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MORPHOLOGICAL AND TECHNOLOGICAL STUDIES ON SOME LENTIL *(Lens culinaris, medik)* GENOTYPES

BY

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ABSTRACT

Morphological and technological traits were utilized to identify some lentil genotypes namely (ILL5782, L318, ILL7706, ILL5993, ILL6461, ILL7556, Line ILL5722 x ILL5728, ILL7616, Line ILL558 x precoz and Line fam. 300 x precoz). Two field experiments were performed at Tag El-Eizz Agriculture Research Station, Agriculture Research Center (ARC), in 2002/2003 and 2003/2004 seasons . The main results can be summarized as follows. Some morphological traits can be used for identify between lentil genotypes such as, ground colour of testa, pattern of testa, cotyledon colour, plant height, flowering and maturity time, 100-seed weight and seed yield (g/m^2). But some morphological traits were not enough to differentiate between lentil genotypes such as seedlings stem pigmentation where it was present in all genotypes. Protein banding patterns of the studied lentil genotypes were identified by using SDS-PAGE electrophoresis and varied among lentil genotypes. While the genotype ILL6461 has the highest number of total protein bands, the genotype Line ILL558 x precoz has the lowest number of total protein bands. From this study, some morphological traits and SDS-PAGE electrophoresis of lentil protein seed could be used for identify between lentil genotypes.

INTRODUCTION

The cultivated area and seed production of lentil in Egypt has declined drastically since 1980 (Hamdi and El-Assily, 1995) consequently, producing early and high yielding lentil lines is an important goal in lentil breeding programs. Introducing exotic entries is a great importance to increase genetic variability of lentil germplasms in Egypt. Identification of important characters of these lines is essential to achieve a successful breeding program, variety registration and field inspection. The characteristics and distinguish a cultivar from another have to be established and easily observed. Varieties identification is carried out by observation and recording a number of morphological characters of seed, seedlings and adult plants as outlined by International Board for Plant Genetic Resources (IBPGR) and International Center for Agriculture Research in Dry Area (ICARDA) in lentil descriptors, 1985. (Ezzat and Ashmawy 1999) and (Hamdi *et al.*, 2002) concluded that, weight of 100-seed, number of days to 50% flowering and seed yield/plant are important characters in lentil breeding

programs and these traits had high hertabilities as well as high genetic varibilities. Thus, selection for these characters would be effective in improving lentil crop. But, the morphological characteristics of lentil and other crops may be affected by environmental factors and soil conditions (Cooke, 1984). Electrophoresis methods have proved to be useful for routine applications such as in seed quality control for genetic purity verification, variety identification. While, SDS-PAGE of seed proteins of pulked seed sample has proved to be an effective method for distinguishing cultivars of largely out breeding grasses, legumes and sugar beet (Ferguson and Grabe, 1986; Cai and Bullen, 1992; Gardiner and Forde, 1992; Oleo *et al.*, 1992; Moller and Spoor, 1993). Also, (Laemmli, 1970) reported that, seed proteins electrophoresis becomes the technique of choice for Laboratory assessment for the identification and characterization of different cultivars. He also added that SDS-PAGE is considered a low cost, reproducible and rapid method for quantifying, comparing and characterizing proteins. Moreover, (Hamdi, 1987) found, highly significant differences among lentil genotypes for seed protein content. He also found significant differences between genotypes and environments on seed protein quality using SDS-acrylamide gel electrophoresis. The objective of this work was to evaluate some morphological and technological traits of some lentil genotypes.

MATERIALS AND METHODS

Present investigation was carried out at the Experimental Farm at Tag El-Eizz Research Station, Dakhlia Governorate in 2002/2003 and 2003/ 2004 seasons. Lentil seed of genotypes (ILL5782, L318, ILL7706, ILL5993, ILL6461, ILL7556, Line (ILL5722 x ILL5728), ILL7616, Line (ILL558 x precoz) and Line (fam. 300 x precoz)), were obtained from National Legumes Program, Field Crops Research Institute, Agriculture Research Center (ARC). Lentil seeds were sown in Randomized Complete Block Design with 4 replicates. Each experimental plot consists of 4 rows, 3m long and 30 cm apart with a plant density of 300 plants/m2. All usual agricultural practices of growing lentil were performed as recommended by Ministry of Agriculture and Land Reclamanation. Morphological studied traits such as seedling stem pigmentation, plant height (cm), time to flowering, time to maturity, flower ground colour, No. of flowers/peduncle, height of lowest pod (cm), pod shedding, pod dehiscence, seed yield (g/m2), protein content (%) were estimated according to (A.O.A.C, 1990), 100-seed weight (g), ground colour of testa, pattern of testa, colour of pattern on testa, cotyledon colour were estimated usually using the recommended lentil descriptors by International Board for Plant Genetic resources (IBPGR) and International center for Agriculture Research in Dry Areas (ICARDA) 1985. Protein extracts of seed of various genotypes were identified by Sodium Dodecyle Sulphate Polyacrylamide Gel Electrophoresis (SDS-PAGE) according to the method of Laemmli, 1970. Data of quantative characters were subjected to statistical analysis of variance using Mstatc computer program, (1994). The averages were compared using the least significant differences (LSD) method

RESULTS AND DISCUSSION

Data found in Table (1) show the morphological traits of the lentil genotypes. Seedlings stem pigmentation of all lentil genotypes was presented. With respect of leaf pubescence, it was slight in genotypes ILL5782, L318 and ILL 7706 dense in genotypes ILL 5993, ILL6461, ILL7556, Line ILL5772 x ILL5728, ILL7616 and Line Fam 300 x precoz, and absent in genotype Line ILL558 xprecoz. The colour of flower ground was violet in all genotypes.Pod shedding was none in genotypes ILL5782 and Line Fam300 x precoz and low in the genotypes L318, ILL7706, ILL 5993, ILL 6461, line ILL5722 x ILL5728 and line ILL558 x precoz whereas medium in the genotypes ILL 7556 and ILL7616. With respect to pod dehiscence, the pods of genotypes ILL5782, L318, ILL 7706, ILL 6461, ILL 7556 and line Fam 300 x precoz were none dehiscenced whereas pods dehiscence of the genotypes ILL 5993, Line ILL5722 x ILL5728 and ILL7616 were medium. On the other hand pods dehiscence was low in the genotype line ILL558 x precoz.

The ground colour of testa was brown in the genotypes ILL5782, L318, ILL 7706, ILL5993, ILL6461, line ILL5722 x ILL5728, line ILL558 x precoz and line Fam 300 x precoz. On the other hand, it was grey in the genotypes ILL 7556 and ILL7616. With respect to the pattern of testa, it was absent in the genotypes ILL5782, ILL 6461, line ILL5722 x ILL5728, line ILL558 x precoz and line Fam300 x precoz, meanwhile it was dotted in the other genotypes. Data presented in (Table 1) showed colour of pattern on testa was absent in genotypes ILL5782, ILL 6461, line ILL5722 x ILL5728, line (ILL558 x precoz and line Fam300 x precoz and it was black in genotypes L318, ILL 7706, ILL 5993, ILL 7556 and ILL7616. The cotyledon colour was orange/red in the genotypes ILL5782, L318, ILL 5993, ILL 7556, line ILL5722 x ILL5728, ILL7616 and Line ILL558 x precoz. It was yellow in other genotypes. From the former observations, some phenotypic traits were not effective for differentiate between some genotypes while seedlings stem pigmentation and ground colour of testa were seemlier in all genotypes. On the other hand, leaf pubescence and seed characters may be effective in differentiate between some genotypes.

Table (2) shows the combined data of quantitative characters of lentil genotypes. Highly significant differences between lentil genotypes were found in all trais. The genotype Line ILL558 x precoz had the highest plant height 42.4 cm followed by genotypes ILL 6461 and ILL 5993 (36.9 cm and 36.3 cm, respectively). On contrast, the genotype (ILL 7556) had the shortest plant height 28.9 cm. The genotype ILL7556 had the earliest flowering time (50 days) meanwhile the genotypes ILL5782 and L318 (54 days). The genotypes ILL 7706, ILL 6461, ILL7616 and line Fam300 x precoz (55 days). The genotype ILL 5993 (56 days), Line ILL5722 x ILL5728 and line ILL558 x precoz had the lately flowering time (57 days). The time to maturity varied among genotypes and ranged from (136.4 days) for the genotype Line Fam300 x precoz to (137.5 days) for the genotype ILL 7556 (140.4) days for the genotype ILL5782 (141 days) for the genotypes L318 and ILL7616, (145.3 days) for the genotype ILL 6461 (146.3

days) for the genotype Line ILL558 x precoz, (148 days) for the genotype ILL 7706. (150.5 days) for the genotype line ILL5722 x ILL5728 and 152 days for the genotype ILL 5993. The significant differences between lentil genotypes indicate that these characters could be helpful for differentiate between them and important in breeding programme. (Ezzat and Ashmawy, 1999). Number of flowers/peduncle ranged from 7.8 for the genotype ILL6461 to 19.4 flowers/peduncle for the genotype line ILL558 x precoz. The height of the first pod in genotype ILL 6461 was 9 cm meanwhile it reached 17.1 cm in the genotype Line Fam300 x precoz.

Average of seed yield gm/m^2 was presented in Table (2), significant differences between the genotypes wre noticed. The highest seed yield was obtained from the genotype line ILL558 x precoz (675 gm/m^2), followed by the genotypes Line fam 300 x precoz, ILL5782, ILL7556, Line Ill5722 x ILL5728, ILL 6461, ILL5993, L318, ILL7706 and ILL7616 414, 354, 342, 339, 333, 315, 252.4, 221.8 and 219 gm/m^2 for, respectively. The genotype ILL7616 had the highest mean of protein percentage (23.59%) meanwhile the genotype ILL5782 had the lowest one (15.81%). 100-seed weight ranged from 3.230 to 2.035 gm, the highest 100-seed weight was obtained from the genotype ILL 5993, on contrast, the lowest weight 2.035 gm was obtained from the genotype L318. The significant differences in quantitative traits among the genotypes revealed that these characters are a good descriptor for identification between lentil genotypes and useful in breeding progarmme. These results agreed with those obtained by (Ezzat and Ashmawy, 1999 and Hamdi *et al.*, 2002).

Data presented in Table (3) and Fig (1) show the distinct differences in protein banding of the studied lentil genotypes. From these results number of total protein bands varied among genotypes. The highest number of total protein bands (14) was obtained from genotype ILL5993 while the lowest number of total bands (10) was obtained from Line ILL558 x precoz. With respect to number of distinguish bands, lentil genotypes were characterized by protein with molecular weights of (116.00,85.696,56.525 and 33.594 KD), (126.073,114.6 and 88.968 KD), (115.657,59.540, and 19.765 KD), (121.575, 94.307,82.502 and 18.753 KD), (71.454 and 32.243 KD), (115.880,62.735,52.942 and 20.439 KD), (50.646 KD), (61.385, 48.883, 34.267 and 16.392 KD), (58.370 and 29.882 KD) and (73.599,63.140,62.825 and 61.475 KD) for lentil genotypes ILL5782, L318, ILL 7706, ILL 5993, ILL 6461, ILL 7556, Line ILL5722 x ILL5728, ILL7616, line ILL558 x precoz and line Fam300 x precoz, respectively. These results agreed with those obtained by Hamdi, 1987,who reported that, significant differences between lentil genotypes and environments on seed protein quality using SDS-acrylamide gel electrophoresis. The results of the present study suggested some morphological characters and applying of seed protein electrophoresis for identify various lentil genotypes.

Table (1): Morphological characters of different lentil genotypes. (Data of 2002/2003 and 2003/2004 seasons).

Characters	ILL5782	L318	ILL 7706	ILL 5993	ILL 6461	ILL7556	Line (ILL 5722xILL 5728	ILL 7616	Line (ILL558 x Precoz	Line (Fam.*380 x precoz*
Seedling stem pigmentation	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present
Leaf pubescence	Slight	Slight	Slight	Dense	Dense	Dense	Dense	Dense	Absent	Dense
Flower ground colour	Violet	Violet	Violet	Violet	Violet	Violet	Violet	Violet	Violet	Violet
Pod shedding	None	Low	Low	Low	Low	Medium	Low	Medium	Low	None
Pod dehiscence	None	None	None	Medium	None	None	Medium	Medium	Low	None
Ground colour of testa	Brown	Brown	Brown	Brown	Brown	Gery	Brown	Gery	Brown	Brown
Pattern of testa	Absent	Dotted	Dotted	Dotted	Absent	Dotted	Absent	Dotted	Absent	Absent
Coulour of pattern on testa	Absent	Black	Black	Black	Absent	Black	Absent	Black	Absent	Absent
Cotyledon colour	Orand-red	Orand-red	Yellow	Orand-red	Yellow	Orand-red	Orand-red	Orand-red	Orand-red	Yellow

Table (2): Quantative characters of different lentil genotypes. (Combined data of 2002/2003 and 2003/2004 seasons)

Characters	Plant height (cm)	Time to flowering (day)	Time to maturity (day)	No. of flowering /peduncle	Height of lowest pod (cm)	Seed yield (g/m2)	Protein content (%)	100-seed weight (g)
ILL5782	35.8	54	140.4	9	15.3	354	15.81	3.156
L318	30.2	54	141	10	16.4	252.4	20.01	2.035
ILL 7706	33.9	55	148	9.3	15.5	221.8	20.14	3.113
ILL 5993	36.3	56	152	9.7	12.5	315	22.76	3.230
ILL 6461	36. 9	55	145.3	7.8	9.1	333	15.77	2.423
ILL7556	28.9	50	137.5	10.8	13.4	342	18.00	3.055
Line (ILL 5722xILL 5728)	35.8	56.8	150.5	8.5	15.0	339.	17.51	2.906
ILL 7616	34.4	55.1	141.4	10	15.9	219	23.59	3.051
Line (ILL558xPrecoz)	42.4	57	146.3	19.4	16.1	675	20.14	2.913
Line (Fam.*300 x precoz*)	35.8	55	136.4	13.3	17.1	414	20.46	3.169
LSD 0.0 5%	0.4	0.8	0.8	0.7	0.7	2.1	0.4	0.001

Table (3): Seed protein fraction (% total protein) for the studied lentil genotypes by using SDS-PAGE electrophoresis.

Protein M.W.KD	ILL5782	L318	ILL 7706	ILL 5993	ILL 6461	ILL7556	Line (ILL 5722xILL 5728)	ILL 7616	Line (ILL558xPrec oz)	ine (Fam.30 x precoz)
169.211	+	+	+	+	+	+	+	+	+	+
126.073		+								
124.545					+		+			
121.575				+						
116.000	+									
115.880						+				
115.657			+							
114.600		+								
105.149.	+	+	+	+	+	+	+	+	+	+
94.307				+						
88.968		+								
85.696	+									
82.502				+						
73.599										+
71.454					+					
64.710	+	+	+	+	+	+	+	+	+	+
63.140										+
62.825										+
62.735						+				
62.262	+	+	+	+	+		+	+		
61.457										+
61.385								+		
60.599	+	+	+	+	+	+	+	+	+	+
59.540			+							
59.360		+		+	+		+			+
58.370									+	
57.755		+	+	+	+	+	+	+	+	+
56.525	+									
52.942						+				
50.646							+			
48.883								+		
41.862	+	+	+	+	+	+	+	+	+	+
34.267								+		
33.594	+									
32.243					+					
31.065			+	+			+			
29.882									+	
24.191	+	+			+	+		+	+	+
20.439						+				
19.765			+							
18.753				+						
16.392								+		
6.178	+	+	+	+	+	+	+	+	+	
No.of total bands	12	13	12	14	13	12	12	13	10	12
No.of distinguish bands	4	3	3	4	2	4	1	4	2	4

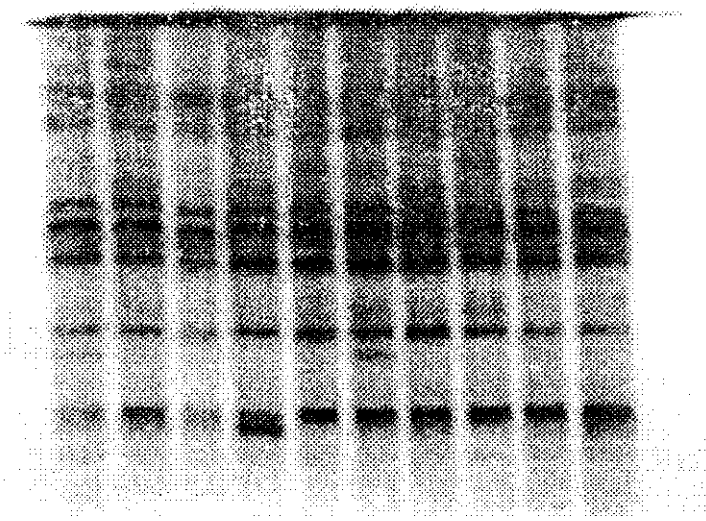

Fig (1): S.D.S. ploy acrylamide gel electrophoresis (SDS-PAGE) of lentil genotypes (ILL5782, L318,ILL7706,ILL 5993,ILL6461, ILL 7556, line (ILL5722 x ILL5728), ILL7616, line (ILL558 x precoz) and line (Fam300 x precoz

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دراسات مورفولوجية وتكنولوجية على بعض التراكيب الو راثية للعدس

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تهدف هذه الدراسة إلى استخدام بعض الصفات المورفولوجية والتكنولوجية لتمييز بعض التراكيب الو راثية المستوردة لنبات العدس وهى ILL5782, L318, ILL7706, ILL5993, ILL6461, ILL7556, Line ILL5772x ILL5728, ILL7616, Line ILL558xPrecoz and Line ILL558xPrecoz . أجريت تجربتان حقليتان بمحطة البحوث الزراعية بتاج العز محافظه الدقهلية- مركز البحوث الزراعية خلال موسمي ٢٠٠٢/٢٠٠٣ م، ٢٠٠٣/٢٠٠٤ م. ويمكن تلخيص أهم النتائج فيما يلي.

أوضحت نتائج التجارب الحقلية إلى وجود بعض الصفات المورفولوجية التي يمكن إستخدامها للتمييز بين التراكيب الو راثية المدروسة وكان من أهمها لون أرضية القصرة، الرسوم الموجودة على القصرة، لون الفلقات، طول النبات، مواعيد التزهير، مواعيد النضج ومحصول البذور/م^2، وزن ال١٠٠ بذره، النسبة المئوية للبروتين.

كما أشارت النتائج إلى وجود بعض الصفات المورفولوجية التي لم يفي إستخدامها فى التمييز بين التراكيب الوراثية المدروسة مثل صبغات غمد الساق حيث كانت موجودة فى جميع التراكيب الوراثية المدروسة ولذلك يجب زيادة قاعدة الإنتخاب حتى يمكن الحصول على العديد من الصفات الوراثية المميزة لهذة التراكيب الوراثية.

وتشير نتائج التفريد الكهربي لبروتين التراكيب الوراثية المدروسة باستخدام SDA-PAGE إلى وجود اختلافات بين الطرز المدروسة. حيث كان هناك عدد من روابط البروتين المميزة للتراكيب الوراثية المدروسة كما أعطى الطراز الوراثى ILL6461 أعلى عدد من روابط البروتين الكلية بينما أعطى الطراز الوراثى Line ILL558xprecoz اقل عدد من روابط البروتين الكلية.

من خلال نتائج هذة الدراسة نجد أن بعض الصفات المورفولوجية و التفريد الكهربي لبروتين التراكيب الوراثية المدروسة كان مفيد فى التمييز بينها لحفظ حقوق المربى إلا أنة يجب زيادة التنوع الوراثى عند الانتخاب للحصول على صفات مورفولوجية أكثر فعالية فى التفتيش الحقلي.