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ASSESSMENT OF SOME GENETIC PARAMETERS FOR RESISTANCE TO LEAF MINER, CHOCOLATE SPOT, RUST AND YIELD OF FABA BEAN in F_2 and F_4 GENERATIONS

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ABSTRACT

Six parental varieties i.e., Giza 3, Improved Giza 3, Giza 429, Giza 716, Giza 843 and Sakha 1 along with check (Giza 402) and their F_2 and F_4 generations of four faba bean crosses i.e. 1) G.3 x G.429 , 2) Improved G.3 x G. 716, 3) G.429 x G.843 and 4) G.843 x Sakha 1 were used to obtain informations about the performance correlation, genetic behaviour, heritability and genetic advance for resistance to leaf miner (Liriomyza congesta, Becher*), chocolate spot (Botrytis fabae* Sard*) and rust (Uromyces fabae Pers,* Schart*) pests, leaf chlorophyll content and seed yield/plant.*

The results indicated highly significant differences among genotypes for all studied characters. The most tolerant faba bean varieties for leaf miner were: Giza 843 followed by G.716 and Sakha 1 and the F_2 and F_4 of G. 429 x G.843 and G.843 x Sakha 1 cross populations. They produced high levels of leaf chlorophyll content and seed yield/plant rather than the susceptible varieties G. 3, Improved G.3, G.429 and the check (G. 402).

Moreover, the most resistant faba bean genotypes to chocolate spot and rust were G. 429 and Sakha 1 as well as the F_2 and F_4 progenies of G. 843 x Sakha 1 , whereas G.3 and Improved G.3 expressed as susceptible ones. Negative and significant correlation was detected between seed yield, leaf chlorophyll content and each of, No. of larvae/100 leaflets, infection type of chocolate spot and rust with some exceptions.

In F_2 generation, the dominance gene action was the predominant type controlling the inheritance of No. of mines/100 leaflets, infection type of chocolate spot and rust, leaf chlorophyll content and seed yield/plant in most studied crosses. Both additive and dominance gene effects were involved in the inheritance of No. of larvae/100 leaflets. The additive gene action was increased with advanced generation, and was more pronounced in the inheritance of No. of mines and larvae/100 leaflets, infection type of chocolate spot and rust and leaf chlorophyll content in F_4 generation. However, the dominance genetic

portion was the prevailed type controlling seed yield/plant in 1st, 2nd and 3rd crosses, whereas the additive was significant in 4th cross only. The estimates of heritability varied greatly from cross to cross and from generation to generation and ranged from moderate for seed yield/plant to high for the remaining studied characters. The expected genetic advance from selection was moderate for rust resistance, leaf chlorophyll content and seed yield/plant and high for chocolate spot resistance.

Key words: ***Faba bean, Leaf miner, Chocolate spot, Rust, Yield, Gene action.***

INTRODUCTION

The prospects of sustaining increased production in faba bean (*Vicia faba* L.) depends on various factors from which pest resistance, is important. Faba bean plants are attacked in the fields by several pests *i.e.* leaf miner (*Liriomyza congesta*, Becher) which causes severe injury of the plant leaves rendering them unfit for biological processes. Also, the formation of punctures in the leaves by the adult females cause significant damage (Parella and Bethke 1988). Furthermore, chocolate spot (*Botrytis fabae* Sard) and rust (*Uromyces fabae* Pers, Schart) are considered of the most destructive diseases and causes considerable losses in faba bean yield (Variously estimated at over 50%) in North Delta region of Egypt, particularly during wet seasons where low temperature and high relative humidity favour its spread and severity (Mohamed 1982).

Understanding the inheritance of host faba bean genotype x pathogen interaction should permit planning of breeding program for pyramiding the resistance genes in the promising genotypes against the pests. Where, development of resistant genotypes is the best practical, most efficient and economical approach of fighting the pests.

The resistance to leaf miner, chocolate spot and rust as well as seed yield/plant was found to be controlled by dominance gene action with low to moderate heritability estimates in narrow sense (El-Hosary *et al* 1998). However, additive gene action was found to be the prevailed type controlling the inheritance of chocolate spot resistance, with high heritability estimates in narrow sense ranged from 69 to 95% (Abo El-Zahab *et al* 1994).

The present investigation aimed to study the mean performance, correlation coefficient, gene action, heritability and genetic advance for leaf miner, chocolate spot and rust resistance as well as leaf chlorophyll content and seed yield/plant.

MATERIALS AND METHODS

Experimental layout

The studied materials represent a portion of breeding program started from 1999/2000 till now. The aim of this study including evaluation of parental materials, F_2 and F_4 generations of four faba bean cross populations for resistance to leaf miner, chocolate spot, rust, leaf chlorophyll content and seed yield/plant. In addition to, estimate correlation, gene action, heritability and genetic advance for the above-mentioned characters.

Therefore, two field experiments were conducted at the Experimental Farm Station, Faculty of Agriculture, Zagazig University. The first one included evaluation of parental varieties differed in their resistance to leaf miner, chocolate spot and rust as well as yield *i.e.* G. 3, Improved G.3, G. 429, G. 716, G. 843 and Sakha 1 and G. 402 as a check variety and F_2 generation derived from four crosses *i.e.* G. 3 x G. 429, Improved G. 3 x G. 716, G. 429 x G. 843 and G. 843 x Sakha 1.

The parental materials and their F_2 populations for each cross were sown in a randomized complete block design with three replications in ridges 3m long and 60 cm width with single seed hills spaced 20 cm apart on one side of the ridge. Each parent and F_2 progenies were represented by 2 and 8 ridges, respectively.

The second experiment included, the parental materials and F4 generation derived from the above-mentioned crosses. Twenty-five F_4 family in each cross in addition to their parents were sown in the first week of November using a randomized complete block design with three replications in each cross. Each parent and family for every cross represents 2 and 3 ridges, respectively with 3 m long and 60 cm width with single seed/hill, spaced 20 cm apart on one side of the ridge.

The susceptible check cultivar Giza 402 was sown surrounding each cross in every experiment to secure adequate source of leaf miner, chocolate spot and rust infection. All recommended agricultural practices for faba bean production were applied.

The recorded data were No. of mines/100 leaflets, No. of larvae/100 leaflets, infection type of chocolate spot and rust and leaf chlorophyll content as well as seed yield/plant.

Leaf chlorophyll content was determine at flowering stage using chlorophyll meter which estimate SPAD value {SPAD 502, Soil-Plant

Analysis Development (SPAD) Section, Minolta Camera Co. Osaka, Japan} according to Castelli *et al* (1996).

For leaf miner and larvae assessment, one hundred leaflets were detached from each germplasm separately at the lower, middle and upper parts of the random plants at 7 days intervals during pod formation till harvest. The leaflets put together in a polyethelene bag and then samples examined in the laboratory by means of a binocular microscope, where number of mines and pest larvae were recorded.

The resistance to chocolate spot and rust diseases were determined during physiological maturity (about 105 days after sowing) according the scales outlined by Hanounik (1986). At harvest, seed yield/plant was recorded.

Biometrical analysis:

The obtained data were subjected to conventional two way analysis of variance. The breeding parameters [m], [d], [h], and potence ratio {h/d} in F_2 generation were estimated according to Hayward *et al.* (1993) as follows:

- The additive genetic component [d]=$\{P_1-P_2\}/2$
- The dominance genetic component [h] was calculated from the following formulae $F_2= m+½h$ .. $h= [m-F_2] / ½$ where
- P_1: mean of the high performing parent.
- P_2: mean of the low performing parent
- F_2: general mean of the F_2 generation
- m: mean of the two parents involved in the cross.

Heritability in broad sense in F_2 generation was computed according to (Weber and Moorthy 1952).

The variances between and within families of F_4 generation were computed to obtain the additive (VD), and dominance (VH) portions of genetic components, heritability in broad (Tb) and narrow (Tn) sense and genetic advance according to Mather and Jinks (1982).

RESULTS AND DISCUSSION

Leaf miner performance

Tables (1 and 2) indicate significant differences between parental faba bean varieties for all the studied characters and their cross populations in both F_2 and F_4 generations. The results suggested the presence of high level of genetic variability varied for further biometrical assessment.

Table 1. Mean performance for parental varieties and their F_2 cross populations for the studied characters.

Characters / Genotypes	No. of mines/100 leaflets	No. of larvae/100 leaflets	Chocolate spot		Rust			Leaf chlorophyll content	Seed yield/plant (g.)
			Infection type	Type	Infection type	Type	Severity %		
I. Parental varieties									
1-Giza 3	244.0	130.0	7	S	7	S	8	36.6	18.666
2-Improved Giza 3	180.0	125.0	7	S	7	S	8	33.0	22.400
3-Giza 429	285.0	145.0	5	MR	3	R	1	41.3	30.928
4-Giza 716	140.0	70.0	5	MR	5	MR	4	44.6	30.500
5-Giza 843	125.0	65.0	5	MR	5	MR	4	43.2	33.140
6-Sakha 1	130.0	80.0	3	R	1	HR	Scarce	42.4	36.150
7-Giza 402 (check)	350.0	210.0	7	S	9	HS	10	33.2	15.100
II. F_2 cross populations									
1-G.3 x G.429	203.0	134.0	5	MR	7	S	8	32.0	25.650
2-Improved G.3 x G.716	162.0	135.0	5	MR	7	S	8	33.8	31.266
3-G.429 x G.843	103.0	70.0	4	R-MR	5	MR	4	39.7	28.680
4-G.843 x Sakha 1	106.0	75.0	6	MR-S	5	MR	4	41.2	35.540
L.S.D. at 0.05									
Parents	55.1	32.0	1.31		1.26		2.8	3.4	2.8
Parents *vs* F2 crosses	48.2	27.1	1.12		1.15		2.1	3.2	2.7

HR: Highly resistant **R: Resistant** **MR: Moderately resistant** **S: Susceptible** **HS: Highly susceptible**

Table 2. Mean performance for parental varieties and their F_4 cross populations for the studied characters.

Characters / Genotypes	No. of mines/100 leaflets	No. of larvae/100 leaflets	Chocolate spot		Rust			Leaf chlorophyll content	Seed yield/plant (g.)
			Infection type	Type	Infection type	Type	Severity %		
I. Parental varieties									
1-Giza 3	240.0	134.0	7	S	9	HS	10	37.1	20.200
2-Improved Giza 3	178.0	128.0	7	S	7	S	8	32.2	21.100
3-Giza 429	290.0	141.0	3	R	3	R	1	40.8	28.052
4-Giza 716	143.0	66.0	5	MR	5	MR	4	45.7	32.314
5-Giza 843	122.0	60.0	5	MR	5	MR	4	41.3	36.520
6-Sakha 1	123.0	82.0	3	R	3	R	1	43.9	38.102
7-Giza 402 (check)	340.0	200.0	7	S	9	HS	10	30.4	16.256
II. F_4 cross populations									
1-G.3 x G.429	200.0	120.0	5	MR	5	MR	4	34.1	28.630
2-Improved G.3 x G.716	155.0	85.0	4	R-MR	5	MR	4	35.0	36.856
3-G.429 x G.843	115.0	45.0	5	MR	5	MR	4	44.6	25.820
4-G.843 x Sakha 1	110.0	40.0	3	R	4	R-MR	2.5	44.9	45.520
L.S.D. at 0.05									
Parents	52.51	35.13	1.80		1.40		2.70	3.11	2.51
Parents *vs* F_4 crosses	45.32	28.41	1.31		1.10		2.20	2.42	2.30

Based on screening of No. of mines/100 leaflets and No. of larvae/100 leaflets, the studied crosses could be classified into three categories as follows:

I. Susceptible x Susceptible

1. G. 3 x G. 429

II. Susceptible x Tolerant or moderate tolerant.

2. G. 429 x G. 843

3. Improved G. 3 x G. 716.

III. Tolerant x Tolerant

4. G. 843 x Sakha 1

The assessment of both No. of mines/100 leaflets and No. of larvae/100 leaflets of the studied genotypes, it could be seen that, the most tolerant faba bean varieties were G. 843 followed by both G. 716 and Sakha 1 as well as their F_2 and F_4 cross populations G. 429 x G. 843 and G. 843 x Sakha 1 which scored the lowest infestation compared to the check variety (G. 402). They produced the highest average values of leaf chlorophyll content (43.15) and seed yield/plant (34.638 g.) rather than the check variety G. 402 (31.8) and (15.678 g.), respectively. The remaining genotypes G. 3, Improved G. 3 and G. 429 as well as their cross populations G. 3 x G. 429 and Improved G. 3 x G. 716 were considered as susceptible ones. They gave moderately low average values of leaf chlorophyll content (35.11) and seed yield/plant (27.770 g.). Therefore, the tolerant parental varieties G. 843, G.716 and Sakha 1 could be involved in faba bean breeding programs aiming to improve leaf miner tolerance. These findings are confirmed by the results obtained in F_2 and F_4 generations which showed transmission of resistant genes from the parents to the progeny in F_2 and F_4 generations. In this respect, significant genetic variations were existed among faba bean genotypes for both leaf miner resistance and/or seed yield (El-Hosary *et al* 1998 and Hammad 2000) and leaf chlorophyll content and seed yield/fed. (Awaad 2002).

Chocolate spot and rust resistance performance:

It could be seen from the data presented in Tables (1 and 2) that, highly significant differences among faba bean genotypes were detected for infection type of chocolate spot and rust, suggesting that these genotypes differed in genes controlling the resistance to faba bean diseases.

According to scoring system of both chocolate spot and rust diseases, the four crosses under investigation could be classified into three different categories as follows:

I. Highly susceptible or susceptible x Resistant or moderate resistant

1. G. 3 x G. 429

2. Improved G. 3 x G. 716

II. Resistant or moderate resistant x Moderate resistant

3. G. 429 x G 843

III. Moderate resistant x Highly resistant or resistant

4. G. 843 x Sakha 1

It is clear from the data presented in Tables (1 and 2) that, faba bean varieties *i.e.* G. 429, Sakha 1 , G. 716 and G. 843 were considered as highly resistant or resistant for both chocolate spot and rust, in addition to their F2 cross population G. 429 x G. 843, F_4 crosses Improved G. 3 x G. 716 and G. 843 x Sakha 1 for chocolates spot resistance. They produced the higher mean performance of both leaf chlorophyll content (41.96) and seed yield/plant (35.378 g.) compared to the check variety G. 402 (31.80) and (15.678 g.), respectively. These results indicate that the resistant genes in the parents were transmitted to the progeny, hereby it is possible to isolate new recombinant lines resistant to chocolate spot and rust with high yield. In this connection, significant genetic variability were recorded among six faba bean parental varieties and their F_1 crosses for chocolate spot resistance (Abo El-Zahab *et al* 1994) and chocolate spot and rust resistance as well as seed yield/plant (El-Hosary *et al* 1998).

Correlation:

The pest attack of faba bean causes a significant loss in seed yield and quality, due to the damage of leaf chlorophyll content and the less effective of photosynthetic activities of leaf area, then the lack of translocation of nutrients towards the pods. Data presented in Table (3) indicate that, negative and significant correlation coefficient has been recorded between leaf chlorophyll content and seed yield/plant on one hand and each of, No. of larvae/100 leaflets, chocolate spot and rust infection with some exceptions, on the other hand. Thus, increasing No. of mines and larvae/100 leaflets, infection type of chocolate spot and rust diseases led to substantial reduction in leaf chlorophyll content and faba bean seed yield. In this respect, leaf miner, chocolate spot and rust are considered of the most destructive pests caused considerable losses of faba bean yield (Mohamed, 1982 and El-Hosary *et al* 1998).

Table 3. Simple correlation coefficient between leaf chlorophyll content and seed yield/plant one hand and the other characters on the other hand

Characters	No. of mines/100 leaflets	No. of larvae/100 leaflets	Infection type of chocolate spot	Infection type of rust
	Parents and their F_2 crosses			
Leaf chlorophyll content	- 0.340	- 0.726*	- 0.428	- 0.719*
Seed yield/plant	- 0.545	- 0.549	- 0.675*	- 0.688*
	Parents and their F_4 crosses			
Leaf chlorophyll content	- 0.453	- 0.700*	- 0.532	- 0.515
Seed yield/plant	- 0.590	- 0.673*	- 0.773**	- 0.664*

* and ** indicate significant and highly significant at 0.05 and 0.01 levels of probability, respectively.

Genetic parameters, heritability and genetic advance:

For F_2 generation, data presented in Table (4) show that the dominance gene effect [h] was the predominant type controlling No. of mines/100 leaflets in 1st, 3rd and 4th crosses, No. of larvae/100 leaflets in 2nd and 3rd crosses, and seed yield/plant in 2nd, 3rd and 4th crosses as well as infection type of chocolate spot and rust as well as leaf chlorophyll content in all crosses, resulting in potence ratio [h/d] more than unity. This result indicate the dispersion of dominant genes which increase expression between the parents.

The additive gene effect [d] was found to be the prevailed type in the inheritance of No. of mines/100 leaflets in 2nd cross, No. of larvae/100 leaflets in 1st and 4th crosses and seed yield in 1st cross, resulting in potence ratio [h/d] less than unity. Thus, phenotypic selection should be used for improving the foregoing characters in the corresponding crosses. Similar result was reported for chocolate spot by Abo El-Zahab *et al* (1994).

Heritability estimates in broad sense (Tb) (Table 4) were high (>50%) for No. of mines/100 leaflets, infection type of chocolate spot and rust in all crosses and No. of larvae/100 leaflets in 1st and 2nd crosses, indicating the effectiveness of selection for improving these characters. Whereas, low to moderate heritability values were recorded for seed yield/plant in all crosses and No. of larvae/100 leaflets in 3rd and 4th crosses.

The data of F_4 generation further subjected to the biometrical analysis to separate out and quantify the total genetic variance to it constituent parts, additive (D) and dominance (H) genetic variances from which the other derived parameters $(H/D)^{0.5}$, heritability in broad (Tb) and narrow (Tn) sense

Table 4. Assessment of gene effects, potence ratio and heritability for the studied characters in F_2 generation of four faba bean crosses

Parameters	[m]	[d]	[h]	[h/d]	[T_b]
Cross populations	No. of mines/100 leaflets				
1-G.3 x G.429	264.5	20.5	123.0	6.00	79.02
2-Improved G.3 x G.716	160.0	20.5	4.0	0.19	60.81
3-G.429 x G.843	205.0	80	204.0	2.55	55.80
4-G.843 x Sakha 1	127.5	2.5	43.0	17.20	61.81
No. of larvae/100 leaflets					
1-G.3 x G.429	137.5	7.5	7.0	0.93	64.31
2-Improved G.3 x G.716	97.5	27.5	75.0	2.73	58.79
3-G.429 x G.843	105.0	40.0	70.0	1.75	32.22
4-G.843 x Sakha 1	72.5	7.5	5.0	0.67	45.44
Infection type of chocolate spot					
1-G.3 x G.429	6.0	1.0	2.0	0.67	78.02
2-Improved G.3 x G.716	6.0	1.0	2.0	2.00	55.02
3-G.429 x G.843	4.5	0.5	1.0	2.00	65.74
4-G.843 x Sakha 1	4.0	1.0	4.0	6.00	60.00
Infection type of rust					
1-G.3 x G.429	5.0	2.0	4.0	1.20	65.38
2-Improved G.3 x G.716	6.0	1.0	2.0	2.00	70.12
3-G.429 x G.843	4.0	1.0	2.0	2.00	75.13
4-G.843 x Sakha 1	3.0	2.0	4.0	2.00	62.09
Leaf chlorophyll content					
1-G.3 x G.429	38.95	2.35	13.9	5.91	57.55
2-Improved G.3 x G.716	38.80	5.80	10.0	1.72	65.14
3-G.429 x G.843	42.25	0.95	5.1	5.37	54.54
4-G.843 x Sakha 1	42.80	0.40	3.2	8.00	56.66
Seed yield/plant					
1-G.3 x G.429	24.797	6.13	1.71	0.28	40.01
2-Improved G.3 x G.716	26.450	4.05	9.63	2.38	56.50
3-G.429 x G.843	32.034	1.11	6.71	6.05	47.80
4-G.843 x Sakha 1	34.645	1.32	1.79	1.36	36.36

m: mean of the two parents involved in the cross.
d: additive gene effect.
h: dominance gene effect.
h/d: potence ratio
Tb: heritability in broad sense

and genetic advance were computed. The results given in Table (5) clearly indicate that, both additive and dominance genetic components were significant in most cases. With advanced generations like F_4, additive genetic variance (D) was the prevailed type controlling No. of mines/100 leaflets, and No. of larvae/100 leaflets in 1st, 3rd and 4th crosses, infection type of chocolate spot in 1st, 2nd and 3rd crosses, infection type of rust in 2nd, 3rd and 4th crosses, leaf chlorophyll content in all crosses as well as seed yield/plant in 4th cross only, resulting in $[H/D]^{0.5}$ less than unity. Therefore superior genotypes could be identified from its phenotypic expression. Similar conclusion was reported for chocolate spot (Abo El-Zahab *et al* 1994).

The dominance genetic variance was found to be the predominant type controlling the inheritance of No. of mines/100 leaflets and No. of larvae/100 leaflets in 2nd cross, infection type of chocolate spot in 4th cross, infection type of rust in 1st cross and seed yield/plant in 1st, 2nd and 3rd crosses, resulting in $[H/D]^{0.5}$ more than unity, indicating over dominance mode of inheritance in this respect. The considerable amount of non-fixable gene type displayed by these characters in the corresponding crosses may suggest that improving these characters could be achieved through hybrid breeding method. Similar findings were detected for leaf miner, infection type of chocolate spot and rust as well as seed yield/plant by El-Hosary *et al* (1998).

It is likely to note that, the dominance genetic component (H) was negative and significant for No. of mines/100 leaflets in 4th cross, No. of larvae/100 leaflets in 3rd cross, infection type of chocolate spot in 2nd cross and infection type of rust in 3rd and 4th crosses, which in favour of decreasing pest infection then increasing insect and diseases resistance, since increasing alleles for resistance were more frequent than decreasing ones.

Broad sense heritability (Tb) estimates (Table 5) were high (>50%) in most cases of F_4 generation. Narrow sense heritability (Tn) values differed from cross to another according to the genetic makeup of the two parents involved in the cross. It was relatively high for No. of mines/100 leaflets in all crosses, infection type of chocolate spot and rust as well as leaf chlorophyll content in three crosses and No. of larvae/100 leaflets in two out of the studied four crosses. These results allowing for considerable progress from selection.

Whereas, low to moderate (Tn) estimates were reported for seed yield/plant and the remaining crosses for the various characters. In this connection, low to moderate (Tn) values were recorded for leaf miner, infection type of chocolate spot and rust and seed yield by El-Hosary *et al* (1998).

Table 5. Assessment of additive (D), dominance (H) genetic variances, heritability and genetic advance for the studied characters in F_4 generation of four faba bean crosses

Parameter	D	H	$\{H/d\}^{1/2}$	T_b	T_n	Gs%
Cross populations	No. of mines/100 leaflets					
1-G.3 x G.429	108.38**	64.72**	0.772	79.97	69.56	3.18
2-Improved G.3 x G.716	96.41**	139.81**	1.204	75.49	55.36	5.98
3-G.429 x G.843	74.03*	28.46**	0.620	71.22	64.96	3.26
4-G.843 x Sakha 1	107.34**	-154.30**	--	75.88	75.88	8.45
No. of larvae/100 leaflets						
1-G.3 x G.429	186.48**	119.91**	0.801	86.11	74.16	8.04
2-Improved G.3 x G.716	9.33*	101.30**	3.295	65.36	17.56	4.36
3-G.429 x G.843	3.61*	-103.14**	--	9.18	9.18	16.82
4-G.843 x Sakha 1	245.89**	155.90**	0.796	91.24	78.73	28.52
Infection type of chocolate spot						
1-G.3 x G.429	19.09**	10.97*	0.758	89.90	78.58	71.84
2-Improved G.3 x G.716	2.05*	-6.43*	--	31.27	31.27	22.77
3-G.429 x G.843	15.57**	12.64**	0.901	81.36	67.60	60.72
4-G.843 x Sakha 1	9.17**	13.06**	1.193	71.72	52.85	55.21
Infection type of rust						
1-G.3 x G.429	2.34	17.76**	2.754	50.46	17.39	8.17
2-Improved G.3 x G.716	12.35**	10.15*	0.906	71.74	59.48	49.01
3-G.429 x G.843	7.60*	-16.41**	--	57.46	57.46	33.48
4-G.843 x Sakha 1	3.80*	-10.61**	--	51.35	51.35	22.28
Leaf chlorophyll content						
1-G.3 x G.429	64.14**	28.71**	0.669	78.62	70.69	25.28
2-Improved G.3 x G.716	123.96**	104.40**	0.918	93.08	76.86	31.79
3-G.429 x G.843	124.84**	118.46**	0.975	72.49	21.49	6.88
4-G.843 x Sakha 1	148.25**	140.20**	0.972	94.52	76.41	26.47
Seed yield/plant						
1-G.3 x G.429	180.75**	539.88**	1.728	77.20	44.15	18.75
2-Improved G.3 x G.716	59.17**	190.62**	1.794	76.39	42.26	16.80
3-G.429 x G.843	104.01**	250.95**	1.553	79.78	49.76	22.24
4-G.843 x Sakha 1	390.01**	387.99**	0.997	78.51	62.84	25.37

The results of expected genetic advance in F_4 generation varied from cross to cross, it was low for No. of mines and larvae/100 leaflets and moderate for infection type of rust, leaf chlorophyll content and seed yield/plant as well as high for infection type of chocolate spot.

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تقدير بعض المعالم الوراثية لمقاومة صانعة أنفاق الأوراق و التبقع البني و الصدأ والمحصول في عشائر الجيل الثاني والرابع من الفول البلدي

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أجريت هذه الدراسة بالمزرعة التجريبية بكلية الزراعة- جامعة الزقازيق مستخدماً ستة أصناف من الفول البلدي متباينة في مقاومتها لصانعة أنفاق الأوراق , والتبقع البني (الشوكلاتي) و الصدأ والمحصول هي؛ جيزة ٣ , جيزة ٣ محسن , جيزة ٤٢٩ , جيزة ٧١٦ , جيزة ٨٤٣ وسخا ١ مع صنف المقارنة (جيزة ٤٠٢) , وعشائر الأجيال الثاني والرابع لأربعة هجن ناتجة عنها هي ١) جيزة ٣ × جيزة ٤٢٩ , ٢) جيزة ٣ محسن × جيزة ٧١٦ , ٣) جيزة ٤٢٩ × جيزة ٨٤٣ (٤ جيزة ٨٤٣ × سخا ١ لتقدير متوسط السلوك , معامل الارتباط , السلوك الوراثي , معامل التوريث والتحسين الوراثي المتوقع لمقاومة صانعة أنفاق الأوراق و التبقع البني و الصدأ ومحتوي كلوروفيل الورقة والمحصول. ويمكن تلخيص أهم النتائج فيما يلي:

اختلفت التراكيب الوراثية معنوياً في جميع الصفات المدروسة. وكانت أكثر أصناف الفول البلدي تحملاً لصانعة أنفاق الأوراق جيزة ٨٤٣ يليه الصنفين جيزة ٧١٦ و سخا ١ وعشائر الجيلين الثاني والرابع للهجين جيزة ٤٢٩ × جيزة ٨٤٣ و جيزة ٨٤٣ × سخا ١ , كما أعطت متوسطات عالية لمحتوي كلوروفيل الورقة ومحصول البذور مقارنة بالأصناف القابلة للإصابة جيزة ٣ , جيزة ٣ محسن , جيزة ٤٢٩ وصنف المقارنة جيزة ٤٠٢.

وكانت أكثر الأصناف مقاومة لمرض التبقع البني والصدأ جيزة ٤٢٩ وسخا ١ ونسل الهجين جيزة ٨٤٣ × سخا ١ في الجيلين الثاني والرابع , في حين كانت الأصناف جيزة ٣ و جيزة ٣ محسن قابلة للإصابة.

أظهرت نتائج الارتباط , وجود ارتباط سالب ومعنوي بين محتوي كلوروفيل الورقة ومحصول بذور النبات علي جانب وكل من ؛ عدد اليرقات/١٠٠ وريقة , وطراز الإصابة للتبقع البني والصدأ

أشارت تقديرات الفعل الجيني في الجيل الثاني , إلي أهمية الفعل الجيني السيادي في وراثة عدد اليرقات/١٠٠ وريقة , طراز الإصابة للتبقع البني والصدأ ومحتوي كلوروفيل الورقة ومحصول بذور/نبات في معظم الهجن. وأظهر كل من الفعل الجيني المضيف والسيادي أهمية في وراثة عدد

اليرقات/١٠٠ وريقة. وقد ازدادت قيمة الفعل الجيني المضيف بتقدم الأجيال ، حين كان هو الأكثر أهمية في وراثة عدد أنفاق الأوراق/١٠٠ وريقة و عدد اليرقات/١٠٠ وريقة ، طراز الإصابة للتبقع البني والصدأ ومحتوي كلوروفيل الورقة في الجيل الرابع. بينما كان الفعل الجيني السيادي هو الغالب في وراثة محصول البذور في معظم الهجن. وقد اختلفت تقديرات معامل التوريث من هجين إلي هجين ومن جيل إلي أخر وتباينت من متوسطة لصفة محصول البذور إلي عالية لباقي الصفات المدروسة. وكان مقدار التحسين الوراثي المتوقع بالانتخاب متوسطاً للمقاومة للصدأ ومحتوي كلوروفيل الورقة ومحصول البذور وعالياً لمقاومة مرض التبقع البني.