eISSN 2583-6986
IDEALISTIC JOURNAL OF ADVANCED RESEARCH IN PROGRESSIVE SPECTRUMS (IJARPS)
A MONTHLY, OPEN ACCESS, PEER REVIEWED (REFEREED) INTERNATIONAL JOURNAL
Volume 03, Issue 11, November 2024

Assessment of Genetic Diversity and Heritability for Yield and Associated Traits of Lentil (*Lens culinaris* Medik.) Genotypes

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Received: 24 Oct 2024 Accepted & Reviewed: 25 Nov 2024, Published : 30 November 2024

Abstract

The present experiment was conducted during the Rabi season of 2023-24 at the Research Farm, Department of Genetics and Plant Breeding, J.V. College, Baraut, Baghpat. The objective was to evaluate twelve agronomic traits across forty lentil genotypes using a randomized block design (RBD) with three replications. Observations were recorded on five randomly selected plants per plot for traits including days to germination, days to 50% flowering, days to maturity, plant height, number of primary and secondary branches, number of pods per plant, seeds per pod, 100-seed weight, seed yield per plant, biological yield per plant, and harvest index. Genotypic differences were evident, particularly in growth patterns. The genotype LC-3002 recorded the highest plant height (41.57 cm), while MC-6 was the shortest (19.03 cm), with a coefficient of variation (CV) of 6.62% for plant height and 0.57% for primary branches. Genotypic coefficients of variation (GCV) and phenotypic coefficients of variation (PCV) were high for number of pods per plant, days to maturity, and biological yield, indicating significant genetic variability. High heritability (>80%) was noted for biological yield, days to flowering, and harvest index, suggesting strong potential for selection. In contrast, traits such as number of pods per plant, plant height, and 100-seed weight exhibited low heritability, indicating limited effectiveness of phenotypic selection. Positive correlations were observed between seed yield and traits such as number of pods per plant, biological yield, and plant height, while biological yield had a negative correlation with harvest index. These findings underscore the potential for selecting high-yielding genotypes based on traits with high heritability and positive correlations with seed yield.

Key words: Genetic variability, heritability, seed yield, biological yield

Introduction

Lentil *(Lens culinaris Medik.)* is a self-pollinated food legume (2n=14) with prime nutritious importance. It is enriched with 25.1% proteins, 59% carbohydrates, 0.5% fats and 2.1 % minerals along with ample quantity of vitamins (Darai *et al*., 2017). Lentils are also high in complex carbohydrates**,** and are good sources of B **v**itamins and minerals like iron**,** magnesium**,** phosphorus, potassium, zinc, copper, and manganese (Pandey *et al.,* 2015). It is a key player for atmospheric nitrogen fixation and is necessarily important for soil, human and animal health (Haque *et al*., 2014). It plays an important role in rain-fed cropping systems, providing an alternative to cereal grains (FAOSTAT 2019). It is cultivated mainly for its seed and only cotyledon is used as food in India. Wild lentils are indigenous to much of the world, including western Asia and North America. They were first cultivated in the Near East's Fertile Crescent and quickly spread to Europe, the Middle East, India, Afghanistan, and Ethiopia (Ilyas *et al.,* 2014). Worldwide, large lentil producing countries include Canada, India, Turkey, Syria, Australia, Nepal, and the United States.

Approximately 95% of Canada's lentils are produced in Saskatchewan. In India, Lentil occupies an area of 1657.5 thousand ha with a production of 1220.0 thousand tones. As per fourth advanced estimate from DES, MoAF & W, Govt. of India, 2022, Uttar Pradesh is the leading lentil producing state in India (0.47 million tons from 0.49 ha. acreage, 36.43 % of national production), followed by Madhya Pradesh (0.44 million tons from 0.49 million ha. acreage, 34.55% of national production), West Bengal (10.53%), Bihar (8.84%) and Jharkhand (4.50%) depending on their contribution in the national production of lentil (Malik *et al.,* 2022).

The knowledge about genetic variability and heritability is helpful to the breeder to articulate selection criteria for improvement of yield associated parameter. The genotype possessing better heritability and genetic advance for various characters may serve as a best parent for any crop improvement programme (Joshi *et al.,* 2019). Additionally, studies on the genotypic correlation of the yield components and morphological traits through path analysis provide information to design appropriate breeding strategy towards improvement of the crop. Therefore, this study aims to assess the genetic diversity of lentil genotypes concerning yield and yield-related traits.

MATERIALS AND METHODS

Experimental materials - The study was conducted using forty lentil genotypes obtained from Indian Agricultural Research Institute (IARI), New Delhi (Table 1).

Experimental details- The experiment was carried out during the Rabi season of 2023-24 at the Research Farm of the Department of Genetics and Plant Breeding at J.V. College, Baraut, Baghpat. The experimental design used was RBD with 3 replications. The genotypes were planted on 1.5 m × 1 m (1.5m^2) plot area. The spacing was 30cm between rows and 8cm between plants. There were three rows per plot and 54 experimental units. The observations were recorded on five randomly selected plant per plot for twelve characters viz, days to germination, days to 50% flowering, days to maturity, number of primary branches, number of secondary branches, plant height (cm), number of pods per plant, number of seeds per pod, 100-seed weight (g), seed yield per plant (g), biological yield per plant (g) and harvest index (%). Analysis of variance was carried out as per standard procedure (Fisher, 1930). Genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) (Burton, 1952), heritability**,** genetic advance**,** genetic divergence were estimated.

Table 1: List of Lentil Genotypes used for the study

SL.NO.	Genotypes	Source
1.	**DPL15**	IARI (New Delhi)
2.	**EC 267544A**	IARI (New Delhi)
3.	**EC 267569A**	IARI (New Delhi)
4.	**EC 267573**	IARI (New Delhi)
5.	**EC 267591**	IARI (New Delhi)
6.	**EC 78395**	IARI (New Delhi)
7.	**EC 78406**	IARI (New Delhi)
8.	**EC 78511**	IARI (New Delhi)
9.	**EC 78513**	IARI (New Delhi)
10.	**EC 78517**	IARI (New Delhi)
11.	**EC 78521**	IARI (New Delhi)

12.	**EC78426**	IARI (New Delhi)
13.	**IG 69568**	IARI (New Delhi)
14.	**IPL 406**	IARI (New Delhi)
15.	**L 4076**	IARI (New Delhi)
16.	**L 4705**	IARI (New Delhi)
17.	**L 4717**	IARI (New Delhi)
18.	**L 4727**	IARI (New Delhi)
19.	**L 4729**	IARI (New Delhi)
20.	**L 5120**	IARI (New Delhi)
21.	**L 9720**	IARI (New Delhi)
22.	**LC 3002**	IARI (New Delhi)
23.	**MC 6**	IARI (New Delhi)
24.	**NDL 1**	IARI (New Delhi)
25.	**P 13115**	IARI (New Delhi)
26.	**P 13119**	IARI (New Delhi)
27.	**P 13122**	IARI (New Delhi)
28.	**P 13128**	IARI (New Delhi)
29.	**P 13135**	IARI (New Delhi)
30.	**P 14106**	IARI (New Delhi)
31.	**P 14109**	IARI (New Delhi)
32.	**P 15151**	IARI (New Delhi)
33.	**P15207**	IARI (New Delhi)
34.	**P 15212**	IARI (New Delhi)
35.	**P 16205**	IARI (New Delhi)
36.	**P 52127**	IARI (New Delhi)
37.	**P 8103**	IARI (New Delhi)
38.	**PC 97**	IARI (New Delhi)
39.	**PDL1**	IARI (New Delhi)
40.	**PSL9**	IARI (New Delhi)

STATISTICAL ANALYSIS- The data was analyzed using ANOVA with the GLM procedure in SAS. Significant treatment means were differentiated via the Student-Neuman-Keuls (SNK) test at a 5% significance level.

RESULTS AND DISCUSSION

Analysis of Variance - The analysis of variance for the 12 characters studied is given in Table 2. There was a highly significant difference ($P < 0.001$) among the tested genotypes for days to germination, days to flowering, days to maturity, plant height, number pods per plant, number of seed per pod and harvest index. Significant differences ($P < 0.05$) were observed for biological yield and seed yield. Non-significant differences were observed for traits like number of primary branches per plant, number of secondary branch/plant and 100-seed weight (Table 2).

Table 2: ANOVA table showing mean squares for genotypes, error mean square and replication mean squares

Characters	Replication	Treatment	Error
Degree of freedom	Df=2	Df=39	Df=78
Day of germination	2.858	0.841	1.029
Days to 50% flowering	2.433	85.094**	8.656
Days to maturity	17.219	34.689**	7.727
Plant height (cm)	11.54	91.450**	9.438
Number of primary branches $plant^{-1}$	0.078	0.507**	0.07
Number of secondary branches $plant^{-1}$	0.268	17.827**	0.368
Number of pods $plant^{-1}$	47.522	642.110**	27.475
Number of seeds pod^{-1}	0.047	0.166**	0.033
100-seed weight (g)	0.082	0.399**	0.032
Seed yield $plant^{-1}$ (g)	0.279	55.730**	0.245
Biological yield $plant^{-1}$ (g)	0.854	2.353**	0.13
Harvest index (%)	9.787	174.802**	2.431

Where, Df= Degrees of freedom, ns=non-significant, * and ** indicates significant and highly significant respectively.

Variability in twelve traits in different lentil genotypes

All genotypes germinated on average eight days after sowing. PSL9 (8.67 days) was the last to germinate, while PDL1, P 14109, MC 6, and L 4727 (7.00 days) germinated the earliest. Significant variation was observed in days to flowering and maturity (Table 3). Genotypes took 76-97 days to flower and 120-135 days to mature. MC-6 (76.67 days) was the earliest to reach 50% flowering, while P15207 (97.67 days) was late. For maturity, MC-6 (120 days) matured earliest, and P-52127 (135 days) was late. Coefficient of variation was low for days to germination (0.01), flowering (6.34), and maturity (5.99). Significant differences were observed in plant height, but not in the number of primary branches (Table 4). Genotypes averaged 32.27 cm in height, with LC-3002 (41.57 cm) being the tallest, and MC-6 (19.03 cm) the shortest. The coefficient of variation for plant height was 6.62, while it was 0.57 for primary branches. The variability observed in germination, flowering, and maturity times suggests genotypic differences in growth patterns, with MC-6 showing early flowering and maturity, making it potentially suitable for shorter growing seasons. Taller plants, like LC-3002, may be advantageous for certain agronomic traits, though shorter genotypes like MC-6 might be preferred for different environments. Despite significant variability in plant height, the stability of traits like primary branches suggests some uniformity across genotypes. The low coefficient of variation for key traits indicates consistency in the data (Kumar *et al.*, 2019).

The significant variation in yield-related traits among lentil genotypes (Table 4) indicates potential for selecting high-yielding varieties, with genotypes like L-9720 and L-5120 showing superior performance. The low coefficient of variation for key traits suggests consistency, while the wide range in pod numbers highlights genetic diversity, offering opportunities for targeted breeding.

eISSN 2583-6986
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Volume 03, Issue 11, November 2024

Table 3: Mean performance of three traits recorded as affected by genotypes

Genotype	Day to germination	Day to 50% flowering	Day to maturity
DPL-15	8.67	91.00	126.33
EC-267544A	8.67	94.33	129.67
EC-267569A	7.33	85.00	126.33
EC-267573	8.33	91.00	125.33
EC 267591	7.33	95.33	128.67
EC 78395	8.00	91.67	126.67
EC 78406	7.67	91.33	122.67
EC 78511	8.00	93.67	130.33
EC 78513	8.67	90.67	127.00
EC 78517	8.00	88.67	128.00
EC 78521	8.00	90.67	127.67
EC78426	8.67	90.67	129.00
IG 69568	8.67	91.67	129.00
IPL 406	8.00	89.67	127.00
L 4076	8.00	90.33	129.00
L 4705	8.67	92.67	130.33
L 4717	8.00	91.00	129.00
L 4727	7.00	91.67	126.00
L 4729	7.33	80.67	120.67
L 5120	7.67	77.33	123.67
L 9720	8.00	88.33	127.00
LC 3002	8.67	92.00	126.67
MC 6	7.00	76.67	120.00
NDL	8.00	95.33	127.67
P 13115	7.67	91.00	131.00
P 13119	8.33	95.67	127.00
P 13122	7.33	95.33	126.33
P 13128	8.00	91.33	127.00
P 13135	7.67	92.33	125.00
P 14106	8.00	89.33	126.67
P 14109	7.00	84.67	134.00
P 15151	8.33	95.00	129.00
P15207	8.67	97.67	134.33
P 15212	7.33	87.00	132.00
P 16205	8.00	77.33	129.00
P 52127	8.00	94.67	135.00
P 8103	8.00	95.00	132.33
PC 97	8.00	89.00	134.33
PDL1	7.00	78.33	128.40
PSL9	8.67	88.33	132.37

Mean	**7.96**	**89.83**	**128.19**
C.D. 1%	**0.01**	**6.34**	**5.99**

Table 4: Mean performance of nine traits recorded as affected by genotypes. Mean with the same letter are not significantly different.

Genotype	PH (cm)	NPBPP	NSBPP	NPPP	NSPP	100-SW(g)	BYPP	GYPP	HI(%)
DPL-15	31.1	3.53	13.53	137	1.04	3.76	21.12	5.44	25.75
EC-267544A	28.59	2.97	6.6	148.2	1.15	2.48	14.76	6.45	43.69
EC-267569A	32.43	3.47	13.4	140.13	1.26	3.56	18.42	6.52	35.41
EC-267573	34.9	2.63	16.73	118.47	1.36	2.14	16.56	5.37	32.39
EC-267591	32.13	3.23	11.37	158.6	1.54	2.53	17.31	5.67	32.74
EC-78395	35.4	2.53	15.33	160.07	1.47	2.34	14.63	7.26	49.58
EC-78406	28.2	3.03	16.4	121.03	1.35	2.99	16.3	5.69	34.9
EC-78511	37.27	2.63	10.3	136.07	1.72	2.55	17.63	5.77	32.69
EC-78513	37.3	3.53	13.57	134	1.16	3.27	16.52	5.19	31.43
EC-78517	34.63	3.73	17.27	130.73	1.17	3.4	28.6	5.7	19.91
EC-78521	21.17	3.43	9.17	129.87	1.38	2.82	14.43	5.65	39.18
EC-78426	31.77	2.3	16.77	147.37	1.3	2.91	17.45	5.52	31.65
IG69568	34.63	3.4	14.4	152.83	1.34	3.16	24.13	7.03	29.13
IPL406	36.63	2.33	6.7	124.6	1.35	2.28	20.91	5.31	25.41
L-4076	36.23	3.53	11.27	138.93	1.31	3.18	20.68	5.56	26.88
L-4705	38	3.2	16.53	165.33	1.23	3.07	25.81	6.7	25.94
L-4717	37.63	3.4	16.8	184.15	1.33	2.38	23.68	6.62	27.94
L-4727	37.4	3.27	12.47	140.67	1.16	3.08	20.95	5.19	24.79
L-4729	25.53	2.47	14.73	123.07	1.35	2.46	23.68	5.11	21.57
L-5120	26.03	2.47	14.83	162.44	1.69	2.64	24.54	7.27	29.61
L-9720	39.83	2.97	16.37	153.07	1.34	2.69	23.47	7.41	31.59
LC-3002	41.57	2.27	13.47	123.43	1.12	2.4	23.04	3.46	15.02
MC-6	19.03	2.47	16.2	123.13	1.24	2.77	24.29	6.52	26.86
NDL-1	31.87	2.53	12.33	154.47	1.24	2.99	14.11	5.59	39.65
P-13115	38.33	3.27	17.33	130.13	1.04	2.44	26.04	3.85	14.8
P-13119	37.27	2.7	16.57	133.33	1.34	3	16.66	6.78	40.68
P-13122	35.17	2.7	17.33	144.27	1.59	2.84	28.34	6.43	22.74
P-13128	34	2.6	12.33	148.47	1.49	2.58	21.6	6.34	29.37
P-13135	35.51	2.53	13.7	163.33	1.42	2.81	20.76	6.34	30.52
P-14106	36	2.97	14.3	158.59	1.42	2.99	23.67	5.44	22.95
P-14109	22.97	2.8	16.5	125.63	1.64	2.69	24.99	6.9	27.58
P-15151	37.1	3.07	16.97	151.47	1.21	2.5	26.97	5.07	18.74
P-15207	35.33	2.63	14.17	150.83	1.76	3.07	25.7	5.5	21.43
P-15212	31.27	2.27	15.87	157.17	1.77	2.82	23.9	5.2	21.76
P-16205	27.57	2.57	14.6	148.5	1.53	2.54	24.8	6	24.22
P-52127	25.53	3.1	16.4	139.77	1.87	3	23.63	6.83	28.93
P-8103	26.53	3.03	14.27	138.53	1.57	2.23	27.8	4.43	15.94
PC-97	28.2	2.77	15.2	146.33	1.9	2.9	26.2	6.8	25.96

PDL1	24.83	2.73	16.83	152.6	1.9	2.57	23.73	5.67	23.87
PSL9	25.97	2.97	14.9	139.63	1.7	3	28.2	6.07	21.51
C.D.1%	6.62	0.57	1.3	11.3	0.389	0.387	1.06	0.77	3.36
Mean	**32.27**	**2.9**	**14.6**	**143.41**	**1.42**	**2.8**	**21.9**	**5.89**	**28.12**
C.D. 1%	**6.62**	**0.57**	**1.3**	**11.3**	**0.389**	**0.387**	**1.06**	**0.77**	**3.36**

Where **DG=** day to germination, **DF**= day to flowering, **DM=** day to maturity, **PH**= plant height, **NPBPP**= number of primary branch/plant, **NSBPP**= number of secondary branch/plant, **NPPP**= number of pods/plant, **NSPP**= number of seed/pods**, BYPP**=biological yield/plant**, SYPP**= seed yield/plant, **100 seed weight, HI**= harvest index

Phenotypic coefficient of variation (PCV) and Genotypic coefficient of variation (GCV)

The phenotypic coefficient of variation (PCV) was generally higher than the genotypic coefficient of variation (GCV) for all traits, highlighting the influence of the environment (Table 5). High GCV was observed for traits such as number of pods per plant (9.98), days to maturity (2.34), and biological yield (19.64), indicating genetic variability. Similarly, high PCV was recorded for number of pods (10.20), biological yield (19.68), and seed yield (15.03), while lower PCV was found for traits like days to germination and 100-seed weight. The differences between PCV and GCV were wide for traits like days to maturity, primary branches, and harvest index, reflecting environmental effects. High GCV for yield-related traits suggests potential for genetic improvement through selection, while lower PCV for traits like 100-seed weight indicates limited scope for improvement.

The wide gap between PCV and GCV for certain traits suggests that environmental factors play a significant role in their expression. However, the high GCV observed in traits such as biological and seed yield indicates good potential for genetic improvement. Lower PCV in traits like days to germination and 100-seed weight suggests limited genetic variability, making selection for these traits less effective. These findings align with previous research, confirming genetic variability in key yield traits and supporting targeted breeding for yield improvement (Khatun *et al.*, 2022).

Table 5: Genotypic and phenotypic coefficient of variability, heritability, genetic advance, and genetic advance percent of the mean of the 12 traits of Lentil varieties

Characters	Heritability (Broad Sense)	Genetic Advance	Genetic Advance mean	GCV (%)	PCV (%)
Days To Germination	0.22	-0.31	-3.94	3.15	6.65
Days to 50% flowering	**0.90**	12.63	14.06	5.62	5.93
Days to maturity	**0.78**	6.98	5.44	2.34	2.65
Plant height (cm.)	**0.90**	13.07	40.51	16.20	17.11

No. of primary branches/Plant	**0.86**	0.94	32.23	13.16	14.18
No. of secondary branches/Plant	**0.98**	6.30	43.18	16.53	16.70
No. of Pods/Plant	0.96	36.97	25.78	9.98	10.20
No. of Seeds/Pod	0.80	0.50	35.17	14.87	16.59
100-Seed weight(g)	0.92	0.89	31.68	12.51	13.05
Biological Yield/Plant(g)	1.00	11.33	51.73	19.64	19.68
Seed Yield/Plant(g)	0.95	2.21	37.49	14.61	15.03
Harvest Index (%)	0.99	19.87	70.67	26.96	27.15

Heritability Estimates in Broad Sense

Heritability values for the 12 studied traits ranged from 4.26% to 94.3% (Table 5). High heritability (>80%) was observed for biological yield, days to flowering, and harvest index, indicating good potential for selection. Low heritability was recorded for traits like number of pods per plant, plant height, and 100-seed weight, making phenotypic selection less effective for these traits. High PCV and GCV for traits like plant height and number of pods suggest that these traits could respond well to selection despite low heritability (Bilal *et al.*, 2018).

High heritability traits, such as biological yield and harvest index, show strong potential for genetic improvement through selection. However, traits with low heritability, like 100-seed weight, may be challenging to improve due to significant environmental influence. This aligns with previous studies suggesting limited progress for low heritability traits in lentil breeding programs (Sharma *et al.*, 2020).

Estimates of Expected Genetic Advance

Genetic advance as a percentage of the mean (GAM) ranged from 70.67% for number of pods per plant to 35.17% for 100-seed weight (Table 5). High GAM was observed for traits like biological yield (11.33%) alongside high heritability, PCV, and GCV. However, traits such as 100-seed weight and seed yield showed low genetic advance, indicating limited variability and high environmental influence. High heritability combined with high genetic advance, as seen in traits like biological yield, suggests these traits are suitable for selection and improvement (Joshi *et al.,* 2019). Conversely, traits with low GCV and GAM, such as 100-seed weight, are heavily influenced by the environment, making selection less effective for these traits. Thus, heritability and genetic advance should be considered together when targeting traits for breeding programs.

Estimates of Correlation Coefficients

Seed yield depends on multiple interrelated traits, making genetic variation crucial for breeders to select desirable types. Understanding the correlation between traits and seed yield helps establish effective selection criteria. Indirect selection via highly heritable traits can improve seed yield. This strategy requires

eISSN 2583-6986
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Volume 03, Issue 11, November 2024

analyzing the relationships between traits, as emphasized by (Sakthivel *et al.*, 2019). Seed yield showed a positive and significant correlation with the number of pods per plant, biological yield, and plant height. Biological yield was also positively correlated with seed yield but negatively with harvest index (Table 6 and 7). Days to 50% flowering and maturity were negatively correlated with seed yield. No significant correlation was found between seed yield and traits like days to germination, primary branches, or 100-seed weight. These findings, supported by previous studies, suggest that plant height and biological yield are key traits for improving seed yield through indirect selection (Takele *et al.*, 2022).

Table 6: Phenotypic correlation coefficients (rp) of yield and yield related traits for Lentil genotypes grown at J.V. college research site (in 2023/24 growing season)

DG	**1**	**0.473**	**0.267**	**0.366**	**0.123**	**-0.149**	**0.075**	**-0.252**	**0.143**	**-0.111**	**0.076**	**-0.082**
D50%F		**1**	**0.372**	**0.53**	**0.216**	**-0.211**	**0.105**	**-0.154**	**0.065**	**-0.233**	**0.151**	**-0.17**
DM			**1**	**0.017**	**0.141**	**-0.005**	**0.213**	**0.469**	**0.027**	**0.298**	**-0.201**	**0.007**
PH				**1**	**0.114**	**0.084**	**0.225**	**-0.397**	**0.017**	**-0.054**	**-0.081**	**-0.208**
NPBPP					**1**	**-0.161**	**0.027**	**-0.358**	**0.524**	**0.038**	**-0.016**	**0.018**
NSBPP						**1**	**-0.032**	**0.117**	**-0.062**	**0.513**	**-0.384**	**0.075**
NPPP							**1**	**0.218**	**-0.008**	**0.098**	**0.139**	**0.403**
NSPP								**1**	**-0.183**	**0.267**	**-0.056**	**0.321**
100SW									**1**	**0.006**	**0.046**	**0.171**
BYPP										**1**	**-0.833**	**-0.048**
HI											**1**	**0.557**

Where DG=days to germination, **DF**= Days to 50% Flowering, **DM**=days to maturity, **PH**=plant height (cm), **NPBPP**= Number of primary branches per plant, **NSBPP**= Number of secondary branch per plant, **NPPP**= Number of pods per plant, **NSPP**= Number of seed per pod, **HSW**= 100-Seed weight, **BYPP**= Biological yield per plant, **SYPP**= Seed yield per plant and **HI**= Harvest Index in percentage.

Table 7: Genotypic correlation coefficients (rg) of yield and yield related traits for the 12 Lentil genotypes grown at J.V. college research site (in 2023/24 growing season)

	DG	D50%F	DM	PH	NPBPP	NSBPP	NPPP	NSPP	100SW	BYPP	HI	SYPP

DG	**1**	**-0.97**	**-0.63**	**-0.94**	**-0.329**	**0.343**	**-0.145**	**0.551**	**-0.296**	**0.216**	**-0.134**	**0.217**
D50%F		**1**	**0.345**	**0.57**	**0.214**	**-0.229**	**0.112**	**-0.164**	**0.054**	**-0.25**	**0.155**	**-0.202**
DM			**1**	**0.006**	**0.121**	**-0.008**	**0.243**	**0.607**	**0.015**	**0.334**	**-0.23**	**0.002**
PH				**1**	**0.087**	**0.084**	**0.242**	**-0.473**	**0.006**	**-0.057**	**-0.09**	**-0.23**
NPBPP					**1**	**-0.192**	**0.005**	**-0.437**	**0.553**	**0.038**	**-0.025**	**0.002**
NSBPP						**1**	**-0.037**	**0.129**	**-0.074**	**0.519**	**-0.39**	**0.078**
NPPP							**1**	**0.243**	**-0.029**	**0.1**	**0.13**	**0.398**
NSPP								**1**	**-0.228**	**0.289**	**-0.081**	**0.324**
100SW									**1**	**0.001**	**0.032**	**0.144**
BYPP										**1**	**-0.84**	**-0.054**
HI											**1**	**0.551**

Where DG=days to germination, **DF**= Days to 50% Flowering, **DM**=days to maturity, **PH**=plant height (cm), **NPBPP**= Number of primary branches per plant, **NSBPP**= Number of secondary branches per plant, **NPPP**= Number of pods per plant, **NSPP**= Number of seed per pod, **HSW**= 100-Seed weight, **BYPP**= Biological yield per plant, **SYPP**= Seed yield per plant and **HI**= Harvest Index in percentage.

CONCLUSION- The study highlights significant genetic variability among lentil germplasm resources, essential for long-term cultivar improvement. Understanding genetic variation and relationships between populations aids breeding programs. The analysis showed high heritability and genetic advance for traits such as days to germination and plant height, indicating they are primarily controlled by additive genes. This suggests effective selection could enhance seed yield. Overall, substantial genetic variation was observed across the 12 traits studied, demonstrating potential for yield improvement. Further research with a larger number of genotypes over multiple locations and years is recommended to confirm the impact of these traits on seed yield.

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