The Genetic Divergence among Pumpkin Segregates (*Cucurbita moschata*) For Some Economic Traits

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ABSTRACT

Pumpkin (*Cucurbita moschata*) is considered an alternative food source required nowadays to fill in the gap of domestic and international demand among developing countries. It is a staple all-purpose edible plant with high nutritional value and low calories urgently needed for therapeutic nutritional patients. Therefore, this study was conducted to investigate the genetic divergence of two newly introduced F_1 pumpkin hybrids under Egyptian climate conditions. Two generations of self-pollination took place to investigate some economic traits during 2019, 2020, 2021, 2022 growing seasons. Results showed that, vegetative traits and flowering dates were negatively affected by the two generations as their means decreased. Also, Fruit yield /plant (g) and number of fruits /plant traits were negatively affected. Fruit characteristics under study, except for fruit moisture content, were affected by selfing. Data of genetic parameters, phenotypic and genotypic coefficient of variations as well as heritability values, showed that; total fruit yield/plant (g) and average fruit weight (g) were significantly affected by the environmental factors, so, selection for these two traits would be difficult. Data clearly detected that; self-pollination in pumpkins for two successive generations revealed inbreeding depression (ID) for some economic traits such as; fruit yield/plant (g) and average fruit weight (g). Yet, correlation results confirmed that; the fruit yield /plant (g) trait was positively correlated with each of; plant length (m), number of nodes/plant, days to the first female flower, sex ratio, number of fruits/plant, and average fruit weight (g).

Keywords: Pumpkin, heritability, inbreeding depression, correlation.

INTRODUCTION

Pumpkin is an annual cucurbit vegetable, family *Cucurbitaceae*, grown all over the world and widely consumed (Jun *et al.*, 2006). Egyptian demand has been increased over the years due to its use; as food, fodder and for oil production. Pumpkin oil demand has been increased in Egypt due to its health benefits and pharmaceutical use in cosmetic industries too (Gomaa *et al.*, 2019). It has high carotenoids, pectin, polysaccharides, minerals, vitamins, flavonoids and phenolic acids (Zhou *et al.*, 2017). It is known to lower cholesterol levels, as well as coronary heart disease risk and hypertension (Hussain *et al.*, 2010). Fruits are used to produce jams, juices, pickles, soups, deserts and also consumed as dried fruits (Provesi *et al.*, 2012 and Assous *et al.*, 2014). It is a staple food due to its high content of carbohydrates and dietary fibers. Its high vitamin B content as well as antioxidants; has a role in reducing certain cancer risks and provide protection against heart diseases, asthma, obesity, diabetes and help in maintaining healthy hair and skin (Akkawi, 2018). Seeds are consumed worldwide as a snack (Cascio, 2007), they can be eaten whole, roasted, or toasted, as a good source of pharmacological ingredients for diabetic patients (Li *et al*., 2003), antifungal (Wang and Ng, 2003), antibacterial and anti-inflammatory agent (Fu *et al*., 2006 and Nkosi *et al*., 2006). Also, it can help in benign prostatic hyperplasia treatment (Dvorkin and Song, 2002).

Pumpkin Egyptian yield production has been increasing steadily over the years due to; improved farming practices, better irrigation methods and high-quality seeds. Exporting value of pumpkins from Egypt increased from 4 million USD in 2014 to 8 million USD in 2018 (El-Sayed and Abdel-Gawad, 2019). Egyptian pumpkin yield was increased from 12.8 to 18.5 tons/ha from 2000 to 2015 (Abdel-Maksoud *et al.*, 2018). In 2021, the Egyptian Ministry of Agriculture and Land Reclamation stated that, pumpkin yield was 30.50 ton/ha with production of 4361.5 ton and areas 143 hectare (Agriculture Statistics, 2021).

Commonly, pumpkin shows a wide range of variability in yield and yield contributing components. Studying the genetic differences in pumpkin is of great importance to understand the flow within its species, currently specific information is available for the morphological characteristics, disease resistance, production potential, and vulnerability to environmental factors, which enabled plant breeders to develop new varieties with more production and adaptable to the surrounding environment (Hosen *et al.*, 2021). Learning inbreeding mechanism in natural populations is a major rule in understanding evolutionary biology (Troianou *et al.,* 2018). To avoid the negative effects of inbreeding depression, breeders followed various strategies, as

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introducing new genetic material from diverse sources, which helps restore the genetic diversity and improve the overall health and performance of the pumpkin population. Furthermore breeders carefully managed breeding programs and select for desirable traits to minimize the inbreeding depression effect and develop healthier and more robust pumpkin varieties (Kinghorn and Kinghorn, 2023).

Therefore, this research was designed to study the genetic divergence among pumpkin segregates for some economic traits during inbreeding generations. Moreover, studying some genetic parameters as; genotypic and phenotypic variations as well as their correlation coefficient among each of the studied characters as a step to develop the best suitable and most efficient breeding program.

MATERIAL AND METHODS

This study was carried out at El-Sabaheya Horticulture Research Station (SHRS), Cross-pollinated Vegetables Research Dept. in collaboration with Medicinal and Aromatic Plants Research Dept., Horticulture Research Institute (HRI) – Agriculture Research Center (ARC), Alexandria, Egypt, during seasons of 2019, 2020, 2021 and 2022.

Genetic Material:

Genetic material was kindly provided by Anhui Jianghuai Horticulture Seeds Co., LTD, China. Two hybrids of pumpkin, newly introduced to the Egyptian lands, were involved in this study: **JY Big Baby (JY-BB)** described as high quality type, dark peeled, flat round shape, 2000 g average fruit weight with excellent quality and high yield. **Small Baby –Chestnut (SB-C)** described as mildew disease resistant type, dark peeled, with vigorous growth and average fruit weight of 550 g.

Experimental Procedure:

The study was carried out along consecutive seasons of 2019, 2020, 2021 and 2022 using two F_1 pumpkin hybrids. The original population seeds (F_1) of the two imported pumpkin hybrids were sown in greenhouse, at first of April 2019 in foam trays. The growing seedlings were transplanted after 21 days for sowing on loamy sand ridges; 150 cm width and 75cm between hills. Normal agriculture practices took place as recommended for commercial pumpkin production in this area. At flowering stage, female flowers were self-pollinated, covered and labeled. At fruit maturity stage, fruits were harvested, and seeds were extracted to get the first segregated generation (SG_1) seeds. SG_1 seeds were planted in the green house at April 2020, with the same cultivation protocol used above (with F_1). Self-pollination was carried out again, to get the second segregated generation (SG_2) seeds. The original population (F_1), SG_1 and SG_2 were planted in two successive summer seasons of 2021 and 2022 for evaluation.

Measurements and Quality Attributes:

A random sample of nine plants from each of the three generations (F_1, SG_1 and SG_2) per plot was selected and tagged for determination of the vegetative traits as; plant length (m), number of nodes/plant, flowering dates; days to first female flower, days to first male flower and sex-ratio. Determination of yield component traits as; total fruit yield/plant (g), number of fruits/plant and average fruit weight/plant (g). For seeds measurements; 100 seeds weight (g) and total seeds yield (g) /fruit. For fruit characteristics the following traits were considered; days to first fruit harvest, fruit shape index as determined by Winiger and Ludwing (1974), fruit peel color, rated from 1-10 where 1, denote green peel color, and 10 denotes dark green peel color (Zoe *et al*., 2011), fruit ripping as described by Kiramana and Isutsa (2017), fruit flesh thickness (%), calculated as a ratio between fruit flesh thickness to fruit diameter. Fruit quality traits included; β- carotene content (mg /100gm fresh weight) as described by Nakdiman and Gabelman (1971), Vitamin C content (mg / 100ml juice) as illustrated by Jacob (1951) and moisture content (%) was calculated according to Ikewuchi and Ikewuchi (2011).

Experimental Layout and Genetic Parameters:

The experimental layout was designed as a randomized complete blocks design (RCBD) with three replicates. The data of the two evaluating seasons were combined together. The collected data were statistically analyzed using the analysis of variance method (ANOVA). Comparisons among the means of the evaluated genotypes i.e. F_1, SG_1 and SG_2 were carried out using Duncan's multiple range test at $p \leq 0.05$ level of probability as explained by Snedecor and Cochran (1980) using Co-Stat 6.4 software program.

Phenotypic and Genotypic Coefficient of Variations (P.C.V and G.C.V) were calculated according to the following equations as mentioned by Burton (1952):

$$P.C.V = (\sqrt{\delta^2_p} / x^-) \times 100 \qquad G.C.V = (\sqrt{\delta^2_G} / x^-) \times 100$$

where; δ^2_p : stands for phenotypic variance and δ^2_G stands for genotypic variance. x^- : general mean of each studied character.

Heritability Percentage (%) was calculated according to Fageria (2001), as:

$$H^2bs = (\delta^2_G/\delta^2_p) \times 100$$

where: δ^2_G : is the genetic variance and δ^2_p : is the phenotypic variance.

Inbreeding depression (ID) was calculated and expressed as a percentage according to Mather and Jinks (1971).

Simple Correlation Coefficient (r) was performed for different pairs of the studied characters as illustrated by Dospekhove (1984).

RESULTS AND DISCUSSION

The study was conducted using two F_1 pumpkin hybrids **JY Big Baby (JY-BB)** and **Small Baby - Chestnut (SB-C)**. F_1, SG_1 and SG_2 seeds were produced after two generations of self-pollination as stated earlier. The produced genotypes were planted again in two successive growing seasons for evaluation (2021 and 2022).

Mean Squares Variances for Vegetative Traits, Flowering Dates and Sex-Ratio:

The analysis of variance data presented in Table (1) showed highly significant differences for plant length and number of nodes/plant traits regarding JY-BB, SB-C and their segregated generations. These results clearly showed that, there are highly variations among the evaluated genotypes (F_1, SG_1, SG_2) of both JY-BB and SC-B. The other tested characters did not show any significant differences among the evaluated genotypes (Table 1).

Mean Squares Variances for the Yield Traits and Seed Measurements:

Analysis of variance in Table (2), showed significant and highly significant differences among the tested traits of total fruit yield/plant, 100 seed weight (g) and total seed weight (g)/ fruit regarding JY-BB generations. As for SB-C generations, number of fruits/plant and total seed weight (g)/plant traits, showed the significant and highly significant differences.

Mean Squares Variances for Fruit Characteristics:

Data of the analysis of variance for fruit characteristics are shown in Table (3). Most of the studied characteristics regarding JY-BB genotypes showed significant and highly significant differences among the testes generations (F_1, SG_1, SG_2), except for fruit peel color, fruit ripping and moisture content traits.

Table 1. Mean squares of ANOVA for the vegetative traits, flowering dates and sex-ratio of JY-BB and SB-C hybrids (F_1) and its segregated generations (SG_1 and SG_2)

S.O.V	d.f.	Vegetative traits		Flowering dates		Sex- ratio (%)
		Plant length (m)	No. of nodes/plant	Days to first female flower	Days to first male flower	
JY Big Baby (JY-BB)						
Blocks	2	0.131	2.012	22.229	0.159	43.73
Generation	2	11.175**	387.313**	2.249	5.417	48.557
Error	4	0.046	8.017	4.199	0.902	45.383
Small Baby –Chestnut (SB-C)						
Blocks	2	0.384	20.058*	5.083	3.195	12.49
Generation	2	8.453**	78.58**	3.725	6.299	41.62
Error	4	0.218	1.749	4.418	1.233	66.41

* and ** denote significant and highly significant at 5% and 1% levels of probability, respectively.

Table 2. Mean squares of ANOVA for yield and seed measurements of JY-BB and SB-C genotypes (F_1) and its segregated generations (SG_1 and SG_2)

S.O.V	d.f.	Yield traits			Seed measurements	
		Total fruit yield/ plant (g)	No. of fruits/ plant	Average fruit weight (g)	100 seed weight (g)	Total seed weight (g)/fruit
JY Big Baby (JY-BB)						
Blocks	2	1463906.3**	1.345*	31397.01	196.57**	113.54**
Generation	2	899996.4**	0.534	16696.14	38.57*	36.163*
Error	4	34611.2	0.088	13936.22	4.98	3.14
Small Baby –Chestnut (SB-C)						
Blocks	2	6933.33	0.257	50.122	1.935	1.918
Generation	2	70159.73	1.33*	8.607	3.763	31.566**
Error	4	29898.45	0.093	1679.21	3.504	1.599

* and ** denote significant and highly significant at 5% and 1% levels of probability, respectively.

Table 3. Mean squares of ANOVA for the fruit characteristics of JY-BB and SB-C genotypes (F_1) and its segregated generations (SG_1 and SG_2)

S.O.V	d.f.	Days to first fruit harvest	Fruit shape index	Fruit peel color	Fruit ripping	Flesh thickness (%)	β-carotene (mg /100g fw)	Vitamin C (mg / 100ml juice)	Moisture content (%)
JY Big Baby (JY-BB)									
Blocks	2	39.16	0.001	0.039	0.05	0.047	8980.28	14.78	0.679*
Generation	2	141.10*	0.020*	0.206	0.05	3.820**	826748.21**	48.44*	0.013
Error	4	19.42	0.003	0.089	0.05	0.190	19682.20	9.78	0.042
Small Baby –Chestnut (SB-C)									
Blocks	2	5.65	8.44	0.150**	0.28*	0.840*	8347.59	6.33	0.31
Generation	2	82.64	0.01	1.500**	0.89**	0.042*	8960200.20**	7.00	0.05
Error	4	17.36	0.01	0.003	0.02	0.006	204710.70	5.33	0.20

* and ** denote significant and highly significant at 5% and 1% levels of probability, respectively.

As for SB-C generations, data in Table (3) showed that, there were significant and highly significant differences among the evaluated generations (F_1, SG_1, SG_2) for the characters fruit peel color, fruit ripping, flesh thickness and β-carotene (mg/100g fw).

Mean Performances of the Vegetative Traits, Flowering Dates and Sex Ratio:

Results illustrated in Table (4) are the averages of the studied vegetative traits, flowering dates and sex-ratio traits as affected by pumpkin genotypes. Results showed significant ($p\leq0.05$) effect on most studied characters regarding JY-BB and SB-C (**F_1**) and their segregated generation (SG_1 and SG_2) except for days to first female flower and sex ratio traits. In general, it could be mentioned that, a clear decline in most studied traits mean values has occurred among the tested generations where F_1 genotypes scored the highest mean values, followed with SG_1 and SG_2 genotypes. This decrease in the mean values of the traits can be attributed to the inbreeding depression.

Mean Performances of the Yield, Yield Contributing Components and Seed Measurement Traits:

Data shown in Table (5) indicated that most studied traits were significantly affected ($P\leq0.05$) by the tested genotypes of both JY-BB and SB-C pumpkin. Recorded data, generally cleared that, F_1 gave the highest mean value for most studied traits (Table 5), on the other hand, the SG_2 possessed the lowest mean values regarding most of the studied characters. This decrease in the average values of these traits can be attributed to the self -pollination that was applied for two successive generations, which led to the occurrence of inbreeding depression phenomenon. Average fruit weight (g) character didn’t significantly get affected by the different pumpkin generations.

Mean Performances of the Fruit Characteristics:

Results presented in Table (6) showed that, there were significant differences among the tested genotypes of JY-BB genotype regarding; days to fruit harvest, fruit shape index, flesh thickness, β-carotene (mg/100 fw) and vitamin C (mg/100ml juice). On the other side, the tested genotypes (F_1, SG_1, SG_2) of SB-C genotype showed significant differences regarding, days to first fruit harvest, fruit peel color, fruit ripping, flesh thickness and β- carotene.

Genetic Parameters:

Phenotypic and Genotypic Coefficient of Variation:

Table (7) showed the phenotypic and genotypic coefficient of variation (P.C.V % and G.C.V %) for JY-BB and SB-C. As for the vegetative traits, P.C.V (%) and G.C.V values (%) were nearly equal in JY-BB and SB-C genotypes, indicating that those characters were not affected significantly by the environmental factors. P.C.V and G.C.V values showed low values for days to first female flower in JY-BB genotype. With respect to days to first male flower trait, data showed that, values of P.C.V and G.C.V were low regarding JY-BB and SB-C genotypes. As results revealed, the environmental effect could be neglected. Table (7) clearly showed that the environmental effects had a great effect on sex ratio trait where the differences between P.C.V and G.C.V were large. Same trend of results were also detected for total fruit yield/plant (g) and average fruit weight (g) where the values of P.C.V and G.C.V showed that these traits were greatly affected by the environmental conditions. It could be concluded that selection for these two previous characters could be difficult.

Table 4. Mean performance of JY-BB and SB-C populations (F_1) and their segregated generations (SG_1 and SG_2) for vegetative traits, flowering dates and sex-ratio

	Vegetative traits				Flowering dates				Sex-ratio %	
	Plant length (m)		No. of nodes/plant		Days to first female flower		Days to first male flower			
Generation	**JY-BB**	**SB-C**	**JY-BB**	**SB-C**	**JY-BB**	**SB-C**	**JY-BB**	**SB-C**	**JY-BB**	**SB-C**
F_1	9.08a	6.62a	55.22a	44.00a	36.78a	40.44a	29.67b	30.22b	63.22a	63.61a
SG_1	6.77b	4.89b	40.00b	40.33b	38.00a	40.00a	32.22a	31.89ab	55.46a	60.89a
SG_2	5.25c	3.26c	33.00c	33.89c	36.33a	38.33a	30.22ab	33.11a	61.17a	56.25a

Means having letter in common do not significantly differ, using Duncan's multiple range test at p= 0.05 level of significance

Table 5. Mean performance of JY-BB and SB-C populations (F_1) and their segregated generations (SG_1 and SG_2) for yield and seed measurements

	Yield traits						Seed measurements			
	Total fruit yield/ plant (g)		No. of fruits/plant		Average fruit weight (g)		100 seed weight (g)		Total seed weight (g)/fruit	
Generation	**JY-BB**	**SB-C**	**JY-BB**	**SB-C**	**JY-BB**	**SB-C**	**JY-BB**	**SB-C**	**JY-BB**	**SB-C**
F_1	5640.77a	1312.22a	5.00a	6.11a	1125.75a	218.46a	35.47a	76.44b	43.82a	3.09a
SG_1	4695.30b	1147.78a	4.89ab	5.44ab	1002.50a	215.59a	33.49ab	86.89a	45.23a	2.85b
SG_2	4688.89b	1006.66a	4.22b	4.77b	1137.04a	215.46a	28.51b	82.55ab	38.64a	2.93ab

Means having letter in common do not significantly differ, using Duncan's multiple range test at p= 0.05 level of significance

Table 6. Mean performance of JY-BB and SB-C populations (F_1) and their segregated generations (SG_1 and SG_2) for fruit characteristics

	Days to first fruit harvest		Fruit shape index		Fruit peel color		Fruit ripping		Flesh thickness (%)		β-Carotene (mg /100g fw)		Vitamin C (mg / 100ml juice)		Moisture content (%)	
Generation	**JY-BB**	**SB-C**	**JY-BB**	**SB-C**	**JY-BB**	**SB-C**	**JY-BB**	**SB-C**	**JY-BB**	**SB-C**	**JY-BB**	**SB-C**	**JY-BB**	**SB-C**	**JY-BB**	**SB-C**
F_1	65.00ab	76.44b	0.73b	0.876a	8.77a	9.66a	4.55a	4.82a	6.02a	3.09a	8958.57a	19015.49a	44.00b	30.00a	89.69a	87.97a
SG_1	74.77a	86.89a	0.90a	0.790a	8.39a	8.44b	4.33a	3.89b	3.82b	2.85b	7910.54c	18172.87a	47.33ab	29.00a	89.77a	87.79a
SG_2	61.55b	82.55ab	0.79ab	0.786a	8.89a	8.44b	4.55a	3.89b	4.49b	2.93ab	8380.13b	15691.13b	52.00a	32.00a	89.64a	87.47a

Means having letter in common do not significantly differ, using Duncan's multiple range test at p= 0.05 level of significance

Table 7. Genetic parameters for JY-BB and SB-C hybrids and their segregated generations: phenotypic and genotypic coefficient of variation (P.C.V and G.C.V), broad sense heritability (h^2bs) and Inbreeding depression (ID)

Traits big	PCV		GCV		h^2bs %		Inbreeding depression (ID)	
	JY-BB	SB-C	JY-BB	SB-C	JY-BB	SB-C	JY-BB	SB-C
Vegetative traits								
Plant length (m)	27.421	34.617	27.251	33.294	98.766	92.503	42.18062	50.75529
No. of nodes/ plant	27.330	11.699	26.515	11.208	94.125	91.772	40.239044	22.97727
Flowering dates								
Days to first Female flower	8.897	5.574	6.968	1.699	61.332	9.294	1.223491	5.217606
Days to first male flower	5.307	4.384	4.312	3.205	66.022	53.425	-1.853724	-9.563203
Sex-ratio %	11.433	14.48	2.116	5.172	3.424	12.757	3.242645	11.57051
Yield traits								
Total fruit yield/ plant (g)	4.712	19.538	2.899	12.563	37.847	41.346	16.875001	23.28573
No. of fruits/ plant	14.193	12.33	12.714	10.985	80.254	79.364	15.6	21.93126
Average fruit weight (g)	12.609	19.005	6.431	1.718	26.015	0.817	-1.002887	1.3732491
Seed measurements								
100 seed weight	23.365	10.458	22.333	4.025	91.361	14.814	19.622216	9.7305389
Total seed weight (g) /fruit	12.637	15.414	11.931	14.301	89.147	86.073	11.821086	15.855235
Fruit characteristics								
Days to first fruit harvest	10.889	8.003	8.686	6.181	63.635	59.651	5.307692	-7.993197
Fruit shape index	12.442	205.408	10.512	205.08	71.382	99.681	-7.9235	10.27397
Fruit peel color	4.379	7.581	2.717	7.556	38.479	99.334	-1.3683	12.6294
Fruit ripping	5.073	11.267	0	10.753	0	91.085	0	19.29461
Flesh thickness (%)	25.236	17.624	23.457	17.428	86.401	97.794	25.41528	5.177994
β-carotene (mg/ 100 g fw)	6.423	10.131	6.203	9.8	93.266	93.58	6.4568341	17.482379
Vitamin C (mg/100ml juice)	9.591	7.769	7.012	1.558	53.441	4.022	-18.18182	-6.666667
Moisture content (%)	0.573	0.611	0.525	0.336	84.089	30.289	0.0557476	0.5683756

Data in Table (7) showed that selection for number of fruits/plant trait could be some how effective where the differences between P.C.V and G.C.V were low. As for seed measurements, data showed that, the environmental factors had low effect on; 100 seed weight and total seed weight /fruit regarding JY-BB and SB-C genotypes, except for 100 seed weight trait for SB-C genotype. As for fruit characters, there was a large variation among characteristics in terms of their influence on the environmental factors. The two tested genotypes JY-BB and SC-B differed between themselves regarding the studied fruit characteristics in the extent to which they affect by the environmental conditions (Table7).

Generally it could be concluded according to the P.C.V and G.C.V values that, the selection could be effective for; day to first fruit harvest, fruit shape index, fruit peel color, flesh thickness and β-carotene traits.

Phenotypic variation is always obvious in fruit shape, weight, color, quality, flesh thickness as well as seed characters (Hernandez *et al.,* 2005). So it's always more easier to distinguish between new introduced breeds by phenotypic characters (Paris, 2000).

Broad-Sense Heritability Estimates (h^2b) and Inbreeding Depression (ID):

Vegetative traits data in Table (7) showed that, plant length and number of nodes/plant possessed high heritability values (more than 66.66%) indicating that, the selection response for these traits would be fast. Same trend of results were noticed for days to first flower regarding JY-BB genotype. The other studied traits i.e. sex-ratio and days to first female flower (for SB-C genotype) gave low heritability estimates (less than 33.33%) indicating that, the selection response would be slow. Days to first male flower regarding SB-C genotype gave moderate heritability value ($33.33\%>h^2b< 66.66\%$). Results illustrated that, inbreeding depression had occurred regarding self-pollination. However earliness traits, which are important in pumpkin plants, with positive signed inbreeding depression results were recorded for both hybrids in the second generation compared to the main population. This indicates that, the second generation exhibited earliness and provides a promising indication for future results in inbreeding and selection programs. However, for days to first fruit harvest trait, positive results were recorded only for JY-BB, indicating that the inbreeding depression resulted in delayed fruit harvest in SB-C. This is a setback for the breeder, as days to first fruit harvest is an important trait. Both hybrids showed depression in days to first male flower, indicating that the inbreeding program resulted in a delay in male flower emergence.

Yield traits data (Table 7) showed that, heritability estimates ranged from high (more than 66.66%) for number of fruits/plants, moderate values ($33.33\%>h^2b< 66.66\%$). For total fruit yield/plant (g) to low values (less than 33.33%) for average fruit weight (g). The previous results illustrated that; selection for number of fruits/plant trait could be highly effective. Vice versa, selection for average fruit weight trait would not be effective.

Broad sense heritability data regarding seed measurements traits were represented in Table (7). Generally heritability estimates showed high values (more than 66.66%) for the studied seed measurements traits, except for 100 seed weight for SB-C genotype. These high heritability values revealed that, the environmental factors had low effect on such characters, and then selection could be highly effective. This result could be attributed to the occurrence of inbreeding depression as shown in Table (7).

Heritability estimates for fruit characteristics, showed a clear and definite trend for a number of traits (fruit shape index, flesh thickness %) and β-carotene where these traits gave high values of heritability (more than 66.66%). This result illustrated that's selection for such characteristics could be highly effective. Days to first fruit harvest trait possessed moderate heritability values. This result obviously showed that, selection of this trait could be effective. A number of other studied fruit characteristics gave a wide range of heritability values as a result of the different evaluated genotypes (JY-BB and SB-C). Values of the inbreeding depression parameters regarding fruit characteristics confirmed the previous results.

Positive inbreeding depression (ID) results were recorded for traits such as plant height, number of nodes/plant, sex-ratio, total fruit yield/plant, number of fruits/plant, 100 seed weight, total seed yield/plant, flesh thickness, β-carotene and moisture content, indicating that, second generation was deteriorated in these traits compared to the first generation. Negative ID results were recorded for vitamin C in both hybrids, indicating that the second generation was superior to the main population in this trait. JY-BB also showed superiority over the main population in average fruit weight, fruit shape index, and fruit peel color, indicating that, the second generation was better than the main population and was not highly affected by inbreeding for those traits. Overall, the results suggest that inbreeding depression affected some traits negatively, while positively affecting others. The results also indicate the need for more generations to achieve the desired improvement in some traits.

Previous results came in agreement with Reifschneider and Monteiro (2005), as they stated that, inbred plants had significantly lower yields and poorer fruit quality traits, such as fruit weight and number of seeds per fruit, compared to outbred plants. Also, Gatti *et al.* (2017) found that inbred plants were significantly more susceptible to powdery mildew compared to outbred plants, indicating that inbreeding depression had reduced the disease resistance. This was also supported by Juan *et al.* (2008), who stated that, one of the negative effects of inbreeding, in pumpkins, is the decrease in vigor and growth (inbreeding depression).The mechanisms underlying pumpkin inbreeding depression are not fully understood, but it was thought to be related to the accumulation of deleterious recessive alleles that reduce fitness when expressed in homozygotes. These deleterious alleles may be more likely to occur in closely related individuals because they share a greater proportion of their genetic material.

Overall, pumpkin inbreeding depression can have significant negative impacts on the yield and quality, as well as their resistance to diseases and pests. To mitigate these effects, it is important to avoid mating closely related individuals and to maintain genetic diversity within pumpkin populations. Also it was mentioned that, *Cucurbita* inbreeding for three years, might or might not affect some traits which could also be influenced by environment (Hayes *et al.,* 2005).

Phenotypic Correlation Coefficient Estimates:

JY-BB correlation coefficient results were shown in Table (8). Values were found positive and significant or highly significant for the following pairs of characters; plant length (m) with each of; number of nodes/ plant, total fruit yield/ plant, number of fruits/ plant, 100 seeds weight and flesh thickness. Number of nodes/ plant with each of the characters: total fruit yield/ plant, number of fruits/plant, 100 seed weight and flesh thickness. Days to first female flower with each of; days to first male flower, total seed weight, days to first fruit harvest, fruit shape index and moisture content. Days to first male flower with each of; days to first fruit harvest, fruit shape index and moisture content. Sex ratio with each of; total fruit yield, average fruit weight, fruit peel color, fruit ripping, flesh thickness and β-carotene. Total fruit yield/ plant with each of; number of fruits, average fruit weight, flesh thickness and β-carotene. Number of fruits/plant with each of; 100 seed weight and total seeds weight. Average fruit weight with each of; fruit peel color, fruit ripping and β-carotene. 100 seed with total seeds weight. Total seed weight with each of; days to first fruit harvest and moisture content. Days to first fruit harvest with each of; fruit shape index and moisture content. Fruit shape index with moisture content. Fruit peel color with fruit ripping. Fruit ripping with β-carotene. Flesh thickness with β-carotene.

JY-BB correlation coefficient values were found negative and significant or highly significant for the following pairs; plant length (m) with vitamin C. Number of nodes /plant with vitamin C. Days to first female flower with each of; sex ratio, average fruit weight, fruit peel color and fruit ripping. Days to first male flower with each of; sex ratio, average fruit weight, fruit peel color, fruit ripping, flesh thickness and β-carotene. Sex ratio with each of; days to first fruit harvest, fruit shape index and moisture content. Total fruit yield/ plant with each of; fruit shape index and vitamin C. Number of fruits/plant with each of; average fruit weight and vitamin C. Average fruit weight with each of; days to first fruit harvest, fruit shape index and moisture content. 100 seed weight with vitamin C. Total seed weight with each of; fruit peel color and vitamin C. Days to first fruit harvest with each of; fruit peel color and fruit ripping. Fruit shape index with each of; fruit peel color, fruit ripping, flesh thickness and β-carotene. Fruit peel color with moisture content. Fruit ripping with moisture content.

SB-C correlation coefficient results were shown in Table (9). Values were found positive and significant or highly significant for the following pairs of characters; plant length (m) with each of; number of nodes /plant, days to first female flower, sex ratio, total fruit yield/ plant, number of fruits/plant, average fruit weight, 100 seed weight, total seeds weight, fruit shape index, fruit peel color, fruit ripping, β-carotene and moisture content. Number of nodes /plant with each of; days to first female flower, sex ratio, total fruit yield/ plant, number of fruits/plant, 100 seed weight, total seeds weight, β-carotene and moisture content. Days to first female flower with each of; sex ratio, total fruit yield/ plant, number of fruits/plant, 100 seed weight, total seeds weight, β-carotene and moisture content. Sex ratio with each of; total fruit yield/ plant, number of fruits/plant, 100 seed weight, total seeds weight, β-carotene and moisture content. Total fruit yield/ plant with each of; number of fruits/plant, average fruit weight, 100 seed weight, total seed weight, fruit shape index, fruit peel color, fruit ripping, β-carotene and moisture content. Number of fruits/plant with each of; average fruit weight, 100 seed weight, total seed weight, fruit shape index, fruit peel color, fruit ripping, β-carotene and moisture content. Average fruit weight with each of; fruit shape index, fruit peel color, fruit ripping and flesh thickness. 100 seed weight with each of; total seed weight, β-carotene and moisture content. Total seed weight with each of; β-carotene and moisture content. Fruit shape index with each of; fruit peel color, fruit ripping and flesh thickness. Fruit peel color with each of fruit ripping and flesh thickness. Fruit ripping with flesh thickness. β-carotene with moisture content.

Table 8. Correlation coefficient values for pairs of studied characters of JY-BB genotypes

	No. N	DFF	DFM	SR	TFY	No.F	AFW	100 SW	TSW	DFH	F.SH	FPC	FR	F. TH	β-C	V.C	MC
PL	0.98**	0.14	-0.32	0.37	0.92**	0.87**	0.04	0.94**	0.66	0.14	-0.44	-0.11	0.12	0.76*	0.65	-0.98**	0.27
No. N		0.05	-0.40	0.45	0.95**	0.82*	0.13	0.90**	0.59	0.04	-0.52	-0.02	0.21	0.82*	0.71	-0.95**	0.18
DFF			0.89**	-0.87**	-0.25	0.61	-0.98**	0.49	0.84*	0.97**	0.82*	-0.98**	-0.97**	-0.53	-0.66	-0.35	0.99**
DFM				-0.97**	-0.66	0.19	-0.96**	0.04	0.50	0.90**	0.99**	-0.91**	-0.98**	-0.86*	-0.93**	0.11	0.83*
SR					0.77*	-0.13	0.94**	0.01	-0.45	-0.87**	-0.96**	0.88**	0.97**	0.88**	0.95**	-0.16	-0.80*
TFY						0.87*	0.83*	0.72	0.32	-0.26	-0.75*	0.28	0.49	0.95**	0.89**	-0.82*	-0.13
No.F							-0.85*	0.99**	0.94**	0.60	0.06	-0.59	-0.38	0.35	0.19	-0.96**	0.71
AFW								-0.31	-0.72	-0.98**	-0.92**	0.99**	0.97**	0.68	0.79*	0.17	-0.95**
100SW									0.89**	0.48	-0.09	-0.46	-0.24	0.48	0.33	-0.99**	0.59
TSW										0.83*	0.38	-0.82*	-0.67	0.02	-0.14	-0.81*	0.90**
DFH											0.83*	-0.96**	-0.97**	-0.54	-0.67	-0.34	0.99**
F.SH												-0.84*	-0.94**	-0.92**	-0.97**	0.24	0.75*
FPC													0.97**	0.56	0.69	0.32	-0.99**
FR														0.73	0.83*	0.10	-0.92**
F.TH															0.99**	-0.60	-0.42
β-C																-0.47	-0.56
V.C																	-0.47

*, ** Significant at 5% and 1% levels of probability, respectively. Where: PL= Plant Length (m), No. N= No. of nodes/plant, DFF= Days to first female flower, DFM= Days to first male flower, SR= Sex- ratio, TY= Total fruit yield/ plant (g), No. F= Number of fruits/plant, AFW= Average fruit weight (g), 100SW= 100 Seed weight (g), TSW= Total seed weight (g)/fruit, DFH= Days to first fruit harvest, F.SH= Fruit shape index, FPC= Fruit peel color, FR= Fruit ripping, F.TH= Flesh thickness (%), β-C= β-carotene (mg/100g fw), V.C= Vitamin C (mg/100ml juice), M.C= Moisture Content (%).

Table 9.Correlation coefficient values for pairs of studied characters of SB-C genotypes

	No. N	DFF	DFM	SR	TY	No. F	AFW	100SW	TSW	DFH	F.SH	FPC	FR	F. TH	β-C	V.C	M.C
PL	0.98**	0.94**	-0.97**	0.99**	0.94**	0.93*	0.89*	0.86*	0.86*	-0.60	0.89*	0.87*	0.87*	0.67	0.96**	-0.64	0.98**
No. N		0.99**	-0.97**	0.95*	0.98**	0.98**	0.80	0.93*	0.93*	-0.45	0.80	0.78	0.78	0.53	0.99**	-0.76	0.95**
DFF			-0.92*	0.98**	0.93*	0.95**	0.69	0.98**	0.98**	-0.29	0.69	0.66	0.66	0.38	0.96**	-0.86*	0.99**
DFM				-0.97**	-0.91*	-0.96**	-0.92*	-0.82	-0.82	0.65	-0.92*	-0.91**	-0.91*	-0.72	-0.93*	0.58	-0.97**
SR					0.98**	0.99**	0.81	0.93*	0.93**	-0.45	0.81	0.78	0.78	0.53	0.99**	-0.76	0.92*
TY						0.96**	0.90*	0.84*	0.84*	-0.62	0.90*	0.89**	0.89*	0.69	0.95**	-0.62	0.98**
No. F							0.88*	0.87*	0.87*	-0.58	0.89*	0.87*	0.87*	0.65	0.96**	-0.65	0.99**
AFW								0.53	0.53	-0.89*	0.96**	0.92*	0.97**	0.93*	0.72	-0.23	0.80
100SW									0.93*	-0.10	0.53	0.50	0.50	0.19	0.97**	-0.94**	0.93*
TSW										-0.10	0.53	0.50	0.50	0.19	0.97**	-0.94**	0.93*
DFH											-0.89*	-0.91**	-0.91*	-0.92*	-0.34	-0.23	-0.44
F.SH												0.98*	0.92*	0.93*	0.72	-0.23	0.80
FPC													0.98**	0.94**	0.70	-0.19	0.78
FR														0.94**	0.70	-0.19	0.78
F.TH															0.42	0.14	0.53
β-C																-0.84*	0.99**
V.C																	-0.77

*, ** Significant at 5% and 1% levels of probability, respectively. Where: PL= Plant Length (m), No. N= No. of nodes/plant, DFF= Days to first female flower, DFM= Days to first male flower, SR= Sex- ratio, TY= Total fruit yield/ plant (g), No. F= Number of fruits/plant, AFW= Average fruit weight (g), 100SW= 100 Seed weight (g), TSW= Total seed weight (g)/fruit, DFH= Days to first fruit harvest, F.SH= Fruit shape index, FPC= Fruit peel color, FR= Fruit ripping, F.TH= Flesh thickness (%), β-C= β-carotene (mg/100g fw), V.C= Vitamin C (mg/100ml juice), M.C= Moisture Content (%).

SB-C correlation coefficient values were found negative and significant or highly significant for the following pairs; plant length (m) with days to first female flower. Number of nodes /plant with days to first female flower. Days to first female flower with each of; days to first male flower and vitamin C. Days to first male flower with each of; sex ratio, total fruit yield, number of fruit/plant, average fruit weight, fruit shape index, fruit peel color, fruit ripping, β-carotene and moisture content. Average fruit weight with days to first fruit harvest. 100 seed weight with vitamin c. Total seed weight with vitamin c. Days to first fruit harvest with each of; fruit shape index, fruit peel color, fruit ripping and fruit thickness. β-carotene with vitamin C.

Studying the genetic correlation of traits is an important phase for traits early selection by indirectly selecting the less genetic complex and high heritable traits to give faster response (Cruz & Regazzi, 1997 and Kurek *et al.*, 2001). Correlation results were supported by others as; Pandey *et al.* (2010) who stated that, flesh thickness and carotenes can be improved by selection while total yield can be improved via hybridization. Ndoro *et al.* (2012); Kiramana and Isutsa (2017) observed that, germination and plant vigor is affected by seed size. Seed germination in early stages is always associated with seed size. Again this was supported by Shivananda *et al.* (2013); Maheswari and HariBabu (2006) who stated that, there were a positive correlation between 100 seed weight and plant length as well as Nagar *et al.* (2017) who reported that, seed yield is positively correlated with 100 seed weight. Moreover it was said by Yadav *et al*. (2006) that, 100 seed weight, length and width are positively correlated with pumpkin fruit weight.

CONCLUSION

Egyptian pumpkin varieties are characterized by large fruit size up to 15 kg / fruit, which is not desired by the domestic consumer and exporting chain. Accordingly, two imported pumpkin hybrids were used in this study, with smaller fruit size (≈ 0.5 to 2 kg/fruit) and high resistance to mildews, to be established in the Egyptian environment to improve the local genetic threshold, as a step to be included in inbreeding programs, to study the reflect of genetic parameters; phenotypic and genotypic coefficient of variations, heritability values, inbreeding depression (ID) as well as correlation coefficients, which help breeders in producing new pumpkin lines with good marketing and exporting qualities, in addition, helping breeders to improve the local landraces of pumpkins and improve their resistance to diseases and insect infestations.

REFERENCES

Abdel-Maksoud, G., H. H. El-Shazly and A. G. El-Sherif. 2018. Pumpkin cultivation in Egypt: Production, challenges, and future prospects. Cogent Food & Agri., 4(1): 146-157.

Agriculture Statistics. 2021. Summer and Nilli Crops for the Agriculture Year (2020/2021). Ministry of Agriculture and Land Reclamation, Economic Affairs Sector p. 392.

Akkawi D. 2018. Egypt plants pumpkin for the first time in 4 governorates. https://www.egypttoday.com/Article/1/56485/Egypt-plants-pumpkin-for-the-first-time-in-4-governorates.

Assous, M. T., M. M. Rashed and R. S. El-Mohamedy. 2014.Chemical composition, antioxidant activity and sensory evaluation of pumpkin (Cucurbita moschata) and dried pumpkin slices as a source of dietary fiber in wheat flour-based biscuits. Journal of food and nutrition research, 2(6): 293-300.

Burton, G.W. 1952. Quantitative inheritance in grass. In proceeding of the six the international grassland congress .Pennsylvania, U.S.A. 1(3): 217-283.

Cascio J. 2007. Pumpkin seeds. Cooperative Extension Service. University of Alaska Fairbanks.

Cruz, C. D., A. J. Regazzi. 1997. Modelos biométricos aplicados ao melhoramento genético. Viçosa, MG: Editora da UFV. 390 p.

Dospekove, B. A. 1984. Field Experimental, statistical, procedures. Mir publishers: 349.

Dvorkin, L. and K. Y. Song.2002. Herbs for benign prostatic hyperplasia. *Annals of Pharmacotherapy* 36 (1): 1443–52.

El-Sayed, E. H., and H. M. Abdel-Gawad.2019.Evaluating the export potential of Egyptian pumpkin. Agricultural and Food Economics. 7(1):3-17.

Fageria, V. D. 2001. Nutrient interactions in crop plants. Journal of Plant Nutrition. 24:1269-1290.

Fu, C., H. Shi and Q. Li. 2006.A review on pharmacological activities and utilization technologies of pumpkin. *Plant Foods for Human Nutrition* 61(2): 73–80.

Gatti, I. L., R. L. F. Gomes, R. C. Barbosa, E. A. A. Silva, R. F. Santos and M. M. Souza. 2017.Resistance of inbred and hybrid pumpkin to powdery mildew. Pesquisa Agropecuária Brasileira, 52(2):119-126.

Gomaa, E. Z., M. A. Abdel-Fattah and S. M. Ahmed. 2019.Chemical characteristics and potential uses of pumpkin oil. Egyptian Journal of Chemistry, 62(6): 1041-1054.

Hayes, C. N., J. M. Winsor and A. G. Stephenson. 2005. Environmental variation influences the magnitude of inbreeding depression in *Cucurbita pepo ssp. Texana (Cucurbitaceae).* Evolution 59(2):276–286.

Hernandez, S.M., C.L. Merrick and L. Eguilarte. 2005.“Maintenance of squash (Cucurbita spp.), landrace diversity by farmers’ activities in Mexico”, Genet. Resour. Crop Evol., 52 (1): 697-707.

Hosen, M. , M. Y. Rafii, N. Mazlan, M. Jusoh, Y. Oladosu, F. Chowdhury, I. Muhammad and M. Khan. 2021.Pumpkin (Cucurbita spp.): A Crop to Mitigate Food and Nutritional Challenges. *Horticulturae .7*(10).352; https://doi.org/10.3390/horticulturae7100352

Hussain, S. A., Tajuddin, A. S. Azmi and I. Ahmed. 2010.Effect of Nigella sativa (Kalwunji) on hypertension: A randomized, double-blind, placebo-controlled trial. Pakistan Journal of Pharmaceutical Sciences, 23(3): 277-281.

Ikewuchi C.J. And C.C. Ikewuchi .2011.Iodometric determination of the ascorbic acid (vitamin c) content of some fruits consumed in a university community in Nigeria. Global journal of pure and applied sciences. 17.(1): 47-49.

Jacob, M.B. 1951. The chemical analysis of food products. D. Van Nostrand Comb. Inc. New York, London:724-732.

Juan, S. E., N. Antoine and D. Patrice. 2008.The Different Sources of Variation in Inbreeding Depression, Heterosis and Outbreeding Depression in a Metapopulation of Physa acuta the Genetics Society of America DOI: 10.1534/genetics.108.092718 1593–1608.

Jun, H.-I., C.-H. Lee, G.-S. Song and Y.-S. Kim. 2006. Characterization of the pectic polysaccharides from pumpkin peel. LWT-Food Sci. and Technology, 39(5): 554–561.

Kinghorn B. and A. Kinghorn. 2023.Management of diversity and inbreeding when importing new stock into an inbred population. J Hered. DOI: 10.1093/jhered/esad027.

Kiramana K. and D. K. Isutsa.2017. First detailed morphological characterization of qualitative traits of extensive naturalized pumpkin germplasm in Kenya. International Journal of Development and Sustainability ISSN: 2186-8662 – www.isdsnet.com/ijds 6 (7): 500-525 ISDS Article ID: IJDSG17071002

Kurek, A. J., F. Carvalho, I.C. Assmann, V. Marchioro and P.J. Cruz. 2001. Análise de trilha como critério de seleção indireta para rendimento de grãos em feijão. Revista Brasileira de Agrociência, 7 (1): 29-32.

Li, Q. H., Z. Tian and T. Y. Cai.2003.Study on the hypoglycemic action of pumpkin extract in diabetic rats. *Acta Nutrimenta Sinica* 25: 34–6.

Maheswari, U. K. and K. HariBabu. 2006. Heritability, correlation and genetic divergence for different seed traits in pumpkin (*Cucurbita moschata*). Orissa Journal of Horticulture 34(2): 6–12. https://www.researchgate.net/publication/321314556_Heritability_correlation_and_genetic_divergence_for_different_seed_traits_in_pumpkin_Cucurbita_moschata#fullTextFileContent

Mather, K. and Y. L. Jinks. 1971. Biometrical Genetics, the study of continuous variation. Cornell State Univ. Press, USA.

Nagar, A., A. K. Sureja, A. D. Munshi, B. Rakesh , K. Sandeep and B. S. Tomar. 2017. Heritability, correlation and genetic divergence for different seed traits in pumpkin (*Cucurbita moschata*). Indian Jo. of Agricultural Sciences 87(11):1519-1523

Nakdiman, M. and W.H. Gabelman .1971.Analytical procedures for detecting carotenoids of carrot (Daucus carota, L.) root and tomato (Lycopersicon esculentum) fruit. J. Amer. Soc. Hort. Sci., 96 (1):702-704.

Ndoro, E., N. S. Dauda and H.B. Chammang. 2012. “Effect of germination media and seed size on germination and seedling vigour of fluted pumpkin (*Telferia occidentalis*) Hook. F”, Internat. J. Agri. Sci., 2 (3): 113-115.

Nkosi, C. Z., A. R. Opoku and S. E. Terblanche. 2006. Antioxidative effects of pumpkin seed (*Cucurbita pepo*) protein isolate in CCl4 induced liver injury in low protein fed rats. *Phytotherapy Research* 20(11): 935–40.

Pandey, S., A. Jha, S. Kumar and M. Rai. 2010. Genetics and heterosis of quality and yield of pumpkin. *Indian J. Hort. 67(3): 333-338*

Paris, H S. 2000. First two publications by Duchesne of Cucurbita moschata (Cucurbitaceae), Taxonomy. 49 (1): 305-319.

Provesi, J. G., L. Cardozo-Filho and M. S. Ferreira. 2012. Pumpkin (Cucurbita moschata) processing: use of enzymes in chemical and functional properties. Journal of Food Processing and Preservation, 36(2): 85-92.

Reifschneider, F. J. B. and J. A. Monteiro. 2005.Inbreeding depression for yield and fruit quality traits in pumpkin (*Cucurbita moschata Duch.*). HortScience, 40(4): 1070-1072.

Shivananda, M. M., M. B. Madalageri, S. Srinivas, A. B. ChikkurMohankumar, and K. Yathiraj. 2013. Genetic divergence studies inpumpkin (*Cucurbita spp.)*. International Journal of PlantScience 8(1): 29–34.

Snedecor, G.W. and W.G. Cochran. 1980.Statistical Methods. 7th Edition, Iowa State University Press, Ames.

Troianou, E., J. Humisan, J.M. Pemberton and Walling. 2018. Estimating selection on the act of inbreeding in a population with strong inbreeding depression. J Evol Biol. 31(12): 1815–1827. doi: 10.1111/jeb.13376

Wang, H. X. and T. B. Ng. 2003. Isolation of cucurmoschin, a novel antifungal peptide abundant in arginine, glutamate and glycine residues from black pumpkin seeds. *Peptides* 24(7): 969–72.

Winiger, F.A. and J.W. Ludwig. 1974.Methoden der Qualitätsbeurteilung bei Kartoffeln für den menschlichen Konsum.Potato Research 17: 434–465.

Yadav, R. K., S. K. Sanwal, D. S. Yadav and P. Sarma. 2006. Correlation and path analysis in pumpkin. Haryana Journal of Horticultural Sciences 35(3/4): 338–9

Zhou, C., L. Mi, X. Hu and B. Zhu. 2017.Evaluation of three pumpkin species: correlation with physicochemical, antioxidant properties and classification using SPME-GC–MS and E-nose methods. J Food Sci Technol 54(10):3118–3131

Zoe, F., M. Lledo, O. Juan and V. M. Francisco 2011. A Model for Qualitative Colour Description and Comparison. Int. Workshop Qualitative Reasoning:17-24.

الملخص العربي

الإختلافات الوراثية بين إنعزالات القرع العسلي لبعض الصفات الإقتصادية

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يعد القرع العسلي أحد البدائل الغذائية المطلوبة حالياً لسد فجوة الطلب محلياً ودولياً خاصاً للبلدان النامية، لما له من قيمه غذائية عالية وسعرات حرارية منخفضة وبذلك يكون مهم لمرضي التغذية العلاجية. استهدفت هذه الدراسة تلبية ذوق إحتياجات المستهلك المحلي ومتطلبات التصدير، حيث تميزت الهُجن تحت الدراسة بصغر حجمها (كجم٢جم)، ومقاومتها العالية لأمراض البياض مما يتيح الفرصة لإدخال الإنعزالات الناتجة في برامج التربية والحصول علي سلالات جديدة ذات صفات تسويقية وتصديرية عالية. وقد أجريت هذه التجربة لدراسة الإختلافات الوراثية وتأثير التربية الداخلية لأثنين من الهُجن المستوردة تحت الظروف المناخية المصرية. كما تم إجراء التلقيح الذاتي لمدة جيلين ومن ثَم تحديد ودراسة أهم الصفات الإقتصاديه خلال مواسم الزراعه من ٢٠١٩ حتى ٢٠٢٢ . أوضحت النتائج أن الصفات الخضرية ومواعيد الإزهار قد تأثرت سلباً خلال أجيال التلقيح الذاتي الأمر الذي أدى إلى إنخفاض القيم الخاصة بها، وأيضا تأثرت سلباً صفات المحصول الثمري/نبات وعدد الثمار/نبات، إضافة إلى الصفات الثمرية ما عدا صفة المحتوى الرطوبي خلال أجيال التلقيح الذاتي. كما أشارت نتائج مُعَامل التباين البيئي ومعامل التباين الوراثي وكذلك درجة التوريث إلى أن صفة متوسط وزن الثمره والمحصول الكلي للثمار/نبات قد تأثرت بشكل كبير بالعوامل البيئية وهذا يوضح أن إجراء الإنتخاب لهاتين الصفتين يحتاج إلى عدة أجيال من الإنتخاب. وقد بينت النتائج المتحصل عليها من التلقيح الذاتي حدوث تدهور ناتج عن التربية الداخلية لبعض الصفات الاقتصادية مثل المحصول الكلي /نبات ومتوسط وزن الثمره. واكدت بيانات مُعَامل الإرتباط المتحصل عليها وجود إرتباط إيجابي قوي بين صفة المحصول الكلي /نبات مع صفات طول النبات، عدد العقد /نبات، عدد الأيام حتى ظهور أول زهرة مؤنثة، النسبة الجنسية، عدد الثمار /نبات ومتوسط وزن الثمره.