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IDENTIFICATION OF PROMISING TRANSGRESSIVE SEGREGATION IN CHICKPEA (Cicer *arietinum* L.)

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ABSTRACT:

Chickpea is the second most important pulse crop in the world after dry bean. This crop has high productivity and holds prominent position in the international food grain trade. The aim of this study was to identify transgressive segregants for yield and yield components under the climate change in F_2 population of cross Vijay x BDNG-2015-3 in chickpea. Three generations of chickpea of the cross Vijay x BDNG-2015-3 were evaluated at Botany Section Farm, College of Agiculture, Dhule (Maharashtra) during *Rabi*, 2017. The field experiment was arranged in a randomized block design (RBD) with three replications. In most of the transgressive segregants, better parent yield was transgressed with transgression of one or several other characters. In general, highest proportion of transgressive segregants were recorded for grain yield per plant (20) followed by 100-seed weight (16), number of seeds per pod (14), number of pods per plant (13), plant spread (13), number of primary branches per plant (13), number of secondary branches per plant (13) and plant height (12). In most of the transgressive segregants, better parent yield was transgressed simultaneously with transgression of one or several other characters. Simultaneous transgression of grain yield per plant in association with plant height, number of primary branches per plant, number of secondary branches per plant, plant spread, number of pods per plant and 100-seed weight was observed more frequently. It was concluded that either grain yield per plant is dependent on this character or there may be linkage drag, so that genes responsible for these characters move together. The most promising transgressive segregants observed in F_2 generation of a cross Vijay x BDNG-2015-3 were needs to be evaluated further under different climate region and different sowing dates for funneling desirable recombinant for early, normal and late sowing under different climate regimes.

Key words: Transgressive segregation, Recombinants, Segregates, Chickpea.

INTRODUCTION:

Chickpea is an important source of protein in the diets of the poor and is particularly important in vegetarian diets. Also, it is being used increasingly as a substitute for animal protein. Chickpeas are a helpful source of zinc, foliate and protein. They are also very high in dietary fiber and hence a healthy source of carbohydrates for persons with insulin sensitivity or diabetes. Chickpeas are low in fat and most of this is polyunsaturated. One hundred grams of mature boiled chickpeas contains 164 calories, 2.6 g of fat (of which only 0.27 g is saturated), 7.6 g of dietary fiber and 8.9 g of protein. Chickpeas also provide dietary calcium (49–53 mg/100g). According to the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) chickpea seeds contain on an average- 23% protein, 64% total carbohydrates (47% starch, 6% soluble sugar), 5% fat, 6% crude fiber and 3% ash. High mineral content has been reported for phosphorus (340 mg/100g), calcium (190 mg/100g), magnesium (140 mg/100g), iron (7 mg/100g) and zinc (3 mg/100g). Recent studies have also shown that they can assist in lowering of cholesterol in the blood stream. Among the food legumes, chickpea is the most hypo-cholesteremic agent; germinated chickpea was reported to be effective in controlling cholesterol level in rats. Glandular secretion of the leaves, stems and pods consists of malic and oxalic acids, giving a sour taste. Medicinal applications include use for aphrodisiac, bronchitis, cholera, constipation, diarrhea, dyspepsia, flatulence, snakebite, sunstroke and warts. Acids are supposed to lower the blood cholesterol levels. Yield is a multidimensional trait that encompasses several different properties and is affected by numerous factors. Yield is a complex character associated with many interrelated components. The application of relevant breeding criteria is very important in the process of breeding and selection of superior genotypes. Many plant breeders have reported transgressive sergeant's in hybrid progenies and suggested that transgressive segregation may be used as a positive tool in plant breeding. The conventional idea of hybridization is to recombine in a new derivative, the desirable characteristics already observed in two parents. Perhaps a more imaginative approach to plant breeding is to consider transgressive segregation. Therefore, transgressive breeding and correlation analysis aims at improving yield or its contributing characters

MATERIALS AND METHODS:

The field experiment was conducted at Botany Section Farm, College of Agriculture, Dhule (India), where three diverse genotypes were evaluated in randomized block design with three replications. Recommended doses of fertilizers and cultural practices were adopted. Sowing was done in rows of 3.0 m length and 30 cm apart accommodating 40 plants at 10.0 cm distance between plants. Seeds were hand dibbled in each row. Two rows were assigned to P_1 and P_2 and 8 rows for F_2 generation for the cross. From each replication at random 40 plants from F_2 generation and 10 plants from parent plot were tagged for recording observations on eight characters for transgressive segregation viz., plant height, number of primary branches per plant, number of secondary branches per plant, plant spread, number of pods per plant, number of seeds per pod, 100-seed weight and grain yield per plant.

The statistical analysis was carried out as per the procedure given by Panse and Sukhatme (1995). Transgressive segregants were estimated by calculating threshold value (T.V.) by the following formula.

$$T.V. = P(+) + 1.96 \times \sigma P(+)$$

Where,

$P(+)$ and $\sigma P(+)$ are the mean and standard deviation of increasing parent, respectively. The individuals transgressed this threshold limit were considered as the transgressive segregants through transgressive segregation.

RESULTS AND DISCUSSION:

In the present investigation, transgressive segregants were recorded in F_2 generation of cross Vijay x BDNG-2015-3 for all the eight characters (10.00 to 16.67%). In case of grain yield per plant 16.67% individuals transgressed beyond the increasing parent. Transgressive segregants were 10.0% for plant height, 10.83% for number of primary branches per plant, 10.83% for number of secondary branches per plant, 10.83% for plant spread, 10.83% for number of pods per plant, 11.67% for number of seeds per pod, 13.33% for 100-seed weight. Auckland and Singh (1976) reported transgressive segregants in respect of plant height (cm), number of seeds per pod, pod number and grain yield per plant (g) in F_2 generation in chickpea. Ugale and Bahl (1980) reported transgressants for all these characters except pod length and cluster per plant with the highest proportion of individuals for plant spread (30.77%). Kant and Singh (1998) observed transgressive segregants in lentil for plant height, yield per plant, primary branches per plant, secondary branches per plant, pods per plant, seed per pod and 100-seed weight. Girase and Deshmukh (2002) reported transgressive segregants in three crosses of chickpea for all seven characters *viz.,* plant height, plant spread, fruiting branches per plant, pods per plant, seeds per pod, 100-seed weight and yield per plant. They observed the highest transgressive segregation for plant height (27%) followed by pods per plant, fruiting branches per plant and yield per plant in both F_2 and F_3 generation. Karkute *et. al.* (2016) observed highest percentage of transgressive segregants for cluster per plant followed by number of pods per plant and seed yield per plant. In all the three crosses they recorded the highest proportions of transgressive segregants for number of pods per plant (46), followed by seed yield per plant (43), pod length (40), number of seeds per pod (36) and 100-seed weight (28) in mungbean.

The simultaneous transgressive segregants were observed in cross Vijay x BDNG-2015-3. More number of simultaneous segregants were observed for grain yield along-with number of pods per plant. The transgressants observed for grain yield were also found simultaneously transgressed for number of primary branches/plant, number of secondary branches/plant, plant spread, number of pods/plant and 100-seed weight (Table 2), indicating their dependency on each other or there may be linkage drag among the genes of these traits. This kind of dependency or desirable linkage drag has great importance in plant breeding for simultaneous improvement. These results are in conformity with the results of Girase and Deshmukh (2002) and Shweta Deokar et al. (2019 & 2020)

Apart from the frequency of transgressants, it will be of great interest to examine the intensities of the characters expression achieved in the transgressants of the cross Vijay x BDNG-2015-3. This will provide an insight into the extended limits and intensities of desired characters expression achieved by transgressive breeding. In the present investigation, the highest yielding transgressants in cross, produced 36.92 g grain yield per plant, as against 18.67 g per plant, produced by their respective increasing parents (Table 3). This intensity for grain yield per plant were 97.75 per cent higher than its respective increasing parents (Table 4).

If we consider transgressive segregants for grain yield per plant in the cross Vijay x BDNG-2015-3, Plant No. 27 was found to be most promising as it has given 97.75 per cent more grain yield per plant in addition to higher expression of number of primary branches per plant, number of secondary branches per plant, plant spread, number of pods per plant and 100-seed weight than the increasing parent.

From this investigation, it can be suggested that the most promising transgressive segregant listed in (Table 4) need to be evaluated further under different climate region and different sowing dates for funneling desirable recombinant for early, normal and late sowing. If it confirms its superiority in further generations may be considered for multi-location evaluation for release as a variety or may be used as a parent in future breeding programme for climate smart agricultur

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Table.1 Threshold value (T.V.), normal deviation value, percentage and range in the values of transgressive segregants (T.S.) in the cross Vijay x BDNG-2015-3

Cross and Characters	**F_2 generation**				
Vijay x BDNG-2015-3	**Threshold value**	**N.D.**	**Frequency**	**T.S.%**	**Range in values of T.S.**
Plant height	72.30	1.31	12	10.00	75.00-98.00
No. of primary branches/plant	02.65	1.34	13	10.83	3.00-3.00
No. of secondary branches/plant	15.40	1.06	13	10.83	16.00-25.00
Plant spread	30.40	1.19	13	10.83	31.00-48.00
No. of pods/plant	159.00	1.4	13	10.83	160.00-197.00
No. of seeds/pod	01.11	0.29	14	11.67	01.13-01.66
100-seed weight	21.20	1.11	16	13.33	21.28-23.17
Grain yield/plant	30.90	1.09	20	16.67	31.05-36.92

Table.2 Number of simultaneous transgressive segregants for yield in combination with other characters in the cross Vijay x BDNG-2015-3

Character combinations Grain yield +	**Number of simultaneous transgressive segregants in F_2 generation**
1. SBP + PLS + PPP + SWT	2
2. PLH + SBP + PLS+ SPP	1
3. SBP + PLS + SPP	1
4. SBP + PLS + PPP	1
5. PBP + PLS + SWT	1
6. SBP + PPP	1
7. PBP + PPP	1
8. SBP + SWT	1
9. PLH + SPP + PPP	1
10. PLH + PLS + SWT	1
11. PPP + SWT	1
12. PLH + PPP	1
13. PLS + SPP	1
14. PPP	3
15. SPP	1
16. GRY	2
Total simultaneous transgressive segregants	18

Table.3 The upper limits achieved by transgressive segregants in respect of eight characters in F_2 generation of the cross Vijay x BDNG-2015-3

Sr. No.	Characters	Highest intensity of character expression
1.	Plant height (cm)	98 (56.6)
2.	Number of primary branches/plant	3 (1.7)
3.	Number of secondary branches/plant	25 (10.9)
4.	Plant spread (cm)	48 (21.4)
5.	Number of pods/plant	197 (100.9)
6.	Number of seeds/pod	1.66 (1.07)
7.	100-seed weight (g)	23.17 (18.86)
8.	Grain yield/plant (g)	36.92 (18.67)

* Figures in the bracket are the mean values of respective increasing parent

Table.4 Promising transgressive segreagant having combinations of desirable attributes

Characters	Plant No.	PLH (cm)	PBP	SBP	PLS	PPP	SPP	SWT	GRY	% yield increased over increasing parent
Vijay x BDNG-2015-3										
F_2	27	50	2^+	25^+	37^+	160^+	1.01	22.85^+	36.92^+	**97.75**
Vijay		55.50	1.60	10.70	21.40	100.90	1.07	18.86	18.67	
BDNG-2015-3		56.60	1.70	10.90	17.50	69.30	1.03	18.67	16.51	

1.	PLH (cm) = Plant height	5.	PPP = No. of pods/plant
2.	PBP=No. of primary branches/plant	6.	SPP= No. of seeds/pod
3.	SBP=No. of secondary branches/plant	7.	SWT = 100-seed weight (g)
4.	PLS = Plant spread	8.	GRY = Grain yield/plant (g

+ Intensity of expression of character higher than the increasing parent