the highest values of means for most studied traits.

II: Effect of Radiation on the Variances of Varieties and hybrids:

The analysis of variances for traits were made for all genotypes for all doses and the results are presented in table 6:

The results showed that the mean squares were highly significant for all studied traits for all doses. The traits of (p.L cm) and (E.y/pkgs) were more affected by 12 and 18kr. gamma-rays. The combined analyses of vafiance for different doses were also made and the results are presented in Table 6

III- Effects Of Radiation On The Amount Of Heterosis

The values of heterosis were determined from the mid-parents and the better parent , in addition, to the means ,ranges for all doses and the results are presented in Table 7

The results indicated that the mean squares of doses were signifcant for all studied traits except for Th.F cm and (T.Y/P kgs) .The results showed that the mean squares of the interaction between radiation doses and replicates were not –significant for all studied traits exept for (E.Y/P gms) , (A.F.W gms) and (F.D cm). The mean squares of genotypes were significant for all studied traits except for (T.Y /P kgs).these results indicated the presence of interaction between genotypes and radiation doses which were significant for all studied traits except for (T.y/pkgs) .

Table 5 : Effect of radiation doses on means for parents and hybrids

Genot-ypes	Dose	P.L cm	No.L/P	E.Y/P gms	A.F.W gms	F.L cm	F.D cm	Th.F cm	T.Y/P kgs
V.1	0	194.65	185.33	0.493	261.21	38.87	6.51	1.71	2.00
	6	205.91	193.67	0.577	285.43	39.34	6.64	1.86	2.22
	12	179.04	179.33	0.363	242.18	34.06	6.12	1.41	1.72
	18	166.00	173.33	0.298	165.79	29.91	5.59	1.12	1.34
V.2	0	176.00	157.67	0.386	201.35	30.69	5.46	1.51	1.36
	6	183.91	168.00	0.429	219.98	32.76	5.51	1.66	1.61
	12	168.23	150.67	0.312	184.28	27.73	5.00	1.37	1.25
	18	158.70	146.67	0.252	165.79	23.68	4.61	1.08	1.07
V.3	0	163.13	154.67	0.349	217.89	33.46	5.02	1.48	1.44
	6	169.80	164.67	0.406	236.61	34.62	5.10	1.62	1.55
	12	158.99	145.00	0.298	199.75	30.78	4.59	1.29	1.22
	18	144.44	138.33	0.223	168.63	27.68	3.53	0.98	1.05
V.4	0	178.32	170.67	0.501	235.37	32.31	6.81	1.91	2.01
	6	193.89	185.33	0.617	259.64	34.10	6.71	2.05	2.33
	12	171.53	166.33	0.408	214.73	29.55	6.37	1.43	1.73
	18	161.44	160.33	0.338	185.64	25.50	6.06	1.13	1.29
H.1 x 2	0	197.62	180.67	0.473	231.29	36.17	6.03	1.75	1.75
	6	199.58	185.00	0.546	247.90	40.61	5.87	1.91	2.06

	12	176.40	179.33	0.382	209.03	32.85	5.48	1.53	1.60
	18	158.96	175.00	0.340	189.32	29.92	5.32	1.27	1.34
H.1 x 3	0	178.77	158.33	0.376	250.09	37.79	5.43	1.58	1.71
	6	188.54	163.66	0.448	265.02	36.31	5.44	1.72	1.78
	12	170.05	163.00	0.310	228.65	34.04	5.10	1.47	1.46
	18	158.96	157.67	0.290	170.25	28.57	4.64	1.12	1.22
H.1 x 4	0	205.57	188.33	0.569	263.60	39.51	6.71	1.84	2.41
	6	212.35	193.67	0.632	312.57	38.35	6.61	1.94	2.52
	12	182.67	183.33	0.417	242.40	33.70	6.31	1.70	1.85
	18	168.90	179.33	0.382	204.15	29.10	5.76	1.46	1.53
H.2 x 3	0	188.76	161.33	0.429	220.41	32.45	5.42	1.53	1.52
	6	192.77	169.33	0.497	242.64	35.21	5.61	1.66	1.67
	12	175.60	152.67	0.363	199.18	30.01	5.00	1.42	1.37
	18	162.38	149.33	0.322	172.75	26.04	4.57	1.47	1.24
H.2 x 4	0	192.20	167.67	0.474	234.31	32.04	6.73	1.69	1.85
	6	197.95	173.00	0.547	276.85	33.47	6.54	1.86	2.10
	12	178.36	160.33	0.409	196.09	29.28	6.29	1.65	1.63
	18	163.95	156.33	0.347	180.89	24.47	5.88	1.30	1.38
H.3 x 4	0	198.61	170.33	0.503	243.11	33.49	6.68	1.79	2.04
	6	200.47	175.00	0.592	303.47	34.67	6.47	1.93	2.34
	12	180.95	166.00	0.413	216.11	30.75	6.25	1.67	1.76
	18	167.65	162.33	0.367	194.59	25.06	5.86	1.35	1.50
L.S.D at 5%	0	2.63	1.72	0.01	10.02	0.48	0.20	0.06	0.08
	6	2.90	1.62	0.01	8,90	0.90	0.21	0.06	0.06
	12	1.91	1.07	0.01	10.13	1.24	0.50	0.08	0.06
	18	1.76	1.64	0.01	2.92	0.97	0.15	0.06	0.04
L.S.D 1%.	0	3.60	2.36	0.02	13.74	0.66	0.28	0.08	0.12
	6	3.97	2.22	0.01	12.21	1.24	0.29	0.08	0.09
	12	2.62	1.47	0.01	13.88	1.70	0.69	0.12	0.09
	18	2.42	2.25	0.02	4.00	1.33	0.20	0.09	0.06

Table 6 : Analysis of variance and mean squares for studied traits.

s.v	d.f	Doses	M.S							
			P.L cm	No.L/P	E.y/p gms	A.F.W gms	F.L cm	F.D cm	Th.F cm	T.y/p kgs
Repli.	2	0	6.25	0.30	0.002	1295.05*	1.21	0.05	0.035	0.070
		6	3.15	0.44	0.002	69.90	2.00	0.14	0.020	0.004
		12	13.28	0.30	0.0015	597.05	8.97	020	0.005	0.010
		18	8.01	8.94	0.00005	47.60	0.29	0.32	0.020	0.003
Geno.	9	0	500.14**	430.50**	0.014**	1185.63**	29.72**	1.47	0.067**	0.280**
		6	421.20**	392.83*	0.018**	2655.26**	20.94**	1.10	0.060**	0.356**
		12	152.02**	510.50**	0.007**	1155.28**	15.13**	1.41	0.076**	0.150**
		18	144.20**	520.61**	0.0008**	515.80**	16.24**	1.99	0.062**	0.080**
Error	18	0	13.39	5.78	0.0003	195.17	0.47	0.08	0.007	0.38
		6	16.27	5.06	0.0002	153.81	1.61	0.09	0.009	0.26
		12	7.06	4.34	0.0001	199.46	2.96	0.57	0.013	0.17
		18	6.08	5.23	0.0003	16.81	1.81	0.04	0.008	0.04

*** : significant at 5% level** **** : significant at 1% level**

Table 7 : combined analysis and mean squeres for studied traits.

S.V	d.f	M.S							
		p.L cm	**No.L/P**	**E.y/p**	**A.F.W gms**	**F.L cm**	**F.D cm**	**Th.F cm**	**T.y/pkgs**
Doses	3	626.97**	1628.39**	0.274**	36439.00	481.15**	5.32**	2.18	2.945
Doses x Repli	8	7.05	2.49	0.001**	502.40	3.11	0.17**	0.02	0.021
Geno.	9	1088.65**	1800.73**	0.041**	4404.17	74.27**	5.75**	0.21**	0771
Geno. x Dos.	27	42.97**	17.90**	0.144**	369.26	2.58	0.07*	1.02*	0.031
Error	72	10.77	1.31	0.0002	141.25	1.71	0.06	0.01	1.39

*** : significant at 5% level** **** : significant at 1% level**

The estimated amounts of heterosis from the mid-parents at 6kr. treatment ranged from 0.74% to 9.71% for (No. L/P) and (A.F.W gms) ,respectively . The results also showed that the calculated values of heterosis at 12kr. treatment ranged from 2.38% to 13.77% for (A.F.W gms) AND (Th.Fcm) ,respectively. The heterosis values calculated for 18kr.ranged from 1.87% to 22.66% for (F.Lcm) and (E.y/pgms) , respectively. Tthe highest value of heterosis was 22.66% for (E.y/ pgms) at 18kr.treatment .The values of heterosis measured from the better parent at 6kr. treatment ranged from -11.83% to –3.14% for (E.y/ pgms) and (p.l cm). respectively .on the other hand ,heterosis values determined for 12kr. tretment ranged from– 11.12% to– 0.95 %for (A.F.Wgms) and (p.L cm) respectively. Heterosis values at 18kr. ranged from –11.88% to 13.27 for (F.D cm) ,and (Th.Fcm) respectively. Many investigators found similar results among them ,(EL-Sharkawy (1993 ,(AbdEL-Rahman (2000) , EL-Mighawry et al (2000.) And AbdEL-Hadi et al (2001).

8

IV – Effects of Radiation on Genetic Variance and Heritability :

Genetic parameters were determined and the heritability values in both broad and narrow sense were calculated for traits and the results are presented in Table 9 .

The magnitudes of genetic parameters indicated that additive genetic variances were larger than those of the non–additive genetic variances at the control except for (No.L/P) and (E.Y/P gms), for 6 Kr. treatment except for (NO L/P) and (E.Y/P gms), and for 18 Kr. treatment except for (P.L cm). The estimated values of broad and narrow sense heritabilities indicated that the heritability values of broad sense were larger in magnitude than their corresponding narrow sense estimates for all studied traits at all doses except for (A.F.W gms) at 18 Kr.

Table 9 : Estimates of additive, non-additive genetic variances, heritability in broad sense and narrow sense.

Genetic Paramameters	Dose	P.L cm	No. L/P	E.Y/P gms	A.F.W gms	F.L cm	F.D cm	Th. cm	T.Y/P kgs
$\sigma^2 A$	0	44.92	18.32	0.0006	119.88	4.74	0.20	0.004	0.04
	6	10.80	8.64	0.0006	443.14	1.64	0.14	0.004	0.036
	12	3.14	42.16	0.0004	150.06	2.26	0.20	0.006	0.014
	18	0.10	35.84	0.0002	12.98	2.54	0.14	0.004	0.004
$\sigma^2 D$	0	4.08	31.04	0.0009	-59.69	0.12	-0.01	0.001	-0.003
	6	10.04	32.98	0.0009	-43.40	0.78	-0.02	0.0003	0.011
	12	2.45	18.88	0.0003	-51.09	-0.98	-0.18	-0.003	0.001
	18	2.22	21.44	0.0002	44.08	-0.38	0.02	0.001	0.002
h^2_b%	0	91.66	96.23	93.75	48.06	96.81	86.36	71.43	84.09
	6	79.36	96.10	93.75	88.63	81.76	80.00	58.90	95.92
	12	70.40	97.70	95.89	59.82	56.39	9.52	42.86	88.24
	18	53.33	97.05	80.00	91.15	78.26	94.12	62.50	85.71
h^2_n %	0	84.03	35.72	43.75	95.73	94.42	90.91	57.14	90.91
	6	41.13	19.95	43.75	98.26	55.41	93.33	54.79	73.47
	12	39.55	67.47	54.79	90.69	99.59	95.24	85.71	82.35
	18	2.30	60.73	40.00	20.73	92.03	82.35	50.00	57.14

The estimated values of heritability in broad sense ranged from 9.52% (F.D.cm) to 97.70% (No.L/P) at 12 Kr. treatment. Heritability values ranged from 79.36% for (P.L cm) to 96.10 (No.L/P) at 6 Kr. treatment, ranged from 9.52% (F.d cm) to 97.70% at 12 Kr. and ranged from 53.33% (P.L cm) to (97.05) at 18 Kr.treatment.

On the other hand, the estimated values of heritability in narrow sense showed that the highest value was 99.56% for (F.L cm) at 12 Kr. treatment, while the lowest value was 2.30% (P.L cm) at 18 Kr. teatment. These results were in agreement with the results obtained by EL-Adl *et al.* (1996) and EL-Mighawry *et al.* (2001)

V- Effect of Radiation on Genotypic and Phenotypic Correlations :

The knowledge of degree and direction of association among different traits of snake cucumber is of great importance. Genotypic and phenotypic correlation coefficients provide a measure of this type of association between traits which may be used as a useful indicator in selection programs. The results are presented in Table 10a , 10b.

The results showed that the magnitudes of the genotypic correlation were almost similar or very close to the corresponding phenotypic correlations. These results were expected since the magnitudes of error covariances in the analysis of covariances were small if compared with the covariances of genotypes. The results appeared that the highest values of phenotypic correlations were obtained for (No.L/P x T.Y/P kgs), (E.Y/P gms x T.Y/P kgs) and (A.F.W gms x T.Y/P kgs). The highest values of genotypic correlation was obtained for (No.L/P x T.Y/P kgs) (0.90). The results cleared a highly significant values for genotypic and phenotypic correlations for (No.L/P x E.y/P gms), (A.F.W gms) and (T.Y/P kgs) and (E.Y/P gms x A.F.W gms, F.D cm and T.Y/p kgs) and (A.F.W gms x T.Y/P kgs). The highest values of genotypic and phenotypic correlations were recorded for (No.L/P x T.Y/P kgs) and (A.F.W gms x T.Y/P kgs) were 1.00 . The results also indicated that the dose of 6 Kr. treatment caused an increasing of genotypic and phenotypic correlations for all studied traits.

The results of this study declared that all studied traits showed positive genotypic and phenotypic correlation coefficients between each other. The results also illustrated that the high dose of 18 Kr. of gamma-rays reduced the linkage among studied traits . These results were in agreement with the results obtained by Kosba et al (1993) , EL-Sharkawy (1993) , Abd EL-Hadi et al (2001) who stated that selection for one trait could improve the other correlated trait at the same time.

Table 10a : Phenotypic correlation among some traits.

Traits	Doses	No.L/P	E.Y/P gms	A.F.W gms	F.L cm	F.D cm	Th.F cm	T.Y/P kgs
No.L/P	0		0.85**	0.71*	0.09	0.15	0.13	0.92**
	6		0.94**	0.82**	0.19	0.29	0.11	1.00**
	12		0.73*	0.61	0.02	0.09	0.05	0.84**
	18		0.53	0.50	0.009	0.04	0.02	0.69*
E.Y/P gms	0			0.71*	0.45	0.72*	0.38	0.87**
	6			0.80**	0.52	0.82**	0.48	0.98**
	12			0.60	0.20	0.59	.19	0.77**
	18			0.50	0.09	0.48	0.09	0.63
A.F.W gms	0				0.39	0.55	0.30	0.86**
	6				0.43	0.66*	0.42	0.95**
	12				0.30	0.42	0.21	0.77**
	18				0.18	0.34	0.09	0.53
F.L cm	0					0.68*	0.20	0.43
	6					0.76**	0.13	0.54
	12					0.56	0.08	0.31
	18					0.39	0.01	0.24
F.D cm	0						0.40	0.30
	6						0.50	0.40
	12						0.28	0.25
	18						0.16	0.18
Th.F cm	0							0.38
	6							0.48
	12							0.29
	18							0.19
T.Y/P kgs	0							
	6							
	12							
	18							

*** : significant at 5% level . ** : significant at 1% level.**

Table 10b : Genotypic correlation among some traits.

Traits	Doses	No.L/P	E.Y/P gms	A.F.W gms	F.L cm	F.D cm	Th.F cm	T.Y/P kgs
No.L/P	0		0.76*	0.78**	0.08	0.13	0.12	0.89**
	6		0.85**	0.88**	0.14	0.22	0.10	0.97**
	12		0.66*	0.69*	0.02	0.07	0.05	0.79**
	18		0.51	0.54	0.008	0.03	0.01	0.56
E.Y/P gms	0			0.77**	0.43	0.74*	0.33	0.85**
	6			0.83**	0.49	0.86**	0.44	0.95**
	12			0.66*	0.22	0.61*	0.13	0.77**
	18			0.54	0.12	0.49	0.02	0.60
A.F.W gms	0				0.37	0.53	0.33	0.94**
	6				0.42	0.62	0.45	1.00**
	12				0.30	0.40	0.27	0.81**
	18				0.21	0.33	0.13	0.58
F.L cm	0					0.60	0.19	0.40
	6					0.60	0.12	0.48
	12					0.50	0.05	0.30
	18					0.39	0.009	0.21
F.D cm	0						0.37	0.29
	6						0.46	0.36
	12						0.22	0.22
	18						0.13	0.15
Th.F cm	0							0.33
	6							0.45
	12							0.25
	18							0.16
T.Y/P kgs	0							
	6							
	12							
	18							

*** : significant at 5% level . ** : significant at 1% level.**

The results showed that the magnitudes of the genotypic correlation were almost similar or very close to the corresponding phenotypic correlations. These results were expected since the magnitudes of error covariances in the analysis of covariances were small if compared with the covariances of genotypes. The results appeared that the highest values of phenotypic correlations were obtained for (No.L/P x T.Y/P kgs), (E.Y/P gms x T.Y/P kgs) and (A.F.W gms x T.Y/P kgs). The highest values of genotypic correlation was obtained for (No.L/P x T.Y/P kgs) (0.90). The results cleared a highly significant values for genotypic and phenotypic correlations for (No.L/P x E.y/P gms), (A.F.W gms) and (T.Y/P kgs) and (E.Y/P gms x A.F.W gms, F.D cm and T.Y/p kgs) and (A.F.W gms x T.Y/P kgs). The highest values of genotypic and phenotypic correlations were recorded for (No.L/P x T.Y/P kgs) and (A.F.W gms x T.Y/P kgs) were 1.00 . The results also indicated that the dose of 6 Kr. treatment caused an increasing of genotypic and phenotypic correlations for all studied traits.

The results of this study declared that all studied traits showed positive genotypic and phenotypic correlation coefficients between each other. The results also illustrated that the high dose of 18 Kr. of gamma-rays reduced the linkage among studied traits . These results were in agreement with the results obtained by Kosba et al (1993) , EL-Sharkawy (1993) , Abd EL-Hadi et al (2001) who stated that selection for one trait could improve the other correlated trait at the same time.

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تأثير الإشعاع على توارث الصفات الإقتصادية فى القثاء

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تم تنفيذ هذا البحث لدراسة تأثير الجرعات المختلفة من أشعة جاما على القثاء ، وفى نفس الوقت تم دراسة إمكانية استحداث التباين والقياسات الوراثية بالإضافة إلى الإرتباط بين الصفات.
تم استخدام أربعة أصناف من القثاء وأجرى التهجين بينهم طبقاً لنظام التهجين فى اتجاه واحد وتم تعريضها جميعاً لأربع مستويات من أشعة جاما : صفر ، ٦ ، ١٢ ، ١٨ كيلورونتجين. حساسية هذه التركيبات الوراثية للإشعاع تم قياسها فى الصفات الآتية :
طول النبات بالسم — عدد الأوراق — التبكير وزن بالجرامات - متوسط وزن الثمرة بالجرامات سمك اللحم بالسم — طول الثمرة بالسم — قطر الثمرة بالسم — المحصول الكلى للنبات بالكيلوجرامات وقد أظهرت النتائج أن المعاملة ٦ كيلورونتجين كانت هى الأفضل لجميع الصفات التى درست وبالنسبة لقوة الهجين والقياسات الوراثية ومعامل التوريث أظهرت المعاملة ٦ كيلورونتجين أيضاً أفضل النتائج وأوضحت النتائج أيضاً أن قيم معامل الارتباط بين الصفات التى درست كانت موجبة وبالتالى فإن الانتخاب لإحدى الصفات سوف يتبعه بالضرورة انتخاب للصفات الأخرى

Table 8 : Means, ranges (of the four parents and their F_1 hybrids) and heterosis from mid and better parents for all traits .

	Dose	P . L Cms	No.L/ P	E. Y/ P gms	A.F. W gms	F . L Cm	F . D Cm	Th . F Cm	T.Y/ P Kgs
M (P)	0	178.03	167.09	0.438	228.96	33.83	5.95	1.65	1.70
	6	188.16	177.92	0.515	250.42	35.21	5.99	1.80	1.93
	12	169.45	160.33	0.345	210.24	30.53	5.52	1.38	1.48
	18	157.65	154.67	0.278	178.78	26.69	4.95	1.08	1.19
Range	0	163.13 – 194.65	154.67 – 185.33	0.349 – 0.501	201.35 – 261.21	30.69 - 38.87	5.02 – 6.81	1.48 – 1.91	1.36 - 2.01
	6	169.80 –205.02	164.67 – 193.67	0.406 – 0.617	219.98 – 285.43	32.76 – 39.34	5.10 – 6.71	1.62 – 2.05	1.55 – 2.33
	12	158.99 – 179.04	145.00 – 179.33	0.298 – 0.408	184.28 – 242.18	27.73 – 34.06	4.59 – 6.37	1.29 – 1.43	1.22 – 1.73
	18	144.44 – 166.00	138.33 – 173.33	0.223 – 0.338	165.79 - 195.04	23.68- 29.91	3.53 - 6.06	0.98 - 1.13	1.05 - 1.34
M(F_1)	0	193.59	171.11	0.471	240.47	35.24	6.17	1.70	1.88
	6	198.59	176.61	0.544	274.74	36.44	6.09	1.84	2.08
	12	177.34	167.44	0.382	215.24	31.77	5.74	1.57	1.61
	18	164.36	163.33	0.314	185.33	27.19	5.34	1.28	1.37
Range	0	178.77 – 205.57	158.33 – 188.33	0.376 – 0.569	220.41 – 263.60	32.04 –39.51	5.42 – 6.73	1.53 – 1.84	1.52 – 2.41
	6	188.54 – 212.35	163.66 – 193.67	0.448 – 0.632	242.64 – 312.57	33.47 – 40.61	5.44 – 6.61	1.66 – 1.94	1.67 – 2.52
	12	170.05 – 182.67	152.67 – 183.33	0.310 – 0.417	196.09 – 242.40	29.28 – 34.04	5.00 – 6.31	1.42 – 1.70	1.37 – 1.85
	18	158.96 – 168.90	149.33 – 179.33	0.290 – 0.382	170.25 – 204.15	24.47 – 29.92	4.57 – 5.88	1.12 – 1.46	1.22 – 1.53
H(MP)%	0	8.74 **	2.41 **	7.53 **	5.03 *	4.17 **	3.70 *	3.03	10.59 **
	6	5.54 **	0.74	5.63 **	9.71 **	3.49 **	1.67	2.22	7.77 **
	12	4.66 **	4.43 **	10.72 **	2.38	4.06	3.99	13.77 **	8.78 **
	18	4.26 **	5.60 **	22.66 **	3.66 **	1.87	7.88 **	18.52 **	15.13 **
H(BP)%	0	- 0.54	- 7.67	- 5.99	- 7.94	- 9.34	- 9.40	- 10.99	- 6.47
	6	- 3.14	- 8.81	- 11.83	- 3.75	- 7.37	- 9.24	- 10.24	- 10.73
	12	- 0.95	- 6.63	- 6.37	- 11.12	- 6.72	- 9.89	9.79 **	- 6.94
	18	- 0.99	- 5.77	0.89	- 4.08	- 9.09	- 11.88	13.27 **	2.24

*** :significant at 5% level** **** :significant at 1% level**