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## Genetic divergence in vegetable cowpea (*Vigna unguiculata* L.)

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**ABSTRACT :** Twenty one genotypes of vegetable cowpea including checks were planted in Randomized Block Design at the experimental farm of Pt.K.L.S.College of Horticulture and Research Station, Rajnandgaon, during 2015-16. The data recorded on twenty one characters were subjected to analysis of variance. The analysis of variance revealed highly significant differences among the genotypes for all the characters studied except pod width. It indicates that sufficient variability existed among the genotype for the mentioned characters. The GCV value was higher for plant height, pod yield per plant indicated that these characters exhibited variability among the genotypes. The highest heritability was recorded for the characters plant height (60DAS), days of maturity, fruiting duration, 50 per cent flowering, pod setting per cent per plant, 100 dry seed weight, 100-green seed weight. The genetic divergence in the present study observed among 21 genotypes of vegetable cowpea, showed low quantum of divergence and was grouped into five clusters On the basis of D<sup>2</sup> analysis. Maximum number of genotypes (9) was accommodated in cluster - II. The average inter and intra cluster divergence (D) values had also been calculated. The intra-cluster distance varied from 0.00 to 5.04. The maximum intra cluster distance was shown by cluster I (5.04) followed by cluster V, cluster II, cluster III and cluster IV. The maximum inter cluster distance was observed in between cluster I and V (5.04). The cluster III showed maximum value for mean green pod yield (146.820g.) followed by cluster IV (146.156g). Crossing between the genotypes of maximum two clusters appeared to be most promising to combine the desirable characters.

**KEY WORDS :** Genetic divergence, D<sup>2</sup> analysis, Vegetable cowpea (*Vigna unguiculata* L.)

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India ranks second for vegetable production in the world. Total production of vegetable in India is 95.0 million tons from an area of 5.98 million hectares and contributes about 14.4 per cent in total world production. Vegetable cultivation in India is mostly adopted by small and marginal farmers. These farmers grow vegetables to generate an additional income from their backyards or small portion of their scarce land holdings which is comparatively well endowed in terms of soil and irrigation.

Vegetable cowpea [*Vigna unguiculata* (L.) Walp.] is one of the most important pulse crops native to central

Africa, belongs to family Fabaceae. Cowpea is called as vegetable meat due to high amount of protein in grain with better biological value on dry weight basis. On dry weight basis, cowpea grain contains 23.4 per cent protein, 1.8 per cent fat and 60.3 per cent carbohydrates and it is rich source of calcium and iron. Apart from this, cowpea forms excellent forage and it gives a heavy vegetative growth and covers the ground so well that it checks the soil erosion. As a leguminous crop, it fixes about 70 – 240 kg per ha of nitrogen per year. Cowpea a warm-season annual and herbaceous legume being drought

tolerant is well adapted to the drier regions of the tropics where other food legumes do not perform well. It grows well even in the soils with more than 85 per cent sand and with less than 0.2 per cent organic matter and low levels of phosphorus. They suitably fit in crop rotations and is also used as a green manure crop, restore soil fertility by fixing nitrogen and checking soil erosion.

Cowpea is a nutritive vegetable which supplies protein 3.5 g, calcium 72.0 mg, phosphorus 59.0 mg, iron 2.5 mg, carotene 564.0 mg, thiamine 0.07 mg, riboflavin 0.09 mg and vitamin C 24.0 mg per 100 g in edible pods. The yield levels of cowpea in Chhattisgarh are low, which is mainly due to the non-availability of desirable high yielding, disease and insect resistant varieties and poor management practices. Hence, the high crop potential and quality are the main targets for effective breeding programme in this crop.

## RESEARCH METHODS

The material for the present study consisted of twenty one genotypes of cowpea and was sown in a Randomized Block Design with three replications. The sowing of experiment was conducted at Pr. Kishori Lal Shukla College of Horticulture and Research Station,

Bhharregaon, Rajnandgaon (Chhattisgarh) during *Kharif* of 2015-16. Five competitive plants were selected at random from each plot and were tagged then the data were recorded. The average value of each character was calculated on the basis of five plants for each genotype in every replication. The genetic divergence in cowpea was estimated by Mahalanobis  $D^2$  statistics. On the basis of magnitude of generalized statistical distance  $D$  ( $D = \sqrt{D^2}$ ) values, the genotypes were grouped into different clusters.

### Group constellation:

Treating  $D^2$  as the generalized statistical distance between a pair of populations (genotypes), all populations were grouped into number of clusters. The criteria used in clustering by this method was that, any two genotypes belonging to the same cluster, at least on an average, show a small  $D^2$  value than those belonging to two different clusters. In other words, if genotypes  $V_1$  and  $V_2$  are close together and genotype  $V_3$  is distant from both as shown by their generalized distance then  $V_1$  and  $V_2$  form a cluster.

## RESEARCH FINDINGS AND DISCUSSION

The present investigation was undertaken to study the mean performance of genotypes and to assess the genetic variability, correlation co-efficient, path coefficient analysis and divergence analysis in cowpea genotypes for green pod yield and its component characters. Analysis of variance was carried out for twenty one characters. The analysis of variance of all the characters under study is presented in Table 1. This analysis of variance revealed that mean sum of squares due to genotypes was highly significant for both level 1 and 5 per cent except the pod width. This indicates existence sufficient variability among the genotype for the mentioned character.

### Range and mean performance:

Mean performance of different characters recorded from the population of cowpea are presented in (Table 2). Range of plant height (cm) was observed between 221.72 to 99.033 cm with mean of 181.620 cm. The range of number of Branch varied from 7.033 to 3.34 with an average 5.18. First node of flowering ranged between 7.04 to 3.34, with an average mean of 5.18. First flowering ranged from 76.35 to 39.93 with an average mean of 57.23. 50 per cent flowering were ranged varied

Sr. No.	Genotype	Source
1.	RJN-CP-2015-01	Durg
2.	RJN-CP-2015-02	Durg
3.	RJN-CP-2015-03	Durg
4.	RJN-CP-2015-04	Durg
5.	RJN-CP-2015-05	Durg
6.	RJN-CP-2015-06	Durg
7.	RJN-CP-2015-07	Rajnandgaon
8.	RJN-CP-2015-08	Rajnandgaon
9.	RJN-CP-2015-09	Rajnandgaon
10.	RJN-CP-2015-10	Rajnandgaon
11.	RJN-CP-2015-11	Durg
12.	RJN-CP-2015-12	Raipur
13.	RJN-CP-2015-13	Raipur
14.	RJN-CP-2015-14	Durg
15.	RJN-CP-2015-15	Durg
16.	RJN-CP-2015-16	Rajnandgaon
17.	RJN-CP-2015-17	Durg
18.	RJN-CP-2015-18	Durg
19.	RJN-CP-2015-19	Raipur
20.	RJN-CP-2015-20	Raipur
21.	Kashi Kanchan(Check)	IIVR

from 69.42 to 46.37 with an average mean of 54.37.

Number of flowers per plant ranged from 29.73 to 17.56 with average mean of 22.35. Number of pods per plant showed a mean value of 12.03 within mean range from 14.89 to 7.41. The green pod yield ranged between 114.71 g to 67.51 g with an averaged mean of 115.15 g. The high range of these characters indicated the presence of sufficient variability in the population.

### Genetic divergence studies:

On the basis of D<sup>2</sup> analysis, twenty one genotypes were grouped into five clusters (Table 3). Maximum number of genotypes were grouped into cluster II (RJN-CP-2015-02,RJN-CP-2015-05,RJN-CP-2015-08,RJN-CP-2015-09,RJN-CP-2015-10,RJN-CP-2015-11,RJN-CP-2015-17,RJN-CP-2015-18,RJN-CP-2015-20) included nine genotypes, whereas, cluster I (RJN-CP-2015-01,RJN-CP-2015-03,RJN-CP-2015-04,RJN-CP-2015-06,RJN-CP-2015-13,RJN-CP-2015-14,RJN-CP-2015-19) included seven genotypes, cluster III (RJN-CP-2015-07, RJN-CP-2015-16) included two genotypes, cluster IV (RJN-CP-2015-12,RJN-CP-2015-15) which is followed by cluster V (Kashi Kanchan) included one genotypes.

The intra-cluster distance varied from 0.00 to 5.04 (Table 4). The maximum intra cluster distance was shown

by cluster I (5.04) followed by cluster V (4.76), cluster II (3.46), cluster III (3.74) and cluster IV (0.00), which indicates the distance, within the cluster. Similar results were found by Kumawat and Raje (2005) that intra cluster distance ranged for cluster IV (0.000) to cluster I (3.377).

The cluster means of the various horticultural traits are presented in Table 5. Among the five clusters, the difference between inter cluster mean was wide for most of the V. Maximum mean goes for plant height (198.53) was recorded in cluster IV, followed by cluster I (197.552), cluster II (181.30), Cluster III (158.33) and cluster V(99.03). Maximum number of branch was recorded in cluster I(6.33) followed by cluster II (6.60), cluster V(5.79), cluster IV (4.81) and cluster III(4.59). Maximum first node of flowering was recorded in cluster III (7.04) followed by cluster II (6.00), cluster I (5.39), cluster IV (4.17) and cluster V (3.91).Maximum number of first flowering was recorded in cluster II(60.95) followed by cluster IV (54.41), cluster I (52.18), cluster III(48.58) and cluster V(39.93).Maximum days of 50 per cent flowering was recorded in cluster II(60.67) followed by cluster IV(54.02),cluster II (52.67), cluster III(49.18) and cluster V(47.67). Maximum number of flower in plant was recorded in cluster III (25.37) followed by cluster IV(22.74), cluster I(22.25), cluster

**Table 1 : Analysis of variance for different characters in vegetable cowpea**

Sr. No.	Characters	Mean sums of square		
		Replication	Treatment	Error
1.	Plant height	2.898	2073.78**	1.713
2.	No. of branch	6.903	3.131**	0.224
3.	First node of flowering	38.708	3.055**	0.07
4.	First flowering	1274.31	78.806**	18.977
5.	50 % flowering	235.284	120.776**	0.365
6.	No. of flower per plant	407.411	36.731**	1.459
7.	No. of pod PP	201.433	14.323**	0.317
8.	Pod length	209.779	84.650**	4.302
9.	Pod weight	268.182	12.036**	0.229
10.	No. of seed per pod	325.167	59.303**	2.508
11.	Pod width	0.029	0.003	0.001
12.	Day of first picking	2788.6	198.044**	7.505
13.	Pod setting % in cluster	177.052	173.767**	0.813
14.	100 dry seed weight	59.274	46.725**	0.428
15.	Fruiting duration	100.652	184.315**	0.488
16.	100 green seed weight	84.187	64.613**	0.652
17.	Days of maturity	2.996	132.18**	0.165
18.	Green pod yield	8950.769	1284.29**	21.771

\* and \*\* indicate significance of values at P=0.05 and 0.01, respectively

II(21.01) and cluster V(18.56).Maximum number of pod per plant was recorded in cluster III(14.73) followed by cluster IV(14.15), cluster I(12.18), cluster V(10.98) and cluster II(10.92). Maximum pod length as recorded in cluster II (29.38) followed by cluster IV(27.64), cluster I (27.25), cluster III (26.13) and cluster V (10.19). Maximum pod weight was recorded in cluster V(16.99) followed by cluster IV(14.60), cluster II (14.24), cluster III (13.54) and cluster I (11.80). Maximum number of

seed per pod was recorded in cluster IV (21.10) followed by cluster II (16.97), cluster I (15.63), cluster III (14.24) and cluster V(10.37). Maximum pod width was recorded in cluster I (0.22) followed by cluster III(0.19), cluster IV (0.18), cluster II (0.15) and cluster V (0.14). Maximum day of first picking was recorded in cluster I (71.32) followed by cluster IV(71.09), cluster III(64.06), cluster I(63.41) and cluster V(47.57). Maximum pod setting per cent in cluster was recorded in cluster

**Table 2 : Range, mean and co-efficient of variation of various characters in vegetable cowpea**

Characters	Mean	Range		Co-efficient of variation (%)	
		Maximum	Minimum	GCV	PCV
Plant height (cm)	181.620	221.720	99.033	14.47	14.488
No. of branch	5.180	7.033	3.340	18.984	21.069
First node of flowering	5.180	7.045	3.326	19.239	19.903
First flowering	57.230	76.358	39.930	8.337	11.646
50 % flowering	54.37	69.423	46.378	11.652	11.705
No. of flower in per plant	22.350	29.733	17.560	15.518	16.453
No. of pod per plant	12.030	14.893	7.410	17.967	18.567
Pod length (cm)	25.481	33.489	10.189	20.310	21.881
Pod weight (g)	14.707	18.589	10.888	13.267	13.648
No. of seed per pod	17.511	26.406	10.370	24.848	26.442
Pod width (mm)	0.163	0.228	0.107	19.234	19.889
Day of first picking	64.784	82.798	47.573	12.302	13.008
Pod setting % in cluster	67.431	89.805	47.029	14.156	14.256
100 dry seed weight (g)	11.746	22.648	6.750	32.464	32.911
Fruiting duration	45.898	58.136	28.653	17.055	17.123
100 green seed weight (g)	15.874	28.810	9.456	29.087	29.528
Days of maturity	102.731	114.396	78.784	6.657	6.669
Green pod yield	115.151	147.719	67.517	17.816	18.271

**Table 3 : Clustering pattern of 21 genotype of vegetable cowpea on the basis of genetic divergence**

Cluster number	Number of genotype included	Name of genotype
I	7	RJN-CP-2015-01,RJN-CP-2015-03,RJN-CP-2015-04,RJN-CP-2015-06,RJN-CP-2015-13,RJN-CP-2015-14,RJN-CP-2015-19
II	9	RJN-CP-2015-02,RJN-CP-2015-05,RJN-CP-2015-08, RJN-CP-2015-09,RJN-CP-2015-10,RJN-CP-2015-11, RJN-CP-2015-17,RJN-CP-2015-18,RJN-CP-2015-20
III	2	RJN-CP-2015-07,RJN-CP-2015-16
IV	2	RJN-CP-2015-12,RJN-CP-2015-15
V	1	Kashi Kanchan

**Table 4 : Intra (bold) and inter cluster distance values in vegetable cowpea**

	1	2	3	4	5
1	5.04				
2	26.97	4.76			
3	64.25	41.45	3.46		
4	51.33	43.46	54.74	3.74	
5	105.54	92.73	85.04	128.13	0.00

**Table 5 : Cluster means for characters among 21 genotype of vegetable cowpea clusters**

	I	II	III	IV	V
Plant height(cm)	197.552	181.303	158.553	198.533	99.033
No. of branch	6.332	6.608	4.599	4.818	5.790
First node of flowering	5.395	6.001	7.045	4.175	3.914
First flowering	52.183	60.955	48.587	54.412	39.931
Days of 50 % flowering	52.672	60.672	49.182	54.027	47.675
No. of flower in plant	22.250	21.014	25.376	22.745	18.565
No. of pod per plant	12.180	10.924	14.735	14.150	10.983
Pop length(cm)	27.253	29.380	26.135	27.642	10.190
Pod weight(cm)	11.800	14.075	13.544	14.606	16.996
No. of seed per pod	15.631	16.976	14.242	21.109	10.370
Pod width(mm)	0.229	0.153	0.198	0.180	0.144
Day of first picking	63.414	71.325	64.067	71.090	47.573
Pod setting % in cluster	54.330	51.599	57.823	61.747	45.880
100 dry seed weight(g)	7.264	12.502	9.839	11.941	7.505
Fruiting duration	43.716	42.053	48.530	45.095	28.654
100 green seed weight (g)	10.460	14.503	14.169	17.195	9.456
Days of maturity	96.001	101.822	97.026	98.161	78.874
Green pod yield (g)	99.501	108.255	146.820	146.156	101.210

IV(61.74) followed by cluster II (57.82), cluster I (54.33), cluster II(51.59) and cluster V (45.88). Maximum 100 dry seeds weight was recorded in cluster I (12.50) followed by cluster IV(11.94), cluster III(9.83), cluster V(7.50) and cluster I(7.26). Maximum fruiting duration was recorded in cluster III (48.53) followed by cluster IV (45.09), cluster I (43.71), cluster II (42.05) and cluster V (28.65). Maximum 100 green seed weight was recorded in cluster IV (17.19) followed by cluster II (14.50), cluster III(14.16), cluster I (10.46) and cluster V(9.45). Maximum mean value for days of maturity was in cluster I (101.82) followed by cluster IV, cluster III, cluster I and cluster V. Maximum green pod yield was recorded in cluster III(146.82) followed by cluster IV (146.15), cluster II(108.25), cluster V (101.21) and cluster I (99.50). Crossing between the genotypes of maximum two clusters appeared to be most promising to combine the desirable characters. Earlier workers like Borah and Khan (2001); Kumawat and Raje (2005 a and b); Lesly *et al.* (2006); Pal *et al.* (2003) and Narayanankutty *et al.* (2003 and 2005) have also indicated the significance of genetic divergence.

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