Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2021; 10(3): 442-447
Received: 16-02-2021
Accepted: 18-03-2021

Ravi Kant Chaurasia
M.Sc. (Agriculture). Agricultural Biochemistry, Department of Crop Sciences, Faculty of Agriculture, MGCGVV, Chitrakoot, Satna, Madhya Pradesh, India

SP Mishra
Associate Professor and Head, Department of Crop Sciences, Faculty of Agriculture, MGCGVV, Chitrakoot, Satna, Madhya Pradesh, India

Neeta Mani
Research Scholar, Department of Biological Sciences, Faculty of Science and Environment, MGCGVV, Chitrakoot, Satna, Madhya Pradesh, India

Navin Kumar
Research Scholar, Genetics and Plant Breeding, Faculty of Agriculture, MGCGVV, Chitrakoot, Satna, Madhya Pradesh, India

Corresponding Author:
Ravi Kant Chaurasia
M.Sc. (Agriculture). Agricultural Biochemistry, Department of Crop Sciences, Faculty of Agriculture, MGCGVV, Chitrakoot, Satna, Madhya Pradesh, India

Assessment of morphological and biochemical characters in lentil (*Lens culinaris* Medik.) genotypes

Ravi Kant Chaurasia, SP Mishra, Neeta Mani and Navin Kumar

Abstract
The Botanical name of lentil is the ("*Lens culinaris* Medik."). It is one of the most nutritious amongst cool or rabi season crop. Lentil seeds contain 25% protein, 0.7% fibre, 0.7% fat, 2.1% minerals and 59% carbohydrate. The soluble protein content was ranged from 14.20% (LL 1427) minimum to 19.64% (LH 1404) maximum and the grand mean was found 16.95%. The phenotypic (8.16) and genotypic (7.95). CV (coefficient of variation) for this character indicating that environment has played significant role to express this character. The oil content in lentil was ranged from 1.17% (L 4076 ch) & (PL247) to 3.67% (RVL 16-4) and the grand mean was 2.27%. The pheotypic (36.36) and genotypic (31.89) CV (coefficient of variation) was found high values for this character indicating that environment has played significant role to expressed this character. The moisture content was varied from 6.67% (NDL 17-29) minimum to 9.00% (VL 529) maximum and the grand mean was found 7.67%. The phenotypic (13.36%) and genotypic (6.36) CV (coefficient of variation) for this character indicating that environment has played significant role to expressed this character.

Keywords: lentil, genetic variability, PCV, GCV, heritability etc.

Introduction
Pulses are the principal source of protein in diet and are an integral part of daily diet because of their high protein content and good amino acid balance in several forms worldwide (Kumar *et al*. 2013) [9]. Lentil is one of the important pulse crops and sometimes it is called poor man's meat (Bhatty, 1988) [3]. It is a bushy annual autogamous diploid (2n=2x=14) legume crop. Its family is Fabaceae. It is generally grown as rain fed crop during winter season. Its protein content ranges from 22 to 34.6% (Sharma *et al*. 2014) [15]. Ash, crude fiber, starch, amylase and total carbohydrates contents in lentil are 3.1, 4.6, 44.3, 36.1 and 63.1% respectively (Bhatty *et al*. 1976) [2]. The knowledge of heritability and genetic advance guides the breeders to select superior parents to initiate an effective and fruitful crossing programme. 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 (Khan *et al*. 2004) [7]. High heritability coupled with moderate to high genetic advance for biological yield per plant, seed yield per plant and hundred seed weight were obtained by Tyagi and Khan, 2011 [16]. Path coefficient analysis is an important technique for partitioning the correlation coefficient into direct and indirect effect of the causal components on the complex component. Sarwar *et al*. (2010) [14] reported that number of pods per plant and harvest index exerted high positive direct effects on seed yield. Azizi *et al*. (2009) [1] observed that positive indirect effects on seed yield exerted by number of pods per plant and 100-seed weight. Hence, these traits could be used in breeding for seed yield in lentil. The adequate information on extent of variability may also be helpful to improve the yield by selecting the yield component traits (Mehandi *et al*. 2013) [11]. Identification and selection of major yield components is an essential prerequisite for lentil improvement. Keeping these considerations in mind, an attempt was made to assess the correlation among the yield components and their direct and indirect effect on seed yield.

Methodology
The present investigation entitled "Assessment of Morphological and Biochemical characters in Lentil (*Lens culinaris* Medik.) Genotypes" were carried out during Rabi 2017-18. The geographic and climatic condition in which the experimental crop was raised and materials used and techniques adopted in conducting the experiment.

The collection of 22 diverse varieties of Lentil tall (*Lens culinaris* Medik.) consisted of the experimental material for the present study. The material was obtained from the Indian Institute of Pulse Research, Kanpur (U.P.). This experimental study was conducted under normal soil and rain fed condition at M.G.C.G.V.V Chitrakoot, Satna (M.P) during 2017-2018. The experiment was laid out fallowing Randomized Block Design (RBD) with three replications during *rabi* 2017-18. The experiment was sown on 18th, November, 2017. Each treatment was grown in 3m X 4m plot spaced 30 cm apart. The plant to plant distance was maintained 10cm by thinning. Recommended agronomic practices and plant protection measures were adopted to raise a good crop. Five plants of each genotype were selected randomly from each replication at maturity to record the data on following pre and post-harvest traits; example-Days to 50% flowering:, Number of primary branches per plant, Plant Stand, Number of pods per plant, Number of seeds per pod, Days to 80% Maturity (DM), Plant height (cm), 100-Seed weight (g), Moisture Content, Oil content (%), Soluble Protein (%) were recorded for various statistical analysis. The codes and symbols used for particular characters.

Results

Table 1: List of lentils (*Lens culinaris* Medik) genotypes and their source of origin

S. No.	Varieties/Genotypes
1	RKL 14-37
2	RKL58 F-3715
3	L 4730
4	L 4731
5	PL 247
6	PL 248
7	JL 3 (Ch)
8	IPL 341
9	IPL 342
10	DPL 62 (Ch)
11	IPL 316 (Ch)
12	KLB 1442
13	RL 9
14	SJL 6-3
15	TCADL 17-5
16	L 4076 (Ch)
17	VL 529
18	NDL 2017-29
19	LL 1427
20	LH 1404
21	RVL 16-4
22	SJL 8

Table 2: Analysis of variance for twelve quantitative and qualitative (Biochemical) characters in lentil large seed

S. No.	Characters	Mean sum of square		
		Replication	Treatments	Error
	d.f.	2	21	42
1	Days to 50% Flowering	0.67	25.63**	9.04
2	Branches/Plant	1.20	3.77*	1.90
3	Plant Stand (%)	10.77	2.17	10.44
4	Pods Per Plant	8.61	239.60***	6.58
5	Seeds/Plant	0.00	0.05***	0.01
6	Days to 80% Maturity	11.95	50.65*	25.42
7	Plant height (cm)	1.29	12.84***	2.31
8	100 Seed Weight (g)	0.05	0.54**	0.20
9	Moisture (%)	0.30	1.52*	0.81
10	Oil (%)	0.06	1.72***	0.15
11	Soluble Protein (%)	0.06	5.55***	0.10
12	Seed Yield (kg/ha)	185.25	17935.32***	274.89

*Significant at 5% probability level; **Significant at 1% probability level.

Table 3: Mean, range, genotypic and phenotypic coefficient of variation for 10 quantitative and qualitative characters in lentil large seed

S. No.	Characters	Mean	Minimum	Maximum	GCV	PCV	Heritability (h2b) in broad sense	Genetic advance	GA%
1	Days to 50% flowering	58.57 ± 1.48	55.15	68.70	5.44	7.42	53.84	4.82	8.23
2	Branches/plant	11.75 ± 0.68	9.75	13.25	6.65	13.34	24.86	0.80	6.83
3	No. of pods/plant	38.33 ± 3.11	16.85	51.25	23.75	28.75	68.24	15.49	40.42
4	Plant height (cm)	33.23 ± 1.03	29.50	36.85	5.60	8.37	44.81	2.57	7.73
5	Days to 80% maturity	102.57 ± 2.64	97.35	111.60	3.62	6.29	33.05	4.39	4.28
6	100-seed weight (g)	4.73 ± 0.18	3.37	5.38	13.82	15.78	76.73	1.18	24.94
7	Moisture (%)	7.76 ± 0.39	6.66	9.01	7.04	12.18	33.41	0.65	8.38
8	Crude protein (%)	22.46 ± 0.18	20.34	27.31	9.66	9.79	97.35	4.41	19.63

9	Oil content (%)	3.50 ± 0.37	2.63	4.75	15.36	26.21	34.31	0.65	18.53
10	Seed yield (kg/ha)	1376.04 ± 43.26	1153.18	1679.53	12.79	14.26	80.55	325.48	23.65

Table 4: Estimates of genotypic correlations for different 10 characters in lentil large seed

S. No.	Characters	Days to 50% flowering	Branches/ plant	No. of pods/plant	Plant height (cm)	Days to 80% maturity	100-seed weight (g)	Moisture (%)	Crude protein (%)	Oil content (%)	Seed yield (kg/ha)
1	Days to 50% flowering	1.000	0.446	0.197	-0.282	-0.412	-0.371	-0.168	-0.190	-0.372	-0.286
2	Branches/plant		1.000	0.807	-0.034	-0.594	-0.432	-0.351	-0.164	-0.720	-0.705
3	No. of pods/plant			1.000	0.200	-0.316	-0.236	-0.118	-0.394	-0.758	-0.511
4	Plant height (cm)				1.000	0.138	-0.334	-0.626	-0.544	-0.046	-0.294
5	Days to 80% maturity					1.000	0.178	0.647	-0.502	0.609	-0.124
6	100-seed weight(g)						1.000	0.112	0.302	0.913	0.550
7	Moisture (%)							1.000	0.047	0.048	0.227
8	Crude protein (%)								1.000	0.281	0.087
9	Oil content (%)									1.000	0.366
10	Seed yield (kg/ha)										1.000

Table 5: Estimates of phenotypic correlations for different 10 characters in lentil large seed

S. No.	Characters	Days to 50% flowering	Branches/ plant	No. of pods/plant	Plant height (cm)	Days to 80% maturity	100-seed weight (g)	Moisture (%)	Crude protein (%)	Oil content (%)	Seed yield (kg/ha)
1	Days to 50% flowering	1.000	0.099	0.070	-0.254	-0.121	-0.231	-0.170	-0.162	-0.211	-0.173
2	Branches/plant		1.000	0.297	0.210	-0.168	-0.203	0.065	-0.044	-0.231	-0.211
3	No. of pods/plant			1.000	0.162	-0.097	-0.195	-0.085	-0.316	-0.204	-0.383
4	Plant height(cm)				1.000	0.259	-0.232	-0.202	-0.327	-0.068	-0.140
5	Days to 80% maturity					1.000	-0.002	0.134	-0.263	0.347	-0.075
6	100-seed weight(g)						1.000	0.098	0.244	0.509	0.468
7	Moisture (%)							1.000	0.016	0.100	0.119
8	Crude protein (%)								1.000	0.179	0.075
9	Oil content (%)									1.000	0.195
10	Seed yield (kg/ha)										1.000

Table 6: Direct and indirect effects for different characters on seed yield per plant at genotypic and phenotypic level in lentil large seed

S. No.	Characters		Days to 50% flowering	Branches/ plant	No. of pods/plant	Plant height (cm)	Days to 80% maturity	100-seed weight (g)	Moisture (%)	Crude protein (%)	Oil content (%)
1	Days to 50% flowering	G	-1.259	-0.561	-0.248	0.356	0.518	0.468	0.212	0.239	0.468
		P	-0.097	-0.010	-0.007	0.025	0.012	0.022	0.016	0.016	0.020
2	Branches/plant	G	-0.772	-1.730	-1.397	0.059	1.029	0.748	0.608	0.284	1.246
		P	-0.006	-0.059	-0.018	-0.012	0.010	0.012	-0.004	0.003	0.014
3	No. of pods/plant	G	-0.193	-0.790	-0.979	-0.196	0.309	0.232	0.116	0.386	0.742
		P	-0.025	-0.107	-0.359	-0.058	0.035	0.070	0.031	0.113	0.073
4	Plant height (cm)	G	0.585	0.071	-0.414	-2.070	-0.287	0.691	1.296	1.126	0.094
		P	0.001	-0.001	-0.001	-0.006	-0.001	0.001	0.001	0.002	0.000
5	Days to 80% maturity	G	0.441	0.637	0.338	-0.148	-1.072	-0.191	-0.693	0.539	-0.652
		P	0.022	0.030	0.017	-0.046	-0.179	0.000	-0.024	0.047	-0.062
6	100-seed weight (g)	G	-0.423	-0.492	-0.269	-0.380	0.203	1.138	0.127	0.343	1.039
		P	-0.098	-0.086	-0.083	-0.098	-0.001	0.424	0.041	0.103	0.215
7	Moisture (%)	G	0.210	0.437	0.147	0.779	-0.805	-0.139	-1.244	-0.058	-0.059
		P	-0.011	0.004	-0.006	-0.013	0.009	0.006	0.065	0.001	0.006
8	Crude protein (%)	G	0.210	0.437	0.147	0.779	-0.805	-0.139	-1.244	-0.058	-0.059
		P	0.033	0.009	0.064	0.067	0.054	-0.050	-0.003	-0.204	-0.036
9	Oil content (%)	G	0.699	1.355	1.427	0.086	-1.145	-1.719	-0.090	-0.529	-1.882
		P	0.008	0.008	0.007	0.002	-0.013	-0.019	-0.004	-0.007	-0.036
10	Seed yield (kg/ha)	G	-0.286	-0.705	-0.511	-0.294	-0.124	0.550	0.227	0.087	0.366
		P	-0.173	-0.211	-0.383	-0.140	-0.075	0.468	0.119	0.075	0.195

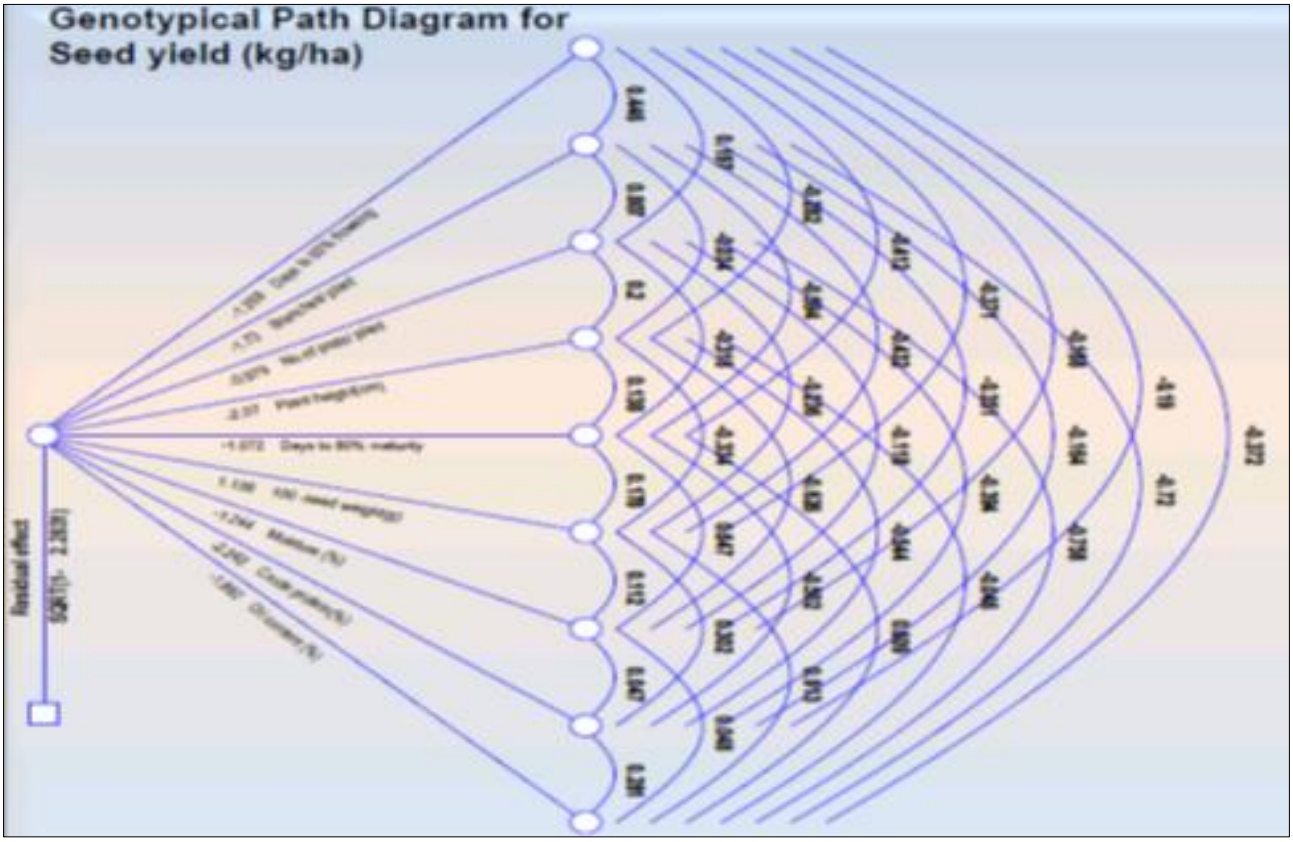

Fig 1: Genotypical path diagram for seed yield (kg/ha)

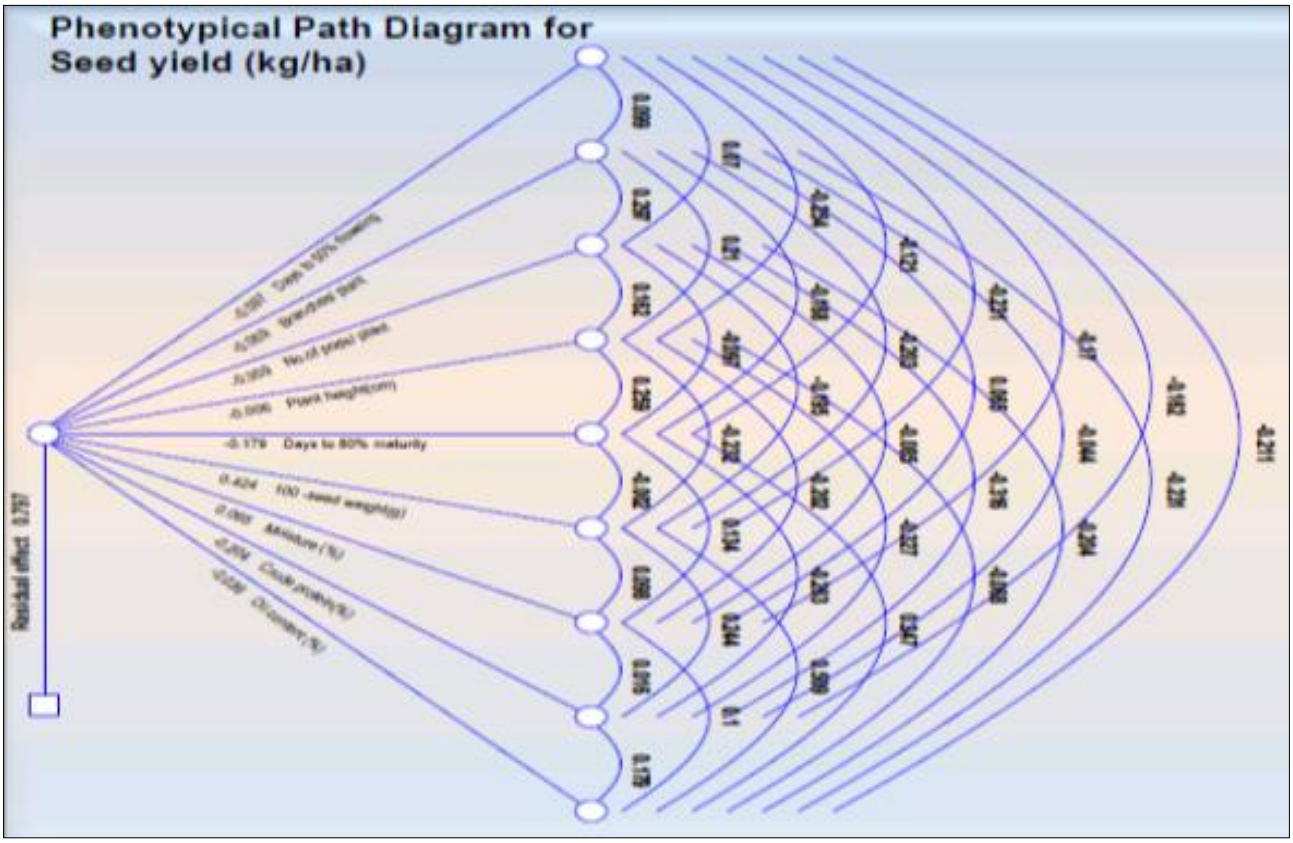

Fig 2: Phenotypical path diagram for seed yield (kg/ha)

Discussion

Genetic variability studies

In present study, the extent of variability was estimated in the 22 genotypes/varieties of lentil for 12 characters. Analysis of variance for design of the experiment indicated highly significant differences for the characters *viz*. days to 50% flowering, no. of primary branches, no. of pods per plant, number of seeds per pod, days to 80% maturity, plant height, 100-seed weight, and seed yield (kg/ha) except plant stand,. Non-significant differences due to replications were observed for all the characters. On-significant differences due to error were observed for all the characters. Oil % indicating that

variability was primarily was due to phenotypic (36.30) and genotypic coefficient of variation (31.89) followed by pods/plant PCV (27.39) and GCV (26.30) was high for this character indicating that environment has played significant role in the expression of this character**.** The similar results were reported by Tyagi and Khan 2011 [16]; and correlated with Jeberson *et al.* 2017 [6]; and Kumar *et al.* 2014 [10]; in mungbean.

Heritability and expected genetic advance along with biochemical studies

In the present study, estimates of heritability in broad sense values were ranged from the heritability values were ranged from (-35.91 per cent for plant stand to 95.54 per cent for plant stand. High estimation of heritability was found in plant stand, soluble protein, pods/plant and oil % While moderate estimates of heritability was found for plant height, seeds per pod where as low heritability estimate was found for remaining characters. In accordance with this results were reported by Jeberson *et al*. 2016 [5]; supported these results.

The expected genetic advance in per cent of mean ranged from -2.27 per cent for plant stand to 57.71 per cent for oil %. All the character showed higher estimates of expected genetic advance were found for oil %, no. of pods/plant, seed yield kg/ha, soluble protein, 100-seed weight, no. of seeds per pod, plant height, primary branches, moisture % and days to 50% flowering while low estimates of expected genetic advance was found for days to 80%. The heritability coupled with high genetic advance ranged from seed yield (kg/ha), pods/plant and plant height. Similar finding has been reported for days to flowering initiation, days to physiological maturity by Gupta *et al*. 2012 [4]; supported these results.

Correlation coefficient studies

In the present investigation, phenotypic and genotypic correlations were estimated. The direction of phenotypic and genotypic correlations was similar for almost all the characters. In general, genotypic correlations were higher than phenotypic ones in magnitude for all the characters. The character which showed negative association at genotypic level also showed negative association at phenotypic level.

The soluble protein showed negative correlation with primary branches and moisture %; moisture % with days to 80% maturity and number of seeds per pod; 100-seed weight with primary branches, seeds per pod and plant height, days to 80% maturity with seeds per pod and pods/plant; seeds per pod with days to 50% flowering and pods/plant with primary branches and days to 50% flowering whereas positive correlation was exhibited by soluble protein with days to 50% flowering and days to 80% maturity; oil% with days to 50% flowering and plant height; plant height with days to 80% maturity, primary branches and days to 50% flowering; seeds per pod with no. of pods/plant exerted substantial positive correlation at genotypic level. This result was corroborated with Khaimichho *et al.* (2014) [8] supported these results.

The soluble protein showed negative correlation with primary branches; 100-seed weight with plant height, plant height with pod/plant; and pods/plant with days to 50% flowering and primary branches whereas positive correlation was exhibited by oil % with plant height; plant height with days to 80% maturity; days to 80% maturity with days to 50% flowering; seeds per pod with no. of pods/plant exerted substantial positive correlation at phenotypic level. The remaining of the correlation coefficient values in the present analysis was too low to be considered important these findings were also reported in accordance by Tadesse *et al*. (2013) [17].

Path coefficient along with biochemical studies

At phenotypic level, path coefficient analysis revealed that, the highest positive direct effect shown on seed yield kg/ha was exhibited by 100-seed weight and moisture while negative direct effect was exhibited by pods per plant followed by crude protein, days to 80% maturity, days to 50% flowering, branches/plant oil %, plant height contributed substantial negative direct effect on seed yield kg/ha at phenotypic level.

The highest positive indirect effect on seed yield kg/ha was exhibited by branches/plant, 100-seed weight, no. of pods/plant *via* oil content; plant height and days to 80% maturity *via* crude protein; plant height and branches/plant *via* moisture %; plant height and branches/plant and days to 50% flowering *via* 100-seed weight; crude protein, branches/plant and days to 50% flowering *via* days to 80% maturity; crude protein, moisture % and days to 50% flowering *via* plant height; oil %, crude protein and days to 80% maturity *via* no. of pods/plant; oil %, days to 80% maturity and moisture % *via* branches/plant and oil %, plant height and crude protein *via* days to 50% flowering exerted substantial positive indirect effect while the highest negative indirect effect on seed yield kg/ha was exhibited by oil content *via* days to 80% maturity; oil content *via* 100-seed weight; no. of pods/plant *via* branches/plant; branches/plant *via* days to 50% flowering; exerted substantial negative indirect effect at genotypic level. These findings were reported in consonance with findings reported by Patil *et al.* 1987 [12]; Tadsee *et al*. 2013; supported these data.

Conclusion

The characters studied were, days to 50% flowering, primary branches, plant stand no. of pod per plant, number of seeds per pod, days to 80% maturity, plant height, 100-seed weight, Moisture %, oil 5, soluble protein and seed yield kg/ha. Analysis of variance for the design of experiments indicated highly significant differences for the characters.

Phenotypic coefficients of variability (PCV) were higher than genotypic coefficients of variability (GCV) for all the characters. Estimates of heritability (broad sense) ranged from (-35.91 per cent for plant stand to 95.54 per cent for plant stand. High estimation of heritability was found in plant stand, soluble protein, pods/plant and oil % The expected genetic advance in per cent of mean ranged from -2.27 per cent for plant stand to 57.71 per cent for oil %.

The heritability coupled with high genetic advance ranged from seed yield (kg/ha), pods/plant and plant height. The seed yield kg/ha showed significant and positive correlation with plant stand, days to 50% flowering, while soluble protein, oil % and no. of pods/plant exhibited significant and negative correlation at genotypic and phenotypic level, respectively. Path coefficient analysis revealed that the highest positive direct effect shown on seed yield kg/ha was exhibited by days to 50% flowering, pods per plant, 100-seed weight, plant height and no. of seeds per pod. At phenotypic level, path coefficient analysis revealed that, the highest positive direct effect shown on seed yield kg/ha was exhibited by days to 50% flowering and plant stand. The estimate of residual factors (0.7506) at phenotypic and (0.5378) at genotypic level was moderate indicating that some of characters affecting seed yield characters have to be included in the present study. Thus, for improving seed yield in Lentil, due emphasis should

be given on seed yield kg/ha, plant height and days to 50% flowering. All these characters had high heritability and highly significant positive correlation with seed yield, which can be increased through direct selection.

Acknowledgements
The authors would like to thank IIPR Agricultural Research Center pulse (Kanpur) team members for managing the trial, data collecting and compiling from each site. The authors also would like to thank M.G.C.G.V.V Chitrakoot, Satna (M.P) staff for facilitating all the necessary resources. Finally, we also would like to thank M.G.C.G.V.V. for financing this study.

References

1. Azizi CS, Mostafaei H, Hassanpanah D, Kazemi AH, Yarnia M. Path coefficient analysis of yield and yield components in promising lentil genotypes under dry land conditions. J New Agri. Sci 2009;5(17):45-56.
2. Bhatty RS, Slinkard AE, Sosulski FW. Chemical composition and protein characteristics of lentils. Canadian Journal of Plant Science 1976;56(4):787-794.
3. Bhatty RS. Composition and quality of lentil (*Lens culinaris* medic): a review. Canadian institute of Food Science and Technology 1988;21(2):144-160.
4. Gupta R, Begum SN, Islam MM, Alam MS. Characterization of lentil (*Lens culinaris* Medik) germplasm through phenotypic marker J Bangladesh Agril. Uni 2012;10(2):197-204.
5. Jeberson MS, Shashidhar KS, Iyanar K. Estimation of genetic variability, expected genetic advance, correlation and path analysis in field pea (*Pisum sativum* L.). Electronic Journal of Plant Breeding 2016;7(4):1074-1078.
6. Jeberson MS, Shashidhar KS, Wani SH, Singh AK. Multivariate analysis in Mungbean (*Vigna radiata* L. Wilczek) for Genetic Diversity under Acidic Soils of Manipur, India. Int. J Curr. Microbiol. App. Sci 2017;6(7):760-769.
7. Khan MD, Khalil IH, Khan MA, Ikramullah. Genetic divergence and association for yield and related traits in mash bean. Sarhad J Agric 2004;20:555-61.
8. Khaimichho EB, Hijam I, Sarkar KK, Mukherjee S. Genetic control and character association estimates of yield and yield attributing traits in some mungbean genotypes, J crop and weed 2014;10(2):82-88.
9. Kumar B, Singh CM, Jaiswal KK. Genetic variability, association and diversity studies in bread wheat. The Bioscan 2013;8(1):143-147.
10. Kumar A, Gill RK, Singh S. Component traits influencing seed yield in recombinant inbred lines of lentil (*Lens culinaris* Medik.). J of App. Nat. Sci 2017;9(2):992-997.
11. Mehandi S, Singh CM, Kushwaha VK. Estimates of genetic variability and heritability for Yield and yield component traits in mungbean. The Bioscan 2013;8(4):1481-1484.
12. Patil VD, Chopde PR, Makne VG. Studies of inter-relationship between yield and yield components in inter-varietal crosses of linseed (*Linum usitatissimum* L.). Acta Agronomica Hungarica 1986;35:129-132.
13. Sarwar G, Abbas G, Asghar MJ. Genetic study for quantitative traits in F5 generation of lentil. J Agri. Res. (Lahore) 2010;48(3):279-288.
14. Sharma V, Paswan SK, Singh VK, Khandagale S. Correlation and path coefficient analysis of economically important traits in lentil (*Lens culinaris* Medik.) germplasm. Bioscan (Ranchi) 2014;9(2):819-822.
15. Tyagi SD, Khan MH. Correlation, Path-coefficient and Genetic diversity in lentil (*Lens culinaris* Medik.) under rainfed conditions. Int. Res. J Plant Sci 2011;2(7):191-200.
16. Tadesse T*, Leggesse T, Mulugeta B, Sefera G. Correlation and path coefficient analysis of yield and yield components in lentil (*Lens culinaris* Medik.) germplasm in the highlands of Bale, Ethiopia. Int. J Biodivers. Conserv 2013;6(1):115-120.