



FABIS

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Information Service**

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(ICARDA)

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FABIS

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COVER PHOTO: Faba bean infected with broad bean mottle virus, a virus which is transmitted by the weevil *Apion arrogans*



Faba Bean Information Service

NEWSLETTER 24 August 1989

CONTENTS

Page
En

SHORT COMMUNICATIONS

Breeding and Genetics

- 3** **Analysis of genetic linkage in faba bean (*Vicia faba* L.)**
 A. Cabrera and A. Martin (SPAIN)
- 6** **Evaluation of genotype and location effects on vicine and convicine contents in**
 ***Vicia faba* L.**
 G. Sixdenier and G. Duc (FRANCE)

Agronomy and Mechanization

- 8** **The effect of sowing date, watering interval and intercropping with sorghum**
 and maize on the yield of faba bean
 O.A.A. Ageeb, F.A. Salih and M.A. Ali (SUDAN)
- 11** **On-farm *Orobanche* control in faba bean in middle Egypt**
 A.M. Nassib and A.H.A. Hussein (EGYPT)

Pests and Diseases

- 16** **Methods for estimating microorganism populations in faba bean phylloplane**
 S.A.M. Omar, Dorreiah E. Salem and S.M.M. El-Gantiry (EGYPT)

- 20 **Temperature as a predisposing factor for wilt and root-rot disease complex of faba bean (*Vicia faba* L.)**
E.M.A. Saeed, S.O. Freigoun, M.E. Omer and S.B. Hanounik (SUDAN)
- 26 ***Apion arrogans*, a weevil vector of broad bean mottle virus**
K.M. Makkouk and S. Kumari (SYRIA)
- 27 **Reaction of faba bean genotypes to natural incidence of broad bean mosaic virus in Pakistan**
S.M. Iqbal, A. Ghafoor, M. Bashir and M. Aftab (PAKISTAN)
- 29 **Faba bean diseases in Tunisia**
A.H. Kamel, H. Halila, H. Ben Salah, M. Harrabi and M. Deghaies (TUNISIA)
- 32 **Selection of herbicides for the control of broomrape (*Orobancha* spp.) in faba bean (*Vicia faba* L.)**
L. Garcia-Torres, F. Lopez-Granados, M. Saavedra and J. Mesa-Garcia (SPAIN)

Seed Quality and Nutrition

- 37 **Hard-seededness in *Vicia faba* L.**
B.N. Jha and R.P. Sinha
- 39 **Contributors' Style Guide (English)**
- 40 **Contributors' Style Guide (Arabic)**

NEWS

- 41 **Book Reviews**
- 42 **Meeting Reports**
- 43 **Forthcoming Events**
- 46 **Announcements**
- 48 **Need More Information ?**

SHORT COMMUNICATIONS

بحوث مختصرة

Breeding and Genetics

التربية والوراثة

Analysis of Genetic Linkage in Faba Bean (*Vicia faba* L.)

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Abstract

Genetic analysis of 10 loci was carried out in faba bean (*Vicia faba* L.). Close genetic linkage ($p = 0.19 \pm 0.04$) was detected between Sdp/sdp locus and the Yg/yg locus. Recombination frequency for Sc/sc locus and N/n locus was 0.44 ± 0.04 , indicating that both loci could be linked. An epistatic action of the Sc allele on the hilum color gene was found. Recombination values for all the remaining dihybrid segregations tested indicated independent assortment for all combinations. The recessive alleles for yellow pigment in the flower (yfyf) had an epistatic effect on the dominant allele of the Sc locus.

Introduction

The genetic map of faba bean (*Vicia faba* L.), in contrast to many other crop species, is not yet well defined. Sirks (1931) studied the linkage in faba bean and found that 19 genetic factors formed four linkage groups. Unfortunately, Sirks' material was lost during the Second World War. Therefore, it was impossible to combine cytologically the four genetic linkage groups with the respective chromosomes. At present, linkage studies are restricted to the work of Picard (1963) and Sjodin (1971).

Because faba bean is a diploid specie with six chromosome pairs and many loci (ICARDA 1986), several linkage associations could be expected. However, the linkage relations of most of the simply-inherited traits have not been analyzed.

This report presents the linkage relations of 10 simply-inherited traits contributing to the construction of the genetic map in faba bean.

Materials and Methods

Different lines of faba bean showing variability for numerous morphological traits were selected from our collection in Cordoba. Gene designation and phenotypic description of the faba bean characters tested are presented in Table 1. Crosses between lines differing in two characters were performed. F1 plants were self-pollinated to produce dihybrid segregations. The crossing and cultivation of segregating progenies were carried out under greenhouse conditions. The Chi-square test of independence was used to detect epistatic and linkage relations. Linkage intensities were calculated by the maximum likelihood method.

Results and Discussion

Table 2 shows the allelic constitution, F2 progeny, and calculated recombination relationships for linkage test. Cross 1 between loci Sdp (solid distribution of pigment in the flower) and Yg (yellow seed coat color) had a significant linkage Chi-square. A recombination frequency of 0.19 ± 0.04 was calculated for both loci.

The Sdp locus segregated independently of both Sc locus controlling brown seed coat (cross 2) and red seed coat locus (cross 3). Similarly, Yf controlling yellow pigment in the flower segregated into a 9:3:3:1 ratio of independence with Sdp (cross 4), Yg (cross 5), R (cross 6), Ti (cross 7), and Dw (cross 8). Nevertheless, a 9:3:4 ratio was obtained in the F2 generation from the cross between Yf and Sc plants indicating that the recessive alleles for yellow

Table 1. Gene designation and phenotypic description of faba bean characters tested.

Character	Loci	Phenotype	
		Dominant	Recessive
White flower	W_2/w_2	Colored	White
Yellow pigment on flower	Yf/yf	Brown	Yellow
Solid distrib. of pigment on flower	Sdp/sdp	Wing spots	Solid
Yellow seed-coat	Yg/yg	Yellow	Normal
Brown seed-coat	Sc/sc	Brown	Normal
Red seed-coat	R/r	Normal	Red
Hilum color	N/n	Black	White
Determinate growth	Ti/ti	Indeterminate	Determinate
Short internodes	Dw/dw	Normal	Short
Unifoliate	$Un-a^1/un-a^1$	Normal	Unifoliate

Table 2. Allelic constitution, F2 progeny, and recombination relationships for faba bean linkage tests.

Cross	Alleles ¹	No. F2 plants					χ^2	Linkage ³ phase	Recombination ² % and SE $\pm$
		A-B	A-bb	aaB-	aabb	Total			
1	$Sdp\ sdp\ Yg\ yg$	44	8	4	13	69	23.13 ***	25.16***	0.19 $\pm$ 0.05
2	$Sdp\ sdp\ Sc\ sc$	148	58	48	21	275	2.18 ns	0.14 ns	I
3	$Sdp\ sdp\ R\ r$	119	33	42	15	209	1.48 ns	0.45 ns	I
4	$Yf\ yf\ Sdp\ sdp$	218	61	64	24	367	3.67 ns	1.13 ns	I
5	$Yf\ yf\ Yg\ yg$	145	55	47	15	262	0.95 ns	0.28 ns	I
6	$Yf\ yf\ R\ r$	87	26	37	14	164	3.67 ns	0.39 ns	I
7	$Yf\ yf\ Ti\ ti$	70	27	27	10	134	0.98 ns	0.02 ns	I
8	$Yf\ yf\ Dw\ dw$	75	23	27	11	136	1.09 ns	0.47 ns	I
9	$Yf\ yf\ Sc\ sc\ +\ +$	86	27	0	51	164	3.32 ns		I
10	$W_2\ w_2\ N\ n$	299	82	102	32	515	2.80 ns	0.26 ns	I
11	$Sdp\ sdp\ N\ n$	77	35	25	7	144	2.57 ns	1.23 ns	I
12	$Yf\ yf\ N\ n$	126	53	39	15	233	2.70 ns	0.11 ns	I
13	$R\ r\ N\ n$	58	21	24	3	106	2.18 ns	1.86 ns	I
14	$Ti\ ti\ N\ n$	64	20	18	4	106	1.03 ns	0.21 ns	I
15	$Dw\ dw\ N\ n$	52	15	17	7	91	0.27 ns	0.15 ns	I
16	$Sc\ sc\ N\ n\ +$	324	0	100	46	380	41.57 ***		0.44 $\pm$ 0.04
17	$R\ r\ Un-a^1\ un-a^1$	51	16	18	6	91	0.55 ns	0.09 ns	I
18	$Ti\ ti\ Un-a^1\ un-a^1$	60	20	12	7	99	2.30 ns	0.82 ns	I
19	$Dw\ dw\ Un-a^1\ un-a^1$	56	21	16	6	99	0.45 ns	0.001ns	I
20	$Ti\ ti\ R\ r$	60	23	19	4	106	1.03 ns	0.94 ns	I
21	$Sdp\ sdp\ Dw\ dw$	95	34	28	8	165	0.75 ns	0.24 ns	I
22	$Ti\ ti\ Dw\ dw$	428	167	160	50	805	3.61 ns	1.46 ns	I
23	$R\ r\ Dw\ dw$	68	27	26	6	127	0.80 ns	0.73 ns	I
24	$Sc\ sc\ R\ r$	66	20	21	6	113	0.32 ns	0.01 ns	I
25	$W_2\ w_2\ Dw\ dw$	67	26	17	5	115	2.63 ns	0.28 ns	I

*** = Indicates significance at $P < 0.001$; ns = not significant at $P > 0.05$

1. + = Fit to 12:3:1 ratio; ++ = fit to 9:3:4 ratio

2. I = Independent

3. C = Coupling

pigment in the flower (yfyf) had an epistatic effect on the dominant allele of the Sc locus. No plant with yellow pigment in the flower and brown or red-brown seed coat has been found. These results indicated that there is a close relationship between flower and seed coat colors.

In confirmity with the observations of Rowlands and Corner (1962), hilum color segregated independently of flower (crosses 10, 11, and 12). Similarly, hilum color segregated into a 9:3:3:1 ratio of independence with the red seed coat gene (cross 13), terminal inflorescence gene (cross 14), and short internodes (cross 15). However, an epistatic action of the Sc allele, controlling brown seeds, on the white hilum color gene (nn) was observed (cross 16). No brown seed with white hilum color has been found. Progeny test from this cross did not segregate into a 12:3:1 expected ratio from a simply dominant epistatic relationship. Recombination frequency for Sc-N loci was 0.44 ± 0.04 indicating that both loci could be linked.

One of the genes controlling the unifoliate character (un-a¹ un-a²) segregated independently of R, Ti, and Dw loci (crosses 17, 18, and 19). A unifoliate mutant used in this work was of the obligate type. As described by Sjodin (1971), this mutant retains the unifoliate character throughout the vegetative phase.

The gene Ti controlling terminal inflorescence has been located on chromosome V by Sjodin using translocation lines (see ICARDA 1986). As can be expected, this locus segregated independently of the R locus (cross 20) which was located on chromosome IV by Cabrera *et al.* (1989) using primary trisomics.

Chi-square test of all the remaining dihybrid segregations showed good agreement with the expected 9:3:3:1 ratio, indicating independence of the loci implicated. The results obtained are not unexpected, given the enormous size of *Vicia faba* chromosomes that makes linkage between such small number of studied characters unlikely.

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References

- Cabrera, A., Cubero, J.I. and Martin A. 1989. Genetic mapping using primary trisomics in *Vicia faba* L. FABIS Newsletter 23: 5-7.
- ICARDA (International Center for Agricultural Research in the Dry Areas). 1986. Third Conspectus of Genetic Variation within *Vicia faba*. ICARDA, Aleppo, Syria. 54 pp.
- Picard, J. 1963. La coloration des teguments du grain chez la feverole (*Vicia faba* L.). Etude de l'heredite des differentes colorations. Annales de l'Amelioration des Plantes 13: 97-117.
- Rowlands, D.G. and Corner, J.J. 1962. Genetic of pigmentation in broad bean (*Vicia faba* L.). Third Congress of Eucarpia, Paris 3: 229-234.
- Sirks, M.J. 1931. Beitrage zu einer genotypischen Analyse der Ackerbohne *Vicia faba* L. Genetica 13: 210-631.
- Sjodin, J. 1971. Induced morphological variation in *Vicia faba* L. Hereditas 67: 155-180.

تحليل الارتباط الوراثي في الفول

ملخص

أجري تحليل وراثي لـ 10 مواضع جينية loci في الفول (*Vicia faba* L.) ، ووجد ارتباط وراثي وثيق ($P = 0.19 \pm 0.04$) بين الموضعين Sdp/sdp و Yg/yg . وبلغ تكرار إعادة اتحاد الجينات للموضعين Sc/sc و N/n 0.44 ± 0.04 مشيراً إلى إمكانية حصول ارتباط فيما بينهما . وقد كشف عن وجود تفوق هجين لاليل Sc على مورث (جين) لون السرة . وقد أشارت قيم إعادة اتحاد الجينات لجميع انعزالات الهجن الثنائية المتبقية والمختبرة إلى وجود تنوع مستقل في جميع التكوينات . وكان للاليلات المتنحية للمصاغ الاصفر في الزهرة (yfyf) تأثير هجين متفوق على الاليل السائد للموضع Sc .

Evaluation of Genotype and Location Effects on Vicine and Convicine Contents in Vicia faba L.

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Abstract

Nineteen spring faba bean genotypes of diverse origin were grown at two different locations in France to investigate the genotype (G), location (L) and G x L effects on the content of vicine (V), convicine (C), and V + C and V/C ratio. Significant genotype and location effects were observed for V and V + C content and V/C ratio, whereas G x L interaction was significant only for C and V/C ratio. Genotypic effect was larger than the location effect suggesting that improvement in these characters could be effected through breeding.

Introduction

The glucosides vicine and convicine contained in green pods and mature seeds of *Vicia faba* L. are recognized as antinutritional factors for humans and animals, and are believed to be responsible for 'Favism' syndrome, leading to haemolytic anaemia in susceptible human beings in the Mediterranean and Middle East regions when consuming faba bean seeds. Genetic differences in vicine and convicine have been reported by several investigators (Jamalian 1978; Bjerg *et al.* 1980). The present study was undertaken to evaluate the genetic variability for vicine and convicine contents, as well as the environmental effect on the content of these glucosides in mature seeds of 19 spring faba bean genotypes grown at two different locations in France.

Materials and Methods

The experiment was conducted at two different locations in France, i.e., INRA Dijon, Domaine d'Epoisses and

INRA Rennes, Domaine de la Motte-au-Vicomte) in 1988. Seeds of 19 faba bean genotypes (11 cultivars and 8 lines of different origins) were sown (early March at Dijon and late March at Rennes) at a density of 15 plants/m² in 5m² plots arranged in a randomized complete block design with two replications. Harvest was at beginning of August in Dijon and end of August in Rennes. Mature seeds were milled according to a standardized technique and analysed for vicine and convicine contents using the HPLC technique (Quemener *et al.* 1982; Duc *et al.* 1988). Results are expressed in percent of seed dry matter.

Results and Discussion

The determinations of vicine (V) and convicine (C) contents were precise because the coefficients of variation measured for V, C, and V + C contents were lower than 7%.

Vicine content was generally higher than convicine content (Table 1), V/C ratio being especially high in cv Troy (V/C = 5.1) with few exceptions of V/C ratio lower than 1 (lines 1086 and 1405 and cv Mikko). Correlation between V and C contents was not significant ($r = -0.26$; 17df).

Analysis of variance for V and V + C content revealed highly significant effects of genotypes and locations ($P < 0.01$) whereas the genotype x location interaction effect was nonsignificant. C content was also affected significantly ($P < 0.01$) by location.

A highly significant genotype x location interaction was measured on C content and V/C ratio. The C content of cv Blandine and line 1086 must have contributed to this interaction. The location effect was also significant ($P < 0.01$) for V/C ratio. Some other genotypes giving extreme values for V, V + C, and C contents are as follows:

Line 1405 with low V (0.29) and low V + C (0.58)
Cv Ascott with low C (0.18) and low V + C (0.68)
Cv Troy with high V (0.92) and low C (0.18)
Line 1086 (*Paucijuga*) with high C (0.75) and high V + C (1.29).

From this high genotype effect when compared to location effect, we conclude the possibility of breeding *Vicia faba* L. for a reduced glucosides content.

Table 1. Vicine (V) and convicine (C) contents (% of seed dry matter) in 19 faba bean genotypes grown at two different locations in France.*

Genotype	Vicine	Convicine		V + C	V/C	
		Dijon	Rennes		Dijon	Rennes
Cultivar						
Blandine	0.70 d	0.33 defg	0.40 d	1.06 b	2.23 f	1.65 ij
Optica	0.52 ef	0.30 efg	0.28 efg	0.81 e	1.81 hi	1.84 ghi
Ticol	0.72 cd	0.35 def	0.33 defg	1.06 b	2.09 fgh	2.10 fgh
Troy	0.92 a	0.18 h	0.19 h	1.11 b	5.48 a	4.66 b
Minica	0.54 ef	0.36 de	0.33 defg	0.89 cde	1.62 ij	1.52 j
Mikko	0.48 f	0.52 c	0.46 c	0.98 bcd	0.93 klm	1.04 kl
Albatros	0.71 cd	0.27 efg	0.27 efg	0.99 bcd	2.65 e	2.59 e
Alfred	0.74 cd	0.31 efg	0.27 efg	1.03 bc	2.52 e	2.60 e
Ascott	0.51 ef	0.18 h	0.18 h	0.63 f	3.00 cd	2.72 e
Victor	0.72 cd	0.26 efg	0.24 gh	0.97 bcd	2.76 de	2.96 cd
Imperial white	0.57 ef	0.31 efg	0.26 fg	0.86 de	2.06 fgh	2.00 fgh
Line						
310 (SW, France)	0.79 b	0.32 defg	0.29 efg	1.10 b	2.52 c	2.64 e
437 (Picardie, France)	0.60 e	0.31 efg	0.27 efg	0.89 cde	2.03 fgh	2.06 fgh
278 (Lorraine, France)	0.68 d	0.32 efg	0.31 efg	0.99 bcd	2.23 f	2.16 fg
1287 (Sweden)	0.85 b	0.26 fg	0.29 efg	1.13 b	3.19 c	3.00 cd
1323 (Ethiopia)	0.58 ef	0.51 c	0.50 c	1.08 b	1.20 k	1.10 kl
1405 (China)	0.29 g	0.28 efg	0.31 efg	0.58 g	1.07 kl	0.87 lm
249 (Bulgaria)	0.54 ef	0.29 efg	0.29 efg	0.83 e	1.88 ghi	1.90 ghi
1286 (<i>V. faba paucijuga</i>)	0.54 ef	0.72 b	0.78 a	1.29 a	0.75 m	0.68 m
Mean	0.63	0.33		0.96	2.16	
<i>Coefficients of variation for:</i>						
- Genotype (G)	47	78		34	91	
- Location (L)	26	5		19	20	
- G x L	6	11		6	11	

* Figures followed by different letter(s) within each column are significantly different ($P < 0.05$) according to the Duncan's Multiple Range Test.

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References

- Quemener, B., Gueguen J. and Mercier C. 1982. Determination of vicine and convicine in faba beans by high pressure liquid chromatography. Canadian Institute for Food Sciences and Technology Journal 15: 109-115.
- Duc G., Sixdenier G., Lila M. and Furstoss V. 1988. Search of genetic variability for vicine and convicine content in *Vicia faba* L. In A First Report on a Gene which Codes for nearly Zero-Vicine and Zero-Convicine Contents. (Huissman, J. and Jansman, A.J.M., eds.), Pudoc Wageningen Publishers, Wageningen, The Netherlands.

تقييم تأثيرات الطراز الوراثي والموقع على محتويات

الفول *Vicia faba* L. من الفيسين Vicine

والكونفيسين Convicine

ملخص

زرع في موقعين مختلفين بفرنسا 19 طرازاً ربيعياً من فول موطنه الأصلية مختلفة، وذلك لدراسة تأثيرات الطراز الوراثي (G) والموقع (L) والأفعال المتبادلة (GxL)، على كمية الفيسين (V) والكونفيسين (C) و V+C ونسبة V/C. وقد لوحظت تأثيرات معنوية للطراز الوراثي والموقع على الـ V و V+C والنسبة V/C، في حين لم يكن الفعل المتبادل GxL معنوياً إلا في C والنسبة V/C فقط. وكان تأثير الطراز الوراثي أكبر من تأثير الموقع، مما يوحي بأنه يمكن إجراء تحسين في هاتين الصفتين عن طريق التربية.

Agronomy and Mechanization

المعاملات الزراعية والمكننة

The Effect of Sowing Date, Watering Interval and Intercropping with Sorghum and Maize on the Yield of Faba Bean

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Abstract

In field trials at Shambat and Wad Medani, Sudan the effect of sowing date (10 Oct and 7 Nov 1982), watering interval (7 and 14 days), and intercropping with sorghum or maize was studied. At both locations, delaying the sowing date from October to November, and watering at 7-day intervals increased the faba bean yield and reduced the incidence of root-rot/wilt disease complex. Intercropping with both the cereal crops although succeeded in reducing the incidence of root-rot/wilt disease complex, it failed to improve faba bean yield as compared to the pure stand.

Introduction

In Sudan, faba bean (*Vicia faba* L.) has recently been introduced to new areas south of Khartoum. However, in these areas the growth and development of faba bean plants are greatly affected by the winter temperatures, which are usually warmer than those of the traditional areas. The winter period is short and therefore tends to set an upper limit to potential yields. Because it will take sometime to find new adaptable varieties with early maturity and tolerance to heat, research programs are mostly directed towards manipulation of cultural practices to create a microenvironment more favourable to plant growth. These include the use of grass mulch (Salih and Ageeb 1983), high plant densities, frequent irrigation, and shade crops (Salih and Ageeb 1988).

As a part of these studies, a field experiment on intercropping of sorghum (*Sorghum bicolor* (L.) Moench) and maize (*Zea mays* L.) with faba bean was carried out with the objective of using these crops as a shelter to reduce the direct effect of heat on faba bean plants, especially with the early sowing date (October). The effects of intercropping on the incidence of root-rot/wilt disease complex and seed yield were recorded. Observations on the effects of different sowing dates and watering regimes on crop establishment and yield were also recorded.

Materials and Methods

A field trial was conducted at Shambat and Gizera (Wad Medani) experimental fields during the winter season of 1982/83 to study the effects of two sowing dates (10 Oct and 17 Nov 1982), two watering regimes (at 7 and 14-day intervals), and three intercrop treatments (nil, sorghum, and maize) on faba bean cv BF 2/2 yield. Treatments were arranged in a split-plot design with complete blocks replicated four times at Wad Medani and three times at Shambat. Sorghum and maize were sown respectively before planting the beans 12 and 4 weeks, at 1.6 m spacing. Two rows of bean plants were alternated with one row of cereal. The faba bean cv BF 2/2 was planted on two rows/ridge at the rate of two seeds/hole and 20 cm spacing between holes within rows. Edges of each row of faba beans had 50 cm of cereal. The cereal crops were fertilized (86 kg N/ha) and irrigated twice to help establish the crop before the start of the differential moisture regime. Following the 7 and 14-day watering intervals, 12 and 6 irrigations were given to the crop during the whole season, respectively.

Results and Discussion

Table 1 shows the effect of intercropping, sowing date, and watering interval on faba bean yield and yield components.

At both locations, the faba bean crop suffered a great deal from intercropping with both the cereal crops. The bean plants were thin and etiolated.

Table 1. The effect of sowing date, watering interval and intercropping with sorghum and maize on the yield of faba bean and mean percentage dead plants at Shambat and Wad Medani locations, Sudan.

Treatment	Seed yield (kg/ha)		Plants/m ²		Pods/plant		100-seed weight (g)		Mean % dead plants*	
	Shambat	Wad Medani	Shambat	Wad Medani	Shambat	Wad Medani	Shambat	Wad Medani	Shambat	Wad Medani
Intercropping										
Sorghum	1120	843	10.2	15.0	18.0	10.0	38.4	38.00	6.46	15.20
Maize	1185	1268	10.7	12.0	15.0	12.0	37.6	39.00	3.87	13.57
Pure stand	2772	1732	14.2	18.0	21.2	13.0	40.0	39.10	8.44	10.82
SE ±	128	121	1.1	1.0	0.6	1.1	0.8	0.44	0.59	0.99
Sowing date										
10 Oct 1982	1585	1042	8.1	10.0	19.1	13.0	41.1	39.80	8.65	19.33
7 Nov 1982	1800	1524	15.3	20.0	16.9	9.0	36.2	37.80	3.87	7.18
SE ±	86	68	0.8	0.4	0.4	0.6	0.6	0.38	0.45	0.88
Watering interval (days)										
7	1870	1435	11.5	15.0	19.3	11.0	39.3	39.40	5.18	12.83
14	1515	1131	11.8	15.0	16.7	11.0	37.9	38.20	7.34	13.68
SE ±	86	68	0.8	0.4	0.4	0.6	0.6	0.38	0.45	0.88

* Mean percentage dead plants transformed into degrees.

Sorghum, which was dense when the faba bean was planted, caused the greatest damage to the bean crop. At Shambat, intercropping reduced the average seed yield of faba bean by 59% as compared to the pure stand. Similarly, at Wad Medani intercropping reduced the average yields of faba bean by 51% and 27% as compared with the pure stand when intercropping was with sorghum and maize, respectively. This was due to the significant reduction in the number of pods/plant and plant stand (number of faba bean plants/m²) at harvest. However, intercropping had no effect on 100-seed weight at Wad Medani, but at Shambat small insignificant reduction occurred.

At Wad Medani and Shambat, delaying the sowing date from 10 October to 7 November significantly increased the average seed yield by 12% and 31%, respectively. This increase was mainly due to a significant improvement in plant stand. At both locations, plant stand in the November sowings was twice that of the October sowings. This may probably be due to the effect of the high temperatures in October on seed germination and seedling development of faba bean, and also on the incidence of root-rot/wilt disease complex (% plants dead). Freigoun (1980) reported that the high

temperatures of October render faba bean plants more susceptible to root-rot/wilt disease complex.

In contrast with seed yield, the number of pods/plant was highest for the October sowings at both the locations. This was mainly due to the low plant stand and high degree of branching associated with the early sowings. October sowing also increased seed size by 12% and 5% over the November sowings for Shambat and Wad Medani, respectively. This could be due to less competition (low number of pods) and/or cooler temperatures during the seed filling stage.

The effect of watering regime on seed yield was significant at both locations. Watering at 7-day intervals increased the grain yield by 19% and 21% over that of the 14-day regime at Shambat and Wad Medani, respectively. The frequent irrigation, besides its main role in satisfying the crop needs, creates a cooler microclimate less favorable for the development of root-rot/wilt disease complex and more favorable to plant growth and development (Ageeb 1979; Salih and Ageeb 1983). The increase in seed yield was due to significant increase in plant stand and number of pods/plant.

The interaction between intercropping and sowing date significantly affected seed yield at both Shambat and Wad Medani localities (Tables 2 and 3). Intercropping faba bean with maize instead of sorghum resulted in a better seed yield in the November sowing only. Whereas, in the October sowing, both intercrops showed a similar effect on bean yield.

Table 1 shows that delayed sowings significantly reduced the incidence of root-rot/wilt disease complex (measured as percentage of dead plants) at the two locations. Frequent irrigation (watering at 7-day intervals) reduced significantly the disease incidence at Shambat locality only. The effect of intercropping on the incidence of root-rot/wilt disease complex in Wad Medani and Shambat was contradictory. At Wad Medani, the faba bean pure stand treatment gave the lowest rate of the disease incidence although the differences were not significant. Whereas, at Shambat the faba bean pure stand treatment gave significantly the highest rate of disease incidence and intercropping faba bean with maize had the lowest percentage of dead plants. In general, the incidence of the root-rot/wilt disease complex at Wad Medani was twice that at Shambat.

Table 2. The effect of the interaction between intercropping and sowing date on seed yield (kg/ha) of faba bean at Shambat.

Sowing date	Intercropping			Mean
	Sorghum	Maize	Pure stand	
		(±211)		(±86)
10 Oct 1982	1066	1050	2639	1585
7 Nov 1982	1173	1321	2905	1800
		(±128)		
Mean	1120	1185	2772	1692

Table 3. The effect of the interaction between intercropping and sowing date on seed yield (kg/ha) of faba bean at Wad Medani.

Sowing date	Intercropping			Mean
	Sorghum	Maize	Pure stand	
		(±118)		(±68)
10 Oct 1982	774	821	1530	1042
7 Nov 1982	917	1714	1935	1524
		(±121)		
Mean	845	1268	1732	1283

This study clearly showed that the sowing date of faba beans under the prevalent agro-climatic conditions is very critical. The growing season is short and limited at the beginning and the end by heat and disease stresses. Soil moisture and heat stress significantly affect the prevalence and severity of wilt disease complex. Even though intercropping had succeeded in reducing the incidence of root-rot/wilt disease complex with early planting, it did not reflect in a better yield due to the smothering effect of the intercrop on faba bean.

References

- Ageeb, O.A.A. 1979. The effect of sowing date and watering interval on the grain yield of broadbean. FABIS Newsletter No. 1: 22-23.
- Freigoun, S.O. 1980. Effect of sowing date and watering interval on the incidence of wilt and root rot diseases in faba bean. FABIS Newsletter No. 2: 41.
- Salih, F.A. and Ageeb, O.A.A. 1983. Effect of sowing date, watering regime and mulching on yield of faba bean. FABIS Newsletter No. 6: 13-15.
- Salih, F.A. and Ageeb, O.A.A. 1988. The effect of plant population, sowing date, and pigeon pea shelter (shading) on the incidence of root rot/wilt disease complex and yield of faba bean. FABIS Newsletter No. 18: 18-19.

تأثيرات موعد الزراعة والمدة الفاصلة بين الريات
والزراعة المتداخلة مع الذرة الرفيعة والذرة
الصفراء على غلة الفول
ملخص

ضمن تجارب حقلية في شمبات ووادي مدني بالسودان درس تأثير موعد الزراعة (10 ت 1 / اكتوبر و 7 ت 2 / نوفمبر 1982)، والمدة الفاصلة بين الريات (7 و 14 يوما)، والزراعة المتداخلة مع الذرة الرفيعة أو الذرة الصفراء. وفي كلا الموقعين أدى تأخير موعد الزراعة من 10 / اكتوبر إلى 2 / نوفمبر والري بفواصل زمنية 7 أيام إلى زيادة غلة الفول، وتقليل الإصابة بمركب مرضي تعفن الجذور / الذبول. ورغم نجاح الزراعة المتداخلة مع المحصولين النجيليين في خفض الإصابة بمركب مرضي تعفن الجذور والذبول، إلا أنها أخفقت في تحسين غلة الفول مقارنة بالحقول المزروعة بالفول لوحده.

On-Farm *Orobanche* Control in Faba Bean in Middle Egypt

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Abstract

Six on-farm trials were conducted in *Orobanche* infested fields in Minia governorate, Egypt, for two seasons (1985-86) to study the effects of different control packages on *Orobanche* infestation in faba bean. The first control package (i.e., planting a tolerant faba bean cv Giza 402 in untilled soil at the high test levels of plant population and fertilizers plus glyphosate application) significantly increased seed and straw yields by 1860 kg/ha (73.5%) and 2560 kg/ha (62.4%), respectively, over the farmer's package (i.e., planting a susceptible faba bean cv Giza 2 in a conventionally tilled soil at the farmers' low levels of plant population and fertilizers). The second control package (same as the first but without glyphosate) significantly increased the seed yield by 1070 kg/ha (62.4%) over the farmer's package. Both the control packages reduced *Orobanche* infection through reducing the number and weight of *Orobanche* spikes/m², the number and weight of *Orobanche* spikes/bean plant, and the number of infested bean plants/m². The economic analysis showed that one Egyptian pound (LE) of total variable cost gained 3.01 LE by applying the first control package, 2.49 LE by applying the second package, and 1.95 LE by applying the farmer's package.

Introduction

Orobanche infestation is one of the main constraints to faba bean production in Egypt. However, breeding work has resulted in developing a new line F 402 (released later as Giza 402) which tolerates the parasite by allowing fewer *Orobanche* spikes to grow and having more parasite-free plants (Nassib *et al.* 1979, 1982). Later, Nassib *et al.* (1983, 1987b) found that the performance of Giza 402 is largely affected by the

environment and the agronomic practices employed. Nassib *et al.* (1985, 1987a) studied the effect of tillage systems on *Orobanche* control in faba bean. They found that planting faba beans on 15 November in untilled soil reduced the number of *Orobanche* spikes/m², and increased the seed yield by 1380 kg/ha (37.6%) over that planted in tilled soil. Other control methods include applying glyphosate (Schluter and Aber 1980; Zahran 1982). The present work was undertaken to study the effect of tillage, plant population, fertilizer application, glyphosate application, and use of tolerant faba bean cultivar on the *Orobanche* infestation and faba bean yield.

Materials and Methods

The on-farm trials were carried out on six fields naturally infested with *Orobanche* in Minia governorate, Egypt, during the winter seasons of 1985-86. The level of *Orobanche* infestation in the six sites ranged from 7 to 29 spikes/m² with an average of 24 spikes/m².

The different treatment combinations were tested in two test packages and one farmer's package. The test packages involved planting the (*Orobanche*-tolerant) faba bean cv Giza 402 in untilled soil at the recommended levels of plant population and fertilizers with and without glyphosate applications in the first and second package, respectively. Whereas, the farmer's package involved planting the (*Orobanche*-susceptible) faba bean cv Giza 2 in conventionally tilled soil, at the farmers' low levels of plant population and fertilizers without application of glyphosate.

Details on seed rate and plant population used in this study are shown in Table 1. The fertilizer applied in the test packages was 33.7 kg N + 71.4 kg P₂O₅/ha whereas the farmers package included no fertilizer. The trials were conducted in a completely randomized block design with four replications. Gross plot size was 200 m² of which only 120 m² was harvested. Seeds were hand-sown on 60 cm wide "old" and newly established ridges in untilled and tilled soil, respectively.

Two sprays of glyphosate (179 cm³ product in 500 l of water/ha each) were applied: the first was at the beginning of flowering and the second two weeks later. In each plot, total number of faba bean plants, number of *Orobanche*-infested plants, as well as the number and air-dry weight of *Orobanche* spikes were recorded at harvest. Logarithmic transformation was applied to number and weight of *Orobanche* spikes and number of infested bean plants before statistical analysis. Data

Table 1. Seed rate and plant population at the test and farmers' levels in the two control packages and the farmers' package.

Farmers' package:									
Package	Cultivar	Location						Mean	SD
		1	2	3	4	5	6		
Seed rate kg/ha									
1	Giza 402	184.5	184.5	184.5	184.5	184.5	184.5	184.5	00.0
2	Giza 402	184.5	184.5	184.5	184.5	184.5	184.5	184.5	00.0
3	Giza 2	171.4	171.4	199.9	171.4	142.8	142.8	166.6	21.5
Plant population/m ²									
1	Giza 402	26.1	27.5	25.7	33.0	28.8	30.6	28.6	2.8
2	Giza 402	27.2	28.2	23.3	25.2	26.2	27.7	26.3	1.8
3	Giza 2	14.7	15.7	19.0	18.9	12.0	13.3	15.6	2.9

Table 2. Effect of *Orobanche* control package on faba bean yields (kg/ha) and parasite infection in Minia Governorate, Egypt, during the 1985 and 1986 seasons.

Package	Cultivar	Year/location ¹							Year/location ¹							Mean
		1985						1986						Mean		
		1	2	3	4	5	6	1	2	3	4	5	6			
Seed yield (kg/ha)																
1	Giza 402	3690	4740	4880	2540	5910	4590	4390	7910	6250	7920	5590	8740	4810	6870	
2	Giza 402	1570	4320	4060	2360	4840	3260	3400	4490	5850	7860	5550	8250	3770	5960	
3	Giza 2	1680	3560	2450	530	4410	2550	2530	5110	4550	7300	1380	6730	2750	4640	
Mean		2310	4210	3800	1810	5050	3470		5840	5550	7690	4170	7910	3780		
LSD (5%)																
Location								0.67							0.94	
Treatment								0.48							1.24	
Loc.x treat.								ns							1.63	
Straw yield (kg/ha)																
1	Giza 402	3690	4740	4880	2540	5910	4590	4390	7910	6250	7920	5590	8740	4810	6870	
2	Giza 402	1570	4320	4060	2360	4840	3260	3400	4490	5850	7860	5550	8250	3770	5960	
3	Giza 2	1680	3560	2450	530	4410	2550	2530	5110	4550	7300	1380	6730	2750	4640	
Mean		2310	4210	3800	1810	5050	3470		5840	5550	7690	4170	7910	3780		
LSD (5%)																
Location								0.67							0.94	
Treatment								0.48							1.24	
Loc.x treat.								ns							1.63	
Number of <i>Orobanche</i> spikes/m ² (log)																
1	Giza 402	1.07	0.55	0.44	0.35	0.89	0.40	0.62	1.33	0.67	1.00	0.35	1.41	0.45	0.87	
2	Giza 402	1.44	0.99	0.76	1.04	1.31	0.66	1.03	1.86	1.20	1.52	1.58	1.77	0.87	1.47	
3	Giza 2	1.42	1.32	0.90	1.13	1.80	0.87	1.24	1.82	1.57	1.59	1.51	2.28	1.01	1.63	
Mean		1.31	0.95	0.70	0.84	1.33	0.64		1.67	1.15	1.37	1.15	1.82	0.78		
LSD (5%)																
Location								0.16							0.20	
Treatment								0.15							0.20	
Loc. x treat.								ns							ns	
Weight of <i>Orobanche</i> spikes (g)/m ² (log)																
1	Giza 402	1.07	0.55	0.44	0.35	0.89	0.40	0.62	1.33	0.67	1.00	0.35	1.41	0.45	0.87	
2	Giza 402	1.44	0.99	0.76	1.04	1.31	0.66	1.03	1.86	1.20	1.52	1.58	1.77	0.87	1.47	
3	Giza 2	1.42	1.32	0.90	1.13	1.80	0.87	1.24	1.82	1.57	1.59	1.51	2.28	1.01	1.63	
Mean		1.31	0.95	0.70	0.84	1.33	0.64		1.67	1.15	1.37	1.15	1.82	0.78		
LSD (5%)																
Location								0.16							0.20	
Treatment								0.15							0.20	
Loc. x treat.								ns							ns	

1. Locations 1 and 4 at El-Tawfekiya village and 2, 3, 5, and 6 at Saft El-Khamar village.

of the two seasons were subjected to combined statistical analysis according to Cochran and Cox (1957).

Results and Discussion

Seed and straw yields

The whole parasite control package (package 1) significantly increased the average seed yield by 1860 kg/ha (73.5%) over the farmer's package (package 3) with a range of 1180-2430 kg/ha. It also, significantly increased the average seed yield by 990 kg/ha (29.1%) over the same package but without glyphosate application (package 2) with a range of 180-2120 kg/ha. This is in agreement with the findings of Schmitt *et al.* (1979), Schluter and Aber (1980), Zahran (1982), and Nassib *et al.* (1985).

Sowing Giza 402 in untilled soil at the recommended levels of plant population and fertilizers, but without

glyphosate application significantly increased the average seed yield by 1070 kg/ha (39.6%) over the farmer's package, with a range of 430-1830 kg/hg at five sites (Table 2).

In contrast to seed yield, straw yield was significantly affected by package x site interaction. Except for site 1, glyphosate application did not significantly increase the straw yield of Giza 402 over no spray. However, the average straw yield of the whole control package was significantly higher than that of the farmer's package by 2230 kg/ha with a range of 620-4210 kg/ha over the six sites (Table 2).

Orobanche infection

The whole control package significantly reduced the number and dry weight of *Orobanche* spikes/m², number and weight of *Orobanche* spikes/faba bean plant, and number of infected faba bean plants/m² as compared with the farmer's package (Tables 2 and 3). This is in

Table 3. Effect of *Orobanche* control package on parasite infection in Minia Governorate, Egypt, during the 1985 and 1986 seasons.

Package	Cultivar	Year/location							Mean	Year/location						Mean	
		1985			1986					1985			1986				
		1	2	3	4	5	6	1		2	3	4	5	6			
		No. of <i>Orobanche</i> spikes/bean plant (log)							Weight of <i>Orobanche</i> spikes (g)/bean plant (log)								
1	Giza 402	0.48	0.54	0.55	0.34	0.54	0.49	0.49	0.65	0.67	1.17	0.38	1.18	0.52	0.76		
2	Giza 402	0.53	0.53	0.49	0.39	0.74	0.43	0.52	0.86	0.71	1.17	0.81	1.16	0.68	0.90		
3	Giza 2	0.58	0.68	0.53	0.62	0.70	0.41	0.59	0.91	0.90	1.29	0.94	1.11	0.52	0.95		
Mean		0.53	0.58	0.52	0.45	0.66	0.44		0.81	0.76	1.21	0.71	1.15	0.57			
LSD (5%)																	
Location									0.09								0.13
Treatment									ns								0.12
Loc. x treat.									ns								ns
		No. of infested bean plants/m ² (log)							% of infested bean plant/m ² (log)								
1	Giza 402	0.81	0.32	0.23	0.29	0.64	0.27	0.43	1.77	1.35	1.29	0.64	1.30	0.81	1.18		
2	Giza 402	0.10	0.68	0.55	0.90	0.75	0.54	0.75	1.36	0.72	0.58	1.41	1.41	1.05	1.07		
3	Giza 2	1.01	0.80	0.61	0.70	1.22	0.71	0.84	1.65	1.20	1.09	1.75	1.84	1.31	1.47		
Mean		0.97	0.60	0.46	0.63	0.87	0.51		1.59	1.09	0.99	1.27	1.45	1.06			
LSD (5%)																	
Location									0.14								0.17
Treatment									0.14								ns
Loc. x treat.									ns								0.38

agreement with the results of Nassib *et al.* (1983, 1987b).

Similarly, the second control package (no glyphosate application) reduced all *Orobanche* infestation attributes, but the difference was significant only with respect to the number of *Orobanche* spikes/m² as compared with the farmer's package.

Glyphosate application significantly reduced the *Orobanche* infestation as compared with no spray (Tables 2 and 3). Similar results were obtained by Schmidt *et al.* (1979), Schluter and Aber (1980), and Zahran (1982).

Except for the percentage of infested faba bean plants/m², there were no significant differences due to interaction of package x location in all *Orobanche* infection attributes (Tables 2 and 3). This exception could be attributed to the uneven distribution of *Orobanche* seeds in soil.

Economic analysis

Profitability of various treatments was determined to

estimate the efficiency of applying the *Orobanche* control packages by using the following formula:

$$\text{Profitability} = \frac{\text{Net benefit}}{\text{Total variable cost}} \times 100$$

Partial budgets were prepared for the three packages at each site and the data were averaged over all sites. In the two seasons, applying the whole parasite control package gave higher yields and gross and net benefit/ha than the package without glyphosate application and the farmer's package (Table 4).

The economic analysis showed that in the first season one Egyptian pound (LE) of total variable cost gained 3.25 LE (LE = 0.44 USD) by applying the whole package as compared with 2.59 LE by applying the package without glyphosate application and 2.24 LE by applying the farmer's package. The corresponding values were 2.81, 2.41, and 1.69 LE in the second season.

On an average, one Egyptian pound of total variable cost gained 3.01, 2.49, and 1.95 LE by applying the whole package, package without glyphosate application, and the farmer's package, respectively.

Table 4. Net benefit and profitability of applying the *Orobanche* control package at the farmers' and test levels in Minia Governorate, Egypt, during the 1985 and 1986 seasons.

	1985 ^a			1986 ^a			Mean ^b		
	Package			Package			Package		
	1	2	3	1	2	3	1	2	3
Variable cost (LE/ha)**:									
Sowing*	120.3	120.3	112.4	139.5	139.5	118.3	129.9	129.9	115.3
N application	15.5	15.5	0.0	15.5	15.5	0.0	15.5	15.5	0.0
P ₂ O ₅ application	16.7	16.7	0.0	16.7	16.7	0.0	16.7	16.7	0.0
<i>Orobanche</i> control	40.5	0.0	0.0	40.5	0.0	0.0	40.5	0.0	0.0
Others***	237.8	237.8	237.8	287.7	287.7	287.7	262.8	262.8	262.8
Total variable cost	430.8	390.3	350.2	499.9	459.4	406.0	465.4	424.9	378.1
Yield (kg/ha):									
Seed	4440	3320	2560	4350	3490	2500	4390	3400	2530
Straw	7360	6070	5650	6380	5860	3620	6870	5960	4640
Revenues (LE/ha):									
From seed yield	1412.4	1056.1	814.3	1543.4	1238.3	887.0	1477.2	1144.1	851.4
From straw yield	418.8	345.4	321.5	358.6	329.3	203.4	388.5	337.0	262.4
Gross benefit	1831.2	1401.5	1135.8	1902.0	1567.6	1090.4	1865.7	1481.1	1113.8
Net benefit	1400.4	1011.2	785.6	1402.1	1108.2	684.4	1400.3	1056.2	735.7
Profitability %	325.0	259.0	224.0	281.0	241.0	169.0	301.0	249.0	195.0

a = average of 3 locations; b = average of 6 locations.

** LE = 0.44 USD

* Differences due to cultivars.

*** Include weed control, irrigation, harvesting, threshing and winnowing.

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References

- Cochran, W.G. and Cox, G.M. 1957. Experimental designs. 2nd ed. John Wiley and Sons. Inc., New York. USA.
- Nassib, A.M., Hussein, A.H.A. and El-Rayes, F.M. 1985. Effect of variety, chemical control, sowing date and tillage on *Orobanche* infection and faba bean yield. The 10 International Congress for Statistics, Computer Sciences, Social and Demographic Research, 30 March- 10 April 1985.
- Nassib, A.M., Hussein, A.H.A. and Hassanein, E.E. 1987a. Effect of tillage, variety and chemical control on *Orobanche* infection and faba bean yield. The 12 International Congress for Statistics, Computer Sciences, Social and Demographic Research, 28 March- 2 April 1987.
- Nassib, A.M., Ibrahim, A.A. and Saber, H.A. 1979. Broomrape (*Orobanche crenata*) resistance in broad beans: breeding work in Egypt. Pages 133-139 in Food Legume Improvement and Development: Proceedings of the First Regional Food Legume Improvement Workshop (Hawtin, G.C. and Chancellor, G.J., eds.), ICARDA/IDRC, 2-7 May 1978, Aleppo, Syria.
- Nassib, A.M., Ibrahim, A.A. and Khalil, S.A. 1982. Breeding for resistance to *Orobanche*. Pages 199-206 in Faba Bean Improvement: Proceedings of the Faba Bean Conference (Hawtin, G. and Webb, C., eds.) ICARDA/IFAD Nile valley Project, 7-11 Mar 1981, Cairo, Egypt. Martinus Nijhoff Publishers, The Hague, The Netherlands.
- Nassib, A.M., Hussein, A.H.A. and Farrage, H.M. 1983. On-farm *Orobanche* control in faba beans in Minia and Kafr El-Sheikh governorates. In Report of the Fourth Annual Co-ordination Meeting, ICARDA/IFAD Nile Valley Project, 10-13 Sept 1983, Khartoum, Sudan.
- Nassib, A.M., Hussein, A.H.A., Saber, H.A. and Mosa, M. 1987. *Orobanche* control package in pilot demonstration plots. The 12 International Congress for Statistics, Computer Sciences, Social and Demographic Research, 28 March- 2 April 1987.
- Schluter, K. and Aber, M. 1980. Chemical control of *Orobanche crenata* in field beans in Morocco. Zeitschrift fuer Pflanzenkrankheiten und Pflanzenschutz 87(8) : 433-438. (c.f. Faba Bean Abstracts 1(2): 113).
- Schmitt, U., Schluter, K. and Boorsma, P.A. 1979. Chemical control of *Orobanche crenata* in broadbeans, FAO Plant Protection Bulletin (1979) 27(3): 88-91. (c.f. Faba Bean Abstracts 1(1): 9).
- Zahran, M.K. 1982. Weed and *Orobanche* control in Egypt. Pages 191-198 in Faba Bean Improvement: Proceedings of the Faba Bean Conference (Hawtin, G. and Webb, C., eds.), ICARDA/IFAD Nile Valley Project, 7-11 Mar 1981, Cairo, Egypt. Martinus Nijhoff Publishers. The Hague, The Netherlands.

مكافحة الهالوك *Orobanche* في حقول الفول عند المزارعين في مصر الوسطى

ملخص

أجريت ست تجارب في حقول المزارعين المصابة بالهالوك في محافظة المنيا بمصر على مدى موسمين (1985 - 1986)، لدراسة تأثير مختلف إجراءات مكافحة الهالوك في الفول. وأدت أول مجموعة من إجراءات المكافحة (أي زراعة صنف فول متحمل، هو جيزة 402، في أرض غير محروثة تتوفر فيها مستويات اختبار عالية من حيث الكثافة النباتية والأسمدة و استعمال الجليفسات) إلى زيادة معنوية في غلة البذور والتبن بمقدارها على التوالي 1860 كغ/هـ (73.5%) و 2560 كغ/هـ (62.4%) أكثر من مجموعة المعاملات التي يتبعها المزارعون (أي زراعة صنف الفول الحساس للإصابة جيزة 2 في تربة محروثة بشكل تقليدي وعند مستويات منخفضة من الكثافة النباتية والتسميد). وقد زادت المجموعة الثانية للمكافحة (نفس سابقتها ولكن بدون جليفسات) الغلة البذرية بشكل معنوي بمقدار 1070 كغ/هـ (62.4%) أكثر من مجموعة المعاملات التي يطبقها المزارعون. وقد أدت مجموعتا المكافحة إلى خفض الإصابة بالهالوك، وذلك بتقليل عدد ووزن نوراتها²، وكذلك عدد نباتات الفول المصابة²م. وقد أظهر التحليل الاقتصادي أن الجنيه المصري الواحد من كلفة المتغير الإجمالية قد زاد إلى 3.01 جنيه بتطبيق مجموعة المكافحة الأولى، وإلى 2.49 جنيه بتطبيق المجموعة الثانية، وإلى 1.95 جنيه بتطبيق المجموعة التي يتبعها المزارعون.

Pest and Disease

الآفات والأمراض

Methods for Estimating Microorganism Populations in Faba Bean Phylloplane

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Abstract

Four different methods were used for estimating microorganism populations in faba bean phylloplane. The number and type of microflora detected differed depending on the method used. The highest number of leaf microorganisms was obtained using the leaf extract technique. The microorganism population changed during the course of the experiment, the number increasing from the second sampling onwards, as the crop progressed from the vegetative stage to the reproductive stage. Some of the isolated microorganisms of the phylloplane showed an antagonistic effect on *Botrytis fabae* Sard. in *in vitro* studies.

Introduction

Leaves of plants grown under field conditions are normally invaded by various microorganisms, but in many instances a large number of the propagules remain dormant or show little activity. Phylloplane (the actual leaf surface) has been examined by many investigators (Blakeman and Brodie 1977; Manners 1981; Edward 1982). Bacteria were the first microorganisms studied in detail (James 1955); fungi ranked the second (Kapoaria and Sinha 1969), while very little attention has been given to actinomycetes (Ruinen 1961).

Several factors might affect leaf microflora populations such as position and age of the leaves, host genotype, prior infection with other organism(s), environmental conditions, and methods employed for detecting them (Last 1955; Burrage 1970; Tukey 1971).

In the present investigation, effects of four methods for estimating microorganisms on faba bean leaves, and plant age were studied on microorganism populations. The interaction between *Botrytis fabae* and some isolated microorganisms *in vitro* was also investigated.

Materials and Methods

The faba bean cultivar Giza 3 was grown in field at Bahtem Agricultural Research Station on 15 Nov 1986. Leaf samples were collected four times at monthly intervals (15 Dec 1986, 15 Jan, 15 Feb, and 15 Mar 1987). The methods employed for estimating phylloplane microorganisms were:

1. Leaf washing technique

The method described by Voznyakovskaya and Khudyakov (1960) was used. Leaves of Giza 3 were cut and transferred directly to the laboratory. The selected leaves represented all stem positions. Discs (5 mm in diameter) were cut from the leaves using a sterilized corkborer, weighted to 2 g and placed in test tubes containing 9 ml sterilized distilled water. Tubes were shaken vigorously for 3 min to wash the leaf discs thoroughly. A series of dilutions for bacteria (10^6), fungi (10^4), and actinomycetes (10^3) were prepared. One ml of the dilution was placed, each in an autoclaved Petridish. The specific media for bacteria (Skinner's medium; Skinner *et al.* 1952), for fungi (Martin's medium; Martin 1950), and for actinomycetes (Jensen's medium; Jensen 1930) were then poured in the plates, mixed well and incubated at $22 \pm 3^\circ\text{C}$. Development of microorganism colonies was tested after 7-10 days of incubation. Four plates were used for each treatment as replicates.

2. Leaf extract technique

The method of Stout (1960), which is based on the detection of microorganisms on and within leaf tissues,

was adopted. Leaf samples were collected and cut to pieces: 2 g fresh leaf weight was crushed using sterilized pestle and mortar, 1 ml of the extracted leaves was added to 9 ml sterilized distilled water in sterilized glass tubes, and then 1 ml of the required diluted leaf extract was poured in sterilized Petri-dish and shaken gently. The plates were incubated at $22 \pm 3^\circ\text{C}$ for 7-10 days. Each treatment was replicated three times.

3. Leaf replica technique

For estimating fungi population on the leaf surface, the method of Birkby and Preece (1981) was used. The basic idea of this technique is peeling off the leaf surface which was previously treated with acrylic resin emulsion (Rohm and Hass Primal Ac-33) to form a transparent replica of the surface with microorganisms embedded in it. Leaf samples were excised and brushed on the abaxial and/or adaxial leaf surface with a thin film of Ac-33 using a camel hair brush. The film was then allowed to dry for about 5 min. The translucent plastic film was peeled off carefully from the leaf surface using sharp forceps and then mounted on microscope slide and viewed. The number of fungi colonies was counted/leaf/cm. No stain was used in this technique. Four leaflets were used for each treatment.

4. Leaf print technique

The basic idea of Last (1955) was used for leaf print. The microorganisms attached to the leaf surface can be printed on the specific medium. Leaves were brought to the laboratory and the upper and/or lower leaf surface was gently printed and left in place on petridishes containing the specific media. One leaflet was used per plate. The plates were incubated at $22 \pm 3^\circ\text{C}$ for 3 days, then the leaf was removed. Numbers of developed microorganisms colonies were counted after 7 days and expressed per unit leaf area. Distribution of microorganisms on the leaf surface was also observed. Four leaflets were used in this test.

Interaction between microorganisms of phylloplane and *B. fabae*

Microorganisms isolated from faba bean phylloplane were grouped according to the genera (for fungi) or their shape and pigmentation (actinomycetes and bacteria). Discs, 5 mm in diameter of *Botrytis fabae*, obtained from 7-day old cultures, were placed in Petridishes containing PDA medium. Discs or strips from actinomycetes and/or bacteria, to be tested against *B. fabae*, were placed on each side of the *B. fabae* disc. The plates were incubated at $20 \pm 3^\circ\text{C}$ for 7 days. Notes on the interaction between *B. fabae* and the tested

organisms were recorded. In this test, 11 different fungi, 2 actinomycete isolates, and 6 groups of bacteria were included; three plates were used for each treatment.

Results

Fig.1 shows the numbers of microorganisms on faba bean leaf surfaces in the leaf washing technique. Bacteria numbers were markedly higher than the fungi, which ranked the second. The numbers of actinomycetes were negligible.

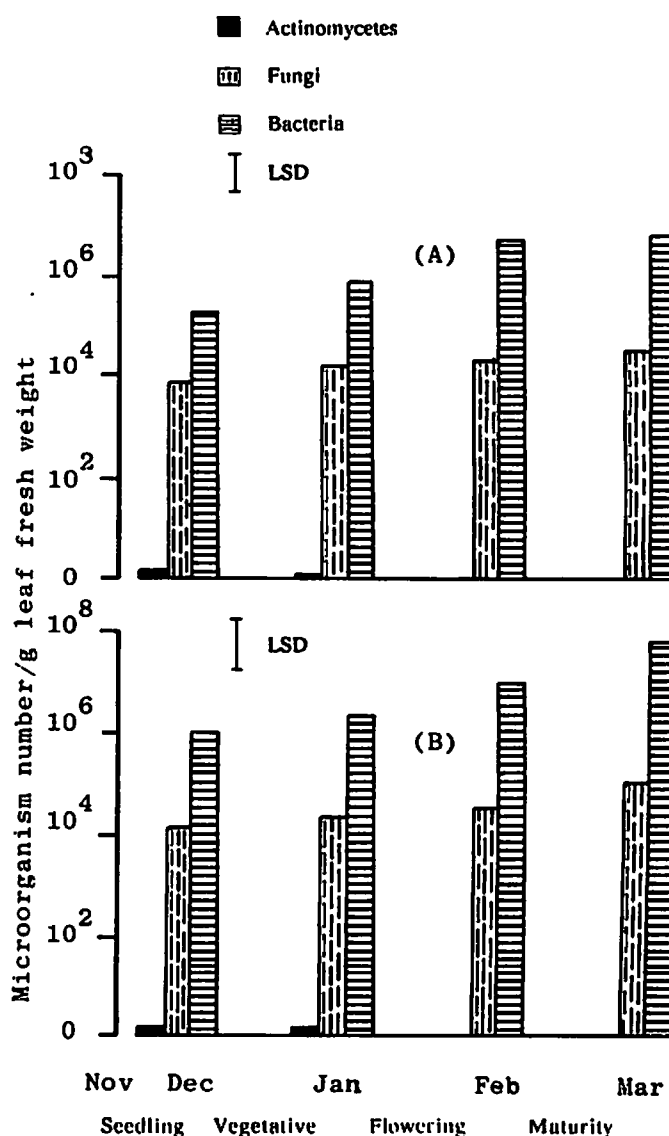


Fig. 1. Microorganisms populations of faba bean phylloplane estimated by (A) leaf washing and (B) leaf extract techniques.

Time course bioassay showed that bacteria and/or fungi populations increased with progress in plant age. Plants in the seedling stage (December) were the least in numbers, whereas at the vegetative stage (January) a notable increase in bacteria and/or fungi colonies was detected. The increase continued up to March when the crop approached maturity. Actinomycete colonies were detected only -in fewer numbers- in the first and second samplings (December and January).

Microorganism populations in faba bean phylloplane estimated by the leaf extract technique showed the same pattern obtained in the leaf washing technique (Fig. 1); a positive correlation between microflora density and plant age was observed and also numbers of the isolated bacteria were higher than the isolated fungi and actinomycetes. However, bacteria count in this technique was higher than that obtained in the leaf washing technique.

Leaf replica technique showed that the number of fungal spores/leaf unit area at the upper leaf surface was higher than that at the lower leaf surface. This phenomenon was noted at all stages of plant growth (Table 1). The number of fungal spores increased with progress in plant age.

Using the leaf print technique (Table 2), higher numbers of bacteria were detected on the leaf surface followed by fungi. However, actinomycete colonies were not distinguished on the plates. Colonies of bacteria and/or fungi printed from the upper leaf surface were slightly more than those printed from the lower leaf surface.

Although there was a slight increase in bacteria and/or fungi colonies over time, the rapid growth of some fungal species covered the other species. Also, the extension and mixing of bacteria gave some

Table 1. Fungi numbers in the lower and upper sides of faba bean phylloplane using leaf replica technique. Figures are means of 4 leaflets.

Time of sampling	Number/cm ² leaf area (x10)	
	Upper side	Lower side
Dec	22.3	18.3
Jan	29.1	20.9
Feb	48.6	39.2
Mar	71.2	63.9

LSD (5%) for months (M) = 6.4, leaf surface (S) = 5.1, and interaction M x S = NS.

difficulty in distinguishing the microflora accurately. Nevertheless, the daily observations using this technique revealed that microorganisms distribution over the leaf surface tended to colonize the areas over and around the midrib and veins.

Interaction between *B. fabae* and the isolated microorganisms

During the course of the study 11 fungi, 6 bacteria, and 2 isolates of actinomycetes, which were frequently isolated from the phylloplane, were tested against *B. fabae* *in vitro*. Results showed that 2 out of the 11 fungi were able to inhibit *B. fabae* growth. These were identified as *Nigrospora* sp. and *Chaetomium* sp. In the case of bacteria, it was found that bacteria with white, brown, or cream pigments were antagonistic to the fungus, whereas bacteria with red, yellow, or orange pigments had no effect on *B. fabae* growth. The two isolates of actinomycetes also showed an antagonistic effect to *B. fabae* growth.

Discussion

The surface of living leaves is colonized by a wide range of microorganisms. Undoubtedly, most of leaf flora are saprophytic ones. The number of microorganisms isolated is affected by several factors, including the method used for study, as was observed in this experiment. The populations in the leaf extract technique were higher than that in the leaf washing, which might be due mainly to the presence of microorganisms within the leaf tissues. However, the distributions of microorganisms on leaf surface can't be determined separately in these two methods.

In the leaf print and leaf replica methods the isolated microorganisms are expressed/unit of leaf area and the number of microorganisms on upper and lower sides of leaf can easily be calculated. The leaf print method permitted identification of bacteria, fungi, and actinomycetes, but the leaf replica technique permitted detection of only fungi. The latter technique can be used for rapid direct microscopic examination.

Microorganism colonies in the leaf print technique were less than those found in the method using leaf replica. It is possible that some of the microorganism spores present on the leaf surface were dead and were not able to germinate in the leaf print technique, whereas in the leaf replica method even the dead spores were counted so that the net count became high.

These results indicated generally that bacteria greatly outnumbered fungi in the faba bean phylloplane;

Table 2. Number of microorganisms in the lower and upper sides of faba bean phylloplane using leaf print technique. Figures are means of 4 leaflets.

Time of sampling	Leaf surface					
	Upper side			Lower side		
	Bacteria	Fungi	Actinomycetes	Bacteria	Fungi	Actinomycetes
Dec	19.3	5.0		13.2	3.2	
Jan	22.0	4.1		15.7	2.2	
Feb	29.7	6.0		20.6	4.0	
LSD (5%)	3.5	1.1		2.9	0.9	

the bacteria colonies isolated were around 10^6 /g fresh weight of leaf. This figure agrees closely with that reported by Eichells *et al.* (1961).

Season and plant age are considered another factors that affect microorganism density. The numbers of microflora in faba bean phylloplane changed from December (one month old plants) to March (four months old plants). There was a notable increase in the population starting at the beginning of flowering and it continued up to March. Because the physiological status of the leaves changes with age, the increase of microorganism density possibly reflected variations in type and amount of nutrients available from the leaves at different ages. Ruinen (1956), working with *Beijerinckia* sp., stated that the number of bacteria increased with leaf age, becoming abundant on old and yellow leaves.

In this study, the distribution of microorganisms between upper and lower leaf surfaces was variable. Stout (1960) stated that the distribution depends upon microorganism type, host plant, and to some extent leaf age. In faba bean leaves, the presented data however, showed more of an increase in microorganisms on the upper than on the lower leaf surface. The leaf orientation perhaps facilitated lodging of air-borne microflora on the upper surface of the leaves.

In the leaf print technique, which presents a mirror image of microorganisms distribution on the leaves, it was observed that microorganisms were scattered randomly over the leaf surface with slightly higher concentration along the midrib and secondary veins. This might be due to the high moisture content in leaf veins, which might support more microflora. Other investigators, however, found that colonies of spore-bolomyces tended to accumulate along leaf margins (Hamilton 1959).

It is evident that some of the numerous microorganisms on leaf surface play a role in antagonism to *B. fabae* fungus. Szejnberg and Blakeman (1973) suggested that epiphytic bacteria with polysaccharide sheaths could act as sinks for nutrients on beetroot leaves, so that spores of *Botrytis cineria* were unable to germinate. A leaf surface microorganism may also produce specific toxins or stimulants affecting *Botrytis* spores. The results reported here demonstrated that some of the isolated bacteria and fungi showed antagonistic effect against *B. fabae* *in vitro*. There is, however, evidence in some cases that the inhibitory agent operating *in vitro* is not always the same as that operating on leaf surface (Last and Deighton 1965). This notwithstanding, it has to be remembered that before using any phylloplane saprophytes to control *B. fabae* it is necessary to ensure that the microorganism does not do any harm to the crop and leave any toxic residues for the consumers of the produce.

References

- Birkby, K.H. and Preece, T.F. 1981. Differentiation of gram negative bacteria in transparent acrylic resin emulsion replicas of surfaces of plants. *Journal of Applied Bacteriology* 50: 59-63.
- Blakeman, J.P. and Brodie, I.D.S. 1977. Competition for nutrients between epiphytic microorganisms and germination of spores of plant pathogens on beetroot leaves. *Physiological Plant Pathology* 10: 29-42.
- Burrage, S.W. 1970. Environmental factors influencing the infection of wheat by *Puccinia graminis*. *Annals of Applied Biology* 66: 429-440.
- Edward, M.C. 1982. Interaction between conidia of *Botrytis cineria* and the phylloplane microflora.

- 7th *Botrytis* symposium. Aberdeen University 6-10th Sept 1982. 44 pp.
- Etchells, J.L., Costilow, R.N., Bell, T.A. and Rutherford, H.A. 1961. Influence of gamma radiation on the microflora of cucumber fruit and blossom. *Applied Microbiology* 9: 145-149.
- Hamilton, E.D. 1959. Studies on the air spor. *Acta Allergologica* 13: 143-175.
- James, N. 1955. Yellow chrominative bacteria on wheat II: Determinative studies. *Canadian Journal of Microbiology* 1: 479-485.
- Jensen, H.L. 1930. Actinomycetes in Danish soil. *Soil Science* 30: 59-77.
- Kapoaria, R.G. and Sinha, S. 1969. Phylloplane mycoflora of pearl millet and its influence on development of *Puccinia penniseti*. *Transactions of the British Mycological Society* 53: 153-155.
- Last, F.T. 1955. Seasonal incidence of sporobolomyces on cereal leaves. *Transactions of the British Mycological Society* 38: 221-239.
- Last, F.T., and Deighton F.C. 1965. The non-parasitic microflora on the surfaces of living leaves. *Transactions of the British Mycological Society* 48: 83-99.
- Manners, J.G. 1981. Biology of rusts on leaf surfaces. Pages 103-104 in *Microbiological ecology of the phylloplane* (Blakeman, J.P., ed.), Academic Press, London, UK.
- Martin, J.P. 1950. Use of acid, rose bengal and streptomycin in the plate method for estimating soil fungi. *Soil Science* 69: 215.
- Ruinen, J. 1956. Occurrence of *Beijerinckia* species in the phyllosphere. *Nature, London* 177: 220-221.
- Ruinen, J. 1961. The phyllosphere. I. An ecologically neglected milieu. *Plant and Soil* 15: 81-109.
- Skinner, F.A., Jones, P.G. and Mollison, J.E. 1952. A comparison of a direct and a plate counting technique for quantitative counts of soil microorganisms. *Journal of General Microbiology* 6: 261-271.
- Stout, J.D. 1960. Bacteria of soil and pasture leaves at Claudelands Showground. *New Zealand Journal of Agricultural Research* 3: 413-430.
- Sztejnberg, A. and Blakeman, J.P. 1973. Studies on leaching of *Botrytis cinerea* conidia and dye absorption by bacteria in relation to competition for nutrients on leaves. *Journal of General Microbiology* 78: 15-22.
- Tukey, H.B. 1971. Leaching of substances from plants. Pages 67-80 in *Ecology of Leaf Surface Microorganisms* (Preece T.F. and Dickinson C.H., eds.), Academic Press, London, UK.
- Voznyakovskaya, Y.M. and Khudyakov, Y.P. 1960. Species composition of the epiphytic microflora of living plants. *Microbiologiya* 29: 97-103.

طرق لتقدير عشائر الأحياء الدقيقة على سطح أوراق الفول

ملخص

استخدمت أربع طرق مختلفة لتقدير عشائر الأحياء الدقيقة على سطح أوراق الفول. وقد توقف عدد وطراز الكائنات النباتية المجهرية التي جرى كشفها على الطريقة المتبعة؛ إذ تم الحصول على أكبر عدد منها باستخدام طريقة مستخلص الورقة. وقد تغيرت أعداد عشائر الكائنات الدقيقة خلال مسار التجربة، حيث أخذت تزداد قدما منذ الاعتيان Sampling الثاني، وأثناء تطور المحصول من الطور الخضري إلى الطور التكاثري. وفي بعض الدراسات المخبرية أظهرت بعض الأحياء الدقيقة المعزولة من سطح الأوراق تأثيرا مضادا لفطر التبقع البني *Botrytis fabae* Sard.

Temperature as a Predisposing Factor for Wilt and Root-rot Disease Complex of Faba Bean (*Vicia faba* L.)

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Abstract

The pathogenicity of four *Fusarium* isolates, i.e., *Fusarium solani*, *F. oxysporum*, *F. acuminatum*, *F. moniliforme* var. *intermedium* and one *Pythium* sp. was tested, alone or in combination on faba bean. All

isolates and their combinations induced typical disease symptoms in early inoculations (15 October), and only mild symptoms in late inoculations (15 November). Positive relationship existed between soil temperature and both disease incidence and severity. High temperatures adversely affected faba bean growth. The importance of soil temperatures as a predisposing factor for wilt and root-rot disease complex became evident.

Introduction

Wilt and root-rot disease complex is one of the most serious diseases of faba bean in the Sudan. It is particularly damaging in early-sown crops where it adversely affects plant population and, thus crop productivity.

Several species of fungi have been reported to be associated with diseased plants. In the Sudan, *Fusarium scerpi* var *compactum* was the first fungus to be isolated from wilted faba bean plants (Tarr 1955). Later, Ibrahim and Hussein (1974) isolated *F. solani* f. sp. *fabae* (Yu and Fang) from faba bean plants and proved its pathogenicity as a causal agent of the root-rot disease. Ibrahim and Owen (1981) isolated four species of *Fusarium* from rotted roots and seeds. These were *F. equiseti* (Corda) sacc., *F. moniliforme* Scheld., *F. oxysporum*, and *F. solani*. The inoculation tests of these isolates revealed that only *F. oxysporum* was responsible for root-rot and for the aerial symptoms that appeared on *Vicia faba* plants.

Salt (1982) reported that the severity of wilt and root-rot disease complex depended on biotic and abiotic factors, which include high soil compaction, high temperature, shortage or excess of water, plant nutrient deficiencies, damage by insects and nematodes, and other fungal or viral diseases.

The objective of the present work was to investigate the identity of the causal agent(s) of the diseases complex and to study the effect of temperature on the genotype of fungus isolates associated with the disease.

Materials and Methods

The pathogenicity of isolates of *Fusarium solani*, *F. oxysporum*, *F. moniliforme* var. *intermedium*, and *F. acuminatum*, together with *Pythium* sp., applied singly or in combination, was studied in pots on faba bean

sown at two different dates. The *Fusarium* isolates are common in the traditional (Northern and Nile provinces) and new areas (Gezira and Rahad schemes, South of Khartoum) of faba bean production. Naturally infested soil from Aliab, Northern Sudan, was also included in the study due to the high disease incidence observed at that site during the 1984/85 season.

Seeds of the faba bean cv BF 2/2 were surface disinfected by soaking in 0.1% mercuric chloride for 2 min and sown, at two different dates (15 October and 15 November), in 30-cm pots containing a sterilized mixture of silt and sand at the ratio of 2:1 (V/V). The soil of pots was sterilized by dry heat at 240°C for 2 h and, 10 seeds were sown per pot. Each pot was inoculated with 20 discs (5 mm diameter) obtained from two-week old single-spore cultures. Inoculated pots were then arranged, in a cage, in a completely randomized design with four replications and watered regularly at 3-day intervals.

Diseased plants were counted at weekly intervals, whereas soil temperature at 10 cm soil depth was daily recorded at 06:00 hrs and at 12:00 hrs. Disease severity was recorded 40 days after sowing, using the 0-5 root blackening scale of Mc Eween *et al.* (1981).

To study the effect of temperature on growth of *Fusarium* isolates, they were grown on potato dextrose agar (PDA) medium for one week. After which, agar discs (about 2 mm diameter) were taken to inoculate 12 petridishes/isolate containing PDA medium. Two crossing lines were drawn on the back of each petridish. The inoculum was placed in close contact with the medium. Three plates of each isolate were then incubated at 20, 25, 30, and 35°C. The radial growth of each isolate was measured daily along the two crossing lines on the back of the plates and the mean colony diameter was calculated after 6 days.

Results

Tables 1 and 2 show that all isolates, applied either alone or in combination, produced the disease symptoms on early-sown plants. Disease incidence was higher in plants grown in Aliab soil than in any of those grown in the artificially inoculated soils. Isolations from diseased faba bean roots of the plants grown in Aliab soil revealed that *Pythium* sp., *Fusarium oxysporum*, and *F. solani* were the most common isolates. Among individual isolates, *Pythium* sp., applied either alone or in combination with any of the *Fusarium* isolates, gave the highest disease incidence, whereas *F. solani* gave the highest disease severity (root blackening).

Table 1. Pathogenicity of organisms isolated from diseased faba bean roots; plants inoculated on 15 October.

Treatment ¹	No. of plants/pot	Plant height (cm)	% diseased plants	Root blackening rating*
1. Infested soil (Aliab)	7.2	9.6	48.6	3.1
2. <i>Pythium</i> sp.	7.0	12.6	35.7	2.2
3. <i>F. o</i> + <i>Pythium</i> sp.	7.5	13.3	30.7	2.3
4. <i>F. s</i>	8.0	14.4	28.8	3.5
5. <i>F. m</i>	7.0	13.2	25.7	2.7
6. <i>F. s</i> + <i>Pythium</i> sp.	9.5	15.3	21.1	3.1
7. <i>F. s</i> + <i>F. m</i>	6.5	13.7	20.0	2.8
8. <i>F. m</i> + <i>F. a</i>	7.2	14.3	17.9	2.7
9. <i>F. o</i>	6.0	12.4	16.7	2.9
10. <i>F. a</i>	5.7	16.2	14.0	3.2
11. <i>F. s</i> + <i>F. o</i>	7.7	15.1	12.9	2.2
12. Sterilized soil (control)	9.5	15.4	0.0	0.8
F-test ²	ns	ns	hs	

1. *F. s* = *Fusarium solani*, *F. o* = *Fusarium oxysporum*, *F. m* = *Fusarium moniliforme* var *intermedium*, and *F. a* = *Fusarium acuminatum*.

2. ns = not significant and hs = highly significant (P = 0.001)

* = Root blackening was assessed on 0-5 scale, where 0 = completely white roots and 5 = completely black roots.

Table 2. Pathogenicity of organisms isolated from diseased faba bean roots; plants inoculated on 15 November.

Treatment	No. of plants/pot	Plant height (cm)	Root blackening rating*
1. Infested soil (Aliab)	9.7	32.1	1.0
2. <i>Pythium</i> sp.	9.2	32.9	0.9
3. <i>F. o</i> + <i>Pythium</i> sp.	9.5	39.2	0.8
4. <i>F. s</i>	10.0	37.9	0.8
5. <i>F. m</i>	10.0	32.8	0.9
6. <i>F. s</i> + <i>Pythium</i> sp.	9.7	35.4	0.8
7. <i>F. s</i> + <i>F. m</i>	10.0	34.9	0.6
8. <i>F. s</i> + <i>F. a</i>	9.2	33.0	0.5
9. <i>F. o</i>	10.0	35.6	1.0
10. <i>F. a</i>	9.6	34.9	0.2
11. <i>F. s</i> + <i>F. o</i>	10.0	36.7	0.5
12. Sterilized soil (control)	10.0	35.4	0.0
F-test ²	ns	ns	ns

1. *F. s* = *Fusarium solani*, *F. o* = *Fusarium oxysporum*, *F. m* = *Fusarium moniliforme* var *intermedium* and *F. a* = *Fusarium acuminatum*.

2. ns = non significant.

The first symptoms of the diseases started to appear 7-10 days after inoculation with *F. solani*, or *F. oxysporum*, or when plants were grown in Aliab soil. The symptoms started as yellowing of the margins and tips of the older leaves. The yellowing then progressed inwards, later turning the leaves completely brown, before drying-up and dying. Infected plants died within 3-4 weeks, leaving behind shrivelled, drooped leaves still attached to the plants (Plate 1). Black rotting of the root system was found to be associated with the aerial symptoms (Plate 2).

High incidence of seed-rotting was recorded in all treatments, especially in the first sowing date (Plate 3). Thus, lower plant population and slower growth rate were recorded in the early-sown plants than in the late-sown ones.

Soil temperatures taken at 06:00 and 12:00 hrs at a depth of 10 cm, were higher during early sowing than during late sowing. Regression analyses revealed the existence of a highly negative relationship between plant height and soil temperature at 06:00 hrs ($r = -0.97$, $R^2 = 0.95$) and 12:00 hrs ($r = -0.96$, $R^2 = 0.94$). On the other hand, a highly positive relationship was found (Figs. 1 and 2) between soil temperatures taken at 6:00 and 12:00 hrs and root blackening ($r = 0.88$, $R^2 = 0.74$; $r = 0.86$, $R^2 = 0.70$, respectively).

Table 3 shows that the optimum growth temperature for all *Fusarium* isolates was between 25 and 30°C, and temperatures outside this range seem to slow the growth of these isolates.

Discussion

The results of this study indicated the association of more than one *Fusarium* species and one *Pythium* sp. with the wilt and root-rot disease complex of faba bean. This is not in agreement with the results of Ali (1974), who reported that only *Fusarium* species was isolated from the roots of faba bean plants showing typical wilt symptoms. Sahab (1970) and Ibrahim (1978) isolated *Fusarium solani* and *F. oxysporum* f.sp. *fabae* from roots of diseased faba bean plants.

The results of the pathogenicity test showed that all the isolates and their combinations were able to induce wilt and root-rot disease symptoms, when inoculation was done early in the season (mid-October). In other parts of the world, only certain species of *Fusarium* such as *F. oxysporum* f.sp. *fabae* in Iraq (Michail *et al.* 1981) and *F. acuminatum* in Scotland (Harrison 1981), have been reported as pathogenic to

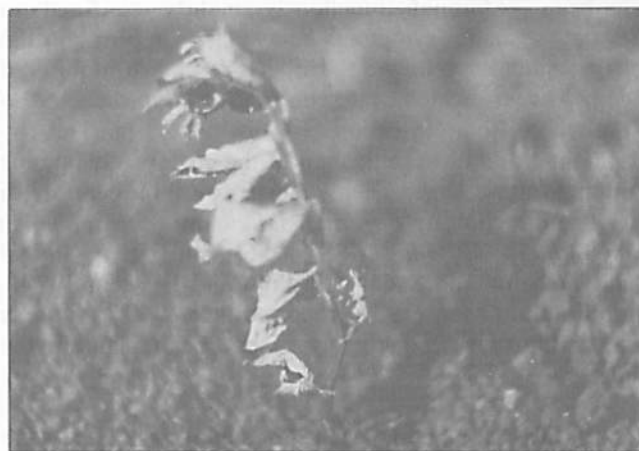


Plate 1. Shrivelled, drooped and dry faba bean leaves still attached to the plant.

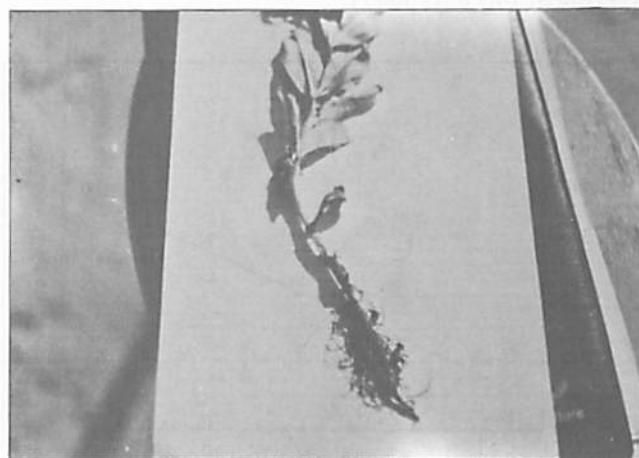


Plate 2. Blackening of the root system.



Plate 3. Seed-rotting before emergence over the soil surface.

faba bean. Although infection is mainly confined to the root system, symptoms may also appear on the foliage, such as yellowing, withering, and drooping of older leaves, which later die and remain attached to the plant. Root infection is obviously marked by blackening and disorganization of the cortex. Symptoms similar to these, have been reported on faba bean as a result of infection by *Fusarium solani* and *Macrophomina phaseolina* in Cyprus (APS 1955) and by *F. solani* f.sp. *fabae* in the Sudan (Ibrahim and Hussein 1974). Ibrahim and Owen (1981) reported that *F. oxysporum* is responsible for foot-rot in faba bean plant in the Sudan.

On the other hand, when inoculation was late in the season (mid-November), all the isolates and their combinations produced only slight symptoms, such as yellowing of the leaf margins of older leaves, which soon recovered and developed normally until the end of experiment (40 days later).

Induction of disease by the isolates inoculated early in the season, might be due to the relatively high atmospheric and soil temperatures, which adversely affected the growth of faba bean plants. The root system under such conditions becomes weak, and hence more vulnerable to attack by various soil-borne fungi as has been observed in case of white clover (*Trifolium repense* L.) (Mc Carter *et al.* 1962). Fulton and Hanson (1960) have reported that root-rot of clover develops more at high temperatures than at low temperatures, when the crop is grown in naturally infested soil.

Regarding the pathogenicity of fungi in combinations, it was evident that higher disease incidence occurred when *Pythium* sp. was combined with *Fusarium oxysporum*. This suggests a synergistic relationship between the two pathogens. On the other hand, lower disease incidence has been observed to occur when faba bean plants were inoculated with a combination of *F. oxysporum* and *F. solani*. Similar

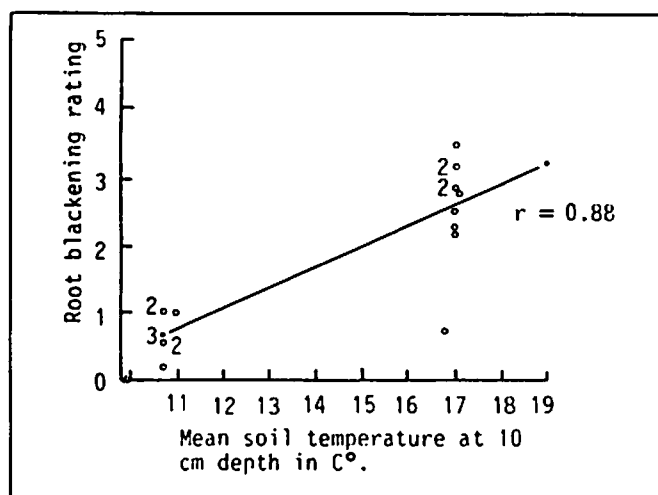


Fig. 1. The relationship between disease severity and soil temperature at 6:00 hrs.

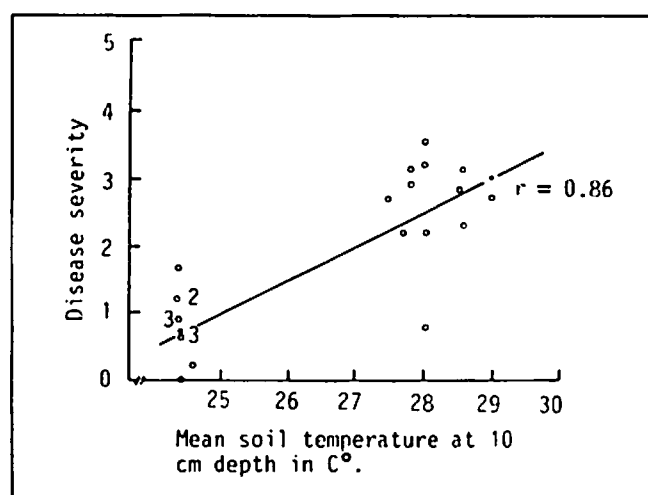


Fig. 2. The relationship between disease severity and soil temperature at 12:00 hrs.

Table 3. Effect of temperature on linear growth (colony diameter in mm) of four species of *Fusarium*.

<i>Fusarium</i> isolate	Mean colony diameter (mm) after 6 days of growth			
	Temperature (°C)			
	20	25	30	35
<i>Fusarium solani</i>	42.7	68.0	70.3	40.0
<i>Fusarium oxysporum</i>	54.0	72.0	43.7	17.7
<i>Fusarium acuminatum</i>	82.6	90.0	85.3	29.0
<i>Fusarium moniliforme</i> var. <i>intermedium</i>	50.3	71.0	42.3	18.7

results were reported by Schneider and Dalchow (1975) when lentil (*Lens culinaris*) was inoculated with the same two fungi. This relationship may be attributed to the existence of antagonistic interaction between *F. oxysporum* and *F. solani*.

The higher incidence of the disease complex in Aliab soil may be due to the presence of *Pythium sp.*, *F. oxysporum*, and *F. solani* in the soil. In spite of the fact that antagonism may be operating between *F. oxysporum* and *F. solani*, the presence of *Pythium sp.* in the Aliab soil may have somehow modified this relationship.

The results of the effect of temperature on fungal growth (Table 3), are in agreement with those obtained by Chi (1959), Chi and Hanson (1964), Agarwal and Sarbhoy (1978), and Salim (1984), who reported that the optimum temperature for mycelial growth of *F. solani* is 28°C. In fact, such temperatures prevail in the Sudan, especially in early sowings thus leading to higher disease incidence and severity.

In conclusion, this investigation has revealed that temperature is the most important predisposing factor for development of root-rot and wilt complex in faba bean. Relatively high temperatures favour fungal growth and adversely affect plant growth, thus shifting the interaction in favour of the pathogen. Under such conditions, all the tested isolates were able to produce severe disease symptoms.

Acknowledgments

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References

- Agarwal, D.K. and Sarbhoy, A.K. 1978. Physiological studies on four species of *Fusarium* pathogenic to soya bean. *Indian Phytopathology* 13: 24-31.
- Ali, M.A. 1974. Glass-house experiment of *Fusarium* wilt of broad bean. Pages 92-93 in *Annual Report 1973-1974*. Gezira Research Station, Wad Medani, Sudan.
- American Phytopathological Society (APS). 1955. Investigations by plant pathologists. *Phytopathology News* 1: 54-56.
- Chi, C.C. 1960. The relation of *Fusarium* species to wilt and root-rots of red clover. (Abstract) in *Review of Applied Mycology* 39: 232.
- Chi, C.C. and Hanson, E.W. 1959. Relation of temperature, pH and nutrition to growth and sporulation of *Fusarium spp.* from red clover. *Phytopathology* 54(9): 1053-1058.
- Fulton, N.D. and Hanson, E.W. 1960. Studies on root-rots of red clover in Wisconsin. *Phytopathology* 50: 541-550.
- Harrison, J.G. 1981. New or unusual records of plant diseases and pests. *Plant Pathology* 30: 121.
- Ibrahim, G. 1978. Investigations of *Fusarium oxysporum* Schl. root-rot of broad bean. Ph.D. thesis, University of Reading, UK.
- Ibrahim, G. and Hussein, M.M. 1974. A new record of root-rot of broad bean (*Vicia faba* L.) from the Sudan. *Journal of Agricultural Science, Cambridge* 83: 381-383.
- Ibrahim, G. and Owen, H. 1981. *Fusarium oxysporum* causal agent of root-rot on broadbean in the Sudan. *Phytopathologische Zeitschrift* 101: 80-89.
- Mc Carter, S.M. and Halpin, J.E. 1962. Effects of four temperatures on the pathogenicity of nine species of fungi on white clover. (Abstract). *Phytopathology* 52: 20.
- Mc Eween, J., Bardner, R., Briggs, G.G., Bromilow, R.H., Cocbain, A.J., Day, J.M., Fletcher, K.E., Legg, B.J., Roughley, R.J., Salt, G.A., Simpson, H.R., Webb, R.M., Witty, J.F. and Yeoman, D.P. 1981. The effects of irrigation, nitrogen fertilizer, and the control of pests and pathogens on spring-sown field beans (*Vicia faba* L.) and residual effects on two following winter wheat crops. *Journal of Agricultural Science, Cambridge* 96: 129-150.
- Michail, H.S., Al'Zarari, J.A., Hussein, S.S. and Tarbeih, M.A. 1980. Studies on *Fusarium* wilt of broad bean (*Vicia faba* L.) in Mousl. Iraq. *Mesopotamia Journal of Agriculture* 15(2).
- Sahab, A.F.S. 1970. Studies on wilt of broad beans. Thesis. Ain Shams University. Faculty of Agriculture. Cairo, Egypt. 123pp. (C.F. Nile Valley Faba bean Abstracts 1982, no. 269).
- Salt, G.A. 1982. Factors affecting resistance to root-rot and wilt diseases. Pages 259-270 in the *Faba Bean Improvement: Proceedings of the Faba Bean Conference* (Hawtin, G. and Webb, C., eds.), ICARDA/IFAD Nile Valley Project, 7-11 Mar 1981, Cairo, Egypt, Martinus Nijhoff Publishers, The Hague, The Netherlands.
- Schneider, R. and Dalchow, J. 1975. *Fusarium inflexum* Schneider, spec. nov. causal agent of a vascular wilt of *Vicia faba* L. in Germany. *Phytopathologische Zeitschrift* 82: 70-82.
- Tarr, S.A.J. 1955. The fungi and plant diseases of the Sudan. Commonwealth Mycological Institute, Kew, England. 99 pp.

الحرارة كعامل مهيج للإصابة الفول (Vicia faba L.) بمركب مرضي الذبول وتعفن الجذور

ملخص

تم على الفول اختبار القدرة الإراضية لأربع عزلات من فطر الفيوزاريوم هي : *Fusarium solani* ، *F. acuminatum* ، *F. oxysporum* ، *F. moniliforme* var *intermedium* ، وعزلة من فطر *Pythium* sp. ، سواء لوحدها أو بتراكيبها. وقد أحدثت جميع العزلات وتراكيبها أعراضاً مرضية نموذجية في التلقيحات المتأخرة (15 تشرين الأول/أكتوبر)، وأعراضاً خفيفة فقط في التلقيحات المتأخرة (15 تشرين الثاني/نوفمبر). ووجدت علاقة إيجابية بين حرارة التربة وكل من حدوث المرض وشدة. وقد أثرت درجات الحرارة العالية بشكل عكسي على نمو الفول، وظهرت بشكل واضح أهمية حرارة التربة كعامل مهيج للإصابة بمركب مرضي الذبول وتعفن الجذور.

Introduction

Broad bean mottle virus (BBMV) is among the economically important viruses which affect faba bean in Syria and other countries in the region (Makkouk *et al.* 1988a). The virus is sap transmissible, and through seeds when plants are also infected with bean yellow mosaic virus (Murant *et al.* 1974; Makkouk *et al.* 1988b). In 1951, Bawden *et al.* failed to transmit BBMV using the bean weevil *Sitona lineatus*. Later, successful transmissions were achieved by Walter and Surin (1973) using three chrysomelid beetles, namely *Acalymma trivittata*, *Diabrotica undecimpunctata*, and *Colaspis flavida*; by Borges and Louro (1974) using *S. lineatus* var *viridifrons*, and by Cockbain (1983) with the weevil *Apion vorax*.

Materials and Methods

The virus isolate (SV 48-86) used in this study, was previously collected from a faba bean field in Jisr El-Shughour, Syria, and identified as BBMV (Makkouk *et al.* 1988b). The virus was maintained on faba bean cv 'Syrian Local'. Weevils used in transmission tests were collected as larvae from lentil buds and faba bean flowers at Tel Hadya, Aleppo, Syria and were identified as *Apion arrogans* Wencker (Fig. 1) by R.T. Thompson, Department of Entomology, British Museum (Natural History), England.

Apion arrogans, a Weevil Vector of Broad Bean Mottle Virus

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Abstract

Apion arrogans Wencker is a weevil which infests naturally crops of faba bean and lentil in Syria. In a glasshouse experiment two field collections of *A. arrogans*, one originating from faba bean and the other from lentil plants, were found to transmit broad bean mottle virus (BBMV).

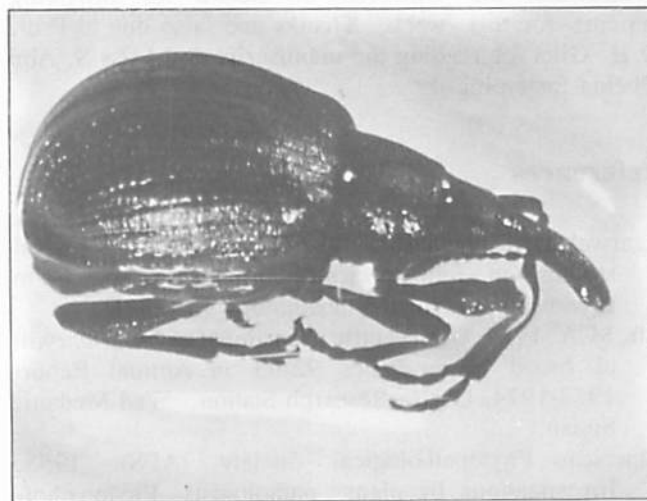


Fig. 1. An adult of *Apion arrogans* weevil, vector of broad bean mottle virus.

Adults were allowed to feed on BBMV-infected faba bean plants for 2 days to acquire the virus and were then transferred to feed on healthy faba bean plants for two days to inoculate the virus. Thereafter, plants were sprayed with an insecticide (Supracide) to kill the insects.

Results and Discussion

When a group of 8-10 adults of *A. arrogans* were fed on BBMV-infected faba bean plant and then transferred to healthy one for virus inoculation, BBMV symptoms appeared 10 days after inoculation. Weevils collected from either faba bean or lentil plants produced similar results. Virus identity on inoculated plants was confirmed by serology (ELISA).

In this experiment, because a small number of weevils was used in the transmission tests, no data on efficiency of BBMV transmission by *A. arrogans* was produced. Considering the results reported earlier by Cockbain (1983) where 20% transmission with another *Apion* species (*A. vorax*) was obtained, *A. arrogans* is likely to play an important role in the ecology of BBMV in Syria. Even though *A. arrogans* has been reported earlier to infest lentil in Syria (Tahhan and Hariri 1982), this is the first report of *A. arrogans* as a vector of BBMV.

References

- Bawden, F.C., Chaudhuri, R.P. and Kassanis, B. 1951. Some properties of broad bean mottle virus. *Annals of Applied Biology* 38: 774-783.
- Borges, M.de Lourdes and Louro, D. 1974. A biting insect as vector of broad bean mottle virus. *Agronomia Lusitana* 36: 215-216.
- Cockbain, A.J. 1983. Viruses and virus-like diseases of *Vicia faba* L. Pages 421-461 in *The Faba Bean (Vicia faba L.)*, (Hebblethwaite, P.D. ed.). Butterworths, London, UK.
- Makkouk, K.M., Bos, L., Azzam, O.I., Kumari, S. and Rizkallah, A. 1988a. Survey of viruses affecting faba bean in six Arab countries. *Arab Journal of Plant Protection* 6:53-61.
- Makkouk, K.M., Bos, L., Rizkallah, A., Azzam, O.I. and Katul, L. 1988b. Broad bean mottle virus: identification, host range, serology, and occurrence on faba bean (*Vicia faba*) in West Asia and North Africa. *Netherlands Journal of Plant Pathology* 94: 195-212.
- Murant, A.F., Abu Salih, H.S. and Goold, R.A. 1974. Viruses from broad bean in the Sudan. *Page 67 in*

the Annual Report of the Scottish Horticultural Research Institute (1973). UK.

Tahhan, O. and Hariri, G. 1982. Survey of lentil insects in Northern and North-Eastern Syria. *LENS Newsletter* 9: 34-37.

Walters, H.J. and Surin, P. 1973. Transmission and host range studies of broad bean mottle virus. *Plant Disease Reporter* 56: 833-836.

Apion arrogans سوسة براعم البقوليات ناقلة لفيروس تبرقش الفول

ملخص

تصيب سوسة براعم البقوليات *Apion arrogans* Wenck بصورة طبيعية محصولي الفول والعدس في سورية. وضمن تجربة في الدفيئة على مجموعتين من تلك السوسة، جمعت الأولى من حقول فول، والثانية من حقول عدس، تبين أنهما يقومان بنقل فيروس تبرقش الفول (BBMV).

Reaction of Faba Bean Genotypes to Natural Incidence of Broad Bean Mosaic Virus in Pakistan

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Abstract

Disease reaction of 18 faba bean genotypes to broad bean mosaic virus was studied under field conditions in Islamabad, Pakistan. The genotypes varied significantly in their reaction to the disease. Of the 18 genotypes tested only one genotype (ILB 2785) rated resistant, 11 were moderately resistant, and 5 were susceptible to the disease. The study indicated the feasibility of developing resistant lines of faba bean to the disease.

Table 1. Reaction of 18 faba bean genotypes to broad bean mosaic virus under natural infection conditions at Islamabad.

Genotype	Percentage of infection ¹	Infection rating	Disease reaction ²
BF 2/2	57.83 A	9	S
Giza (improved)	17.78 CD	5	MR
Giza 402	18.93 CD	5	MR
Hudeiba 72	40.48 B	7	S
Reina blanca	24.36 CD	5	MR
SML	16.19 CD	5	MR
ILB 2785	9.43 D	3	R
ILB 2786	30.03 BC	7	S
ILB 2788	19.48 CD	5	MR
ILB 2789	18.97 CD	5	MR
NEB 2727/75	20.27 CD	5	MR
2095/76	20.76 CD	5	MR
187/2324/79	57.37 A	9	S
187/1104/80	19.20 CD	5	MR
314/1188.218	20.68 CD	5	MR
343/1131/82	35.51 B	7	S
345/1179/82	19.35 CD	5	MR
Bakla (Local check)	17.56 CD	5	MR

1. Figures followed by the same letter(s) are not significantly different at $P < 0.05$.

2. S = susceptible, MR = moderately resistant, and R = resistant.

Introduction

In Pakistan, faba bean (*Vicia faba* L.) is grown on a small scale in areas where rainfall is high. Among the production constraints of the crop, viruses are considered the most important. They reduce the yield up to 80% (Błaszczak and Fiedorow 1979). Occasional incidence of mosaic has been reported by Azad *et al.* (1961). Nagi and Nariani (1970) indicated the viral nature of faba bean mosaic. Detailed study on purification, electron microscopy and serology of the causal virus have been reported by Chowla and Nariani (1975). While, Hussein (1985) reported that mosaic is caused by two viruses: pea mosaic virus and broad bean mosaic virus which can be present separately or in combination.

Studies on the genetic resistance of faba bean cultivars against bean yellow mosaic virus and other viruses were conducted by Tobla (1980). However, no such work appears to have been done in Pakistan. Thus the present work was undertaken to study the disease reaction of 17 faba bean genotypes received from ICARDA, Syria, and 1 local check 'Bakla' to broad bean mosaic virus.

Materials and Methods

The experimental material consisting of 17 faba bean genotypes received from ICARDA, Syria, and 1 local check 'Bakla' was planted in a field in Islamabad, Pakistan, in a randomized complete block design with three replications. Each genotype was planted in six rows 4 m long and 60 cm apart with 10 cm between plants within rows. Screening was conducted under natural conditions of infection. Final observations were recorded at maturity stage (25 days before harvest) and percentage of disease infection was calculated for each genotype. Disease severity was not correlated with yield because the crop was affected badly by hail storm at maturity. Disease reactions were measured on the 1-9 rating scale developed by Mayee and Dattar (1986). The data was statistically analyzed and least significant differences were calculated at $P < 0.05$ according to the Duncan's multiple range test.

Results and Discussion

Of the 18 genotypes tested, 1 genotype (ILC 2785) rated resistant with a disease reading of 3 (% infection

9.53). 11 were moderately resistant with a disease reading of 5 (% infection ranged from 16.19 to 24.36), and 5 genotypes viz., BF 2/2, Hudeiba 72, ILB 2786, 187/2324/179, and 343/1131/82 were susceptible to highly susceptible. Their disease readings ranged from 7 to 9 with % infection of 30.03 to 57.83. The genotype BF 2/2 was the most susceptible (Table 1).

The aphid population gave a clue that the disease was aphid-borne in nature. Such findings had already been reported by Capoor and Verma (1950) on *Dolicus lablab*.

The disease spread was high because the crop was sown late in the season and during this period the temperature was favorable for aphid and ultimately for virus multiplication. Thus it was confirmed that mosaic is most serious on late sown crop. Similar findings had been reported by Hussein (1985).

The differential interactions observed in the 18 genotypes of faba bean to broad bean mosaic virus, indicated the feasibility of developing resistant cultivars. The genotypes that were resistant in this study will be retested in the next winter season to confirm their resistance and also to evaluate some of their agronomic and economic traits.

References

- Azad, R.N., Nagaich, B.B. and Sehgal, P.O. 1961. Broad bean mosaic virus. *Indian Phytopathology* 14:169-173.
- Blaszczak, W. and Fiedorow, Z. 1979. Virus diseases of broad bean. *Biuletyn Instytutu Hodowli i Aklimatyzacji Roslin* 137:11-12 (c.f. *Faba Bean Abstracts* 1(1):28, 1981).
- Capoor, S.P. and Verma, P.M. 1950. A new virus disease of *Dolicus lablab*. *Current Science* 19:248-234.
- Chowla, S.C. and Nariani, T.K. 1975. Purification, electron microscopy and serology of broad bean mosaic virus. *Indian Phytopathology* 28:230-234.
- Hussein, M.M. 1985. Root rot/wilt complex, powdery mildew and mosaic disease of faba bean and their control. Pages 119-127 in *Faba Beans, Kabuli Chickpeas, and Lentils in the 1980s: Proceedings of the International Workshop on Faba Beans, Kabuli Chickpeas, and Lentils in the 1980s* (Saxena, M.C. and Varma, S., eds.), ICARDA, 16-20 May 1983, Aleppo, Syria.
- Mayee, C.D. and Dattar, V.V. 1986. *Phytopathometry. Technical Bulletin-1. Marathwada Agricultural University, Parbhani, India.* 146pp.
- Nagi, L.S. and Nariani, T.K. 1970. A mosaic disease of

broad bean (*Vicia faba* L.). Page 545 in *Proceedings of the 57th Session of Indian Science Congress. Kharaghpur, India.*

Rohloff, H. and Stulpnagel, R. 1984. Resistance to bean yellow mosaic virus in *Vicia faba*. *FABIS Newsletter* No. 9:37-40.

Tobla, M.N. 1980. A note on bean yellow mosaic and other viruses in Egypt. *FABIS Newsletter* No. 2:42.

تفاعل طرز وراثية للفول مع الإصابة الطبيعية بفيروس موزاييك الفول في باكستان

ملخص

درس التفاعل المرضي لـ 18 طرازا وراثيا من الفول مع فيروس موزاييك الفول تحت الظروف الحقلية في اسلام آباد بالباكستان. وقد تبينت الطرز الوراثية بشكل معنوي في درجة تفاعلها مع المرض. ومن بين الـ 18 طرازا المختبرة وجد طراز وراثي واحد فقط (ILB 2785) مقاوم، و 11 طرازا متوسط المقاومة، و 5 طرز حساسة للمرض. وقد أشارت هذه الدراسة إلى إمكانية استنباط سلالات فول مقاومة للمرض.

Faba Bean Diseases in Tunisia

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Abstract

A survey of 86 faba bean fields distributed across Tunisia during the 1986/87 season revealed that 91% of them were infested with one or more diseases. The dominant disease was chocolate spot, followed by alternaria leaf spot and ascochyta blight.

Introduction

Faba bean (*Vicia faba* L.) is a major food legume crop in Tunisia. It is mainly grown in the northern zone. However, in the central and southern parts, faba bean is grown on small areas basically for own use by farmers. In the higher rainfall areas in Tunisia various diseases attack faba bean. In 1981, an epidemic of chocolate spot resulted in 80% yield loss (ICARDA/INRAT 1982).

Some reports on disease distribution and/or incidence in Tunisia have been published in the past

(Dickmann 1982; ICARDA 1982). However, no systematic surveys had been conducted across the country. Therefore, a survey was undertaken to find the incidence of various diseases of faba bean in the major production areas of Tunisia.

Materials and Methods

The survey was conducted in March and April 1987, when the crop is generally at an early reproductive stage of development, and covered 86 fields in the northern, central, and southern parts of the country (Fig.1). The route was planned to cover the major growing areas of

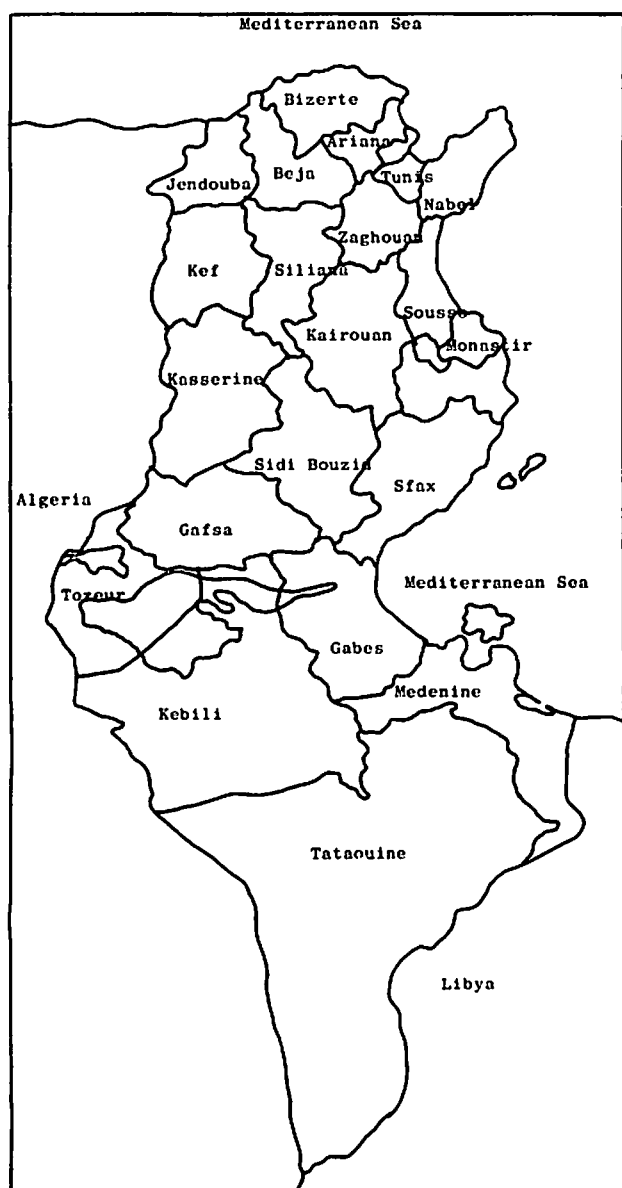


Fig. 1. Governorates of Tunisia.

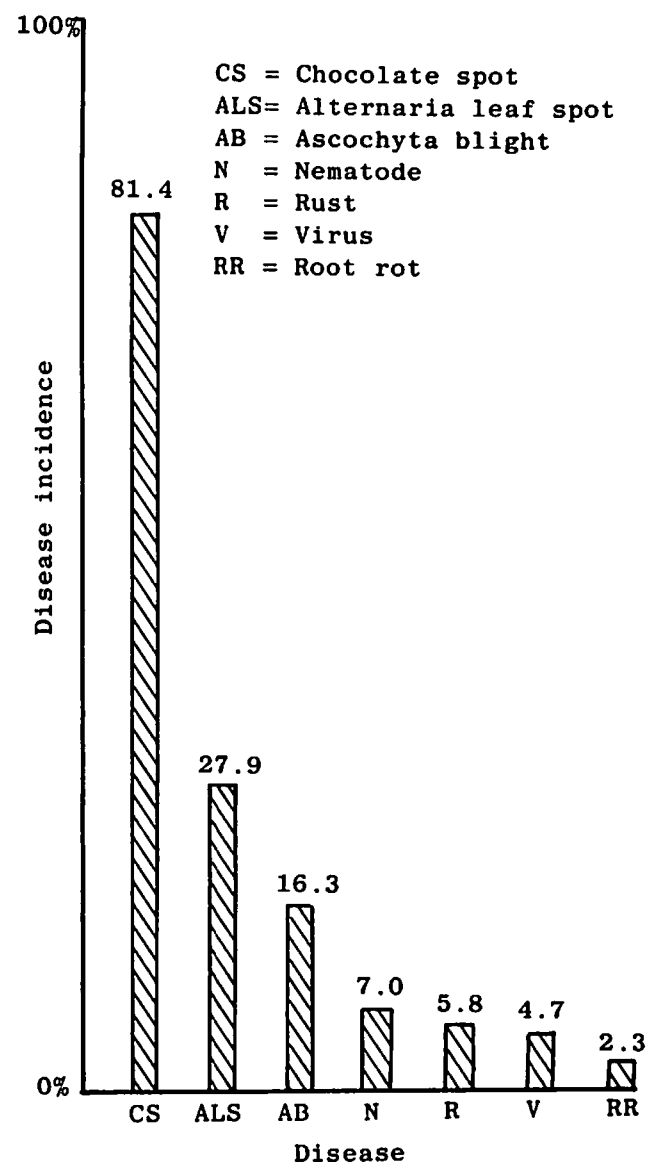


Fig. 2. Incidence of major faba bean diseases in Tunisia during the 1986/87 season.

fabia bean. Disease diagnosis was based on visual symptoms, and when necessary, was confirmed in the laboratory using standard isolation techniques on samples collected in the field. Disease incidence was expressed as the number of fields infected expressed as the percentage of the total number of fields assessed. The severity of infection was also estimated.

Results and Discussion

One or more than one disease was recorded from about 91% of these fields and the following diseases, in a descending order of incidence were identified: chocolate spot, alternaria leaf spot, ascochyta blight, stem nematode, rust, viral diseases, and root-rot (Table 1 and Fig. 2)

Chocolate spot incited by *Botrytis fabae* was the most prevalent disease, followed by alternaria leaf spot and ascochyta blight. Although chocolate spot is known to occur mainly in humid climate, it was found even in the semiarid areas of Tunisia - in the center and south. The severity of infection was high in the north where the prevailing environmental conditions are

conducive to the disease. It reached 50, 60, and 70% leaf coverage in fields at Beja, Bizerte, and Ariana, respectively. In spite of the high severity of infection, the "agressive" type of infection was not detected during the survey. *Alternaria* leaf spot was identified from 27.9% of the fields, but the severity of infection was in general limited. *Ascochyta* blight caused by *Ascochyta fabae*, a seed and air borne disease was found, especially in the northern governorates and was detected in 16.3% of the fields surveyed, but again the severity of infection was in general limited except in one field at Beja where it reached 90%.

Infection by the stem nematode (*Ditylenchus dipsaci*) was identified at a low frequency in various fields mainly in the north. Virus diseases, rust and root-rot were less important this year.

The insect pests detected during the survey included: leaf miners, aphids, thrips, stem borer, and the parasitic weed broomrape (*Orobancha* spp.), but their occurrence this season did not warrant special attention.

The amount and distribution of rain in the north was favorable for the development of majority - but not

Table 1. Faba bean diseases by governorate.

Governorate and number of fields surveyed	Disease incidence (%)						
	Chocolate spot	Alternaria leaf spot	Ascochyta blight	Stem nematode	Rust	Virus	Root-rot ¹
Northern zone							
Bizerte 16	87.50(14) ^a	25.00 (4)	31.25 (5)	6.25 (1)			
Ariana 2	100.00 (2)	50.00 (1)	50.00 (1)				
Nabeul 1	100.00 (1)						
Zaghouan 5	100.00 (5)	60.00 (3)	20.00 (1)	20.00 (1)			
Beja 5	60.00 (3)	40.00 (2)	40.00 (1)	20.00 (2)			
Jendouba 7	85.71 (6)	14.29 (1)					
Kef 5	100.00 (5)	20.00 (1)	40.00 (2)	40.00 (2)			
Siliana 2	100.00 (2)						
Central zone							
Kairouan 9	88.89 (8)	55.56 (5)	11.11 (1)				
Sousse 2	100.00 (2)				50.00 (1)		
Mahdia 7	100.00 (7)	14.29 (1)					
Sfax 6	100.00 (6)	16.67 (1)			16.67 (1)		
Sidi Bouzid 7	57.14 (4)	28.57 (2)	14.29 (1)	14.29 (1)	28.57 (2)	14.29 (1)	
Kasserine 1			100.00 (1)				
Southern Zone							
Gafsa 3	66.67 (2)				33.33 (1)	66.67 (2)	33.33 (1)
Tozeur 2		50.00 (10)				50.00 (1)	
Kebili 1							
Gabes 5	60.00 (3)						

¹ Including Rhizoctonia.

^a Figures in parenthesis are number of infected fields.

all - of the potentially important diseases. The rainfall in the center and south was below average and this prevented large development of different diseases in these areas.

Although the present survey reports the disease situation in Tunisia during one crop season; 1986/87, it is the first complete survey conducted on a country basis covering all the governorates of Tunisia and the oasis in the south. Disease samples from the oasis, where faba bean is grown as irrigated crop on very small holdings, were collected to compare their virulences with those collected from the other regions.

The results of this survey are of major importance as they provide a basis for the national crop improvement program in the area of breeding for disease resistance.

Acknowledgments

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References

- ICARDA/INRAT. 1982. Progress report 1981. Tunisia/ICARDA Cooperative Program. North African Regional Project on Food Legume Improvement. 89 pp.
- Dickmann, M.B. 1982. Survey on pests and diseases of faba beans (*Vicia faba*) in Egypt, Morocco and Tunisia. FABIS Newsletter 4: 44.
- Harrison, J.G. and Lowe, R. 1987. Wind dispersal of conidia of *Botrytis* spp. pathogenic to *Vicia faba*. Plant Pathology 36: 5-15.

أمراض الفول في تونس

ملخص

كشف حصر أجري، خلال موسم 1986/87، في 86 حقلا مزروعا بالفول، موزعة في أنحاء تونس، عن أن 91 % منها مصاب بمرض أو أكثر. وكان أكثر الأمراض شيوعا التبقع البني (الشوكولاتي)، يليه تبقع الأوراق اللترناري، والتبقع الاسكويثي.

Selection of Herbicides for the Control of Broomrape (*Orobanche* spp.) in Faba Bean (*Vicia faba* L.)

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Abstract

The effects of 20 herbicides applied postemergence, and 5 herbicides applied either preemergence or preplant incorporated on faba bean for the control of broomrape (*Orobanche crenata* Forsk.) were tested under the field and greenhouse conditions, respectively. Most herbicides tested were developed in the last decade, and each was applied at four different doses. Some glyphosate analogs (i.e., glyphosine and mon-8000), imidazolinones (imazaquin and imazethapyr), and sulfonylureas (chlorsulfuron, at extremely low rates) proved effective against broomrape, apparently without crop phytotoxicity.

Introduction

Broomrape (*Orobanche crenata* Forsk.) is a common parasitic weed in the Mediterranean area. It mainly infests legume crops, e.g., faba bean (*Vicia faba* L.), pea (*Pisum sativum* L.), chickpea (*Cicer arietinum* L.), and lentil (*Lens culinaris* M.), causing considerable reduction in yields and indirectly the area under these crops.

Up to now, it has not been possible to develop faba bean lines resistant to broomrape. Other control methods include reducing the frequency of host crops in the rotation, delaying sowing dates, using trap crops, and sterilization of the soil. But these methods are either only partially effective or very expensive, and thus not practical.

Kasasian (1973) tested a large number of herbicides against broomrape. He was the first to report the

efficacy of glyphosate (N-phosphonomethyl-glycine) in controlling *O. crenata* in faba bean. Other workers (Schmitt *et al.* 1979; Jacobson and Kelman 1980; Mesa-Garcia *et al.* 1984; Mesa-Garcia and Garcia-Torres 1985) studied the use of this herbicide on faba bean and other crops.

In Spain, the use of glyphosate for the control of broomrape in faba bean was registered in 1984 and presently it is widely accepted by farmers. However, Mesa-Garcia *et al.* (1984) reported that tolerance of faba bean to glyphosate is limited, and high rates with repeated applications of glyphosate might be phytotoxic to the crop. Moreover, the use of glyphosate to control *O. crenata* in pea and sunflower (*Helianthus annuus* L.) was not practical, as these crops did not tolerate the herbicide (Garcia-Torres *et al.* 1987).

Since Kasasian's study (1973), little similar work has been carried out. Therefore, this study was undertaken to test the efficiency of about 25 different herbicides in controlling broomrape in faba bean and also to determine their phytotoxic effects on the crop under the field and greenhouse conditions. Most herbicides used in this study were developed during the last decade, and their selection was based on their activity and persistence in the soil and/or their ability to be absorbed through the leaves and readily translocated through the phloem.

Materials and Methods

A field experiment was conducted during the 1987/88 season at Pachena (Arjona, Jaen), Spain to test the efficiency of 20 different herbicides in controlling broomrape (*Orobancha crenata* Forsk) in faba bean. Seeds of the faba bean cv 'Alameda' were sown 3 Nov 1987 in plots naturally infested with broomrape. Each plot consisted of two rows 8 m long. The first attachments of broomrape to faba bean were observed in late February. Herbicides were applied postemergence 11 Mar 1988 on faba bean plants at the early flowering stage (plant height was about 95 cm). At that date most broomrapes were at the "c" (small nodules with shoot bud visible) and "d" (shoot bud and roots well developed) growth stages (Mesa-Garcia and Garcia-Torres 1985). The herbicide treatments were applied using an experimental AZO sprayer (with SS-8001 nozzles), delivering 175 l/ha at 3 kg/cm² pressure. The experimental design was a split-plot in randomized complete blocks with herbicides in the main plots and doses in the sub-plots. Each block was replicated two times.

Phytotoxicity was assessed visually, 14 days after applying the herbicides, using a rating scale of 0-100, with 0 indicating no injury and 100 complete kill. Treatment efficiency was determined by counting the number of emerged broomrapes/plant on each plot on four consecutive dates, starting 18 April and at 8-10 days interval. The average number of emerged broomrapes/plant and their standard deviation was then calculated for each treatment.

All the herbicides, including the glyphosate, were applied only once to compare the persistence of their activities in controlling broomrape, although it is known that under the conditions of the experiment at least two repeated applications (60 g/ha each) of glyphosate are needed to control the broomrape (Mesa-Garcia and Garcia Torres 1985).

A second experiment was conducted in a greenhouse to test the efficiency of five preplant-incorporated herbicides and one postemergent herbicide against broomrape. Seeds of the faba bean cv Alemada were sown in 18-cm pots, containing 1 kg of soil mixture: 1/3 limy clay; 1/3 sand; and 1/3 peat (v/v/v). The day:night temperature of the greenhouse was maintained at 20/10 C $\pm$ 4 C. The soil of each pot was infested with 20 mg of *O. crenata* seeds before planting. The herbicides were applied using a mobile-sprayer at the conditions mentioned above. Preplant herbicides were thoroughly mixed after application. Each herbicide was applied at four different rates. Phytotoxicity was determined one month after faba bean emergence. Efficiency was determined by counting the number of emerged broomrapes/pot, on four consecutive dates at 7-10 days interval. The experiment was laid out in a completely randomized design with four replications (four pots/treatment).

Results and Discussion

In the field experiment, broomrape infection was very severe and the parasite attachment and emergence periods lasted 5-6 weeks each. For a given herbicide, the delay in the emergence of broomrape indicates that the herbicide is effective immediately after application, but not persistent enough to control the parasite after this period.

Glyphosate (Round-up) at 0.06 kg a.i./ha was able to control the broomrapes attached to the crop during the first three weeks only (Table 1). However, although glyphosate at 0.120 kg a.i./ha was more persistent, it did not control the infestation completely.

Table 1. Effect of different herbicides applied postemergence at four different rates on *O. crenata* and faba bean grown at Pachena (Arjona, Jaen), Spain during the 1987/88 season.

Herbicide	Dose (kg/ha a.i.)	Phyto- toxicity	No. of emerged broomrapes/ faba bean plants				
			1	2	3	4	5
Glyphosate (Round-up)	0.015	0 (0)*	1.3 (0.7)	5.7 (1.7)	8.6 (6.3)	13.0 (6.7)	12.8 (6.7)
	0.03	15 (21)	0.6 (0.1)	3.0 (0.1)	5.2 (3.8)	11.2 (1.2)	11.2 (1.2)
	0.06	15	0.1 (0)	0.8 (0.5)	2.4 (2.5)	8.4 (6.0)	10.4 (5.0)
	0.12	30	0 (0)	0.3 (0)	0.8 (0.8)	2.9 (0.6)	7.0 (0.8)
Glyphosine (Polaris)	0.7	0 (0)	1.0 (0.6)	1.9 (0.1)	4.2 (1.5)	5.4 (1.5)	8.9 (3.1)
	1.4	30 (0)	1.5 (1.0)	0.2 (0.4)	0.7 (0.3)	1.1 (0.3)	4.9 (1.3)
	2.8	40 (14)	1.1 (1.5)	-	0	0.1 (0.1)	0.5 (0.5)
	5.6	50 (0)	1.3 (1.3)	0.2 (0.1)	0.1 (0.1)	0.1 -	0 -
Mon-8000 (Polado)	0.08	15 (21)	0.1 (0.2)	0.5 (0.6)	0.9 (0.3)	4.3 (0.2)	7.9 (3.2)
	0.17	30 (0)	-	0	0.3 (0.2)	1.4 (0.5)	4.9 (0.8)
	0.34	50 (0)	-	0	0	0.1 (0.1)	1.8 (0.7)
	0.78	50 (0)	0 (0)	0	0	0	0.1 (0.1)
Imazaquin (Scepter)	0.1	25 (35)	1.5 (0.7)	5.7 (2.3)	7.5 (3.4)	9.3 (3.0)	10.8 (4.2)
	0.2	15 (21)	0.1 (0.1)	1.5 (0.3)	5.6 (0.4)	7.3 (3.0)	9.2 (2.5)
	0.4	40 (14)	0.2 (0.1)	0.9 (0.4)	4.4 (0.3)	7.8 (3.2)	9.0 (2.1)
	0.8	30 (0)	0.2 (0.1)	0.3 (0.1)	1.9 (0.1)	6.1 (3.6)	7.8 (3.2)
Imazethapyr (Ac-499)	0.05	0 -	1.0 (0.3)	2.1 (0.7)	6.7 (1.0)	8.3 (2.5)	9.6 (3.0)
	0.10	0 -	1.0 (0.3)	2.3 (0.7)	6.4 (1.2)	8.0 (2.0)	9.1 (2.5)
	0.20	0 -	0.8 (0.6)	2.6 (1.0)	7.0 (3.4)	8.8 (4.0)	11.6 (5.0)
	0.40	0 -	0 -	1.5 (0.5)	3.6 (0.5)	6.1 (1.7)	7.5 (2.3)
Control			2.2 (0.5)	5.0 (0.8)	7.1 (2.5)	9.8 (2.4)	10.4 (2.6)

* Figures in parenthesis are standard deviation.

Glyphosine (Polaris) at 1.4 kg a.i./ha resulted in better control of broomrape than glyphosate at 0.120 kg a.i./ha. It was also more persistent (Table 1). However, at 2.8 kg a.i./ha it was slightly phytotoxic to faba bean plants. Complete broomrape control was achieved with glyphosine at 5.6 kg a.i./ha, but phytotoxicity was very high: severe apical chlorosis, curling of leaves, and reduction of plant height and yield. On the other hand, glyphosine at 1.4 and 2.8 kg a.i./ha did not reduce the yield as compared with the control.

Mon-8000 (Polado) at 0.08 and 0.17 kg a.i./ha effectively controlled broomrape, but was slightly phytotoxic to the crop. However, although higher doses of the chemical (0.34 and 0.78 kg a.i./ha) were able to completely control broomrape, they adversely affected the bean plants. Their visual phytotoxic effect at 12-14 days after treatment was very severe, causing considerable reduction in the production of pods. Pod production was also reduced by mon-8000 when applied at 0.08 kg a.i./ha, but this reduction was due to competition between faba bean plants and broomrape.

Imazaquin (Scepter) at 0.4 and 0.8 kg a.i./ha controlled broomrape satisfactorily for 2-3 weeks after application, but was moderately phytotoxic to the crop. Treatment with imazaquin at 0.2 kg a.i./ha was less persistent than with the higher doses, although it showed a slight phytotoxic effect on bean plants.

Imazethapyr (AC-499) at the highest dose (0.40 kg a.i./ha) efficiently controlled broomrape for two weeks. However, it did not seem very persistent.

The two herbicides, imazapyr (Arsenal) at 0.018-0.150 kg formulated product/ha and chlorsulfuron (Glean) at 0.0018-0.015 kg a.i./ha were highly phytotoxic to faba bean plants, and thus their effects on broomrape could not be evaluated in the field. However, in the greenhouse, chlorsulfuron applied at the lowest rate (0.0018 kg a.i./ha) controlled broomrape efficiently and was not phytotoxic to the bean plants.

The following herbicides applied postemergence (data not shown) had either a low or no effect on broomrape at the range of rates shown in parenthesis: pendimethalin (Stomp, 0.25-2.24 kg a.i./ha), flumprop-methyl (Mataven, 0.08-0.675 kg a.i./ha), glufosinate (Finale, 0.18-1.5 kg a.i./ha), BASF-517 (Focus, 0.012-1.0 kg a.i./ha), bifenox (0.12-1.12 kg a.i./ha), metazachlor (BASF-47914-H, butizan, 0.125-1.0 kg a.i./ha), sethoxydim (Poast, 0.125-1.0 kg a.i./ha), haloxifop-etoxyethyl (Gallant-125, 0.156-1.25 kg a.i./ha), triclopyr (Garlon-4, 0.0312-0.25 kg a.i./ha),

fluazipop-009 (0.07-0.56 kg a.i./ha), fluazipop-500 (0.07-0.57 kg a.i./ha), and clopyralid (Lontrel, 1.8-15.0 kg a.i./ha).

In the greenhouse (data not shown), preplant incorporation of metolachlor (Dual) at 3.6 kg a.i./ha and chlorsulfuron at 0.0037 or 0.0075 and postemergence application of chlorsulfuron at 0.0018 kg a.i./ha controlled broomrape satisfactorily without phytotoxic effects on the crop. Mon-097 (Acetochlor) at 2.24 or 4.48 kg a.i./ha controlled the broomrape, although it was highly phytotoxic to bean plants. Other treatments tested in the greenhouse as preplant incorporation of bifenox (Modow) at 0.25-2.24 kg a.i./ha and preemergence application of metazachlor (Butisan) at the range of 0.025-2.0 kg a.i./ha had either a low or no effect on broomrape.

In conclusion, postemergence applications of glyphosine at 1.4 kg a.i./ha and mon-8000 at 0.08 or 0.17 kg a.i./ha were better in controlling broomrape than the conventional treatment with glyphosate. In this regard, attention also should be paid to some other herbicides i.e., imazethapyr and chlorsulfuron (applied postemergence) and metolachlor and chlorsulfuron (preplant incorporated).

Further studies should be conducted with the herbicides that proved active against broomrape in faba bean to get information on their possible use in future. Also, crop response to herbicides under weed-free conditions should be determined, because the potential advantage to control the parasite must not be shaded by crop yield reduction caused by the herbicide, since this may occur with some chemicals even without visible injury.

References

- Garcia-Torres L., Mesa-Garcia J. and Romero-Munoz, F. 1987. Agronomic problems and chemical control of broomrapes (*Orobancha* spp) in Spain: a studies review. Pages 241-248 in Parasitic Flowering Plants: Proceedings of the 4th International Symposium on Parasitic Flowering Plants (Weber, H. Chr. and Forstreuter W., eds.), Marburg, FRG.
- Kasarian, L. 1973. Control of *Orobancha*. Pesticides Article and News Summaries (PANS) 19: 368-371.
- Mesa-Garcia J. and Garcia-Torres L. 1985. *Orobancha crenata* (Forsk) control in *Vicia faba* L. with glyphosate as affected by herbicide rates and parasite growth stages. Weed Research 25: 129-134.

- Mesa-Garcia J., De Haro A. and Garcia-Torres L. 1984. Phytotoxicity and yield response of Broad bean (*Vicia faba*) to glyphosate. Weed Science 32: 445-450.
- Schmitt, U.D., Schulter, K. and Boorsma, P.A. 1979. Control quimico de *Orobanche crenata* en habas. Bol. Fitosanitario FABO, 27: 88-91.
- Jacobson, R. and Kelman, Y. 1980. Effectiveness of glyphosate on broomrape (*Orobanche* spp.) control in four crops. Weed Science 28: 692-698.

اختيار مبيدات أعشاب لمكافحة الهالوك
Orobanche spp. على الفول (*Vicia faba* L.)

ملخص

تم اختبار تأثير 20 مبيدا عشبيا بعد الإنبات، و 5 مبيدات عشبية سواء قبل الإنبات أو قبل الزراعة في مكافحة الهالوك المفروض *Orobanche crenata* Forsk. على الفول تحت ظروف الحقل والدفيئة على التوالي . وكانت معظم المبيدات العشبية المختبرة قد طورت خلال السنوات العشر الماضية، وأضيف كل منها بأربع جرعات مختلفة. وقد أثبتت نظائر الجليفوسات (أي جليفوسين و 8000 - mon) والاميدازولينون (imazethapyr و imazaquin) وسلفونوليرياس (chlorosulfuron) بنسب منخفضة جدا (فعاليتها ضد الهالوك بوضوح دون تأثير سمي على المحصول.

Seed Quality and Nutrition

جودة البذور والتغذية

Hard-Seededness in Vicia faba L.

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Abstract

Thirteen genotypes of faba bean (*Vicia faba* L.) were screened for hard-seededness and different methods of seed treatment were employed to reduce this problem. Hard seed percentages ranged between 64 in DB-15 and 94 in DB-3. Among the different methods employed, a small incision in the seed coat was found to be the most effective in breaking the hard-seededness followed by scarification with seed scarifier. In seed testing laboratories, the small incision method can be safely employed to break the hard-seededness in *V. faba*.

Introduction

Literature shows that in certain countries hard-seededness is common in some faba bean (*Vicia faba* L.) genotypes. It is regarded as one of the factors responsible for seed dormancy. Even under suitable conditions, the germination of hard faba bean seeds is poor. This is mainly due to the thickness and impermeability of seed coat. Mayer and Mayber (1982) reported that impermeability of seed coat is common in the Leguminosae family. The presence of the palisade layer in seed coats of certain hard legume seeds is assumed to be causally connected with their high degree of impermeability (Esau 1979).

Such seeds create a serious problem while testing germination in seed testing laboratories. Therefore,

the present study was undertaken to screen some of the genotypes for hard seeds and to develop an easy and reproducible procedure for breaking seed dormancy (hard-seededness) in faba bean.

Materials and Methods

The hard-seededness of 13 genotypes of faba bean (DB-1, DB-3, DB-6, DB-11, DB-14, DB-15, DB-20, DB-24, DB-29, DB-12, DB-82-2-2, DB-83-1, and DB-83-10) was determined by recording the initial germination percentage for each genotype according to ISTA (1985). Seed samples of the 13 faba bean genotypes were collected one week after the harvest of the 1987 crop. To investigate the feasibility of breaking seed dormancy, a sub-sample of 400 seeds was obtained from the original seed sample of each genotype and subjected to the following physical and chemical treatments:

- *Incision*: A small incision was made in the seed coat by a sharp razor, taking care of embryonal axis.
- *Scarification by sand paper*: Seeds were placed on ordinary sand paper and rubbed against its surface for 5 min.
- *Hot water*: Seeds were soaked in hot water at $80 \pm 2^\circ\text{C}$ for 5 min.
- *Scarification*: Seeds were scarified with seed scarifier for half a minute.
- *Sulphuric acid treatment*: Seeds were kept in perforated pots and dipped in concentrated sulphuric acid (H_2SO_4) for 5 min, followed by thorough washing in running tap water.
- *Control*: No pretreatment was applied.

The 400 seeds of each treatment were tested for germination in four replications. Data was statistically analyzed with the transformed values.

Results and Discussion

The data on germination of the 13 faba bean genotypes is presented in Table 1. The germination percentage of

Table 1. Germination percentage for seeds of 13 faba bean genotypes as affected by different treatments to break seed dormancy. Each value is a mean of 4 replications of 100 seeds/treatment.

Genotype	Germination %					
	Control	Incision	Sand paper	Hot water	Concentrated H ₂ SO ₄	Scarification
DB-1	9	99	17	4	19	75
DB-3	6	98	4	18	17	82
DB-6	9	99	12	13	65	80
DB-11	11	98	21	15	28	65
DB-14	15	96	17	28	38	72
DB-15	31	97	27	39	45	78
DB-20	14	98	11	15	28	70
DB-24	21	97	17	18	30	71
DB-29	17	99	15	25	75	65
DB-12	11	98	18	20	31	63
DB-82-2-2	23	97	23	30	33	72
DB-83-1	8	98	7	18	38	76
DB-83-10	6	99	8	14	18	72
Mean	13.9	97.9	15.2	19.8	35.8	72.4
SE $\pm$	1.32	0.91	1.43	1.21	2.38	1.80

untreated seeds ranged from 6-31 with an average of 13.92, and the percentage of hard seed ranged from 64 in DB-15 to 94 in DB-3.

The treatment of seed was effective in increasing the germination percentage in most cases (Table 1). Among the various methods tested, a small incision in the seed coat and scarification with seed scarifier were able to completely eliminate the hard-seededness in all the genotypes tested. They also increased the germination percentage (percentage of normal seedlings) from 13.92 (control) to 97.92 (small incision) and 72.38 (seed scarification). The difference between the last two treatments may be attributed to the ununiform seed scarification, which resulted in an increased number of abnormal seedlings. Although treatment with sulfuric acid increased the percentages of normal seedlings in DB-29 (75%) and DB-6 (65%), it did not show similar effect on the remaining genotypes. The highest amounts of hard faba bean seeds were recorded when seeds were scarified over sand paper or treated with hot water, indicating the ineffectiveness of these treatments in breaking hard-seededness in *Vicia faba*.

From the results of this study, it can be concluded that, in seed testing the problem of hard-seededness in faba bean can easily be overcome by carefully making a small incision on the seed coat without damaging the embryo.

References

- ISTA 1985. International rules for seed testing (Rules and Annexes). Seed Science and Technology 13(2): 299-513.
Esau, K. 1976. Anatomy of seed plants. Willey Eastern, Ltd. New Delhi, India. 550 pp.
Mayer, A.M. and Mayber, A.P. 1982. Germination of seeds. Third Edition. Pergamon Press. New York, USA. 53 pp.

(*Vicia faba* L.) صلالة البذور في الفول

ملخص

تمت التجربة لصلادة البذور في 13 طرازاً وراثياً من الفول (*Vicia faba* L.)، باتباع طرق معاملة للبذور مختلفة للتقليل من حدة تلك المشكلة. وقد تراوحت النسبة المئوية للبذور الصلدة بين 64 في DB-15 و 94 في DB-3. ومن بين الطرق المختلفة المستعملة وجد أن إحداث حُر صغير في غلاف البذرة من أكثرها فعالية لكسر صلالة البذور، يليه الخدش بخدشات البذور. ويمكن استخدام طريقة الحز بشكل مأمون في مخبر اختبارات البذور لكسر صلالة البذور في الفول.

Contributors' Style Guide

Policy

The aim of FABIS Newsletter is to publish quickly the results of recent research on faba beans. Articles should normally be brief, confined to a single subject, good quality, and of primary interest to research, extension, and production workers, and administrators and policy makers.

Style

Articles should have an abstract (maximum 250 words) and whenever possible the following sections: introduction, materials and methods, and results and discussion. Authors should refer to recent issues of FABIS for guidance on format. Articles will be edited to maintain uniform style but substantial editing will be referred to the author for his/her approval; occasionally, papers may be returned for revision.

Disclaimers

The views expressed and the results presented in the newsletter are those of the author(s) and not the responsibility of ICARDA. Similarly, the use of trade names does not constitute endorsement of or discrimination against any product by ICARDA.

Manuscript

Articles should be typed double-spaced on one side of the page only. The original and two other legible copies should be submitted. The contributor should include his name and initials, title, program or department, institute, postal address, and telex number if available. Figures should be drawn in India ink; send original artwork, not photocopies. Define in footnotes or legends any unusual abbreviations or symbols used in a figure or table. Good quality black and white photographs are acceptable for publication. Photographs and figures should preferably be 8.5 cm or 17.4 cm wide.

Units of measurement are to be in the metric system; e.g. t/ha, kg, g, m, km, ml (=milliliter), m².

The numbers one to nine should be written as words except in combination with units of measure; all other numbers should be written as numerals; e.g., nine plants, 10 leaves, 9 g, ninth, 10th, 0700 hr.

Examples of common expressions and abbreviations

3 g; 18 mm; 300 m²; 4 Mar 1983; 27%; 50 five-day old plants; 1.6 million; 23 ug; 5°C; 1980/81 season; 1980-82 seasons; Fig.; No.; FAO/USA. Fertilizers: 1 kg N or P₂O₅ or K₂O/ha.

Mon, Tues, Wed, Thurs, Fri, Sat, Sun; Jan, Feb, Mar, Apr, May, June, July, Aug, Sept, Oct, Nov, Dec. Versus = vs. least significant difference = LSD, standard error = SE +, coefficient(s) of variation = CV(s). Probability: Use asterisks to denote probability * = P<0.05; ** = P<0.01; *** = P<0.001.

Botanical: Include the authority name at the first mention of scientific names, Cultivar(s) = cv(s), variety = var(s), species = sp./spp., subspecies = subsp., subgenus = subg., forma = f., forma specialis = f. sp.

References

Journal articles: Khalil, S. A. and Harrison, J.G. 1981. Methods of evaluating faba bean materials for chocolate spot. FABIS No. 3: 51-52.

Books: Witcombe, J. R. and Erskine, W. (eds.). 1984. Genetic resources and their exploitation-chickpea, faba beans, and lentils. Advances in Agricultural Biotechnology. Martinus Nijhoff/Dr. W. Junk Publishers, The Hague, The Netherlands, 256 pp. s 1; *Articles from books:* Hawtin, G. C. and Hebblethwaite, P. D. 1983. Background and history of faba bean production. Pages 3-22 in *The Faba Bean (Vicia faba L.)* (Hebblethwaite, P.D., ed.). Butterworths, London, England.

Papers in Proceedings: Hawtin, G. C. 1982. The genetic improvement of faba bean. Pages 15-32 in *Faba Bean Improvement: Proceedings of the Faba Bean Conference* (Hawtin, G. and Webb, C., eds.), ICARDA/IFAD Nile Valley Project, 7-11 Mar 1981, Cairo, Egypt.

Submission of articles

Contributions should be sent to FABIS, ICARDA, P.O. Box 5466, Aleppo, Syria.

تعليمات النشر باللغة العربية

سياسة النشر :

تهدف هذه النشرة العلمية الى نشر نتائج البحوث الجديدة بالسرعة الممكنة . والغاية من هذه التعليمات مساعدة الباحثين على صياغة بحوثهم بالشكل الذي يسهل تبادل المعلومات فيما بينهم على اختلاف أعمارهم ومشاريتهم العلمية . وهذه المطبوعة تعنى بنشر الاوراق العلمية والبحوث المختصرة والمقالات المكتوبة بلغة واضحة واسلوب علمي ، والمطبوعة بمسافات مزدوجة بين السطور على ورق اطواله 21 x 28 سم على وجه واحد فقط . ترسل نسخة أصلية عن البحث وتعلنون جميع المراسلات الى عنوان النشرة . ويشترط في المادة المرسله للنشر الا تقدم الى أى جهة أخرى . ولا تعبر نتائج البحوث المنشورة الا عن وجهة نظر أصحابها . كما ان استعمال الاسماء التجارية لا يعني بالضرورة ان ايكاردا تحبذ استعمال أى من هذه المنتجات مقارنة بمثيلاتها التجارية .

منهج الكتابة :

تكتب وترتب البحوث بالشكل التالي : 1 (عنوان مناسب لا يزيد على 70 حرفا ، يليه اسم وعنوان الباحث / الباحثين . 2) ملخص بالعربية يتألف من فقرة واحدة لا تزيد على 200 كلمة توجز العمل ، والنتائج المتوصل اليها ، بأقصر وأوضح طريقة ممكنة . 3) مقدمة وتبرز أهمية موضوع البحث وتستعرض بشكل نقدي الاعمال والبحوث السابقة المتعلقة بذلك . 4) المواد والطرق وتشمل المعلومات الخاصة بموقع تنفيذ التجربة ، والمواد والطرق المستعملة ، مع تحديد تصميم التجربة المتبع . 5) النتائج والمناقشة وتظهر المعلومات والبيانات التي حصل عليها الباحث ، ومدى أهميتها . 6) التوصيات ان وجدت فتكتب بفقرات محددة ومرفقة . 7) كلمة الشكر عند اللزوم . 8) ملخص بالانكليزية مترجم عن العربية بأسلوب علمي ينسجم مع روح اللغة الانكليزية . 9) المراجع ويتم العزو اليها في النص بكتابة كنية المؤلف وعام النشر بين قوسين ، واذا كان للمرجع أكثر من ثلاثة مؤلفين تكتب كنية الاول وتضاف اليها كلمة " وآخرون " اذا كان المرجع بالعربية أو *et al.* اذا كان المرجع بالاجنبية . اما عن ترتيب المراجع في نهاية المطبوعة فيتم هجائيا وبصورة مستقلة لكل من المراجع العربية والاجنبية . تستثنى المقالات من الترتيب السابق : مقدمة ومواد وطرق ... انما يكتفى بوضع ملخص لها بالعربية وآخر بالانكليزية ، يضاف الى ذلك ضرورة تقسيمها الى فقرات تحمل كل منها عنوانا مناسباً . وينصح هنا بالرجوع الى آخر أعداد هذه النشرة للتعرف الى طريقة اعداد المخطوطة وترتيب المراجع .

الجدول والاشكال والصور :

تفضل الجداول الصغيرة على الكبيرة ، والبسيطة على المعقدة . ويجب ان يحمل كل جدول رقما معينا حسب وروده في النص ، مع عنوان مناسب . وتستعمل الصور (الابيض والاسود فقط) والاشكال والرسوم الاصلية وليس صوراً عنها ، على ان تكون في عمود واحد (8.8 سم) او عمودين (17.7 سم) ويشار الى مكانها المناسب في النص ، ويراعى فيها ان تكون واضحة المعالم ، وتحمل عنوانا وارقاما متسلسلة حسب ورودها في البحث .

الارقام ووحدات القياس :

تستعمل في جميع مطبوعات ايكاردا الارقام العربية Arabic figures (1 ، 2 ، 3 ، 4 ، 5 ، 6 ، 7 ، 8 ، 9) ، ووحدات القياس الدولية SI Units مثل : طن/هـ ، كغ ، غ ، م ، كم ، مم ، م² .

الاختصارات والرموز :

5 غ ، 325 مم ، 300 م² ، عام 1983 ، موسم 1988/89 ، موسما 1987-1989 ، مواسم 1986 - 1989 ، 20 م² ، الجدول 1 ، الشكل 5 ، الفاو (منظمة الاغذية والزراعة) ، ف م ع (الفرق المعمول عليه LSD) .

NEWS

اخبار

Book Reviews

مطالعات في الكتب

Salt-Affected Soils

By Istvan Szabolcs

Published by CRC Press, Inc., Florida, USA. 1989

ISBN 0-8493-4818-8

Hardcover price 163 USD

274 pp.

This book presents a state-of-the-art review of the entire problem of soil salinity, including the nature of this phenomenon and the extent of salt-affected soils in different parts of the world in relation to the environmental conditions under different climatic, geochemical, and hydrological circumstances. The book also stresses that it is important to characterize the main areas where salt-affected soils appear and the physical and chemical properties that have a bearing on the potential for agricultural production, horticulture and silviculture, and on environmental problems.

Contents: i)salt-affected soils as a world problem, ii)landscape geochemistry of salt-affected soils, iii)behavior and effect of the principal types of salt and their compounds in formation of salt-affected soils, iv)types, formation and properties of salt-affected soils, v)secondary salinization and/or alkalization of irrigated soils and potential salt-affected soils, vi)principles of utilization and reclamation of salt-affected soils, vii)references, and viii)index.

Constraints to Production of Pulses in Bangladesh

By E.S. Elias

Published by the Regional Research and Development
Centre for Coarse Grains, Pulses, Roots and Tubers

ISBN 979-8058-60-0

Softcover price 5.00 USD

93 pp.

This research report analyzes the declining per capita availability of pulses in Bangladesh. The focus is on the socio-economic position of pulses in relation to farm profitability, labor, and capital inputs. The author indicates that the increasing commercialization of agriculture has bypassed pulse crops. In view of the nutritional importance of pulses, he recommends more policy attention to improve the position of pulses in relation to other crops, and calls for more upstream research to generate more production technology.

If you have any

- * faba bean news
- * announcements of meetings
- * book reviews
- * new research interests
- * suggestions

Please send them to:

FABIS
ICARDA, Box 5466
Aleppo, SYRIA

Meeting Reports

تقارير المؤتمرات

Faba Bean Workshop in Zaragoza

A workshop on the present status and future prospects of faba bean production and improvement in the Mediterranean countries was held in Zaragoza, Spain from 27-29 June 1989. Scientists from 11 Mediterranean countries participated in the workshop, which was organized by the Centre International de Hautes Etudes Agronomiques Mediterraneennes (CIHEAM), the International Center for Agricultural Research in the Dry Areas (ICARDA), and the European Community Commission (ECC).

The continued importance of faba bean in human nutrition, animal feed, and farming systems was stressed in all papers, but it was also noted that both acreage and production have been decreasing steadily over the past two decades. This is mainly due to several technical and economic constraints as listed below:

- Biotic constraints; e.g., lack of high and stable yielding cultivars and susceptibility to parasitic weeds, diseases, and insect pests.
- Abiotic stresses; e.g., drought, heat, and cold.
- Poor crop management; e.g., planting date, population density, weed control, P fertilization, mechanization, etc.
- Anti-nutritional factors and their negative effect on consumption.
- Inefficient extension of important research findings.
- Low market prices.
- Competition from subsidized crops; e.g., sunflower.

Most of the constraints are common throughout the Mediterranean region, although their severity varies from country to country. However, because the European Mediterranean countries have generally stronger research capabilities than the NARs in the remaining countries, the need for collaboration, training, and networking was stressed in discussions at the workshop. Already network development has been initiated in West Asia and North Africa by ICARDA. This may be extended to include all sides of the Mediterranean.

Although several research results presented in the workshop were promising in solving the production constraints mentioned above, the participants felt the need for further efforts in several research areas. Based on the deliberations and discussions during the workshop, research priorities, areas and mechanisms of collaboration were determined.

The proceedings of the workshop will be published by CIHEAM.

International Symposium on Faba Bean Production and Improvement Research in China

A symposium on faba bean production and improvement was held at Hangzhou, China 24-26 May 1989. Scientists from throughout China, as well as senior representatives of the Chinese Academy of Agricultural Sciences (CAAS), the Zhejiang Academy of Agricultural Sciences, the Zhejiang Commission of Science and Technology, and ICARDA participated.

All aspects of faba bean research were presented and discussed at the symposium. As this was the first such meeting to bring together Chinese faba bean scientists from around the country, it provided an excellent opportunity to review the current status of production and research, and also to develop a strategy for future research activities. It is hoped that the constructive and interesting discussions held will foster the development of closer collaboration and exchange of germplasm material between Chinese scientists in a regional faba bean research network.

At the end of the meeting, the participants agreed on the development of coordinated trials for screening for yield and disease resistance in the autumn planted area, which currently accounts for over 90% of the total faba bean production in China.

The proceedings of the symposium will be published by ICARDA in collaboration with the CAAS.

Forthcoming Events

أحداث مرتقبة

Symposium on Land Drainage for Salinity Control in Arid and Semi-Arid Regions

The symposium, organized by the Advisory Panel on Land Drainage in Egypt, and sponsored by the Ministry of Public Works and Water Resources, Egypt and the Ministry of Foreign Affairs, The Netherlands, will be held in Cairo, Egypt, 26 Feb -3 Mar 1990. There will be five sessions, namely (i) physical features of areas in need of drainage; (ii) design of drainage systems; (iii) drainage technology; (iv) ecological aspects, including reuse of drainage water; and (v) economy of drainage. Each session will be introduced by a keynote speaker followed by a presentation of papers and a discussion.

For more information please write to:

Secretariat
Drainage Research Institute
Irrigation Building 13
Giza Street, Giza, EGYPT

First International Conference on Soil Solarization

The conference, organized by the Faculty of Agriculture, University of Jordan and the Food and Agriculture Organization of the United Nations (FAO), will be held in Amman, Jordan, 19-15 Feb 1990. The objective of the conference is to discuss and illustrate available technology on soil solarization as an integrated method of improving plant health, growth, and yield in arid agriculture and as a safe, cheap, and effective alternative to chemical treatment. The program will include: (i) invited papers on principles and technology of soil solarization, application of soil solarization in different cropping systems and the control of multiple plant pathogens and pests, and future technological developments and uses of soil

solarization; (ii) contributed research papers on new findings on soil solarization; and (iii) demonstrations on soil solarization.

For more information, write to:

Dr. W. Abu-Gharbieh
Faculty of Agriculture
University of Jordan
Amman, JORDAN

The Second International Food Legume Research Conference

This conference will be held in Cairo, Egypt in March 1991. The objectives of the meeting will be (1) to review and assess recent results from national and international research programs on cool season food legumes and (2) to develop strategies for increasing production per unit area and increasing use of these cool season food legumes in various cropping systems. Both basic and applied research will be addressed and multidisciplinary research efforts will be emphasized.

Recent success in development of low neurotoxin lines of grass pea (*Lathyrus sativus*) has resulted in the addition of this promising cool season food legume to the list of species, i.e., pea (*Pisum sativum*), lentil (*Lens culinaris*), faba bean (*Vicia faba*), and chickpea (*Cicer arietinum*) that were covered in the first meeting, held at Spokane, Washington, USA in 1986.

For additional information, please write to:

Dr. A.E. Slinkard
IFLRC-II
Crop Development Center
University of Saskatchewan
Saskatoon, Sask. S7N 0W0
CANADA

International Symposium on Aphid-Plant Interaction: Population to Molecules

The symposium, sponsored by the Oklahoma State University and the USDA, Agricultural Research Service, will be held at Stillwater, Oklahoma, USA, 12-17 Aug 1990. The symposium will provide a forum for international scientists to present their latest results in aphid related research. Leading scientists in the respective fields will give keynote addresses, and voluntary papers will highlight research activities from many parts of the world. The main topics of the meeting will be: (i) tritrophic aspects of aphid/host interactions; (ii) genetics and host plant resistance to aphids; (iii) molecular basis for aphid/plant interactions; (iv) aphids as virus vectors; and (v) synthesis of new strategies for aphid management.

For more information please write to:

Aphid Symposium Committee
Department of Entomology
Oklahoma State University
501 Life Science West
Stillwater, Oklahoma 74078, USA

International Conference on Agricultural Engineering

The conference will be held 24-27 Oct 1990 at Berlin, Federal Republic of Germany.

For further information, please write to:

Mr. Dipl.-Ing. Erich Luckey
Verein Deutscher Ingenieure
VDI-Fachgruppe Landtechnik
Graf-Recke-Strasse 84
D-4000 Duesseldorf 1
Federal Republic of Germany

DOCUMENT COLLECTION

With the financial support of the International Development Centre (IDRC), ICARDA is building up its document collection on faba bean. The collection will be used to supply needed documents to scientists in developing countries.

We would be grateful if readers who have any relevant documents would send them to:

FABIS
ICARDA
Box 5466
Aleppo, Syria

**ICARDA publications deposited at
AGRICULTURAL libraries**

ICARDA is inviting many of the AGRICULTURAL libraries to accept all its publications in English and French and to make these available to other libraries under normal inter-library loan and photocopy procedures.

Libraries that have accepted to do so are listed here:

Libraries Division
Agriculture Canada
Ottawa K1A 0C5
CANADA

Telex 533283 canagric ott

Helsinki University
Library of Agriculture
Viikki
SF-00710 Helsinki
FINLAND

Telex 122 352 hymk sf
Telefax (90)708 5011

J-F. Giovannetti
Chef du Service Central IST
Avenue du Val de Montferrand
BP 5035
34032 Montpellier Cedex
FRANCE

Telex 480 762f

Library
Agricultural University
Postbus 9100
6700 HA Wageningen
NETHERLANDS

Telex 45015 blhwg nl

John Hjeltnes
Head Librarian
The Library of the Agricultural University
of Norway
P.O. Box 12
N-1432 Aas-NLH
NORWAY

Telex (56) 77125 nlhbi n

Announcements

إعلانات

Future Surveys on Legume Storage Insect Pests

Since its establishment in 1977, ICARDA has given the study of the problem of legume storage insect pests a high research priority. After conducting a survey of the importance, distribution, and control methods of faba bean, lentil, and chickpea storage insect pests in Syria and Jordan in collaboration with the respective national programs, ICARDA is now in the position to work with other national programs in West Asia and North Africa to undertake similar surveys. ICARDA entomologists will be happy to provide information on survey methodologies and techniques, or participate in the designing and conduct of surveys with national programs and assist in developing research projects for cheap and safe control of storage insects of seed legumes.

For further information, contact:

Leader
Food Legume Improvement Program
ICARDA, P.O. Box. 5466, Aleppo
SYRIA

ICARDA Faba Bean Improvement Research Transferred to Douyet, Morocco

As of 1 Sept 1989 the faba bean improvement team of ICARDA, comprised of Dr. Salim B. Hanounik, Pathologist, and Dr. Larry D. Robertson, Breeder, will be stationed at Douyet Research Station of INRA near Fes, Morocco. This is the result of the decision by ICARDA to decentralize its breeding work and bring it closer to the national programs. This process was

started last season with the planting of about 4 ha with different trials and nurseries at Douyet Research Station.

With this transfer to the heartland of faba bean production in the ICARDA region, the national programs in North Africa should have easier access to developed materials. This move will increase ICARDA scientists' contacts with the scientists of the region and will help develop stronger national faba bean improvement teams capable of assuming major responsibility for cultivar development and release.

The shift to Morocco will result in several research priority shifts, such as the reduction of work on breeding for ascochyta blight resistance, and increased effort on developing resistance to *Orobanche* and stem nematodes. Work of a medium to long-term interest, such as development of determinates, independent vascular supply (IVS), and closed flower (self-pollinated) types requiring a strong central facility will be continued from the North African research base at Douyet.

ICARDA's central headquarters will not entirely terminate faba bean activities. The most important activity that will continue at headquarters is that related to the genetic resources of faba bean. ICARDA will continue not only to maintain the current ILB and BPL (pure-line) collections but also to expand them. Also continuing will be a component of general training on faba bean, and the FABIS Information Network. FABIS Newsletter will continue to be published at ICARDA headquarters.

This move of ICARDA's faba bean improvement team to Morocco is a reflection of ICARDA's commitment to accelerate the pace of developing national program capabilities. We wish the team all success in this important move and look forward to fruitful results.

Release of Faba Bean Lines in Peru

At the Universidad Nacional Agraria, Lima, Peru three faba bean lines -- Sevilla Giant, Aquadulche, and Reina Blanca -- will be increased in 1990 for release to farmers.

International Course for Development-Oriented Research in Agriculture (ICRA)

ICRA is a post-academic course for young agricultural scientists working in developing countries. Its aim is to prepare them for applying their specialized training to research designed to produce results that are appropriate to the circumstances of farmers and compatible with the broader aims of governments. The course will be held at Wageningen, The Netherlands from 15 Jan to 4 Aug 1990.

The ICRA training will provide participants with the necessary background knowledge and awareness of opportunities for, and constraints to, agricultural development and enable them to use this knowledge in their own research programs.

The course combines theoretical training in Wageningen with a 3-month field study in a developing country.

Scholarships are available covering all travel costs, tuition, board and lodging at Wageningen and in the field, health insurance and modest allowances for incidental expenses. Closing date for applications is 1 Sept 1989.

Minimum requirements are:

- An M.Sc. or equivalent degree from a recognized university
- Good knowledge of English language
- Age under 35.

For further information and an application form, write to:

The Director of Studies
ICRA, P.O. Box 88
6700 AB Wageningen, The NETHERLANDS

Courses in Agriculture and Rural Development, 1990, Skills and Training in the United States for Foreign Professionals

The US Department of Agriculture (USDA) will offer participants from developing countries, 37 courses in agriculture and rural development. The courses covering a broad range of subject matter, from technical agricultural fields to field management, communication, and trainer development, will last from 2 to 13 weeks and include a mix of practical experience, field observation, and classroom activity. The courses are highly interactive so participants can share ideas with each other as they gain knowledge and practical skills.

For further information, please contact:

Short Course Coordinator
International Training Division
Office of International Cooperation and
Development (OICD)
US Department of Agriculture
Washington, D.C. 20250-4300
Telex 7400228 CDOP UC

Course on Legumes in Cropping systems of the Tropics and Subtropics

The Centre for Agriculture in the Tropics and Subtropics of the University of Hohenheim will organize the second interdisciplinary 3-weeks-course (in summer 1990) on legumes in cropping systems of the tropics and subtropics.

The main objective of the course is to discuss the principles of legumes and the benefits and possibilities of their integration into tropical and subtropical cropping systems, with particular emphasis on recent research developments and their importance in tropical production systems.

For more information and application forms, write to:

The Course Coordinator
Centre for Agriculture in the
Tropics and subtropics
University of Hohenheim
P.O. Box 700562
7000 Stuttgart 70
FEDERAL REPUBLIC OF GERMANY

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Free Catalog of ICARDA Publications

Request your list of all currently available publications from the Scientific and Technical Information Program (STIP).

ICARDA Information Brochure

ICARDA's historical background and research objectives are outlined in English and Arabic. For your copy, contact STIP.

LENS (Lentil Newsletter)

This newsletter is produced twice a year at ICARDA. Short research articles are published and comprehensive reviews are invited regularly on specific areas of lentil research. The newsletter also includes book reviews, key abstracts on lentils, and recent lentil references. For further information write LENS.

RACHIS (Barley, and Wheat Newsletter)

This ICARDA service is aimed at cereals researchers in the Near East and North Africa region and Mediterranean-type environments. It publishes up-to-the-minute short scientific papers on the latest research results and news items. RACHIS seeks to contribute to improved barley and durum wheat production in the region; to report results, achievements, and new ideas; and to discuss research problems. For further information, write RACHIS.

Field Guide to Major Insect Pests of Faba Bean in the Nile Valley (English and Arabic)

This pocket field guide for research and extension workers explains how to identify and control the main insect pests of faba bean in Egypt and Sudan. The distribution, description, and biological characteristics are given for each insect, along with the type of injury, assessment of damage, and recommended control measures. A key to injuries is included. Insects and the damage they cause on faba beans are illustrated with 41 color photos. For your copy, write FLIP.

Field Manual of Common Faba Bean Diseases in the Nile Valley (English and Arabic)

This pocket field manual is a tool for field workers to diagnose and control diseases of faba beans in Egypt and Sudan. Symptoms, development, and control of various diseases are discussed, and symptoms are illustrated with 38 color photos. Also included are rating scales for disease resistance in faba bean lines and a glossary of basic phyto-pathological terms. For your copy, write FLIP.

Field Guide to Major Insect Pests of Wheat and Barley (Arabic)

This field guide in Arabic covers fungal, bacterial, viral, and physiological diseases, as well as insects and nematodes, that attack wheat and barley crops in the Middle East and North Africa. Forty-four insects and diseases are discussed and illustrated with 72 color photos. For your copy, write Cereals Improvement Program.

Introduction to Food Legume Physiology

This comprehensive 105-page technical manual is designed for food legume scientists and their support staff. It covers several areas of food legume physiology in a practical way, with examples whenever possible. The book contains four chapters covering the following: plant structure and physiological functions; mineral nutrition; photoperiodism, vernalization, crop canopy and radiation, and growth analysis; and physiology and crop improvement. For your copy, write Training Coordination Unit.

ICARDA's Food Legume Improvement Program

In English and Arabic, the 24-page illustrated information brochure briefly describes research projects on lentil, faba bean, and chickpea treated either as single crops or as a group. For your copy, write FLIP.

Screening Chickpeas for Resistance to Ascochyta Blight A Slide-tape Audio-tutorial Module

This slide-tape audio-tutorial module is the first in the food legume training series. It is designed for the use of legume trainees during the training courses at ICARDA as well as for scientists and their support

staff in the various national programs. This module is also useful educational material for universities and training departments in national research systems. For your copy of this publication or package, write Training Coordination Unit.

Checklist of Journal Articles from ICARDA 1978 - 1987

This checklist, compiled to bring information to the attention of the scientific community, consists of references of articles by ICARDA research scientists submitted to refereed scientific journals as of 1978. Each reference includes within year of publication: author, primary title, volume number, issue number, pagination, language code of the article and/or summary when necessary, and AGRIS reference number. For your copy write STIP.

Opportunities for Field Research at ICARDA

This brochure is intended primarily to assist Master of Science candidates, who are enrolled at national univer-

sities within ICARDA region and selected for the Graduate Research Training Program. It explains to them the opportunity they have to conduct their thesis research work at ICARDA research sites under the supervision of distinguished international scientists. For your copy, write GRI Program, Training Coordination Unit.

Opportunities for Training and Post-Graduate Research at ICARDA

ICARDA has active training courses on the development and improvement of food legumes, cereals, and forages with ICARDA's research scientists, trained instructors, and proven programs. For a complete brochure of the training opportunities at ICARDA, write Training Coordination Unit.

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اعلان الى العلماء والباحثين العرب الكرام

يسر المركز الدولي للبحوث الزراعية في المناطق الجافة (ايكاردا) ، اعلامكم بان مركز بحوث التنمية الدولية (IDRC) في اوتاوا بكندا ، قد وافق على تقديم دعم مالي لمشروع فابيس FABIS مدته ثلاث سنوات اعتبارا من بداية عام 1987 ولغاية 1989 ، علما بان ادراج اللغة العربية ضمن النشرة الاخبارية للقول يشكل أحد أهم أهداف هذا المشروع .

وبمزيد من السرور تعلن اسرة تحرير " FABIS " للباحثين العرب العاملين في مجال تحسين محصول الفول أنها تصدر نشرتها العلمية باللغتين العربية والانكليزية . لذا فيرجى من الاخوة العلماء الراغبين في نشر بحوثهم باللغة العربية التفضل بارسالها الى العنوان التالي : نشرة " فابيس " ، ايكاردا - قسم التوثيق ، ص.ب. 5466 حلب - سورية .

الآفات والأمراض

- 21 اختيار مبيدات أعشاب لمكافحة الهالوك (*Orobancha* spp.) على
الفول (*Vicia faba* L.)
- 24 أمراض الفول في تونس
- 26 تفاعل طرز وراثية للفول مع الإصابة الطبيعية بفيروس موزاييك الفول في باكستان
- 27 سوسة براعم البقوليات *Apion arrogans* ناقله لفيروس تبرقش الفول
- 33 الحرارة كعامل مهيج لإصابة الفول (*Vicia faba* L.) بمركب مرضي الذبول
وتعفن الجذور
- 37 طرق لتقدير عشائر الأحياء الدقيقة على سطح أوراق الفول

المعاملات الزراعية والمكننة

- 42 مكافحة الهالوك *Orobancha* في حقول الفول عند المزارعين في مصر الوسطى
- 45 تأثيرات موعد الزراعة والمدة الفاصلة بين الريات والزراعة المتداخلة مع الذرة
الرفيعة والذرة الصفراء على غلة الفول

التربية والوراثة

- 47 تقييم تأثيرات الطراز الوراثي والموقع على محتويات الفول *Vicia faba* L.
من الفيسين Vicine والكوفيسين Convicine
- 50 تحليل الارتباط الوراثي في الفول

فَابِسْ

مشروع المعلومات المتخصصة عن الفول

فابس ، نشرة علمية 24 آب 1989

المحتويات

صفحة

Ar

أخبار

للمزيد من المعلومات

اعلانات

أحداث مرتقبة

تقارير المؤتمرات

مطالعات في الكتب

دليل إسهامات القراء

5

7

10

11

12

14

بحوث مختصرة

جودة البذور والتغذية

16

صلادة البذور في الفول (*Vicia faba* L.)

ايكاردا والمجموعة الاستشارية للمحوت الزراعية الدولية

يمثل الهدف العام للمركز الدولي للمحوت الزراعية في المناطق الحافة (ايكاردا) في زيادة الاساحه الزراعيه والموارد العذائيه الصاحه في المناطق الريفيه والحضرية بهدف تحسين الوضع الاجتماعي والاقتصادي لسعوب البلدان الناميه وخاصه في شمال افريقيا وغرب آسيا . ويركز ايكاردا اهتماماتها بصورة رئيسه على المناطق التي تعتمد في رزاعها على الامطار السنويه التي تتراوح من 200-600 مم سنويا . وعندما يستدعي الضروره سيمد دائره جوبها ليعطى مناطق بيئته مروه او داب امطار موسمه .

ويصطلح المركز بمسؤوليه عاليمه في تحسين الشعير والعدس والفول . وبمسؤوليه اقليميه في تحسين الفصيح والحمص والنظم الزراعيه والنزوه الحيوانيه والمراعي والمحاصيل الطلفه . كما ويعتبر بذريت وباهيل الناحين الزراعيين في البلدان الناميه . وتبادل سائح انجوت مهمهم احد اهم الاسطه التي تقوم بها ايكاردا .

وقد تاهمت المجموعه الاستشاريه للمحوت الزراعيه الدوليه (CGIAR) تأسس ايكاردا في سوريه عام 1977 كمركز للمحوت لا يوحى الربح . اما المجموعه الاستشاريه للمحوت الزراعيه الدوليه فهي هيئته غير رسميه من المبرعين بضم حكومات ومنظمات ومؤسسات خاصه . وتدعم المحوت الزراعيه في جميع ارجاء العالم بهدف تحسين الاسايح العذائيه في البلدان الناميه . وذلك من خلال سكه موله من ثلاثه عشر مركزا دوليا للمحوت من بينها ايكاردا . وتعطى أعمال السكه جوتا على أنظمه المحاصيل والنزوه الحيوانيه التي يسهم في تأمين ثلاثه ارباع العدا في البلدان الناميه .

فابيس

صدر ايكاردا نشره " فابيس " FABIS " العلميه ثلاث مرات في السنه بدعم مالي من مركز جوتو السيمه الدوليه (IDRC) في اوتاوا بكندا . وهي نشره علميه مخصصه بالفول . ويعتبر وسيله اتصال لتبادل سائح الجوتو حول هذا النبات . وتضم النشره جوتا محمديه بهدف الي اتصال المعلومات بسرعه . اضافه الي بعض المقالات العامه التي تدعو اليها اسره التحرير بشكل منظم وسنحاول محالات معينه من جوتو الفول . كما تضم السيره بعض الاعلانات . وهذه النشره تقدم المعلومات حول جوتو الفول دون مقابل من خلال مسائم الاستجواب والمصور النسخي (الفوتوكوبي) وجمع الوثائق العلميه المتعلقه بالفول .

الاشتراكات

توزع نشره " فابيس " العلميه دون مقابل للناحين المعنيين بسات الفول . وللإشتراك فيها يرجى الكتابه الي :

FABIS/Documentation Unit/ICARDA, P.O.Box 5466
Aleppo, Syria

هيئته التنسيق

كندا : الدكتور س. برييه . قسم علوم النبات . جامعه مانسوتا . وسنج . مانسوتا R3T 2N2
مصر : الدكتور عبد الله نصيب . معهد المحاصيل الحقلية . مركز المحوت الزراعيه . الجيزه 12619
اليابان : الدكتور ك. كوجي . كلمه الزراعيه . جامعه كاهاوا 2393 Ikenobe. Miki-tyo. Kagawa-Ken
السودان : الدكتور ف. ت. صالح . هيئته المحوت الزراعيه . محطه جوتو سباط . ص.ب. 30 حطوط حال .
سوريه : الدكتور م. ساكينا . برنامج تحسين البقوليات العذائيه . ايكاردا . ص.ب. 5466 . حلب .
البرازيل : الدكتور ه. ايدار . المركز الوطني لمحوت البر والفاصوليا BR-153. km 4-Gionia/Anapolis
Caixa Postal 179. 74.000-Goiania. Goias
فرنسا : الدكتور ج. بيلارد 4. Rue du 8 Mai. 36. 100 Neuvy-Pailloux
ايطاليا : البروفيسور سي. دو نانشه . معهد البيولوجيا الزراعيه . جامعه بوسا . فيربو .
اسبانيا : الدكتور ج. ي. كويرو . المدرسه العلميه العليا للهندسه الزراعيه . قسم البوابه . ص.ب. 3048 . قرطبه .
المملكه المتحده : الدكتور د. ت. بوند . معهد تربيه النبات . باريس ليس . بيرومستحيون . كامبردج .

هيئته التحرير

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Apion aragans

فابِس

نشرة علمية متخصصة بالفول

آب/اغسطس 1989

العدد 24



المركز الدولي للبحوث الزراعية في المناطق الجافة

ايكاردا

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