Genetic Variability in Some Quantitative Characters of Lentil (*Lens esculentus* Moench.)

by

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Introduction: Lentil, being a nutritious pulse crop of wider agro-climatic adaptability, has not drawn the attention of plant breeders for its improvement. Evaluation of genetic and phenotypic association of characters may help in determining the extent of improvement to be made in some quantitative characters. Correlation studies are meant to determine the relationship among various traits which are useful in making selection. The present investigation was undertaken for determining the genotypic, phenotypic correlations, coefficients of determination, heritability, coheritability and genetic advance.

Materials and Methods: Twenty-one strains were grown in randomised block design with three replications. Ten plants were selected at random in each replication for each treatment. The observations were recorded on different morphological characters such as vegetative period (X_1), number of primary branches (X_2), number of secondary branches (X_3), plant height (X_4), number of pods per plant (X_5), number of seeds per pod (X_6), yield per plant (X_7) and number of seeds per plant (X_8). The different statistics were calculated according to the different workers *viz.* correlation (Miller *et al.* 1958), heritability (Johnson *et al.* 1955) and genetic advance (Robinson *et al.* 1949). The formulae are given below.

$$\text{Genotypic correlation (rg)} = \frac{\text{Genotypic covariance of x and y}}{\sqrt{\text{Genotypic variance of x} \times \text{Genotypic variance of y}}}$$

$$\text{Phenotypic correlation (rph)} = \frac{\text{Phenotypic covariance of x and y}}{\sqrt{\text{Phenotypic variance of x} \times \text{Phenotypic variance of y}}}$$

$$\text{Coefficient of determination} = \text{Squared values of simple correlation } (r^2)$$

$$\text{Heritability} = \frac{\text{Genotypic variance}}{\text{Phenotypic variance}} \times 100$$

$$\text{Coheritability} = \frac{\text{Genotypic covariance}}{\text{Phenotypic covariance}} \times 100$$

$$\text{Genetic advance} = \frac{\text{K. Genotypic variance}}{\sqrt{\text{Phenotypic variance}}}$$

Results and Discussions: Genotypic, phenotypic correlation coefficients, coefficient of determination and coheritability estimates are given in Table 1 and heritability and genetic advance in Table 2.

Genotypic and phenotypic correlations: The positive and highly significant genotypic correlations were recorded between number of primary branches and yield per plant (0.590), number of secondary branches and yield per plant (0.550), number of primary branches and number of secondary branches (0.963), number of primary branches and number of pods per plant (0.522) and number of secondary branches and number of pods per plant (0.758).

Yield per plant has not shown significant genotypic association with number of pods per plant (0.300) and plant height (0.170). Similarly number of seeds per pod has not been found to be in genotypic association with plant height (0.056) and total number of pods per plant (0.157) (Table 1).

TABLE 1. *Genotypic, phenotypic correlations, coefficient of determination and coheritability among different pairs of characters in Lentil*

Character combinations	Correlations		Coefficient of determination	Coheritability %
	Genotypic (rg)	Phenotypic (rph)		
X_2X_7	0.590**	0.479*	19.00	43.02
X_3X_7	0.550**	0.501*	25.00	61.50
X_1X_7	0.170	0.152	1.70	54.78
X_5X_7	0.300	0.422	26.31	26.21
X_3X_8	0.963**	0.730**	26.11	57.54
X_2X_5	0.522*	0.830*	95.84	19.32
X_2X_4	0.251	0.317	91.01	63.17
X_5X_8	0.758**	0.579**	24.40	47.00
X_4X_6	0.056	0.065	5.19	40.40
X_6X_6	0.157	0.101	5.15	53.68

** and * denote significance at 1% and 5% level of probability respectively

Phenotypically yield per plant has been found to be associated with number of primary branches (0.479) and number of secondary branches (0.501). Primary branches were also found to be phenotypically associated with number of secondary branches (0.730) and number of pods per plant (0.830). Number of pods per plant has also shown association with number of secondary branches (0.579) while other character combinations have not shown significant phenotypic correlations (Table 1).

In general, genotypic correlation coefficients were higher than the phenotypic correlation coefficients for the corresponding pairs of variables. However, these differences were slight in few cases. Similar results were also obtained by Singh *et al.* (1968) in mungbean, Johnson *et al.* (1955) in soybean and Povilaitis (1965) in tobacco.

Coefficient of determination: When two characters were considered together, the maximum variability present in the population was found in two character combinations *i. e.* number of primary branches and total number of pods per plant (95.84%) and number of primary branches and plant height (91.01%). A moderate variability was observed in number of pods per plant and yield per plant (26.31%), number of secondary branches and yield per plant (25.00%), number of secondary branches and number of pods per plant (24.40%) combinations while other character combinations contributed a very small quantity of variability to the total variability present in the population (Table 1).

Heritability: It is clear from Table 2 that the heritability of individual character when considered, the plant height and number of primary branches have shown maximum heritability with the values 98.18% and 89.25%, respectively, while other characters have shown a more or less similar magnitude of heritability.

TABLE 2. *Estamates of heritability and genetic advance in different traits of Lentil*

Characters	Heritability %	Genetic advance	Genetic advance in percent of mean
Number of primary branches	56.90	0.52	10.44
Number of secondary branches	89.25	6.59	36.31
Plant height (cm)	98.18	2.78	10.16
Number of pods per plant	58.14	17.18	21.82
Number of seeds per pod	64.69	0.39	25.58
Yield per plant (g)	69.54	1.12	0.97

Coheritability: The different quantitative character combinations were evaluated for their joint inheritance. It was found that the combinations like number of primary branches and plant height (63.17%), number of secondary branches and yield (61.50%), number of primary branches and number of secondary branches (57.74%), plant height and yield per plant (54.78%), number of pods per plant and number of seeds per pod (53.68%), number of secondary branches and number of pods per plant (47.00%), number of primary branches and yield per plant (43.02%) and plant height and number of seeds per pod (40.40%) have shown considerably higher coheritability. This indicates that these characters are not much affected by environment and selection for yield should be more effective if it is based on these component characters. Other characters have shown very poor coheritability.

Genetic advance: The number of secondary branches, number of pods per plant and number of seeds per pod have shown maximum potentiality for improvement at 5% selection intensity while number of primary branches and

plant height showed a meagre indication for such improvement. It is also evident from Table 2, that the most important character, yield per plant, has shown very poor response to selection. This however, indicates that efforts for selecting high yielding varieties can be successful by applying selection pressure on yield contributing characters such as number of ~~primary~~ secondary branches, number of pods per plant, number of seeds per pod *etc.* rather than yield as such.

Summary: Genotypic, phenotypic correlation coefficients, heritability, coheritability and genetic advance were worked out between eight economic characters of lentil. Yield was found to be genotypically associated with the number of primary branches, number of secondary branches and negatively associated with number of seeds per pod, while other yield contributing characters were also found genotypically associated.

Yield was found to be associated phenotypically with number of primary branches, and number of secondary branches. Similarly number of primary branches was found to be phenotypically associated with the number of secondary branches and number of pods per plant, the later was found to be associated with number of secondary branches.

The maximum heritability was recorded in plant height and number of secondary branches and other characters have shown more or less equal amount of heritability. The coheritability estimate values were found considerably higher for eight pairs of characters. Other associations showed more or less similar trend of moderate coheritability. The values of genetic advance indicated that number of seeds per pod, number of pods per plant and number of secondary branches can be improved by applying certain selection intensity.

Acknowledgement: The authors' thanks are due to the Economic Botanist (Legumes) Government of Uttar Pradesh, Kanpur for providing material.

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