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CLASSIFICATION OF URIDBEAN GERMPLASM FROM DIVERSITY ZONES OF UTTAR PRADESH

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The landraces in Uridbean (*Vigna mungo* L.) were collected from diversity rich zones in Uttar Pradesh, India. The collections were characterized for visual traits and quantitative characters. The ordination of genotypes were done by principal component analysis. The classification gave 13 clusters and many resistant genotypes for viral diseases were identified. The genetic donors for yield, pod and flowering traits were isolated along with green seeded erect types which are not found frequently.

Key words : Uridbean, landraces, germplasm, classification

Uridbean [*Vigna mungo* (L.)] Hepper is an important pulse crop of Indian subcontinent. India being one of the important centre of diversity, a thrust for germplasm collection, evaluation and conservation is a desired necessity to keep pace with increasing population. Allard (1960) and Harlan (1956) also speculated the problem of germplasm conservation, while discussing natural variability of plants and pointed out that centre of diversity are in constant process of genetic erosion. Unfortunately, the progress in breeding often by selection and purification of genetically mixed landraces inevitably led to more uniformity and less genetic variability within the variety that was presented in the original landrace. Keeping this view in mind, explorations were conducted in the districts of Uttar Pradesh namely, Hardoi, Barabanki, Bareilly, Sitapur and eight districts in Kumaon and Garhwal which were reported to be rich in diversity for local types in this crops (Paroda and Arora, 1991). For estimation of diversity within the germplasm, the classification of germplasm accessions into homogenous groups is utmost desirable practice using multivariate parameters instead of using univariate methods. It was presumed that the genotypes originated from distantly separated regions of the world are likely to be different in their genetic make up. However, several scientists for different crop species have supported no parallelism in geographical distribution and genetic diversity (Malhotra and Singh, 1971). The collected 150 accessions of uridbean were subjected to principal component analysis (PCA) for classification in the present study.

MATERIALS AND METHODS

One hundred fifty accessions collected from diversity zones of Uttar Pradesh were sown in the month of July at Crop Research Station, Pantnagar in augmented design with four checks namely Narendra Urid-1, Pant Urid-35, Type-9, and Pant Urid-19 after every 10 plots of new accessions. Each plot of accession as well as checks consisted of 2 rows of 4m length. The row spacing was 30 cm and plant spacing was kept

10 cm. All accessions were assigned in 15 blocks with 4 repeated checks in every block. The trial was protected for insect/pest. Observations for various characters viz., plant height (cm), days to 50 per cent flowering, days to maturity, pods per plant, pod length (cm), seeds per pod, 100 seed weight (g) and yield kg/ha were subjected to statistical analysis. The analysis of variance was performed in augmented design using method given by Federer (1961) and elaborated by Federer and Raghav Rao (1975). The genotypic means were adjusted for the block effects as measured by the check plots. The total number of block were determined by relationship

$$b > \left[\frac{10}{c-1} + 1 \right]$$

where, b = number of blocks

c = number of checks

The adjustment factor $r_j = (1/C)\ (B_j\text{-}M)$ = Mean of jth block minus grand mean. The adjusted yields were calculated by substracting r_j from actual observations.

$$y_i = y_{ij} - r_j$$

where,

Y_{ij} = yield of i^{th} variety occurring in jth block.

Further classificatory analysis was done on these adjusted values of variables.

For extracting the principal components correlation matrix was obtained by adjusted means of variable as matrix. The matrix of r non zero eigen values was utilized to extract r principal components. Thus from a matrix of 6 non-zero eigen values, the 6 principal components (PCP) were extracted.

Here the 1st PCP represented largest variance of random linear combination of variables represented in data matrix. The other PCPs were orthogonal axis of 1st PCP. The measure of degree of fit or fraction of total variance explained by 6 principal components were obtained as fraction of non zero eigen values and total R eigen values.

The genetic divergence among genotypes was studied using non hierarchical euclidian, cluster analysis model described by Beale (1969) and elaborated by Spark (1973). The PCPs obtained from original variables were utilized for this analysis. The assumption for this method was that the euclidian distances 'D' separating 'n' points in a 'P' dimensional space are proportional to the dissimilarities between the objects and secondly, that no object can belong simultaneously to two clusters.

RESULTS AND DISCUSSION

The analysis of variance performed for augmented designs revealed sufficient differences among checks. The results for mean and range in various characters has been given in Table 1. The range of characters is indicative of high amount of variability as the plant height ranged from 28 to 80 days and maturity ranged from 58 days to 116 days. The pods per plant showed tremendous variability with minimum of 9.9 up to 116.6 pods. The pod length varied from 2.9 to 7.12 and seed weight from 1.32 to 4.72 g. The maximum yield was obtained in accession ShU 96133 which was a local collection from district Nainital. The earliest accession in flowering and maturity was ShU 9547. Accession ShU 9534 (from Hardoi) was having the highest number of pods and found resistant to both yellow mosaic and leaf crinkle virus.

Such landraces with useful traits impart a possibility of direct utilization. The values of eigen vectors, roots and variation explained is given in Table 2. The maximum value of eigen roots 2.89 was obtained by 1st eigen vector followed by 1.85, 1.08, 0.833, 0.69, 0.42, 0.18, 0.33 by other corresponding seven vectors. The different vectors

Table 1. Mean and range of various quantitative characters in uridbean germplasm

Particulars	Characters							
	Plant height (cm)	Days to 50% flowering	Days to maturity	Pods/plant	Pod length (c,)	Seed/pod	100 seed weight (g)	Yield (kg/ha)
Accessions	90.83 (125.5-183.8)	54.93 (18.4-79.7)	86.37 (58- 116)	30.20 (9.9-116.6)	4.22 (2.90-7.12)	6.67 (3.42-7.61)	3.24 (1.32-4.72)	1057 (709-2839)
Check 1 (Narendra Urd 1)	191.5	42.93	75.53	44.87	4.567	6.507	3.175	2301
Check 2 (PU-35)	112.3	42.73	74.67	42.93	4.567	6.780	3.039	1602
Check (T-9)	93.87	43.20	76.00	35.53	4.380	6.820	3.197	1371
Check-4 (PU-19)	101.6	43.93	75.00	39.07	4.300	6.593	2.984	1709
CV %	16.13	3.773	4.164	26.80	5.263	6.321	8.858	18.63

(Range in parenthesis)

Table 2. Eigen vectors, eigen roots and associated variance for different components in urid germplasm

Particulars	Characters							
	Plant height (cm)	Days to 50% flowering	Days to maturity	Pods/plant	Pod length (cm)	Seed/pod	100 seed weight (g)	Yield (kg/ha)
Plant height (cm)	0.38	0.40	–0.14	–.23	–0.16	0.51	0.56	–0.027
Days to 50% flowering	–0.35	0.57	–0.039	0.050	0.19	–0.026	–0.048	0.71
Days to maturity	–0.33	0.58	–0.02	0.07	0.21	–0.032	–0.09	'0.69
Pods/plant	0.42	0.28	0.10	0.06	–0.14	–0.80	0.23	0.002
Pod length (cm)	0.35	–0.08	–0.21	–0.30	0.84	–0.065	–0.064	0.01
Seeds/Pod	0.15	–0.016	–0.68	0.70	0.01	0.04	–0.003	0.003
100 seed weight (g)	0.22	0.009	0.66	0.57	0.31	0.23	0.13	0.03
Yield (kg/ha)	0.48	0.28	0.06	–0.04	–0.22	0.18	–0.76	0.03
Eigen roots	2.89	1.85	1.08	0.833	0.69	0.42	0.18	0.033
Variation (%)	36.13	23.20	13.54	10.42	8.63	5.36	2.27	0.41

associated with various characters have shown positive and negative values as contribution obtained for vectors. The contribution of positive and negative values is based on relative proportion of multivariates in the formation of orthogonal vectors as the observable variates are presented as a function of smaller number of latent vectors so that few orthogonal variates are obtained (Morrison, 1976).

The maximum variation of 36.13 per cent was explained by 1st vector and rest of the variation 23.20, 13.54, 10.42, 8.63, 5.36, 2.27 and 0.41 were explained by other seven vectors. The maximum variation contributed for first vector is from characters plant height, pods per plant and yield kg/ha. The first six principal components explained 97.31 per cent variation which were utilised for clustering purpose.

Table 3. Average inter and intra cluster distances in uridbean germplasm

Cluster No.	1	2	3	4	5	6	7	8	9	10	11	12	13
1.	(1.106)												
2.	1.791	(1.212)											
3.	1.687	1.50	(1.239)										
4.	3.379	3.085	2.541	(1.566)									
5.	2.283	2.601	2.467	1.939	(1.023)								
6.	3.156	2.601	2.966	3.995	3.143	(1.030)							
7.	2.742	.2.238	3.057	3.17	1.916	2.158	(1.340)						
8.	5.493	4.010	4.716	4.068	4.962	5.367	4.500	(1.976)					
9.	4.402	3.976	3.946	4.436	4.220	4.635	4.506	6.166	(1.412)				
10.	3.140	3.117	2.409	2.545	2.261	2.389	2.906	5.582	4.014	(1.307)			
11.	2.880	2.249	2.350	3.154	2.529	1.443	2.150	5.037	3.313	1.654	(1.078)		
12.	2.487	2.376	2.902	3.011	1.865	3.526	2.102	4.883	3.160	3.333	2.683	(1.193)	
13.	12.409	12.409	12.303	12.465	12.353	12.302	12.398	13.137	12.876	12.469	12.347	12.000	(0.000)

(Values in parenthesis are intra cluster distance)

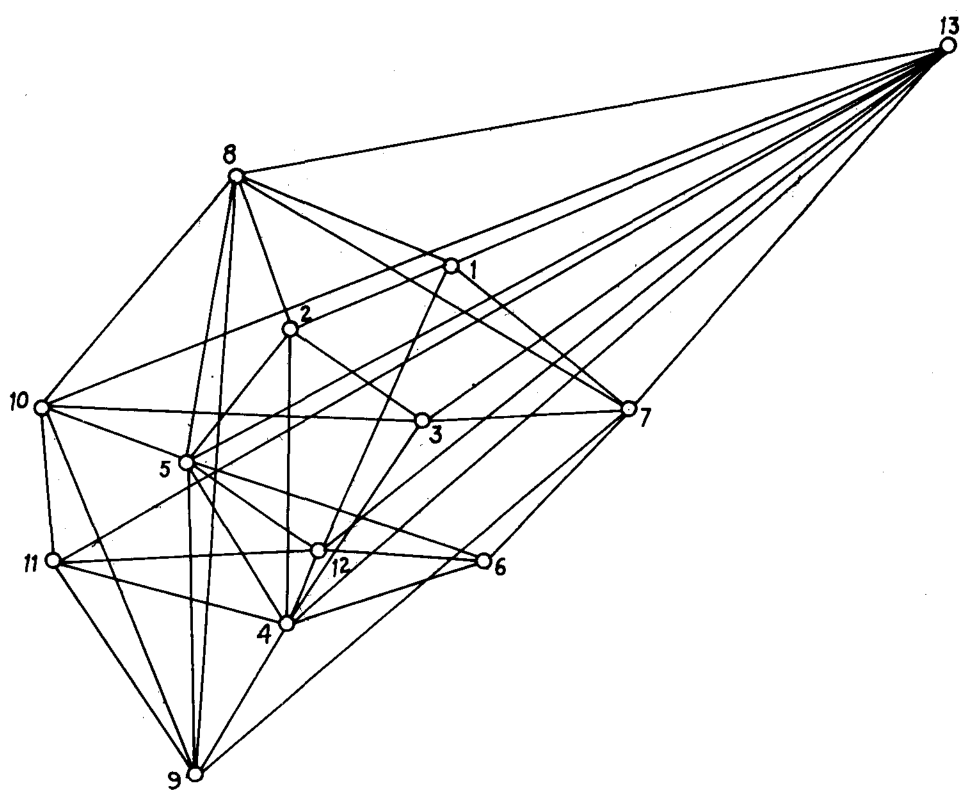

Fig. 1. Cluster diagram showing relative inter cluster distances among uridbean germplasm

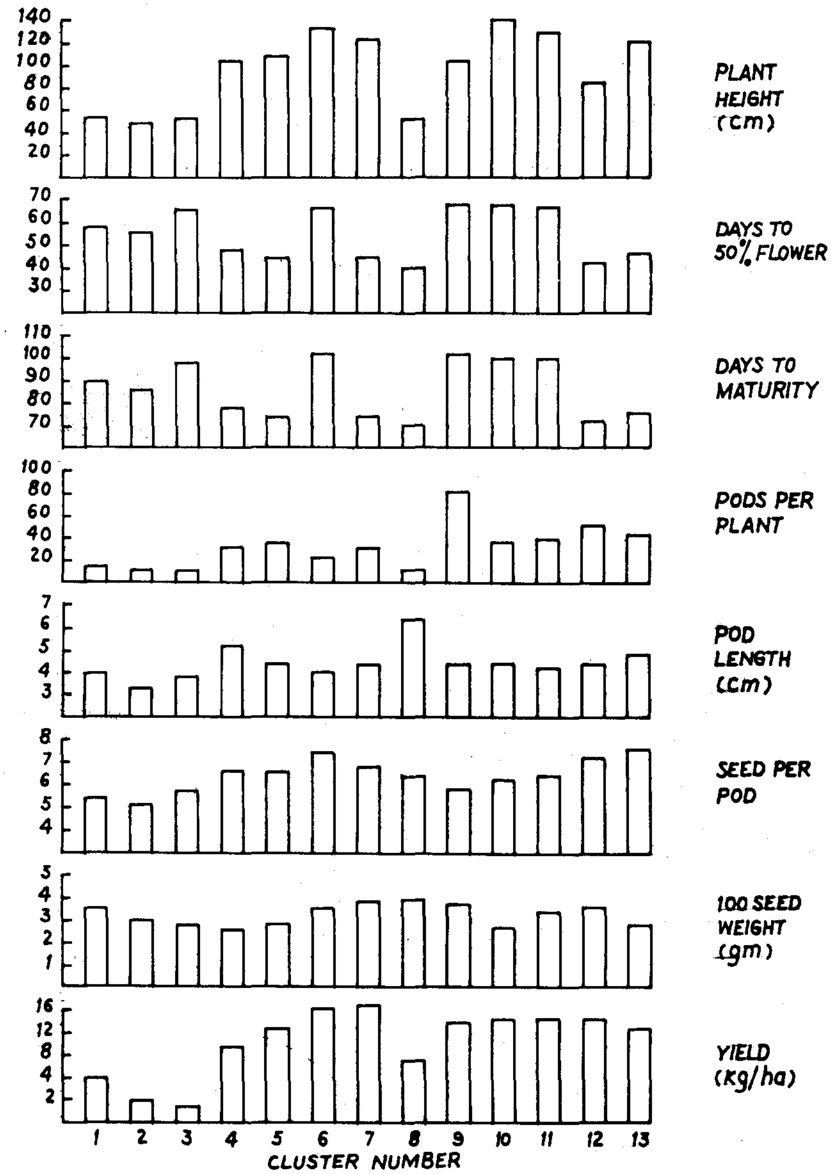

Fig. 2. Cluster mean different characters in urid bean germplasm

The cluster analysis grouped 154 accessions into 13 clusters which was found appropriate as determined by F test. The non- hierarchical clustering procedures followed, allows solution to large data problems because it is not necessary to calculate and store the similarity matrix everytime. The inter and intra cluster distance between and within clusters have been given in Table 3.

The maximum intra cluster distance 1.976 was found in cluster No. 8 and minimum in cluster No. 6. This distance is indicative of relative divergence among similar genotypes within a group. The maximum inter cluster distance was between cluster Nos. 13 and 10. These clusters had accessions collected from various different localities. The arrangement of accessions in between clusters was found independent of their locality of collections indicating that pattern of diversity in urdbean is not location specific.

The cluster means as depicted in Fig. 2 revealed that within clusters the accessions with distinct characters, clustered together making a particular cluster distinct. The tallest accession were recorded in cluster No. 10 which had highest mean of 139.27 cm, cluster No. 8 had early flowering and maturity types. The maximum number of pods with mean value of 44 per plant were obtained in cluster No. 13 which is a single entry cluster with accession ShU-9641 collected from Shergarh in district Bareilly. This cluster also had maximum number of seeds per pod. The entry was typically distinct and exclusive. This cluster was in maximum diverse·end (Fig. 1). Although such classificatory studies in urbean are scanty, in other crops like wheat Wrigley *et al.* (1982) have done such studies.

The presentation in the Fig. 2 allowed convenient selection of superior cluters for different traits and their accessions within these clusters. The promising accessions identified as genetic donors have been given in Table 4, which can be utilized in breeding programmes.

Table 4. Identified genetic donors for various characters in uridbean germplasm

Character		Entry Name
1.	Plant Height (cm)	ShU 9511, ShU 9512, ShU 9537, ShU 9539, ShU 9606
2.	Days to 50% flowering	ShU 9636, ShU 9603, ShU 9610
3.	Days to maturity	ShU 9636, ShU 9603, ShU 96104
4.	Pods/Plant	ShU 9636
5.	Pod Length (cm)	ShU 96104, ShU 9603, ShU 9634
6.	Seed/Pod	ShU 9641
7.	100 Seed Weight (g)	ShU 9536, ShU 9603, ShU 96104

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