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MISR 3, A NEW *OROBANCHE* TOLERANT FABA BEAN VARIETY

Attia, Sabah M. M. M. El-Hady, H. A. Saber, M.A. Omer, S.A. Khalil, Mahmoud Samia A. , A. A. M. Ashrei, Rehab, A. M. Abd-Elrahman, M. A. M. Ibrahim, Zeinab, E. Ghareeb,* T. S. El-Marsafawy, E.H. El-Harty, E . A. A. El-Emam, F.H. Shalaby, A.G. Helal, A.M. El-Garhy, E.M. Rabie, M. Abdeen, M. El-Noby, Kh. M. M., Yamani, Abd El-Aal H. T., M. A. Ibrahim, R.A. Abo Mostafa, W. El-Rodeny, K. M. Morsy, Noher, A. Mahmoud** Azza F. El-Sayed and Hend A. Ghannam**

Field crops Res. Institute, ARC , Giza.
*Center Lab. For Design and Stat. Anal. Res., ARC, Giza..
**Plant pathology Res. Institute, ARC, Giza.

ABSTRACT

Ten promising Orobanche tolerant faba bean genotypes were evaluated with Misr 1 and Giza 843 (tolerant) and Giza 40 (susceptible) under free and highly Orobanche infested fields at Giza Research Station from 2005/06 to 2007/08 growing seasons. The same materials were evaluated under farmers' fields in Behera and Sharkia Governorates during 2008/09 season under free and natural infested soils. Demonstration plots were conducted at Behera and Sharkia in Orobanche heavy infested farmers' fields to demonstrate to the farmers the level of resistance in the new tolerant genotype. At Giza Research Station, the promising genotype X-1722 exceeded the other genotypes by an average of 2-80 % for seed yield/plant. For seed yield /fed. results indicated that X-1722, X-1714 and Misr 1 could be considered tolerant to Orobanche compared with the susceptible check. In on farm trials, X-1722 seed yield exceeded Misr 1 and Giza 843 by 4 and 30%. The promising X-1722 seed yield exceeded the recommended tolerant cultivar Giza 843 by 19.5– 31.5% at Sharkia and by 26.2– 34.0% at Behera in season 2011, and has been released as a new variety in 2011 season with the name of Misr 3.

Key words: ***Faba bean, Orobanche tolerance, Newly released variety.***

INTRODUCTION

In Egypt faba bean is considered the most important food legume that provides adequate amount of protein supply in the diet. In addition, the dry seeds contain about 58% carbohydrates, which considered as a good source of energy. Besides its contribution to soil nitrogen fertility through N_2-fixation. The cultivated area across the last five years (2008 – 2012) was 61000 fedan with an average yield of 8.87 ard/fed. Broomrape (*Orobanche crenata*, Forsk) is known to be the highly damaging parasite plant affecting faba bean production in Egypt. When infestation levels are high, there can be complete failure of the crop.

Various control methods have been proposed, ranging from cultural practices such as hand weeding, solarization, trap and catch crops, delayed sowing dates and crop rotation, to use of chemical and biological control methods. However, no single method has provided satisfactory control (Parker 1994 and Rubiales *et al* 2002). Little success has been achieved in breeding legumes for broomrape resistance due to the scarcity of sources of resistance and the complex inheritance of those available so far (Cubero *et*

al 1994 and Rubiales 2003). Thus, there is a great need for development of resistant cultivars and for better understanding of inheritance of resistance (Sillero *et al* 2005).

Several resistant lines and cultivars have been described in the last few decades such as VF-172, Baraka, ILB437, ILB4357 and ILB4360 breeding lines (Cubero 1973, Cubero *et al* 1992 and Khalil *et al* 2004).

In Egypt, plant breeders developed family 402 as the first source for resistance to *Orobanche crenata* (Nassib *et al* 1979). An intensive breeding program started utilizing the resistant germplasm accessions, breeding lines, landraces and recommended cultivars through hybridization and selection. This program resulted in releasing three cultivars (Giza 429, Giza 674 and Giza 843) having high level of resistance to *Orobanche* and became available to the Egyptian farmers (Khalil *et al* 1994, Attia 1998 and Saber *et al* 1999). The promising genotype 667/153/87 has been released as new cultivar under the name Misr 1 in 2001 (Saber *et al* 2002).

At the Faculty of Agriculture, Cairo University they succeeded to develop three tolerant genotypes; Cairo 241, Cairo 1 and Cairo 2, (Darwish and Abdalla, 1994 and Abdalla and Darwish 1996 a and b 2004). Recently three *Orobanche* tolerant faba bean varieties have been released under the names: Cairo 4, Cairo 5 and Cairo 25 (Abdallah and Darwish 2008).

The objective of this work was to evaluate the newly developed faba bean cultivar (Misr 3) as a new source for *Orobanche* resistance, which may be useful genetic stock in food legume breeding programs in Egypt under natural infestation in farmer fields.

MATERIALS AND METHODS

A diallel mating design was performed among eight faba bean genotypes (Attia 1998). Five F_2 populations were promising for *Orobanche* tolerance and rehybridization took place with both L-667 (Misr 1), and L-101 from Faculty of Agriculture, Cairo University in 1999. Ten genotypes (Table 1) were established and evaluated with Misr 1 and Giza 843 (tolerant), and the highly susceptible cultivar Giza 40 under heavy infested field with *Orobanche* at Giza Research Station, ARC, Egypt from 2000 to 2004 seasons and all plants that have tolerance and low dry weight of *Orobanche* were selected and bulked. A randomized complete block design with three replications was used. Each genotype was represented by three ridges, 3m long and 60 cm apart with single seeded hills at one side of the ridge and 20cm between hills.

The previous genotypes were evaluated in farmers' fields in Behera and Sharkia Governorates during 2008/09 season under naturally infested soils with *Orobanche*. A randomized complete block design with three replications was used and the plot size was 5.4 m^2.

During 2008/09 and 2009/10 seasons, eight demonstration plots were conducted in Behera and Sharkia Governorates (each 0.5 fed) in heavy *Orobanche* infested farmers' fields to demonstrate to the farmers the level

of resistance in the new cultivar "Misr 3". The data were analyzed using randomized complete block design as outlined by Gomez and Gomez (1984).

The reduction due to *Orobanche* infestation was calculated according to the formula:

$$\text{Reduction\%} = \frac{\text{Seed yield of free field - Seed yield of infested field}}{\text{Seed yield of free field}} \%$$

Table 1. Pedigree and reaction to *Orobanche* of thirteen faba bean genotypes.

Genotype	Pedigree	Reaction to *Orobanche*
X-1722 (Misr 3)	**L-667 X (Cairo241 XG.461)**	**Tolerant**
X-1714	**L-667 X (G.429 X G.843)**	**Tolerant**
X-1715	**L-101 X (G.429 X G.843)**	**Tolerant**
X-1716	**L-667 X (G.674 X BPL536)**	**Tolerant**
X-1717	**L-101 X (G.674 X BPL536)**	**Tolerant**
X-1718	**L-667 X (G.843 X Cairo241)**	**Tolerant**
X-1719	**L-101 X (G.843 X Cairo241)**	**Tolerant**
X-1720	**L-667 X (G.843 X BPL536)**	**Tolerant**
X-1721	**L-101 X (G.843 X BPL536)**	**Tolerant**
X-1723	**L-101 X (Cairo241 X G.461)**	**Tolerant**
Misr 1	**Giza 3 X 123A/45/76**	**Tolerant**
Giza 843	**Cross 461 X Cross 561**	**Tolerant**
Giza 40	**Single plant selection from Rebaia 40**	**Highly susceptible**

All materials were obtained from Field Crops Research Institute (FCRI) except BPL material was obtained from ICARDA, the parental genotype Cario241 was obtained from Agronomy Department, Faculty of Agriculture, Cairo University.

Figure (1): summarizes origin of the new variety Misr 3 coupled with Table 3

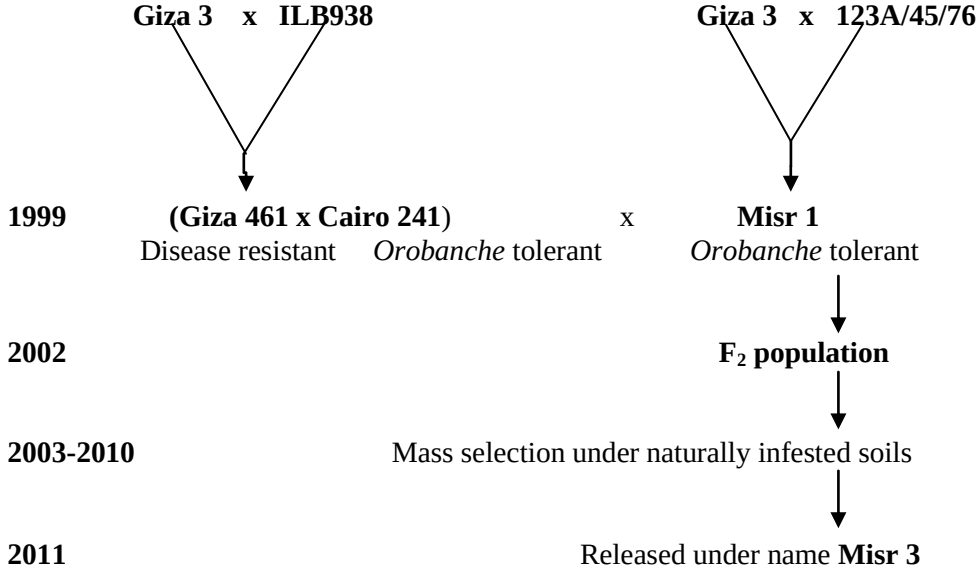

Fig 1. Chart of the origin of the newly released *Orobanche* tolerant faba bean variety Misr 3

RESULTS AND DISCUSSION

The data of Misr 3 variety were collected from Giza Research Station and from on farm and demonstration fields as follows:

Giza Research Station

Data presented in Tables (2, 3, 4 and 5) indicated that all tested genotypes and the two tolerant check cultivars; Giza 843 and Misr 1 exceeded the susceptible check Giza 40 in seed yield.

For number of pods/plant, X-1714, X-1716 and X-1722 were the least affected genotypes. X-1714 recorded the least reduction value due to *Orobanche* infestation (24.90%), followed by X-1716 (30%) and X-1722 (30.8%). However, Giza 40 recorded the highest reduction value (100%). Misr 3 was superior in number of pods/plant, and had 29 and 49% relative increase compared with the check cultivars Giza 843 and Misr 1, respectively and exceeded the other genotypes by an average of 3-46% (Table 2).

For seed yield/plant, results presented in Table (3), showed a significant effect of studied genotypes on seed yield/plant across the three seasons. The promising genotype Misr 3 exceeded the tolerant check cultivars Misr 1 and Giza 843 by 4 and 30%, respectively and exceeded the other genotypes by an average of 2- 80%.

Table 2. Average number of pods/plant of faba bean genotypes evaluated under both free and infested soils with *O. crenata* at Giza Research Station (2005/06, 2006/07 and 2007/08 growing seasons).

Genotype	2005/06		2006/07		2007/08		Average		Reduction %	Relative increase%
	Free	Infested	Free	Infested	Free	Infested	Free	Infested		
X-1722 (Misr 3)	34.3	23.0	12.1	11.0	31.7	20.1	26.0	18.0	30.8	
X-1714	31.1	23.0	20.0	15.9	18.8	13.5	23.3	17.5	24.9	03
X-1715	30.7	11.0	17.0	16.4	22.2	20.8	23.3	16.1	30.9	12
X-1716	31.9	13.3	15.7	13.7	22.5	21.9	23.3	16.3	30.0	10
X-1717	37.0	13.3	13.3	12.7	24.1	21.1	24.8	15.7	36.7	15
X-1718	26.7	15.7	20.4	11.0	21.1	17.1	22.7	14.6	35.7	23
X-1719	23.8	09.0	15.8	11.7	18.0	16.9	19.2	12.5	34.9	44
X-1720	24.2	13.7	19.5	10.3	21.2	18.0	21.6	14.0	35.2	29
X-1721	28.9	14.3	15.1	05.7	20.7	16.9	21.6	12.3	43.1	46
X-1723	30.5	08.0	15.5	09.0	22.9	21.6	23.0	12.9	43.9	40
Misr 1	26.3	11.0	14.6	10.2	28.4	15.2	23.1	12.1	47.6	49
Giza 843	35.2	11.7	20.7	11.3	27.1	19.0	27.7	14.0	49.5	29
Giza 40	25.7	00.0	18.4	00.0	21.6	00.0	21.9	00.0	100.0	-
L.S.D.$_{0.05}$	7.9	7.5	4.1	6.9	5.5	8.8	-	-	-	

For statistical analysis one is added to all numbers but actual values are tabulated

$$\text{Reduction \%} = \frac{\text{Seed yield of free field - Seed yield of infested field}}{\text{Seed yield of free field}} \%$$

Relative increase of Misr 3 over other tested genotypes.

Table 3. Mean seed yield/plant (g) of faba bean genotypes evaluated under both free and infested soils with *O. crenata* at Giza Research Station (2005/06, 2006/07 and 2007/08 growing seasons).

Genotype	2005/06		2006/07		2007/08		Average		Reduction %	Relative increase %
	Free	Infested	Free	Infested	Free	Infested	Free	Infested		
X-1722 (Misr 3)	43.0	40.8	26.0	22.7	59.8	52.8	42.9	38.8	**10.0**	
X-1714	48.5	39.2	40.9	35.7	40.3	36.3	43.2	37.1	**14.1**	**105**
X-1715	44.9	28.6	31.8	26.8	47.9	40.7	41.5	32.0	**22.9**	**121**
X-1716	51.3	27.6	33.4	25.5	55.1	35.9	46.6	29.7	**36.3**	**131**
X-1717	48.6	22.7	28.3	24.3	45.1	39.2	40.7	28.7	**29.5**	**135**
X-1718	44.0	35.0	44.5	22.5	49.6	37.1	46.0	31.5	**31.5**	**123**
X-1719	43.5	21.0	33.6	22.7	38.7	30.8	38.6	24.8	**35.8**	**156**
X-1720	33.9	31.6	37.7	21.6	48.9	43.4	40.2	32.2	**19.9**	**120**
X-1721	40.1	22.0	30.3	08.5	44.9	40.7	38.4	23.7	**38.3**	**164**
X-1723	40.7	15.6	35.3	17.9	50.5	40.8	42.2	24.8	**41.2**	**156**
Misr 1	31.0	28.8	30.6	24.8	46.5	41.0	36.0	32.5	**10.0**	**119**
Giza 843	49.0	30.6	29.9	24.7	47.6	40.9	42.2	32.0	**24.2**	**121**
Giza 40	31.7	00.0	40.2	00.0	44.0	00.0	38.6	00.0	**100.0**	
L.S.D.$_{0.05}$	**20.2**	**20.0**	**09.5**	**11.0**	**09.4**	**11.8**	-	-	-	

For statistical analysis one is added to all numbers but actual values are tabulated.

Table 4. Mean seed yield ard/fed. of faba bean genotypes evaluated under both free and infested soils with *O. crenata* at Giza Research Station (2005/06, 2006/07 and 2007/08 growing seasons).

Genotype	2005/06		2006/07		2007/08		Average		Reduction %	Relative increase %
	Free	Infested	Free	Infested	Free	Infested	Free	Infested		
X-1722 (Misr 3)	12.0	10.0	11.4	10.3	10.5	9.2	11.3	9.9	**12.4**	
X-1714	12.0	8.6	10.5	10.2	11.0	10.3	11.1	9.7	**12.6**	**102**
X-1715	11.8	7.1	9.7	7.8	9.7	7.0	10.4	7.3	**29.8**	**136**
X-1716	13.0	8.3	9.4	6.8	10.3	6.9	10.9	7.3	**33.0**	**136**
X-1717	9.5	5.5	10.0	4.6	10.3	6.3	09.9	5.5	**44.4**	**180**
X-1718	10.5	7.2	10.3	6.5	11.2	6.4	10.7	6.7	**37.4**	**146**
X-1719	10.3	7.6	10.4	8.0	12.4	5.8	11.0	7.1	**35.5**	**139**
X-1720	9.6	8.2	10.9	9.6	10.5	7.3	10.3	8.4	**18.4**	**118**
X-1721	11.4	7.6	10.8	6.9	11.0	6.4	11.0	7.0	**36.4**	**141**
X-1723	10.8	7.0	9.2	6.5	12.0	6.3	10.7	6.9	**29.0**	**143**
Misr 1	11.0	8.3	11.4	9.9	11.3	10.2	11.2	9.5	**15.2**	**104**
Giza 843	11.7	7.1	10.8	7.5	11.8	8.3	11.5	7.6	**33.9**	**130**
Giza 40	13.0	0.0	11.0	0.0	10.4	0.0	11.5	0.0	**100.0**	
L.S.D.$_{0.05}$	**4.76**	**1.30**	**3.07**	**1.40**	**1.23**	**0.45**	-	-	-	

For statistical analysis one is added to all numbers but actual values are tabulated.

Misr 3 significantly exceeded all genotypes in seed yield per feddan (Table 4) followed by X-1714 and Misr 1. Reduction in seed yield of infested compared with healthy plants for X-1722, Misr 1 and X-1714 were 10%, 15% and 14.1%, respectively. These findings indicated clearly that Misr 3 could be considered tolerant to *Orobanche*. Results of seed yield/fed also, indicated that Misr 3, X-1714 and Misr 1 could be considered tolerant to *Orobanche* and Giza 40 was highly susceptible one because all plants of the latter genotype were completely parasitized. Data presented in Table (5),

showed that *Orobanche* dry weight/m^2 were significantly affected by genotype in the three growing seasons. The lowest values of *Orobanche* dry weight were recorded on Misr 3 whereas; the highest values were recorded on Giza 40.

Table 5. Mean dry weight (g/m^2) of *Orobanche* spikes parasitized faba bean genotypes under infested soils with *O. crenata* at Giza Research Station (2005/06, 2006/07 and 2007/08 growing seasons).

Genotype	2005/06	2006/07	2007/08
X-1722 (Misr 3)	2.1	6.2	12.4
X-1714	4.4	6.9	12.1
X-1715	2.1	8.7	15.3
X-1716	5.6	9.6	17.6
X-1717	4.3	8.5	17.0
X-1718	2.1	8.9	10.0
X-1719	6.9	8.9	10.8
X-1720	6.6	7.8	15.0
X-1721	8.6	9.2	16.6
X-1723	7.0	9.0	16.3
Misr 1	9.9	8.2	6.3
Giza 843	9.4	10.4	10.9
Giza 40	13.7	15.7	20.4
$L.S.D._{0.05}$	**4.3**	**2.7**	**7.6**

***Orobanche* spikes were collected just when its plants started to death, and their data were recorded immediately.**

On farm trials

Data presented in Tables (6, 7 and 8) indicated that, Misr 3 was the most tolerant genotype at both Behera and Sharkia Governorates and it had the lowest reduction in number of pods/plant (29.7%), seed yield/plant (22.3%), and seed yield/fed (20%).Whereas, the susceptible cultivar Giza 40 had the highest values of reduction (100%). Regarding seed yield/fed, Misr 3 exceeded Misr 1 and Giza 843 by 4 and 30%, respectively and exceeded all other genotypes by an increase ranging from 13 to 39% (Table 8).

Demonstration fields

Results of demonstration fields at Behera and Sharkia indicated that seed yield of the new cultivar Misr 3 exceeded the recommended cultivar Giza 843 by 26.2 – 34.0% and by19.5 – 31.5% at Behera and Sharkia Governorates during the two seasons 2008/09 and 2009/10, respectively (Table 9). The *Orobanche* dry weight (g/m^2) of Misr 3 ranged from 71g to 90g at Behera and from 88 to 110g at Sharkia compared with Giza 843 ranged from 120g to 192g at Behera and from 146 to 192g at Sharkia Governorate.

Table 6. Average number of pods/plant of faba bean genotypes evaluated under both free and infested soils with *O. crenata* in farmers' fields at Behera and Sharkia Governorates (2008/09 season).

Genotype	Behera		Sharkia		Average		Reduction %	Relative increase%
	Free	Infested	Free	Infested	Free	Infested		
X-1722 (Misr 3)	25.5	21.3	44.5	28.0	35.0	24.6	**29.7**	
X-1714	10.8	8.0	34.0	16.5	22.4	12.3	**45.1**	**200**
X-1715	15.5	7.8	31.5	17.0	23.5	12.4	**47.2**	**198**
X-1716	16.0	6.3	26.8	12.8	21.4	9.5	**55.6**	**259**
X-1717	21.3	11.0	31.8	14.3	26.5	12.6	**52.5**	**195**
X-1718	23.3	11.0	32.0	14.0	26.1	12.5	**52.1**	**197**
X-1719	20.3	9.3	28.3	12.8	24.3	11.0	**54.7**	**224**
X-1720	18.0	11.5	38.3	13.0	28.1	12.3	**56.2**	**200**
X-1721	20.2	9.3	35.8	11.8	27.9	10.5	**62.4**	**234**
X-1723	12.3	6.5	30.3	9.8	21.5	8.1	**62.3**	**303**
Misr 1	27.0	15.8	28.5	10.3	27.8	13.0	**53.2**	**189**
Giza 843	28.0	13.3	40.3	10.0	34.1	11.6	**66.0**	**212**
Giza 40	19.3	0.0	24.3	0.0	21.8	0.0	**100.0**	
$L.S.D._{0.05}$	**8.23**	**5.12**	**9.39**	**5.18**	-	-	-	

For statistical analysis one is added to all numbers but actual values are tabulated.

Table 7. Mean seed yield/plant (g) of faba bean genotypes evaluated under both free and infested soils with *O. crenata* in farmers' fields at Behera and Sharkia Governorates (2008/09 season).

Genotype	Behera		Sharkia		Average		Reduction %	Relative increase %
	Free	Infested	Free	Infested	Free	Infested		
X-1722 (Misr 3)	54.4	49.6	80.7	55.0	67.3	52.3	**22.3**	
X-1714	30.4	19.2	80.0	40.7	55.2	29.9	**45.8**	**175**
X-1715	30.4	13.0	70.6	35.1	50.5	24.1	**52.3**	**217**
X-1716	34.4	12.7	70.6	34.6	52.5	23.6	**55.0**	**222**
X-1717	28.1	19.5	76.2	32.8	52.1	26.1	**49.9**	**200**
X-1718	35.8	22.7	81.8	33.9	85.8	28.3	**67.0**	**185**
X-1719	41.8	17.1	71.4	21.3	56.9	19.2	**66.3**	**429**
X-1720	56.0	24.5	69.2	33.1	62.6	28.8	**54.0**	**182**
X-1721	29.7	13.9	83.1	26.6	56.4	20.2	**64.2**	**259**
X-1723	29.3	12.7	73.8	24.8	51.5	18.7	**63.7**	**280**
Misr 1	56.5	27.5	86.6	17.4	71.5	22.4	**68.7**	**234**
Giza 843	61.5	30.6	79.3	20.4	70.4	25.5	**63.8**	**205**
Giza 40	31.8	00.0	53.6	00.0	42.7	00.0	**100.0**	
$L.S.D._{0.05}$	**9.41**	**7.33**	**11.17**	**9.61**	-	-	-	

For statistical analysis one is added to all numbers but actual values are tabulated.

Table 8. Mean seed yield/fed (ard) of faba bean genotypes evaluated under both free and infested soils with *O. crenata* in farmers' fields at Behera and Sharkia Governorates (2008/09 season).

Genotype	Behera		Sharkia		Average		Reduction %	Relative increase%
	Free	Infested	Free	Infested	Free	Infested		
X-1722 (Misr 3)	12.0	9.8	12.0	9.5	12.0	9.6	**20.0**	
X-1714	10.8	8.6	11.8	8.3	11.3	8.5	**24.8**	**113**
X-1715	11.1	7.9	9.5	8.6	10.3	8.2	**20.4**	**117**
X-1716	10.1	7.6	9.0	7.8	9.5	7.7	**18.9**	**125**
X-1717	11.3	7.0	10.4	7.5	10.8	7.3	**32.4**	**132**
X-1718	9.4	7.6	10.0	6.8	9.7	7.2	**25.8**	**133**
X-1719	10.7	8.0	9.7	6.0	10.2	7.2	**29.4**	**133**
X-1720	11.4	8.3	10.3	8.7	10.9	8.5	**22.0**	**113**
X-1721	10.2	7.3	9.5	6.4	9.8	6.9	**30.0**	**139**
X-1723	11.6	8.0	10.3	7.5	11.0	7.7	**30.0**	**125**
Misr 1	11.9	9.3	11.2	8.9	11.5	9.1	**20.9**	**105**
Giza 843	12.1	9.3	12.2	8.6	12.1	9.0	**25.6**	**107**
Giza 40	10.8	0.0	10.3	0.0	10.5	0.0	**100.0**	
$L.S.D._{0.05}$	**3.79**	**0.91**	**3.78**	**0.72**	-	-	-	

For statistical analysis one is added to all numbers but actual values are tabulated.

Table 9. Mean seed yield of Misr 3 cultivar grown in infested demonstration field at Behera and Sharkia Governorates (2008/09 and 2009/10 seasons).

Season	Location	Area (fed)	Seed yield ard./fed.		Relative increase%	*Orobanche* dry weight (g/m^2)	
			Misr 3	Giza 843		Misr 3	Giza 843
2008/09	**Behera**	**0.5**	**9.3**	**7.8**	**19.2**	**90**	**192**
	Sharkia	**0.5**	**11.0**	**8.2**	**34.0**	**88**	**166**
2009/10	**Behera**	**0.5**	**10.0**	**7.6**	**31.9**	**71**	**120**
	Sharkia	**0.5**	**10.6**	**8.4**	**26.2**	**110**	**146**

CONCLUSION

1- Breeding efforts to increase *Orobanche* resistance in faba bean are limited, despite the fact that *Orobanche* is the most important yield-reducing factor in production area in Egypt. However, breeding work proved effective in generating new source for resistance to *Orobanche* that will be also useful genetic stock to be used in crossing program.

2- We hope that more farmers will be able to obtain seed stocks of this *Orobanche* tolerant genotype in order to extend faba bean growing to cover more acreage to retain self sufficiency of this important food crop.

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مصر ٣ صنف فول بلدي جديد متحمل للهالوك

صباح محمود عطية – منير محمد الهادى – حمدى عزيز صابر – ممدوح أحمد عمر – شعبان على خليل – سامية على محمود– عزام عبد الرازق عشرى – رحاب أحمد عبد الرحمن – مصطفى عبد المؤمن ابراهيم – زينب السيد غريب* – تامر سلامة المرصفاوى – إيهاب حلمى الحارتى – السعيد عبد المجيد الإمام – فاروق حامد شلبى – أحمد جمال هلال – عادل محمد الجارحى – السيد محمد ربيع – مصطفى عابدين بخيت– محمود النوبى رسلان – خالد محمد يمانى – هشام طه عبد العال – محمد عباس ابراهيم – رفعت عبدالسلام أبو مصطفى – وليد محمد الرضينى – قدرى مصطفى مرسى – نوهير عبد النظير محمود** – عزه فتحى السيد**

و هند أبو الفتوح غنام

قسم بحوث المحاصيل البقولية – معهد بحوث المحاصيل الحقلية – مركز البحوث الزراعية – الجيزة – مصر

* المعمل المركزي لبحوث التصميم والتحليل الاحصائى – مركز البحوث الزراعية – الجيزة – مصر

** معهد بحوث أمراض النباتات – مركز البحوث الزراعية – الجيزة – مصر

يعتبر الفول من أهم البقوليات الغذائية فى مصر وهو يوفر كمية من البروتين في النظام الغذائي وهو أيضا مصدر مهم للنيتروجين الذى يثبت فى التربة.

ومن المعروف أن حشيشة الهالوك هى عبارة عن نبات متطفل يسبب ضرر بالغ على إنتاج الفول البلدى فى مصر عندما تكون مستويات الإصابة مرتفعة، وقد تم تقييم عشرة عشائر مبشرة من الفول البلدى للتحمل للهالوك مقارنة مع الصنف مصر ١ والصنف جيزة ٨٤٣ (متحملين للإصابة) والصنف جيزة ٤٠ (حساس) في محطة بحوث الجيزة خلال المواسم ٢٠٠٦/٢٠٠٥ إلى ٢٠٠٨/٢٠٠٧ تحت ظروف الإصابة الطبيعية بالهالوك في تصميم القطاعات الكاملة العشوائية فى ثلاث مكررات. وتم دراسة صفات عدد القرون/نبات، محصول البذور (أردب/فدان) بالإضافة إلى الوزن الجاف للهالوك (جرام). أشارت النتائج إلى تفوق التركيب الوراثى الجديد X-1722 مقارنة ببقية التراكيب الوراثية المختبرة بنسب تتراوح بين ٣- ٤٩ %، ٥- ٥٦%، ٢- ٨٠% للصفات المدروسة على التوالى. وقد أجريت نفس التجارب فى الأراضى الموبوءة بالهالوك بحقول المزارعين المكبرة في محافظتى البحيرة والشرقية موسم ٢٠٠٩/٢٠٠٨ لدراسة مستوى المقاومة في التركيب الجديد، وأوضحت النتائج تفوق التركيب الوراثى X-1722 لصفة محصول البذور/فدان بنسبة تتراوح بين ٤- ٣٠% . وقد تفوق التركيب الجديد X-1722 على الصنف المتحمل للإصابة بالهالوك (جيزة ٨٤٣) فى محصول البذور بنسبة تراوحت بين ١٩,٥-٣١,٥٪ في الشرقية وبنسبة ٢٦,٢-٣٤,٠٪ في البحيرة في موسم ٢٠١١، وقد تم تسجيل هذا التركيب الجديد تحت إسم "مصر ٣".

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