

**PRODUCTIVITY OF SOME FABA BEAN
VARIETIES AND SUSCEPTIBILITY TO
INFESTATION WITH *LIRIOMYZA CONGESTA*
(BECKER) AND *BRUCHUS RUFIMANUS* BOH.
UNDER MARYOUT RAINFED CONDITIONS**

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The incidence of the leafminer *Liriomyza congesta* (Becker) and *Bruchus rufimanus* Boh. was studied in fourteen faba bean varieties and bred lines under Maryout rainfed conditions during 2000/2001 growing season. According to the percentage of infestation, the fourteen varieties could be divided into the following groups: The first group: exhibiting the least level of infestations were recorded for Giza Blanca, FLR, Giza 461 L.149, and L.143, i.e. 31.05, 29.12, 28.00, 26.58 and 25.17% respectively. The second group: moderate infestation with the leafminer was found for Mar.3, HBP-B, and Mar.4 were 43.65, 39.51, and 36.15%, respectively. The third group; included plants more susceptible to *L. congesta* infestation HBP-D, L.145, Mar.2, Mar.1 and HBP-C varieties where the infestation percentage were found to be 53.57, 52.61, 50.00, 49.37, and 46.85%, respectively. The fourth group: included the most susceptible plant, i.e. HBP-MSR as percentage of infestation reached 59.13%. It was noticed that leaves lower in the plant strata were found to be the most infested by the leafminer followed by the medium level and least in the upper level for faba bean plant. Statistical analysis showed highly significant differences in the percentages of infestation of faba bean seeds by the *B. rufimanus*. The results indicated that the highest infestation occurred in HBP-MSR, HBP-D, L.145 and HBO-C bred lines, where 18.43, 12.71, 11.04 and 10.38 %, respectively were recorded. Low infestations in HBP-B, Mar.4, FLR and Mar.2 lines were found to be 4.85, 4.50, 4.17 and 3.93%, respectively. The other varieties exhibited moderate infestation.

Keywords: faba bean, leafminer, *Liriomyza congesta*, bruchid beetle, *Bruchus rufimanus*.

The faba bean, *Vicia faba* (L.) is a plant of economic importance in Egypt. Continuous efforts are carried out to increase faba bean production mainly in newly reclaimed lands, e.g. in Maryout sector (Omar *et al.*, 1998 a and b) and in North Sinai (Hassanein and Afiah, 2002). Improved crop varieties as well as breeding of new genotypes are in constant demand to increase crop productivity. The faba bean plant is attacked by several insect pests, in the field as well as during storage (Abou-Attia, 1999 and Farouk *et al.*, 2002). In the field, the leafminer *Liriomyza congesta* (Becker) (Diptera: Agromyzidae) causes considerable crop damage (Aly and Makadey 1990; Mousa *et al.*, 1994 and Salem *et al.*, 1998). Another insect pest attacking faba bean is *Bruchus rufimanus* Boh. (Coleoptera: Bruchidae). These beetles infest faba beans in the field and in the stores causing considerable damage, (Shalaby *et al.*, 1999 and Abdel-Aziz and Ismail 2000).

The aim of the present work was to compare the productivity of three local faba bean varieties grown in reclaimed desert land at Maryout under rainfed conditions with 11 faba bean bred lines. Also to compare the susceptibility of these 14 varieties to infestation by the leafminer, *L. congesta* (Becker) in the field and the bruchid, *Bruchus rufimanus* during storage.

MATERIALS AND METHODS

The experiment was conducted at Maryout Research Station belonging to Desert Research Center during the faba bean agricultural season from November 2000 until April 2001. Fourteen faba bean seeds varieties and bred lines were included in the present experiment as follows:

- 1-Four new bred lines introduced by ICARDA:
HBP-B, HBP-C, HBP-D and HBP-MSR.
2. Four new bred lines produced by DRC faba bean breeding program:
Mar-1, Mar-2, Mar-3 and Mar-4
- 3-Three newly bred lines produced at the Faculty of Agriculture,
Moshtohor University: L.143, L.145 and L.149.
- 4- Local Bedouins variety at El-Farafra Oasis; FLR.
- 5- Two local varieties Giza Blanca and Giza 461, which were considered as control.

The total area planted was about one feddan, the block design was adopted.

The 14 faba bean varieties and bred lines were cultivated in rows spaced 50 cm. between them and 25 cm apart between hills (2 plants/hill) and replicated three times in randomized complete blocks design. The normal agricultural practices were carried out except that pesticides were not used at any time. Irrigation was only used at seed sowing from the available water source (Ecc 3.2 dSm⁻¹). The following growing stages of faba bean

plants were dependant on rainfall (120.4 mm for the mentioned season). To compare the productivity of the fourteen faba bean varieties and bred lines, the following parameters were studied:

- 1- Average height of the growing plants was measured and number of branches / plant counted.
- 2- Numbers of pods/ plant and seeds per pod were calculated following harvesting.
- 3- Seed yield /m² calculated.

For each parameter studied the average of fourteen plants from each variety and bred lines were randomly chosen. To determine infestation by the leafminer *L. congesta*, the first investigation was conducted after 35 days following seed sowing. This was again repeated every ten days, up to plant maturation making a total of five investigations. At each observation, five plants from each variety and bred line were randomly chosen from three different levels; upper, middle and lower-strata. These investigated leaves were marked so as not to be included in the following observation. The investigated leaves which caused by *L. congesta* were counted and recorded. After plant maturation, the faba bean seeds of each genotype were harvested separately and each was stored in clean glass jars of 1kg capacity. The investigation for faba bean seed infestation by *B. rufemanus* was observed during storage. For this purpose, 200 gm. of each bean seed variety and bred lines were randomly chosen. The infested and non infested bean seeds were separated and counted and percentage infestation calculated. Statistical analysis of the obtained data was carried out for analysis of variance according to Snedecor and Cochran (1980). Means were compared using the L.S.D. values proposed by Waller and Duncan (1969).

RESULTS AND DISCUSSION

1-Seed Yield and its Components

Significant differences were found (Table 1) among faba bean varieties and bred lines for all studied traits. The local faba bean genotype, Giza 461 and bred line Mar.4 were the tallest plants measuring 92.10 and 89.70 cm., respectively. Meanwhile, Mar.1, HBP-MSR and L.145 were the shortest plants measuring 69.60, 71.80 and 71.90 cm., respectively. It is noteworthy that the height of plant was insignificantly associated with its seed yield. The bred lines Mar.3, Mar.2 and HBP-C ranked first for weight of seed yield/ m² i.e. 655.4, 624.9 and 612.5 g, respectively. The lowest weight of seed yield/ m² Giza were recorded for 461, FLR, L.143, L.145, and HBP-B as 439.6, 448.6, 477.20, 484.3, and 509.4, respectively. The highest numbers of pods per plant were observed as 20.51 and 18.04, for Mar.2 and L.149, respectively. These findings are in agreement with the results obtained by Omar *et al.* (1998 a and b).

TABLE (1). Plant characteristics of faba bean varieties and bred lines under Maryout rainfed conditions.

Varieties and bred line	Plant height (cm)	No. of branches / plant	No. of pods / plant	No. of seeds / pod	Seed yield/m ² (g)	RI %
HBP-B	86.4	2.3	14.33	2.86	509.4	-1.71
HBP-C	72.5	3.4	17.68	3.15	612.5	15.41
HBP-D	79.3	2.5	15.10	2.61	565.7	8.41
HBP-MSR	71.8	2.0	13.78	2.86	572.7	9.53
Mar.1	69.6	2.8	13.93	1.93	594.5	12.85
Mar.2	80.5	3.2	20.51	2.85	624.9	17.09
Mar.3	85.2	2.7	17.82	3.28	655.4	20.95
Mar.4	89.7	3.5	16.97	3.06	592.7	12.59
FLR	73.0	2.2	15.35	3.25	448.6	-15.49
L.143	88.7	3.3	15.56	3.22	477.2	-8.57
L.145	71.9	3.8	15.30	2.93	484.3	-6.98
L.149	83.4	2.9	18.04	3.14	540.8	4.20
Giza Blanca	78.0	3.1	12.26	2.19	518.1	-
Giza 461	92.1	2.6	13.71	2.97	439.6	-17.86
Mean	80.15	2.88	15.74	2.88	545.46	-
LSD 0.05	2.05	0.13	0.91	1.32	15.43	-

RI %= Relative increase in seed yield over check cultivar (Giza Blanca) under rainfed conditions.

2-Seasonal Abundance of *L. congesta*

The percent of infestation with *L. congesta* in faba bean in the field varied according to the varieties and bred lines at the growing stage of the plants. Fourteen varieties and bred lines could be divided into the following groups according to the statistical analysis at the first investigation on 31st December, 2000. Table (2) showed high significant difference in the first group, the least level of leaves infestations by *L. congesta* were recorded for Giza Blanca, FLR, Giza 461 L.149, and L.143, were 31.05, 29.12, 28.00, 26.58 and 25.17% respectively. The second group, exhibited moderate infestation with the leafminer and included Mar.3, HBP-B and Mar.4, were 43.65, 39.51, and 36.15% respectively. The third group included the susceptible plant to *L. congesta* infestation where percentages of infestation recorded 53.57, 52.61, 50.00, 49.37, and 46.85% for HBP-D, L.145, Mar.2,

Mar.1 and HBP-C bred lines, respectively. The fourth group, the largest level of *L. congesta* infestation was HBP-MSR, which recorded 59.13%.

TABLE (2). Percentages of infestation by the leafminer, *Liriomyza congesta* on faba bean varieties and bred lines, cultivated at newly reclaimed land of Maryout.

Varieties and bred lines	Percentage of <i>L. congesta</i> infestation on faba bean leaves per plant					Average
	Dec. 31, 2000	Jan.10, 2001	Jan.20, 2001	Jan.30, 2001	Feb.9, 2001	
HBP-B	39.51 ± 3.41	29.31 ± 1.17	20.76 ± 2.95	30.34 ± 1.47	17.56 ± 1.82	27.50 ± 3.01
HBP-C	46.85 ± 3.71	39.14 ± 1.61	32.72 ± 3.50	29.20 ± 2.82	21.72 ± 2.50	33.93 ± 2.93
HBP-D	53.57 ± 3.99	41.52 ± 2.02	34.73 ± 3.03	21.46 ± 2.42	13.55 ± 2.05	32.97 ± 2.80
HBP-MSR	59.13 ± 3.73	47.28 ± 1.41	44.14 ± 4.38	36.01 ± 3.40	26.47 ± 3.23	42.61 ± 3.38
Mar.1	49.37 ± 4.11	40.89 ± 3.62	34.93 ± 3.19	22.54 ± 2.90	14.37 ± 2.73	32.42 ± 3.35
Mar.2	50.00 ± 3.81	37.25 ± 3.20	29.81 ± 3.30	17.18 ± 2.12	8.89 ± 2.01	28.63 ± 2.97
Mar.3	43.65 ± 3.62	38.34 ± 3.49	32.46 ± 4.46	16.55 ± 1.92	7.76 ± 1.69	27.75 ± 2.89
Mar.4	36.15 ± 3.44	27.61 ± 3.38	24.68 ± 3.22	22.41 ± 2.17	11.45 ± 2.12	24.45 ± 2.81
FLR	29.12 ± 4.21	22.03 ± 3.44	17.06 ± 2.66	11.78 ± 2.01	7.16 ± 1.96	17.43 ± 2.98
L.143	25.17 ± 3.27	21.11 ± 3.01	18.87 ± 3.79	12.85 ± 0.96	5.44 ± 2.88	16.69 ± 2.94
L.145	52.61 ± 3.93	39.06 ± 3.64	31.28 ± 3.57	31.28 ± 1.47	18.14 ± 1.89	34.47 ± 3.07
L.149	26.58 ± 3.44	22.58 ± 3.33	17.44 ± 3.32	11.17 ± 1.85	4.96 ± 1.46	16.55 ± 2.81
Giza Blanca	31.05 ± 3.64	24.03 ± 2.67	22.65 ± 2.29	17.22 ± 2.36	10.58 ± 2.15	21.11 ± 2.68
Giza 461	28.00 ± 3.45	23.17 ± 2.93	17.99 ± 2.41	12.29 ± 2.05	5.47 ± 1.53	17.38 ± 2.56
Mean	38.52 ± 3.70	32.38 ± 2.92	27.14 ± 3.23	20.89 ± 2.23	12.43 ± 2.29	26.71 ± 2.93
L.S.D. at 0.05	4.98	3.15	2.98	3.01	2.87	

Generally, this trend could be applied for the following dates of inspection i.e. at 10, 20, 30 January and 9 February, 2001 (Table 3 and Fig.1). However, there was a gradual decrease in infestation level, with the growing of the plants to reach a minimum average of 12.43% at the last investigation (February 9). From the fore-mentioned results, varieties and bred lines L.149, L.143, Giza 461 and FLR could be considered the most resistant to *L. congesta* infestation in the field. The highest mean infestation rate with the leafminer *L. congesta* was 41.23% on the lower level of the plant, followed by the medium level (27.14%). The lowest infestation rate of 11.75% was obtained on the high level of the plant. These differences were statistically significant.

TABLE (3). Vertical distribution of *Liriomyza congesta* infestation on faba bean plants.

Varieties and bred lines	Percentage of <i>L. congesta</i> infestation / level for plant			Average
	Lower level	Medium level	Upper level	
HBP-B	38.91± 2.57	28.93±2.06	14.66 ±1.88	27.50 ± 2.19
HBP-C	51.73 ± 2.69	34.83± 2.15	15.24 ± 1.36	33.93 ± 2.14
HBP-D	48.21±3.25	36.93± 3.10	13.78 ± 1.46	32.97 ± 2.72
HBP-MSR	67.12± 3.30	41.57± 2.78	19.15± 1.62	42.61 ± 2.66
Mar.1	51.11 ± 3.00	31.66±2.79	14.50 ± 1.68	32.42 ± 2.56
Mar.2	46.14 ± 3.39	29.01± 2.79	10.74 ± 1.79	28.63 ± 2.73
Mar.3	45.86 ± 3.40	27.21 ± 1.77	10.18 ± 1.75	27.75 ± 2.44
Mar.4	39.13 ± 3.09	25.09 ± 1.77	9.12 ± 1.97	24.45 ± 2.35
FLR	25.11 ± 3.35	18.00 ± 3.06	9.17 ± 1.46	17.43 ± 2.75
L.143	23.39 ± 2.72	19.24 ± 1.47	6.31 ± 1.27	16.68 ± 3.34
L.145	54.36 ± 2.98	34.81± 2.87	14.25 ± 1.93	34.47 ± 2.64
L.149	26.11 ± 3.20	16.43± 1.79	7.12 ± 1.25	16.55 ± 2.24
Giza Blanca	35.31 ± 2.97	18.78 ± 1.43	9.24 ± 1.42	21.11 ± 2.07
Giza 461	24.78 ± 2.99	17.42 ± 1.63	9.94 ± 1.32	17.38 ± 2.11
Mean	41.23± 3.06	27.14± 2.25	11.75 ± 1.58	26.71 ± 2.30
1.SD at 0.05	4.02	3.52	3.65	

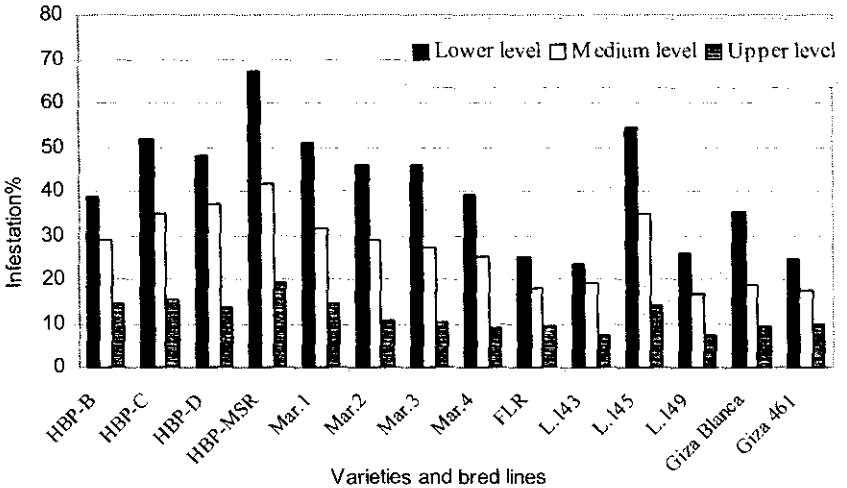


Fig (1). Vertical distribution of *Liriomyza congesta* infestation on faba bean varieties and bred lines tested.

These results are in agreement with those reported by Sharaf El-Din *et al.* (1997) and Hammad (2000) who revealed that the peak of infestation on broad bean was in late December and early January. Farouk *et al.* (2002) had also reported the seasonal fluctuation of infestation by the leafminer *L. congesta* until mid February. Abou-Attia (1999) indicated that some faba bean lines were found to be susceptible to *L. congesta* infestation such as Giza Blanca and Giza 466, while some varieties were resistant such as Giza 461.

3- Faba Bean Bruchid Beetle; *Bruchus rufimanus* Boh.

The percentage of infestation of faba bean seeds by *B. rufimanus* varied according to the different varieties and bred lines and ranged between 3.93 and 18.43%. The most susceptible faba bean bred lines to *B. rufimanus* infestation were HBP-MSR, HBP-D and L145, where the rates of infestation were 18.43, 12.71 and 11.04%, respectively. Meanwhile infestation of HBP-C, Mar.1, and Mar.3 bred lines were low i.e. 10.38, 8.96, and 8.24%, respectively, followed by Giza 461, L 143, L 149 and Giza Blanca i.e. 7.77, 7.25, 7.05 and 6.71%, respectively. The least infestations were obtained for HBP-B, Mar. 4, FLR and Mar. 2 bred lines as 4.85, 4.50, 4.17, and 3.93%, respectively.

The mean heaviest weight of single faba bean seed after harvest was 1492.54 and 1219.51 mg for Mar.1 and Giza Blanca, respectively (Tables 4 and 5 and Fig.2). For these two types it is noteworthy that the numbers of seeds in 200 g. were little (134 and 164 seeds, respectively). The lowest weights of seeds were recorded for FLR, L143, Mar-4 and Giza 461 being 595.24, 604.23, 692.04 and 706.71 mg, respectively. The reduction in weights of faba bean seeds could be caused by *B. rufimanus* infestation during storage. Varieties and bred lines HBP-MSR, FLR, L 134, L 145 and HBP-D to be considered the most susceptible to infestation by *B. rufimanus* while bred line Mar.2 is the most tolerant to infestation. Probably, infestation with *B. rufimanus* occurred in the field (Bishara *et al.*, 1967) where the adult of these beetles could remain inside the testa of the plant or hide between petals of the bean flowers for about two or three months. When the weather becomes favorable the insects fly and begin to lay eggs. The different levels of infestation with *B. rufimanus* to faba bean varieties could be attributed to pod shell thickness and the ability of larvae to penetrate the pod as suggested by Caswell (1984) and Huis (1991).

TABLE (4). Percentage of infested seeds of faba bean plants with *Bruchus rufimanus* planted in Maryuot.

Varieties and bred lines	Total No. of seeds in 200 g. soon after harvest			Infestation %
	<i>Uninfested</i>	<i>Infested</i>	<i>Total</i>	
HBP-B	255	13	268	4.85
HBP-C	259	30	279	10.38
HBP-D	213	31	234	12.71
HBP-MSR	177	40	207	18.43
Mar.1	122	12	134	8.96
Mar.2	269	11	280	3.93
Mar.3	245	22	267	8.24
Mar.4	276	13	289	4.50
FLR	322	14	336	4.17
L.143	291	24	331	7.62
L.145	266	33	279	11.04
L.149	277	21	298	7.05
Giza Blanca	153	11	164	6.71
Giza 461	261	22	283	7.77
Average	249.00	21.21	260.64	80.6
LSD at 0.05				1.88

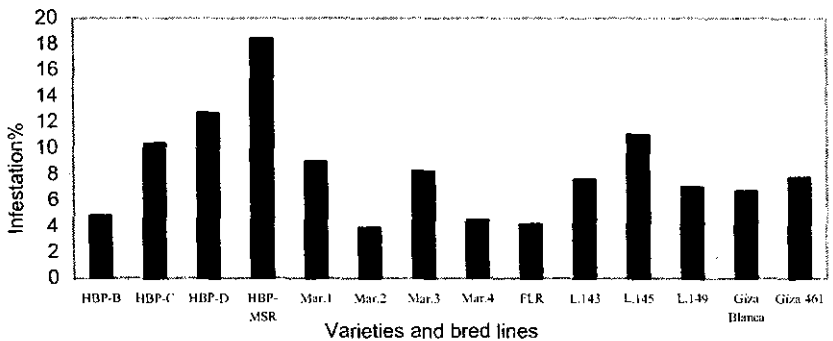
**Fig (2).** Percentage of faba bean seeds infested with *B. rufimanus*.

TABLE (5). Percentage of reduction in weights of faba bean seeds caused by *Bruchus rufimanus* Boh. during storage.

Varieties and bred lines	Mean weight of single seed (mg) after harvest	Dates of inspection								
		1/ 7/ 2001			1/ 9/ 2001			1/ 11/ 2001		
		Mean weight of single seed (mg)		Reduction in weight (%)	Mean weight of single seed (mg)		Reduction in weight (%)	Mean weight of single seed (mg)		Reduction in weight (%)
		Healthy	Infested		Healthy	Infested		Healthy	Infested	
HBP-B	746.27	731.34	692.31	5.34	758.82	653.84	13.83	752.94	615.38	18.27
HBP-C	716.85	741.31	666.67	7.46	731.66	633.33	13.44	718.15	600.0	16.45
HBP-D	854.70	845.07	741.94	12.20	845.07	709.68	16.02	845.07	677.42	19.84
HBP-MSR	966.18	971.75	875.0	9.96	966.10	800.0	17.19	960.45	720.00	25.04
Mar.1	1492.54	1524.59	1416.67	7.08	1508.20	1333.33	11.59	1475.41	1200.00	18.67
Mar.2	714.29	730.48	727.27	0.44	728.62	727.27	0.19	728.62	681.82	6.42
Mar.3	749.06	767.35	727.27	3.24	765.31	681.82	10.91	751.02	636.36	15.27
Mar.4	692.04	675.72	653.85	3.24	673.91	615.38	8.69	673.91	576.92	14.39
FLR	595.24	602.48	571.43	5.15	599.38	500.0	16.58	590.06	448.57	23.98
L.143	604.23	680.41	625.0	8.14	664.95	583.33	12.27	652.92	500.00	23.42
L.145	716.85	721.80	696.97	3.44	712.41	636.36	10.68	699.25	545.45	21.99
L.149	671.14	678.70	666.67	1.77	671.48	619.05	7.81	657.04	571.43	13.03
Giza Blanca	1219.51	1294.12	1272.72	1.65	1264.71	1181.82	6.55	1241.83	1000.00	19.47
Giza 461	706.71	704.98	681.82	3.29	703.07	636.36	9.49	697.32	590.90	15.26
Mean	817.54	833.58	786.83	5.17	828.12	736.54	11.09	817.43	648.80	18.95
LSD at 0.05	192.62			2.80			3.86			6.94

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انتاجية بعض التراكيب الوراثية من الفول البلدى وحساسيتها للإصابة بصناعة الأنفاق وخنفساء الفول الكبيرة تحت الظروف المطرية بمريوط

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قسم وقاية النبات - مركز بحوث الصحراء - المطرية - القاهرة - مصر

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يهدف هذا البحث إلى تحديد السلالات التي تجمع بين الجينات المسؤولة عن تحمل الإجهاد الجفافى مع الجينات المسؤولة عن مقاومة الآفات الحشرية من صناعات الأنفاق وخنفساء الفول الكبيرة في الحقل.

أجرى هذا البحث في محطة بحوث مريوط التابعة لمركز بحوث الصحراء خلال موسم الزراعة ٢٠٠١/٢٠٠٠ وذلك لتقييم حساسية أربعة عشر تركيب وراثي من الفول (ثمانية سلالات محلية وأربعة مستوردة من ايكاردا بالإضافة إلى صنفين للمقارنة) وتم الحصول على النتائج الآتية:

١- صناعة الأنفاق:

ظهرت هذه الآفة الحشرية بداية من شهر ديسمبر حتى نهاية موسم النمو وأوضحت النتائج وجود فروق معنوية بين التراكيب الوراثية المختبرة، لذلك قُسمت إلى أربع مجموعات: المجموعة الأولى: وهي مجموعة أقل حساسية وأكثرها تحمل للإصابة بتلك الحشرة وتشتمل على FLR ، Giza Blanca ، Giza 461 ، L.149 ، L.143 حيث كانت نسبة الإصابة ٣١٠٠٥، ٢٩٠١٢، ٢٨٠٠٠، ٢٦٠٥٨، ٢٥٠١٧% على التوالي. أما المجموعة الثانية تشتمل على تلك الأصناف ذات درجة إصابة معتدلة من حيث الأنفاق في الوريقات مثل Mar.3، HBP-B، Mar.4 والمجموعة الثالثة تشتمل الأصناف التي تعتبر حساسة بالإصابة الحشرية HBP-D ، L.145، Mar.2، Mar.1، HBP-C حيث سجلت ٥٣٠٥٧، ٥٢٠٦١، ٥٠٠٠٠، ٤٩٠٣٧، ٤٦٠٨٥% على التوالي. أما المجموعة الرابعة تشتمل صنف واحد HBP-MSR وهي الأكثر حساسية وتعداد بتلك الحشرة حيث سجلت نسبة الإصابة ٥٩٠١٣%. ولوحظ أن الجزء السفلي لنباتات الفول أكثر حساسية للإصابة بالحشرة صناعة الأنفاق عن كلا من الجزء الأوسط والجزء العلوي للنباتات.

٢- خنفساء الفول الكبيرة:

تبدأ الإصابة في الحقل وتستمر في المخزن. أوضح التحليل الإحصائي وجود فروق معنوية بين الأصناف المختبرة. كانت أعلى نسبة مئوية للحبوب المصابة بهذه الحشرة في السلالات HBP-MSR، HBP-D، L.145، HBP-C بنسب ١٨٠٤٣، ١٢٠٧١، ١٠٠٤ و١٠٠٣٨% على التوالي ويليهما في المقاومة السلالات Giza Blanca، HBP-B، Mar.4، FLR، Mar.2 بينما أخذت باقي الأصناف الأخرى إصابات حشرية متوسطة. نستنتج من ذلك أن معظم السلالات المحسنة وراثياً والتي تم تربيتها تحت الظروف المحلية كانت أكثر مقاومة لصناعات الأنفاق وأقل إصابة بخنفساء الفول الكبيرة.