

**Investigations on faba bean, *Vicia faba* L.  
24- Cairo 4, Cairo 5 and Cairo 25 new varieties  
tolerant to *Orobanche***

**M.M. F. Abdalla and D. S. D. Darwish**

Agronomy Department, Faculty of Agriculture, Cairo University.

**INTRODUCTION**

*The broomrape *Orobanche crenata* is a dangerous parasite to faba bean. Many farmers abandoned cultivating faba bean because of the spread of this parasite in their fields. The area grown by this crop has been decreased to almost one half of what has been grown 20 years ago. Therefore breeding and distributing faba bean varieties tolerant/resistant to *Orobanche* has become a must.*

*We succeeded in our faba bean programme to develop five varieties, three of which are tolerant to the broomrape parasite (Darwish and Abdalla 1994, Abdalla and Darwish 1996, 2004). We started with selection among and within a collection of land races (Abdalla et al 1982). Cairo 241 and Cairo 375 were high yielding selections; the first is tolerant to *Orobanche* and the other is profuse in flowering. Each of Cairo 1, Cairo 2 and Cairo 3 were developed from seed blending of several genotypes. Cairo 1 and Cairo 2 are tolerant to broomrape. Since the start of breeding for tolerance to broomrape (Abdalla 1982), a methodology was developed to select using the concept of breeding for uniform resistance. Seeds of selected plants were blended and sown in a field close to an apiary to encourage cross pollination. Continuous selection was practiced to upgrade levels of tolerance (resistance).*

*More genotypes were used in addition to the land races. Crosses were made between promising genotypes. Selection was practiced within segregating generations for tolerance to *Orobanche*. Three *Orobanche* fields in three different Governorates were used to screen for broomrape tolerance. However, most of the work was done in the *Orobanche* field of the Faculty of Agriculture, Cairo University. Developing an *Orobanche* tolerant variety has become a standard routine as follows: a) search and induction of useful variability; b) selection for tolerance; c) inbreeding; d) blend of tolerant stocks and expose to cross pollination; and e) reselection and rebreeding.*

*Sometimes data of combining ability are utilized before synthesizing the blends and certain cross combinations are developed for practicing selection. Because of the complexity of inheritance of *Orobanche* tolerance (Darwish et al 2007) heterogeneous populations of faba bean are developed for tolerance in order to match the parasite heterogeneity.*

*In this article reference will be made to a three varieties that have been newly developed from our faba bean programme to tolerate *Orobanche* parasitism.*

**Key Words:** *Faba beans, New varieties, Orobanche tolerance, Blends.*

**Investigations on faba bean, *Vicia faba* L.  
24- Cairo 4, Cairo 5 and Cairo 25 new varieties  
tolerant to *Orobanche***

**M.M. F. Abdalla and D. S. D. Darwish**

Agronomy Department, Faculty of Agriculture, Cairo University.

**INTRODUCTION**

*The broomrape *Orobanche crenata* is a dangerous parasite to faba bean. Many farmers abandoned cultivating faba bean because of the spread of this parasite in their fields. The area grown by this crop has been decreased to almost one half of what has been grown 20 years ago. Therefore breeding and distributing faba bean varieties tolerant/resistant to *Orobanche* has become a must.*

*We succeeded in our faba bean programme to develop five varieties, three of which are tolerant to the broomrape parasite (Darwish and Abdalla 1994, Abdalla and Darwish 1996, 2004). We started with selection among and within a collection of land races (Abdalla et al 1982). Cairo 241 and Cairo 375 were high yielding selections; the first is tolerant to *Orobanche* and the other is profuse in flowering. Each of Cairo 1, Cairo 2 and Cairo 3 were developed from seed blending of several genotypes. Cairo 1 and Cairo 2 are tolerant to broomrape. Since the start of breeding for tolerance to broomrape (Abdalla 1982), a methodology was developed to select using the concept of breeding for uniform resistance. Seeds of selected plants were blended and sown in a field close to an apiary to encourage cross pollination. Continuous selection was practiced to upgrade levels of tolerance (resistance).*

*More genotypes were used in addition to the land races. Crosses were made between promising genotypes. Selection was practiced within segregating generations for tolerance to *Orobanche*. Three *Orobanche* fields in three different Governorates were used to screen for broomrape tolerance. However, most of the work was done in the *Orobanche* field of the Faculty of Agriculture, Cairo University. Developing an *Orobanche* tolerant variety has become a standard routine as follows: a) search and induction of useful variability; b) selection for tolerance; c) inbreeding; d) blend of tolerant stocks and expose to cross pollination; and e) reselection and rebreeding.*

*Sometimes data of combining ability are utilized before synthesizing the blends and certain cross combinations are developed for practicing selection. Because of the complexity of inheritance of *Orobanche* tolerance (Darwish et al 2007) heterogeneous populations of faba bean are developed for tolerance in order to match the parasite heterogeneity.*

*In this article reference will be made to a three varieties that have been newly developed from our faba bean programme to tolerate *Orobanche* parasitism.*

**Key Words:** *Faba beans, New varieties, Orobanche tolerance, Blends.*

#### Cairo 4

Many selected lines of faba bean that are tolerant to *Orobanche* (Abdalla and Darwish 1998) were grown in a field close to an apiary to encourage cross pollination. This occurred during two seasons 1996/1997 and 1997/1998. From these materials 200 lines were grown under insect-free cage for two seasons using single seed descent. The resulting inbred lines were evaluated in Giza (Fac. Agric. Cairo Univ.) fields during the seasons 2001/2002 and 2002/2003.

The susceptible and less performing lines were discarded. Only 19 lines remained for further studies. Similar quantities of seeds of each line were blended to synthesize Cairo 4. During 2003/2004 this variety was grown at three locations: Kafr El-Zayat (Beihera Governorate), Kafr Yousef (Dakahlia Governorate) and Giza (Fac. Agric. Cairo Univ.). Further materials of Cairo 4 were grown on large scale in demonstration and farmers fields during the seasons 2004/2005 to 2007/2008. Data of seed yield are presented in Table (1).

**Table 1. Seed yield of Cairo 4 grown at different locations and seasons.**

Season	Location	Holder	Area (fed.)	Seed yield ard./fed.
2003/2004	Kafr El-Zayaat (Beheira Govern.),	El-Shahat Bazeed	1.0	14.0
	Kafr Yousef, (Dakahlia Govern.)	Hani Zaki	0.5	12.9
	Giza	Fac. Agric. Cairo Univ.	0.5	7.0
2004/2005	Kafr Yousef	Hani Zaki	0.5	11.0
	Giza	Fac. Agric. Cairo Univ.	0.5	8.5
2006/2007	Kafr Yousef	Hani Zaki	3.0	10.2
	Kafr Yousef	El-Shahat Bazeed	20.0	14.0
	Giza	Fac. Agric. Cairo Univ.	0.7	7.5
2007/2008	Kafr Yousef	Hani Zaki	2.0	5.8
	Abou Zaher	Islam Metwally	1.0	10.0
	Menshet Nasser (Dakahlia Govern.)	Ahmed Habel	1.0	8.0
	Giza	Fac. Agric. Cairo Univ.	0.7	8.0

It is observed from data of Table (1) that yield of Cairo 4 is satisfactory. Yield differed from season and holder to another. Private farmers were better faba bean producers compared to Giza research station of Fac. Agric. Cairo University. Yield of 2007/2008 was relatively lower than other seasons because of the cold weather prevailed during early

vegetative growth of the crop which retarded flowering and consequently adversely affected seed yield.

Seeds of Cairo 4 was sent to ARC for registration and certification. The variety performed very well during 2006/2007 and 2007/2008 in ordinary and *Orobanche* fields of ARC at Giza and Sakha research stations.

Also members of the Food Legumes Program visited farmers fields at Kafr Yousef grown by Cairo 4. They were very satisfied with the performance of this variety in that area.

### Cairo 5

A diallel was performed among five inbred line parents of faba beans, three of which are *Orobanche* tolerant (see Abou Taleb and Darwish 2003 and Abdalla *et al* 2007). From the ten segregating populations, 21 families were selected as tolerant to *Orobanche*. These were blended and subjected to multiplication under *Orobanche*-infected and free fields.

The resulting blend was grown on large scale in demonstrations and farmers fields in different locations. Yield results are presented in Table (2).

**Table 2. Seed yield of Cairo 5 grown at different locations and seasons.**

Season	Location	Holder	Area (fed.)	Seed yield Ard./fed.
2006/2007	Kafr Yousef	Hani Zaki	4.0	9.6
	Kafr Yousef (Dakahlia Govern.),	El-Shahat Bazeed	16.0	12.0
	Giza	Fac. Agric. Cairo Univ.	0.75	7.3
2007/2008	Kafr Yousef	Hani Zaki	3.0	5.8
	Giza	Fac. Agric. Cairo Univ.	0.5	7.5

Here too the Cairo 5 variety performed better in farmers fields compared to governmental locations. Also yield of 2007/2008 season was relatively less than the 2006/2007 season. A ten kilograms of seeds was handed over to ARC for registration and certification. The ARC staff and ourselves visited Kafr Yousef and ARC-Giza research station and were satisfied with the variety performance.

### Cairo 25

This variety was synthesized by blending fixed weight of seeds from 24 faba bean genotypes. Ancestors of these genotypes are: Giza 843, Giza 429, Misr 1 and Misr 2 (from ARC-Giza) and 9 HYTO, 18 HYTO, 21

HYTO, 23 HYTO and 24 HYTO (from Agron. Dept. Fac. Agric. Cairo University).

The ancestors were evaluated and selected under *Orobanche* fields in three locations: Faculty of Agriculture, Cairo University, Giza; Agriculture Research Center, Giza and Sids Research Station, Beni Sueif Governorate.

After seed multiplication of the blended stocks, seeds were grown from 2005/2006 to 2007/2008 seasons in different locations in large demonstrations and farmers fields. Results obtained are presented in Table (3).

**Table 3. Yield of Cairo 25 grown at different locations and seasons.**

Season	Location	Holder	Area (fed.)	Seed yield Ard./fed.
2005/2006	Kafr Yousef (Dakahlia Govern.)	Hani Zaki	0.5	12.9
	Giza	Fac. Agric. Cairo Univ.	0.5	7.4
2006/2007	Kafr Yousef	Hani Zaki	3.0	9.5
	Kafr Yousef	El-Shahat Bazeed	20.0	13.0
	Giza	Fac. Agric. Cairo Univ.	1.0	6.8
2007/2008	*Kafr Yousef	Hani Zaki	3.0	6.0
	Kafr Yousef	Tawfic Bazeed	2.5	7.0
	Abou Zaher	Islam Metwally	1.0	10.0
	Menshet Nasser (Dakahlia Govern.)	Ahmed Habel	1.0	7.5
	Giza	Fac. Agric. Cairo Univ.	0.7	6.5

It is observed from the data presented for Cairo 25 that, it is high yielding variety and yield at farmers field is much better than the yield at the research station. It is also noticed that yield at 2007/2008 was relatively lower than previous seasons. This is mainly due to the very cold weeks that prevailed in that season which affected yield of faba bean particularly in Kafr Yousef, Abou Zaher and Menshet Nasser where the crop is mostly grown later than recommended.

Ten kilograms of seeds of Cairo 25 was handed over to ARC for registration and certification. The variety performed well in ARC fields during visits to Giza and Sakha Research Stations of ARC. In addition, members of the Food Legumes Program from Giza Station of ARC have visited different locations where Cairo 25 was grown. They were happy with the performance of this variety in different farmers' fields. These farmers have previously abandoned growing faba bean because of

*Orobanche* attack. But they returned to growing the crop after we gave them seeds from Cairo varieties that are tolerant to *Orobanche*.

We do hope that after certification of these varieties more farmers will be able to obtain seed stocks of these *Orobanche* tolerant genotypes in order to extend faba bean growing to cover more acreage to retain self sufficiency of this important food crop.

## REFERENCES

- Abdalla, M.M.F. (1982).** Characteristics of a local faba bean collection and its reaction to *Orobanche*. G. Hawtin and C. Webb (Eds.) Faba Bean Improvement: 207-212, Martinus Nijhoff, Netherlands.
- Abdalla, M.M.F. and D.S. Darwish (1996).** Investigations on faba beans, *Vicia faba* L. 7. Cairo 2 and Cairo 241, two new *Orobanche* tolerant varieties. Proc. 7<sup>th</sup> Egypt. Agron. Conf. Mansoura: 187-201.
- Abdalla, M.M.F. and D.S. Darwish (1999).** Breeding faba bean for *Orobanche* tolerance using the concept for uniform resistance. In: J. Kroschel, M. Abderabihi, H. Betz (eds.), Advances in parasitic weed control at on-farm level. Vol. II. Joint action to control *Orobanche* in the WANA region. Magraf Verlag, Weikersheim, Germany, 205-213.
- Abdalla, M. M. F. and D. S. Darwish (2004).** Cairo 3: a new faba bean variety with high quality characteristics (note). Egypt. J. Plant Breed. 8: 351-352.
- ABDALLA, M.M.F., A.A. METWALLY, S.E. EL-KALLA, A.T. EL-KASSABY and M.A. YOUSEF (1982).** Evaluation of a local collection of faba beans at three locations. Bull. Fac. Agric. Cairo Univ. 33: 49-62.
- Abdalla, M.M.F., D.S. Darwish, M.A. Omar and T.S.A. El-Marsafawy (2006).** Investigation on faba beans, *Vicia faba* L. 20. Selection and performance of *Orobanche* tolerant material under different environments. Egypt. J. Plant Breed. 10(1): 203-221.
- Abou Taleb, S.M.A-E. and D. S. Darwish (2003).** Stomatal characteristics of some faba bean genotypes and the effects of *Orobanche* parasitism on transpiration and yield. Egypt. J. Plant Breed. 7 (2): 205-226.
- Darwish, D.S. and M.M.F. Abdalla (1994).** Investigations on faba beans, *Vicia faba* L. 4. Cairo 1 and Cairo 375, two newly developed varieties. Proc. 6<sup>th</sup> Conf. Agron. Al-Azhar Univ., Cairo, Egypt, Sept, Vol II: 633-650.
- Darwish, D.S., M.M.F. Abdalla, M.A.Omar, S. R. E. Abo-Hegazy and T.S.A. El-Marsafawy (2007).** Investigations on faba beans, *Vicia faba* L. 23-Genetic analysis of *Orobanche* tolerance/resistance. Proc. Fifth Plant. Breed Conf. May 27 (Giza). Egypt. J. Plant Breed. 11 (2):953-967. Special Issue.

## دراسات على الفول البلدى

٢٤- قاهرة ٤، قاهرة ٥، قاهرة ٢٥ أصناف جديدة تتحمل الهالوك

مظهر محمد فوزى عبدالله، درويش صالح درويش

قسم المحاصيل - كلية الزراعة - جامعة القاهرة

لقد أصبح هالوك الفول البلدى من المتطفلات الخطيره فى الزراعه المصريه والتي جعلت العديد من المزارعين يقلعون عن زراعة هذا المحصول الغذائى الهام، مما أدى الى نقص المساحه المنزرعه من الفول (خاصة مع التوسع فى زراعة القمح) الى ما يقرب من نصف المساحه التى كانت منزرعه منذ عشرون عاماً. لذلك وجب الاهتمام بتربية أصناف من الفول تتحمل (تقاوم) الهالوك وتوزيعها على المزارعين حتى يمكن زيادة مساحه الفول الى ما يعطى الانتاج اللازم للاكتفاء الذاتى من هذا المحصول. وفى هذا البحث تم التسجيل لأستنباط ثلاثة أصناف من الفول البلدى التى تتحمل الهالوك وهى قاهرة ٤، قاهرة ٥ و قاهرة ٢٥. وكيفية تربيتها للمقاومه والمحصول المتحصل منها عند الزراعات الموسعه فى التجارب الارشاديه وفى حقول المزارعين. وقد أظهرت هذه الاصناف تحملاً جيداً للهالوك ومحصولاً مرتفعاً. وقد تم ارسال تقاوى من هذه الاصناف الثلاثه الى مركز البحوث الزراعيه للتسجيل والاعتماد لكى يساهم توزيعها على المزارعين فى حل مشكله توفير الاصناف المقاومه للهالوك من الفول.

المجله المصريه لتربية النبات ١٢ (١): ٣١٥ - ٣٢٠ (٢٠٠٨)