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Transgressive Segregation Study in F_3 Population of Four Groundnut Crosses

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Transgressive segregation is a very important phenomena where the segregating individual will possesses the value for a character which is exceeding the better parent. In the present study transgressive segregants were studied in four crosses for SCMR(SPAD Chlorophyll meter reading), SLA (specific leaf area), total biomass per plant, shoot weight per plant, root weight per plant, shelling out-turn per plant, harvest index per plant, pod yield per plant and kernel yield per plant. All the characters under study showed transgressive segregation in all the four crosses. This indicates that the parents posses different alleles and genes governing respective characters from which it could be inferred that there is a lot of scope to bring in beneficial alleles into a single genotype through rigorous selection and handling of these segregants evaluating the segregants for different characters along with selection for yield to arrive at a desirable plant type through selection in later generations.

Introduction

Many plant breeders have reported transgressive segregations in hybrid progenies and suggested transgressive segregation may be used as a positive tool in plant breeding. The conventional idea of hybridization is to develop a new hybrid derivative for recombination of desirable characteristics already observed in their parents; perhaps a more appropriate approach is to consider the possibilities of using transgressive segregation. Transgressive segregation refers to appearance of individuals, in the progeny from a hybrid, which exceed either of the two parents of the hybrid with respect to one or more characters. Such plants are produced by accumulation of favourable genes from both the parents as a consequence of segregation and recombination. Success in obtaining the desired transgressive segregants depends on obtaining genetic recombination between both linked and unliked alleles (Briggs and Allard, 1953). Keeping in view of the importance of transgressive segregants, the present investigation was carried in F_3 generation on inter varietal crosses of groundnut.

Materials and Methods

The present investigation was carried out during *kharif* 2013 at Regional Agricultural Research Station, Tirupati situated at an altitude of 182.90 m above MSL , 13°N latitude and 79°E longitude. The experimental soil was of sandy clay loam type. The experimental material consisted of four F_3 populations derived from TCGS 1043 × ICGV 05163, TCGS 1043 × ICGV 06045, TCGS 1043 × ICGV 93261 and TCGS 1043 × ICGV 913 and five parents involved *viz*, ICGV 05163, ICGV 06045, ICGV 93261, TCGS 913 and TCGS 1043. F_3 population in each cross was derived from raising seeds obtained from single pods picked up from each plant in F_2 population. The material was made available by the Principal Scientist (Plant Breeding), Regional Agricultural Research Station, Tirupati.

Four F_3 populations and five parents were sown in unreplicated plot on 17th July 2013. The F_3 populations were grown in 15 rows of 5 m length and parents in 4 rows of 5 m length for. The parents and the F_3 populations were sown following a spacing of 30 cm between the rows and 10 cm between the plants within a row.

The field was ploughed and harrowed to a fine tilth. The crop was raised with protective irrigation during *kharif* 2013. The crop was fertilized at 20 kg N, 40 kg P_2O_5 and 50 kg K_2O and 500 kg gypsum ha^{-1} in the form of urea, single super phosphate and murate of potash respectively. Weeding was carried out twice before 45 DAS during the crop growth period. Data on the following nine characters viz., SCMAR, SLA, total biomass, shoot weight, root weight, shelling out-turn, harvest index, mature pod weight and kernel weight were recorded during the course of experimentation. Data were collected on 250 randomly selected plants in each cross and 30 plants in each parent for study.

In the present study, transgressive segregants were identified by finding the number of plants exceeding mean value of the higher parent or lagging behind the mean value of the lower parent by critical difference at 5 percent level.

Results and Discussion

In the present study, transgressive segregants were identified that had values exceeding mean value of the higher parent or lagging behind the mean value of the lower parent by critical difference at 5 percent level. The number of such plants that fitted this definition among all the four crosses is presented in table 1. F_3 plants that surpassed the parental limits were observed in all the crosses for SCMR, SLA, total biomass, shoot weight, root weight, shelling out-turn, harvest index, pod yield per plant and kernel yield per plant.

The transgressive segregants with higher value of SCMR were high in F_3generation of TCGS 1043 × TCGS 913 (170 plants) followed by TCGS 1043 × TCGS 93621 (79 plants) and TCGS 1043 × ICGV 06045 (25 plants) while it was low in TCGS 1043 × ICGV 05163 (22 plants). Transgressive segregants with lower value of SCMR were higher in TCGS 1043 × ICGV 93261 (124 plants) followed by TCGS 1043 × ICGV 06045 (120 plants), TCGS 1043 × TCGS 913 (113 plants) and TCGS 1043 × ICGV 05163 (86 plants).The higher SCMR of male parent, ICGV 05163 of 44.61 is responsible for lower number of transgressive individuals in the cross. Individuals with SCMR around 47 were recorded in the crosses indicating the differential contribution of alleles from both the parents involved in respective crosses. Vasanthi *et al.*, (2005) also observed higher number of transgressive individuals in the lower extreme of the distribution i.e., negatively skewed distribution in F_2 populations of five crosses studied.

The transgressive segregants with higher value of SLA were high in F_3 generation of TCGS 1043 × ICGV 06045 (210 plants) and it was low in rest of the three crosses, TCGS 1043 × ICGV 93261 (67 plants), TCGS 1043

× TCGS 913 (61 plants) and TCGS 1043 × 05163 (59 plants). The transgressive segregants with low value of SLA were highest in TCGS 1043 × ICGV 05163 (162 plants) followed by TCGS 1043 × TCGS 913 (103 plants) and TCGS 1043 × ICGV 93261 (70 plants) while it was low in TCGS 1043 × ICGV 06045 (12 plants). This indicates scope for selection of high WUE plants in crosses TCGS 1043 × ICGV 05163 and TCGS 1043 × TCGS 913 as low SLA is correlated to high WUE (water use efficiency).

The transgressive segregants with higher value of total biomass were high in F_3 generation of TCGS 1043 × ICGV 06045 (69 plants) followed by TCGS 1043 × TCGS 913 (49 plants) and TCGS 1043 × ICGV 05163 (37 plants) while it was low in TCGS 1043 × ICGV 93261 (32 plants).The transgressive segregants with lower value of total biomass was high in TCGS 1043 × TCGS 913 (122 plants) followed by TCGS 1043 × ICGV 93261 (104 plants) and TCGS 1043 × ICGV 06045 (64 plants) while it was low in TCGS 1043 × ICGV 05163 (37 plants).

The transgressive segregants with higher value of shoot weight were high in F_3 generation of TCGS 1043 × ICGV 06045 (76 plants) followed by TCGS 1043 × TCGS 913 (47 plants) and it was equal in both TCGS 1043 × ICGV 05163 (46 plants) and TCGS 1043 × ICGV 93261 (46 plants). The transgressive segregants with lower value of shoot weight was high in TCGS 1043 × TCGS 913 (115 plants) followed by TCGS 1043 × ICGV 93261 (75 plants) and

TCGS 1043 × ICGV 06045 (47 plants) while it was low in TCGS 1043 × ICGV 05163 (27 plants).

The trasnsgressive segregants with higher value of root weight high in F_3 generation of TCGS 1043 × ICGV 06045 (113 plants) followed by TCGS 1043 × ICGV 05163 (86 plants) and TCGS 1043 × ICGV 93261 (55 plants) while it was low in TCGS 1043 × TCGS 913 (12 plants). The transgressive segregants with lower value of root weight was high in TCGS 1043 × ICGV 93261 (114 plants) followed by TCGS 1043 × TCGS 913(62) and two crosses with same values, TCGS 1043 × ICGV 05163(47) and TCGS 1043 × ICGV 06045 (47).

The transgressive segregants with higher value of shelling out-turn were high in F_3 generation of TCGS 1043 × TCGS 913 (116 plants) followed by TCGS 1043 × ICGV 06045 (69 plants) and TCGS 1043 × ICGV 05163 (61 plants) while it was low in TCGS 1043 × ICGV 93261 (49 plants). The transgressive segregants with lower value of shelling out-turn was high in TCGS 1043 × ICGV 93261 (57 plants) followed by TCGS 1043 × ICGV 06045 (37 plants) and TCGS 1043 × TCGS 913 (34 plants) while it was low in TCGS 1043 × ICGV 05163 (22 plants).

The transgressive segregants with higher value of harvest index were high in F_3 generation of TCGS 1043 × TCGS 913 (87 plants) followed by TCGS 1043 × ICGV 06045 (33 plants) and TCGS 1043 × ICGV 05163 (32 plants) while it was low in TCGS 1043 × ICGV 05163 (29 plants). The transgressive segregants with lower value of harvest index was high in TCGS 1043 × ICGV 93261 (186 plants) followed by TCGS 1043 × ICGV 05163 (161 plants) and TCGS 1043 × ICGV 06045 (139 plants) while it was low in TCGS 1043 × TCGS 913 (93 plants).

Transgressive segregants with higher value of mature pod weight per plant is high in F_3 generation of TCGS 1043 × TCGS 1043 (60 plants) followed by TCGS 1043 × ICGV 06045 (58 plants) and TCGS 1043 × ICGV 05163 (29 plants) while it was low in TCGS 1043 × ICGV 93261 (17 plants).

Table.1 Transgressive segregants for nine characters in F_3 population of four groundnut crosses

Trait/Cross	F_3 generation		Parents		No. of transgressive segregants	
	Highest plant value	Lowest plant value	Higher value	Lower value	Higher than highest parent	Lower than lowest parent
SPAD chlorophyll meter reading						
TCGS1043×ICGV05163	48.0	33.0	44.61	41.17	22	86
TCGS1043×ICGV06045	48.6	28.6	43.78	41.17	25	120
TCGS1043×ICGV93261	49.9	32.1	41.63	41.17	79	124
TCGS1043×TCGS913	46.7	30.7	41.17	39.24	170	113
Specific leaf area						
TCGS1043×ICGV05163	333.00	98.0	177.39	171.65	59	162
TCGS1043×ICGV06045	343.67	155.0	191.00	177.39	210	12
TCGS1043×ICGV93261	340.00	110.3	212.62	177.39	67	70
TCGS1043×TCGS913	330.90	118.8	189.39	177.39	61	103
Total Biomass per plant						
TCGS1043×ICGV05163	68.7	4.4	36.92	16.60	37	37
TCGS1043×ICGV06045	78.9	5.2	25.06	16.60	69	64
TCGS1043×ICGV93261	60.5	5.3	27.68	16.60	32	104
TCGS1043×TCGS913	47.3	3.0	20.25	16.60	49	122
Shoot weight per plant						
TCGS1043×ICGV05163	55.0	1.9	16.92	7.40	46	27
TCGS1043×ICGV06045	51.7	1.8	13.19	7.40	76	47
TCGS1043×ICGV93261	41.4	1.5	13.12	7.40	46	75
TCGS1043×TCGS913	25.7	1.3	9.62	7.40	47	115
Root weight per plant						
TCGS1043×ICGV05163	2.0	0.1	0.74	0.38	86	47
TCGS1043×ICGV06045	2.0	0.1	0.43	0.38	113	47
TCGS1043×ICGV93261	1.2	0.1	0.49	0.38	55	114
TCGS1043×TCGS913	0.9	0.1	0.58	0.38	12	62
Shelling out-turn						
TCGS1043×ICGV05163	79.7	12.0	72.30	52.24	61	22
TCGS1043×ICGV06045	80.0	17.9	72.30	53.40	69	37
TCGS1043×ICGV93261	79.9	20.0	72.30	59.32	49	57
TCGS1043×TCGS913	81.0	16.7	72.30	63.60	116	34
Harvest index						
TCGS1043×ICGV05163	68.3	17.0	51.80	44.55	32	152
TCGS1043×ICGV06045	69.4	18.0	51.80	40.90	33	128
TCGS1043×ICGV93261	67.8	16.7	51.80	46.86	29	182
TCGS1043×TCGS913	73.2	16.5	51.80	47.05	87	83
Mature pod weight per plant						
TCGS1043×ICGV05163	27.7	0.8	16.97	8.40	29	82
TCGS1043×ICGV06045	32.1	0.9	10.30	8.40	58	119
TCGS1043×ICGV93261	28.7	0.2	13.22	8.40	17	153
TCGS1043×TCGS913	21.4	0.7	9.31	8.40	60	123
Kernel weight per plant						
TCGS1043×ICGV05163	21.0	0.2	9.26	6.10	48	105
TCGS1043×ICGV06045	20.5	0.1	6.10	5.60	83	126
TCGS1043×ICGV93261	20.3	0.1	7.96	6.10	83	170
TCGS1043×TCGS913	14.5	0.2	6.10	5.96	76	121

Transgresssive segregants with lower value of mature pod weight per plant was high in TCGS 1043 × ICGV 93261 (153 plants) followed by TCGS 1043 × TCGS 913 (123 plants) and TCGS 1043 × ICGV 06045 (119 plants) while it was low in TCGS 1043 × ICGV 05163 (82 plants). Transgressive segregants with higher value of kernel weight per plant is high in F_3 generation of two crosses, TCGS 1043 × ICGV 06045 (83 plants) and TCGS 1043 × ICGV 93261 (83) followed by TCGS 1043 × TCGS 913 (76 plants) and TCGS 1043 × ICGV 05163 (48 plants). Transgressive segregants with lower value of kernel weight per plant was high in TCGS 1043 × ICGV 93261 (170 plants) followed by TCGS 1043 × ICGV 06045 (126 plants) and TCGS 1043 × TCGS 913 (121 plants) while it was low in TCGS 1043 × ICGV 05163 (105 plants).

Transgressive individuals with values exceeding the better parent were observed in all the crosses for SCMR, SLA, total biomass, harvest index, shoot weight, root weight, shelling out-turn, mature pod weight and kernel weight per plant. This indicates that the parents posses different alleles and genes governing respective characters from which it could be inferred that there is a lot of scope to bring in beneficial alleles into a single genotype through rigorous selection and handling of these segregants evaluating the segregants for different characters along with selection for yield to arrive at a desirable plant type through selection in later generations. Jayalakshmi (2000) reported transgressive segregants in F_2 and F_3 generation of 21 crosses for majority of physiological and yield attributes in groundnut. Monpara *et al.,* (2004) observed in F_2 generation, transgressive segregants for plant height, pods per plant and pod yield per plant and concluded that the parents involved contributes different alleles. Kshirsagar *et al*., (2013) reported transgressive segregation for plant height, days to first flowering, days to first harvesting, number of harvestings, yield per plant, average fruit weight, average fruit diameter, pericarp thickness, number of locules per plant and harvesting duration in F_3 generation of two inter varietal crosses in tomato. Pradeep and Sumalini (2003) studied the transgressive segregation in cotton for F_2 and F_3 generation. Uma and Salimath (2003) investigated transgressive segregants for yield and its major component traits in segregating population of cowpea. De Vincente *et al.,* (1993) reported transgressive segregation for eight traits during F_2 generation of interspecific tomato hybrids. Shirkole (2006) reported transgressive segregation for nine characters in three crosses during F_2 generation in tomato. Stommel (2001) developed three tomato breeding line by advancing hybrid derivative up to F_5 generation. Radkov (1980) studied yield related characters in French bean during F_2 and F_3 generations and found transgressive segregants for important traits like pod and seed weight per plant. Khrostovaska *et al.,* (1975), observed transgressive segregation in hybrid derivatives of pea up to 8 generation. Ugale (1980) studied three crosses in chick pea and recorded transgressive segregants in all the crosses for nine characters.

In conclusion transgressive individuals with values exceeding the better parent were observed in all the crosses for SCMR, SLA, total biomass, harvest index, shoot weight, root weight, shelling out-turn, mature pod weight and kernel weight per plant. This indicates that the parents possess different alleles and genes governing respective characters indicating the scope to bring in beneficial alleles into a single genotype through rigorous selection and evaluation of the segregants for different characters along with selection for yield to arrive at a desirable plant type through selection in later generations.

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