

Winner of DR Banyal Memorial Best Paper Award 2016

**Genetic variability and character association among
biometrical traits in F_3 generation of lablab bean,
Lablab purpureus (L) Sweet**

SA GADAKH, GS KADAM* and TEJASHREE S LACHYAN

**Department of Agricultural Botany, College of Agriculture,
Dr Balasaheb Sawant Konkan Krishi Vidyapeeth
Dapoli 415712 Maharashtra India**

***Department of Agricultural Botany, College of Agriculture
Mahatma Phule Krishi Vidyapeet, Rahuri 413722 Maharashtra, India
Email for correspondence: tejashreelachyan@gmail.com**

ABSTRACT

The investigation was carried out to elicit the information on nature and amount of variability generated in F_3 generation of lablab bean, *Lablab purpureus* (L) Sweet with nineteen crosses. Each cross grown with 120 plants per cross was raised during Rabi 2013-14. The amount of variability generated F_3 segregating generations for yield per plant and some of its components like seed yield per plant, plant height and number of peduncles per plant was considerably high. Correlation studies revealed positive association of number of pods per plant, number of peduncles per plant, 100-seed weight, primary branches per plant and days to maturity with seed yield per plant. The path analysis studies indicated that the character number of pods per plant, number of peduncles per plant, hundred seed weight, days to first flowering had direct positive effect on grain yield.

Keywords: *Lablab purpureus*; F_3 generation; variability; correlation; path analysis

INTRODUCTION

Lablab bean, *Lablab purpureus* (L) Sweet is an important vegetable grown in India and is very nutritive vegetable grown for fresh consumption. Its dry seeds are used as pulse. A wide range of variability exists in its pod shape, size and colour and other agronomic characters. A complete knowledge on interrelationship of plant

character like grain yield with other characters is of paramount importance to the breeder for making improvement in complex quantitative character like grain yield for which direct selection is not much effective and it is a pre-requisite for starting a systematic breeding programme. Therefore study of genetic variability coupled with heritability is more useful in predicting the resultant effect of selection.

The present investigation was undertaken to assess the genetic variability, heritability and genetic advance in lablab bean.

MATERIAL and METHODS

Raising F₃ generation

The experimental material consisted of nineteen F₃ lablab bean progenies (Table 1). The experiment was conducted in compact family block design with three replications. The seeds of lablab bean were dibbled at 60 x 45 cm distance between and within rows and plants. Each plot was 3.75 x 3 m having five rows in each plot. Each row contained eight plants thus there were 40 plants per plot that constituted 120 plants per cross in three replications.

Observations were recorded from five randomly selected plants on twenty one quantitative phenological, growth and yield parameters and one quality parameter. Phenotypic and genotypic coefficients of variation (expressed in %) were calculated by using the formula given by Burton and de Van (1952), heritability by the formula given by Hanson et al (1956) and expected genetic advance by Johnson et al (1955) at 5 per cent selection intensity.

RESULTS and DISCUSSION

It was observed that the average of overall F₃ families was 29.34 g (Table 2). Maximum family mean for seed yield per

plant was 42.97 g which was recorded in DPLW-61 x DPLW-29 followed by DPLW-31 x DPLW-48 (41.30 g). The lowest family mean for seed yield per plant was 18.87 g recorded in family DPLW-61 x DPLW-51. Between progenies the third progeny had given maximum yield (47.30 g) followed by first progeny (45.80 g) of family DPLW-61 x DPLW-29 which recorded highest seed yield per plant while lowest seed yield per plant was exhibited by first progeny of family DPLW-61 x DPLW-51 (16.70 g). The widest family range for seed yield per plant was 17.00 to 32.80 g recorded by DPLW-61 x DPLW-31 followed by DPLW-51 x DPLW 29 (15.00 to 18.00 g) and DPLW-48 x DPLW-51 (21.00 to 22.70 g). The minimum family range was (21.00 to 22.00 g) observed in DPLW-15 x DPLW-48 while overall progenies range was 14.70 to 47.30 g.

Among all the families DPLW-61 x DPLW-29, DPLW-31 x DPLW-48 and DPLW-46 x DPLW-61 showed significant variation among themselves (Table 3). Family DPLW-61 x DPLW-29 showed 18.49 per cent GCV, 22.60 per cent PCV, 66.90 per cent heritability, 6.33 per cent genetic advance and 31.15 per cent genetic advance as per cent of mean and variability parameters GCV, PCV, h², GA and GAM were 13.05, 14.46, 81.36, 4.93 and 24.24 per cent in DPLW-31 x DPLW-48 and 13.70, 15.31, 80.05, 5.13 and 25.25 per cent in DPLW-46 x DPLW-61

Genetic variability, character association in lablab bean

Table 1. Detail of F₃ progenies of lablab bean with cross combinations

F1	DPLW-51 x DPLW-29	F8	DPLW-48 x DPLW-51	F15	DPLW-31 x DPLW-51
F2	DPLW-61 x DPLW-10	F9	DPLW-46 x DPLW-61	F16	DPLW-31 x DPLW-48
F3	DPLW-61 x DPLW-31	F10	DPLW-61 x DPLW-51	F17	DPLW-46 x DPLW-31
F4	DPLW-46 x DPLW-10	F11	DPLW-10 x DPLW-15	F18	DPLW-31 x DPLW-15
F5	DPLW-15 x DPLW-29	F12	DPLW-46 x DPLW-51	F19	DPLW-10 x DPLW-31
F6	DPLW-61 x DPLW-29	F13	DPLW-61 x DPLW-48		
F7	DPLW-15 x DPLW-48	F14	DPLW-46 x DPLW-48		

Table 2. Progeny and family means for seed yield per plant in lablab bean

Family	Progeny mean					Family mean	MSS	Range	
	1	2	3	4	5			Min	Max
DPLW-51 x DPLW-29	14.7	15.8	22.8	21.3	27.0	20.33	78.042	14.7	27.0
DPLW-61 x DPLW-10	22.0	18.0	22.7	24.0	19.8	21.30	17.017	18.0	24.0
DPLW-61 x DPLW-31	24.0	32.3	32.8	30.8	17.0	27.40	39.642	17.0	32.8
DPLW-46 x DPLW-10	37.3	38.8	34.7	34.2	39.2	36.83	16.125	34.2	39.2
DPLW-15 x DPLW-29	20.0	28.3	22.0	21.8	27.0	23.83	29.975	20.0	28.3
DPLW-61 x DPLW-29	45.8	43.8	47.3	37.3	40.5	42.97	49.392*	37.3	47.3
DPLW-15 x DPLW-48	30.0	31.2	30.8	28.3	30.3	30.13	3.642	28.3	31.2
DPLW-48 x DPLW-51	33.7	36.8	30.5	29.2	25.7	31.17	54.792	25.7	36.8
DPLW-46 x DPLW-61	36.8	39.7	44.0	37.5	41.2	39.83	25.208*	36.8	44.0
DPLW-61 x DPLW-51	16.7	19.7	19.8	19.0	19.2	18.87	4.892	16.7	19.8
DPLW-10 x DPLW-15	19.2	21.5	21.0	28.0	29.2	23.77	60.775	19.2	29.2
DPLW-46 x DPLW-51	33.2	31.8	32.2	27.2	26.3	30.13	29.600	26.3	33.2
DPLW-61 x DPLW-48	20.0	26.8	26.0	28.0	24.0	24.97	29.517	20.0	28.0
DPLW-46 x DPLW-48	40.5	37.5	36.0	36.5	30.7	36.23	38.192	30.7	40.5
DPLW-31 x DPLW-51	21.8	22.8	24.0	21.0	21.3	22.20	4.475	21.0	24.0
DPLW-31 x DPLW-48	41.5	38.2	40.2	41.0	45.7	41.30	22.725*	38.2	45.7
DPLW-46 x DPLW-31	26.2	25.0	26.3	28.5	26.3	26.47	4.808	25.0	28.5
DPLW-31 x DPLW-15	33.8	30.0	32.8	35.0	28.3	32.00	22.875	28.3	35.0
DPLW-10 x DPLW-31	27.2	26.3	29.8	26.3	29.0	27.73	7.692	26.3	29.8
Combined family mean						29.34	800.78*	18.87	42.97
MSS between the progenies in different families							176.29*	14.67	47.33

MSS= Mean sum of squares, Max= Maximum, Min= Minimum

	SE±	CD _{0.05}
Between family means	0.64	1.30
Between progeny means of same family	1.26	2.91
Between progeny means of different families	2.06	4.76

respectively. Variability parameters between families were 24.85 per cent GCV, 25.00 per cent PCV, 98.84 per cent heritability, 14.93 per cent genetic advance and 50.90 per cent genetic advance as per cent of mean while values for same parameters between progenies of different families were 25.94, 26.50, 95.83, 15.34 and 52.30 per cent respectively.

The high values of GCV and PCV suggested that there is a possibility of improvement through direct selection for the traits. High values of genotypic and phenotypic variance for seed yield per plant followed by plant height were also reported by Arunachala (1979) and Basawana et al (1980) in field bean and Muralidharan (1980) in lablab bean.

Effect of genotypic and phenotypic correlation on yield and other contributing characters

At genotypic level (Table 4) the character seed yield per plant had positive and highly significant correlation with plant height (0.199), primary braches per plant (0.984), number of peduncles per plant (0.995), days to maturity (0.526), number of pods per plant (0.990), and 100-seed weight (0.947), negative but highly significant correlation with number of seeds per plant (-0.207), positive but non-significant correlation with days to first flowering (0.079) and non-significant negative correlation with protein content (-0.0945). At phenotypic level seed yield

per plant noticed highly significant positive correlation with number of pods per plant (0.906), 100-seed weight (0.820), number of primary branches per plant (0.705), number of peduncles per plant (0.803) and days to maturity (0.278). However it had negative and highly significant correlation with plant height (-0.179) and number of seeds per pod (-0.140), positive and non-significant correlation with days to first flowering (0.025) and negative correlation with the protein content (-0.826).

Similar kind of results were found by Lal et al (2005) in Dolichos bean. Kabir and Sen (1987) reported number of pods per plant had positive correlation with seed yield per plant.

Genotypic correlation coefficient partitioned for path coefficient analysis

Table 5 (Fig 1) depicts the path coefficient analysis based on the correlation coefficient using grain yield as the dependent factor (effect) and other quantitative characters viz number of pods per plant, number of seeds per pod (g), number of peduncles per plant, 100-seed weight (g), plant height, number of primary branches, days to first flowering, days to maturity and protein content (%) as independent characters.

Number of pods per plant had high positive direct effect at phenotypic and genotypic levels on yield per plant. It had high positive indirect effect through number

Table 3. Variability parameters for seed yield per plant (g) in lablab bean

Source	Er MSS	δ^2g	δ^2p	GCV (%)	PCV (%)	h^2_{bs}	GA	GAM
Between families	0.62	53.18	53.80	24.85	25	98.84	14.93	50.90
Between progenies of same family								
DPLW-61 x DPLW-29	6.99	14.13	21.13	18.49	22.60	66.90	6.33	31.15
DPLW-31 x DPLW-48	1.61	7.04	8.65	13.05	14.46	81.36	4.93	24.24
DPLW-46 x DPLW-61	1.93	7.76	9.69	13.70	15.31	80.05	5.13	25.25
Between progenies of different families	2.52	57.92	60.44	25.94	26.50	95.83	15.34	52.30

GCV= Genotypic correlation coefficient, PCV= Phenotypic correlation coefficient,

of peduncles per plant and number of primary branches per plant at both phenotypic and genotypic levels while negative indirect effect via plant height, number of seeds per pod and protein content. The results are in accordance with the findings of Kurane (1997) and Basavarajappa and Byregowda (2004) in lablab bean. Number of seeds per pod had low positive at phenotypic and high positive direct effect at genotypic level on yield per plant. It had low positive indirect effect on yield per plant through protein content, plant height and days to flowering while negative indirect effect was via number of primary branches, number of peduncles per plant, days to maturity, number of pods per plant and 100-seed weight. Shinde (2011) reported positive direct effect of number of pods on grain yield per plant at genotypic and phenotypic levels.

Number of peduncles per plant had positive direct effect on yield per plant at

genotypic and low negative direct effect at phenotypic level. However it showed high indirect positive effect through number of pods per plant, 100-seed weight and number of primary branches per plant at genotypic level. Kurane (1997) reported high positive direct effect of number of peduncles on yield per plant.

100-seed weight had high positive direct effect at genotypic and low positive direct effect at phenotypic level on yield per plant. It showed significant correlation with yield per plant due to its indirect effect through days to first flowering, primary branches per plant, days to overall maturity and number of pods per plant. Pawar (1998) reported high positive direct effect of 100-grains weight on yield per plant.

The character plant height had low negative direct effect on yield per plant at phenotypic and high negative effect at genotypic level. It had positive indirect effect

Table 4. Estimates of genotypic and phenotypic correlation coefficient between different characters in lablab bean

Character		# pods/ plant	# seeds/ pod (g)	# peduncles/ plant	100-seed weight (g)	Plant height	# primary branches	Days to first flowering	Days to maturity	Protein content/ (%)	Seed yield plant (g)
# pods/plant	G	1.000	0.263**	0.999*	0.945**	0.186**	0.975**	0.036	0.488**	-0.161**	0.990**
	P	1.000	-0.185**	0.892**	0.891**	-0.188**	0.741**	0.014	0.256**	-0.158*	0.906**
# seeds/pod (g)	G		1.000	-0.291**	-0.199**	0.826**	-0.247**	0.177**	-0.101	0.503**	-0.207**
	P		1.000	-0.172**	-0.136*	0.581**	-0.144*	0.148*	-0.045	0.359**	-0.140*
# peduncles /plant	G			1.000	0.934**	-0.224**	0.966**	0.072	0.512**	-0.143**	0.995**
	P			1.000	0.813**	-0.202**	0.669**	0.057	0.267**	-0.130*	0.803**
100-seed weight (g)	G				1.000	-0.108	0.999**	0.056	0.409**	-0.173**	0.947**
	P				1.000	-0.097	0.730**	0.044	0.189**	-0.166**	0.820**
Plant height	G					1.000	-0.196**	0.359**	-0.098	0.291**	0.199**
	P					1.000	-0.162**	0.239**	-0.027	0.077	-0.179**
# primary branches	G						1.000	-0.047	0.394**	-0.161**	0.984**
	P						1.000	-0.067	0.157*	-0.124*	0.705**
Days to first flowering	G							1.000	0.523**	-0.008	0.079
	P							1.000	-0.010	0.008	0.025
Days to maturity	G								1.000	0.131*	0.526**
	P								1.000	0.077	0.278**
Protein content (%)	G									1.000	-0.0945
	P									1.000	-0.826**
seed yield/ plant (g)	G										1.000
	P										1.000

*Significant at 5 % level, **Significant 1% level, G= Genotypic correlation coefficient, P= Phenotypic correlation coefficient

Table 5. Direct and indirect effects of yield components on grain yield in F₃ generation of lablab bean

Character	# pods/ plant	# seeds/ pod (g)	# peduncles/ plant	100-seed weight (g)	Plant height	# primary branches	Days to first flowering	Days to maturity	Protein content (%)
# pods/plant	0.848	-0.223	0.847	0.801	-0.157	0.826	0.030	0.413	-0.136
# seeds/pod (g)	-0.066	0.253	-0.073	-0.050	0.209	-0.062	0.044	-0.025	0.127
# peduncles/plant	0.136	-0.039	0.137	0.128	-0.030	0.132	0.009	0.070	-0.019
100-seed weight (g)	0.447	-0.094	0.442	0.473	-0.051	0.473	0.027	0.193	-0.082
Plant height	0.054	-0.240	0.065	0.031	-0.291	0.058	-0.104	0.028	-0.084
# primary branches	-0.412	0.104	-0.408	-0.422	0.084	-0.423	0.020	-0.166	0.068
Days to first flowering	0.002	0.011	0.004	0.003	0.023	-0.003	0.065	0.034	-0.0006
Days to maturity	-0.013	0.002	-0.013	-0.011	0.002	-0.010	-0.014	-0.027	-0.003
Protein content (%)	-0.006	0.018	-0.005	-0.006	0.010	-0.006	-0.0003	0.004	0.037

on yield through number of peduncles per plant, days to overall maturity, number of pods per plant and hundred seed weight at genotypic level. Similar kind of results were reported by Pawar (1998) in Indian bean.

Number of primary branches per plant had low positive direct effect on yield per plant at phenotypic and negative direct effect at genotypic level. Low indirect and positive effect through number of seeds per plant at genotypic and Low indirect and positive effect through number of pods per plant at phenotypic level were noticed for these characters. The findings are similar to that of Basavarajappa and Byregowda (2004) who reported low positive direct effect of primary branches per plant on yield per plant.

Days to first flowering had significant positive correlation with grain yield at both genotypic and phenotypic levels. It had positive direct effect on yield per plant. Its indirect effects via number of peduncles per plant, plant height, number of seeds per pod and 100-seed weight were low and positive. Pandey et al (1980), Bendale et al (2008) and Shinde (2011) reported similar kind of results in lablab bean.

Days to overall maturity had negligible direct positive effect at phenotypic and low negative direct effect on yield per plant at genotypic level. Similar results were found by Gondhalekar (2013). Protein content had low positive direct effect at

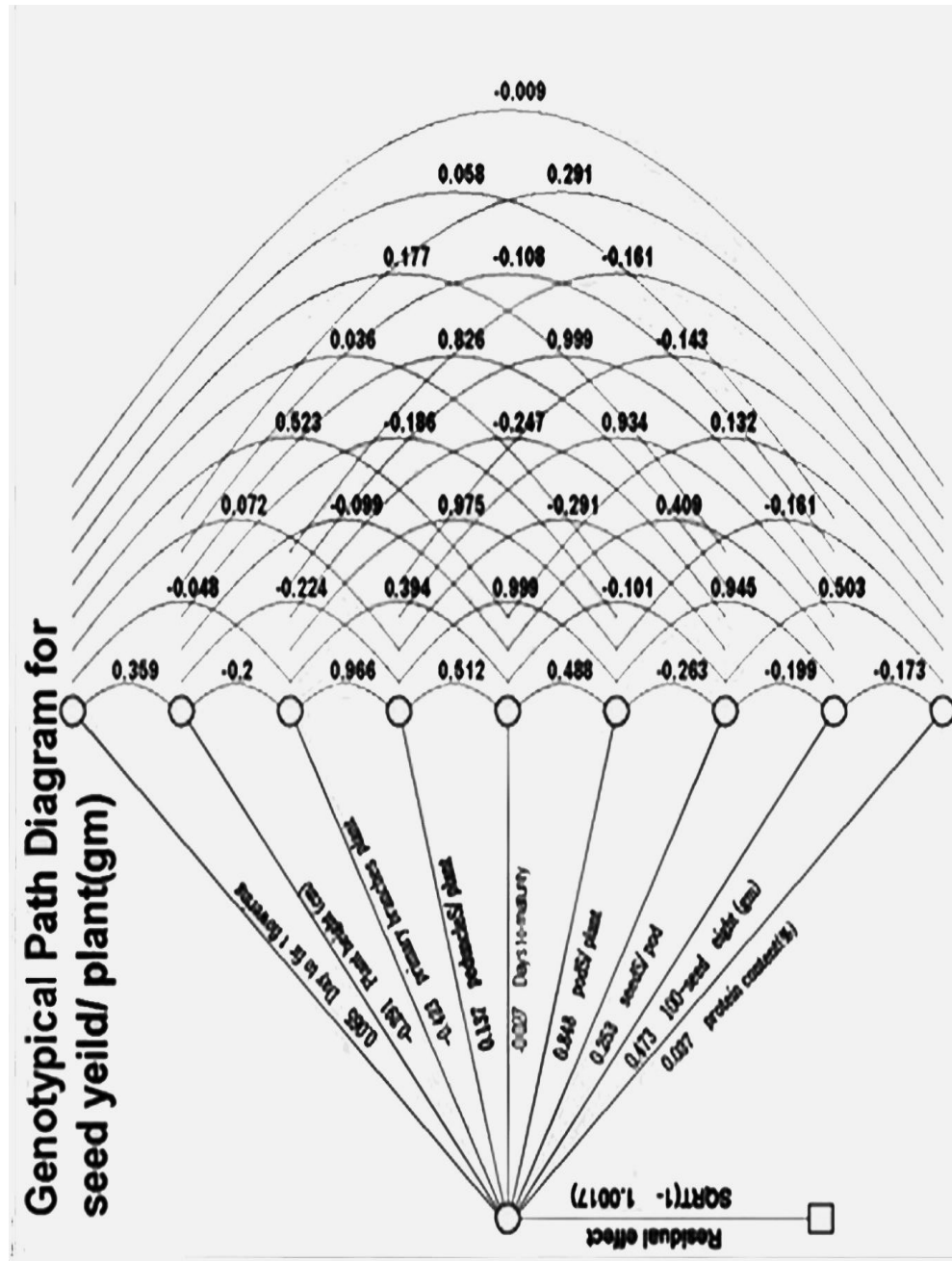


Fig 1. Genotypic path diagram for seed yield per plant (g)

genotypic and phenotypic levels on yield per plant.

CONCLUSION

Wide range of variation was noted in F_3 population of lablab bean. The characters plant height, 100-seed weight, peduncles, branches and seed yield per plant showed comparatively higher estimates of genotypic and phenotypic coefficients of variation indicating high level of variability and ample scope for effective improvement. These characters also had higher estimates of heritability coupled with high genetic advance as per cent of mean indicating that these characters are controlled by additive gene action. Correlation studies revealed strong positive association of seed yield per plant with days to overall maturity, number of pods per plant, 100-seed weight, number of primary branches per plant and number of peduncles per plant both at phenotypic and genotypic levels which suggested to pay attention on these characters along with yield. Promising progenies among the population were DPLW-61 x DPLW-29, DPLW-31 x DPLW-48, DPLW-46 x DPLW-61, DPLW-46 x DPLW-10 and DPLW-46 x DPLW-48.

REFERENCES

- Arunachala A S.1979. Genetic variability and correlation studies in field bean (*Dolichos lablab* L). Mysore Journal of Agricultural Sciences **8(3)**: 369-372.
- Basavarajappa PS and Byregowda M 2004. Assessment of field bean germplasm of southern Karnataka and isolation of elite genotype. Mysore Journal of Agricultural Sciences **38(4)**: 474-479.
- Basawana KS, Pandita ML, Dhankar PS and Pratap PS 1980. Genetic variability and heritability studies on Indian bean (*Dolichos lablab* var *lignosus* L). Haryana Journal of Horticultural Science **9(1-2)**: 52-55.
- Bendale VW, Ghangurde MJ, Bhawe SG and Sawant SS 2008. Correlation and path analysis in *Lablab purpureus* (L) sweet. Orissa Journal of Horticulture **36(1)**: 49-52.
- Burton GW and DeVane EH 1952. Estimating heritability in tall fescue (*Festuca arundinacea*) from replicated clonal material. Agronomy Journal **45**: 478-481.
- Gondhalekar PS 2013. Variability studies in F_2 generation of lablab bean (*Lablab purpureus* (L) Sweet). MSc (Agric) thesis, Dr Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India.
- Hanson CH, Robinson HF and Comstock RE 1956. Biometrical studies of yield in segregating populations of Korean lespedeza. Agronomy Journal **48(6)**: 268-272.
- Johnson HW, Robins HF and Comstock RE 1955. Estimate of genetic and environmental variability in soybeans. Agronomy Journal **47(7)**: 314-318.
- Kabir J and Sen S 1987. Studies on genetic variability and heritability in *Dolichos* bean. Annals of Agricultural Research **8(1)**: 141-144.
- Kurane AS 1997. Variability studies in F_2 generation of lablab bean (*Lablab purpureus* (L) Sweet). MSc (Agric) thesis, Dr Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India.
- Lal H, Rai M, Verma A and Vishwanath 2005. Analysis of genetic divergence of *Dolichos* bean (*Lablab purpureus*) genotypes. Vegetable Science **32(2)**: 129-132.

- Muralidharan K 1980. Studies on genetic divergence and breeding behavior of few intervarietal crosses in field bean. MSc (Agric) thesis, University of Agricultural Sciences, Bangalore, Karnataka, India.
- Pandey RP, Assawa BM and Assawa RK 1980. Correlation and path coefficient analysis in *Dolichos lablab* Linn. Indian Journal of Agricultural Sciences **50(6)**: 481-484.
- Pawar RM 1998. Genetic variability, correlation, path and D² analysis in Indian bean (*Lablab purpureus* (L) Sweet). MSc (Agric) thesis, Gujarat Agricultural Univeersity, Navsari, Gujarat, India.
- Shinde VK 2011. Genetic Studies in Wal (*Lablab purpureus* (L) Sweet). MSc (Agric) thesis, Dr Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India.

Received: 1.10.2015

Accepted: 13.6.2016