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Lens NEWSLETTER

THE INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH
IN THE DRY AREAS (ICARDA)

UNIVERSITY OF SASKATCHEWAN

ICARDA and CGIAR

The overall objective of the International Center for Agricultural Research in the Dry Areas (ICARDA) is to increase agricultural productivity and food availability in both rural and urban areas, thus improving the economic and social well-being of people in developing countries, particularly in North Africa and West Asia. The center focuses mainly on winter rainfall areas with 200-600 mm annual precipitation. When appropriate, research also covers environments with monsoon rainfall or irrigation.

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LENS

LENS Newsletter is produced twice a year at ICARDA in cooperation with the University of Saskatchewan, Canada with the financial support of the International Development Research Centre (IDRC), Ottawa, Canada. LENS, the newsletter of the Lentil News Service, is a forum for communicating lentil research results. Short research articles provide rapid information exchange, and comprehensive reviews are invited regularly on specific areas of lentil research. The newsletter also includes book reviews, key abstracts on lentils, and recent lentil references. The Lentil News Service provides information on lentil research free of charge through a question and answer service, photocopies, and searches of a lentil document collection.

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COVER PHOTO: Lentil harvest in Kameshly on a farmer's field by swathe-mowers of General Organization of Agricultural Mechanization of the Government of Syria. The 4m wide mower cuts the crop leaving it in a swathe.
Photo Credit: Dr. W. Erskine

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RESEARCH ARTICLES البحوث

Breeding and Genetics التربية والمورثات

Talia 2 - a lentil cultivar for Lebanon

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Abstract

Description is given of Talia 2, a new lentil cultivar released in Lebanon. In comparative performance of lentil cultivars at Beqa'a valley during 1980-89 seasons, Talia 2 gave an average seed yield of 1501 kg/ha in comparison with 1191 kg/ha for Lebanese local. Talia 2 matures earlier. It is less tall. The seed coat is mid-brown. The average seed weight is 2.76 g/100 seeds. The protein content is 28.8 and cooking time is 35 min.

Introduction

Lentil is an important dietary item in Lebanon. A total of approximately 4000 ha is grown with lentil annually (FAO 1987) and there is a considerable quantity of lentil seed imported. The joint breeding program of the Agriculture Research Institute, Tel Amara, Lebanon and the International Center for Agricultural Research in the Dry Areas (ICARDA) has produced a new lentil cultivar for Lebanon, which has been released as Talia 2.

Talia 2 is a small-seeded, red cotyledon lentil with a higher yield than Lebanese local (ILL 4399). The results of 13 yield trials spread over the seven seasons 1980/1981 to 1988/1989 and three sites in the Beqa'a valley (AREC American University of Beirut Farm, and Terbol and Kfardan Stations of ICARDA) show an average seed yield of 1501 kg/ha for Talia 2 compared to 1191 kg/ha for Lebanese local giving a yield advantage of 26% (**Table 1**). In a large-scale test carried out in the 1988/1989 season by the Agricultural Research Institute (ARI), Talia 2 yielded 777 kg/ha in contrast to Lebanese local which yielded 241 kg/ha.

Talia 2 flowers and matures earlier than Lebanese local and is less tall (**Table 2**). Its seed coat colour is mid-brown without any pattern. The average seed weight of Talia 2 is 2.76 g/100 seeds compared to 3.30 g/100 seeds for Lebanese local. The protein contents of Talia 2 and Lebanese local are 28.8 and 28.5%, respectively. The cooking times for Talia 2 and Lebanese Local are 35 and 25 mins, respectively. The methods used to measure cooking time and protein content are given in Erskine *et al.* (1985).

Talia 2 originates from a single plant selection, 78S 260013 made in 1978 at ICARDA, Aleppo from a germplasm accession ILL 16 collected at Salt in Jordan in 1972 by the Arid Lands Agricultural Development Program, Lebanon.

Table 1 Seed yield (kg/ha) of Talia 2 and Lebanese local lentil in Lebanon from 1990 to 1989

		Cultivar		
Season	Location	Talia 2	Lebanese local	LSD (5%)
1980/81	AREC	1844	1320	831
1980/81	Kfardan	992	896	453
1980/81	Terbol	1463	1108	825
1981/82	Kfardan	530	577	279
1981/82	Terbol	2352	1785	469
1982/83	Terbol	2298	1796	414
1983/84	Terbol	1622	1267	310
1984/85	AREC	257	761	300
1984/85	Terbol	1979	1500	237
1987/88	Terbol	1239	1153	228
1987/88	ARI	2600	2000	
1988/89	Terbol	1565	1074	270
1988/89	ARI	777	241	
Mean		1501	1191	
% advantage		26		

Table 2 The mean and standard error (in parentheses) of key traits of Talia 2 and Lebanese local over different numbers of trials

Trait	Talia 2	Lebanese local	Number of locations
Time to flower (days)	143 (±4.1)	147 (±4.4)	8
Time to maturity (days)	188 (±3.2)	193 (±3.5)	7
Plant height (cm)	33 (± 2.8)	36 (± 2.5)	8
100 seed weight (g/100 seeds)	2.76 (±0.34)	3.30 (±0.16)	2
Protein content (%)	28.8	28.5	1
Cooking time (min)	35 (± 0)	25 (± 5.0)	2

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تاليا 2 – صنف عدس مُعتَمَد في لبنان

ملخص

يقدم هذا المقال وصفا لصنف العدس الجديد تاليا – 2 المعتَمَد في لبنان. وضمن تجارب نفذت في وادي البقاع خلال المواسم 1980 – 1990 أعطى ذلك الصنف متوسط غلة بذرية 1501 كغ/هكتار مقابل 1191 كغ/هكتار أعطاها الصنف اللبناني المحلي. إضافة إلى أن ذلك الصنف أكثر باكورية، وأقصر طولا، وغلاف بذرته بني متوسط، ووزن حبته بالمتوسط 2.76 غ/100 حبة. أما المحتوى البروتيني فهو 28.8، وزمن الطهي 35 دقيقة.

إلى العلماء العرب الكرام

تعلمون أن إدراج اللغة العربية ضمن هذه النشرة كان أحد أهم أهداف مشروع "لنس"، الذي كان يدعمه مركز بحوث التنمية الدولية IDRC . وبمزيد من السرور تعلن أسرة تحرير "لنس " عن وصول بعض الأوراق العلمية المكتوبة باللغة العربية . والتي أخذت تظهر على صفحات هذه النشرة بدءا من المجلد 14 . لذا يرجى من الباحثين العرب، العاملين في مجال تحسين محصول العدس، الراغبين في نشر بحوثهم باللغة العربية إرسالها إلى العنوان التالي :

نشرة "لنس "
قسم التوثيق
ايكاردا
ص.ب. 5466، حلب، سورية .

Effect of lentil residue management on the productivity and NPK removal by lentil-rice double cropping

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Abstract

A field experiment conducted at the Indian Agricultural Research Institute, New Delhi for two years showed that rice grain yield was 0.3-0.5 t/ha more when grown after lentil than after fallow. Incorporation of lentil residues in soil resulted in a removal of 46-89 kg/ha of the primary nutrients (15-36 kg N, 25-10 kg P_2O_5, and 28.5-43 kg k_2O) less than by lentil-rice double cropping. Incorporation of lentil residues is thus recommended as a soil recuperative practice.

Introduction

'Wheat-rice' is the most prevalent double cropping system in North-western India, producing about 10-14 t/ha of grain. However, this cereal-cereal double cropping system is fairly exhaustive and removes 400-500 kg/ha/yr of NPK (Sharma and Prasad 1980). Nutrient removal by this double cropping system far exceeds the applied doses of primary nutrients and the continuous depletion of soil fertility decreases crop yields. Lentil, a highly profitable crop is suggested as an alternative crop to wheat for maintaining soil fertility (George and Prasad 1989). John *et al.* (1989) reported that cowpea residue (grain harvested and straw incorporated in soil) gave higher grain and straw yield and N uptake by rice than fallow. The present investigation was made to study the effect of lentil residue management in the productivity and NPK removal by rice-lentil double cropping.

Materials and Methods

A field experiment was conducted during the 1983-85 seasons at the Indian Agricultural Research Institute, New Delhi. The soil of the field was sandy clay loam of pH 7.5 (1:2.5 soil to water). It was low in total N (0.063%) and available P (17.5 ppm).

Lentil was grown during winter (November - April) and rice during the following rainy season (July - October). There were 3 treatments. 1. fallow, 2. lentil (grain and residue (straw) removed and only root residue remained), and 3. lentil (grain) removed, residue (straw) incorporated in the soil one week after lentil harvest. (These plots needed light irrigation to incorporate lentil residue in the soil). No cultivation was done in May and June. Land was prepared by ploughing, flooding, and puddling in July and rice was transplanted.

Lentil variety Pant L-4 was sown in the third/fourth week of November and harvested in the last week of April. Lentil as well as fallow plots received 13 kg P/ha as ordinary super phosphate.

Rice variety Pusa 169 was transplanted in the first week of July and harvested in the last week of October. All plots received 60 kg/ha as urea, 22 kg P/ha as ordinary superphosphate, 42 kg K/ha as muriate of potash, and 20 kg zinc sulphate/ha.

Grain and straw yield of lentil and rice were recorded and samples were drawn for total N, P, and K analysed by the procedures described by Prasad (1982), NPK uptake by the crop was calculated by multiplying the grain and straw yields with their respective NPK contents and summing them.

Results and Discussion

Lentil grain yield was about 1.1 t/ha in the 1983/84 season and 1.9 t/ha in 1984/85 season (**Table 1**). Lentil straw yield was about 2.7 to 3 more than that of grain. The total biomass yield of lentil was 3.8 t/ha in the 1983/84 season and 7.5 t/ha in the 1984/85 season. Lower grain and straw yield of lentil in the 1983/84 season was due to lentil introduction for the first time to that field. In the second year, lentil *Rhizobia*, present in the soil, gave better nodulation, plant growth, and yield. Rice grain and straw yield was similar in the two years of study and the total biomass yield

Table 1 Grain and straw yield of lentil and succeeding rice as influenced by lentil residue management

Residue management	Lentil (t/ha)			Rice (t/ha)			Lentil+ rice
	Grain	Straw	Total	Grain	Straw	Total	(grain t/ha)
				1983/84			
Fallow (no-residue-rice)	-	-	-	4.6	5.2	9.8	4.6
Lentil (residue removed)-rice	1.1	2.7	3.8	4.8	5.6	10.4	5.9
Lentil (residue* incorporated)-rice	1.1	-	1.1	4.9	6.1	11.0	6.0
SEm ±	0.08	-	-	0.07	0.05	-	-
LSD 0.05	NS	-	-	0.24	0.16	-	-
				1984/85			
Fallow (non residue)-rice	-	-	-	3.9	6.0	9.9	3.9
Lentil (residue removed)-rice	1.9	5.6	7.5	4.2	6.5	10.7	6.1
Lentil (residue incorporated)-rice	1.8	-	1.8	4.3	6.7	11.0	6.1
SEm ±	0.04	-	-	0.05	0.12	-	-
LSD 0.05	NS	-	-	0.17	0.42	-	-

* Straw yield was recorded and samples taken for NPK analysis before incorporation in soil

was 9-11 t/ha. In the first year of the study (1983/84) grain yield of rice was significantly more when lentil straw was incorporated in soil. However, in the second year of the study (1984/85), lentil root residues alone significantly increased the grain yield of the succeeding rice crop. There was a further increase when lentil residue was incorporated, but it just missed reaching the level of significance at 5%.

Straw yield of rice grown after lentil was also significantly more than after fallow in both years. Lentil root residues alone significantly increased the straw yield of rice as compared to fallow. Incorporation of lentil residues produced significantly more rice straw than root residues only in the 1983/84 season.

The total productivity (grain yield) of lentil-rice double cropping was about 6 t/ha as compared to 3.9 to 4.6 t/ha for fallow-rice.

Removal of Nitrogen

Nitrogen, removed by lentil was 67.9 kg/ha in the 1983/84 season and 109.2 kg/ha in the 1984/85 season (**Table 2**). The variation in the quantity of N removed by lentil in the two seasons was due to large variation in the grain and straw yield in the two seasons. Grain accounted for about 58 to 65% of the total N removed by lentil crop. Thus incorporation of lentil residue resulted in a return of 35 to 42% of the total N removed by the lentil crop to soil.

Nitrogen removed by rice was significantly more (6-10 kg/ha) with rice grown after lentil than rice grown after fallow. Incorporation of lentil residue further increased the N removal by rice about 13-25 kg/ha more as compared to fallow.

Incorporation of lentil residues in soil gave higher productivity of the lentil-rice cropping system and higher N removal by lentil, but it resulted in 15.2 to 36.0 kg/ha less removal of N from soil as compared to treatment where lentil residues were removed.

Removal of Phosphorus

Phosphorus removal by lentil was about 9 kg/ha during the 1983/84 season, while it was 19 kg/ha in the 1984/85 season (**Table 3**). The variation in the quantity of P removal by lentil in the two seasons was due to a large variation in the grain and straw yield in the two seasons. In both seasons, the grain accounted for about half of the P removal by lentil crop. Thus incorporation of lentil residue resulted in a return of about half of total P removed by the lentil crop to soil.

Phosphorus removed by the rice crop was significantly more (3.6 kg/ha) when grown after lentil than after fallow in the 1983/84 season. Incorporation of lentil residues further increased the P removal by the rice crop, about 5.9 kg/ha more as compared to fallow.

Incorporation of lentil residues gave higher productivity of lentil-rice cropping system and higher P removal by rice, but it resulted in 2.4 to 10.4 kg/ha less removal of P from soil as compared to the treatment where lentil residues were removed.

Table 2 Nitrogen removal by lentil-rice double cropping as influenced by lentil residue management

Residue	Lentil (kg/ha)			Rice (kg/ha)			Lentil + rice (kg/ha)
	Grain	Straw	Total	Grain	Straw	Total	
1983/84							
Fallow (no residue)-rice	-	-	-	52.5	23.3	75.8	75.8
Lentil (residue removed)-rice	39.6	28.3	67.9	59.4	26.2	85.6	153.5
Lentil (residue incorporated)-rice	38.2	-	38.2	69.5	30.6	100.1	138.3
SEm ±	2.90	-	-	0.92	0.67	1.43	-
LSD 0.05	NS	-	-	3.19	2.32	4.96	-
1984/85							
Fallow (no residue)-rice	-	-	-	49.4	30.9	80.3	80.3
Lentil (residue removed)-rice	71.1	38.1	109.2	51.9	34.6	86.5	195.7
Lentil (residue-incorporated)-rice	66.3	-	66.3	57.8	35.6	93.4	159.7
SEm ±	1.80	-	-	1.22	0.74	1.35	-
LSD 0.05	NS	-	-	4.23	2.55	4.67	-

Table 3 Phosphorus removal by lentil-rice double cropping as influenced by lentil residue management

Residue	Lentil (kg/ha)			Rice (kg/ha)			Lentil + rice total (kg/ha)
	Grain	Straw	Total	Grain	Straw	Total	
1983/84							
Fallow (no residue)-rice	-	-	-	10.3	5.1	15.4	15.4
Lentil (residue removed)-rice	4.1	4.5	8.6	12.5	6.5	19.0	27.6
Lentil (residue incorporated)-rice	3.9	-	3.9	14.0	7.3	21.3	25.2
SEm ±	0.30	-	-	0.12	0.16	0.20	-
LSD 0.05	NS	-	-	0.43	0.57	0.70	-
1984/85							
Fallow (no residue)-rice	-	-	-	7.2	3.7	10.9	10.9
Lentil (residue removed)-rice	8.8	10.4	19.2	7.5	3.6	11.1	30.3
Lentil (residue incorporated)-rice	8.2	-	8.2	7.8	3.9	11.7	19.9
SEm	0.22	-	-	0.14	0.18	0.18	-
LSD 0.05	NS	-	-	0.49	NS	NS	-

Removal of Potassium

Potassium removal by lentil was 42.6 kg/ha in the 1983/84 season and 55.0 kg/ha in the 1984/85 season (**Table 4**). The variation in the quantity of K removal by lentil in the two seasons was due to a large variation in the productivity in the two seasons. Grain accounted for about 82 to 84% of the total K removal by the lentil crop. Thus, incorporation of lentil residues resulted in a return of 16 to 18% of the total K removed by the lentil crop to the soil.

Potassium removal by the rice crop grown after lentil was more (4.4 to 7.4 kg/ha) as compared to that after fallow. Incorporation of lentil residues further increased the K removal by the rice crop, 10.7 to 12.1 kg/ha more as compared to fallow.

Incorporation of lentil residues gave higher productivity of lentil-rice cropping system and higher removal of K by rice, but it resulted in 28.5 to 429 kg/ha less removal of K from soil as compared to the treatment where lentil residues were removed.

Table 4 Potassium removal by lentil-rice double cropping as influenced by lentil residue management

Residue	Lentil (kg/ha) Grain	Straw	Total	Rice (kg/ha) Grain	Straw	Total	Lentil + rice (kg/ha)
			1983/84				
Fallow (no residue)-rice	-	-	-	13.8	45.4	59.2	59.2
Lentil (residue removed)-rice	6.7	35.9	42.6	13.9	49.7	63.5	106.2
Lentil (residue incorporated)-rice	6.4	-	6.4	14.2	57.1	71.3	77.7
SEm ±	0.36	-	-	0.28	1.78	1.90	-
LSD 0.05	NS	-	-	NS	6.15	6.57	-
			1984/85				
Fallow (no residue)-rice	-	-	-	7.8	89.1	96.9	96.9
Lentil (residue removed)-rice	9.5	45.5	55.0	7.7	96.6	104.3	159.3
Lentil (residue incorporation)-rice	8.8	-	8.8	7.8	99.8	107.6	116.4
SEm ±	0.25	-	-	0.55	2.74	2.85	-
LSD 0.05	NS	-	-	1.91	9.48	NS	-

Table 5 NPK removal by lentil-rice double cropping as influenced by lentil residue management

Residue	Lentil (kg/ha) Grain	Straw	Total	Rice (kg/ha) Grain	Straw	Total	Lentil + rice total (kg/ha)
			1983/84				
Fallow (no residue)-rice	-	-	-	76.6	73.8	150.5	150.5
Lentil (residue removed)-rice	50.4	68.7	119.1	85.8	82.5	168.2	287.3
Lentil (residue incorporation)-rice	48.5	-	48.5	97.7	95.0	192.7	241.2
			1984/85				
Fallow (no residue)-rice	-	-	-	64.4	123.7	188.3	188.3
Lentil (residue removed)-rice	89.4	94.0	183.4	67.1	134.8	201.9	385.3
Lentil (residue incorporated)-rice	83.3	-	83.3	73.4	139.3	212.7	296.0

Removal of total primary nutrients (NPK)

Removal of the total primary nutrients (NPK) by lentil crop was 119.1 kg/ha in the 1983/84 season and 183.4 kg/ha in the 1984/85 season (**Table 5**). The variation in the quantity of these elements removed by lentil in the two years was due to a large variation in the productivity in the two years. Grain accounted for about 50 to 60% of the total of NPK removed by the lentil crop. Thus, incorporation of lentil residues resulted in a return of 40 to 50% of the total NPK removed by lentil to soil.

The removal of NPK by rice crop when grown after lentil was more (13.6 to 17.7 kg/ha) than grown after fallow. Incorporation of lentil residues further increased the removal of primary elements by rice crop; 24.4 to 42.2 kg/ha more as compared to fallow.

Incorporation of lentil residues gave higher productivity of lentil-rice cropping system and higher NPK removal by rice, but it resulted in 46.1 to 89.3 kg/ha less removal of primary nutrients from soil as compared to the treatments where lentil residues were removed.

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تأثير إدارة حصيد العدس في الإنتاجية وإزالة NPK بالزراعة المزدوجة عدس – أرز

ملخص

أظهرت تجربة حقلية، نُفذت على مدى سنتين لدى معهد البحوث الزراعية الهندي في نيودلهي، أن الغلة الحبية للأرز كانت تزيد على 0.3 – 0.5 طن/هكتار إذا ما زرع بعد عدس مما بعد بور. وأدى قلبُ حصيد (بقايا محصول) العدس في التربة إلى إزالة 46 – 89 كغ/هكتار من العناصر الغذائية الرئيسية (15 – 36 كغ N، 10 – 25 كغ P_2O_5، و 28.5 – 43 كغ K_2O)، وهي أقل مما تسببه الزراعة المزدوجة عدس – أرز. لذا يوصى بقلب حصيد العدس كممارسة زراعية لتعويض ما تخسره التربة.

Effect of sowing date and row spacing on the yield of lentil varieties

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Abstract

The response of the lentil varieties (JLS-1 and Sehore 74-5) to sowing date on 15 and 30 Oct and 15 and 30 Nov and the three row spacings 15, 22.5, and 30 cm was studied in Central India during the 1982-84 seasons. Sowing lentil on 15 Oct was most advantageous. Delay in sowing time beyond 30 Oct decreased grain yield significantly. Sehore 74-3, a bold seeded cultivar, out-yielded the standard variety JLS-1 in both seasons. There was no significant variation in grain yield due to row spacing.

Introduction

Lentil, (*Lens culinaris* Medik.) is an important pulse crop in India. It is grown on an area of 288.2 thousand hectares with an annual production of 126.3 metric tonnes in Madhya Pradesh (MPDA 1984). The average yield 438 kg/ha is, however, low. The adoption of improved production technology coupled with suitable sowing time, row spacing, and high yielding varieties can improve the productivity substantially. The present investigation was an attempt to study the response of lentil varieties to different sowing dates and row spacings.

Materials and Methods

A field study was conducted at the Research Farm of J.N. Krishi Vishwa Vidyalaya, Campus- Rafi Ahmed Kidwai College of Agriculture, Sehore (M.P.) for the two winter seasons of 1982-84. The treatments consisted of different combinations of four sowing dates (15 and 30 Oct and 15 and 30 Nov), three row spacings (15, 22.5, and 30 cm), and two varieties (JLS-1 and Sehore 74-3). The treatments were replicated four times in a split plot design with sowing date in the main plots and combinations of row spacings and varieties in sub plots. The net sub plot was 3.6 x 5.0 m^2. The trial was sown on clay loam soil with an average of 215.0, 7.6, and 335.4 kg/ha of available N, P_2O_5, and K_2O, respectively with pH of 7.30. A uniform seed rate of 30 kg/ha was applied for each plot. A basal dose of 100 kg/ha of di-ammonium phosphate (DAP) was given to each plot at the time of sowing. A pre-sowing irrigation was given to ensure good germination. One more irrigation (75 mm water) was given 45 days after sowing before flowering.

Total rainfalls of 95.8 and 100 mm were recorded during October - March in the 1982/83 and 1983/84 seasons, respectively.

Results and Discussion

Sowing date: Sowing date in the 1982/83 season had a significant influence on grain yield and yield components (**Table**). Lentil sown on 15 Oct on an average recorded a significant increase of 82.6 and 158.0% in grain yield as compared to the respective sowing times of 15 and 30 Nov. This sowing date 15 Oct also recorded 13% higher grain yield than sowing on 30 Oct.

During the second 1983/84 season however, the first two sowing dates were at par. Sowing on 30 Oct, on the basis of the two year average, produced 61.7 and 128.4% higher grain yield than 15 and 30 Nov, respectively. The increase in grain yield was mainly due to an increase in the various yield attributing parameters like the number of branches/plant, number of pods/plant and number of grains/plant, and 1000-seed weight. The early sown crop had favourable weather conditions early in the season, namely temperature, conducive to good germination, and crop development resulting in higher values of yield attributes and grain yield. The late sown crops suffered due to low temperatures early in the season and high temperature and hot winds later in the season at pod formation and grain development stages.

These results corroborate the findings of Shrivastava (1979), Ahlawat *et al.* (1982), and Duiwedi *et al.* (1987).

Row spacing: The influence of row spacing on grain yield and yield components (pooled), except for the number of grains/plant, was not significant (**Table**). Similar findings were also reported by Shrivastava (1979) and Singh and Ram (1986).

Variety: The varietal effect on grain yield was significant. Variety Sehore 74-3 yielded 24.2% more grain yield than JLS-1 on average. Variety Sehore 74-3 also produced a higher number of branches, number of pods, and number of grains/plant and thousand grain weight than JLS-1.

The interactions were not significant for grain yield and yield components.

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تأثير موعد الزراعة والمسافة بين السطور في غلة أصناف من العدس

ملخص

خلال الفترة من 1982 – 1984 دُرِست في وسط الهند استجابة صنفي العدس (JLS-1 و Sehore 74-5) لمواعيد الزراعة: 15 و 30 ت1/اكتوبر و 15 و30 ت2/نوفمبر، ولثلاث مسافات بين السطور: 15 و 22.5 و 30 سم. وقد كانت زراعة العدس في 15 ت1/اكتوبر الأكثر نجاحا، وأدى تأخيرها إلى ما بعد 30 ت1 إلى تدني الغلة الحبية بدرجة معنوية. وقد تفوّق الصنف Sehore 74-5، الكبير الحبة، على الصنف القياسي JLS-1 في كلا الموسمين. ولم يظهر فرق معنوي في الغلة الحبية يعود إلى المسافة بين السطور.

Table Effect of sowing dates and row spacings on grain yield and yield components (pooled data of two years) of lentil varieties

Treatment	Grain yield (kg/ha) 1982/83	1983/84	Mean	Number of branches/ plant	Number of pods/ plant	Number of grains/ plant	1000-seed weight (g)
Sowing date							
15 Oct	1564	1248	1406	4.70	45.53	57.82	33.01
30 Oct	1320	1170	1245	4.60	43.37	53.57	32.46
15 Nov	717	822	770	4.48	42.00	51.24	31.35
30 Nov	464	625	545	4.37	36.35	42.89	30.80
S.Em. ±	72	75	52	0.11	0.91	1.11	0.25
L.S.D. at 5%	230	239	153	0.31	2.68	3.28	0.74
Row spacing (cm)							
15.0	964	888	926	4.38	39.05	46.90	31.40
22.5	983	1002	993	4.61	42.36	52.45	32.40
30.0	1101	1008	1055	4.62	44.03	54.80	32.20
S.Em. ±	58	68	44	0.09	1.72	2.52	0.30
L.S.D. at 5%	-	-	-	-	-	6.98	-
Variety							
JLS-1	914	854	884	4.26	37.30	45.38	30.02
Sehore 74-3	1118	1078	1098	4.82	46.32	57.38	33.80
S.Em. ±	47	55	36	0.06	1.15	1.68	0.20
L.S.D. at 5%	133	156	100	0.17	3.19	4.65	0.56

Lentil weeds in Rampur, Chitwan Valley, Nepal

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Abstract

The weeds associated with lentil in the Chitwan Valley of Nepal are reported. Information on occurrence and dominance of weeds of lentil at the Agronomy Farm in Rampur, Chitwan Valley is given.

Introduction

Lentil (*Lens culinaris* Med.) is the most important grain legume of Nepal. The average total area sown to this crop was 114,333 ha with an average yield of 0.574 t/ha in the 1986-88 seasons (DFAMS 1988). The crop is highly infested with different kinds of winter weeds, thus the grain yield is decreased upto 72% due to weed competition (Chaudhary and Singh 1987). Ranjit and Bhattarai (1988) reported that the broad leaved weed species dominated weed composition and population in lentil fields in hilly and terai regions of Nepal. However, weeds associated with lentil in the Chitwan Valley of Nepal were not reported so far. Therefore, this study was undertaken to obtain information on the occurrence and dominance of weeds of lentil at the Agronomy Farm in Rampur, Chitwan Valley, Nepal.

Materials and Methods

In February 1989, a weed survey was made in the lentil field at the Agronomy Farm of the Institute of Agriculture and Animal Science (IAAS), Rampur (224 m MSL). The area under study is situated in the Chitwan Dun Valley (27°30' - 27°45'N latitude and 84° - 85°E longitude) in Nepal. The climate is hot, humid, and sub-tropical. The one square meter quadrat was used to count weeds and crop plants. Twenty temporary sampling quadrats were taken randomly at the flowering stage of the crop. Frequency percentage, abundancy, density, their relative values, and importance value indices (IVI) were calculated as per Ambashtha (1984) and Curtis and Cottam (1962). Other weed species outside the sampling units were also collected to record all weed species associated with the crop.

Results and Discussion

Twenty-seven angiosperm weed species were identified from the survey area (**Table**). These species represented 23 genera and 15 families. Of the total number of the species recorded, the Leguminosae, Compositae, Polygonaceae, and Gramineae made up 18.5%, 14.8%, 14.8%, and 11.1%, respectively. These accounted for 59% of all species. The remaining families were represented by a single species. The monocot species were few in number. All the weeds recorded except *Cynodon dactylon* (L.) Pers. were annuals. Of the total species, 22 were recorded from the quadrats. The average density of the lentil plants was 52.7/m^2. However, the average density of weeds was recorded as 201 plants/m^2.

Frequency

There were 6 species which were found at a frequency level of 76-100% amongst quadrats. The weeds with 100% frequency comprised of *Vicia sativa* L., *Polygonum plebejum* R. Br., *Chenopodium album* L. among the dicots and *Cynodon dactylon* (L.) Pers. and *Digitaria adscendens* (HBK) Henr. among the monocot species. There were only 7 weeds at a frequency level of 26-75%. The other species were recorded at frequency levels below 21%.

Abundance

The above five species with 100% frequency value, *Ageratum houstonianum* Mill. with 60% frequency value, and *Eleusine indica* (L.) Gaertn. with 75% frequency value had more than 14 abundance value. The rest species had less than 14 abundance value.

Density

The density values presented in Table reveal that *Vicia sativa, Chenopodium album,* and *Cynodon dactylon* were recorded as 38.0, 36.5, and 28.5 plants/m^2, respectively. Rajbhandary (1988) also reported the dominance of *Vicia sativa* in lentil in Nepal. The weeds with 10-15 plants/m^2 comprised *Ageratum houstonianum, Polygonum plebejum,* and *Eleusine indica*. The other species were found at less than one density value.

Table Scientific names, importance value index (IVI), frequency (%F), abundance (A), and density (D) of weed species recorded from lentil fields of the IAAS Agronomy Farm, Rampur, Chitwan, Nepal 1989.

Scientific name	IVI	%F	A	D
Cynodon dactylon (L.) Pers.	43.6	100	38.0	38.0
Vicia sativa L.*	42.3	100	36.5	36.5
Chenopodium album L.*	38.3	100	32.5	32.1
Digitaria adscendens (HBK) Henr.	35.1	100	28.5	28.5
Polygonum plebejum R. Br.	22.8	100	14.8	14.8
Ageratum houstonianum Mill.	21.8	60	23.0	13.8
Eleusine indica (L.) Gaertn.	20.6	75	17.4	13.1
Polygonum lanigerum R. Br.	16.0	60	13.3	8.0
Heliotropium ovalifolium Forsk.	12.6	85	5.5	4.7
Polygonum barbatum L.	10.5	55	7.8	4.3
Polycarpon prostratum (Forsk.)Asch. & Sch.	7.6	35	7.4	2.6
Vicia tetraspermum Moench.	6.9	50	3.3	1.7
Vicia hirsuta (L.) S.F. Gray*	5.5	35	3.9	1.4
Oxalis corniculata L.	4.1	20	4.5	0.9
Gnaphalium purpureum L.	2.8	20	1.8	0.4
Anagallis arvensis L.*	2.3	10	3.0	0.3
Fumaria parviflora Lam.	1.9	15	1.0	0.2
Wahlenburgia marginata (Thunb.) DC	1.7	5	3.0	0.2
Alternanthera sessilis (L.) DC	1.6	10	1.5	0.2
Medicago lupulina L.	0.9	5	1.0	0.1
Solanum nigrum L.	0.9	5	1.0	0.1
Lathyrus aphaca L.	0.9	5	1.0	0.1
Launaea aspleniifolia (L.) DC.	-	-	-	-
Lactuca polysephala Benth	-	-	-	-
Mazus pumilus (Burm. f.) Steen.	-	-	-	-
Potentilla supina L.	-	-	-	-
Rumex dentatus L.	-	-	-	-

* also reported by Ranjit and Bhattarai (1988) as common lentil weeds-species present in the fields, but ecological data not assigned.

Importance Value Index (IVI)

The four species of weeds with more than 27 IVI were Cynodon dactylon, *Vicia sativa, Chenopodium album,* and *Digitaria adscendens.* These species contributed 67.1% to the total weed population. Of these, *Digitaria adscendens* was found in vegetative stage at the time of the survey. In addition to these four species, the other three weeds namely *Polygonum plebejum, Ageratum houstonianum,* and *Eleusine indica* had indices more than 20. The weeds with less than 2 IVI value comprised six species namely *Fumaria parviflora* Lam., *Wahlenburgia marginata* (Thunb.) DC., *Alternanthera sessilis* (L.) DC., *Medicago lupulina* L., *Solanum nigrum* L., and *Lathyrus aphaca* L.

The weeds covered in the present study and earlier report of Ranjit and Bhattarai (1988) were *Chenopodium album*, *Anagallis arvensis* L., *Vicia hirsuta* (L.) S. F. Gray, and *Vicia sativa.* But the species *Capsella bursa-pastoris* (L.) Medik., *Spergula arvensis* L., *Sienebiera pinnatifida, Alopecurus pratensis* L., and *Phalaris minor* Retz. reported in the previous study were not found in the present study. The 18 weeds of the present study are additional plant pests associated with lentil crop in Nepal. Chaudhary and Singh (1987) reported the abundance of *Chenopodium album* and *Vicia sativa* along with *Melilotus indica* (L.) All., *Anagallis arvensis,* and *Phalaris minor* in Indian lentil fields. Of these, *Melilotus indica* and *Phalaris minor* were not found in the present study.

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أعشاب العدس في رامبور بوادي شيتاوان في نيبال

ملخص

تهتم هذه الورقة بالأعشاب التي تنمو في حقول العدس بوادي شيتاوان في نيبال، وتزوِّد بمعلومات عن أعشاب العدس وتفشيها في مزرعة البحوث الواقعة في ذلك الوادي.

Lentil production in highland Balochistan, Pakistan: Current status

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Abstract

The production of lentil in the Balochistan highlands of Pakistan is currently largely subsistence in character. The productivity, both per farmer and throughout the area is low. Consumption in both rural and urban areas is, however, widespread and sustained. Urban consumption is reliant upon imported material. Very small seed size and lack of cleanliness in the marketing of the local landrace are important factors in the current low level of local productivity. The scope for increasing production through adapted larger-seeded varieties and improved agronomy seems large at present.

Introduction

The Indo-Pakistan sub-continent is an important lentil growing area. In the period 1975-85, Pakistan had a total area of 75,900 ha annually under lentils, constituting 4.9% of the total area under pulses in the country. This produced 30,700 t with an average yield of 393 kg/ha. Seventy five percent of this production was from the Punjab while the remainder was from the Sind and North-West Frontier Province. However, the area officially under lentil in Balochistan was almost negligible being less than 200 ha (Government of Pakistan 1988). Lentil, being a suitable legume species for cultivation under the Mediterranean conditions could be more widely and intensively grown in the Balochistan highlands, where the climate is also Mediterranean, albeit of a severe continental type. In addition, lentils could become a much more important source of dietary protein, since their relative price is only about one fifth of that of red meat (GOP 1988).

A formal survey was conducted in November 1988 in the southern, central, and northern areas of highland Balochistan. On the basis of previous informal surveys and data gathering, it had been determined that a sample size of 77 farmers including 23 from Khuzdar district (region 1), 31 from Kalat, Kachhi, Quetta, and Pishin districts (region 2) and 23 from Loralai and Zhob districts (region 3) would be a sufficient and adequately representative sample. Within the three selected regions of highland Balochistan, villages as well as farmers were selected for questioning at random with the initial provision that they were currently lentil producers.

The survey was made as a first step to collect information to:

(a) The present status of the lentil crop, its area, production, and yields in highland Balochistan,

(b) The reasons why so few farmers grow lentils, and

(c) The opportunities for future increases in the area and production intensity of lentils in highland Balochistan.

Characteristics of lentil farmers

The lentil producers interviewed were in general both larger than average land owners with 27 ha and animal owners (39 sheep and goats). However, the total land area under lentil was less than 0.5 ha per respondent per year with yields averaging between 300-425 kg/ha in the last three years, which was sufficient only for their own domestic consumption needs. More than 80% of all farmers were operating a mixed dryland crop/livestock enterprise which was reliant solely on family labour. Threshing operations in Balochistan are usually done by human and animal labour and thus constitute a major input to farming operations especially for cereals. Sixty-eight percent of the farmers felt that lentil required 75% less labour than was needed for wheat and thus increased competition for labour would not be a constraint to greater lentil production.

Ninety percent of the farmers presently growing lentil indicated that their families were growing the crop at the time of the establishment of Pakistan in 1947 and that there has been little change in the hectarage since then. As the population of Balochistan has increased at least fourfold in that time, it is evident that the lentil area is not responsive currently to urban market demand. Answering the question why they do not grow more lentils, half the farmers indicated that the lack of demand and low prices for the crop were the main reasons for their unwillingness to grow more lentils. The second most important reason cited was that of preferring wheat over lentil and other crops due to concerns for domestic food security.

A large majority of farmers considered that lentils needed better quality land than wheat. The predominant cropping sequence was continuous monoculture on individual fields; the farmers perceive this system to be beneficial as they believe that yields of all crops are higher if each crop is sown in the same field as the year before. This suggests that soil borne diseases are not a major problem and also possibly that inoculation by native Rhizobia may be of importance.

Yields are low (<350 kg/ha), which suggests that a potential for an increase exists. The farmers were asked about the main problems they experienced when growing lentils. Insects are a major concern for farmers. It was not possible to ascertain definitely from the farmers which insects were involved, but from their descriptions the likelihood is that aphids and army worms are the major contributors to yield losses.

Lentil consumption and disposal

The farmers were asked to detail the various ways they use their lentil grain and straw (**Table**).

It is evident from the data presented in the table that only 10% of lentil production is available for sale outside of domestic uses. Furthermore, the suggestion that only 6% of the crop is used for next year's seeds implies, using average yields, that seed rates may be as low as 25 kg/ha. This could be a major factor in the low yield levels obtained.

Despite the very small area under currently lentils in highland Balochistan, consumption, in contrast, is widespread and sustained. Boiled lentil grains are used separately, or with bread, as curries, and soups are also now becoming popular among segments of society. As part of the lentil survey, households were asked how much and how often they ate lentils. More than 80% of the families were eating lentil at least 1-3 times a week. If it is assumed that an average household is growing less than 0.75 ha of lentil with an average yield of 300 kg/ha, then consumption per household will be approximately 4.3 kg/week which implies that with 10 consuming members per household (Nagy and Sabir 1987) each consumer is getting somewhat less than 150 gm per lentil meal. This is not a large intake and suggests that there is a scope, and perhaps a need, for a greater home consumption.

The farmer households were also asked about their personal preference between small-seeded and large-seeded lentils. The local landrace has a very small grain size (14.5 gm/1000 whole seeds) whereas "imported" lentils have larger seed size, such as those from Sind (25.2 gm/1000 whole seeds) or the Punjab (27.3 gm/1000 whole seeds). Seventy-five percent of respondents said that they preferred a larger seed size. This could mean that there might not be much increase in the market demand for the local ultra-small seeded lentils, even if local production could be considerably augmented. In contrast, the successful introduction of a large-seeded cultivar adapted to the environmental conditions of highland Balochistan could overcome this lack of consumer interest, and lead to an increased demand (and profitable market) for lentil grown in Balochistan.

Table Lentil consumption and disposal in highland Balochistan

Consumption/disposal	% produce Grain	% produce Straw
Human consumption	70	-
Sale	10	-
Poor/religious tax etc.	10	0
Relatives/friends	4	7
Next year seeds	6	-
Sheep/goats	-	23
Draft animals	-	70

Marketing and prices

Although only one local Balochi variety is produced, there are at least three other varieties that are imported and sold in various town and city markets. The three main imported varieties are Sindhi, Punjabi, and Turkish. A Quetta market survey indicated that most of the province's lentil requirements are met by imported Turkish material (approximately 25 gm/1000 whole seeds). In 1989 the average prices were around 9.5 Rs/kg (de-hulled) with Turkish lentils having a slight premium. Informal consumer surveys have suggested that the predominance of sales of the Turkish material over Punjabi and Sindhi is as a result of their cleanliness.

It is evident that the growth, production, marketing, and consumption of lentils in Balochistan is neither well understood nor documented. This paper attempts to redress this position. Lentils are not a major crop in Balochistan, but potentially could be more important than seems to be the case today. As large increases are forecast in the human population, there is obviously a great need for agronomic research to improve lentil production in Balochistan. Improved seed rates, water harvesting, insect control, and provision of an improved large seeded frost tolerant variety are all possible major interventions. These conclusions largely underpin AZRI's research program which has been ongoing since 1985 and which has the identification of cold tolerant large seeded varieties and improved methods of water harvesting as its principal thrusts. Insect control issues and seed rate considerations will also receive more attention in the future.

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الوضع الحالي لإنتاج العدس في الأراضي المرتفعة ببلوخستان في الباكستان.

ملخص

إن إنتاج العدس في الأراضي المرتفعة من بلوخستان في الباكستان يتصف حاليا بالانخفاض الشديد إلى درجة الكفاف؛ فالإنتاجية متدنية سواء على مستوى المزارع أو المنطقة، ومعدّلات الاستهلاك تتنامى بسرعة في المناطق الريفية والحَضَرية على السواء، ويعتمد الاستهلاك في المدن على الاستيراد. ويعتبَر صغر حجم الحبة الشديد، ووجود أجرام كثيرة في بذار الأصل المحلي المطروح في السوق من العوامل الهامة لتدني مستوى الإنتاج المحلي حاليا. ويبدو أن أفق زيادة الإنتاجية، من خلال تبنّي أصناف متأقلمة كبيرة الحبة ومعاملات زراعية محسّنة، يزداد في الوقت الحاضر.

Assessment of lodging resistance in lentil by a lodging instrument

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Abstract

Lodging was artificially induced in lentil with a lodging instrument. Calibration of the instrument indicated that the best results were obtained from a pressing of 5 cm for 20 - 30 minutes. The use of the instrument allowed calculation of the Bending Index (BI) a reflection of elastic abilities. Although lentil genotypes varied for BI and this parameter was correlated with lodging scores, the association was not strong enough to justify the utilization of the instrument in a breeding program. This method was compared to other proven methods that can induce lodging artificially or predict to a high degree standing ability.

Introduction

Lentil (*Lens culinaris* Medik.) lodges at physiological maturity, but the peak is reached at full maturity. Lodging results in grain and straw losses specially when the crop is harvested by a machine (Erskine and Goodrich 1988). The major goal of the national lentil programs in West Asia and North Africa is to reduce the cost of lentil production by a machine harvest, accordingly studies were conducted at ICARDA to identify sources of standing ability.

In many countries and at ICARDA the incidence of lodging is evaluated using a scale of 1 to 5. As lodging is affected by environmental factors such as soil moisture, it is necessary to develop methods whereby lodging can be induced artificially or predicted closely when environmental conditions are not conducive.

Artificially induced lodging was attempted in many other crops. Laude and Pauli (1965) pinched the culms of cereal plants to the ground. Sisler and Oslon (1951) induced lodging by using a long board to push plants.

At ICARDA, research was conducted to induce lodging artificially. As part of this research, a lodging instrument was developed and this investigation was carried out to calibrate the instrument and to test lentil genotypes.

Materials and Methods

The Instrument

The instrument illustrated in Fig. 1 induces lodging in lentil by pressing a row of plants towards the soil surface. The ability of the plant to spring back to the original height, after release of pressure, is used as an indicator of elasticity. The latter is a function of inherent ability to stand and resist forces inducing lodging. Hence, the pressing force of the instrument simulates the natural forces of wind and rain which cause lodging.

The instrument is anchored, in a levelled position, to the soil by its pointed feet. The pressing rod is adjustable and can be fixed at the desired height by side screws.

Lentil genotypes

ILL 5582 was used in calibration of the instrument. Thirty lentil genotypes were used in testing.

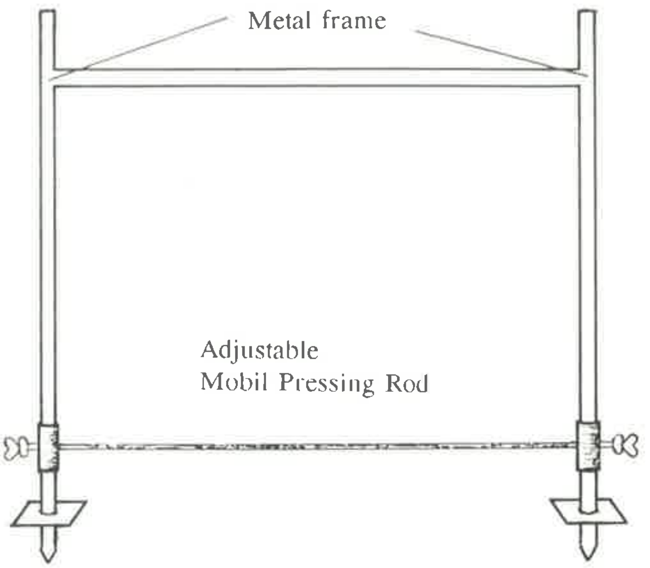

Fig. 1 Lodging insturment

Treatments

Tests were conducted during the years 1987 and 1988 at Tel Hadya, ICARDA main research station at Aleppo to calibrate the instrument for desired height and duration of pressing. A 0.5 m row of lentil plants (200 plants/sq.m) was pressed by the instrument for the following combinations:

Pressing Ht (cm): 5, 8, 10, and 14
Pressing duration (min): 5, 15, 20, and 60

The instrument was used to induce lodging in 30 lentil genotypes at ICARDA main station, Tel Hadya in 1987. The design was RCBD with 3 replications.

Measurements

Canopy height was measured prior to and 24 hrs. after pressing using a styrofoam sheet. From these measurements the Bending Index (BI) was calculated as described by Mera (1987) who measured canopy height before and after natural lodging:

$$BI = H_1/H_2$$

Lodging scores were recorded and correlated with bending indices.

Results and Discussion

Lodging induced by the instrument resulted mostly in stem lodging as the pressing force falls mainly on the stem and branches with less force on the roots. The combination 5 cm pressing height and 20 to 30 minutes duration of pressing resulted in damage to the genotype ILL 5582, a genotype with good standing ability, that was the most close to simulate natural lodging. Hence, this combination was used in the study to induce lodging. The correlation between lodging scores and induced bending index was 0.285, i.e. (r^2 = 0.08) only 8% of variation in lodging score is explained by induced bending index. Although the lodging instrument was designed to induce lodging in all environments, specially dry environments in which less biomass is produced and hence less lodging, the weak correlation between BI and lodging scores would limit the utility of the instrument in a breeding program. Other approaches tested at ICARDA have proven more successful in meeting this objective. Hanati *et al.* (unpublished data) was able to demonstrate that increased soil moisture can be used effectively as a screening technique to induce lodging. Erskine and Goodrich (1988) established stem diameter as a useful criterion in single plant selection for reduced lodging. This latter method is easy to apply, less expensive, and non-destructive.

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تقدير مدى مقاومة العدس للرقاد باستخدام جهاز خاص

ملخص

استُحدِثَ الرقاد اصطناعيا في العدس بواسطة جهاز خاص لذلك. وبمعايرة الجهاز ظهر أنه تمّ الحصول على أفضل النتائج عند ضغط 5 سم لمدة 20 – 30 دقيقة. وقد أتاح ذلك الجهاز حساب دليل الانحناء BI الذي يعكس القدرات المرنة. ومع تباين طرز العدس الوراثية في قيم ذلك الدليل، الذي يرتبط بدرجات الرقاد، فإن الرابطة لم تكن قوية بشكل يكفي تبريرَ استخدام الجهاز في برنامج التربية. وقد قورنت هذه الطريقة بطرائق أخرى مجرّبة، وأثبتت قدرتها على استحداث الرقاد اصطناعيا أو التنبؤ بالقدرة على الإنتصاب إلى درجة عالية.

Developmental and cytological effects of herbicides Prometryne, Trifluralin, and EPTC in lentil

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Abstract

The cytological and developmental effects of the herbicides prometryne Gesagard, trifluralin Treflan and EPTC Eptam were studied in lentil seeds at different concentrations. All herbicides reduced seed germination, seedling growth, and mitotic activity of root-tip cells of lentil and these effects increased as the concentration of all herbicides increased. Trifluralin was most potent in reducing seedling growth and mitotic index, while EPTC showed higher potency in reducing germination percentage and in inducing clastogenic effects which resulted in the formation of different types of aberrations, i.e., C-metaphase, binucleate, tetraploid cells, unequal tripolar anaphase, bridges, lagging, and stickiness of chromosomes.

Introduction

In Egypt, as in many other countries, the large scale application of pesticides has been extended to almost all the fields. These pesticides may be considered as a main source of soil and water pollution in rural areas of Egypt.

The side effects of these chemicals, especially herbicides and their residues on treated crop plants and successive crops, particularly their effects at the cell level, are not clearly known. This fact emphasizes the need for adopting a reliable mutagen testing when these agrochemicals are being applied continously.

Several investigators suggested the study of chromosomal aberrations as a suitable monitoring system to detect mutations caused by various chemicals in higher plants (Wuu and Grant 1967; Tobgy *et al.* 1969; Amer and Farah 1976; Surianni 1978).

This paper investigates the cytological effects of three herbicides namely Prometryne, Trifluralin, and EPTC in root-tip cells of lentil. Prometryne was chosen because it is recommended in Egypt for annual weed control in lentil, Trifluralin is widely used in many field crops and vegetables, and EPTC is recommended for some other crops like onion and potatoes at relatively high rates (9.5 - 14 l/ha) that may lead to the presence of high residue levels. Lentil was also selected as an inexpensive testing system for the mutagenic effects of these herbicides in higher plants.

The effect of these herbicides on germination and seedling growth was also investigated.

Materials and Methods

The effects of the herbicides Prometryne 80% WP (prometryne: 2,4-bis (isopropylamino)-6-(methylthio)-s-triazine), Trifluralin 48% EC (trifluralin: a,a,a-trifluoro-2,6-dinitro-N-N-dipropyl-p-toluidine), and EPTC 72% EC (EPTC: S-ethyl dipropyl thiocarbamate) were monitored on germination, growth, mitotic activity, and chromosomal aberrations in lentil.

The seeds were soaked in fresh aqueous preparation of different concentrations of each herbicide (**Table 1**) for 6 h. at a temperature of 20 + -2°C. The seeds were then thoroughly washed in running water and germinated in petri-dishes. The control samples were soaked in distilled water under the same conditions.

Table 1 Effect of the herbicides Prometryne, Trifluralin, and EPTC on seed germination and seedling growth of lentil

Herbicide concentration (ppm)	Germination (%)	Seedling growth: Shoot length (cm)	Seedling growth: Primary root length (cm)
Control	100.00± 0.00	12.9	7.6
Prometryne			
625	86.67 ± 3.40	9.4	6.4
1250	80.00 ± 4.00	8.7	5.2
2500	73.33 ± 4.42	7.2	4.0
5000 [1]	66.67 ± 4.71	6.0	3.5
Trifluralin			
19.53	96.00 ± 1.96	6.4	3.2
78.13	88.00 ± 3.25	2.5	1.5
312.50	80.00 ± 4.00	1.3	0.9
1250.00 [3]	80.00 ± 4.00	0.7	0.4
EPTC			
3750	86.67 ± 3.47	7.6	3.7
7500	83.33 ± 3.73	5.4	1.8
15000 [2]	33.33 ± 4.71	3.8	0.9

1, 2, 3 = Concentration of two times, one time and half the field rate, respectively

Data were collected on germination, seedling growth, and cytological examination. For the cytological study, the roots which reached 0.5-1.0 cm in length were excised and fixed in 3:1 ethanol: glacial acetic acid for 24 h. The roots were stored in 70% ethanol at 4°C. Five preparations were made and 1% aceto-orceine was used for staining. Hydrolysis in 0.1 N HCl at 70°C for 10 min. was used before staining. The frequency of mitotic activity and mitotic aberration was calculated.

Results and Discussion

Effect on germination and seedling growth

The effect of the three herbicides on the germination is shown in **Table 1**. EPTC was the most potent inhibitor of lentil seed germination, while Trifluralin was the least active one. It was also observed that these compounds decreased seedling growth especially at higher concentrations. Trifluralin was more effective in reducing seedling growth than the other herbicides. Thick roots and stunting of seedlings were also observed in case of treatment with Trifluralin. It was suggested that growth stunting might be an outcome of inhibition of mitosis and/or chromosomal damage with secondary physiological changes (Sparrow *et al.* 1952; and Abd-Alla and El-Keredy 1977).

Cytological observations

Antimitotic effects

The percentage of the different mitotic stages in the root-tips of lentil treated with different concentrations of the tested herbicides are presented in **Table 2**.

The results of Treflan treatments clearly showed that each of the three concentrations 19.53, 78.13, and 312.50 ppm caused a significant gradual reduction in the percentage of different mitotic stages, i.e. prophase, metaphase, anaphase, and telophase compared with the control. At the

Table 2 Rate of mitotic activity in root tips of lentil treated with different concentrations of the herbicides Prometryne, Trifluralin, and EPTC

Herbicide Concentration (ppm)	Interphase No.	Interphase %	Prophase No.	Prophase %	Metaphase No.	Metaphase %	Anaphase No.	Anaphase %	Telophase No.	Telophase %	Mitotic index (%)	Mitotic inhibition (%)
Control	4722	85.7	302	5.5	168	3.1	142	2.6	178	3.2	14.3 ±0.47	-
Prometryne												
625	4310	85.8	286	5.7	160	3.2	96	1.9	172	3.4	14.2 ±0.49	0.70
1250	3060	86.7	205	5.8	104	2.9	62	1.8	99	2.8	13.3 ±0.57	6.99
2500	2880	87.7	190	5.6	92	2.7	54	1.6	82	2.4	12.7 ±0.58*	11.19
5000[1)]	2690	91.0	102	3.5	68	2.3	41	1.4	55	1.9	9.0 ± 0.53**	37.06
Trifluralin												
19.53	2826	90.7	82	2.6	74	2.4	53	1.7	82	2.6	9.3 ± 0.52**	34.97
78.13	3020	92.4	73	2.2	77	2.4	30	0.9	70	2.1	7.6 ± 0.46**	46.85
312.50	1856	95.1	34	1.7	28	1.4	19	1.0	15	0.8	4.9 ± 0.49**	65.73
1250.00[3)]	990	98.8	12	1.2	-	-	-	-	-	-	1.2 ± 0.34**	91.61
EPTC												
3750	4220	86.8	238	4.9	152	3.1	92	1.9	160	3.3	13.2 ± 0.49	7.69
7500	3110	88.5	159	4.5	98	2.8	58	1.7	90	2.6	11.5 ± 0.54**	19.58
15000[2)]	3065	92.6	94	2.8	52	1.6	36	1.1	64	1.9	7.4 ±0.45**	48.25

*, ** Significant at 0.05 and 0.01 level

1), 2), 3): Concentration of two times, one time and half the field rate, respectively highest concentration (1250 ppm), none of these stages was observed. The data also indicated that the percentage of the interphase stage was increased above the control level at all the tested concentrations. The mitotic index (MI) % decreased at all concentrations with its lowest value (1.2%) in the highest concentration used.

Data collected on the herbicide EPTC revealed that the four mitotic stages were also reduced under each concentration used, while the percentage of cells with interphase was increased compared with the control. The mitotic index for each concentration was reduced with increasing the concentration of the herbicide, and reached about half of the control value in the highest concentration applied.

The results of the herbicide Prometryne were similar with that of EPTC except that the last herbicide had a slight effect on mitotic activity.

It may be concluded from the results that all the tested herbicides acted as antimitotic agents. The most potent one was the herbicide Trifluralin. This compound caused complete inhibition of mitosis at the concentration of 1250 ppm. These results are in general agreement with those found by Lignowski and Scott (1972), Reddy and Suberamanyam (1984), Badr (1986), and Badr and Ibrahim (1987).

Spindle disfunction

The tested herbicides the inhibited spindle formation leading to C-metaphase (**Plate 1-a**). C-metaphase cells after restitution are known to give rise to polyploid cells (**Plate 1-b**). Spindle disfunction also lead to the scattering of chromosomes at meta-anaphase, irregular formation of cell plate at ana-telophase, and unequal distribution of chromosomes (**Plate 1-d**). The error of spindle organisation could even lead to split and tripolar spindle (**Plate 1-e**). Sticky telophase cells with laggards (**Plate 1-d**) were also observed.

Inhibition of cytokinesis

The tested herbicides suppressed the cytokinesis leading to the formation of binucleate cells (**Plate 1-f**). Kihlman and Levan (1949) concluded that such a change had led to polyploidy.

Clastogenic effects

Only EPTC induced clastogenic effects such as breaks, fragments, laggards, and bridges (**Plate 1-g**). Clastogenic effects were more pronounced at the highest concentration used (**Table 3**). The results obtained are also in agreement with those found using different herbicides in the root-tip cells of different plant materials (Anderson 1969; Lignowski and Scott 1972; Bartele and Helton 1973; Banda and Sharma 1980; Jain and Sarbhoy 1987).

The results obtained suggest a possible role of herbicides, even the recommended ones, in affecting lentil plants, especially when higher rates are incorrectly applied. Therefore, much care is needed in the application practice of these chemicals, and attention must be paid to the residue levels of persistent herbicides used in the area. Furthermore, field studies are apparently important to clarify the role of the regular use of such pesticides in affecting the characteristics and stability of the crop.

Table 3 The percentage of different mitotic aberrations in lentil root-tips induced by the treatment with different concentrations of Prometryne, Trifluralin, and EPTC

Type of Aberration[1]	Herbicides concentration (ppm)										
	Prometryne				Trifluralin				EPTC		
	625	1250	2500	5000[2]	19.53	78.13	312.50	1250.00[4]	3750	7500	15000[3]
C-metaphase	5.7	7.0	8.1	10.5	11.3	14.0	16.7	-	8.6	9.9	14.6
Tetraploid cells	1.3	2.8	3.1	4.1	7.6	7.2	6.3	-	2.2	2.7	3.7
Binucleate cells	3.1	4.0	4.5	5.6	8.2	8.8	11.5	-	4.7	4.4	6.9
Unequal tripolar	0.3	0.9	1.4	2.3	3.1	4.0	5.2	-	0.5	0.7	2.0
Bridges	-	-	-	-	-	0.4	1.0	-	-	0.5	1.6
Fragments	-	-	-	-	-	-	-	-	-	0.2	0.8
Lagging chromosomes	-	0.2	-	0.8	1.4	2.0	3.1	-	-	0.5	1.2
Stickiness	3.2	3.6	4.3	5.3	6.9	7.6	8.3	-	4.4	4.7	5.3

1) Abnormalities were absent from control roots
2) 3), 4): Concentration of two items, one time and half the field rate, respectively

تأثيرات خلوية وتكوينية لمبيدات الأعشاب جيساجارد وتريفلان وإبتام في العدس

ملخص

دُرست التأثيرات الخلوية والتكوينية لثلاثة مبيدات أعشاب: جيساجارد (برومترين) وتريفلان (تريفلورالين) وإبتام (EPTC) في بذور نبات العدس، وذلك بتراكيز مختلفة. وقد حدّت المبيدات الثلاثة من إنبات البذور، ونمو البادرات، والانقسام غير المباشر (الميتوزي) لخلايا القلنسوة في جذور العدس. وازدادت تلك التأثيرات مع زيادة تركيز جميع تلك المبيدات. وكان تريفلان الأكثر تأثيرا في إضعاف نمو البادرات وتقليل دليل الانقسام غير المباشر، أما إبتام فأثر أكثر في خفض نسبة الإنبات والحصول على أزهار غير متفتحة مما أدى إلى إحداث أنماط مختلفة من الانحرافات الصبغية مثل: الطور الاستوائي – ج، ثنائي النوى، وخلايا رباعية التضاعف، وعدم التساوي في الطور الانفصالي الثلاثي القطب، والجسور الصبغية، وظهور صبغيات متلكّئة و لزجة.

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Lentil gall midge (*contarinia lentis*) - an aggressive pest of lentil

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Abstract

A detailed description is given of the egg, larva and imago of the lentil gall midge (*Contarinia lentis*). The damage caused by this pest, and the pest's life-history in lentil crops in Czechoslovakia are described briefly.

Introduction

In Czechoslovakia, the first outbreak of lentil gall midge (*Contarinia lentis* Aczel, 1942) was reported by Baudys in 1929. Enormous losses of yield due to this midge in Hungary forced Hungarian farmers between the period 1935-1941 to stop growing lentil as a crop (Fleischmann 1938; Nanninger 1942; Aczel 1944). From 1964 onwards, this midge has been responsible for considerable crop losses in France (Coutin 1965 Minssen and Pacqueteau 1969; Dardy and Wimmer 1983). From 1984 onwards, similar gall midge problems have been encountered in Czechoslovakia (Kolesik 1987, 1988). The lentil gall midge has, however, not yet reached pest status in countries other than those mentioned already (Tahhan and Hariri 1982; Skuhrava 1986).

In 1985 we started to study the morphology, life cycle, ecology, and control of this midge. The present work was carried out to acquaint research and production workers with an insect that could attain pest status in lentil crops grown in other countries under certain circumstances.

Materials and Methods

Ten specimens of each stage of the lentil gall midge were measured. The eggs and larvae were obtained in 1984 from a heavily-damaged lentil crop growing in Hlohovec, Czechoslovakia. The adults measured emerged from midge larvae maintained in damp sand.

The life cycle of the pest in the field was studied in the neighbourhood of Hlohovee during the period 1985-1988.

Results and Discussion

Life history

In Czechoslovakia the lentil gall midge has one generation each year. The adult midges emerge from the previous-year's lentil fields between the end of May and the beginning of July. The females mate close to their sites of emergence and are then blown by the wind to new lentil fields. Once they are in a suitable crop, the gravid females lay their eggs in the buds of lentil flowers. Once larvae hatch from these eggs and start to feed, the plant responds by producing the characteristic gall. In about July, larvae of the last midge instar fall to the soil, where they hibernate in cocoons until next spring.

The amount of damage caused by the midge is expressed as the percentage of the total pods that are galled. There is a linear function between lentil yield y and damage x:

$$y = 0.01\ e\ (100 - x)$$

where e is the yield expected in the absence (0%) of damage (Kolesik and Kolesik 1989). Lentil gall midge damage can be extremely serious in certain localities. In the 1985-1988 seasons the level of damage in affected lentil stand crops in Czechoslovakia ranged from 3 to 52%. Despite high losses in certain localities, however, the average crop loss throughout the whole country was 5% in 1985 (resulting yield: 5025 t obtained from 5542 ha), 5% in 1986 (5631 t, 5646 ha), 3% in 1987 (6317 t, 5846 ha), and 4% in 1988 (5761 t, 4780 ha) (Kolesik and Kolesik 1989).

Morphology

Egg

The eggs dissected from the abdomen of the female are kidney-shaped and have a flagellum that issues from the shorter side of the egg. The eggs are transparent and their contents are homogenous (**Fig. 1**). The average length of the eggs is 0.22 mm (range 0.18 - 0.26 mm). The average egg width is 0.10 mm (range 0.09 - 0.10 mm). The average fla-

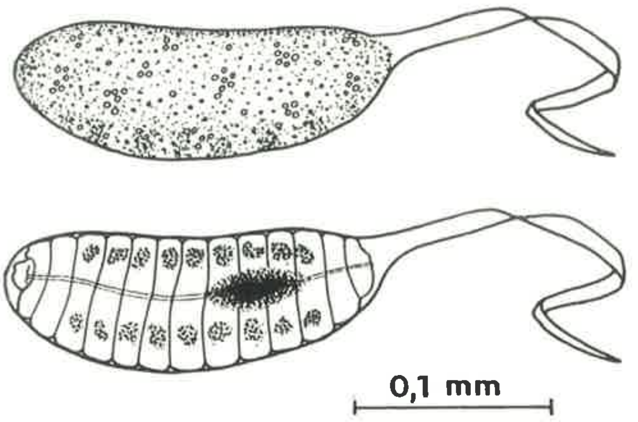

Fig. 1 Egg after laying (Above). Egg before hatching of larva (Below)

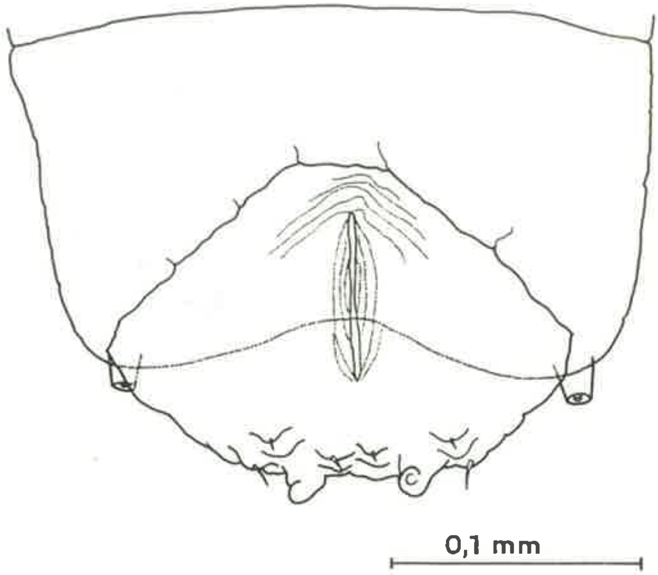

Fig. 2 Anal region of larva

gellum length is 0.24 mm (range 0.17 - 0.29 mm). The cytoplasm of the egg becomes divided into several segments several hours after laying. At the end of the embryonic development, the first instar larva can be seen moving within the egg sheet (**Fig. 1**).

Larva

The first instar larva is transparent and is about as long as the egg. The final instar larva is yellow and has an elongate cylindrical body. The average length of the final instar is 2.3 mm (range 1.9 - 2.7 mm) and its average width is 0.6 mm (range 0.4 - 0.7 mm). The larva consists of the head, and one collar, three thoracic, and nine abdominal segments. The head is trapezoid, 73 µm (range 68-79 µm) long and 64 µm (range 54-70 um) broad. Each antenna has two segments. The first is 8 µm (range 7-9 µm) long and 13 µm (range 11-16 µm) broad; the second 15 µm (range 14-17 µm) long and 8 µm (range 7-9 µm) broad. Both the dorsal and ventral sides of the larval skin are smooth. Dart fields are clearly visible on the ventral side of the second and third thoracic, and all abdominal segments. Although none of the head, collar, sternal, lateral, dorsal, pleural, ventral, or anal papillae possess setae, the three pairs of the terminal rapillae have a short seta. In contrast the fourth pair of the terminal papillae are enlarged, sclerotized and without setae (**Fig 2**). On the ventral side of the first thoracic segment there is a spatula sternalis, which helps the larva to drop of its host plant (**Figs. 3 and 4**). The total length of the spatula sternalis = 141 um (range 126 - 152 µm), the depth of the depression = 9 µm (range 7 - 13 µm), the width between the tips of the lobes = 28 µm (range 22-35 µm), the span of the lobes = 45 µm (range 41-52 µm). Aguilar and Coutin (1967) gave the following measurements: total length = 200 µm, depth of the depression = 15 um, width between the lobes = 40 µm, and span of the lobes = 60 µm.

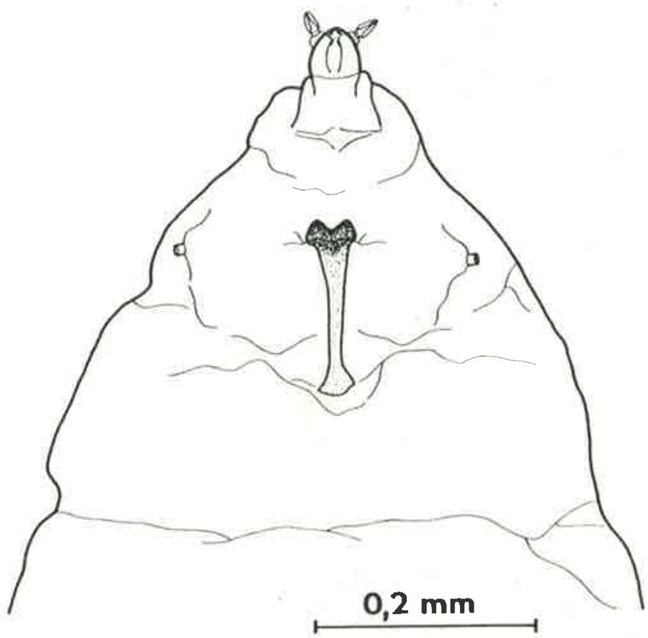

Fig. 3 Head region of larva

Male

Body length is 1.6 mm (range 1.3-1.9 mm). On the head, the eyes are holoptic and consist of a great number of ommatidia, and the antennae each consist of 14 segments. (**Fig. 5**). The first segment (scape) is 44 um (range 39-50 um) long and 50 um (range 43-54 um) wide; the second (pedicel) 37 um (range 32-43 um) long and 41 um (range 36-43 um) wide. The following 12 segments (flagellomers) are bi-

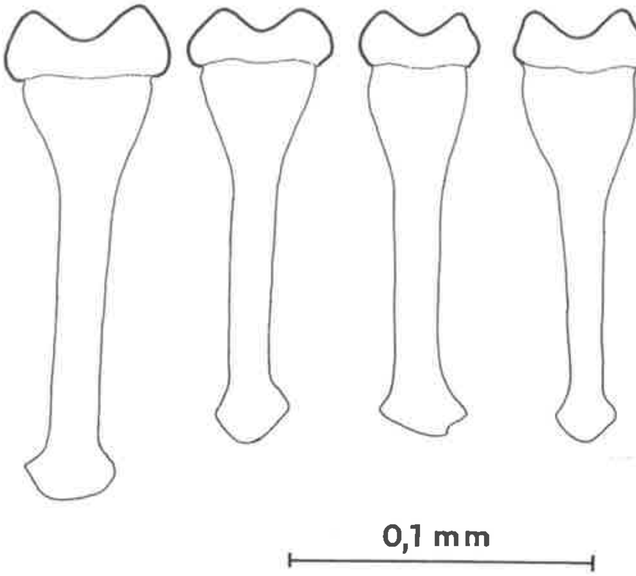

Fig. 4 Spatula sternalis *Spatula sternalis*

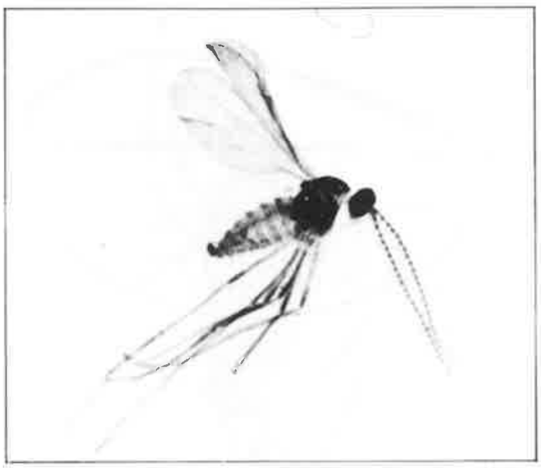

Fig. 5 Male (photograph by J. Blahvtiakova)

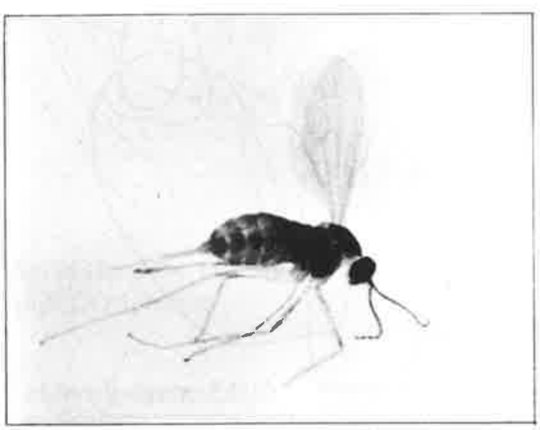

Fig. 6 Female (photography by J. Blahvtiakova)

nodal; the first and the second are fused (**Fig. 7**). The measurements of the fifth flagellomers are presented in **Table 1.** The last flagellomer is 99 µm (range 86-116 µm) long, its apical lobe is 14 um (range 11-16 µm) long (**Fig. 8**). Each node is covered with microtrichia. There is a whorl of simple firm setae and a whorl of looped circumfila on each node. Both whorls extend about to the half of the next node. The palps are made of four segments (**Fig. 9**). The measurements of palps are presented in **Table 2**. The wings have simple venation (**Fig. 10**) and are covered with hairs. Wing length is 1.5 mm (range 1.3-1.7 mm). Wing width is 0.6 mm (range 0.5-0.7 mm). Description of genitalia (**Fig. 11**). clasper segment is slightly narrowed distally, inferior lamella is deeply divided, superior lamella and subgenital plate are angular, and the aedeagus is slight. The legs are

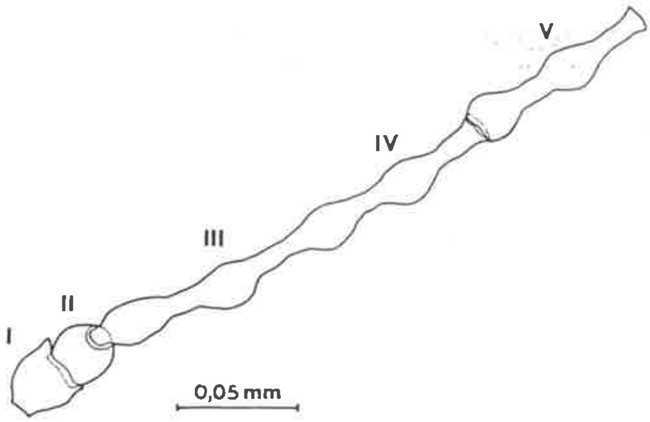

Fig. 7 First five segments of male antenna - drawn without setae (I. Scape, II. Pedicel, III. The third segment, IV. The fourth segment, V. The fifth segment)

Table 1 Measurements of male flagellomer in um

	1st node		1st neck		2nd node		2nd neck	
	Length	Width	Length	Width	Length	Width	Length	Width
Average	27	32	24	13	37	31	41	12
Range	20-32	27-34	16-30	11-14	32-41	27-32	34-45	10-15

covered with hairs. The tarsal claws are simple, about twice as long as the empodium, and bent at the last third (**Fig. 12**). The colour of freshly-caught males is as follows: flagellum, dark brown; scape and pedicel, pale brown; eyes, black; neck, pale yellow; palps, yellow-grey; thorax, dark brown; legs, sulphur yellow with a black scale strip along segments (segments near joints are brown); abdomen, non-sclerotized parts are sulphur yellow; tergites, dark brown; sternites, pale grey; and the halteres are grey.

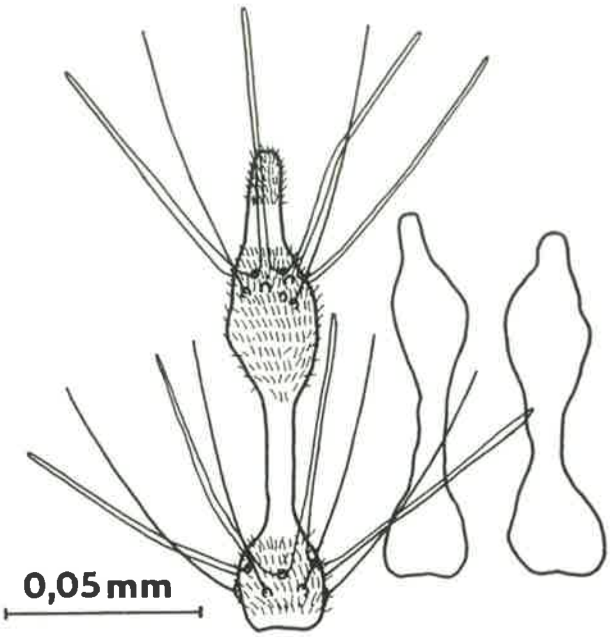

Fig. 8 The last segment of male antenna

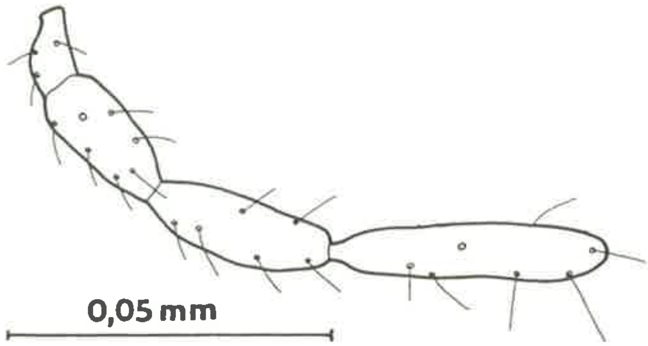

Fig. 9 Palps

Table 2 Measurements of male palps in µm

	1st palp		2nd palp		3rd palp		4th palp	
	Length	Width	Length	Width	Length	Width	Length	Width
Average	26	18	49	21	58	19	75	18
Range	20-32	16-23	45-55	18-25	45-64	17-23	66-84	15-20

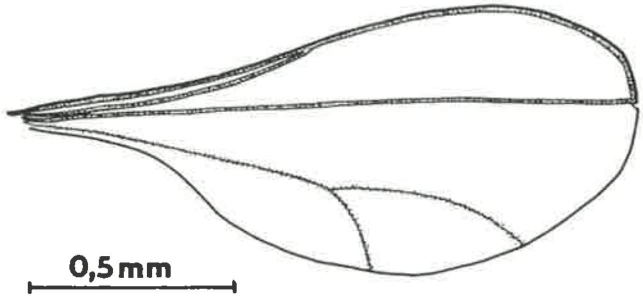

Fig. 10 Wing

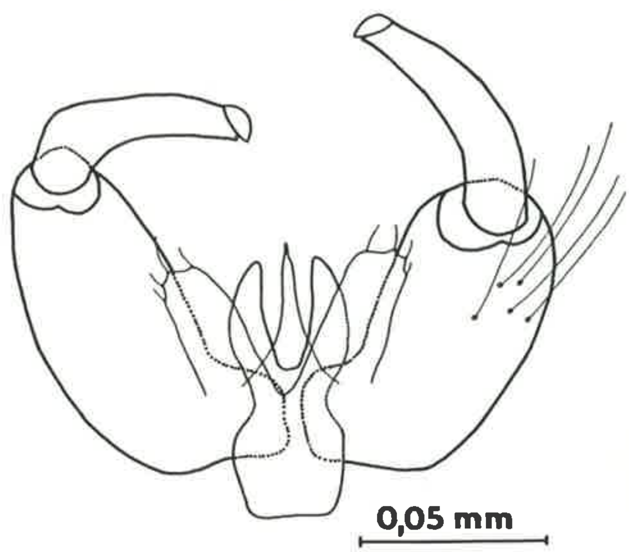

Fig. 11 Male genitalia

Female

Body length is 1.7 mm (range 1.4-2.0 mm). Antennae consist of 14 segments (**Fig. 6**). Scape is 40 µm (range 34-45 µm) long, and 43 µm (range 39-48 µm) wide. Pedicel is 42 µm (range 36-43 µm) long and 38 µm (range 34-43 µm) wide. Twelve flagellomers, each consisting of cylindrical node and a comparatively short neck. The first and the second flagellomers are longer than the others. The node of the fifth flagellomer is 48 µm (range 45-57 µm) long and 27 µm (range 25-32 µm) wide, the neck is 15 µm (range 11-18 µm) long and 11 µm (range 9-14 µm) wide. Each node is covered with microtrichia and firm setae. The terminal flagellomer is 64 µm (range 52-84 µm) long and ends in a 12 µm (range 7-14 µm) long taper (**Fig. 13** left). The palps consist of four segments. The measurements of palps are presented in **Table 3**. Wing length is 1.6 mm (range 1.4-1.8 mm). The ovipositor is long and retractile and tapers into a pair of narrow terminal lobes (**Fig. 13** right). The colour and other morphological characteristics of the female are the same as those of the male.

Description of Infestation

The attack by larvae of the lentil gall midge is characterized by the flower organs degenerating and being replaced by the production of a gall 6-8 mm long and 3-5 mm wide (**Fig.14**). No seed is formed within the gall. The proportion of flowers galled on one plant can be as high as 80%.

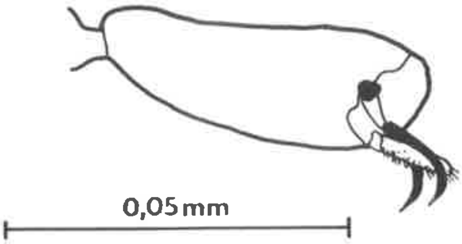

Fig. 12 Tarsal leg segment with claws snad empodium

Table 3 Measurements of female palps in µm								
	1st palp		2nd palp		3rd palp		4th palp	
	Length	Width	Length	Width	Length	Width	Length	Width
Average	28	17	46	22	53	20	68	19
Range	25-32	14-20	41-50	20-27	45-68	18-25	64-79	16-23

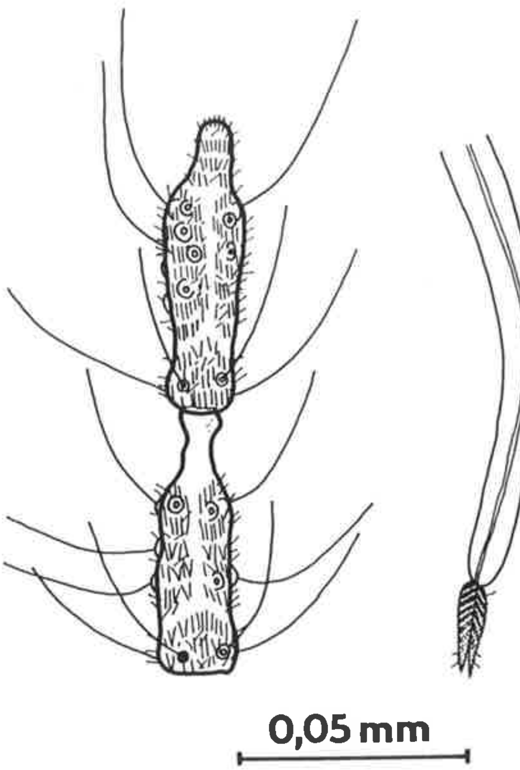

Fig. 13 (left) The last two segments of female antenna (right) Ovipositor

Acknowledgement

We are grateful to Dr. S. Finch (Institute of Horticultural Research, Wellesbourne, Warwick, UK) for providing the text correction.

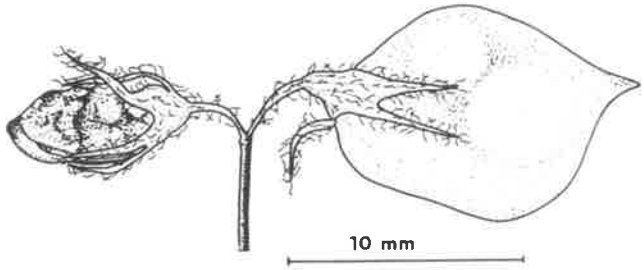

Fig. 14 Infestation symptom (left, a gall; right, a normal pod)

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ذبابة العدس العفصية

Contarinia lentis - آفة خطيرة على العدس

ملخص

يعطي هذا البحث وصفا للبيضة واليرقة والحشرة الكاملة لهذه الذبابة، ويتعرّض باختصار للضرر الناجم عنها، وتاريخ حياتها على محصول العدس في تشيكوسلوفاكيا.

Identification of resistant sources to ascochyta blight in lentil

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Abstract

A study was conducted of ascochyta blight reactions of lentil genotypes under artificial epiphytotic conditions in the field. The disease severity was recorded on 1-9 scale. Out of 152 genotypes tested to blight, 17 cultivars were highly resistant, 40 were resistant, and 34 showed an average reaction while the rest were susceptible to highly susceptible.

Introduction

Lentil (*Lens culinaris* M.) is an important pulse crop grown during the winter season in Pakistan. In recent years, ascochyta blight, one of the major factors limiting the expansion of lentil cultivation, attacked the lentil crop. Severe foliar infection causes yield losses of over 40% (Gossen and Morrall 1983). *Ascochyta lentis* Bond and Vassil was recorded on lentil for the first time in Pakistan during 1982 and its seed borne nature was also confirmed by (Khan *et al.* (1983). Bondartzeva and Vassilievsk (1940) made investigations on the blight of lentil caused by *A. lentis*. The chemical control of lentil blight has been studied and some fungicides were found effective (Bashir *et al.* 1986; Iqbal *et al.* 1989), but their use at the farmer's level was uneconomic and laborious. Khatri and Singh (1975) tested 947 lentil lines against the pathogen. Only one line showed no pod infection. Varietal differences in resistance to blight were also found by Singh *et al.* (1982). During the 1984/85 season, a severe epiphytotic of *A. lentis* on lentil crop planted at NARC, Islamabad was observed (unpublished work). Most of the local and exotic cultivars were susceptible to blight. The present investigations were undertaken to identify sources of resistance to lentil blight and their possible use in breeding for disease resistance.

Materials and Methods

A total of 152 cultivars of lentil received from the National Agricultural Research Centre (NARC), Islamabad; Ayub Agricultural Research Institute (AARI), Faisalabad; and the International Centre of Agricultural Research for Dry Areas (ICARDA), Syria were screened during the *rabi* season of 1988/89 at NARC, Islamabad, under artificial epiphytotic conditions supplemented with infection cum indicator rows. The lines were planted in October in a single row plot of 4 m long with 30 cm row to row spacing. To provide the desired quantity of inoculum for disease development, a highly blight susceptible lentil variety "Masoor 85" was planted after every two test entries.

In the first week of January, diseased plant debris, collected from the previous year, was chopped and spread in the field. In mid-February, a spore suspension of *A. lentis* (5×10^4 spores ml^{-1}) was sprayed. Due to unfavorable weather conditions for the development and spread of the disease, spraying of spore suspension was repeated weekly.

Inoculated plants were sprayed twice with water every day. The first spray in the morning and the other one in the evening to provide maximum humidity. The water spray continued till the killing of spreader rows.

Disease intensity was recorded twice at the times of flowering and maturity, respectively on a numerical rating scale of 1-9 (**Table 1**). The genotypes were grouped into different categories according to their reaction to the disease.

Table 1 Results of lentil genotypes resistant to ascochyta blight at NARC, Islamabad

Disease grade	Disease intensity	Disease reaction	Number of entries	% of total
1	No visible lesions observed	Highly resistant	17	11.2
3	Few scattered lesions usually seen after careful searching	Moderately resistant	40	26.3
5	Lesions common and easily observed on plants	Average reaction	34	22.4
7	Lesions very common and all damaging	Moderately susceptible	19	12.5
9	Lesions extensive on all plantparts, defoliation, drying of branches, and killing of some parts	Highly susceptible	42	27.6

Table 2 Reaction of lentil genotypes to ascochyta blight

Disease reaction	Lentil genotype
1	Precoz x 830-2, Precoz x L830, Precoz, Precoz x 74TA 9, Precoz x L830, Precoz x L830, ILL 5562 x ILL 936, FLIP 84-27L, FLIP 86-49L, ILL 858, Lenka, 78S 26018, 78S 26052, FLIP 84-43L, FLIP 84-85L, FLIP 84-55L, FLIP 86-12L
3	88503, 88507, 88508, 88509, 88510, 88527, 88548, 86592, 86599, FLIP 86-38L, 74TA 441 x Pant L639, ILL 1386 CXJD. L c., FLIP 86-39L, L18-12XSLL, L9-12 Giza 9, T36 x 74TA 138, ILL 5562 x ILL 5659, T36 x 74TA 260, 76TA 66088 x 76TA 66054, E-1-42, FLIP 84-112L, Pant 639 x Silaim, LL 116 x 74TA 441, 76TA 66088 x 76TA 66054, 78TA 82600 x 76TA 66054, 18-12 x 76TA 66088, 18-12 x 78S 26013, ILL 2439, LG-14, UJL-81129, 78S 26033, 78S 26038, FLIP 84-44L, FLIP 84-60L, FLIP 84-80L, FLIP 84-81L, FLIP 84-96L, FLIP 84-38L,FLIP 86-39L, FLIP 87-68L.
5	88504, 88511, 88512, 88516, 88518, 88525, 88530, 88543, 88546, 88547, 86618, 86586, 88587, 86593, FLIP 84-78L, Giza 9 x LL-1, 38S 26004 x Pant L406, FLIP84-78L, L1282, L830 x 76TA 66089,18-12 x 78S 26013, LL116 x 74TA 441, 18-12 x 78S 26013, 18-12 x 76TA 66088, 78S 26004 x 76TA 66054, 78S 26004 x L830, LL116 x Silaim, 83S 176 x LG 112, 18-12 x Silaim, 18-12 x 78S 26013, 78S 26004 x L830, S30116, FLIP 88-33L, FLIP86-16L.
7	88501, 88502, 88505, 88515, 88519, 88520, 88521, 88523, 88526, 88528, 88539, 88541, AARIL-33, Local Queta, 162, 18-12 x Silaim, L830 x 76TA 66088, 18-12 x ILL-16, FLIP 87-70L.
9	88506, 88513, 88514, 88517, 88522, 88524, 88529, 88531, 88532, 88533, 88534, 88535, 88536, 88537, 88538, 88540, 88543, 88544, 88545, 88511, 86612, 86613, 86620, 9-6 MASOOR-88, Pant L-639, AARI L-492, MASOOR-85, NO-25, AARI L-498, AARI L-495, AARI L-496, AARI L-497, AARI L-490, AARIL-349, AARI L-502, AARI L-490, L-1278, L-1057, LL-37, LL-1, Pant L-538.

Results and Discussion

The results (**Table 2**) showed that out of 152 lentil varieties/lines screened under field conditions, 17 varieties showed immunity to the disease. 40 varieties were resistant, and 34 showed intermediate (average) reaction, while the rest were susceptible to highly susceptible to blight.

Precoz (ILL 4605), a bold seeded lentil variety, was found highly resistant to blight. The genotypes with Precoz as a parent showed the same reaction. Precoz has subsequently been tested in the blight areas of Pakistan and maintained its resistance to blight. It is now in use as a resistant parent in the development of blight resistant varieties.

Out of 509 lentil genotypes in Argentina assessed for disease reaction to ascochyta blight, 115 were reported as highly resistant (Mitidieri 1974). In India, Khatri and Singh (1975) tested 947 lines and found that only five were highly resistant. Indicating either high aggressiveness of the isolates or narrow diversity of the genetic material studied. Morrall and Sheppard (1981) reported significant differences among breeding lines of lentil with regards to disease reaction. In this study, a great diversification in lentil to blight reaction is revealed to confirm that developing highly resistant cultivars should be a future objective for disease control.

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تحديد مصادر مقاومة للتبقع الأسكوكيتي على العدس

ملخص

أجريت دراسة على تفاعلات طرز وراثية من العدس مع التبقع الأسكوكيتي تحت ظروف عدوى إصطناعية وبائية في الحقل. وقد سُجلت شدة المرض باستعمال سلّم تساعي. ومن بين 152 طرازا وراثيا جرى اختبارها لمقاومة التبقع كان 17 صنفا شديد المقاومة، و 40 مقاوما، وأظهر 34 صنفا تفاعلا معتدلا مع المرض. أما باقي الأصناف فكانت بين حسّاسة إلى شديدة الحساسية.

Rhizoctonia solani: a new root rot disease of lentil in Pakistan

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Abstract

In field and laboratory trials at the National Agricultural Research Centre, Islamabad, Pakistan, in spring of 1988 and 1989, lentil was observed to be affected by root rot (*Rhizoctonia solani*) recorded for the first time in Pakistan. The symptoms are described.

Lentil was observed to be affected by a root rot disease at the National Agricultural Research Centre, Islamabad during the spring of 1988/89 season. Foliage of diseased plants were dull green in color which turned pale yellow and/or reddish brown later on. The lower leaves showed wilting and within a few days these symptoms progressed upwards and ultimately the whole plant died. The roots of wilted plants were brown to reddish brown in color and showed rotting symptoms. Vascular system was completely destroyed by the causal fungus.

The causal fungus was isolated on Potato Dextrose Agar (PDA) from infected roots. The pathogenicity was tested by sowing clean lentil seeds in soil infested artificially with the causal fungus. The pathogen was reisolated and found to be identical with the original one.

The fungus colony on PDA medium was light brown in color and produced a number of sclerotia within a few days. The sclerotia were variable in size and shape, and were superficially borne on mycelium. The mycelium was brown, septate, and the number of branches was constricted at the point of origin. The fungus was identified as *Rhizoctonia solani* (Wilson and Brandsberg 1965). *R. solani* causing root rot lentil was reported by Kannaiyan and Nene (1973) in India. But this is the first record in Pakistan although its association with the root rot of chickpea (*Cicer arietinum*) and many other crops was already reported by Mirza and Qureshi (1978).

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Rhizoctonia solani : مرض عفن جذور جديد على العدس في الباكستان

ملخص

ضمن تجارب حقلية ومخبرية نفذها، في ربيع 1988 و 1989، المركز الوطني للبحوث الزراعية بإسلام آباد في الباكستان شوهدت إصابة بعفن الجذور (*Rhizoctonia solani*) على العدس، وسُجِّلت لأول مرة هناك. وفي هذه الورقة وصف لأعراضها.

Occurrence of *Epicoccum* and *Stemphylium* leaf spot of *Lens culinaris* Medik. in Hungary

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Abstract

In field trials conducted in Hungary during the 1988/89 season, *Epicoccum purpurascens* Ehrenb. ex Schlecht. and *Stemphylium botryosum* Wallr. were observed as new pathogens on lentil. Both fungi caused leaf spots on adult plants, but the older leaves were more susceptible to pathogenic attack than younger leaves. The pathogens were isolated from spotted leaflets then identified. Their pathogenicity was observed in a glasshouse, and both were pathogenic to lentil plants. The oldest leaflets were the most highly infected. Severe symptoms of disease were also observed on the leaves damaged by *Tetranichus urticae* Koch red mite. Different leaf-pathogens cause major yield losses on lentils. The pathogens *Botrytis cinerea* Pers ex Fr. (Folk 1974), *Peronospora lentis* Gaum. and *Uromyces viciae-craccae* Constant (Podhradszky 1968) were earlier observed in Hungary. Two new fungi were observed causing leaf spot on lentil plants in the summers of 1988 and 1989.

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Materials and Methods

The plant material was collected from diseased plants as leaves with spots. The leaflets cut from leaves with spots, were investigated microscopically for pathogenic conidia. Some were placed in a moisture chamber and were incubated until sporulation.

The fungi were identified according to culture and morphological characters (Domsch, Gams and Anderson 1980).

Results and Discussion

The two new fungi (*Epicoccum purpurascens* Ehrenb. ex Schlecht. and *Stemphylium botryosum* Wallr.) were identified from spotted lentil leaflets. Their symptoms were not distinguishable from each other or the early symptoms of *Botrytis cinerea* Pers ex Fr. The symptoms were small reddish spots on older leaflets. The sporulation was not observed on samples collected from the field.

The spots rapidly spread in the moisture chamber and became brownish or blackish. Sporulation was observed on decayed leaflets and on moist blotter around them.

E. purpurascens grew well on oat meal agar and malted Leonian's media, and sectors were often formed similarly (Kilpatrick and Chilvers 1981). The colonies grew fast reaching 6, 5-8 cm in diameter after 10 days, with sectors bearing different aerial mycelium. The fungus sporulated well in sectors without aerial mycelium. Sporulation was not observed in sectors with extensive aerial mycelium. The blastoconidia were found in sporodochia (**Fig. 1**) and were globose to pyriform, 14, 4-26, 8 um in diameter.

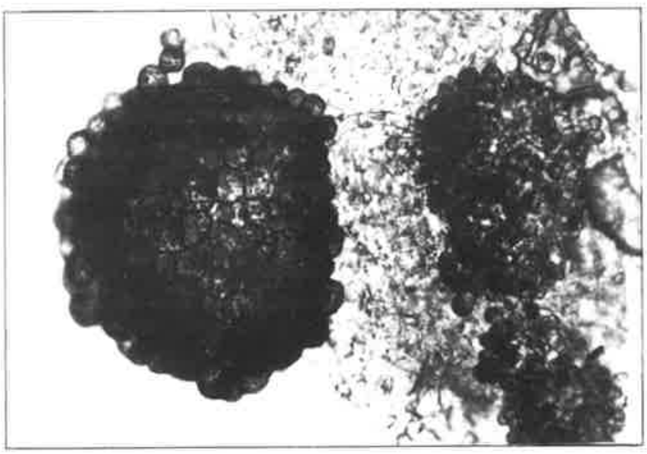

Fig. 1. Sporodochium of *Epicoccum purpurascens*

S. botryosum grew also well on tested media, but sectors were not formed. Its colonies are fast growing too and small stromates are formed in them. The fungus sporulated well on plates, forming conidia on dark conidiophores. The conidia are subglobose or ovoid, constricting at the median (**Fig. 2**). The characters observed were similar to those reported by Corlett *et al.* (1982) and Domsch *et al.*

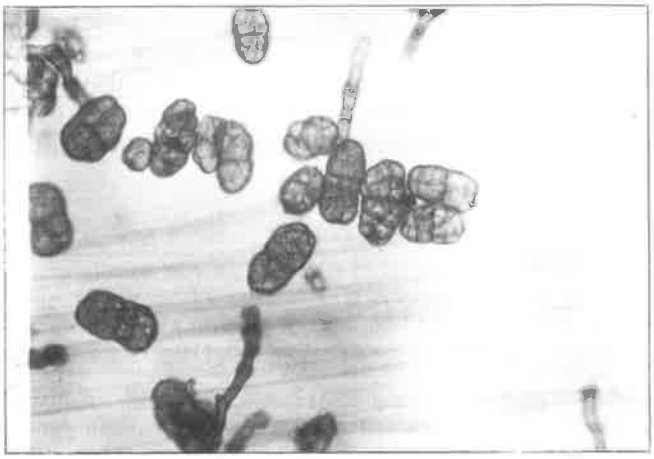

Fig. 2. Conidia of *Stemphylium botryosum*

(1980). Mature sexual form was not observed in cultures, but was on overwintered lentil straw lying on the soil. However, the pathogenicity of ascospores harvested from *Pleospora tarola* (Simmons 1985) was not tested. (**Fig. 3**).

Fig. 3. Mature asci and ascospores of *Pleospora tarola*

In glasshouse experiments, both fungi caused symptoms on infected lentil plants. These were small reddish brown on younger leaves similar to field symptoms, but were larger and blackish on older leaves of *E. purpurascens* and greyish in the centre with reddish ring on leaves with *S. botryosum*. Serious infection was developed on plants previously damaged by red mite. (*Tetranychus urticae* Kohn). A similar effect was observed earlier in our investigations on *Alternaria alternata* /Fr./ Keissler - *Vicia faba* L. and *Botrytis cinerea* Pers. ex Fr. - *Arachys hypogaea* L. parasite - host relationships (Simay 1987 and 1990). These results show that both fungi are weak parasites.

E. purpurascens is a well known soil fungi (Domsch *et al.* 1980), and it occurs on different plant material. It causes leaf spot on different plants too (Gupta and Karwasra 1982; Mueller 1964), but was not known as plant pathogen earlier in Hungary. *S. botryosum* is however a well known plant pathogen for leguminous plants in Hungary (Voros and Husz 1965; Simay 1988 and 1989). Although it is also known on lentil in other countries (Bark and Zahid 1986), this is the first report on the occurrence of this pathogen on lentil in Hungary.

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إصابة العدس *Lens culinaris* Medik بتبقع الأوراق المتسبب عن الفطرين *Epicoccus* و *Stemphylium* في هنغاريا

ملخص

لوحظ في التجارب الحقلية المنفذة في هنغاريا خلال الموسم 89/1988 ظهور *Epicoccum purpurascens* Ehrenb. و *Stemphylium botryosum* ex Schlecht Wallr. كممْرضين جديدين على العدس. وقد سبّب هذان الفطران تبقع الأوراق على النباتات الكاملة، إلا أن الأوراق الأقدم كانت أكثر عُرضة للإصابة من الأوراق الأفتى. وقد تمّ عزل المرضِين من وريقات مصابة بالتبقع ثم جرى تحديدهما، ودراسة قدرتهما الإمراضية في الدفيئة. كان كلاهما ممرضا لنباتات العدس، وكانت الوريقات الأقدم أكثر عرضة للإصابة. وشوهدت أعراض شديدة للمرض على الأوراق المصابة بالعنكبوت الأحمر *Tetranichus urticae* Koch. وتؤدي مختلَف ممرضات الأوراق إلى ضياع كبير في غلال العدس. وفي هنغاريا شوهدت سابقا الممرضات التالية: *Botrytis cinerea* Pers ex Fr. (Folk 1974), *Perenospora lentis* Gaum, & *Uromyces viciae-craccae* Constant (Podhradszky 1968)، ولوحظ في صيف 1988 و 1989 فطران جديدان يسببان تبقع الأوراق على العدس.

LENTIL INFORMATION معلومات متخصصة عن العدس

LENS Bookshelf

Oram, P. and Belaid, A. 1990. Legumes in Farming Systems. 206 p. ICARDA, Aleppo, Syria.

This book reports the results of a project jointly undertaken between ICARDA and IFPRI. The theme is to analyse the existing evidence on the value of legumes in production systems in the region with respect to both their contribution to soil fertility under stressful conditions, and the possibilities for expansion in their use as livestock feed; and to assess in-depth on the potential pay-off of further investment in the improvement of lentil (taking into account the contribution to human nutrition, foreign trade, and the sustainability of production systems in the region) in order to determine the appropriate allocation of its resources.

Osman, A.E., Ibrahim, M.H., and Jones, M.A. 1990. The role of legumes in the farming systems of the Mediterranean areas. Proceedings of a workshop. Tunis, Tunisia, 20-24 June 1988. Kluwer Academic Publishers Group, P.O. Box 322, 3300 AD Dordrecht, The Netherlands.

Legumes are of immense value in the rainfed farming systems of the Mediterranean area because they are an important source of protein for humans and livestock, and can play a key role in improving the soil. Food legumes have been grown in these areas for thousands of years, but their productivity has been limited by the low yield potential of the commonly grown land races and their susceptibility to pests, diseases and other environmental stresses. The concept of forage legumes as crops, however, has yet to be developed, and then the crops fitted into the farming systems. ICARDA and UNDP organized a workshop on 'The Role of Legumes in the Farming Systems of the Mediterranean Areas', June 20-24, 1988, in Tunis, and the proceedings are published in this volume. The papers review the roles of pasture, forage and food (chickpea, faba bean, lentil and pea) legumes, and relate them to human and animal nutrition, sustainability of production, crop rotations and socioeconomic conditions.

Key Lentil Abstracts

Bayaa, B. and Erskine, W. 1990. **A screening technique for resistance to vascular wilt in lentil.** *Arab Journal of Plant Protection* 33(1): 30-33. ICARDA, Aleppo, Syria.

Vascular wilt caused by *Fusarium oxysporum* f.sp. *lentis* is the major disease on lentil (*Lens culinaris*) in Syria. Although extensive screening has been done in the field at ICARDA, it was necessarily opportunistic because of the uneveness of wilt distribution. A simple, rapid and repeatable technique has been developed in the plastic house to screen lentil germplasm at the seedling stage for resistance to wilt. The technique involved planting of one row of each of the test lines with a susceptible check at every 5th row in metal trays containing field soil and inoculation of 14-day old plants with a liquid culture of *F. oxysporum* isolated from the stems of wilted plants. Final disease incidence was recorded eight weeks after sowing. A total of 162 lines were screened using this technique and 29 suggested presence of resistance as no disease developed. The repeatability of the technique was high with a correlation of $r = 0.86$ ($P < 0.01$) between repeated sowings of 25 lines. Eighteen of the lines were grown in the field where their reaction was same as in the plastic house.

Erskine, W., Bayaa, B. and Dholli, M. 1990. **Effect of temperature and some media and biotic factors on the growth of *Fusarium oxysporum* f.sp. *lentis* and its mode of seed transmission.** *Arab Journal of Plant Protection* 8(1): 34-37. ICARDA, Aleppo, Syria.

This study was conducted to determine the effects of some factors, namely temperature (10, 15, 20, 25 and 30°C) and media (potato dextrose agar, lentil dextrose agar and (Czapek), on the growth *in vitro* of *Fusarium oxysporum* f.sp. *lentis* in order to produce sufficient inoculum for the development of a screening technique, as well as to clarify such aspects of disease epidemiology as mode of seed transmission and association with nematodes and antagonistic bacteria. The optimum temperature for fungal growth was 22°C. Maximum mycelial growth and sporulation were obtained on lentil dextrose agar. *In vitro* studies revealed an antagonistic effect between the fungus and a *Pseudomonas* sp. isolated from infected soil. The following nematode genera were associated with wilt in the field: *Ditylenchus dipsaci, Aphelenchoides* spp. *Aphelenchus* spp., *Helicotylenchus* spp., *Heterodera* spp. *Meloidogyne* spp., *Pratylenchus* spp. and *Tylenchorhynchus* spp. with the former being the most prevalent. The fungus was not present either in the endosperm or under the seed coat of seed from a crop showing wilt symptoms.

Erskine, W., Rihawi, S. and Capper, B.S. 1990. **Variation in lentil straw quality.** *Animal Feed Science and Technology* **28**: 61-69. ICARDA, Aleppo, Syria.

Seasonal and genetic variation in the potential feeding value of lentil straw, a regionally important sheep feed, was measured in two seasons on eleven diverse *macrosperma* lentil selections under rainfed conditions in north Syria. Digestible dry matter (DMD) was 46% in the 1981-1982 season and 43% in the 1982-1983 season. The genotype-year interaction mean squares for all straw quality parameters were greater than their respective genotypic mean squares indicating low genetic variation, as judged by laboratory methods of assessing straw value and a poor expected response to selection for improved straw quality. In another experiment, the partition of dry matter within the straw of six selections was measured in one environment. Proportions of leaf, branch, pod and root tissue within straw were 38, 34, 23 and 5% respectively. Their mean DMD values were 62, 36, 44 and 22%, respectively. The results indicated that variation in straw quality is largely due to differences in the partition of dry matter between plant parts.

Hoffman, D.L., Muehlbauer, F.J. and Ladizinsky, G. 1988. **Morphological variation in *Lens* (Leguminosae).** *Systematic Botany* **13**(1): 87-96. Washington State University, Department of Agronomy and Soils, Pullman, Washington 99164, USA.
Principal component analyses were utilized to ascertain phenetic relationships within *Lens,* a genus which has been recently subjected to intensive bopsystematic and evolutionary study. The first analysis was conducted on a combination of qualitative and quantitative characters and a second analysis was conducted on quantitative characters only. In the first analysis, *L. orientalis* grouped closest to *L. culinaris,* the cultivated species. The second closest to *L. culinaris* was *L. nigricans* while *L. ervoides* was the most removed. Two accessions of *L. nigricans* and one accession of *L. ervoides* were spatially removed from their respective groups. The second analysis yielded similar results except that a larger number of *L. nigricans* separated from the main group. These results agreed with recent cytogenetic studies and also provided new insight in understanding the evolution of *Lens*.

McKenzie, B.A. and Hill, G.D. 1990. **Growth, yield and water use of lentils (*Lens culinaris*) in Canterbury, New Zealand.** *Journal of Agricultural Science, Cambridge* **114**: 309-320. Lincoln University, Department of Plant Science, Canterbury, New Zealand.

Lentils (*Lens culinaris* Medik.) were sown on eight sowing dates from April to November in two seasons in Canterbury, New Zealand. In 1984/85, six sowing dates were combined with two lentil cultivars (Olympic and Titore) and two irrigation treatments. In 1985/86, Titore was sown on two dates, with four irrigation treatments. An additional experiment grown under rain shelters examined the response of Titore to four irrigation regimes. The 1984/85 season was dry and rainfall was only 70% of the long-term mean. In this season, seed yield was high, 3.3 t/ha from the May sowing. The 1985/86 season was wetter than average and seed yields were lower, ranging from 0.6 to 1.5 t/ha. Under rain shelters, seed yield ranged from the equivalent of 0.32 to 2.5 t/ha. Sowing date had the most marked effect on seed yield. In the 1984/85 season, all autumn and winter sowings yielded 2.4-3.3 t/ha, whereas the spring sowings yielded 0.5-1.5 t/ha. In 1985/86, unirrigated plots from the May sowing yielded 1.5 t/ha, whereas all other plots yielded c. 0.8 t/ha. Generally, the small-seeded cultivar Titore outyielded Olympic. Dry matter (DM) accumulation followed similar trends to seed yield. Seasonal DM accumulation followed a sigmoidal curve. Functional growth analysis indicated that plants from autumn/winter sowings had a weighted mean absolute growth rate of 110-171 kg/ha per day, whereas spring-sown plants grew at 96-137 kg/ha per day. The maximum crop growth rate was 230 kg/ha per day in the July 1984 sowing. There was little positive response to irrigation in both seasons. Under rain shelters, there was a linear increase in both dry matter and seed production with increased total water. Fully irrigated plants produced 1.27 g DM and 0.72 g seed/m per mm of water received. In the first experiments there was no relationship between maximum potential soil moisture deficit (D) and yield. Under rain shelters, however, there was a linear relationship which indicated a limiting deficit of c. 130 mm. The relationship showed that, for each millimetre increase in D above D, 0.39% of the maximum yield was lost. Under the rain shelters, there was a strong relationship between yield and actual evapotranspiration (ET). Water-use efficiency (WUE) ranged from 2.81 g DM/m^2 per mm ET in unirrigated plots to 0.69 g seed/m^2 per mm ET. The results showed that lentil growers in Canterbury, and presumably in similar environments, are unlikely to benefit from irrigating their crops. In such environments, lentils appear to be an ideal dryland crop.

Schotzko, D.J. and O'Keeffe, L.E. 1988. **Effects of food plants and duration of hibernal quiescence on reproductive capacity of pea leaf weevil (Coleoptera: Curculionidae).** *Journal of Economic Entomology* **81**(2): 490-496. University of Idaho, Department of Plant, Soil and Entomological Sciences, Moscow, Idaho 83843.

The effects of duration of the hibernal quiescent period, migrational state, food plant (pea, lentil, or alfalfa), and absence of food on fecundity and fertility of pea leaf weevil, *Sitona lineatus* (L.), were compared in the laboratory. Two rearing techniques were used to determine preovipositional and ovipositional periods, number of eggs laid, and rate of egg laying for *S. lineatus* field-collected monthly over several seasons. The fecundity of *S. lineatus* was significantly affected by the food provided, with weevils fed pea foliage having the highest fecundity. The lowest level of oviposition was observed for weevils provided lentil foliage or starved. The spring migrational state of *S. lineatus* and number of months spent in hibernal quiescence had a significant effect on oviposition.

Schotzko, D.J. and O'Keeffe, L.E. 1988. **Effects of food type, duration of hibernal quiescence, and weevil density on longevity of *Sitona lineatus* (Coleoptera = Curculionidae).** *Journal of Economic Entomology* **81**(6): 1631-1636. University of Idaho, Department of Plant Soil and Entomological Sciences, Moscow, Idaho 83843.

Adult longevity of *Sitona lineatus* (L.) was significantly affected by the kind of food provided and weevil density. Weevils maintained as single reproductive pairs and fed pea foliage lived longer than those fed alfalfa, whereas if maintained in groups of 13 reproductive pairs, the alfalfa-fed weevils lived longer in three of six months of field collection. The shortest life spans for weevils in low or high densities were observed when weevils were fed lentil foliage or starved. Female *S. lineatus* lived significantly longer than males when maintained as single reproductive pairs, but there were no significant differences between female and male longevity when weevils were kept in groups of 13 reproductive pairs. The spring migrational state of the weevils and the number of months spent in hibernal quiescence also had a significant effect on longevity.

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Second International Food Legume Research Conference
12 - 16 April 1992, Cairo, Egypt

The First International Food Legume Research Conference (IFLRC-I) on pea (*Pisum sativum*), lentil (*Lens culinaris*), faba bean (*Vicia faba*), and chickpea (*Cicer arietinum*) was held at Spokane, Washington, U.S.A. in 1986. It was a resounding success with over 500 registrants from 50 countries. The program consisted of 91 papers coauthored by 202 contributors from 40 countries. The Conference Proceedings was published as: Summerfield, R.J. (ed.). World Crops: Cool Season Food Legumes. 1988. Kluwer Academic Publishers, Dordrecht, The Netherlands.

The success of IFLRC-I has prompted development of the Second International Food Legume Research Conference (IFLRC II) from April 12-16, 1992 in Cairo, Egypt. Recent success in development of low neurotoxin lines of grass pea (*Lathyrus sativus*) has resulted in the addition of this promising cool season food legume to the list of species covered.

The objectives of IFLRC-II are to 1) review and assess recent results from national and international research programs on cool season food legumes and 2) develop strategies for increasing production per unit area and increasing use of these cool season food legumes in various cropping systems. Both basic and applied research will be addressed and multidisciplinary research efforts will be emphasized.

The organizing committee is developing the program and details will be available in the Second Announcement. The primary function of this First Announcement is to alert everyone to the time and date so they can make plans to attend. In addition the organizing committee wishes to develop an updated mailing list of interested food legume researchers and those involved in technology transfer of these research results.

For further information regarding reservation for 1992 IFLRC-II, Cairo, Egypt, please contact:

Dr. A.E. Slinkard
Crop Development Centre
University of Saskatchewan
Saskatoon
Saskatchewan, S7N OWO
Canada

ANNOUNCEMENTS

REPORTING OF MUTANTS IN LENS

Manuscripts that report new mutants in lentil will not be accepted for publication in LENS unless 1) the mode of inheritance has been determined, 2) seed of the homozygous mutant is provided to the Lentil Gene Bank (heterozygous for lethal or semi-lethal mutants), and 3) a gene symbol is proposed (the gene symbol should be patterned after the system used for genes in *Pisum*, as outlined in the *Pisum* Newsletter 9: 67-70, 1977, a copy of which can be obtained from either of the Technical Editors).

FORMATION OF LENTIL GENE BANK

As genetic information on lentil increases, the need for a central gene bank arises. Accordingly, the Crop Development Centre, University of Saskatchewan is initiating a Lentil Gene Bank to serve as a repository for lentil genes. Thus, as soon as a researcher describes a gene in the literature, determines its mode of inheritance and assigns a gene symbol, he is requested to send 20 seeds carrying the gene and 20 seeds carrying its contrasting allele to the Lentil Gene Bank. All genotypes in the bank will be available to interested researchers within the limits of available seed.

As soon as you have described a gene in lentils, determined its mode of inheritance and assigned a gene symbol, please submit seed samples to:

Lentil Gene Bank
c/o Dr. A. E. Slinkard
Crop Development Centre
University of Saskatchewan
Saskatoon
Saskatchewan, S7N OWO
CANADA

For further information write to Training Department

Forthcoming Conferences and Events - 1990

1990

November

Modern Methods of the Study of *Rhizobium*
Bangkok, Thailand 01-28 Nov.
Contact: NIFTAL Project Director, NIFTAL Project, 1000 Holomua Rd., Paia, Hawaii 96779-9744, USA.

This course aims to provide training in rhizobia culture, strain identification, genetics of rhizobia, and inoculant production and field application. The course sponsors are the Biological Nitrogen Fixation Resource Center, for South and Southeast Asia, Thailand Department of Agriculture, NIFTAL (Nitrogen Fixation by Tropical Agricultural Legumes) Project and Miran, and the University of Hawaii's Biotechnology Program.

1992

June

1st European Conference on Grain Legumes
Angers, France, 1-3 June
Contact: Secretariat, First European Conference on Grain Legumes, UNIP, 12, Avenue George V, 75008 Paris, France.

The conference will cover the following legume species: Field pea, faba bean, white lupin, chickpea, and lentil. Oral presentations and posters will be grouped into the following nine areas of interest: Genetic resources and breeding, molecular biology and biotechnology, plant physiology, agronomy, pathology, seed composition, use for animal feed, use for human feed, and economics.

April

Second International Food Legume Research Conference
Cairo, Egypt, 12-16 April
Contact: Dr. A.E. Slinkard, Crop Development Centre, University of Saskatchewan, Saskatoon, Saskatchewan, S7N OWO, Canada.

The objectives of the conference are to 1) review and assess recent results from national and international research programs on cool season food legumes and 2) develop strategies for increasing production per unit area and increasing use of these cool season food legumes in various cropping systems. Both basic and applied research will be addressed and multi-disciplinary research efforts will be emphasized.

Contributors' Style Guide

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

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

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

Language
LENS Newsletter is published in English but ICARDA will publish 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, postal address, and telex number if available. Figures should be drawn in India ink: send original artwork, not photocopies. Define in footnotes or legends any unusual abbreviations or symbols used in a figure or table. Good quality black and white photographs are acceptable for publication. Photographs and figures should preferably be 8.5 cm or 17.4 cm wide.

Units of measurement are to be in the metric system: e.g. t/ha, kg, g, m, km, ml (= milliliter), 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
3 g; 18 mm; 300 m^2; 4 Mar 1983; 27%; 50 five-day old plants; 1.6 million; 23 ug; 5°C; 1980/81 season; 1980-82 seasons; Fig.; No.; FAO; USA. Fertilizers: 1 kg N or 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: Slinkard, A. E. 1981. Eston lentil. Canadian Journal of Plant Science 61: 733-734.

Books: Webb, C. and Hawtin, G. (eds.). 1981. Lentils. ICARDA/CAB, CAB, Slough, England. 216 pp.

Articles from books: Solh, M. and Erskine, W. 1981. Genetic resources. Pages 53-67 *in* Lentils (Webb, C. and Hawtin, G., eds.). ICARDA/CAB, CAB, Slough, England.

Papers in Proceedings: Hariri, G. 1979. Insect pests of chickpea and lentils in the countries of the Eastern Mediterranean: A review. Pages 120-123 *in* Food Legume Improvement and Development: Proceedings of a Workshop, /University of Aleppo (Hawtin, G. and Chancellor, G.J., eds.). ICARDA/Aleppo University, May 1979, Aleppo, Syria. ICARDA/IDRC, Ottawa, Ontario, Canada.

Submission of articles
Contributions should be sent to LENS, Library, ICARDA, P.O. Box 5466, Aleppo, Syria.

تعليمات النشر باللغة العربية

سياسة النشر :

تهدف هذه النشرة العلمية إلى نشر نتائج البحوث الجديدة بالسرعة الممكنة . والغاية من هذه التعليمات مساعدة الباحثين على صياغة بحوثهم بالشكل الذي يسهل تبادل المعلومات فيما بينهم على اختلاف أمصارهم ومشاربهم العلمية . وهذه المطبوعة تُعنى بنشر الأوراق العلمية والبحوث المختصرة والمقالات المكتوبة بلغة واضحة وأسلوب علمي، والمطبوعة أيضاً بمسافات مزدوجة بين السطور على ورق أطواله 21 x 28 سم على وجه واحد فقط . ترسل نسخة أصلية عن البحث، وتُعنوَن جميع المراسلات إلى عنوان النشرة . ويشترط في المادة المرسلة للنشر ألا تقدم إلى أي جهة أخرى . ولا تعبِّر نتائج البحوث المنشورة إلا عن وجهة نظر أصحابها . كما أن استعمال أسماء تجارية لا يعني بالضرورة أن ايكاردا تحبذ استعمال أي من هذه المنتجات مقارنة بمثيلاتها التجارية .

منهج الكتابة :

تكتب وترتب البحوث بالشكل التالي : 1) عنوان مناسب لا يزيد على 70 حرفا، يليه اسم وعنوان الباحث/ الباحثين . 2) ملخص بالعربية يتألف من فقرة واحدة لا تزيد على 200 كلمة توجز العمل والنتائج المتوصل اليها بأقصر وأوضح طريقة ممكنة . 3) مقدمة تبرز أهمية موضوع البحث، وتستعرض بشكل نقدي الأعمال والبحوث السابقة المتعلقة بالموضوع المدروس . 4) المواد والطرق وتشمل المعلومات الخاصة بموقع تنفيذ التجربة، والمواد والطرق المستعملة، مع تحديد تصميم التجربة المتبع . 5) النتائج والمناقشة، وتظهر المعلومات والبيانات التي حصل عليها الباحث، ومدى أهميتها . 6) التوصيات إن وجدت وتُكتب بفقرات محددة ومُرقمة . 7) كلمة الشكر عند اللزوم . 8) ملخص بالإنكليزية مترجم عن العربية بأسلوب علمي ينسجم وروح اللغة الإنكليزية . 9) المراجع ويتم العزو إليها في النص بكتابة كنية المؤلف وعام النشر بين قوسين. وإذا كان للمرجع أكثر من ثلاثة مؤلفين تكتب كنية الأول وتضاف إليها كلمة "وآخرون" إذا كان المرجع بالعربية أو *et al.* إذا كان المرجع بالأجنبية . أما عن ترتيب المراجع في نهاية المطبوعة فيتم هجائيا وبصورة مستقلة، ولكل من المراجع العربية والأجنبية . تستثنى المقالات من الترتيب السابق : مقدمة ومواد وطرق ... إنما يكتفى بوضع ملخص لها بالعربية وآخر بالإنكليزية، يضاف إلى ذلك ضرورة تقسيمها إلى فقرات تحمل كل منها عنوانا مناسبا. وينصح هنا بالرجوع إلى آخر أعداد هذه النشرة للتعرف إلى طريقة إعداد المخطوطة، وترتيب المراجع .

الجداول والأشكال والصور :

تفضل الجداول الصغيرة على الكبيرة، والبسيطة على المعقدة . ويجب أن يحمل كل جدول رقما معيناً حسب وروده في النص، مع عنوان مناسب . وتستعمل الصور (الأبيض والأسود فقط) والأشكال والرسوم الأصلية وليس صوراً عنها، على أن تكون بعرض عمود واحد (8.8 سم) أو عمودين (17.7 سم)، ويشار إلى مكانها المناسب في النص، ويراعى فيها أن تكون واضحة المعالم، وتحمل عنوانا وأرقاما متسلسلة حسب ورودها في النص .

الأرقام ووحدات القياس :

تستعمل في جميع مطبوعات ايكاردا الأرقام العربية Arabic figures(1، 2، 3، .... 9) ، ووحدات القياس الدولية SI Unites مثل : طن/هـ، كغ، غ، م، كم، مم، م^2 .

الاختصارات والرموز :

5 غ، 325 مم، عام 1983، موسم 1988/89، موسما 1987 – 1989، مواسم 1986 – 1989، 20 م^2 ، الجدول 1، الشكل 5، الفاو (منظمة الأغذية والزراعة)، ف م ع (الفرق المعوَّل عليه LSD) .

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

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Checklist of Books, Reports and Journals published outside ICARDA 1973-1988
This checklist, compiled to bring information to the attention of the scientific community and especially to those collaborating with ICARDA, consists of references of books, reports and journals prepared and/or edited by ICARDA scientists and published outside ICARDA as of 1973. Each reference includes within year of publication: author, primary title, pagination, place of publication and publisher, ISBN, AGRIS reference number and price. For your copy write: CODI.

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

Screening Chickpeas for Resistance to Ascochyta Blight A Slide-tape Audio-tutorial Module
This slide-tape audio-tutorial module is the first in the food legume training series. It is designed for the use of legume trainees during the training courses at ICARDA as well as for scientists and their support staff in the various national programs. This module is also useful educational material for universities and training departments in national research systems. For your copy of this publication or package, write: Training Coordination Unit.

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نشرة علمية متخصصة بالعدس

مجلد 17 ، عدد 1 ، 1990

المركز الدولي للبحوث الزراعية في المناطق الجافة
(ايكاردا) ، حلب ، سورية

جامعة ساسكاتشيوان
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