SELECTION CRITERIA FOR THE IMPROVEMENT OF SEED YIELD AND ITS COMPONENTS IN ADVANCED GENERATIONS OF LENTIL (*Lens culinaris* Medik)

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Present study was conducted at Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad during the years 2006 and 2007 with the objectives; to study the inheritance of seed yield and related traits in both hybridized (F_6) and mutated (M_6) populations of lentil and to determine the best selection criterion for the improvement of seed yield. Different genetic parameters (variances, heritabilities, genetic gains and correlations) were computed to study the inheritance pattern and interrelationships of different traits. High heritability was observed for days to flower (97.40%), plant height (90.80%), pods per plant (86.20%), hundred seed weight (83.50%) and seed yield per plant (91.80%) in F_6 and for days to flower (96.9%), days to mature (91.8%), hundred seed weight (89.0%) and seed yield per plant (94.0%) in M_6 generation. High heritability coupled with moderate to high genetic advance was noted for plant height (90.8%, 16.29) pods per plant (86.20%, 25.53) hundred seed weight (83.50%, 35.67) and seed yield per plant (91.80%, 35.84) in F_6 generation and for days to flower (96.9%, 25.08), hundred seed weight (89.0%, 25.56) and seed yield per plant (94.0%, 37.01) in M_6 generation. The traits mentioned were found to be under the control of additive genes. Seed yield had positive and significant correlation with pods per plant in M_6 and with seed weight in both generations. It was concluded that seed weight and pods per plant may be used as selection criterion in both hybridized and mutated populations for the improvement of seed yield.
Keywords: *Lens culinaris* Medik, selection criterion, correlation, seed yield, F_6 generation, M_6 generation

INTRODUCTION

In cereal-based diet of common man, Lentil plays an important role to meet the protein requirements. It is an important long day pulse crop and has both food and medicinal value. The major lentil producing regions are Asia and West Asia-North Africa region. Lentil is most important pulse crop in India and about half of the worldwide production are from India. In Pakistan, it is an important traditional winter pulse crop locally known as “Masoor” having about 25% protein (Gupta, 1982). It is planted on an area of 39.0 thousand hectares with an annual production of 21.1 thousand tones and having an average seed yield of 541 kg/ha (Anon., 2007-08).

The ultimate aim in most of the plant breeding programmes is the enhancement of crop productivity per unit area. Seed yield is the ultimate expression of different yield contributing traits in lentil. Inability to visually recognize small differences in quantitative traits among single plants have led to frequent attempts to find associated traits that are more amenable to visual selection. The correlation coefficient gives the measure of relationship among traits and provides the degree to which various characters are associated with productivity.

Significant phenotypic and genotypic differences were observed between the mutated and hybridized generations by Solanki and Sharma (1999). Panse (1957) observed that genotypic correlation was of higher magnitude than phenotypic ones. High heritability coupled with moderate to high genetic advance for traits like plant height, hundred seed weight, pods per plant and seed yield per plant has been reported in literature (Asifa *et al.,* 2005; Bicer and Sarkar, 2004 and Sadiq *et al.*, 2005). In certain studies on lentil, days to flower and days to mature appeared to be useful traits because of high heritability (Chakrabarty *et al*., 2003). Pods per plant, hundred seed weight and seed yield per plant could be used as selection criteria as suggested by Sarwar *et al.* (2004) and Dewey and Lu (1959). However, Low heritability coupled with low genetic advance for number of primary branches has also been noted (Singh and Singh, 2004). Amarah *et al.* (2006) found positive and significant correlation for pods per plant and hundred seed weight with seed yield. Selection based on yield components is advantageous if different yield related traits have been well documented (Robinson *et al.*, 1951; Singh and Singh, 1995).

MATERIALS AND METHODS

The research work was carried out at Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad during the years 2006 and 2007. The experimental material comprised of ten true breeding selected lines of hybridized population (F_6) originating through six crosses (NL-7556 x Turk Masoor, Masoor-2002 x Masoor-93, NL-7715 x NL-7911, Turk Masoor x Masoor-2002, PL-406 x Masoor-2002 and ILL590 x 88527) and thirty three true breeding selected lines of mutated population (M_6) originating through induced mutation of Turk Masoor (20KR), M-93 (10KR) and 23111 (10KR). The material was sown in a randomized complete block design with three replications. Each single row was 4m long, spaced 0.3m apart and with 0.1m plant to plant distance. It represented single plant selection. Data were recorded for days to 50% flower, days to mature, plant height, number of primary branches, number of pods per plant, hundred seed weight and seed yield per plant. Five equally competitive random plants were selected from F_6 and M_6 generations for data recording at maturity.

The mean data were subjected to the analysis of variance (Steel *et al.,* 1997). Whereas components of variance, coefficients of variation, heritability and genetic advance were computed by following the method proposed by Robinson *et al.* (1951). Correlation coefficient analysis was also performed according to Singh and Chaudhary (1985).

RESULTS AND DISCUSSION

Highly significant differences were observed for all the traits except number of primary branches in both F_6 and M_6 generations (Table 1) that indicated the presence of variation among selections for almost all the traits. Genetic variability was greater in M_6 generation as compared to F_6 generation for most of the traits (Table 2), indicating that mutated population is more amenable to selection as compared to hybridized population. The results are in accordance with Solanki and Sharma (1999).

High heritability coupled with high genetic advance were observed for seed yield per plant and hundred seed weight in both generations (Table 2). Similar results were reported by Asifa *et al*. (2005), Bicer and Sarkar (2004) and Sadiq *et al.* (2004), indicating that these traits are mainly controlled by additive type of genes. However, Low heritability coupled with low genetic advance was observed for number of primary branches in both generations (Table 2). Thus these characters are not controlled by additive genes. Our results agreed with those of Singh and Singh (2004). High heritability with low genetic advance was also observed for days to flower in F_6 generation and for days to mature in M_6 generation (Table 2).

The genotypic and phenotypic correlations exhibited similar trends but genotypic correlations were of higher magnitude than phenotypic ones. The results were in accordance with the findings of Panse (1957). In M_6 generation, days to flower and days to mature had negative correlation with seed yield (Table 3), indicating that selection could be made for early flowering and/or early maturity. Hundred seed weight in M_6 generation had highly significant positive correlation with seed yield (Table 3). Sarwar *et al.* (2004) also found similar results. Pods per plant and hundred seed weight had highly significant and positive correlation with seed yield in F_6 generation (Table 3). The results are in accordance with Amarah *et al*. (2004) and Sarwar *et al.* (2004).

CONCLUSION

From these studies it might be concluded that seed yield can be improved in both hybridized and mutated populations by selecting ideotypes having more number of pods per plant coupled with larger seed weight.

Table 1. Analyses of variance of different morphological and economic traits in F_6 (top figures) and M_6 (bottom figures) generations of lentil

	Days to flower	Days to mature	Plant height (cm)	Number of Primary branches	Pods/plant	100-Seed weight (g)	Seed yield (Kg/ha)
Sum of Squares	1960.54 9116.13	176.97 1894.75	319.50 536.34	2.70 8.18	19942.00 5747.00	5.28 11.13	44.85 298.79
Mean Squares	217.84** 284.88**	19.67** 59.21**	35.50** 16.76**	0.30 ^{NS} 0.26 ^{NS}	2215.78** 1796.03**	0.59** 0.35**	4.99** 9.33**
F Value	113.80 94.71	6.42 34.41	30.72 7.93	1.59 0.84	19.75 4.80	16.21 25.25	34.44 48.28

** = Significant at 0.01 probability level.

Table 2. Genetic parameters in F_6 (top figures) and M_6 (bottom figures) Generations

Traits	V_G	V_P	h^2%	PCV%	GCV%	G.A.
Days to flower	71.97 93.96	73.88 96.97	97.40 96.90	10.29 12.90	10.15 12.69	6.69 25.08
Days to mature	5.53 19.17	8.59 20.89	64.40 91.80	2.29 3.91	1.83 3.36	30.44 8.09
Plant height (cm)	11.49 4.89	12.60 6.10	90.80 69.8	8.69 6.71	8.28 5.61	16.29 9.01
Number of Primary branches	0.04 0.17	0.23 0.29	16.40 5.80	15.34 15.71	6.21 3.78	5.24 2.01
Pods/plant	70.12 47.64	81.34 84.32	86.20 56.50	14.36 13.53	13.33 10.17	25.53 15.77
100-seed weight (g)	0.19 0.11	0.22 0.12	83.50 89.00	20.71 13.57	18.92 12.80	35.67 25.56
Seed yield/plant (Kg/ha)	1.62 3.05	1.76 3.24	91.80 94.00	18.97 19.09	18.17 18.51	35.84 37.01

V_P = Phenotypic variance
V_G = Genotypic variance
PCV% = Phenotypic coefficient of variation
h^2 = heritability
G.A. = Genetic advance
GCV% = Genotypic coefficient of variation

Table 3. Estimates of genotypic (top figures) and phenotypic (bottom figures) correlation coefficient in F_6 (above diagonal) and M_6 generation (below diagonal) of lentil

Traits	Days to flower	Days to mature	Plant height (cm)	Primary branches	Pods/ plant	100-seed weight (g)	Seed yield/ plant (Kg/ha)
Days to flower		-0.32 -0.28	0.65* 0.63*	-0.68 -0.24	-0.51 -0.46	0.29 0.26	-0.31 -0.30
Days to mature	0.85** 0.80**		0.03 0.06	0.34 -0.30	0.47 0.27	0.56 0.39	0.58 0.41
Plant height (cm)	0.25 0.20	0.46** 0.37*		-0.95** -0.32	0.08 0.06	0.54 0.48	0.13 0.11
Number of Primary branches	0.59** 0.15	0.44* 0.19	1.29* 0.32*		0.01 0.00	-0.34 -0.09	0.23 0.05
Pods/plant	0.18 0.13	0.11 0.13	-0.02 -0.02	0.62** 0.23		-0.16 -0.09	0.30 0.25
100-seed weight (g)	-0.92** -0.84**	-0.67** -0.58**	-0.22 -0.17	-0.69** -0.11	-0.40* -0.27		0.64* 0.56
Seed yield/plant (Kg/ha)	-0.67** -0.65**	-0.58** -0.51**	-0.24 -0.16	0.02 0.12	0.43* 0.37*	0.49** 0.47**	

*, ** = Significant at 0.05 and 0.01 probability levels, respectively.

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