

Genetic divergence in Indian blackgram (*Vigna mungo*) cultivars\*P K KATIYAR<sup>1</sup> and G P DIXIT<sup>2</sup>

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Received: 22 July 2009; Accepted: 5 November 2009

**Key words:** Urdbean, Cluster analysis, Cultivars, Divergence

Blackgram (*Vigna mungo* L.) is an important pulse crop cultivated across the country during rainy (*khari*), winter (*rabi*) and spring season. On account of its short duration, photo-insensitivity and dense crop canopy, it assumes special significance in crop intensification and diversification, conservation of natural resources and sustainability of production system. Further, the use of parents based on the genetic divergence is a pre-requisite for a successful breeding programme. The ordination technique, like principal component analysis, followed by cluster analysis was found to be useful tool (Katiyar and Dixit 2009) for getting multi-correlated variables into another set of uncorrelated variables which can be utilized for classification of genotypes into homogenous groups. The use of non-hierarchical Euclidean cluster analysis to estimate genetic divergence and for classification of germplasm has been suggested. In view of above, the present study has been undertaken *inter alia* to facilitate an inventory of what is available in the cultivars and to assess the value of released varieties.

A total of 46 diverse cultivars, viz 'Azad Urd 1', 'Azad Urd 2', 'AKU 9904', 'CO 5', 'GU 1', 'JU 2', 'KU 96-3', 'LBG 20', 'LBG 17', 'LBG 611', 'LBG 623', 'LBG 645', 'LBG 648', 'LBG 685', 'LBG 402', 'Manikya', 'Mash 1-1', 'Mash 218', 'Mash 414', 'Naveen', 'NDU 1', 'PDU 1', 'RBU 38', 'Sekhar U 1', 'Sekhar U 2', 'Sekhar U 3', 'Sarlahi', 'TU 94-2', 'TAU 1', 'TAU 2', 'T 9', 'TMV 1', 'TPU 4', 'Uttara', 'UL 338', 'Vamban 1', 'Vamban 2', 'WBU 108', 'G 338', 'UG 1008', 'Pragya', 'Pant U 19', 'Pant U 30', 'Pant U 35', 'Pant U 31', and 'Pant U 40' released and notified in India for different zones were evaluated at Indian Institute of Pulses Research, Kanpur (26.28° N and 80.21° E) in a randomized block design with 3 replications over 3 years (2006, 2007 and 2008) during *khari* season. Observations were recorded on 5 competitive plants for 10 quantitative traits namely, days to 50% flowering, plant height (cm), number of primary branches, number of clusters/plant, number of pods/plant, number of seeds/pod, pod length (cm), 100-seed weight (g),

days to maturity and yield/plant (g). The principal component analysis was carried out to transform the interdependent variables into a set of independent variables (Hotelling 1933, Mardia 1971). These principal components scores were used to compute Euclidean distances based on non-hierarchical cluster analysis through SPAR I (Beale 1969, Spark 1973). This method characterizes genetic divergence on the basis of similarity and dissimilarity denoted by aggregate effects of agronomic traits under study.

Cultivars were also evaluated for 8 qualitative attributes, viz growth habit, plant habit, leaflet shape (terminal), premature pod colour, mature pod colour, pod pubescence, seed colour and seed coat lustre.

Seven clusters (I to VII) of blackgram cultivars were derived on the basis of similarity in morphological characters from the non-hierarchical Euclidean cluster analysis. The cluster V (14 cultivars) contains the maximum number of cultivars, while cluster I (3 cultivars) have minimum number. These well characterized groups were obtained by transforming the metric attributes into a single index of similarity in the form of principal components. The first component was a measure of pods/plant and number of cluster/plant as the co-efficients associated with these traits have the maximum magnitude (Table 1). The second principal component was determined by plant height, 100-seed weight and no. of seeds/pod. Days to 50% flowering and pod length were represented by third principal component, whereas fourth principal component was a measure of days to maturity, number of primary branches and yield/plant.

Average distance of clusters from cluster centroids ranged from 1.113 to 2.359. It was maximum in cluster VII and minimum in cluster V. Therefore, utilizing the cultivars from these cluster in hybridization programme may result in the putative transgressive segregants. So far as inter-cluster distance is concerned, cluster II and VI centroids were the farthest (4.001) from each other. The minimum distance was observed between III and VII (1.357). These observed distances reflect the genetic diversity in cultivars and their linkage with respect to one another.

The released varieties were grouped into 7 clusters. The

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Table 1 Eigen vectors of 10 standardized variables for the first 4 principal components

Variable	Principal component			
	1	2	3	4
Days to 50% flowering	-0.035	-0.116	0.429	0.183
Plant height (cm)	0.139	0.491	-0.080	-0.0195
Number of primary branches	-0.137	-0.039	0.191	0.376
Number of clusters/plant	0.435	0.186	0.207	-0.135
Number of pods/plant	0.481	0.003	-0.120	-0.006
Number of seeds/pod	-0.161	0.422	0.117	0.113
Pod length (cm)	0.097	0.185	0.446	0.161
100-seed weight (g)	0.157	0.449	-0.155	-0.017
Days to maturity	0.159	-0.192	0.143	0.488
Yield/plant (g)	-0.218	0.024	0.204	0.421

cultivars for maximum number of seeds/pod fell in cluster I ('LBG 20', 'Azad U 1', 'LBG 623'), highest cluster/plant and pods/plant fell in cluster II ('Mash 414', 'Azad U 2', 'G 338', 'Sarala', 'Pant U 30', 'Pant U 40'), minimum plant height fell in III ('Pant U 31', 'KU 96-3', 'WBU 108', 'Pant U 19'), maximum 100-seed weight and pod length fell in cluster IV ('Sekhar 1', 'Sekhar 2', 'Sekhar 3', 'TMV 1', 'Uttara', 'RBU 38'), highest yield/plant fell in cluster V ('AKU 9904', 'CO 5', 'LBG 17', 'LBG 611', 'Mash 1-1', 'LBG 645', 'LBG 402', 'Naveen', 'TAU 1', 'TAU 2', 'TPU 4', 'Vamban 2', 'UG 1008', 'Pragya'), early flowering and maturity fell in cluster VI ('T 9', 'Pant U 35', 'PDU 1', 'Mash 218') and maximum primary branches fell in cluster VII ('Vamban 1', 'GU 1', 'JU 2', 'Manikya', 'NDU 1', 'Pant U 31', 'TU 94-2', 'LBG 648', 'LBG 685'). The potential donors for quantitative attributes are presented in Table 2. The frequency distribution of qualitative attributes of released cultivars is depicted in Table 3.

The cultivars included in a particular group exhibited more or less similar characteristics but differed from those included in other groups. Selecting cultivars from these groups and using them in hybridization would prove fruitful in urdbean improvement programme.

Table 2 Promising donors for quantitative attributes of 46 released cultivars of urdbean

Attribute	Promising cultivars
Primary branches (> 3.5)	'Vamban 1', 'GU 1', 'JU 2', 'Manikya', 'NDU 1', 'TU 94-2', 'Azad Urd 1'
Plant height (< 35 cm)	'Pant U 31', 'KU 96-3', 'Azad U 2', 'WBU 108'
Pods/plant (> 35)	'G 338', 'Azad U 2', 'Pant U 40', 'Sarala', 'Pant U 30', 'WBU 108', 'Vamban 1'
Pod length (> 4.5 cm)	'Sekhar U 2', 'Sekhar U 3', 'RBU 38', 'TU 94-2', 'GU 1', 'NDU 1'
Seeds/pod (> 5)	'LBG 20', 'Azad U 1', 'LBG 623', 'Pant U 30', 'Pant U 35', 'Pant U 31'
Seed size (> 4.5 g/100 seed weight)	'Sekhar U 1', 'TMV 1', 'RBU 38', 'GU 1'

Table 3 Frequency distribution and example varieties of qualitative attributes of 46 released cultivars of urdbean

Plant descriptors	Range of expression	No. of varieties	Example varieties
Growth habit	Erect	30	'T 9', 'TAU 1'
	Semi-erect	11	'Pant U 35', 'NDU 1'
	Spreading	5	'Vamban 1', 'Naveen'
Plant habit	Determinate	7	'T 9', 'Pant U 19'
	Indeterminate	39	'Vamban 1'
Leaflet shape (terminal)	Deltoid	0	Nil
	Ovate	16	'CO 5'
	Cunate	1	'Vamban 1'
Pod colour (premature)	Lanceolate	29	'Pant U 19', 'WBU 108'
	Green	13	'Pant U 19', 'T 9'
	Yellowish green	22	'PDU 1', 'Sekhar U 2'
Pod pubescence	Dark green	11	'Uttara'
	Absent	4	'T 9', 'TAU 2'
Pod colour (mature)	Present	42	'Pant U 19', 'NDU 1'
	Buff (off-white)	22	'PDU 1'
Seed colour	Brown	10	'Sekhar 2', 'TU 94-2'
	Black	14	'Uttara', 'TAU 1'
Seed lusture	Green	2	'Sekhar U 2'
	Greenish brown	13	'JU 2'
Seed lusture	Black	31	'Uttara'
	Shiny	6	'LBG 17'
	Dull	40	'Uttara', 'NDU 1'

SUMMARY

Genetic divergence analysis using principal components and non-hierarchical Euclidean cluster analysis was carried out in 46 cultivars of urdbean (*Vigna mungo* L.). These cultivars were grouped into 7 clusters, of which cluster V accommodated more than 25% of released varieties. Average distance of clusters from cluster centroids ranged from 1.113 to 2.359. The hybridization programme based on such analysis has been suggested which is likely to prove fruitful in urdbean improvement programme.

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