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STUDY ON GENETIC VARIABILITY, CORRELATION AND PATH ANALYSIS OF *DOLICHOS* BEAN GERMPLASM OF TRIPURA

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Twenty-two landraces of *Dolichos* bean were collected from Tripura during 1988 and evaluated at Barapani Farm, CIAR Research Complex for NEH Region. A wide range of genetic variability was recorded for all the characters. High heritability accompanied by high genetic advances were recorded in pods/plant, pod yield/plant and pods/panicle. Number of pods/plant, pod yield/plant and panicles/plant were highly associated with pod yield and contributed maximum indirectly via number of pods/plant, while number of pods/plant and single pod weight contributed maximum, directly. Hence for the improvement of *Dolichos* bean by selection, maximum emphasis should be given on these four characters *viz.* pods/panicle, panicle/plant, pods/plant and single pod weight.

Key words : *Dolichos* bean, landraces, collection, genetic variability, correlation, path analysis.

Dolichos lab lab (Roxd) L. (syn. *Lab-lab purpuria* var. *typicus*) is an important vegetable legume of North Eastern Hill Regions of India. Among the North Eastern states, it is widely cultivated in Tripura for its green pods. Plant of *Dolichos* thrives well in slant sloppy hills and *tilla* land of state. It indicates that climate of the state is quite conducive for the commercial cultivation of this crop in the state. However, a very little attention has been paid with respect to the genetic improvement of this crop, while a number of its landraces with genetic variability are available (Singh *et al.*, 1979, Baswana *et al.*, 1980, Kabir and Sen, 1987) in *Dolichos* bean. Therefore, the present study was planned to explore the landraces of this crop grown in the state and study their genetic variability, correlation and path analysis in order to select suitable genotypes for utilization in breeding programme.

MATERIALS AND METHODS

Twenty-two landraces of *Dolichos* bean were collected from Melaghar, Teliamura, barahmura, Mohanpur, Eshar Hill and Korilong areas of Tripura during November, 1988 and evaluated at ICAR Research Complex for N.E.H.

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Region, Barapani, Meghalaya. Experiment was laid out in randomised block design with three replications during the year 1989-90. Each germplasm accession was sown in hill with spacing of 1.00 × 0.75 m. Three seeds were sown in each hill and after germination, one plant was allowed to grow in each hill. A basal fertilizer dose of 25 kg Na/ha (two splits), 40 kg/ha P_2O_5 and 30 kg K/ha was applied in form of urea, single super phosphate and murate of potash, respectively.

Bamboo staking was done after 3 weeks of sowing. Pod characters were recorded from 10 pods selected at random from third picking. The total of all the pickings from each germplasm was used to compute the number of pods/plant and green pod yield/plant. Observations were recorded on days to flowering (DF), panicle length (PEL), pod length (PL), pod width (PW), pod thickness (PT), single pod weight (SPW), number of pods/panicle (NP/P), and pod yield/plant (PY/P). Heritability (in broad sense) and genetic advances were calculated as per procedures described by Johnson *et al.* (1955). Correlation and path analysis were worked out by as per model given by Panse and Sukhatme (1957) and Deway and Lu (1959).

RESULTS AND DISCUSSIONS

A wide range of variations were observed in colour distribution on pod, stem and flower (Table 1). The pod and stem were grouped into green, red, cream and their different shades, while flowers colour was noted white or red only. Pods were either straight (finger shape) or curved. Among all the germplasm, RCDL-21 bore dark red finger shaped pods, which appeared to be rare material. Most of the germplasm had green or cream pods, green or cream stem and white or red flowers and red or purple pod combination with red stem and red flowers. However, exceptions were also recorded in RCDL-5, RCDL-6 and RCDL-19.

Genetic Variability and Heritability

Data on yield and yield attributes, heritability, and genetic advances are presented in Table 1. The differences among the germplasm lines were significant for all the characters studied. RCDL-18 expressed earliest flowering (77 days after sowing), however, it was statistically at par with RCDL-3 and RCDL-7. The highest pod length was recorded in RCDL-18 followed by RCDL-20 and RCDL-19. Single pod weight was maximum in RCDL-19 (5.98 g). It may be due to the cumulative effect of higher pod width (2.47 cm), pod thickness (0.83 cm) and pod length (11.70 cm). The maximum number of pods/plant was recorded in RCDL-9 (304.1) which was followed by RCDL-10 (283.2). Moreover, maximum pod yield/plant was recorded in RCDL-3 (1.45 kg) and found statistically superior to RCDL-9 (1.16 kg), RCDL-2 (1.08 kg) and RCDL-10

Table 1. Evaluation of *Dolichos lab-lab* var. *tipicus* germplasm

Accession (1)	Pod colour (2)	Stem colour (3)	Flower colour (4)	Pod shape (5)	Days to flowering (6)	Panicle length (cm) (7)	Pod length (cm) (8)	Pod width (cm) (9)	Pod thickness (cm) (10)	Weight/ pod (g) (11)	No. of pods/ panicle (12)	No. of panicles/plant (13)	No. of pods/ plant (14)	Pod weight/ plant(kg) (15)
RCDL-1	DPR	R	R	SC	87.3	16.67	6.91	1.63	0.80	4.49	6.5	22.7	145.9	0.622
RCDL-2	G	G	W	S	89.0	18.77	10.16	1.76	0.83	5.64	9.1	21.5	192.6	1.082
RCDL-3	LPR	R	R	S	81.0	22.90	9.41	1.52	0.74	4.65	11.1	29.1	212.5	1.451
RCDL-4	G	G	W	S	92.7	26.23	7.24	1.12	0.63	3.18	10.0	17.2	105.7	0.328
RCDL-5	G	G	R	S	89.7	16.73	8.24	1.42	0.64	3.84	8.9	13.7	68.1	0.261
RCDL-6	LPR	G	R	C	92.7	12.93	8.12	1.93	0.75	4.27	5.6	16.8	91.5	0.390
RCDL-7	LPR	R	R	C	81.0	30.96	8.32	1.49	0.63	3.27	10.	20.1	209.3	0.892
RCDL-8	C	C	W	C	85.3	29.23	5.84	1.86	0.74	3.73	9.0	21.8	191.2	0.712
RCDL-9	C	C	W	C	81.0	28.53	6.50	1.91	0.72	3.84	12.3	26.1	304.1	1.167
RCDL-10	C	G	W	C	92.3	25.23	6.10	2.12	0.67	3.67	12.8	22.9	283.2	1.031
RCDL-11	LPR	PR	R	C	99.0	24.33	7.00	1.47	0.69	3.32	8.0	19.7	153.9	0.511
RCDL-12	LPR	PR	R	SC	83.7	21.53	8.88	1.44	0.61	3.26	5.1	17.0	86.9	0.281
RCDL-13	PR	R	R	SC	86.3	29.63	8.11	2.01	0.78	3.98	12.0	20.3	244.0	0.971
RCDL-14	LR	R	R	SC	86.0	32.00	6.53	1.87	0.84	3.87	10.4	24.8	257.4	0.994
RCDL-15	LPR	R	R	SC	93.0	24.63	7.10	1.77	0.82	4.19	9.1	22.5	201.7	0.842
RCDL-16	PG	R	R	S	104.0	20.43	6.93	1.07	0.74	3.69	7.1	20.5	141.8	0.523

(Contd. to next page)

Accession (1)	Pod colour (2)	Stem colour (3)	Flower colour (4)	Pod shape (5)	Days to flowe-ring (6)	Panicle length (cm) (7)	Pod length (cm) (8)	Pod width (cm) (9)	Pod thickness (cm) (10)	Weight/ pod (g) (11)	No. of pods/ panicle (12)	No. of panicl-es/plant (13)	No. of pods/ plant (14)	Pod weight/ plant(kg) (15)
RCDL-17	PR	R	R	S	104.3	29.06	8.92	0.94	0.99	4.43	9.1	15.7	140.5	0.619
RCDL-18	G	G	R	SC	77.7	20.87	12.43	2.31	0.72	5.25	4.3	20.5	87.1	0.455
RCDL-19	LPR	G	R	SC	101.0	19.07	11.70	2.47	0.83	5.98	6.2	21.1	124.8	0.762
RCDL-20	LR	R	R	SC	92.3	19.83	12.37	2.32	0.78	5.67	4.6	21.2	94.4	0.536
RCDL-21	DR	R	R	S	100.7	27.23	7.67	0.98	0.87	3.21	4.2	9.8	41.5	0.129
RCDL-22	C	C	W	SC	94.7	24.46	8.37	2.02	0.97	4.33	3.5	9.1	31.9	0.138
SEm					2.88	1.35	0.17	0.06	0.12	0.18	1.09	1.64	26.54	0.105
CD at 5%					4.75	2.23	0.99	0.10	0.20	0.29	1.81	2.70	43.79	0.174
h^2(%)					87.36	93.49	99.32	99.06	26.74	97.17	87.69	89.85	91.66	91.42
GA(%)					16.05	47.69	51.54	52.09	10.36	53.06	71.39	47.33	105.08	104.03

DPR = Dark purple red, G = Green, LPR = Light purple red, C = Cream, PR = Purple red, LR = Light red, PG = Purple green, DR = Dark red, R = Red, W = White, SC = Slightly curved, S = Straight, C = Curved

(1.03 kg), might be due to the optimum single pod weight and number of pods/plant.

A wide range of variation was observed for all the characters. Heritability estimates were high for characters namely, pod length, pod width, single pod weight, panicle length, pods/plant, pod weight/plant, panicles/plant, pods/panicle and days to first flowering (Table 2). Inspite of high heritability values for most of the traits, estimate of genetic advance (% mean), ranged from 10.63 to 105.08. High heritability values were associated with high values of genetic advance (% mean) for pods/plant, pod weight/plant, pods/panicle and moderately were obtained for single pod weight, pod width, pod length and panicle length. High heritability accompanied by high genetic advance was more useful than the heritability alone and considerable importance could be made in these characters when predicting the resultant effect for selecting the best individuals (Johnson *et al.*, 1995). High heritability along with high genetic gain indicated in these characters due to considerable additive gene effects (Panse, 1957). In some characters like days to flowering had a high heritability but low genetic gain. Such characters are more likely to be under the control of non-additive gene and selection for this character will be less effective (Panse, 1957). Additive effect for pod yield and pod number have been observed by Arunachala (1979) and Baswana *et al.*, (1980) for *D. lab-lab.*

Table 2. Correlation among certain characters in *Dolichos bean* (pole type)

Character	PEL	PL	PW	PT	SPW	NP/PE	NPE/P	NP/P	PY/P
DF	–0.127	0.315	–0.112	0.458*	0.180	–0.325	–0.519*	–0.443*	–0.302
PEL		–0.458	–0.095	0.117	–0.399	0.541**	0.197	0.499*	0.247
PL			0.262	0.329	0.774**	–0.543**	–0.172	–0.455*	–0.068
PW				–0.089	0.633**	0.120	0.591**	0.342	0.521*
PT					0.263	–0.333	–0.295	–0.198	–0.031
SPW						–0.326	0.224	–0.113	0.360
NP/PE							0.638**	0.879**	0.650**
NPE/P								0.862**	0.868**
NP/P									0.864**

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

Correlations

Table 2 presents the data on correlation studies. Analysis of simple correlation between the characters pointed out a significant positive correlation for days to flowering with pod thickness and significantly negative association

with number of panicle/plant and number of pod/plant while loose association with yield/plant. It clearly indicates that early flowering can increase the number of pods/plant and number of panicle/plant might be due to prolonged fruiting periods and *vice-versa* with late flowering. In agreement with the present observations, Arunachala (1978) also reported positive correlation between number of pods and pod yield. Number of panicles/plant has significant association with pods/plant and pod yield/plant (Joshi, 1971).

Path Analysis

The maximum direct effect (1.315) was contributed by number of pods/plant followed by single pod weight (0.694). The positive direct effect of number of pods/plant was somewhat diminished by the factors i.e. days to flowering (-0.008), panicle length (00.032), pod width (-0.072), single pod weight (-0.079), number of pods/panicle (0.012) and number of panicles/plant (-0.186), thereby accounting a highly significant correlation of 0.864. The direct effect of number of panicles/plant was negative (-0.216) but very high indirect effect *via* number of pods/plant (1.133), gave significant correlation (0.868) to the yield/plant. Similarly, number of pods/panicle was negative direct effect (-0.139) but positive indirect effect (1.156) contributed strong toward a significant correlation (0.650). The direct effect of pod length (-.0080) was negative but due to positive indirect effect via single pod weight (0.537) and negative via number of pods/plant (-0.599) contributed negligible to the yield/plant (-0.069) Table 3. This was apparent in long-podded genotype in RCDL-18 and RCDL-20 having minimum number of pods/plant and it reduced yield/plant. The contribution of the residual factor was worked out as 0.0156.

Table 3. Path analysis in *Dolichos* for pod yield/plant

Character	DF	PEL	PL	PW	PT	SPW	NP/PE	NPE/P	NP/P	PY/P
DF	0.018	0.008	–0.025	0.024	–0.025	0.125	0.045	0.112	–0.582	–0.582
PEL	–0.002	–0.064	0.037	0.020	–0.006	0.277	–0.075	–0.042	0.657	0.247
PL	0.006	0.029	–0.080	–0.055	–0.018	0.537	0.075	0.037	–0.599	–0.068
PW	–0.002	0.006	–0.021	–0.211	0.005	0.439	–0.017	–0.127	0.449	0.521
PT	0.008	–0.007	–0.026	0.019	–0.055	0.182	0.046	0.064	–0.261	–0.031
SPW	0.003	0.025	–0.062	–0.134	0.015	0.694	0.045	–0.048	–0.149	0.360
NP/PE	–0.006	–0.034	0.044	–0.025	0.018	–0.226	–0.139	–0.138	1.156	0.650
NPW/P	–0.009	–0.013	0.014	–0.125	0.016	0.155	–0.089	–0.216	1.331	0.868
NP/P	–0.008	–0.032	0.037	–0.072	0.011	–0.079	–0.122	–0.186	1.315	0.864

Residual = 0.0156

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