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# Characterization and genetic diversity analysis in field bean [*Lablab purpureus* (L.) Sweet] collections of Karnataka

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## ABSTRACT

**Forty three pendal and seventy one non-pendal genotypes were collected from different parts of Karnataka. The pendal and non-pendal genotypes were evaluated separately in two different experiments following randomized complete block design at Dharwad during *kharif* 2007-08. In order to characterize and differentiate the genotypes, observations on 20 quantitative and 26 qualitative characters at different growth stages of the plants were recorded. The analysis of variance suggested significant variation for all the characters in both pendal and non-pendal genotypes. GCV was the highest for number of green pods/plant and green pod yield/plant in both the types. High variation was observed for leaf, inflorescence, flower, pod and seed characters among pendal and non-pendal genotypes. $D^2$ statistic grouped the non-pendal genotypes into 13 distinct clusters, indicating ample diversity among the genotypes. The 43 pendal type genotypes were grouped into six clusters and had high range of inter-cluster distance compared to non-pendal types, suggesting greater diversity among the genotypes. However, genetic diversity was not related to geographical diversity in both pendal and non-pendal types. Diverse genotypes in both pendal (DDGC 18, DDGC 35, GL 509, GL 502 and DDGC 32) and non-pendal (GL 63, GL 77, GL 56, GL 70 and GL 37) types were identified for hybridization to generate high variability. Wide variability for all the qualitative traits (such as growth habit, branch orientation, stem pigmentation, and the like) was observed in both pendal and non-pendal types.**


***Key words*:** Dolichos bean, Field bean, Genetic diversity, Germplasm, Pendal type

Field bean [*Lablab purpureus* (L.)Sweet], also called hyacinth bean/dolichos bean, belongs to family Fabaceae and is one of the most ancient crops. It is presently grown through out the tropical regions in Asia, Africa and America. In Karnataka, it occupies an area of 0.6 lakh hectares with production of 0.26 lakh tones and productivity of 438 kg/ha (Anonymous 2006). It is cultivated either as a pure crop or mixed with other crops such as finger millet, groundnut, castor, corn or sorghum. It is also grown in home garden. It is a multipurpose crop grown for pulse, vegetable and forage. There are two distinct types of field bean; *Lablab purpureus* var. *typicus* and *Lablab purpureus* var. *lignosus*. Variety *typicus* is a garden/pendal type and cultivated for its soft and edible pods. Variety *lignosus* is commonly known as field bean/non-pendal type and cultivated for both green and dry seed (Purseglove 1968). *Lablab purpureus* is also grown under varied agricultural practices (sole crop, mixed crop, inters crop, forage crop, catch crop, kitchen garden, *etc*).

Although field bean is cultivated throughout Karnataka, no concerted effort has been made to collect and conserve the available genetic resources. A wide genetic variability is available *in situ* in farmers' fields and/ or kitchen gardens, offering scope for selection (Byre Gowda 2005). Information on divergence and germplasm characterization in field bean is scanty and also not well-documented. The present investigation is an attempt to document such information in available collections of field bean.

## MATERIALS AND METHODS

A total of 56 field bean genotypes were collected from different parts of North Karnataka; 33 were non-pendal (field) and 23 were pendal (garden) types. In addition, 20 garden type and 38 field type genotypes were obtained from the germplasm bank maintained at UAS, Bangalore. Most of these genotypes were collected from Southern parts of Karnataka. Altogether 43 pendal and 71 field types were evaluated separately in two different experiments during the year 2007-08 *kharif*. Both the experiments were conducted at Botanical Garden, UAS, Dharwad.

In the first experiment, only the field type genotypes were grown in a randomized complete block design (RCBD) with two replications. Each genotype was sown in a single row with a row length of 3.0 m with an inter row spacing of 60 cm and inter plant spacing of 25 cm under rainfed conditions. All the agronomic practices were followed to raise a good crop. Six plants were randomly taken from each genotype per replication. Out of the six, three plants were used for recording green pod observations, and the remaining three plants were used for taking dry pod and dry seed yield observation. In the second experiment, only pendal types were used. Each pendal type genotype was sown in a row length of 3.6 m with an inter row spacing of 90 cm and inter plant spacing of 60 cm under rainfed conditions. Staking was given to each plant with bamboo pole having branches as a support to climb. Three plants were randomly selected from each genotype per replication to record observations on days to flowering, primary branches/plant, racemes/ plant, raceme length, flower buds/raceme, nodes/raceme, green pods/plant, green pod length, green pod width, seeds/pod, green pod yield/plant (g), seed length (fresh), seed width (fresh), test weight (fresh), shelling percentage in fresh pods, dry seed yield/plant (g), seed length (dry), seed width (dry), test weight (dry) and shelling percentage in dry pods. The dry seed yield/plant was not recorded for pendal types. The plants were scored for 26 qualitative traits using standard scales (Shivashankar *et al.* 1977, Savitha 2008) at different stages of crop growth. Based on the qualitative data, the genotypes were classified into different groups.

The statistical analysis of individual quantitative characters was carried out by taking the mean values over two replications. The mean and range was determined for each trait separately for two experiments. Mahalanobis $D^2$ statistic (1936) was used for assessing the genetic divergence between genotypes.

## RESULTS AND DISCUSSION

The ultimate goal of any plant breeding programme is to improve crop plants for agronomic and economic superiority. Improvement in productivity of any crop depends on the availability of variable material or germplasm for utilizing it in breeding programmes and successful determination of its breeding value. The assessment of variability in the local cultivars and land races and utilization of them in breeding programmes is more prudent than looking for world collections. The local germplasm will have adaptive traits to regional requirements.

The analysis of variance revealed highly significant differences among genotypes in both pendal and field types with respect to all the 20 quantitative characters studied (Data not presented). This indicated that the lines under study were genetically diverse. High diversity for many quantitative traits in field bean has also been observed earlier in different collections (Borah *et al.* 1992, Basavarajappa and Byre Gowda 2000). The range was wide for all 20 characters in both pendal and non-pendal types. The estimates of genetic coefficient of variation (GCV) were also moderate to high for many of the characters studied (Table 1). The GCV was the highest for important yield traits like number of green pods per plant and green pod yield per plant in both the types, suggesting ample opportunity to select genotypes for high yield. Among field types, there were many genotypes which were significantly superior in yield to the best checks 'HA 3' and 'HA 4' (which are the dominant varieties in Karnataka). In general, wide variability was observed for the yield and yield components in both garden and field types.

Quantification of genetic diversity existing within and between groups of germplasm is important and particularly useful in the choice of parents to be hybridized for creating higher variability in segregating populations and obtaining useful recombinants. The 71 field bean genotypes were grouped into 13 distinct clusters, indicating prevalence of

**Table 1. Mean and range observed for different quantitative characters in pendal and non-pendal genotypes of *Lablab purpureus* (L.) Sweet**

| Characters | Field type | | | Garden type | | |
|---|---|---|---|---|---|---|
| | Mean | Range | GCV | Mean | Range | GCV |
| Days to 50% flowering (no.) | 85.55 | 41.00-107.00 | 20.35 | 100.20 | 71.00-143.00 | 20.54 |
| Primary branches/plant (no.) | 3.08 | 2.35-7.00 | 22.85 | 2.71 | 1.83-3.50 | 8.25 |
| Flower buds/raceme (no.) | 31.44 | 9.35-51.00 | 22.25 | 31.02 | 12.50-47.17 | 28.07 |
| Racemes/plant (no.) | 12.53 | 3.80-28.60 | 38.43 | 33.02 | 6.83-63.00 | 45.17 |
| Raceme length (cm) | 27.92 | 15.24-47.50 | 15.41 | 22.57 | 4.80-35.07 | 33.07 |
| Nodes/raceme (no.) | 9.52 | 5.20-13.55 | 11.40 | 8.27 | 2.50-12.83 | 29.51 |
| Green pod length (cm) | 5.43 | 4.35-7.55 | 9.14 | 7.09 | 4.47-15.95 | 32.54 |
| Green pod width (cm) | 1.84 | 1.30-2.40 | 12.45 | 1.82 | 1.33-2.35 | 12.60 |
| Green pods/plant (no.) | 68.70 | 13.75-153.88 | 38.88 | 138.53 | 42.00-379.16 | 55.91 |
| Seeds/pod (no.) | 3.91 | 3.30-4.70 | 5.25 | 4.53 | 3.50-5.80 | 12.42 |
| Seed length (Fresh) (cm) | 1.37 | 1.05-1.60 | 7.25 | 1.42 | 1.22-1.69 | 6.23 |
| Seed width (Fresh) (cm) | 0.88 | 0.70-1.10 | 6.79 | 0.95 | 0.77-1.18 | 9.99 |
| Test weight (Fresh) (g) | 50.95 | 30.35-64.35 | 16.83 | 62.25 | 33.90-85.85 | 19.14 |
| Shelling % (fresh pods) | 57.77 | 33.50-67.75 | 15.16 | 56.53 | 40.90-73.61 | 15.57 |
| Seed length [Dry] (cm) | 0.94 | 0.75-1.05 | 6.28 | 0.90 | 0.75-1.27 | 11.58 |
| Seed width [Dry] (cm) | 0.70 | 0.60-0.90 | 5.44 | 0.66 | 0.49-0.78 | 7.49 |
| Test weight (Dry) (g) | 25.25 | 18.95-33.95 | 12.64 | 33.12 | 21.80-54.87 | 24.06 |
| Shelling % (dry pods) | 74.67 | 55.76-84.05 | 5.58 | 74.05 | 53.30-81.98 | 6.62 |
| Green pod yield/plant (g) | 172.87 | 31.0-439.64 | 38.90 | 477.06 | 169.40-861.79 | 36.18 |
| Dry seed yield/plant (g) | 48.77 | 4.85-125.50 | 48.21 | | | |

high diversity in the materials studied (Table 2). Cluster II was the largest with 35 genotypes followed by cluster V (11 genotypes), cluster III and IV (each with 6 genotypes). Clusters VII, VIII, IX, X, XI, XII and XIII, each contained one genotype only. The genotypes, which fell within the clusters, by and large exhibited narrow range of genetic variability. As many as 35 genotypes in cluster III indicated that majority of the genotypes in the local germplasm of field bean are genetically similar. Nevertheless, formation of 13 clusters with different frequencies of genotypes itself indicated a large extent of diversity among the genotypes evaluated. Formation of clusters (VII to XIII) with solitary entry might be due to total isolation preventing the formation of gene flow or intensive natural/human selection for diverse adaptive complexes. Most of these collections were from remote villages and maintained by farmers over years. Therefore, it is possible that they could be reproductively isolated. However, the cluster formation did not include any geographical isolation. For example, clusters I, II, III, IV and V comprised genotypes collected from different districts of Northern and Southern Karnataka. Such non correlation of geographical distribution with clustering pattern has also been observed in Dolichos bean (Pujari 2000, Nandi *et al*. 2000). However, clustering pattern following their respective geographical origin was also observed (Basavarajappa and Byre Gowda 2000). Based on inter cluster distance ($D^2$ values), the genotypes belonging to cluster I and VI appeared to be more diverse (363.51) followed by cluster VI and XII (304.64), cluster IV and I (298.65) and cluster VI and III (269.43), suggesting that selection of genotypes from these divergent groups would result in higher magnitude of heterosis for the characters concerned. Such crosses may also generate more desirable recombinants in segregating generations due to allele frequency differences between these genotypes.

The 43 pendal type genotypes were grouped into six clusters and had high range of inter cluster $D^2$ values, suggesting greater diversity among the genotypes. Among clusters, two clusters had solitary entry (cluster V and VI); cluster I, IV, III and II had two, four, fifteen and twenty genotypes, respectively (Table 3). Most of the pendal types were collected from the kitchen garden, which is maintained as perennials for many years. Therefore, there could be less exchange of seed material. Further, there is a reproductive barrier as they were not grown as populations in the field. Still a large number of genotypes were grouped into cluster II with 20 genotypes, suggesting similarity among genotypes for many traits. In addition, the cluster formation did not include any geographical isolation. The clusters I, II, and III comprised genotypes collected from different districts of Northern and Southern Karnataka. The molecular studies also showed that there is less diversity in the field bean, although a wide range of phenotypic diversity is reported (Mass *et al*. 2005). The lack of genetic diversity could be one of the reasons for the lack of relationship between geographical isolation and genetic diversity in Field bean. The inter cluster distance was highest (779.68) between cluster I and V, indicating high diversity between the genotypes. Cluster I with two genotypes and cluster V with one genotype were the most divergent groups based on inter cluster distance. It is desirable to select these accessions as parent from these two clusters in recombination breeding programmes for obtaining desirable segregants.

The characterization of genotypes based on the qualitative traits is very useful to differentiate the genotypes as they are highly heritable and less influenced by environmental conditions. Further, association of any qualitative characters with desirable traits/yield components serves as a marker in the selection process. The results of the

**Table 2. Clustering pattern in field bean/ non pendal genotypes of *Lablab purpureus* (L.) Sweet**

| Cluster | No. of entries | Genotypes | Source (district) |
|---|---|---|---|
| I | 2 | HA 3, HA 4 | Checks |
| II | 35 | GL 34, GL 62, GL 63, GL 30, DDGC 65, GL 49, GL 77, GL 47, DDGC 109, DDGC 57, DDGC 45, GL 414, DDGC 47, DDGC 39, GL 31, DDGC 43, GL 68, GL 28, DDGC 62, GL 66, GL 97, GL 37, GL 51, GL 415, DDGC 66, GL 100, DDGC 61, DDGC 67-1, GL 9, DDGC 40, DDGC 68, GL 17, DDGC 53, GL 50, DDGC 55 | Belgaum (5), Dharwad (3), Bellary (1), Bagalkot (2), Bijapur (3), Dvanagere (1), UAS, Bangalore (20) |
| III | 6 | GL 413, DDGC 46, DDGC 49, DDGC 44, GL 411, DDGC 63 | Dvanagere (2), Dharwad (2), Belgaum (1), UAS, Bangalore (2) |
| IV | 6 | GL 20, GL 21, GL 79, GL 48, DDGC 58, DDGC 59 | Belgaum (1), Davanagere (1), UAS, Bangalore (4) |
| V | 11 | DDGC 50, DDGC 52, 321, DDGC 64, DDGC 38, DDGC 71, 246, GL 43, DDGC 67, DDHC 48, GL 56 | Belgaum (3), Davanagere (2), Dharwad (2), UAS, Bangalore (4) |
| VI | 4 | GL 75, GL 85, GL 93, GL 70 | UAS, Bangalore (4) |
| VII | 1 | NA4 1 | UAS, Bangalore |
| VIII | 1 | GL 13 | UAS, Bangalore |
| IX | 1 | DDGC 56 | Belgaum |
| X | 1 | DDGC 72 | Dvanagere |
| XI | 1 | DDGC 54 | Belgaum |
| XII | 1 | DDGC 51 | Belgaum |
| XIII | 1 | DDGC 41 | Davanagere |

**Table 3. Clustering pattern in pendal genotypes of *Lablab purpureus* (L.) Sweet**

| Cluster | No. of entries | Genotypes | Source |
|---|---|---|---|
| I | 2 | DDGC 11, DDGC 15 | Dharwad (2) |
| II | 20 | GL 554, GL 558, DDGC 25, DDGC 21, 559, GL 565, GL 534, DDGC 18, DDGC 8, DDGC 20, GL 548, DDGC 36, DDGC 35, DDGC 32, GL 557, DDGC 17, DGC 30, GL 545, DDGC 22, DDGC 27 | Bijapur (1), Bellary (4), Belgaum (6), Davanagere (1), UAS, Bangalore (8) |
| III | 15 | GL 532, GL 566, DDGC 17, GL 553, GL 509, GL 550, GL 524, GL 529, GL 520, DDGC 73, GL 543, GL 504, DDGC 24, DDGC 31, GL 502 | Belgaum (2), Bellary (1), Bijapur (1) UAS, Bangalore (11) |
| IV | 4 | GL 553, DDGC 23, DDGC 28, DDGC 23 | Bellary (1), Davanagere (1), Belgaum (1), UAS, Bangalore (1) |
| V | 1 | DDGC 10 | Bijapur |
| VI | 1 | DDGC 29 | Bagalkot |

variability observed for 26 qualitative characters in the germplsam collected are presented in the Tables (4a-4d). Wide range of variation was observed for growth habit, leaf, inflorescence, flower, pod and seed characters. The pendal types were indeterminate, whereas in field bean both determinate and semi-determinate types were observed. The semi-determinate types were more (83.10%) than determinate types (16.9%). Such variation for growth habit was observed in a study involving 107 genotypes collected from 20 different countries (Sultana 2001). Most of the genotypes were local collections and not consciously bred. Therefore, the majority of the genotypes turned out to be semi determinate types. However, for commercial cultivation, determinate types are preferred. The genotypes showed three types of branch orientation in Dolichos bean. Most of the determinate types showed short and erect lateral branches. The non-pendal types did not show any variation with respect to stem pigmentation. On the other hand, the stem pigmentation varied from almost solid to no pigmentation in pendal types. Majority of the pendal genotypes did not show any pigmentation on stem. In six genotypes (DDGC 7, DDGC 15, DDGC 10, GL 548, GL 563) the pigmentation was extensive, while three genotypes (DDGC 11, DDGC 73 and GL 504) showed pigmentation only at nodes. The stem pigmentation is used as one of the dominant markers in crops like rice and finger millet as a marker to identify true hybrids.

Leaf hairiness was classified into moderately pubescence, low pubescent and glabrous. All the 3 types of leaf hairiness were observed in both pendal and non-pendal genotypes. In non-pendal genotypes, the low pubescence type (71.83%) had the highest frequency followed by moderately pubescence (18.30%) and glabrous (9.85%). On the other hand, glabrous were in high frequency among pendal types. Leaf pubescence has been reported to be very useful for insect and virus resistance in many crop plants. Field bean, being a pulse crop, is susceptible to many insects and viruses. Therefore, the role of pubescence in reducing the susceptibility to pests has to be explored in Dolichos bean.

**Table 4a. Variability for plant growth habit and leaf characters and their frequency in local collections of *Lablab purpureus* (L.) Sweet**

| S. N. | Trait | Type | Frequency | |
|---|---|---|---|---|
| | | | Pendal genotypes | Non-pendal genotypes |
| 1 | Growth habit | Determinate | 0 | 12 (16.90) |
| | | Semi determinate | 0 | 59 (83.90) |
| | | Pendal | 43 (100) | 0 |
| 2 | Branch orientation | Short and erect lateral branches | 0 | 8 (11.26) |
| | | Branches tending to be perpendicular to main stem, medium in length | 0 | 6 (8.45) |
| | | First lateral branches long and spreading over ground | 43 (100) | 57 (80.28) |
| 3 | Stem pigmentation | No pigmentation | 33 (76.74) | 71 (100) |
| | | Extensive | 6 (13.95) | 0 |
| | | Localized at nodes | 3 (6.97) | 0 |
| | | Almost solid | 1 (2.32) | 0 |
| 4 | Leaf vein colour | Green | 42 (97.67) | 71 (100) |
| | | Purple | 1 (2.38) | 0 |
| 5 | Leaf anthocyanin | Absent | 43 (100) | 71 (100) |
| | | Present | 0 | 0 |
| 6 | Leaf colour | Pale green | 24 (55.81) | 15 (21.12) |
| | | Green | 19 (44.18) | 56 (78.87) |
| 7 | Leaf hairiness | Glaborous | 29 (67.44) | 7 (9.85) |
| | | Low pubescence | 7 (16.27) | 51 (71.83) |
| | | Moderately pubescence | 7 (16.52) | 13 (18.30) |
| 8 | Leaf shape | Ovate | 43 (100) | 71 (100) |

Value in parenthesis is % value

**Table 4b. Variability for inflorescence and flower characteristics and their frequency in local collections of *Lablab purpureus* (L.) Sweet**

| S.N. | Trait | Type | Frequency | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pendal types | | | | Non-pendal types | | | |
| 1 | Raceme position | Within foliage | 17 (39.53) | | | | 1 (1.40) | | | |
| | | Intermediate | 0 | | | | 3 (4.22) | | | |
| | | Emerging from leaf canopy | 26 (60.46) | | | | 67 (94.36) | | | |
| 2 | Flower characters | | *FBC* | *SPC* | *WPC* | *KPC* | *FBC* | *SPC* | *WPC* | *KPC* |
| | | White | 01 (2.32) | 33 (76.67) | 33 (76.74) | 33 (76.74) | 0 | 67 (94.36) | 67 (94.36) | 67 (94.36) |
| | | Cream | 0 | 0 | 0 | 0 | 5 (7.04) | 1 (1.40) | 1 (1.40) | 1 (1.40) |
| | | Light yellow | 32 (74.41) | 0 | 0 | 0 | 63 (88.73) | 0 | 0 | 0 |
| | | Pruple | 10 (23.25) | 10 (23.25) | 10 (23.25) | 10 (23.25) | 3 (4.22) | 3 (4.22) | 3 (4.22) | 3 (4.22) |

Value in parentheses is % value; FBC: Flower bud colour, SPC: Standard petal colour, WPC: Wing petal colour, KPC: Keel petal colour

**Table 4c. Variability for pod characters and their frequency in local collections of *Lablab purpureus* (L.) Sweet**

| S.N. | Trait | Type | Frequency | | | |
|---|---|---|---|---|---|---|
| | | | Pendal types | | Non-pendal types | |
| | | | Unripe (fresh pod) | Matured (fresh pod) | Unripe (fresh pod) | Matured (fresh pod) |
| 1 | Pod attachment | Erect | 29 (67.44) | 5 (11.62) | 71 (100) | 8 (11.26) |
| | | Intermediate | 4 (9.30) | 5 (11.62) | 0 | 63 (88.73) |
| | | Pendant | 10 (23.25) | 20 (46.51) | 0 | 0 |
| 2 | Pod curvature | Straight | 15 (34.88) | | 46 (64.78) | |
| | | Slightly curved | 28 (65.11) | | 25 (35.21) | |
| 3 | Pod pubescence | Glabrous | 41 (95.34) | | 71 (100) | |
| | | Moderately pubescent | 2 (4.65) | | 0 | |
| 4 | Pod beak | Short beak | 43 (100) | | 71 (100) | |
| 5 | Pod constriction | No constriction | 18 (41.86) | | 13 (18.30) | |
| | | Slightly constricted | 19 (44.18) | | 56 (78.87) | |
| | | Constricted | 6 (13.95) | | 2 (2.81) | |
| 6 | Pod colour | White | 9 (20.93) | | 0 | |
| | | Green | 32 (74.41) | | 71 (100) | |
| | | Purple | 1 (2.32) | | 0 | |
| | | Dark purple | 1 (2.32) | | 0 | |

Value in parentheses is % value

**Table 4d. Variability (quantitative) for seed characters and their frequency in local collections of *Lablab purpureus* (L.) Sweet**

| S.N. | Trait | Type | Frequency | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Pendal types | | | Non-pendal types | | |
| | | | YSC | MSC | DSC | YSC | MSC | DSC |
| 1 | Seed colour | Green | 43 (100) | 25 (60.46) | 0 | 70 (98.59) | 71 (100) | 0 |
| | | Cream | 0 | 0 | 0 | 1 (1.40) | 0 | 2 (2.81) |
| | | Purple | 0 | 1 (2.32) | 0 | 0 | 0 | 0 |
| | | Brown | 0 | 3 (6.97) | 21 (48.83) | 0 | 0 | 8 (11.26) |
| | | Black | 0 | 1 (2.32) | 11 (25.58) | 0 | 0 | 0 |
| | | White | 0 | 2 (4.65) | 0 | 0 | 0 | 17 (23.94) |
| | | Golden brown | 0 | 0 | 1 (2.32) | 0 | 0 | 0 |
| | | Nearly sand stone | 0 | 0 | 2 (4.65) | 0 | 0 | 25 (35.21) |
| | | Tata mimosa/dry mehandi colour | 0 | 0 | 6 (13.95) | 0 | 0 | 4 (5.62) |
| | | Dawn lustrous | 0 | 0 | 2 (4.65) | 0 | 0 | 14 (19.71) |
| | | Pinkish | 0 | 10 (23.25) | 0 | 0 | 0 | 0 |
| | | | *YS (F)* | | *Dry* | *YS (F)* | | *Dry* |
| 2 | Seed shape | Round | 1 (2.32) | | 1 (2.32) | 2 (2.81) | | 53 (74.64) |
| | | Oval | 42 (97.6) | | 42 (97.67) | 69 (97.18) | | 18 (25.35) |
| | | Flat | 0 | | 0 | 0 | | 0 |
| 3 | Seed texture | Smooth | 43 (100) | | | 71 (100) | | |

Value in parentheses is % value; YS (F): Fresh seed, YSC: Young seed colour, MSC: Matured seed colour, DSC: Dry seed colour

**Fig 1.** Variation observed for green pod (A), dry seed (B), seed coat colours and flower colours in the local collections of *Lablab purpureus* (L.) Sweet

Three different raceme positions were observed *viz.*, within foliage, intermediate and emerging from leaf canopy. Similarly variation for flower bud and its petal colour was observed in both pendal and non-pendal types. Wide variation for flower colour was observed in both pendal and non pendal genotypes. The flower colour varied from purple to pure white. The highest frequency of genotypes recorded light yellow colour followed by purple in both types. Similarly variation was observed for standard petal, wing and keel petal colour. Flower colour can be used as a marker to identify genotypes/ varieties. A wide variability was observed for pod characters *viz.*, pod attachment, pod curvature, pod constriction and pod colour except pod beak in both pendal and non-pendal types. Three types of pod attachment, erect, intermediate and pedant; two types of pod curvatures, straight and slightly curved and short pod beak were also observed in both pendal and non-pendal types (Shivashankar *et al.* 1989, Mohan and Aghora 2006). Similarly, pod constriction and pod colour differences were observed. In pendal types four different pod colours *viz.*, green, white, purple and dark purple were observed among which green pod colour was the dominant one. There was only one genotype each with purple (GL 559) and dark purple (GL 529). The variation in pod characteristics is important as there is a lot of variation in consumer preference for pod colour, size and constriction. The variability can be utilized while breeding for region specific Dolichos beans. Further, pod characters like pod attachment and pod curvature also play an important role in insect resistance which should be explored as field bean is attacked by many insects at pod formation stage. The seed coat colour showed wide variation among the genotypes. A total of 11 seed colours namely green, cream, purple, brown, black, white, golden brown, nearly sand stone, tata mimosa, dawn lustrous and pinkish were observed at different stages *viz.*, young seed, matured seed and dry seed. The seed colour at young stage was found to be green in all the genotypes of pendal and non-pendal types, whereas in mature seeds, the seed colours – green, pink, brown, white, black and purple – were observed with varied frequency. Only one genotype 'GL 559' had purple pod colour as well as seed colour at maturity. The genotypes 'DDGC 18' and 'GL 532' exhibited white seed colour. The genotypes 'GL 509', 'GL 548' and 'GL 524' had brown seed colour at maturity stage. The seed colour variation is another important parameter to characterize the genotypes/varieties for easy identification and differentiation of germplasm lines/varieties. Such variation in seed colour was also observed for dry seeds. The highest frequency of genotypes among pendal type had brown seeds. In non-pendal types it was sand stone followed by white, dawn lustrous, brown, tata mimosa and cream. For seed shape also there was a lot of variation. In pendal type, the frequency of round (2.30%) and oval (97.67%) were same in young and dry seeds. On the otherhand, in non-pendal types the highest frequency (97.18%) of genotypes showed oval shape at young seed stage while at dry seed stage the highest frequency of genotypes (74.64%) had round seeds. All the genotypes had smooth seed texture.

In conclusion, there is a wide variability for all the qualitative traits in both pendal and non-pendal types. Further, the genotypes 'GL 63', 'GL 77', 'GL 56', 'GL 70' and 'GL 37' among field types and 'DDGC 18', 'DDGC 35', 'GL 509', 'GL 502' and 'DDGC 32' among pendal types recorded significantly higher yield than the check varieties. These lines need to be tested in large plots. Genetics of majority of the traits particularly in pendal types are scanty. There is a need to study the genetics of these traits and the linkage between different qualitative traits and their influence on seed yield and yield components for utilization in Dolichos bean improvement programmes.

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