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Transgressive segregation in F_2 and backcross generations of cowpea (*Vigna unguiculata* L.)

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Abstract
The present investigation was carried out to estimate extent of transgressive segregants for the important yield and yield contributing characters using F_2 generations of two crosses and four backcrosses of cowpea. The experiment was conducted during *kharif* season 2020-21 at Experimental Farm, Department of Agricultural Botany, College of Agriculture, Latur. The experimental material comprised of three parents, F_2. and backcrosses. Observation were recorded on days to 50% flowering, days to maturity, number of primary branches per plant, plant height (cm), number of pods per plant, pod length (cm), number of seeds per pod, test weight (gm) and grain yield per plant (gm). In this investigation total one hundred and thirty one transgressive individuals with values exceeding the better parent were observed in two crosses for seed yield with two or more yield contributing characters likes' number of primary branches per plant, plant height, number of pods per plant, pod length, number of seeds per pod, and test weight. Individual transgressing simultaneously for plant height and test weight, seed yield were common compared to other combinations.

Keywords: F_2, backcross generations, cowpea, *Vigna unguiculata* L.

Introduction

Cowpea [*Vigna unguiculata* (L.) Walp.] is a annual, autogamous leguminous crop belonging to family Leguminoseae with a diploid chromosome number of 2n=2x=22. It is a native to India (Vavilov, 1949) [17], but tropical and central Africa is also considered as secondary centre of origin, where wild races are found even now (Ng and Marechal, 1985) [10]. Out of five subspecies, cowpea contains three cultivated species *viz.*, *V. unguiculata*, *V. cylindrica* and *V. sesquipedalis.* It is one of the most ancient, multi-seasonal, multipurpose *i.e.* food, feed, vegetable, fodder and green manure and a legume crop known to man. It is widely adopted and grown all over the world as pulse and vegetable crop. It is tropical grain legume which plays an important nutritional role in developing countries of the tropics and sub tropics, especially in Sub-Saharan Africa, Asia, Central and South America.

It has been referred to as "Poor man's meat" because of its high protein content. Dry seeds of cowpea contains high amount of quality protein (23.4%), carbohydrate (60.3%), fat (1.8%) and sufficient amount of calcium (76 mg/100 gm), iron (57 mg/100 gm) and vitamins such as thiamine (0.92 mg/100 g), riboflavin (0.18 mg/100 g) and nicotinic acid (1.9 mg/100 g) (Chatterjee and Bhattaacharya, 1986) [2]. The crop is more tolerant to low fertility, due to its high rates of nitrogen fixation (Elawad and Hall, 1987) [4], effective symbiosis with mycorrhizae (Kwapata and Hall, 1985) [8] and ability to adapt to soils with wide range of pH when compared to other popular grain legumes (Fery, 1990) [5].

The global production of dried cowpeas exceeds 7.5 million tonnes. Africa is the biggest producer. Nigeria is the world's largest producer and consumer, accounting for 48 percent of global production and consumption. In India, the cowpea is grown in an area of about 3.9 million ha. In India, it is mostly cultivated in Haryana, Punjab, Delhi, West UP, with certain regions of Rajasthan, Kerala, Tamil Nadu, Karnataka, Gujarat, and Maharashtra states

Cowpea is being a predominantly self-pollinated crop. The development of extra early maturing (60-70 days) and medium maturing (75-90 days), non-photosensitive lines with good grain quality and potential for dual-purpose use as (i.e., food and fodder), either for use as a sole crop and as an intercrop in multiple cropping systems are the major targets of cowpea breeding programme. The breeding strategy for development pure-line varieties suitable to variety of situations likes agro-ecological zones, plant types, growth habit, days to maturity and seed type involves selection of potential genotypes from the exiting germplasm, utilising them in the hybridization programme and isolation of superior genotypes in the segregating generation for above traits. Thus, goal can be achieved by transgressive segregation as it is a useful approach for yield and its contributing traits such as pod length, number of pods per plant, number of seeds per pod, 100 seed weight, and seed yield. Transgressive segregants are the plants that fall outside the range of parents. Generally, it observed within the progenies of early segregating generation. There are many causes of obtaining transgressive segregates in segregating generations. One of the main cause is due to recombination of additive alleles. Recombination results in new pairs of alleles at two or more loci, complementary gene effects. These different pairs of alleles can give rise to new phenotypes if gene expression has been changed at these loci.

Materials and Methods

During the kharif of 2021, the current research was carried out at the Research Farm of Department of Genetics and plant Breeding, College of Agriculture, Latur. The F_2 of two crosses, GDVC-2 x LC-1 and GC 6 x LC-1 were obtained by selfing of F_1 involving three diverse parents *viz.*, GDVC-2, GC-6 and LC-1 during *kharif*, 2019-20. The back cross generations, BC-1 and BC-2 were obtained by crossing of F_1 of two crosses with its respective recurrent parents. Thus, seed of P_1, P_2, P_3, their F_2 crosses and backcrosses were evaluated. The experimental material was tested in two replications in a Randomized Block Design (RBD) under rainfed conditions during the kharif of 2021. Line sowing was used to sow the seeds, with a 45 cm row spacing and a 30 cm plant spacing, respectively. In each treatment and replication, observations were made on each plant. Days to flowering, days of maturity, plant height (cm), number of primary branches per plant, number of pods per plant, pod length (cm), number of seeds per pod, 100 grains weight (gm), grain yield (gm). Except for the border rows, the plants were chosen from the centre of the row. For all 9 yield and yield contributing characteristics utilised in the analysis, the replication means based on chosen plants were employed. The study was based on Panse and Sukhatme's proposed paradigm (1985) [11].

Result and Discussion

Transgressive segregation analysis studies

A study of the transgressive segregation between F_2 generations and backcrosses for yield and yield contributing components is important for selecting features that have a clear influence on yield and may benefit in breeding material selection. In the present investigation transgressive segregants were recorded for seven characters and are summarized in Table No 1. Transgressive segregants were not observed for days to 50% flowering and days to maturity. For various characters, the frequency of transgressive segregants was varied from cross to cross.

For plant height (cm), the transgressive segregants ranged from 13.33 percent (GC-6 × LC-1) × GC-6 to 35 percent (GC-6 x LC-1). The highest number of transgressive segregants were observed for this traits in GC-6 x LC-1-F_2 (42%) followed by (GDVC-2 × LC-1) × LC-1-BC_2 (23.33%), GDVC-2 x LC-1-F_2 (20.83%), GC-6 × LC-1) × LC-1-BC_2 (17.50%), (GDVC-2 × LC-1) × GDVC-2- BC_1 (14.17%) and (GC-6 × LC-1) × GC-6- BC_1 (13.33%).

Transgressive segregants were observed for number of primary branches in (GDVC 2 x LC-1) x LC-1- BC_2 (3.33%) followed by (GC-6 × LC-1) × GC-6- BC_1 and (GDVC 2 x LC-1) x GDVC-BC_1 (0%).

Transgressive segregants were observed for number of pods per plant in (GC 6 x LC-1) x LC 1-BC_2 (32.50%) followed by (GDVC- × LC-1) × LC 1-BC_2 (0.83%) and (GC 6 x LC-1)-F_2 (0.83%).

For pod length (cm), the transgressive segregants were ranged from 0 percent (GC-6 × LC-1- F_2) to 9.19% percent (GC-6 x LC-1) x GC 6-BC_2. The highest number of transgressive segregants were observed for this traits in (GC-6 x LC-1) x GC 6-. BC_2 (9.19%) followed by GDVC-2 × LC-1-F_2 (7.0%), (GDVC-2 × LC-1) × GDVC-2- BC_1 (2.0%), (GDVC-2 × LC-1) × LC 1-BC_2 (2.0%) and (GC-6 x LC-1) x LC-BC_2 (0.83%).

The cross, GDVC-2 x LC-1-F_2 (4.17%) had the highest number of transgressive segregants (5) followed by cross (GC-6 x LC-1) x GC 6-BC_1 (3.33%), GC 6 x LC 1-F_2 (0.83%) and (GC-6 × LC-1) × LC-1-BC_2 (0.83%) for seeds per plant.

For test weight (gm), the transgressive segregants ranged from 6.6 percent (GC-6 × LC-1) × L BC_2 (6.67%) to 38 percent (GC-6 × LC-1) × GC-6 BC_1. The highest number of transgressive segregants were observed for this traits in (GC-6 × LC-1) × GC-6 BC_1 (38%) followed by (GDVC-2 × LC-1) × GDVC 2-BC_1 (33.0%), GDVC-2 x LC-1-F_2 (32.0%), (GDVC 2 × LC-1) × LC-1-BC_2 (24.0%), (GC-6 × LC-1) × F_1(14.00%) and (GC-6 × LC-1) × LC-1BC_2(8.0%). Transgressive segregation for test weight per plant was also reported by Ugale and Bahl (1980) [16], Manjunatha (1991) [9] and Jaiswal and Singh (1986) [7] in chickpea and Dhole and Reddy (2012) [3] in Mungbean.

(GC-6 × LC-1) × LC-1-BC_2 (4.17%) recorded the highest number of transgressive segregants (5) followed by cross GC-6 x LC-1-F_1 (1.67%), GDVC 2 x LC 1-F_2 (0.83%) and (GDVC 2 × LC-1) × LC-1-BC_2 (0.83%) for grain yield per plant. In chickpea, transgressive segregation for seed yield was described by Ugale and Bahl (1980) [16], Girase and Deshmukh (2002) [6], Jaiswal and Singh (1986) [7], Shivakumar (2013) [14], Manjunatha (1991) [9], Auckland and Singh (1976) [1] and Raval (2018) [12]. In Mungbean transgressive segregation for seed yield has also been reported by Singh (1996) [15].

Table 1: Transgressive segregants and frequency percentage observed for nine characters in the F_2 generations of two crosses

Characters	Cross	Increasing parent	Transgressive segregants	
			Frequency	%
Plant height (cm)	GDVC-2 x LC-1	LC-1	25	20.83
	GC-6 x LC-1	LC-1	42	35
	(GDVC-2 × LC-1) × GDVC-2	LC-1	17	14.17
	(GDVC-2 × LC-1) × LC-1	LC-1	28	23.33
	(GC-6 × LC-1) × GC-6	LC-1	16	13.33
	(GC-6 × LC-1) × LC-1	LC-1	21	17.50
	Mean		24.83	20.69
Number of primary branches per plant	GDVC-2 x LC-1	LC-1	-	-
	GC-6 x LC-1	LC-1	1	0.83
	(GDVC-2 × LC-1) × GDVC-2	LC-1	-	-
	(GDVC-2 × LC-1) × LC-1	LC-1	4	3.33
	(GC-6 × LC-1) × GC-6	LC-1	3	2.50
	(GC-6 × LC-1) × LC-1	LC-1	-	-
	Mean		1.33	1.11
Number of pods per plant	GDVC-2 x LC-1	LC-1	-	-
	GC-6 x LC-1	LC-1	1	0.83
	(GDVC-2 × LC-1) × GDVC-2	LC-1	-	-
	(GDVC-2 × LC-1) × LC-1	LC-1	1	0.83
	(GC-6 × LC-1) × GC-6	LC-1	-	-
	(GC-6 × LC-1) × LC-1	LC-1	3	2.50
	Mean		0.83	0.69
Pod length (cm)	GDVC-2 x LC-1	LC-1	7	5.83
	GC-6 x LC-1	LC-1	-	-
	(GDVC-2 × LC-1) × GDVC-2	LC-1	**2**	1.67
	(GDVC-2 × LC-1) × LC-1	LC-1	**2**	1.67
	(GC-6 × LC-1) × GC-6	LC-1	11	9.17
	(GC-6 × LC-1) × LC-1	LC-1	1	0.83
	Mean		3.83	3.19
Number of seeds per pod	GDVC-2 x LC-1	LC-1	5	4.17
	GC-6 x LC-1	LC-1	1	0.83
	(GDVC-2 × LC-1) × GDVC-2	LC-1	-	-
	(GDVC-2 × LC-1) × LC-1	LC-1	-	-
	(GC-6 × LC-1) × GC-6	LC-1	4	3.33
	(GC-6 × LC-1) × LC-1	LC-1	1	0.83
	Mean		1.83	1.52
100 grains weight (gm)	GDVC-2 x LC-1	LC-1	32	26.67
	GC-6 x LC-1	GC-6	14	11.67
	(GDVC-2 × LC-1) × GDVC-2	LC-1	33	27.50
	(GDVC-2 × LC-1) × LC-1	LC-1	24	20
	(GC-6 × LC-1) × GC-6	GC-6	38	31.67
	(GC-6 × LC-1) × LC-1	GC-6	8	6.67
	Mean		24.83	20.69
Grain yield (gm)	GDVC-2 x LC-1	LC-1	1	0.83
	GC-6 x LC-1	LC-1	2	1.67
	(GDVC-2 × LC-1) × GDVC-2	LC-1	-	-
	(GDVC-2 × LC-1) × LC-1	LC-1	1	0.83
	(GC-6 × LC-1) × GC-6	LC-1	-	-
	(GC-6 × LC-1) × LC-1	LC-1	5	4.17
	Mean		1.5	1.25

Conclusion

The transgressive segregants in desired direction were recorded for all of the characters in the F_2 and backcross generation generations. Simultaneous transgression of seed yield with plant height, number of primary branches per plant, number of pods per plant, pod length, number of seeds per pod, test weight was observed among the three hundred and ninety four transgressive individuals with values greater than the better parent. In general the highest proportion of transgressive segregation were recorded for plant height followed by 100 grain weight, pod length, number of seeds per pod, grain yield and number of pods per plant.

Based on the high values of transgressive segregants observed, it was determined that when the appropriate intensity of characteristics is not accessible in the parents, transgressive breeding can be utilised to successfully extend the limits of character expression.

References

1. Auckland AK, Singh KB. The exploitation of natural genetic variability for the improvement of chickpea (*Cicer arietinum* L.). International symposium on genetic control of diversity in plants Lahore, Pakistan; c1976.
2. Chatterjee BN, Bhattacharya KK. Principle and practices of grain legume production. Oxford and IBH publishing Co. Ltd., New Delhi; c1986.

3. Dhole VS, Reddy KS. Gnetic analysis and transgressive segregation for seed weight and seed yield in F_2 populations of mungbean; c2012.
4. Elawad HOA, Hall AE. Influences of early and late nitrogen fertilization on yield and nitrogen fixation of cowpea under well-watered and dry field conditions. Field Crops Res. 1987;15:229-244.
5. Fery RL. The cowpea: production, utilization and research in the United States. Hort. Rev. 1990;12:197-222.
6. Girase VS, Deshmukh RB. Transgressive segregation of grain yield and its components in Chickpea. Journal of Maharashtra Agriculture Universities. 2002;27(1):015-018.
7. Jaiswal BD, Singh BD. Introgression of genes for yield and yield traits from *C. reticulatum* into *C. arietinum*. International Chickpea Newsletter. 1986;14:7.
8. Kwapata MB, Hall AE. Effects of moisture regime and phosphorus on mycorrhizal infection, nutrient uptake, and growth of cowpeas [*Vigna unguiculata* (L.) Walp.]. Field Crops Res. 1985;12:241-250.
9. Manjunatha S. (1991). Transgressive segregation and gene action studies in chickpea (*Cicer arietinum* L.). (Ph.D. Thesis) Indian Agricultural Research Institute, New Delhi.
10. Ng NQ, Marechal R. Cowpea taxonomy, origin and germplasm. In: Cowpea research, production and utilization. Singh SR and Rachie KO. (eds.) Wiley, New York, 1985, 11-21.
11. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. ICAR, New Delhi; c1985. p. 381.
12. Raval L, Pithia MS, Mehta DR, Mungra KS, Shah S. Spectrum of variation and transgressive segregation in F_2 generation of Desi chickpea. Electronic Journal of Plant Breeding. 2018;9(1):18-24.
13. Salunke MD, Pithia MS, Metha DR. Estimation of heterosis, inbreeding depression and transgressive segregation in Mungbean (*Vigna radiata* L.) International Journal of current Research. 2016;8(12):43430-43433.
14. Shivakumar MS, Salimath PM, Suma SB, Timmanna PO, Shridevi O. Assessment of variability and identification of transgressive segregants for yield and yield component traits in early segregating generations of chickpea. Legume Genomics and Genetics. 2013;4(3):22-26.
15. Singh MN, Singh RM, Singh RP. Studies on Hybrids and Transgressive Segregates In. Wide Crosses of Mungbean and Urdbean. Indian Journal of Genetics and Plant Breeding. 1996;56(01):109-113.
16. Ugale SD, Bahl PN. Incorporation of germplasm from Kabuli to Deshi and vice versa in chickpea (*Cicer arietinum* L.). India-Oxford and IBH. Publishing Co., New Delhi; c1980. p. 646.
17. Vavilov NI. The origin, variation, immunity and breeding of cultivated plants. Chronica Botanica. 1949;13:1-54.
18. Yadav UV, Toprope VN, Mali BB. Transgressive Segregation Analysis in F2 Generation in Cowpea. Multilogic in Science. 2021;40(12):2277-7601.
19. Salimath PM, Patil SA, Chetti MB. Variability and transgressive segregation for yield and yield components in chickpea crosses. Karnataka J Agric. Sci. 1997;10(2):373-377.