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IDENTIFICATION OF PROMISING RECOMBINANT THROUGH TRANSGRESSIVE SEGREGATION AND INTER-RELATIONSHIP ANALYSIS IN CHICKPEA

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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 and to estimate the correlation coefficients for yield and yield components under the climate change in F_2 population of cross PG-13107 x BDNG-797 in chickpea. Three generations of chickpea of the cross PG-13107 x BDNG-797 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 plant height (19), number of pods per plant (16), plant spread (15), number of seeds per pod (14), number of primary branches per plant (13), 100-seed weight (11), and number of secondary branches per plant (10). 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 cross PG-13107 x BDNG-797 were plant no. 30. Phenotypic correlation of grain yield per plant with nine other characters studied in F_2 generation of the cross indicated, significant and positive correlations with number of primary and secondary branches per plant, plant spread, number of pods per plant, number of seeds per pod and 100-seed weight. These characters also showed significant and positive correlation among themselves uniformly. From the above observations the improvement in grain yield of chickpea appears to be possible by selection through aforesaid characters.

***Key words**: Transgressive segregation, Correlation coefficient, 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 segregants 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 through transgressive segregation.

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 and ten characters for correlation analysis viz., days to 50 per cent flowering, days to maturity and characters including for the study of transgressive segregation.

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 x б P(+)

Where,

P(+) and б P(+) are the mean and standard deviation of increasing parent, respectively

The individuals transgressed this threshold limit were considered as the transgressive segregants.

Correlation coefficients were worked out as per the procedure of Dewey and Lu (1959), given below

$$r_{Pxy} = \frac{\text{Cov. xy}}{\sqrt{\text{Vx.Vy}}}$$

Where,

Cov.xy = Covariance between the characters x and y

Vx = Variance of the character x

Vy = Variance of the character y

RESULTS AND DISCUSSION:

Transgressive segregation

In the present investigation, transgressants were recorded in cross PG-13107 x BDNG-797 in F_2 generation for all the eight characters (8.33 to 16.67%). In case of grain yield per plant 16.67% individuals transgressed beyond the increasing parent. Transgressive segregants were 8.33% for number of secondary branches per plant, 9.16% for 100-seed weight, 10.83% for number of primary branches per plant, 11.67% for number of seeds per pod, 12.50% for plant spread, 13.33% for number of pods per plant, 15.83% for plant height. 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 PG-13107 x BDNG-797. 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). 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 PG-13107 x BDNG-797. 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 37.10 g grain yield per plant, as against 18.75 g per plant, produced by their respective increasing parents (Table 3). This intensity for grain yield per plant were 97.86 per cent higher than its respective increasing parents (Table 4).

If we consider transgressive segregants for grain yield per plant in the cross PG-13107 x BDNG-797, Plant No.30 was found to be most promising as it has given 97.86 per cent more grain yield per plant in addition to higher expression of plant height, number of primary branches per plant, number of secondary branches per plant, plant spread, number of pods per plant and number of seeds per pod 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. If it confirms its superiority in further generations may be considered for multi-location evaluation

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for release as a variety or may be used as a parent in future breeding programme.

Correlation coefficient:

Among the phenotypic correlation of grain yield per plant with nine other characters studied in F_2 generation of cross PG-13107 x BDNG-797, significant and positive correlation were observed with number of primary branches per plant, number of secondary branches per plant, plant spread, number of pods per plant, number of seeds per pod and 100-seed weight. These characters also showed significant and positive correlation among themselves uniformly in the F_2 generation. Among these associations consistent and high value of correlation coefficient were obtained for grain yield with number of pods per plant (0.8852) while, medium values were obtained for 100-seed weight (0.5682), number of secondary branches (0.5676), plant spread (0.4036), number of seeds per pod (0.2250) and number of primary branches per plant (0.1873). Significant association of these traits with grain yield have been previously reported by Talebi *et al.,* (2007) and Prakash (2013). He reported significant positive correlation among yield contributing characters like pod weight, pods per plant and 100-seed weight as observed in present study. He also reported maximum correlation (r=0.99) between grain yield and pod weight.

In the cross there is the positive and significant correlation between grain yield per plant with number of primary branches per plant, number of secondary branches per plant, plant spread, number of pods per plant and 100-seed weight. These results are in accordance with those obtained by Girase and Deshmukh (2020); Muhammad *et al.,* (2004) and Vaghela *et al.,* (2009). While, Kobraee *et al.*, (2010) reported grain yield had positive and highly significant correlation with plant height and number of pods per plant. Malik *et al.,* (2010) showed grain yield per plant had highly significant positive correlation with number of secondary branches per plant and number of pods per plant. Gaikwad and Monpara (2011) reported highly significant and positive correlation of grain yield per plant with number of pods per plant, secondary branches per plant and 100-seed weight. The correlation coefficient was positive between grain yield per plant and days to flowering and maturity (Table 5). The association between days to 50 per cent flowering and days to maturity in the cross were significantly positive, indicated that the genotype required more days for flowering are late for maturity. Such condition is desirable for irrigated condition in chickpea. Similar results were also reported by Girase and Deshmukh (2002).

Phenotypic correlation of number of pods per plant with grain yield was the highest in F_2 generations of the cross. This, association would be useful indirectly, as improvement in componential character through selection could result in improvement of single plant yield, as a result of expected correlated response. Bhushan and Jaiswal (2009) also reported similar results. The r values of grain yield with number of pods per plant, plant spread, number of secondary branches per plant, 100-seed weight and number of primary branches per plant ranges from 0.1873 to 0.8852, indicating that the values of these associations were not uniformly higher in F_2 generation of cross. The magnitude of correlated response to selection would be different in segregating generations. Any attempt to look for increase in r value may not be desirable for all association but for certain association like grain yield with 100-seed weight and number of pods per plant and number of seeds per pod with 100-seed weight is desirable.

The presence of such plasticity in r value may provide more opportunity for better selection response.

Generally negative correlation has been existed between pod number and 100-seed weight but in present investigation positive and significant correlation were observed; it might be due to breakdown of undesirable linkage between these characters in F_2 generation. The F_2 is highly segregating generation, which gives the opportunity of breakdown of undesirable linkage between the genes of number of pods per plant and number of seeds per pod with 100-seed weight. It makes possible to funnel out more pod number with more 100-seed weight recombinants under the climate change.

Based on the present investigation, it can be concluded that more emphasis will have to be given for number of primary branches per plant, number of secondary branches per plant, plant spread, number of pods per plant and 100-seed weight during selection. From the above observations the improvement in grain yield of chickpea appears to be possible by selection through aforesaid characters. Similar observations were also made by Girase and Deshmukh (2002).

REFERENCES:

Auckland, A. K. and K. B. Singh. 1976. 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.

Bhushan, S. and H. K. Jaiswal. 2009. Correlation and path analysis in short duration chickpea. *Journal of Food Legumes,* 22(4): 302.

Dewey, D. R. and K. H. Lu. 1959. Correlation and path analysis of crested wheat grass seed production. *Journal of Agronomy,* 51: 515-518.

Gaikwad, S. R. and B. A. Monpara. 2011. Genetic variation in F2 populations and their potential in the improvement of seed yield in chickpea (*Cicer arientinum* L.). *Journal of Agriculture Research and Technology*, 36(3): 527-530.

Girase, V. S. and R. B. Deshmukh. 2002. Transgressive segregation of grain yield and its components in Chickpea. *Journal of Maharashtra Agricultural Universities*, 27(1): 015-018.

Kant, L. and D. P. Singh. 1998. Transgressive segregation of yield and yield components in lentil. *Indian Journal of Genetics*, 58: 343-347. Karkute S. M., V. S. Girase and A. J. Patil. 2016. Transgressive segregation in mungbean (*Vigna radiata* L. Wilczek). *Journal of Agriculture Research and Technology*, 41(1): 48-51.

Karkute S. M., V. S. Girase and A. J. Patil. 2016. Transgressive segregation in mungbean (*Vigna radiata* L. Wilczek). *Journal of Agriculture Research and Technology*, 41(1): 48-51.

Kobraee, S., K. Shamsi, B. Rasekhi and S. Kobraee. 2010. Investigation of correlation analysis and relationships between seed yield and other quantitative traits in chickpea (*Cicer arientinum* L.). *African Journal of Biotechnology*, 9(16): 2342-2348. Malik, S. R., A. Bakhsh, M. A.

Malik, S. R., A. Bakhsh, M. A. Asif, U. Iqbal and S. M. Iqbal. 2010. Assessment of genetic variability and interrelationship among some agronomic traits in chickpea. *International Journal of Agriculture and Biology*, 12(1): 81-85.

Muhammed Azharudheen, T. P. 2010. Evaluation of RILs for nutritional traits in groundnut (*Arachis hypogaea L.).*M.Sc. (Agri.) Thesis, University of Agricultural Sciences, Dharwad, 36(3): 583-588.

Panse, V. G. and P. V. Sukhatme. 1995. Statistical methods for Agricultural Workers. ICAR, New Delhi, pp. 359.

Prakash, V. 2013.Component analysis for grain yield on chickpea (*Cicer arientinum* L.) under moisture deficit conditions. *Journal of Progressive Agriculture*, 4(1): 51-52.

Talebi, R., F. Farzad and N. B. Jelodar. 2007. Correlation and path coefficient analysis of yield and yield components of chickpea under dry land condition. *Asian Journal of Plant Sciences,* 6(7): 1151- 1154.

Ugale, S. D. and P. N. Bahl. 1980. Incorporation of germplasm from Kabuli to Deshi and *vice versa* in Chickpea (*Cicer arientinum* L.) India–Oxford and IBH. Publishing Co., New Delhi, pp. 646.

Vaghela, M. D., V. K. Poshiya, J. J. Savaliya, B. K. Davada and K. D. Mungra. 2009. Studies on character association and path analysis for seed yield and its components in chickpea (*Cicer arientinum* L.). *Legume Research,* 32(4): 245-249.

Table.1 Threshold value (T.V.), normal deviation value, percentage and range in the values of transgressive segregants (T.S.) in the cross PG-13107 x BDNG-797

Cross and Characters	**F_2 generation**				
PG-13107 x BDNG-797	**Threshold value**	**N.D.**	**Frequency**	**T.S.%**	**Range in values of T.S.**
Plant height	79.82	1.03	19	15.83	80.00-90.00
No. of primary branches/plant	02.92	1.84	13	10.83	3.00-3.00
No. of secondary branches/plant	14.83	1.36	10	8.33	15.00-20.00
Plant spread	28.08	1.09	15	12.50	29.00-43.00
No. of pods/plant	138.70	1.21	16	13.33	140.00-182.00
No. of seeds/pod	01.35	1.03	14	11.67	01.36-01.95
100-seed weight	20.84	1.72	11	9.16	21.02-22.10
Grain yield/plant	30.23	0.98	20	16.67	32.98-37.10

Table.2 Number of simultaneous transgressive segregants for yield in combination with other characters in the cross PG-13107 x BDNG-797

Character combinations Grain yield +	**Number of simultaneous transgressive segregants in F_2 generation**
1. PBP + SBP + PLS + PPP + SWT	3
2. PLH + SBP + PLS+ PPP + SWT	1
3. PBP + PLS + PPP + SPP	1
4. PLH + SBP + PPP	1

5. PBP + PLS + PPP	1
6. PBP + SBP + PPP	1
7. SBP + PPP + SWT	1
8. PLH + PPP + SPP	1
9. PLH + SPP + SWT	2
10. SBP +PLS + PPP	1
11. SBP + PLS + SPP	1
12. PPP + SWT	1
13. PPP	2
14. SPP	2
Total simultaneous transgressive segregants	**19**

Table.3 The upper limits achieved by transgressive segregants in respect of eight characters in F_2 generation of the cross PG-13107 x BDNG-797

Sr. No.	**Characters**	**Highest intensity of character expression**
1.	Plant height (cm)	90 **(63.8)**
2.	Number of primary branches/plant	3 **(2)**
3.	Number of secondary branches/plant	20 **(9.9)**
4.	Plant spread (cm)	43 **(18.7)**
5.	Number of pods/plant	182 **(84.1)**
6.	Number of seeds/pod	1.95 **(1.16)**
7.	100-seed weight (g)	22.10 **(18.93)**
8.	**Grain yield/plant (g)**	**37.10 (18.75)**

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

Table.4 Promising transgressive segreagants having combinations of desirable attributes

Characters	**Plant No.**	**PLH (cm)**	**PBP**	**SBP**	**PLS**	**PPP**	**SPP**	**SWT**	**GRY**	**% yield increased over increasing parent**
PG-13107 x BDNG-797										
F_2	30	85+	2+	11+	24+	140+	1.52+	17.43	37.10+	**97.86**
Vishal		52.30	2.00	9.30	18.00	79.60	1.16	18.13	16.91	
Digvijay		63.80	1.70	9.90	18.70	84.10	1.16	18.93	18.75	

+ Intensity of expression of character higher than the increasing parent

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