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## Genetic Variability and Heritability for Grain Yield and Other Characters in Lentil

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**Abstract:** Genetic variability and heritability were estimated for grain yield and six other characters in lentil. Experimental material included five lentil cultivars and 26 lentil lines grown during 1999/2000 and 2000/2001. Maximum variability was recorded for biological yield; grain yield and seed yield plant<sup>-1</sup>. Maximum heritability was found for seed weight and days to 50% flowering.

**Key words:** Lentil, (*Lens culinaris* Medik.), variance components, heritability

### INTRODUCTION

Lentil (*Lens culinaris* Medik.) is the first major grain legume crop in Turkey, particularly in Southeast Anatolia region. The average yield (1050 kg ha<sup>-1</sup>) is low. Knowledge of heritabilities of economically important characters are critical in selection studies. Most of the characters had medium to high estimates of heritability such as 1000 seed weight, days to maturity, days to flowering, seed yield plant<sup>-1</sup>, also the highest estimates were noted for seed weight followed by days to maturity<sup>[1]</sup>. Rajput and Sarwar<sup>[2]</sup> reported that high heritability for plant height (0.92) and the highest heritability (0.99) was for 100 grain weight. Serene *et al.*<sup>[3]</sup> also reported that high heritability and medium genetic advance for 100-seed weight. The aim of this work was to identify variability and heritability estimates of economically important grain yield and yield components in lentil.

### MATERIALS AND METHODS

Five checks and 26 lentil (*Lens culinaris* Medik.) lines which were developed from previously collected landraces in the Southeast Anatolia of Turkey, were evaluated during the growing seasons of 1999/2000 and 2000/2001, in randomised complete block design with three replications, in plots of rows, 4 m long and spaced 20x2.5 cm at University of Dicle, Faculty of Agriculture, Diyarbakir-Turkey.

The observations were recorded on a sample of 10 randomly selected plants from each plot for seven characters. Data was combined over two growing seasons. Plot means were used to estimate the mean, range, phenotypic and genotypic variance and heritability. Variance components were estimated from

expected mean squares<sup>[4]</sup>. Heritability of grain yield, days to maturity, plant height, seed weight, total biological yield, seed yield per plant were estimated as a ratio of genotypic variance to phenotypic variance. Analysis of variance was computed by TARIST packet programme.

### RESULTS AND DISCUSSION

A combined analysis of variance for 31 lentil genotypes over two years for all observed characters indicated that year, genotype and genotype x year interaction were significant. The effects of years were larger for all characters except seed weight. Maximum variability was recorded for biological yield; grain yield and seed yield plant<sup>-1</sup> (Table 1).

Days to 50% flowering of genotypes varied between 145.7-162.0 days. Days to 50% flowering had high heritability value (0.82). Muehlbauer *et al.*<sup>[1]</sup> had also reported that this character had moderately large heritability.

Days to maturity ranged from 180.9 to 196.2 days. The medium heritability (0.53) was for this character.

Plant height, measured from ground level to the plant tip, varied between 25.8 and 40.2 cm with mean 32.5 cm. The maximum height was attained by the genotype BM 760. Plant canopy height exhibited moderately high heritability (0.63). Low estimates of heritability for this character in lentil has been reported in previous studies<sup>[5,6]</sup>.

The mean seed yield plant<sup>-1</sup> was 1.03 g plant<sup>-1</sup>. Control-4 had maximum seed yield plant<sup>-1</sup> (1.64 g plant<sup>-1</sup>) followed by BM 499 (1.51 g plant<sup>-1</sup>). Relatively low heritability (0.26) was found for seed yield plant<sup>-1</sup> as Muehlbauer *et al.*<sup>[1]</sup> reported. Opposite our finding Hamdi *et al.*<sup>[7]</sup> reported high variability and high heritability for seed yield plant<sup>-1</sup> in lentil.

**Table 1: Analysis of variance some characters on 31 lentil genotypes grown during 1999/2001**

Variation sources	D.F	DAF	DM	PH	SW	GY	TBY	SYP
Years	1	2960.0**	2000.5**	8767.3**	57.8 **	370779.8**	9700221.2**	10.4**
Error	4	0.828	3.086	29.0	0.929	678.451	29471.145	0.332
Genotype	30	174.8**	158.3**	66.0**	103.8**	4814.6**	5876.333 **	0.27**
Genotype x year	30	31.8**	74.438**	23.6**	9.1**	2841.1**	4489.806*	0.23**
Error	120	2.528	3.280	5.76	1.400	687.617	2699.478	0.100
Corrected	185	51.1	50.7	66.3	19.561	3706.3	56502.851	0.212
Range over years		145.7-162.0	180.9-196.2	25.8-40.2	29.9-44.9	103.9-197.5	382.7-520.8	0.72-1.64
Mean		154.0	187.79	32.52	35.12	143.13	459.35	1.103
CV%		4.65	3.79	25.03	12.59	42.53	51.74	41.71

\*,\*\* significant at 0.05 and 0.01 probability levels, respect. DAF: Days to Flowering, DM: Days to Maturity, PH: Plant Height, SW: Seed Weight, GY: Grain Yield, TBY: Total Biological Yield, SYP: Seed Yield Per Plant

**Table 2: Estimated of variance components and heritability of some characters on 31 lentil genotypes during 1999/2001**

Expected mean squares		DAF	DM	PH	SW	GY	TBY	SYP
Genotypic	$\sigma^2 e + r\sigma_{gy}^2 + ry\sigma_g^2$	24.265	13.86	8.07	16.21	328.92	231.16	0.014
Gen. x years	$\sigma^2 e + r\sigma_{gy}^2$	9.764	23.75	5.945	2.573	717.85	596.78	0.0457
Phenotypic	$\sigma^2 g + \sigma_{gy}^2 / y + \sigma^2 e / r y$	29.568	26.28	12.00	17.73	802.45	979.46	0.0539
Heritability%	$\sigma^2 g / \sigma^2 p$	0.82	0.53	0.67	0.91	0.41	0.24	0.26

DAF: Days to Flowering, DM: Days to Maturity, PH: Plant Height, SW: 1000 Seed Weight, GY: Grain Yield, TBY: Total Biological Yield, SYP: Seed Yield Per Plant

**Table 3: The mean for some characters on 31 lentil genotypes grown over two years (1999/2001)**

Genotypes	DAF	DM	PLHT	SYP	SW	GY	TBY
BM 760	158.83b-e	186.33e-g	40.17a	0.942g-k	38.04b-d	140.197f-j	510.34a-c
BM 670	154.50i-k	186.66ef	33.83c-h	1.074c-k	36.70de	113.963i-l	433.76d-h
BM 711	159.00b-d	195.00a	32.50e-i	1.004f-k	35.08fg	119.380h-l	456.95b-g
BM 329	155.33h-j	186.50ef	29.67i-l	1.006e-k	30.27kl	133.565f-l	415.60gh
BM 479	153.17k	184.33g-j	30.50h-k	1.078c-k	39.18b	129.328g-l	439.36d-h
BM 585	162.17a	195.83a	34.33b-h	0.876i-k	33.57h	103.943l	434.65d-h
BM 734	155.17i-j	188.00e	35.00b-f	0.854j-k	34.29gh	117.710i-l	382.72h
BM 592	159.00b-d	192.83bc	34.33b-h	0.897h-k	31.15j-l	117.377i-l	447.13d-g
BM 221	160.50ab	196.00a	33.67d-h	1.051c-k	32.14ij	110.863j-l	419.81f-h
Control-1	157.17e-g	190.66d	36.50bc	1.037c-k	31.10j-l	132.307g-l	472.21a-g
BM 117	159.83bc	185.00f-i	34.33b-h	0.719k	35.18fg	110.102kl	435.83d-h
BM 500	146.33o	183.00i-m	28.83k-n	1.202b-j	38.31bc	170.808a-e	511.45ab
BM 409	157.67d-g	196.17a	32.00f-j	1.196b-j	30.35kl	143.497e-i	473.08a-g
BM 143	158.67c-f	194.67ab	35.17b-e	1.018d-k	36.07ef	135.555f-k	476.50a-f
BM 601	158.67c-f	186.50ef	35.50b-d	0.842jk	35.32f-g	130.808g-l	487.39a-d
BM 151	157.83d-g	194.83ab	35.00b-f	1.080c-k	31.94j	119.827h-l	461.26a-g
BM 499	146.83o	181.83l-n	31.67g-j	1.515ab	39.19b	197.502a	512.63ab
BM 20	151.33l	185.33f-h	35.00b-f	0.933g-k	31.24j-l	134.292f-k	434.81d-h
BM 34	145.67o	180.83n	32.50e-i	1.390a-c	37.79cd	179.880a-c	520.79a
BM 152	148.83m	182.17k-n	31.67g-j	1.077c-k	31.34jk	148.290d-h	451.36c-g
BM 498	154.33jk	183.33h-l	34.67b-g	1.334a-f	44.95a	125.040g-l	447.21d-g
BM 33	147.00no	181.00mn	27.33l-o	0.979f-k	34.14gh	180.250a-c	455.71b-g
BM 35	146.67o	183.83h-l	26.17n	1.371a-d	33.56h	185.270ab	426.08e-h
BM 497	147.33m-o	185.33f-h	26.83m-o	1.368a-e	44.15a	164.020b-f	484.54a-e
BM 31	145.83o	184.17h-k	25.83o	1.267b-g	31.83j	176.428a-d	460.38b-g
BM 496	146.83o	185.17f-h	30.50h-k	1.228b-i	44.24a	179.557a-c	456.52b-g
BM 201	159.83bc	195.67a	32.33e-j	1.001f-k	31.59jk	112.235j-l	438.91d-h
Control-2	158.17c-f	192.50cd	36.83b	0.849jk	34.46gh	110.685j-l	486.47a-d
Control-3	148.67mn	182.50j-n	29.50j-m	1.111c-k	29.96l	186.788ab	458.89b-g
Control-4	156.17g-i	185.00f-i	33.17d-i	1.644a	38.11bc	174.433a-d	482.35a-e
Control-5	157.00f-g	190.67d	32.83d-i	1.256b-h	33.36hi	153.020c-g	465.08a-g
LSD=	1.824	2.077	2.755	0.363	1.357	30.076	59.591

DAF: Days to Flowering, DM: Days to Maturity, PLHT: Plant Height, SW: Seed Weight, GY: Grain Yield, TBY: Total Biological Yield, SYP: Seed Yield Per Plant

Seed weight of genotypes varied between 29.9 and 44.9 g. The genotypes had similar seed weight values over years. While Control-3 had the lowest seed weight, but the genotypes BM 496, 498 and 497 had the highest seed weight. The highest heritability (0.91) was noted for this character as reported by Rajput and Sarwar<sup>[2]</sup> and Serene *et al.*<sup>[3]</sup>.

The mean grain yield of lentil genotypes was 1431.26 kg ha<sup>-1</sup> and ranged from 1039.4 to 1975.0 kg ha<sup>-1</sup>.

BM 499 had the highest yielding genotype. Moderate heritability (0.41) was observed for this character. Effect of environment on this character seemed high, since there was large variation from one year to another.

The biological yield varied between 3827.1-5207.9 kg ha<sup>-1</sup> low heritability (0.24) was found for biological yield.

As a result of this study; days to 50% flowering, days to maturity, seed weight and plant height appear to

have large heritabilities indicating low environmental effects for these characters. But seed yield plant<sup>-1</sup> and biological yield have low heritability values indicating high environmental effects on those characters.

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