FABIS

Faba Bean Information Service

NEWSLETTER
No. 11
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INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH IN THE DRY AREAS
(ICARDA)

The Center and its Mission

The International Center for Agricultural Research in the Dry Areas (ICARDA) was established in 1977 to undertake research relevant to the needs of developing countries and specifically for the agricultural systems in West Asia and North Africa. The overall objective of the Center is to contribute towards increased agricultural productivity, thereby increasing the availability of food in both rural and urban areas, and thus improving the economic and social well-being of people.

Though devoted mainly to winter-rainfed agriculture in areas with 200-600 mm rainfall per annum, ICARDA has world responsibility for the improvement of barley, lentil, and faba bean. Where logical, ICARDA's area of concern thus extends into environments with monsoon rainfall or with irrigation. In the winter-rainfed areas, research is also carried out on wheat, kabuli chickpea, and pasture and forage crops. Development of improved farming systems is a major component in the Center's research program. The Center undertakes and supports training.

ICARDA is one of 13 international research centers receiving support from donors through the Consultative Group on International Agricultural Research (CGIAR). Donors to ICARDA have included Australia, the Arab Fund for Social and Economic Development, Belgium, Canada, Denmark, Ford Foundation, France, the Federal Republic of Germany, the World Bank, Italy, International Fund for Agricultural Development, International Development Research Centre, Mexico, the Netherlands, Norway, Organization of Petroleum Exporting Countries, Saudi Arabia, Spain, United Kingdom, Sweden, United Nations Development Programme, and United States Agency for International Development.

COVER PHOTO: Farmers in the Northern Province of Sudan learn from project scientist the improved production package being evaluated in the farmer-managed on-farm trials.

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THE INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH IN THE DRY AREAS
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CONTENTS

Seed Quality and Nutrition

GENERAL ARTICLE

A REVIEW OF THE PRESENT STATUS AND FUTURE PROSPECTS OF *VICIA FABA* L. IN CYPRUS

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Introduction

Faba bean (*Vicia faba* L.) is the fourth most important pulse crop in the world after dry beans, dry peas, and chickpeas (Hawtin and Stewart 1979). China produces about two-thirds of the world's total production, while the second largest producer is Ethiopia with about 7%. Other important regions for faba bean production are northern Europe, the Mediterranean Basin, and Latin America (Hawtin and Hebblethwaite 1983).

Faba bean is an important grain legume in much of the northern temperate zone and at higher altitudes in the cool season of some sub-tropical regions. In some Asian, African, and Mediterranean countries the green or ripe seeds provide a substantial part of the protein in human diets. In western Europe the use of fresh or preserved faba bean is confined to restricted areas and to the large-seeded varieties; Smaller-seeded varieties are cultivated on a larger scale for animal feed and, on a limited scale, for racing pigeons. Faba bean is also occasionally used in mixtures with other crops for silage or for green manure, and the crop also functions as a beneficial break from cereals (Bond 1976). However, few countries supply all their animal protein feed from faba beans.

According to Bond (1979) the species *Vicia faba* L. is divided into the subspecies or botanical varieties, *major, equina, minor,* and *paucijuga*. In the UK and where English is spoken in Europe, *V. faba equina* and *minor* are usually referred to as field beans, and *V. faba major* as broad beans. Within this there is the subdivision of field beans into horse beans (*equina*), which may be either winter or spring-sown types, and tick beans (*minor*). Broad beans are often classified as either long-pod or Windsor types.

In Cyprus, broad bean (*V. faba major*) is one of the major pulses (Table 1). The area under cultivation during the last 20 years and the production and value of fresh and dry broad beans are shown in Table 2.

Table 1. Area, production, exports, imports and value of the major pulses in Cyprus during 1982.

Crop	Area (ha)	Production (t) fresh	Production (t) dry	Value (1000 C£)	Export Quantity (t)	Export Value at FOB prices (1000 C£)	Import Quantity (t)	Import Value at CIF prices (1000 C£)
Faba bean	1,071*	1,016	1,524	688.0*	916.0	369.2	231.0	89.8
Haricot bean	616*	1,981	559	854.0*	261.5*	107.7*	691.0	269.2
Chickpea	2,268		183	57.6	5.1	2.5	257.0	67.5
Lentil	136		102	36.0	25.0	9.3	382.2	133.7
Cowpeas	402	1,016	203	448.0			327.0	126.1

* fresh + dry.

Table 2. Area, production, and value of faba bean in Cyprus, 1960-1982.

Year	Area (ha)	Fresh			Dry		
		Production (t)	Average price (C£/t)	Value in 1000's C£ at current prices	Production (t)	Average price (C£/t)	Value in 1000's C£ at current prices
1960-64	14,793	3132	39.3	122.6	5388	105.4	562.3
1965-69	10,609	5030	31.5	157.5	8533	80.1	670.6
1970-74	14,726	7163	46.0	230.0	11430	111.2	1248.2
1975	1,339	813	52.5	42.7	1524	122.0	186.0
1976	1,539	1016	64.4	65.4	1778	141.7	252.0
1977	1,339	1168	80.9	94.5	1422	185.1	263.2
1978	1,339	1219	72.9	88.9	2032	196.9	400.0
1979	1,473	1168	104.6	122.2	1829	208.6	381.6
1980	1,606	1016	115.2	117.0	2235	196.9	440.0
1981	1,339	1118	129.9	145.2	1829	189.0	345.6
1982	1,071	1016	145.7	148.0	1524	354.3	540.0

Faba beans are consumed locally as immature green pods or seeds as well as mature dry seeds. Cyprus is self-sufficient in this crop, and exports a large amount of seed every year (Table 3). A small amount of green seeds as well as the imported dry small seeds are preserved by canning, mainly for export. By-products of seed production and a failed green crop are utilized for animal feed.

In 1980 a study of the present status and future prospects of the crop was undertaken by the Agricultural Research Institute, Cyprus. The results of this study and updated information are presented in this paper.

Present status of the crop

Faba bean is traditionally grown in the Orounda-Peristerona area in the Nicosia district where it is one of the main crops, grown in rotation with cereals and vegetables. In these areas the crop is exclusively grown for dry-seed and normally receives spate irrigation. It is also one of the main

Table 3. Exports and imports of dry faba bean, Cyprus, 1960-1982.

Year	Exports			Imports		
	Quantity (t)	Price (C£/t)	Value at FOB prices (1000 C£)	Quantity (t)	Price (C£/t)	Value at CIF prices (1000 C£)
1960-64	1890	89.2	162.8	775	69.9	52.5
1965-69	5435	79.5	462.1	2305	49.1	94.5
1970-74	4166	133.4	510.8	298	182.9	44.9
1975	411	233.7	96.1	49	235.8	11.6
1976	645	239.7	154.6	59	252.2	15.0
1977	536	247.3	132.6	122	215.7	26.3
1978	1644	266.1	437.5	91	135.2	12.3
1979	1313	283.8	372.7	80	174.2	14.0
1980	1242	279.7	347.4	60	266.7	16.0
1981	1109	288.4	319.8	86	334.9	28.8
1982	916	403.1	369.2	231	388.7	89.8
	Exports			Imports		
Country	Lebanon, Iraq, Syria, Jordan, and others			USA, Greece, Morocco, UK, Holland and others.		

crops in some villages of Paphos area, where it is grown mainly under dryland conditions, but is given 1-2 irrigations at critical stages, when water is available. On a smaller scale, it is grown in the Limassol district in rotation with other crops. In the Larnaca area it is grown on a very small scale and exclusively for green pods and seeds, while in the Famagusta area it is usually grown within other crops for family use only.

Almost all the faba bean area is under the local variety, while an introduced variety is grown on a very small scale. The local variety has an indeterminate growth habit with three ovules per pod. Plants are relatively short, with pods produced on the lower nodes. Flowers are white with black spots, relatively few in each node. The variety is a *major* type with large seeds, but the size and shape of seeds is uneven. The introduced variety has long pods with up to six seeds per pod, with smaller seeds than the local variety.

The crop is usually sown in December to February and matures during May-June, depending on the year and the locality. In the Larnaca area it is sown in late September-early October in order to supply the early market with green pods. The crop is hand-sown, either broadcast or sown in rows 30-90 cm apart. A mouldboard plow or a ridger plow is used to cover the seed. Seed rates range from 149 to 209 kg/ha. Fertilizers (phosphorus, nitrogen, and potassium) or manure are used.

Traditionally, harvesting is by hand. Plants are pulled up and are allowed to dry off. When they have completely dried off, seeds are threshed from the plant debris on a threshing floor, by means of a special piece of wood or a tractor rolling over them, and then winnowed (Photiades and Alexandrou 1979). However, a specially modified combine harvester has been used successfully to harvest faba beans in the western part of the country. One harvesting method which is used with some modifications in the Polis area, and which is recommended to the farmers by Xenophontos (1983), is to cut the crop before it is completely dry with a cutter bar and to use a threshing machine to separate the seed from the straw after drying. However, the local variety constrains mechanization; pods are carried low on the plant, making cutting difficult, and the large seeds are difficult to thresh by machine. In addition, the stoniness of the fields in many cases prevents the use of a cutter bar.

Weeds are an important problem in faba bean crops. Until recently, weed control involved hand-hoeing once or twice. Recently, chemical herbicides have been applied pre-emergence or post-emergence with satisfactory results.

A serious problem is presented by broomrape (*Orobanche* spp.). The crop in infested fields may be totally destroyed. *Orobanche* spp. can produce up to a million seeds per plant, which reinfest the land before the end of the cropping season. A susceptible crop cannot be grown for many years following orobanche infestation because the parasite's seeds survive dormant in the soil (Basler 1979). In the Mediterranean region two species, *O. ramosa* and *O. crenata*, prevail and cause considerable losses in tomato, potato, tobacco, sunflower, faba bean, and other crops (Saghir and Dastgheir 1979). Nattrass (1936) reported that in Cyprus faba beans suffered most severely from *Orobanche crenata* and suggested hand pulling of orobanche spikes before the flowers set seed. This is very laborious, however, and since orobanche has not been controlled infestation is increasing. In recent research work in Egypt the herbicides Lancer (glyphosate) and Kerb (propyzamide) showed good control of orobanche (Zahran *et al.* 1980; Zahran 1982).

Observations by the ARI nematologist (Philis, personal communication) have shown that faba beans are seriously attacked by a seed and soil-borne nematode, the stem eelworm, *Ditylenchus dipsaci*. It usually attacks the base of the plant but may extend to the pod bearing region. The giant race of this species was found to be a serious pest of faba bean in the Mediterranean region (Hooper 1980). The occurrence, distribution, and infestation intensity of *D. dipsaci* in Cyprus has recently been reported by Augustin (1983) in a study which also included Syria and Egypt. This nematode can withstand desiccation and can be dispersed in dried plant debris and especially in seed.

Sitona weevil is a serious pest of faba bean in Cyprus. In the case of heavy infestation, the plants may be completely defoliated. The weevil attacks many leguminous plants, including peas, beans, alfalfa, and clover (Kawar 1979).

Other pests of broad beans in Cyprus are aphids (*Aphis rumicis* L.) and seed beetles (*Bruchus rufimanus* and *Bruchus dentipes*). Common diseases are chocolate spot (*Botrytis fabae*), *Cercospora fabae, Ascochyta* sp., *Uromyces fabae, Fusarium* spp. and possibly others. *Botrytis fabae* can be very important, becoming epidemic in hot and humid spring weather during flowering and fruit maturation, causing large yield losses. Farmers plow-in crops which are severely infected (Djerbi *et al.* 1979). Advice to farmers on control of pests and diseases and crop production is given in leaflets of the Department of Agriculture, Cyprus (Soteriadou and Orphanides 1976; Xenophontos 1983).

Lodging can also cause significant yield reductions, especially under high fertility and high rainfall or irrigated conditions.

The local variety is not suitable for the canning and freezing industry. However, one of the canning companies uses the local variety only as green seeds. The same company uses imported dry seeds of small-seeded varieties of *V. faba* (*foulia*) and exports the products to Arab countries. The quantity produced varies according to demand. One canning company introduced seed of the Triple-White variety (UK) which is very good for canning and freezing. The variety was grown but failed to form pods and seeds although it had extremely good vegetative growth.

Seed is not produced under the supervision of the Agronomy and Seed Production Section (ASPS) of the Department of Agriculture. Each farmer produces his own seed or purchases it from the market. However, the ASPS conducts germination and purity tests on seed for export.

Faba bean research in Cyprus

In Cyprus, research work on faba bean until 1980 was restricted to the introduction and testing of a number of varieties, none of which has proved to be better than the local one. Absence of weed, disease, and pest control results in severe crop losses. Lack of mechanization of sowing and harvesting reduces the timeliness of these operations, increases losses, and results in high labor costs. The agronomy of the crop has not been studied.

No research has been carried out concerning the marketing prospects of the crop. The trade is carried out by private companies and exports are based upon the demand of customers. Seed from Cyprus is preferred due to the size, the good germination of the seed (about 90%), and because the local variety is well adapted to the environmental conditions of the Near East and can supply the early market for green pods and seeds. However, the size of the seed is uneven and much has to be discarded. To maintain this market it is essential to offer good quality seed at competitive prices.

In many developed countries field beans are used as a protein source for animal feeding. In Cyprus, seed cake (mainly soya bean) is imported as a protein source for animal feeding. In 1983 45,000 t were imported, costing about C£ 7.5 million, almost double the quantity imported in 1978 (28,000 t, C£ 3 million). To save forgeign exchange the prospects for growing small faba beans for animal feed must be investigated.

Research priorities

In 1980, as a result of a survey carried out in Cyprus on all aspects concerning the crop, the following research priorities were suggested for the cultivation of *V. faba* in Cyprus (Della 1982):

Introduction of a crop protection system for weeds, orobanche, *Ditylenchus* spp., and *Sitona* spp. control as a prequisite to any future work.

Mechanization, which saves labor and could be initially concentrated on the use and modification of existing equipment.

Improvement of varieties for both human consumption and animal feeding.

Current research work at the Agricultural Research Institute

Varietal improvement: In 1981 a project was initiated at the ARI for the improvement of the local variety. The basic material used in this program was local germplasm consisting of 100 accessions of the local variety from the collection maintained at the Agricultural Research Institute. The collection was carried out in Cyprus in 1980 by ARI in cooperation with IBPGR (Della 1980). Preliminary evaluation of the local germplasm was made and selection was carried out between and within populations. The best populations and lines (progenies of single plants) were tested in replicated trials at several locations, both under dryland and irrigated conditions. In addition, a number of large- and small-seed varieties and promising lines were introduced from ICARDA and tested under local conditions. None of the introduced varieties yielded better or was earlier than the local variety. However, the work will continue and more emphasis will be given to the testing of small-seeded varieties for animal feed.

Animal feeding trials: A trial was conducted in 1981 by the Animal Production Section (1982) of the ARI using faba beans as a substitute for soya bean meal in lamb fattening diets. It was found that faba beans can be used in lamb feeding diets at levels up to 20% without methionine supplementation. Faba beans and common vetch seed were tested in another trial as substitutes for soya bean meal in lamb and kid fattening diets. Lamb growth rates were similar between groups fed soya bean or faba bean. Feed to gain ratio was slightly better in the control diet (soya bean meal). Kids had similar weight gain and feed efficiency on all diets. The digestibility coefficients of nitrogen, organic matter, and gross energy were also similar for all diets with both species (Animal Production Section, 1983).

Weed and orobanche control: A trial of pre-emergence herbicides was conducted in 1981, in cooperation with ICARDA. All treatments were very effective against weeds, and did not affect the emergence of the crop (Plant Protection Section 1982). In 1982 chemical weed-control trials as well as orobanche control trials, were established by the Plant Protection Section (1983) in Orounda and Peristerona areas. Results were very promising. The trials were repeated in 1983.

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SHORT COMMUNICATIONS

General

ECONOMIC ANALYSIS OF FARMER–MANAGED TRIALS ON FABA BEANS IN SUDAN 1982/83

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Faba bean (*Vicia faba*) is becoming increasingly important in Sudanese diets. Its consumption is no longer confined to urban areas, as in the past, but has spread to almost all parts of the country. This is associated with a three-fold increase in the area under the crop between the 1960s and the 1970s and a yield increase of about 25% (Salkini *et al.* 1983a). All of the domestic production is consumed in Sudan, and additional quantities of faba beans have been imported in 1981 and 1983.

In spite of the increased production levels there has been a trend of rising prices for faba beans. For example, in the Zeidab area, farmgate prices reached LS 581/t in 1982/83 (Faki 1983), compared with LS 362/t in 1979/80 (Salkini *et al.* 1983b). Retail prices of more than LS 1600/t in major consuming centers in 1982/83 indicate high marketing margins, with estimated price elasticity of demand of only 0.2 (El Mubarak Ali *et al.* 1984). This indicates opportunities for profit from faba beans for both farmers and marketing agencies.

In Sudan, 98% of the crop is grown in the Northern and Nile provinces of the Northern Region. Despite overall increases in yields, the potential for further increases are enormous (El Sarrag 1981; Salkini and Nygaard 1983). Since 1960, considerable research has been conducted on problems which limit yield and on improving quality (Salih 1980). Since the 1978/79 season, increased research efforts have been supported by the ICARDA/IFAD Nile Valley Project, which has focused on yield improvement via a multidisciplinary approach. Testing of research findings in farmers' fields (on-farm research) has been the major activity of the project.

This paper presents the agroeconomic results of the farmer-managed trials on faba beans in Sudan in 1982/83. These trials were conducted at several sites in each of three large irrigation schemes: Aliab, Zeidab, and Seleim. The trials were mostly managed by the farmers, with supervision and monitoring by scientists and technicians. The effects of early sowing (from the last week of October to the first week of November), more frequent irrigation (every 10 days), and pest control when insect infestations were noted, were compared with farmers' practices in these areas of late sowing, fewer irrigations (every 15-20 days), and no pest control. At Seleim, handweeding was also included in the trial. All other operations were done according to the farmers' normal practices. The area of each farmer-managed plot was about 0.5 ha. Seed yields, costs, and benefits estimated from the trial plots were compared with those of the rest of the farmers' fields by partial budget analysis (Table 1).

Farmgate prices prevailing at harvest time in each region, used in the budgets, were LS 519, LS 581, and LS 667 in Aliab, Zeidab, and Seleim, respectively. Irrigation water is the most expensive of the variable costs. The water rate on government schemes in 1982/83 was LS 85.7/ha/season, corresponding to LS 14.29/ha/irrigation, assuming 6 irrigations per season as general practice in these areas; this was the figure used in calculating the budgets.

Results

The practices tested significantly increased seed yields by 515, 1119, and 564 kg/ha in Aliab, Zeidab, and Seleim, respectively, over the farmers' practices. Allowing for the increased costs, the test package was profitable at all sites in Zeidab and Seleim, and at five out of seven sites in Aliab (Table 1). Average marginal rates of return were 188% in Aliab, 307% in Zeidab, and 217% in Seleim, reflecting favorably on the test package. There was, however, considerable variation in profitability between farms, especially in the Aliab and Zeidab schemes.

While these figures are realistic for both Aliab and Zeidab, the situation is different for Seleim, where irrigation is done with small, privately-owned pumps. The prevailing practice is that the pump owner receives half of the crop as payment. Assuming this as the irrigation cost, profitability of the test package for farmers in Seleim is lower than that of their normal practices in three cases out of four (Table 2).

Table 1. Comparison of test (T) and farmers' (F) practices on farmer-managed trials in Aliab, Zeidab, and Seleim, 1982/83.

	Farm								
	1	2	3	4	5	6	7	Mean	SD
Aliab				Grain yield (kg/ha)					
T	2301	3784	3068	2118	2300	2446	3798	2831	667
F	1918	2453	2410	1611	2333	2269	3215	2316	462
T-F	383	1331	658	507	−33	177	583	515*	401
				Net benefits (LS/ha)					
T	970	1721	1349	856	951	1027	1728	1229	344
F	860	1117	1075	719	1075	1042	1493	1054	223
T-F	110	604	274	137	−124	−15	235	175	217
Zeidab				Grain yield (kg/ha)					
T	3932	3432	2499	4136	2499	4998		3583	895
F	3213	2356	875	2549	2124	3665		2464	882
T-F	719	1076	1624	1587	375	1333		1119**	454
				Net benefits (LS/ha)					
T	2062	1743	1218	2181	1218	2653		1846	518
F	1744	1245	385	1358	1128	2023		1314	515
T-F	318	498	833	823	90	630		532	267
Seleim				Grain yield (kg/ha)					
T	3557	3320	3343	3537				3439	375
F	3237	2813	2453	2998				2875	286
T-F	320	507	890	539				564**	206
				Net benefits (LS/ha)					
T	1971	1871	1911	2015				1942	55
F	1925	1668	1412	1769				1694	187
T-F	46	203	499	246				249	163

* = significant at P = 0.05.
** = significant at P = 0.01.
Sources: El Sarrag and Nordblom (1983) and Faki (1983).

The estimated fixed and variable costs for operating the small pumps in the Seleim area were LS 69/ha/irrigation, which was applied to the budgets for farmers who are pump owners (Table 3). It is evident from Tables 2 and 3 that, given the high water costs at Seleim, the profitability of the test package is questionable, even though highly significant increases in crop yields were obtained. This demostrates the importance of checking the economics of a new technology from the farmers' point of view prior to making recommendations.

Table 2. Net benefits of test and farmers' practices in Seleim, at water rates equal to half the value of the crop, 1982/83 (LS/ha).

Practice	Farm 1	2	3	4	Mean	SD
Test	991	895	1024	1039	988	56
Farmers'	1215	1047	880	1059	1050	119
Test - farmers'	-224	-152	144	-20	-62	139

Table 3. Comparison of net benefits for test and farmers' practices at Seleim with water rates equal to pump operation costs, 1982/83 (LS/ha).

Practice	Farm 1	2	3	4	Mean	SD
Test	1369	1269	1364	1413	1354	53
Farmers'	1787	1285	1084	1331	1372	257
Test - farmers'	-418	-16	280	82	-18	254

Table 4. Differences in net benefits between test and farmers' practices with hypothetical increases in water charges of 33 and 100% in Aliab and Zeidab, 1982/83.

Rate/site	Mean difference (LS/ha)	SD
A. 33% increase[1]		
Aliab	156	215
Zeidab	512	267
B. 100% increase[2]		
Aliab	127	224
Zeidab	475	269

1. LS 19.05/ha/irrigation.
2. LS 28.56/ha/irrigation.

Due to a continuing trend of increase in the cost of irrigation and an expected rise in water charges in the government irrigation schemes, hypothetical increases of 33 and 100% in water charges were used in calculations of net benefits (Table 4

Even with these high water costs, the test package could be recommended to farmers in the Zeidab area as being profitable. Results of a large pilot production trial involving 77 farmers and 140 ha in Zeidab during the 1983/84 season confirmed the biological and economic basis for optimism about the new recommended package in Zeidab.

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CALLUS FORMATION AND PLANT REGENERATION FROM EXPLANTS OF *VICIA FABA* L. AND *VICIA NARBONENSIS* L.

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Introduction

The *in vitro* culture and regeneration of plants is fundamental to the application of cell and protoplast technology to crop improvement (Razdam and Cocking 1981). Regeneration of whole plants from callus culture has proved difficult in grain legumes. However, it has been reported in alfalfa (McCoy and Bingham 1977), *Stylosanthes* (Scowcroft and Adamson 1976), red clover (Phillips and Collins 1979), *Glycine canescens* (Kameya and Widholm 1981), and *Pisum sativum* (Malmberg 1979). Razdam and Cocking (1981) reported that *V. faba* explants from roots, cotyledons, and hypocotyl gave only callus tissue. Malmberg (1979) showed that different genetic material may react *in vitro* in a different way. The purpose of this study was to investigate the *in vitro* reaction of two populations, one *V. faba* cultivar Polycarpe, and one *V narbonensis* (A201).

Materials and Methods

The plant material used was as follows:

a. *Vicia faba*, cv Polycarpe. This cultivar is well adapted in Greece and has been selected from the Italian variety Vesuvio.
b. *Vicia narbonensis*: A201, a native population from Turkey provided by Mr. Podimatas, Forage Crops Research Institute of Larissa, Greece.

Seeds were sterilized by dipping them in 75% alcohol for 3 minutes, surface sterilized with 20% Javex (6% Sodium hypochlorite) for 15 minutes, rinsed in sterile distilled water three times and germinated in the dark at 24.5°C in culture media:

a. B_5 (Gamborg *et al.* 1968) with three concentrations of 2, 4-D (1, 2, and 3 mg/l).
b. MS (Murashige and Skoog 1962) with three concentrations of 2, 4-D (1, 2, and 3 mg/l), and
c. MS without 2, 4-D.

Three to four weeks later plantlets from seeds germinated in media with 2, 4-D were dissected aseptically under a stereo-microscope and explants from apex, epicotyl, cross, root, and cotyledon were transferred petri dishes with various culture media: (a) B_5 with 1 mg/l BA (6-benzyladenine) and 1 mg/l NAA (Naphthylacetic acid), (b) B_5 with 1 mg/l BA, 1 mg/l NAA, and 2 mg/l kinetin, (c) MS with 1 mg/l BA, and 1 mg/l NAA, and (d) MS with 1 mg/l BA, 1 mg/l NAA, and 2 mg/l kinetin. The explants were incubated in a growth chamber at 26-27°C under 16 hours light. The culture media were renewed every 4-5 weeks.

The plantlets from seeds that were germinated in media without 2, 4-D were also dissected aseptically under a stereo-microscope and explants of the forementioned tissues were transferred to petri dishes with culture media of MS containing 2 mg/l of 2, 4-D. These explants were cultured in the dark in a growth cabinet at 24.5°. Three to four weeks later they were transferred to culture media without 2, 4-D similar to the ones mentioned before.

Results and Discussion

Seeds of both *V. faba* and *V. narbonensis* germinated faster in B_5 plus 2, 4-D than in MS plus 2, 4-D. The epicotyls and roots were swollen in both cases, but the two species differed in root or shoot growth. *Vicia faba* showed greater shoot than root growth and *vice versa* for *V. narbonensis*. Therefore, presence of 2, 4-D during germination affected the two species differently. Furthermore, when the explants were transferred to media without 2, 4-D *V. faba* developed darker and harder callus than *V. narbonensis*.

The culture media MS plus 2, 4-D seemed to be better than B_5 plus 2, 4-D for the growth of *V. faba* and *V. narbonensis*. Only one explant (an apex) from seeds germinated in B_5 plus 2, 4-D and subsequently grown in B_5 with growth hormones developed roots. In contrast, five explants (one apex and four epicotyls) from seeds germinated in MS plus 2, 4-D developed shoot or roots. Razdan and Cocking (1981) reported that explants from root, cotyledons, and hypocotyl formed only callus. The development of roots or shoots observed in our material could be due to the addition of 2, 4-D in the culture media during germination. Table 1 and Fig. 1 show that the explants formed better and larger callus when 2, 4-D was included in the culture media during germination. This, together with the observation that only explants from seeds germinated in MS plus 2, 4-D formed both roots and shoot (Table 2) indicated that 2, 4-D in the culture medium during germination might induce regeneration of *Vicia* species.

A larger percentage of explants from *V. narbonensis* produced both roots and shoot than from *V. faba* (Table 2). The only explant (epicotyl) of *V. faba* that produced roots and shoot died when transplanted. Two apex explants of *V. narbonensis* produced roots that reached a length of 3 cm. These roots died in the next few days. There were three epicotyl explants of *V. narbonensis*, however, that produced both roots and shoots. One of them died from contamination before it was transplanted. The second died 20 days after transplantation to a pot due to overwatering and the third grew normally (Fig. 2).

Table 1. Mean weight (g) of 70-day old cultured tissue derived from seed of a *Vicia faba* cultivar and a *V. narbonensis* population germinated in MS medium with (+) or without (–) 2, 4-D.

Species	Cultivar or population	2, 4-D	Weight (g) X ± Sx
V. faba	Polycarpe	+	0.832[1] ± 0.152[a]
		–	0.313 ± 0.065[b]
V. narbonensis	A201	+	1.035 ± 0.126[a]
		–	0.343 ± 0.061[b]

1. Means followed by different letters are significantly different from one another ($P < 0.01$).

1

Fig. 1. Callus formation of epicotyl explants of *Vicia narbonensis* (A201) cultured in MS medium with (3) and without (1,2) 2,4-D.

2

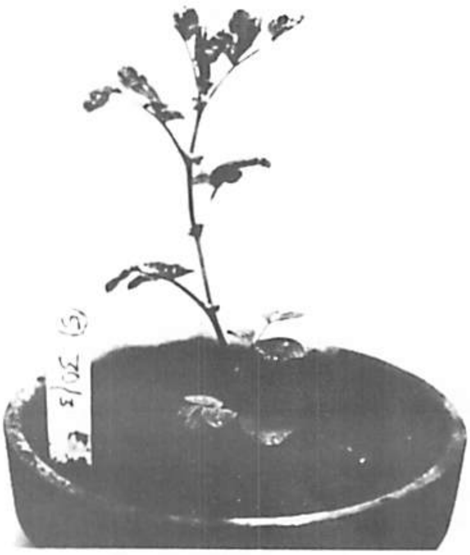

Fig. 2. Regenerated plant from *Vicia narbonensis* epicotyl of a seedling germinated in MS plus 2,4-D.

Table 2. Shoot and root formation in explants of *V. faba* cv Polycarpe and *V. narbonensis* (A201) cultured in MS medium containing 2, 4-D.

Species and cultivar	Explant type	Number of explants	Number of rooted explants	Number of shooted explants	Number of explants with root and shoot
V. faba					
Polycarpe	Apex	31	3(9.7)[a]		0
	Epicotyl	78	8(10.3)	1(1.3)	1(1.3)
	Root	33	10(30.3)	0	0
	Cotyledon	36	4(11.1)	0	0
	Cross	18	1(5.6)	5(27.8)	0
V. narbonensis					
A201	Apex	26	3(11.5)		2(7.7)
	Epicotyl	38	3(7.9)	1(2.6)	3(7.9)
	Root	30	2(6.7)	1(3.3)	0
	Cotyledon	34	1(2.9)	0	0
	Cross	6	0	0	0

a. Number in brackets indicates the success in percent.

Thus addition of 2, 4-D to the culture media during germination yielded more callus and induced root and shoot formation in some of the explants, and regeneration of *V. narbonensis* from epicotyl explants was possible. It was also indicated that there is a potential of *V. faba* regeneration given that one of the epicotyl explants produced roots as well as shoot. However, further investigation is needed to elucidate the effect of 2, 4-D incorporation in the growth media during seed germiantion.

Acknowledgements

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THE POSSIBILITY OF SELECTION FOR HIGHER PROTEIN CONTENT IN FABA BEAN (*VICIA FABA* L.)

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El Sayed *et al.* (1982) found a range in protein content of 18.6-37.8% (mean 28.4%) in the World Faba Bean Pure Line collection, when grown in the same location. The authors suggested that the higher protein lines could possibly be used as parents to improve the protein content of the crop. To determine the stability of protein content across different growing locations and seasons, approximately 100 genotypes, covering the full range of protein contents, were grown during 1983/84 at 3 locations, Tel Hadya and Lattakia in Syria, and Terbol in Lebanon. Since the 1981/82 collection had been planted at Tel Hadya, the 1983/84 series enabled the effect of growing season to be studied, as well as the effects of growing location within a single season.

Materials and Methods

The genotypes were planted in 1-m rows, with 10 seeds per genotype. At Tel Hadya the lines were grown in an insect-proof screenhouse to produce selfed seed. At each location 50 kg P_2O_5/ha was applied. Protein content was determined by near-infrared reflectance (NIR) spectroscopy using the Pacific Scientific Food Quality Analyzer, Model FQA51A. Calibration was based on determination of protein by the Kjeldahl test (AACC Method 46-12) using 50 samples (AACC 1969). The NIR protein content was verified on every tenth sample by Kjeldahl analysis. Standard deviation of differences between Kjeldahl and NIR protein was 0.28% and coefficient of variability was 1.13% . Moisture was determined by air oven drying at 130°C using AACC Method 44-15A (AACC 1969). Results are reported on a moisture-free basis using the mean moisture percentage for all samples (9.7%).

Results

Mean protein content, standard deviations, and ranges are summarized in Table 1.

The data from 1983/84 plantings showed less variance than the 1981/82 data. The protein contents of individual genotypes from each planting were statistically compared with those of the others. The results are summarized in Table 2.

Table 1. Protein content (%) of the highest and lowest protein lines in faba bean pure line nurseries, Tel Hadya (1981/82 and 1983/84), Lattakia, and Terbol, 1983/84.

	Tel Hadya 1981/82	Tel Hadya 1983/84	Terbol 1983/84	Lattakia 1983/84
Mean	28.33	29.46	29.16	18.54
CV	14.5	9.2	5.7	9.0
Highest	38.12	35.43	34.00	33.53
Lowest	21.24	22.69	24.23	21.04
No.	92	92	92	53

Table 2. Statistical comparison of protein contents of faba bean pure lines between three locations, and between two seasons at Tel Hadya.

Comparison	Coefficient of correlation
Tel Hadya 1981/82: Tel Hadya 1983/84	0.39
Tel Hadya 1983/84: Terbol 1983/84	0.61
Tel Hadya 1983/84: Lattakia 1983/84	0.13
Terbol 1983/84: Lattakia 1983/84	0.33

The low coefficients of correlation indicated that heritability of protein content was relatively low when all genotypes were considered, and that, in general, protein content appeared to be influenced more by season and growing location than by genetic constitution. Many of the high protein lines identified in 1981/82 did not retain their protein levels between seasons or locations. The means and coefficients of variability were next computed for all four plantings. Due to severe disease not all lines planted at Lattakia survived to produce seed, so that in some cases the data only represent three plantings, Tel Hadya for 1981/82 and 1983/84, and Terbol, 1983/84. Coefficients of variability (CV) ranged from 2.1 to 21.5%. About 65.6% of the lines had a CV of less than 10% . Twelve percent had a CV of 15-21.5% and it is possible that these lines were not breeding true. On the other hand four lines were identified with CV ranging from 2.2 to 5.2% , while retaining a high protein content (average 33.6%), while four others were consistently low in protein. These lines are shown in Table 3.

Table 3. Faba bean genotypes with consistent protein content across locations and seasons.

	Accession No.	Mean protein[1]	CV (%)	No. of observations
	505	34.1	2.2	3
	400	34.1	3.9	3
High	494	33.6	5.2	4
	303	32.7	2.9	3
	369	23.9	9.1	3
	907	24.8	5.0	3
Low	774	24.8	5.1	3
	361	25.0	8.0	4

1. Protein % = total N% x 6.25, dry basis.

The identification of several lines with consistent protein content across growing locations and seasons is in agreement with the observations of Sjodin *et al.* (1981), who concluded that higher protein content could be achieved in the faba bean by selection. The existence of lines which consistently differed widely in protein content enables a study of the pattern of inheritance of protein content in the faba bean under the conditions prevailing in northern Syria, and other areas of the eastern Mediterranean.

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Physiology and Microbiology

ASCORBIC ACID IN RELATION TO DROUGHT RESISTANCE IN *VICIA FABA* L.

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In India, there is a need for a food legume to replace lathyrus in crop rotations, because lathyrus (*Lathyrus sativus*) contains a neurotoxin, BOAA, which may be harmful to humans. Faba bean has shown promise as a potential replacement for *Lathyrus sativus* (Singh *et al.* 1982).

Farmers favor growing lathyrus for its hardy and drought tolerant nature. Thus, breeding drought tolerant varieties of faba bean is of prime importance if it is to be adopted. The lack of knowledge of the genetic and biochemical systems related to drought tolerance is an important constraint to development of these varieties.

This study investigated the relationship between ascorbic acid content of faba bean seedlings and drought tolerance.

Materials and Methods

Fifteen varieties of faba bean were grown in Petri dishes (10 cm diameter) with water or mannitol solution. The mannitol solution contained 75 g mannitol/liter of distilled water, giving an osmotic potential of 10.16 atm (Knipe and Herbel 1960). The distilled water and mannitol solutions represented nonstressed and stressed conditions, respectively. Length of the plumule and radicle were measured seven and 10 days after germination. Seeds were considered germinated when the plumule was 2 mm long. Ascorbic acid content of the faba bean seedlings was determined 30 days after planting, by the method given by Oser (1965).

Results and Discussion

There were no significant differences in plumule length among the seeds grown in distilled water, but highly significant differences (P = 0.01) among those grown in mannitol solution. Six varieties (JV–2, –9, –70, –77, –83–1, and JV–83–2) had plumules of 2.47 cm or longer seven days after germination (Table 1). The ranking of the varieties for plumule length was similar 10 days after germination. JV–2 had the longest plumule (3.70 cm), but was not significantly different from JV–77 and JV–70.

A similar pattern was observed for radicle length (Table 1). Seven days after germination in mannitol solution, JV–77 had the longest radicle (2.82 cm). Six other varieties had radicles of 2.35 cm or longer (JV–2, –3, –9, –70, –83–1, and JV–83–2), while the remainder had significantly (P = 0.01) shorter radicles (1.05 - 1.49 cm). JV–2 had the longest radicle (3.56 cm) 10 days after germination in mannitol solution. Varieties JV–7, –10, –11, –13, –31, –32, –35, and JV–73 had significantly (P = 0.01) shorter radicles than the other varieties.

Table 1. Average length (cm) of plumule and radicle seven and 10 days after germination in mannitol solution (stressed conditions).

	7 days after germination		10 days after germination	
Varieties	Plumule	Radicle	Plumule	Radicle
JV-2	2.69	2.54	3.70	3.56
JV-3	2.36	2.42	3.21	3.19
JV-7	1.43	1.05	1.66	1.57
JV-9	2.77	2.47	3.25	3.45
JV-10	1.02	1.06	1.70	1.57
JV-11	1.25	1.30	1.63	1.71
JV-13	1.18	1.49	1.55	1.78
JV-31	1.56	1.25	1.69	1.89
JV-32	1.75	1.17	1.94	1.79
JV-35	1.57	1.24	1.86	1.98
JV-70	2.47	2.35	3.51	2.88
JV-73	1.31	1.37	1.66	1.95
JV-77	2.76	2.82	3.56	3.25
JV-83-1	2.50	2.39	3.04	3.06
JV-83-2	2.54	2.35	3.35	2.83
LSD (P = 0.05)	0.35	0.99	0.33	0.54

Ascorbic acid content of the seedlings 30 days after planting ranged from 2.41 to 6.73 mg/g fresh tissue and 3.41 to 9.34 mg/g fresh tissue for those grown in water and mannitol, respectively (Table 2). Seedlings grown in mannitol solution had significantly higher ascorbic acid contents than those grown in distilled water.

Table 2. Ascorbic acid content (mg/g fresh tissue weight) of faba bean seedlings 30 days after sowing in water and mannitol.

	Ascorbic acid content (mg/g fresh tissue)		
Varieties	Water	Mannitol	Percent increase Mannitol/water
JV-2	3.09	6.23	102
JV-3	2.93	3.55	21
JV-7	2.91	3.41	17
JV-9	5.96	6.52	9
JV-10	4.68	6.83	46
JV-11	3.03	3.75	24
JV-13	3.12	4.32	38
JV-31	2.99	4.65	56
JV-32	2.83	3.67	30
JV-35	3.98	4.97	25
JV-70	3.06	4.02	31
JV-73	2.85	4.56	61
JV-77	2.38	8.67	264
JV-83-1	2.41	6.60	173
JV-83-2	6.73	9.34	39

Variety JV–77 showed the largest increase in ascorbic acid content when grown in mannitol solution (264%), followed by JV–83–1 (173%) and JV–2 (102%). All three varieties had shown good plumule and radicle growth under stressed conditions. This increase in ascorbic acid content when grown under drought stress has also been observed to be related to drought resistance in barley (Chinoy *et al.* 1965). Varieties JV–9 and JV–83–2, which also performed well under stressed conditions, showed small increases in ascorbic acid content when grown in mannitol solution, but had the highest concentration when grown in distilled water. High concentration of ascorbic acid under nonstressed conditions has also been found to be related to drought resistance in wheat (Lukichera 1968).

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THE EFFECT OF SOIL MOISTURE ON GROWTH AND YIELD OF FABA BEAN (*VICIA FABA* L.)[1]

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According to Sprent *et al.* (1977), soil moisture stress is one of the most limiting factors affecting faba bean production in semi-arid and arid regions throughout the world. Seed yield may decrease as a result of water stress at any growth stage; however, some growth stages are more sensitive than others (El Nadi 1970).

Semi-arid and arid regions are becoming increasingly important in agricultural production to meet the demands of an increasing world population. Irrigated acreage of faba bean is increasing in an effort to maximize production in many dryland areas. Research on vegetative and reproductive responses of faba bean to applied moisture is limited. The objective of this research was to determine the effect of soil moisture on growth and yield of faba bean.

Materials and Methods

Field plantings were made at the Arthur Post Field Research Laboratory, Bozeman, Montana, USA. Soil type was a Bozeman silt loam (fine-silty, mixed, Argic Pachic Cryoborolls). Composite soil samples of 8 cores per replication were taken on 24 April 1984 at depths of 0-30 and 30-60 cm to determine initial soil fertility. Samples were oven-dried at 80°C with forced-air for 48 hours and analyzed by standard soil test methods in the Montana State University Soil and Plant Testing Laboratory. The soil contained 81, 85, and 775 kg/ha of N, P, and K, respectively. Bulk densities at depths of 0-30 and 30-60 cm were 1.23 and 1.30 g/cc, respectively. The experimental site was fallowed the year prior to planting.

Faba bean cv Ackerperle was planted on 26 May 1982 at a rate of 13 seeds/m with 30 cm row spacing in 4-row plots. Seeds were sized to minimize variation. Commercial granular rhizobium inoculum (strain Q, Nitragin Co., Milwaukee, WI, USA) was applied at 17 kg/ha.

A line-source irrigation system similar to the one described by Hanks *et al.* (1976) was utilized to apply four moisture levels of high, intermediate, low, and none to faba bean. Total water applied and accumulative evapotranspiration (ET) are given in Table 1. Irrigation frequency was based on 6.7 cm of evapotranspiration loss. Main plots were 2.4 x 6 m with four replications.

Table 1. Irrigation regimes for faba bean field experiments at Bozeman, Montana, USA, 1982.

Irrigation regime	Total water applied (Precip. + irrigation) (mm)	Accumulated ET[1] (mm)
None	272	354
Low	292	371
Intermediate	418	484
High	485	551

1. Total water in soil profile at planting + total precipitation + total water applied as irrigation—total water in soil profile at harvest.

Shoot and seed dry weight were recorded at harvest at the same physiological maturity stage. A 1-m^2 area was harvested in each subplot and data were expressed on a per plant basis.

All growth parameters were regressed with accummulated ET (total water in profile at planting + total precipitation + total irrigation − total water in profile at harvest). Soil moisture levels were determined by gravimetric methods.

Results and Discussion

Total water applied was closely related to accumulated ET (r^2 = 0.99, Fig. 1). The relationship was as expected and verifies the precision of the line-source irrigation system.

Days to maturity for plants receiving high, intermediate, low, and no irrigation were 134, 134, 127, and 118, respectively. Shoot dry weight (g/plant) increased 93% between the non-irrigated and high irrigation treatments (Fig. 2). Maximum forage production of faba bean is dependent on supplemental moisture levels in low precipitation areas.

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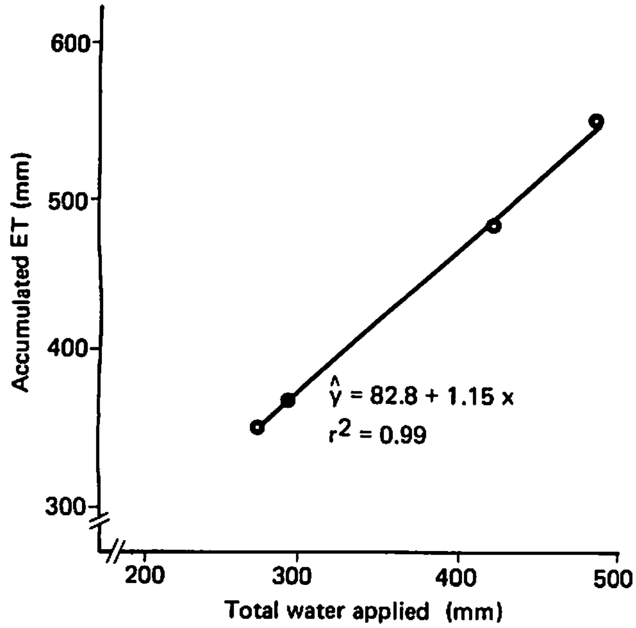

Fig. 1. Relationship of seasonal evapotranspiration (ET) to water applied at four irrigation levels (none, low, intermediate, high) to faba bean in 1982 at Bozeman, Montana, USA.

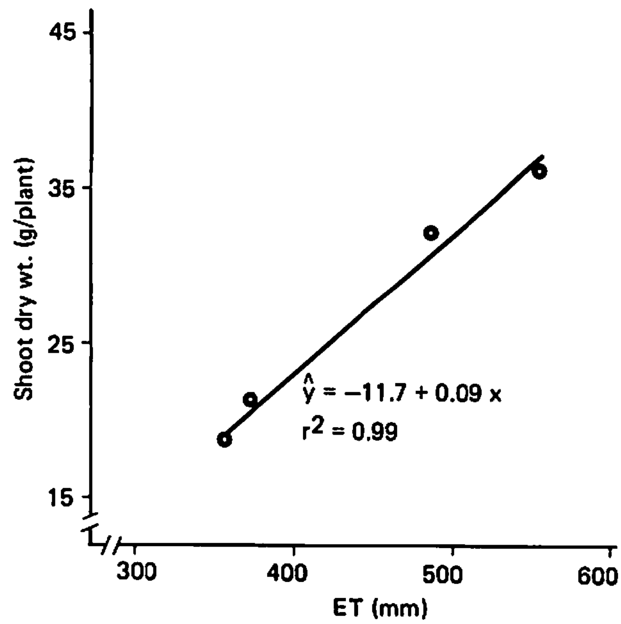

Fig. 2. Relationship of faba bean shoot dry weight at harvest to four seasonal evapotranspiration (ET) levels representing none, low, intermediate, and high irrigation regimes in 1982 at Bozeman, Montana, USA.

Seed dry weight (g/plant) increased 125% between the non-irrigated and high irrigation treatments (Fig. 3). Seed yields projected on an area basis for the high, intermediate, low, and non-irrigated treatments were 2,881, 2,665, 1,673, and 1,203 kg/ha, respectively.

Buss and Lockerman (1983) reported an increase in faba bean seed yield with irrigation. Our data showed a moisture x maturity interaction with a 16-day delay in seed maturity between the non-irrigated and high irrigation treatments. Seed yields increased as irrigation level was increased.

Conclusion

These data agree with previous reports (Farah 1981; Krogman *et al.* 1980) which show that both vegetative and reproductive growth of faba bean markedly respond to supplemental moisture under low precipitation conditions. Conversely, many other legumes show increased vegetative growth with suppressed reproductive growth under high moisture regimes. Irrigation timing needs to be evaluated to fully exploit faba bean forage and seed production. Additionally, potential lodging effects under high available moisture conditions need to be determined.

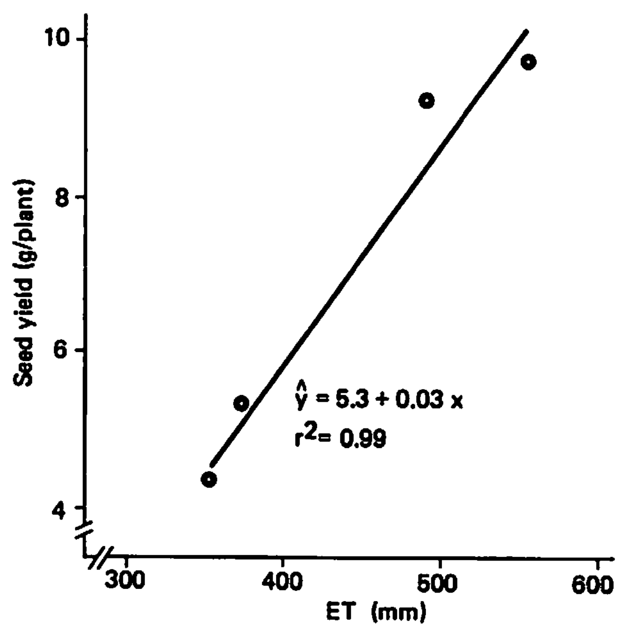

Fig. 3. Relationship of faba bean seed yield to four seasonal evapotranspiration (ET) levels representing none, low, intermediate, and high irrigation regimes in 1982 at Bozeman, Montana, USA.

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Note to Contributors

Articles should have an abstract (maximum 250 words) and whenever possible the following sections: introduction, materials and methods, and results and discussion.

IDENTIFICATION OF SOME SOURCES OF RESISTANCE TO DISEASES IN FABA BEANS II—RUST (*UROMYCES FABAE*)

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Introduction

Rust caused by *Uromyces fabae* is the second most destructive disease of faba beans (*Vicia faba* L.) in North Delta Region of Egypt. Williams (1978) reported that severe early infection can reduce yields by as much as 45%. Hooker (1969) and Wilcoxon *et al.* (1975) pointed out that resistance to rust in field crops could be based on slow rusting. Conner and Bernier (1982) found significant differences between 20 faba bean accessions for their area under disease progress curves (AUDPC). Their results indicated that three accessions consistently had low values and another six accessions had values that shifted from low to intermediate. The other 11 accessions were either fast rusters or behaved inconsistently.

The present studies aimed to identify sources for rust resistance among faba bean breeding lines in Egypt.

Materials and Methods

The studies were carried out under the natural epiphytotic conditions at Sakha and Nubaria Research Stations (North Delta Region) during 1980/81, 1981/82, and 1982/83, to test the reaction of several faba bean genotypes (Khalil *et al.* 1984) to rust infection. Reaction to rust disease was recorded as percentage infection in the field.

Results and Discussion

1980/81 season

The average percentage of initial rust infection at Sakha ranged from 1 to 20% on 6 March. This gradually increased to its maximum level on 15 April, with a range of 5-45%. Disease development (the difference between the initial and maximum levels of infection) was calculated for the tested genotypes. Out of 34 breeding lines seven proved promising: 249/801/80, 249/802/80, 249/803/80, 249/ 804/80, Seville Giant, R.C. 39/80, and ILB 938, as these showed the lowest level of infection, and were clearly slow rusters compared with the two check cultivars, Giza 3 and Rebaya 40 (Fig. 1). High rates of disease development were recorded for eight lines, while the remaining 19 lines were intermediate.

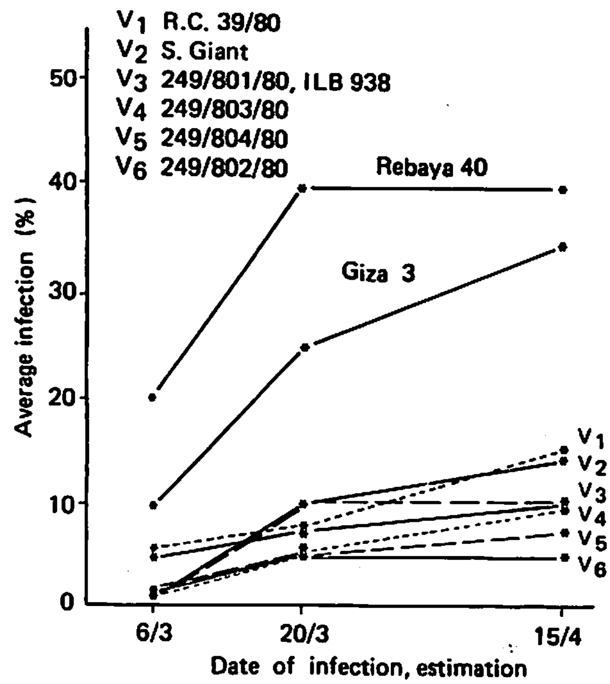


Fig. 1. Development of field infection with rust on seven faba bean breeding lines compared with the check cultivars Giza 3 and Rebaya 40 at Sakha Research Station, 1980/81.

Diathane M 45 fungicide significantly decreased rust infection. Susceptible lines responded better to fungicide application than resistant ones.

1981/82 season

There were significant differences among the genotypes for their average reaction to rust (Fig. 2) at Nubaria on 16 March. Lines 249/802/80, 249/803/80, 249/804/80, and ILB 938 were significantly better than the check cultivar Giza 3.

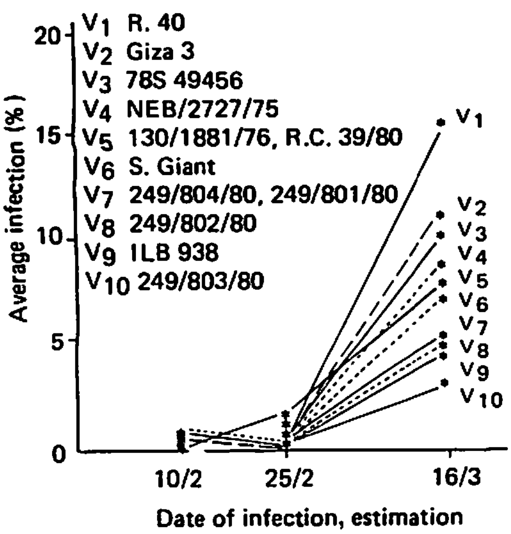


Fig. 2. Development of field infection with rust on 12 faba bean genotypes at Nubaria, 1981/82.

Agrimycin application had no significant effect; also the interaction between genotypes and spray treatment was nonsignificant.

1982/83 season

The incidence and development of rust infection on the tested genotypes was estimated under artificial and natural epiphytotics of chocolate spot disease at both sites.

Inoculation with chocolate spot significantly decreased the average rust infection of all tested genotypes at Nubaria, with no significant genotype x inoculation interaction. However, at Sakha there was a significant interaction: two lines, 249/803/80 and 249/804/80 reacted to rust infection similarly under both inoculated and uninoculated treatments, whereas the other six lines showed significant increase in rust infection under artificial inoculation with chocolate spot disease. Mayhew and Ford (1971) pointed out that *Physarum polycephalum*, a mexomycete, produced an inhibitor to infection of tobacco and bean by TMV and of *Vigna sinensis* by TRSV. Environmental factors (temperature, humidity, etc.) and genetic constitution of the host and pathogen might have caused the genotype x inoculation interactions observed at Sakha.

On average of both chocolate spot inoculation treatments (uninoculated and inolulated) the genotypes showed significant differences in rust reaction on 8 February, 8 March, and 23 March at Nubaria (Fig. 3a) and 13, 20, 27, March, and 6 April at Sakha (Fig. 3b). Line ILB 938 and Reina Blanka at Nubaria and 249/804/80 at Sakha proved resistant to rust (slow rusting). ILB 938 and 249/804/80 also showed resistance at both locations during 1981/82 season.

In conclusion, four faba bean lines with slow-rusting resistance in all three years were identified: 249/804/80, 249/803/80, Reina Blanka, and ILB 938. These findings are in accordance with those of Conner and Bernier (1982).

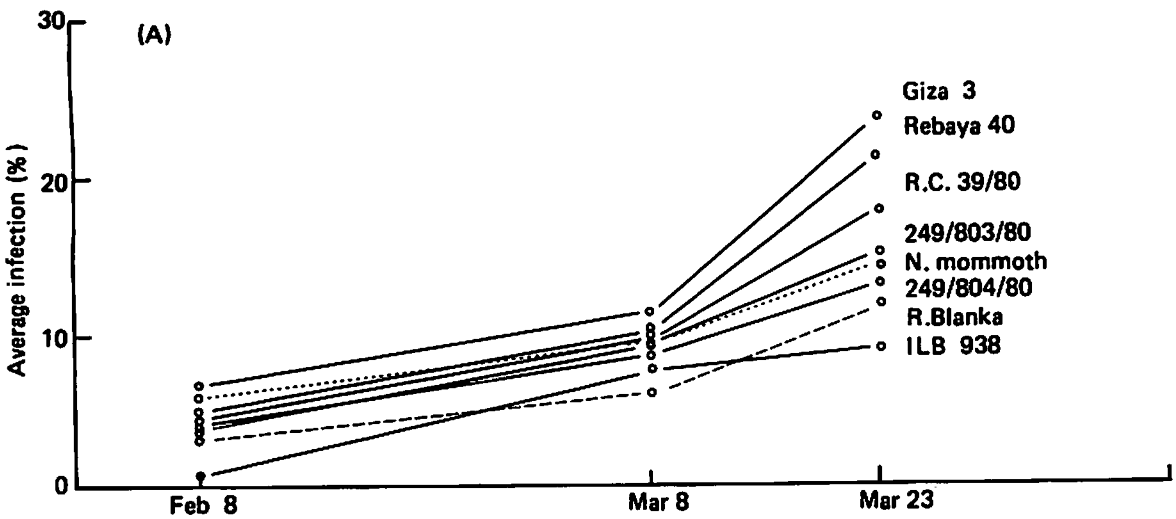
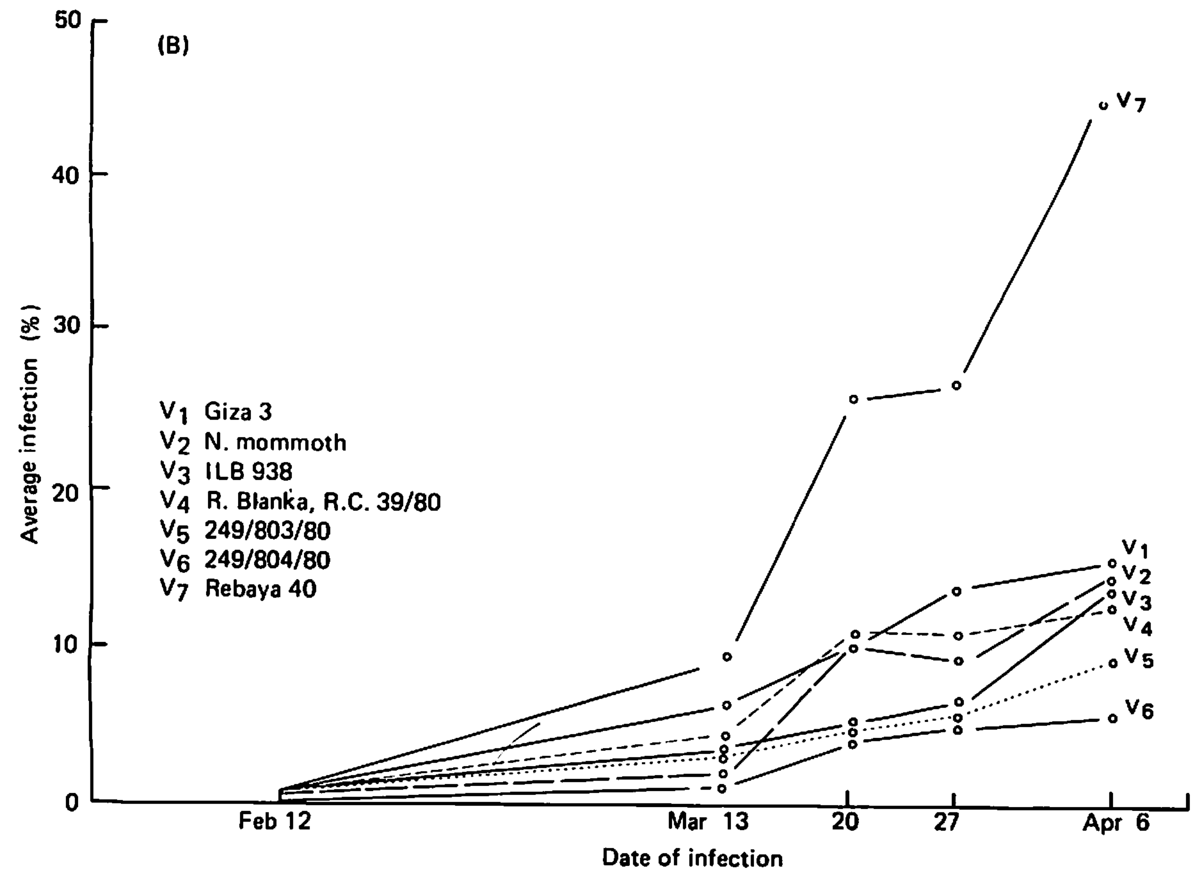


Fig. 3. Development of natural infection with rust on eight faba bean genotypes at Nubaria (A) and Sakha (B) in the 1982/83 season. The data are the average of the two chocolate spot inoculation treatments, viz. uninoculated and inoculated with *Botrytis fabae.*



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EFFECT OF *OROBANCHE CRENATA* PARASITIZING *VICIA FABA* PLANTS ON THE ACTIVITY OF PEROXIDASE AND POLYPHENOL OXIDASE IN DIFFERENT PARTS OF THE HOST AND PARASITE

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Introduction

Relatively little work has been done on the activity of various enzymes in orobanche and its hosts (Tincheva 1970; Mattoo 1973; Matto and Mattoo 1974; Mattoo *et al.* 1971; Singh and Krishnan 1977; Panchenko and Antonova 1976).

Polyphenol oxidase is known as the phenolase complex, as it is composed of two enzymes, one of which possesses only catecholase activity, whereas the other shows both cresolase and catecholase activity.

Robb *et al.* (1964) noticed during their studies on activation of tyrosinase in faba bean that the mechanism for increasing phenolase activity could occur in the plant tissues after infection or after wounding.

Fehrmann and Dimond (1967) found that, in potato plants, polyphenol oxidase activity was higher in growing than in mature tissues, and higher in root tissues than in leaves. They found little correlation between polyphenol oxidase activity and resistance of tissue to infection by phytophthora.

Fehrmann and Dimond (1967) found a positive and striking correlation between peroxidase activity in different organs of potato plants and resistance to *Phytophthora infestans*. Peroxidase activity increases considerably during the course of the defence reaction against invading hyphae.

The main purpose of this research was to develop background information on polyphenol and peroxidase activity which might be useful in investigating the relationship between the host and parasite.

Materials and Methods

Pot experiments were carried out at the Agricultural Research Centre, Department of Crop Physiology, Giza, Egypt, during 1982/83 and 1983/84.

In 1982/83 clay loam soil was used while in 1983/84 a sand culture technique, similar to that described by Hewitt (1952) was used. The pots, 25 cm in diameter, were placed in a wire greenhouse. Plants in the sand-culture were irrigated with a complete nutrient solution, according to Hoagland and Arnon (1950).

Method of planting:

Seeds of *Vicia faba* variety Giza 2 were sown on 18 Nov 1982 and 9 Nov 1983 in the two experiments respectively. Each experiment included 50 pots; 1 g of orobanche seeds was mixed with the soil or the sand of each pot.

Sampling:

Three samples were taken each month, representing vegetative, flowering, and maturity stages. Plants were separated into roots, shoots, pods, and orobanche when present.

Methods of Analysis:

Determination of enzymic activities:
Enzyme extraction was done according to the method of Maxwell and Bateman (1967). Fresh plant tissues (0.5 g) were ground with 0.1 M sodium phosphate buffer, pH 7.1 (16 ml buffer/g fresh tissues). The ground tissues were strained through four layers of cheese-cloth and the filtrate was centrifuged at 3000 rpm for 20 min at 6°C. The supernatant fluid was used for enzyme assay.

Peroxidase activity (PA) was determined according to the method described by Allam and Hollis (1972). The rate of oxidation of pyrogallol to pyrogallin in the presence of hydrogen peroxide was measured by near infra-red spectroscopy at 425 nm. The sample cuvette contained 4.0 ml of 0.1 M potassium phosphate buffer (pH 7.0), 0.3 ml enzyme extract, 0.3 ml of 0.05 pyrogallol, and 0.1 ml of 1.0% H_2O_2.

Polyphenol oxidase activity (PPO) was determined by the method of Maxwell and Bateman (1967). The reaction mixture contained 1.0 ml enzyme extract, 4.0 ml freshly prepared 0.1 M sodium phosphate buffer (pH 7.0), and 1.0 ml of 0.1 M catechol. The changes in absorbance at 495 nm were recorded every 15 seconds.

Results and Discussion

Peroxidase (PA):

Peroxidase activities were determined as the change in absorbance/g fresh weight/min. Leaves of infected plants showed higher rates of peroxidase activity especially during flowering and maturing stages (Table 1). This means that peroxidase activity increases at the early stages of infection by the parasite, because orobanche seeds germinate when the host starts to flower. Zaghloul (1931) stated that orobanche plants were observed one week before flowering of the host plant, and never occurred before that.

The same trend was observed in stem, roots, and pods. A very high rate of PA was observed in the roots of infected plants during flowering. The same results were obtained by Tincheva (1970), who found that peroxidase activity increased in tobacco plants with the increase in infestation by broomrape. Panchenko and Antonova (1976) studied the role of extracellular enzymes of broomrape in the penetration of host roots and the protective reaction of resistant forms of sunflower and noticed that high peroxidase activity accompanied by high respiratory activity is characteristic of plants producing haustoria; growth tubes of the parasite which did not contain peroxidase were not viable. They also found that parasitic peroxidase is incorporated by the host into lignin and thus inactivated, and that the lignin on the cell wall of the haustoria also prevents the flow of nutrient from host to parasite.

Table 1. Average peroxidase activity in different organs of healthy and infected *Vicia faba* plants parasitized by *Orobanche crenata* at different growth stages and orobanche shoots (Absorbance/g fresh weight/min.).

	Leaf		Stem		Root		Pod		
Sampling date	H	I	H	I	H	I	H	I	Orobanche
					First season				
17/1/83	24.35	20.59	8.45	6.08	110.88	119.69			
17/2/83	22.12	31.65	14.60	24.10	156.75	325.10			65.81
18/3/83	24.36	43.75	16.10	19.84	87.40	149.25	21.28	30.31	20.77
					Second season				
11/1/84	27.30	24.58			103.75	111.69			34.02
9/2/84	29.05	35.76	19.77	29.17	162.80	331.15			64.00
10/3/84	24.57	51.87	11.41	19.39	92.50	156.30	21.83	33.74	29.31

H = healthy; I = infected.

Table 2. Average polyphenol oxidase activity in different organs of healthy and infected *Vicia faba* plants parasitized by *Orobanche crenata* at different growth stages and also the orobanche shoots (as absorbance/g fresh weight/min.).

	Leaf		Stem		Root		Pod		
Sampling dates	*H	I	H	I	H	I	H	I	Orobanche
					First Season				
17/1/83	1.43	0.69	0.47	0.27	0.95	0.57			
17/2/83	4.47	3.52	1.26	0.95	2.32	3.44			2.00
18/3/83	2.69	1.86	1.56	1.94	2.63	3.33	1.76	1.37	2.19
					Second Season				
11/1/84	1.71	1.51			1.81	1.63			1.47
9/2/84	4.09	3.54	1.49	0.95	2.90	3.72			3.48
10/3/84	2.48	1.73	1.34	1.89	2.56	3.86	1.32	1.08	1.74

*H = healthy, I = infected.

Lower rates of PA were observed in orobanche than in the host root in both seasons.

Thus, it can be concluded that peroxidase activity increases considerably during the course of the defence reaction against invading parasites, as indicated by the much higher activity of the enzyme in the roots than in other organs, as a result of the direct connection between the host and parasite. These results indicate that peroxidase may play an important role in the regulation of host defence against the parasite.

Polyphenol oxidase (PPO):

The activities of polyphenol oxidase were determined as the change in absorbance at 495 nm/g fresh weight/min.

Contrary to the findings for peroxidase activity, polyphenol oxidase activity showed higher values in healthy plants than infected ones except in the stem at maturity and the roots at both flowering and maturity stages, when infected plants showed high values (Table 2). These results agree with those previously reported by Tincheva (1970).

At flowering and maturity stages, PPO activities were increased markedly in infected roots.

PPO activity in the orobanche was generally less than in infected roots. Fric (1976) reported that the determination of the role of the phenolase within host-parasite interaction is very difficult, because biochemical symptoms of disease are determined by the genetical, physiological, and biochemical characteristics of both the host plant and the parasite. He also stated that the increase in phenolase activity in the host tissue, especially at and around infection sites, is a common response to a large number of plant diseases. The increased phenolase activity in diseased or wounded tissues is generally accompanied by increased concentration of phenolic substances. The increase in PPO activity in roots and parasite may be due to the close connection between the host and parasite. It has been demonstrated that there is an efficient transport system between faba bean (*Vicia faba*) and orobanche parasitizing them (Kokina 1946; Privat 1960; Rakhimov 1967; Singh *et al.* 1968).

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THRIPS' EGGS IN FLOWERS OF FABA BEANS

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Kakothrips pisivorus (Westwood) [= *Kakothrips robustus* (Uzel)] (Insecta, Thysanoptera, Thripidae) breeds in flowers of *Pisum, Vicia* and *Lathyrus* spp. and is widespread in Europe (Mound *et al.* 1976). It is a pest of peas (e.g. Franssen 1960) and sometimes of faba beans (Williams 1915; Buhl 1937; Faber 1977). Adults and larvae feed on pollen (Kirk 1984a); it is not known whether this has a significant effect on pollination. The life cycle and biology of *K. pisivorus* on faba beans has been studied (Williams 1915; Buhl 1937; Kirk 1984b).

The eggs are reniform, opaque white, and about 0.35 mm long. The size increases as the egg develops; some methods of preparing specimens may also change the size. Eggs are often laid at night (Buhl 1937) and are inserted just below the surface of plant tissue. A couple of days before hatching, the eyes become visible as two red dots. On faba beans, most eggs are laid in the stamen sheath, with a few in the pistil, in the base of the young developing pod, and in the petals. Most eggs can be found in fully open or recently closed flowers (Kirk 1984b).

There is no reliable way to identify the eggs, apart from waiting for them to hatch, although there can be strong circumstantial evidence from the characteristic egg distribution in the flowers and from the presence of the larvae and adults which can be readily identified (Speyer and Parr 1941; Mound *et al.* 1976). The larvae are yellow or orange and are distinct in having a black tip to the abdomen.

K. pisivorus eggs were common in fully open flowers of *Vicia faba* L. in Cambridge, England during 1982 and 1983 (Table 1). The eggs found by Rowland *et al.* (1981) in the pistils of faba bean flowers from Cambridge were considered likely to be *Apion* sp. They could well have been *K. pisivorus.*

The eggs were visible under a stereoscopic microscope, but were made clearer in the stamen sheaths by leaving the flowers in 70% alcohol for at least three days (Fig. 1). Eggs did not appear to be scattered indiscriminately over the flower. In order to investigate the distribution of eggs, 50 fully open flowers on the highest flowering racemes were collected from an infested field of winter beans var Bulldog at the University of Cambridge Farm on 5 June 1982. A total of 752 eggs (mean 15.0 eggs per flower) were found. Twenty-two eggs (3%) were in the keel petals and 730 eggs (97%) were in the stamen sheath. Eggs were not seen in the pistils of these flowers; eggs were commoner in this position in older flowers in which the developing young pod was growing beyond the stamen sheath. Vascular bundles down the length of the sheath showed up well after being soaked in alcohol, and naturally divided each side of the stamen sheath into five parallel strips. Each strip was divided into four equal lengths by eye so that the eggs could be counted in each of 40 sections of about 1.5 mm^2 (Fig. 2). The mean number of eggs per section was calculated and converted into a percentage of the mean number of eggs per flower. Eggs were mainly at the base of the sheath and in sloping bands along it, as found by Buhl (1937). The precision of the mapping further revealed that the eggs closely followed the edges of the overlying keel petals.

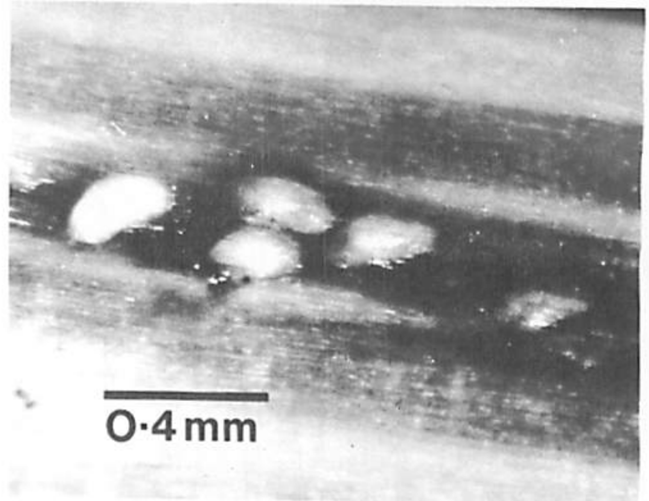

Fig. 1. Photograph of eggs of *Kakothrips pisivorus* in a stamen sheath of *Vicia faba* after being left in 70% alcohol for several days.

Table 1. The mean (± standard error of the mean) and maximum number of eggs of *Kakothrips pisivorus* per stamen sheath and the percentage of sheaths with eggs. Samples were of fully open flowers of *Vicia faba* in Cambridge, England. Maris Bead is a spring variety and Bulldog is a winter variety. n is the number of flowers sampled.

Variety	Date	Number of eggs in sheath: Mean	Max	Percentage of sheaths with eggs	n
Bulldog	June 1982	14.6 ± 1.6	51	88	50
Bulldog	June 1982	2.8 ± 0.9	17	56	25
Maris Bead	July 1982	1.2 ± 0.2	12	44	150
Bulldog	June 1983	7.5 ± 0.7	42	67	150
Bulldog	July 1983	3.9 ± 0.4	21	63	150

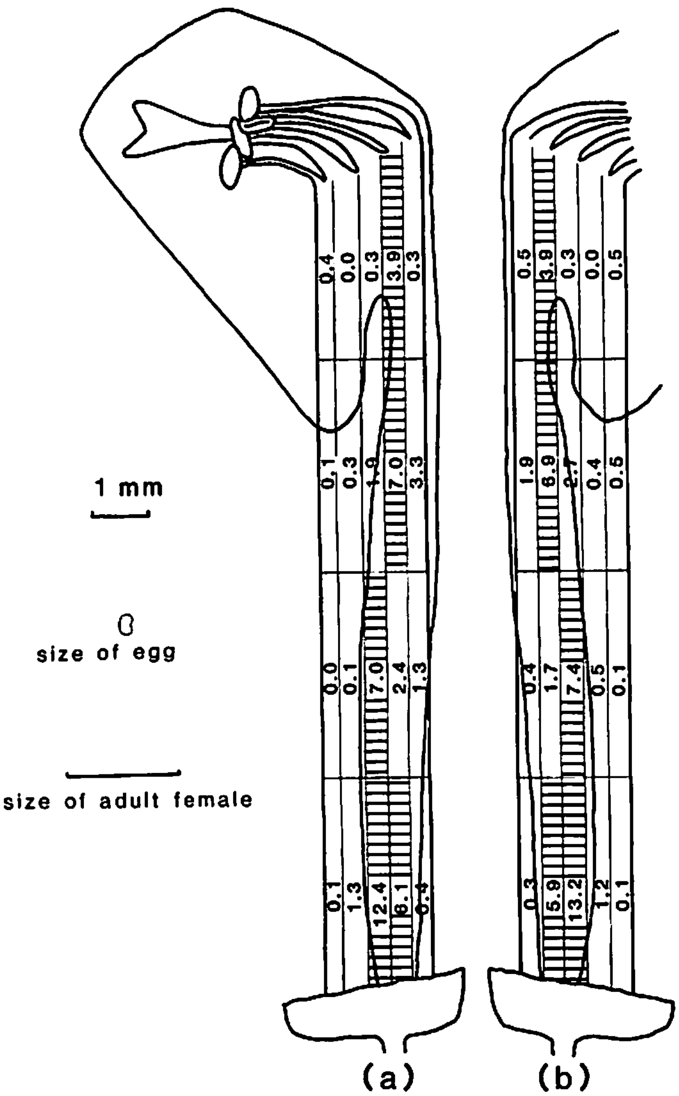

Fig. 2. Diagram of the stamen sheath and overlying keel petal of a flower of *Vicia faba*, with the mean number of eggs/section expressed as a percentage of the mean total for the flower. Sections with more than 3.5% of the eggs are shaded. (a) and (b) show opposite sides.

Since all parts of the stamen sheath are of similar softness, there is apparently nothing to prevent eggs from being laid anywhere in the stamen sheath. The position of adult females in the flowers was investigated to see whether this shed further light on the egg distribution. Flowers from the same field were picked and immediately pulled open slowly at 1700 hrs on 27 June 1982. Adult females were present and remained still in 24 flowers. Of these, 16 were at the distal end of the keel sheath, five were on the stamen sheath, and four were on the standard. All five of those on the stamen sheath lay by the edge of the keel sheath and had their abdomens toward the base of the flower. The high proportion of eggs at the base of the stamen sheath presumably reflects this orientation. The orientation may be a response to tactile stimuli from the space between the stamen sheath and the petals above it.

Eggs were just under the edge of the keel petals, so it appears that the females lie along the stamen sheath by the edge of the keel petal and push the end of the abdomen just underneath the keel before ovipositing. *Isoneurothrips australis* (Bagnall) also appears to lay eggs particularly in corners or crevices of a flower (Laughlin 1970). The distribution of *K. pisivorus* eggs within the stamen sheath appears to be influenced by the arrangement of the petals; varieties of faba bean with new floral structures may have different egg distributions and thus different levels of *K. pisivorus* infestation.

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Seed Quality and Nutrition

VARIATION IN TANNIN CONTENT OF FABA BEAN (*VICIA FABA*) SEED-COATS

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Introduction

Faba bean seeds contain antinutritive factors which reduce their feeding value (Marquardt 1983). Seed coats of colored-flowered varieties of faba bean contain up to 8% tannin (Griffiths and Jones 1977), while seeds of white-flowered varieties are practically tannin-free.

White-flowered faba beans are more susceptible to disease (Mandels and Reese 1966) and to seed coat damage and discoloration (Crofts *et al.* 1980) than colored-flowered varieties. Thus, low-tannin colored-flowered cultivars are needed, but selecting for low- and high-tannin lines from a colored-flowered *Vicia faba* population has been unsuccessful (Sjodin *et al.* 1981). This investigation studied the variability of tannin content in the seed coats of two highly inbred lines, F_1 and F_2 plants from their cross, and a *Vicia faba* cultivar.

Materials and Methods

More than 40 inbred lines were analyzed for tannin content in 1980. Two of them (14 and 43), sharply differing in tannin content, were crossed with each other. Plants of both parental lines were in the sixth selfed generation (S_6). The F_1 plants were grown in bee-proof conditions. In 1983 the inbred lines, the F_1 and F_2 populations, and cv Nadwislanski were grown under open pollination conditions. Ten seeds from the 2nd-3rd basal pod-bearing node were collected from each plant for analysis. From 58 to 98 individual plants from each of the parental lines, F_1 and F_2 populations, and cv Nadwislanski were analyzed. Tannin content was determined according to Burns (1971).

Results

The results are presented in Fig. 1 and Table 1. Since no reciprocal effects were found (P = 0.05) the F_1 data for 14 x 43 and 43 x 14 were pooled. The parental lines differed substantially in seed-coat tannin content (1.99 and 5.69%). The average tannin contents in F_1 and F_2 were 3.25% and 3.04% , respectively, less than the midparent

Table 1. Seed-coat tannin content (%), 1000-seed weight (g), and correlation coefficients for three faba bean lines and F_1 and F_2 progenies.

		Tannin content in seed coat (%)		1000-seed weight (g)		
Plant material	Number of plants	Mean	CV (%)	Mean	CV (%)	Correlation coefficient
Cv. Nadwislanski	60	4.52	46	625	12	0.24
Line 14	58	1.99	35	831	8	–0.22
Line 43	60	5.69	27	433	8	–0.19
F_1 14 x 43 and reciprocal	62	3.25	28	688	8	–0.09
F_2 14 x 43 and reciprocal	98	3.04	35	696	11	–0.13

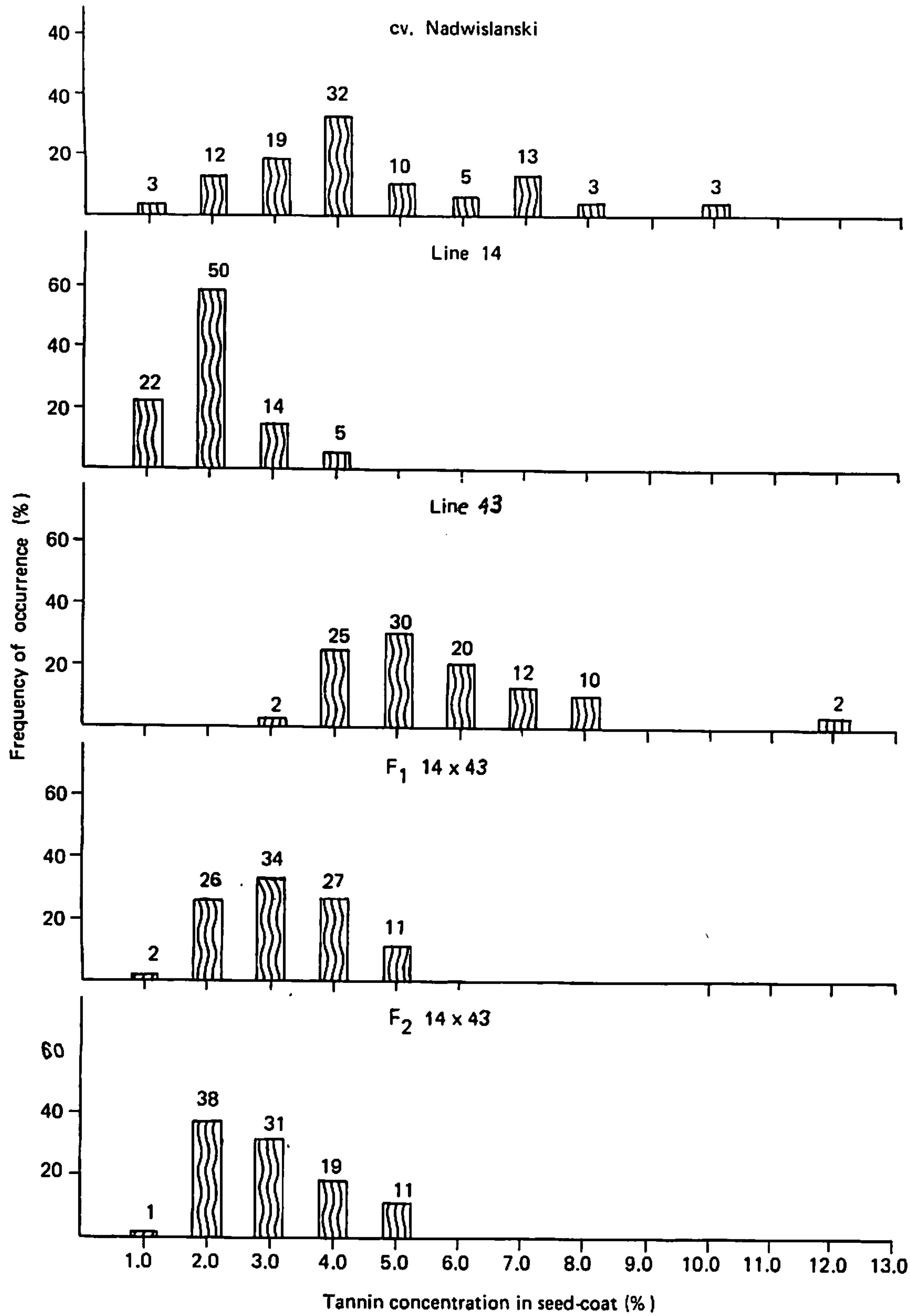

Fig. 1. Frequency distribution of seed-coat tannin concentration in three parent lines and F_1 and F_2 populations of *Vicia faba.*

value (3.84%). The range and distribution of the variation in tannin content in F_1 and F_2 were similar (Fig. 1). No increase in range of variation was observed in the F_2 as compared with the F_1, and there was only a slight increase in the percentage of low-tannin individuals (up to 2.5% tannin). None of the F_2 plants contained more than 5.5% tannin in the seed coat.

Generally, variation in seed-coat tannin content was rather high (Table 1), with CVs 3-fold larger than the CVs for 1000-seed weight.

Cv Nadwislanski had a relatively high mean tannin content (4.52%) and the highest CV (46%). No significant (P = 0.05) correlation between tannin content and 1000-seed weight was found.

Additionally, tannin content was analyzed in eight plants of cv Nadwislanski which formed lateral shoots. Such plants rarely occur when the crop is grown at a normal density. Seeds were collected from basal (A) and apical (B) pods on the main stem and from lateral shoots (C). In the seed coats of A, B, and C the mean tannin content was 3.31, 6.50, and 7.21% , respectively. The differences between the means, however, were not significant (LSD = 3.37 at P = 0.05) due to large plant-to-plant differences.

Discussion

It was found that tannin content in *Vicia faba* seed coats shows large genetic and environmental variation. The extremely low tannin content ($<0.1\%$) of white-flowered varieties (Crofts *et al.* 1980; Sjodin *et al.* 1981) and large intervarietal differences in tannin content of colored-flowered lines are genetically controlled (Raczynska-Bojanowska *et al.* 1985). In this study, line 43 contained nearly three times as much tannin in the seed coat as line 14. Factors responsible for non-genetic variation have not been yet precisely defined. Environmental factors (soil, climate), disease, and, presumably, the stage of development of the maternal plant at the time of seed setting and filling are likely to cause variation in tannin content. Variation of tannin content between years (Raczynska-Bojanowska *et al.* 1985) and the increase of phenolic compounds due to pathogen invasion (Mansfield and Hutson 1980) indicate the strong effect of environmental factors. Based on the data from this study concerning the ranges and coefficients of variation in the highly inbred parental lines (S_6), and in their F_1 's it is evident that the effect of environmental factors is considerable.

Large, though not consistent, differences in tannin content depending on the site on the maternal plant from which the seeds were collected were found in this study. A highly significant relationship between tannin content and node position was found by Raczynska-Bojanowska *et al.* (1985). It does not seem likely that such large differences can be exclusively accounted for by the time distance separating pod setting and filling at successive nodes.

There is no data in the literature on genetic factors which control tannin content in colored-flowered faba bean varieties. The range and distribution of tannin content values in the F_2 as compared with the F_1 and parental lines observed in this study indicate that control of this trait may be polygenic. Further investigations are being conducted by the authors to elucidate this matter.

The results from this study also highlight the point that in the selection for low tannin content, seed sampling should be given due consideration.

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ANNOUNCEMENTS

Reprints

ICARDA has been designated as the world center for information on faba beans, and as such we are trying to assemble a complete collection of papers relevant to this subject.

We would be most grateful if readers who have published papers relating to faba beans would send reprints to:

FABIS
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P.O. Box 5466, Aleppo, SYRIA

Mailing List

We are having many items of correspondence returned, due to those on our mailing list having changed their addresses or left their place of employment without notifying us. Obviously this represents a considerable waste of money to the FABIS service.

We request that those who currently receive FABIS should inform us of any change in their address or position in good time to allow us to maintain an efficient service.

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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, please write to Training Department.

Lentil Experimental News Service (LENS)

LENS, a scientific newsletter published jointly by the University of Saskatchewan and ICARDA with financial support from IDRC, is designed to improve communication among world lentil researchers.

For your free copy write to:

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Documentation Unit, ICARDA,
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ADVANCE NOTICE

International Food Legume Research Conference, 6-11 July 1986, Spokane, Washington

Selected topics include: Germplasm; Breeding; Biotechnology; N_2 Fixation; Nitrogen and Carbon Economy; Physiology; Environmental Stress; Tillage and Systems Management; Weeds, Pests, and Diseases; Integrated Pest Management; Harvesting and Storage; Commodity Utilization and Nutrition; Economics; Marketing, Trade, and Policies.

Complementary workshops and open discussion sessions will address topics such as N_2 Fixation Research Methods; Rhizosphere Ecology; Seed Quality; Innoculant Production Technology; Small Farm Technology; Systems Production Alternatives; Human Nutrition; and Knowlledge Assessment, Integration, and Retrieval Systems.

The Conference program has been carefully formulated to interface all aspects of both applied and basic research involving pea, lentil, faba bean, and chickpea. Seventy-nine plenary and invited papers co-authored by more than 250 contributors from 46 countries have been identified in a program planned by an International Advisory Board in collaboration with the Local Organizing Committee.

International Advisory Board

Dr. R. J. Summerfield	University of Reading, United Kingdom; Conference Editor
Dr. G. C. Hawtin	International Development Research Centre (IDRC)
Dr. Y. L. Nene	International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
Dr. M.C. Saxena	International Center for Agricultural Research in the Dry Areas (ICARDA)

International Observer

Dr. H. A. Al-Jibouri	Food and Agriculture Organization of the United Nations

Local Organizing Committee

Dr. R. H. Lockerman	Conference Chairman, Montana State University, U.S.A.
Dr. D.F. Bezdicek	Program Chairman, Washington State University, U.S.A.
Dr. F.J. Muehlbauer	United States Department of Agriculture/Agricultural Research Service, Pullman, Washington, U.S.A.
Dr. J. M. Kraft	United States Department of Agriculture/Agricultural Research Service, Prosser, Washington, U.S.A.
Dr. G.A. Lee	University of Idaho, U.S.A.
Dr. L. E. O'Keeffe	University of Idaho, U.S.A.
Mr. H. L. Blain	American Dry Pea and Lentil Association (ADPLA); Washington and Idaho Associations of Dry Pea and Lentil Producers

The organizers for the International Food Legume Research Conference on pea, lentil, faba bean, and chickpea (6-11 July 1986 in Spokane, Washington, U.S.A.) are collaborating with the organizers for the Second International Conference on the Biology of the Leguminosae (to be held 23-27 June 1986, jointly by the Missouri Botanical Garden and the Royal Botanic Gardens, Kew, U.K.) in St. Louis, Missouri, U.S.A. The Biology of the Leguminosae Conference in St. Louis will address the biology, ecology, evolution, and taxonomic classification of the legume family. Conversely, the International Food Legume Research Conference will address *basic and applied agricultural research directed toward the assessment and improvement of specific cool-season food legumes.*

Scientific and leisure activities for the interim between the two Conferences (28 June- 5 July) are being planned for the participants wishing to attend both meetings. Proposed interim activities include visits to the Northern Great Plains, Rocky Mountains, and national and provincial parks such as Banff, Glacier, Grand Teton, and Yellowstone.

Additional information concerning the Conference on the Biology of the Leguminosae can be obtained from Dr. James L. Zarucchi, Legume Conference Coordinator, Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166 U.S.A. (Telephone: 314-577-5100; Telex: 466224; Cable: MOBOTSTL).

Information concerning the *International Food Legume Conference on pea, lentil, faba bean, and chickpea,* as well as the interim conference activities, can be obtained from:

Dr. R. H. Lockerman, Chairman
International Food Legume Research Conference
Plant and Soil Science Department
Montana State University
Bozeman, Montana 59717 U.S.A.

Telephone: 406-994-5064
Telex: 910-963-2066

Forthcoming Meetings

8-15 Aug 1985

Science and Technology Education and Future Human Needs

An international conference will be held at Bangalore, India, 8-15 Aug, 1985. The principal aim of the conference is to identify practical ways in which science and technology education can contribute to national development. It is hoped that one of the outcomes of the conference will be a reappraisal of what should be taught in both schools and universities in order to promote development.

18-25 Aug 1985

13th International Congress of Nutrition, Brighton, UK

Contact: Nutrition Society,
Chandos House,
2 Queen Anne Street,
London, W1M 9LE, UK

9-13 Sept 1985

VIII BOTRYTIS Symposium, Alba, Italy

This symposium will be held at Alba (50 km from Turin, North-Western Italy). As in the previous symposia, there will be presentation of papers, group discussions and field visits to wine grape production areas.

Contact: Dr. A. Garibaldi
Instituto di Patologia Vegetale,
Via Giuria, 15 - 10126 Torino, Italy

21-25 Oct 1985

Arid Lands Conference, Arizona, USA

Contact: Dr. G.P. Nabham
Office of Arid Land Studies,
University of Arizona,
Tucson, Arizona 85721, USA

23-27 June 1986

II International Legume Conference, St. Louis, USA

The Second International Conference on the Biology of the *Leguminosae* is to be held at St. Louis, Missouri jointly by the Missouri Botanical Garden and the Royal Botanical Gardens Kew, UK. The conference will address the biology, ecology, evolution, and taxonomic classification of the legume family.

Contact: Dr. James L. Zarucchi
Legume Conference Coordinator,
Missouri Botanical Garden,
P.O. Box 299, St. Louis,
Missouri 63166, USA

29 June-5 July 1986

IV Latin American Botanical Congress, Medellin, Colombia

Contact: Dr. Enrique Forero
Presidente, Comite Organizador,
IV Congreso Latinoamericano de Botanica,
Apartado 54546
Bogota 2, Colombia

6-11 July 1986

International Food Legume Research Conference on Pea, Lentil, Faba bean, and Chickpea, Spokane, Washington, USA

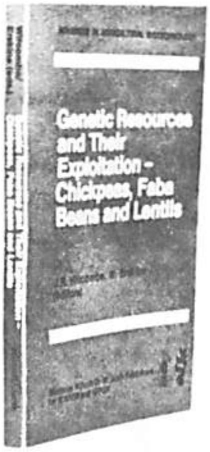
(See advance notice on page 30)

15-22 Aug 1986

IV International Lupin Conference, Geraldton, W. Australia

Contact: The Secretary
4th International Lupin Conference,
Conventions Department,
P.O. Box 489, G.P.O.,
Sydney, N.S.W. 2001,
Australia

BOOK REVIEWS



The International Center for Agricultural Research in the Dry Areas (ICARDA)
and
The International Board of Plant Genetic Resources (IBPGR)
Introduce . . .

GENETIC RESOURCES AND THEIR EXPLOITATION
CHICKPEAS, FABA BEANS AND LENTILS
By J.R. Witcombe and W. Erskine (editors)

ICARDA and IBPGR present a 256 page book designed for all breeders. This unique work provides a continuum between the collection,evaluation, and utilization of genetic resources.

ISBN 90-247-2940-8
256 pages, Paperback

Genetic Resources and their Exploitation–Chickpeas, Faba beans and Lentils is a reference that bridges the gap between the genetic resources literature and the legume breeding literature.

Genetic Resources and Their Exploitation - Chickpeas, Faba beans and Lentils

The book, a joint endeavor of ICARDA and IBPGR, is based on lectures delivered by specialists in a 1982 training course sponsored by both institutions at ICARDA on the genetic resources of chickpeas, faba beans, and lentils. The book provides a continuum between the collection and evaluation of genetic resources, and their utilization. It discusses collecting and maintaining genetic resources of chickpeas, faba beans, and lentils.

The book is divided into eighteen chapters covering:

- practical collection and initial documentation of food legume germplasm
- keys to successful storage of samples of orthodox seeds
- seed storage methods under ideal conditions: low moisture content and low temperature
- main steps for computerizing passport and evaluation data
- collection, isolation and maintenance of food legume Rhizobia
- plant quarantine principles, methodology, and seed health of food legumes
- utilizing food legumes' wild relatives and primitive types
- utilizing genetic resources in a national food legume program
- taxonomy, distribution, and evolution of chickpea and its wild relatives
- collecting and evaluating chickpea genetic resources
- exploitation of chickpea genetic resources
- taxonomy distribution and evolution of faba bean and its wild relatives
- genetic resources of faba beans
- strategies for exploiting the faba bean gene pool
- evaluating and utilizing faba bean germplasm in an international breeding program
- taxonomy, distribution, and evolution of lentil and its wild relatives
- genetic resources of lentils
- evaluating and utilizing lentil germplasm in an international breeding program

A limited number of copies of the book are available free for ICARDA cooperators working in developing countries, from FABIS/ICARDA/P.O. Box 5466/Aleppo, Syria.

Other copies are available from the publisher:
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The Netherlands

FIELD MANUAL OF COMMON FABA BEAN DISEASES IN THE NILE VALLEY

By C.C. Bernier, S.B. Hanounik, M.M. Hussein, and H.A. Mohamed

This comprehensive 40-page reference field manual is designed to help scientific workers, trainees, and extension workers identify common faba bean diseases in the field. It describes the causal agents, their survival, and life cycles to explain the factors that influence disease development; covers the symptoms, development and control measures of each disease; includes an appendix on rating scales for disease resistance, a glossary of basic phytopathological terms, and references for further reading. Color photographs of 38 important diseases are included. For your copy of this publication, write to:

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FIELD GUIDE TO MAJOR INSECT PESTS OF FABA BEAN IN THE NILE VALLEY

By C. Cardona, E.Z. Fam, S.I. Bishara, and A.C. Bushara

This comprehensive 60-page reference field guide is designed for research and extension workers. It contains information about the most common and damaging insect pests that attack faba bean crops in the Nile Valley. It offers extensive coverage of the practical considerations necessary in the identification of the insects, assessment of damage or population levels, and proper insect control practices. The guide is primarily based upon the updated findings of the national research programs. It includes a glossary of basic entomological terms, a key to injuries, official common names and some commercial names of chemicals, an index of common and scientific names of insects cited in the text, and references for further reading. Color photographs of 41 important insects are included. For your copy of this publication, write to: FABIS/ ICARDA/P.O. Box 5466/Aleppo, Syria.

El-Fouly, M.M. (ed.). 1984. **Proceedings of a grain legumes workshop**, March 1981, International Center for Rural Development, Mariut, Egypt. Sponsored by NRC, Cairo, GTZ, W. Germany, and ICARDA. 311 pp., bibl., tabs.

This publication contains papers presented by Egyptian scientists working at Agriculture Research Center, Institute of Nutrition, and different Universities in Egypt. Crops covered include all food legumes including *Vicia faba*. The publication includes the recommendations for future research and the statistics on area and yield of different food legumes in Egypt for 1978-82 period.

Available from Dr. M.M. El-Fouly, NRC, Cairo, Egypt.

Cubero, J.I., Moreno, M.T. (eds.). 1983. **Leguminosas de grano.** Mundi-Prensa, Madrid, Spain, 359 pp.

Various aspects of grain legumes production and improvement are presented in this multi-author book. The legumes covered include *Vicia faba, Lens culinaris,* and *Cicer arietinum.* The coverage includes environmental requirements, symbiotic nitrogen fixation, mineral nutrition, method of cultivation in Spain, diseases and pests, and nutritive value for human consumption and animal feed.

Hubblethwaite, P.D., Dawkins, T.C.K. and Heath, M.C. (eds.). 1984. *Vicia faba:* **Agronomy, physiology and Breeding:** Proceedings of a seminar in the CEC Programme of Coordination of Research of Plant Protein Improvement, Commission of the European Communities, 14-16 Sept 1983, Nottingham, United Kingdom. Martinus Nijhoff/Dr. W. Junk Publishers, P.O. Box 566, 2501 CN, The Hague, The Netherlands. 333 pp. ISBN 90-247-2964-5.

This book contains the proceedings of a seminar held 14-16 Sept 1983, in Nottingham, United Kingdom and sponsored by the Commission of the European Communities. The proceedings, containing 34 papers, are divided into sections to examine current research on physiology and agronomy, on breeding and cytogenetics, and on nutrition and quality. The book also contains conclusions, general discussion and recommendations, and the list of participants.

Chapman, G.P. and Tarawali, S.A. (eds.). 1984. **Systems for cytogenetic Analysis in *Vicia faba* L.:** Proceedings of a seminar in the EEC Programme of Coordination of Research on Plant Productivity, Commission of the European Communities, 9-13 Apr 1984, Wye, UK. Martinus Nijhoff/Dr. W. Junk Publishers, P.O. Box 566, 2501 CN, The Hague, The Netherlands, 191 pp. ISBN 90-247-3089-9.

This book contains the proceedings of a seminar held 9-13 Apr 1984, in Wye, UK and sponsored by the Commission of the European Communities. The proceedings, containing 18 papers, are divided into seven sections on intact and broken chromosomes, trisomics and linkage, disease resistance, population genetics, interspecies hybridisation, haploidy, and mutation breeding. The book also contains conclusions and an appendix.

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Contributors' Style Guide

Policy

The aim of the newsletter is to publish quickly the results of recent research. Articles should normally be confined to a single subject, be of good quality and of primary interest to research, extension and production workers, administrators and policy makers. Articles for publishing in the newsletter should not be submitted to or published in any other journal.

Editing

Articles will be edited to preserve uniform style but substantial editing will be referred to the author for his 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.

Language

The Newsletter will be published in English but ICARDA will endeavour to translate articles submitted in Arabic and French.

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 and postal address and telex number if available. Photographs, figures, tables etc. should be either 8.5 cm wide (single column) or 17.5 cm wide (double column including space). Figures and diagrams 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.

Units of measurement are to be in the metric system, e.g., t/ha, kg, g, m, km, ml (= mililiter), m^2.

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

3g, 18 mm, 300 m^2, 4 Mar 1983; 27% ; 50 five-day old plants; 1.6 million; 23 μ g; 5°C; 1980/81 season; 1981-82; Fig., No.; FAO, USA. *Fertilizers:* 1 kg N or P_2O_5 or K_2O/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: Murphy, P.T. and Milfin, B.J. 1982. The origin of barley. Euphytica 31: 183-192.

Books: Brues, A.M. 1952. Mineral cycling. Prentice-Hall, Englewood Cliffs, NJ, USA. 200pp.

Articles from books: Hastings, Sir G. 1908 (reprinted 1966). *Cajanus indicus* (arhar). Pages 196-200 *in* The Farm Products of India (Rao, D.M. and Murphy, R.E., eds.). Today and Tomorrow Printer and Publisher, New Delhi, India.

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.C. and Webb, C. eds.), ICARDA/IFAD Nile Valley Project, 7-11 Mar 1981. Cairo, Egypt. Martinus Nijhoff Publishers, The Hague, The Netherlands.

FABIS 11/1200/April 1985