



Research Article

STUDIES ON 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 & 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 number Pod width. It indicates that sufficient variability among the genotype for the mentioned characters. The Genotypic coefficient of variation value was higher for plant height, pod yield per plant indicated that these characters exhibit variability among the genotypes. The highest heritability was recorded for the characters plant height (60DAS), days of maturity, fruiting duration, days to (50%) flowering, pod setting % /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 D2 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.

Keywords- Genetic Divergence, D² analysis, Vegetable Cowpea (*Vigna unguiculata* L.)

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Introduction

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 [1-3].

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% sand and with less than 0.2% 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 [4-6].

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 [7-9].

Material and Methods

For the present study twenty one genotypes of cowpea and was sown in a Randomized Block Design with three replications. The sowing of experiment conducted at Pt. Kishori Lal Shukla collage of Horticulture and Research Station, Bhamra, Rajnandgaon (Chhattisgarh) during kharif of 2015-16. Five competitive plants were selected at random from each plot and were tagged then the data was 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 lettuce was estimated by Mahalanobis D2 statistics. On the basis of magnitude of generalized statistical distance D (D= D2) values, the genotypes were grouped into different clusters [10-12].

Group Constellation: Treating D2 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 D2 value than those belonging to two different clusters. In other words, if genotypes V1 and V2 are close together and genotypes V3 is distant from both as shown by their generalized distance then V1 and V2 from a cluster [13-17].

Result 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% 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 were 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 range between 7.04 to 3.34, with an average mean of 5.18. First flowering were ranged from 76.35 to 39.32 with an average mean of 57.23. 50% flowering were ranged from 69.42 to 46.37 with an average mean of 54.37.

Table-1 List of vegetable cowpea (*Vigna unguiculata* L.) genotype and their sources:

S.N.	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	IIVR
	Kanchan(Check)	

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 indicates the presence of sufficient variability in the population.

Table-2 Analysis of Variance for different characters in vegetable cowpea:

Character	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 flowers in Plant	407.411	36.731**	1.459
7 No of pods per plant	201.433	14.323**	0.317
8 Pop length	209.779	84.650**	4.302
9 Pod weight	268.182	12.036**	0.229
10 No of seeds 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

*, Significant at 5%, **, significant at 1%

Table-3 Range, mean and coefficient of variation of various characters in vegetable cowpea:

Character	Mean	Range		Coefficient of variation (%)	
		Maximum	Minimum	Genotypic coefficient of variation	Phenotypic coefficient of variation
Plant height(cm)	181.620	221.720	99.033	14.47	14.488
No of Branches	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 flowers per plant	22.350	29.733	17.560	15.518	16.453
No of pods per plant	12.030	14.893	7.410	17.967	18.567
Pop 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 seeds 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(gm)	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-4 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-5 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

Genetic Divergence:

On the basis of D2 analysis, twenty one genotypes were grouped into five clusters [Table-4]. Maximum number of genotypes were grouped into cluster II (nine genotypes), followed by cluster I (seven genotypes), cluster III (two genotypes), cluster IV (two genotypes) and cluster V (Kashi Kanchan) included only one genotype as a check.

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 (4.75), cluster II (3.46), cluster III (3.74) and cluster IV (0.00), which indicates the distance, within the cluster. Similar results found by Kumawat and Raju (2005a) that intra cluster distance ranged for Cluster IV (0.000) to Cluster I (3.377).

Table-6 Cluster means for characters among 21 genotypes 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

The cluster means of the various horticultural traits are presented in [Table-6]. Among the five clusters, the difference between inter cluster mean was wide for most of the cluster V. Maximum mean goes for plant height (198.53) was recorded in cluster IV, followed by cluster I (197.552), and minimum for cluster V (99.03). Maximum number of branches was recorded in cluster I (6.33) followed by cluster II (6.60) and cluster III (4.59). Maximum first node of flowering was recorded in cluster III (7.04) followed by cluster II (6.00), while maximum number of first flowering was recorded in cluster II (60.95). Maximum days of 50% flowering was recorded in cluster II (60.67) and maximum number of flowers in plant was recorded in cluster III (25.37) followed by cluster III (25.37). The maximum number of pods per plant was recorded in cluster III (14.73) followed by cluster IV (14.15), cluster I (12.18), cluster V (10.98) and minimum in 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 (14.07), cluster III (13.54) and cluster I (11.80). Maximum number of seeds per pod was recorded in cluster IV (21.10) followed by cluster II (16.97) and minimum value was noted in cluster V (10.37). Maximum fruiting duration was recorded in cluster III (48.53) followed by cluster IV (45.09) and maximum 100 green seed weight was recorded in cluster IV (17.19) followed by cluster II (14.53). Maximum green pod yield was recorded in cluster III (146.82) followed by cluster IV (146.15). The group constellation showed that cluster III (RJN-CP-2015-07, RJN-CP-2015-16) and cluster IV (RJN-CP-2015-12, RJN-CP-2015-15) were highly divergent for green pod yield from all other genotypes. This indicated that crossing RJN-CP-2015-07, RJN-CP-2015-16, RJN-CP-2015-12 and RJN-CP-2015-15 will be planned by using this desirable useful transgressive genotype for green pod yield in vegetable cowpea for Chhattisgarh plains crossing between the genotypes of maximum two clusters appeared to be most promising to combine the desirable characters. Earlier workers like Borah *et al.*, Kumawat *et al.*, Lesly *et al.*, Pal *et al.* and Narayanankutty *et al.* have also indicated the significance of genetic divergence.

Conflict of Interest: None declared

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