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Transgressive Segregation and Selection Indices Analysis in F_2 Generation of Soybean

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A B S T R A C T

The soybean or soya bean (*glycine max* L.) is a species of legume native to East Asia widely grown for its edible bean, which was numerous uses. The aim of this study was to identify the superior transgressive segregants and estimate the correlation coefficient between seed yield, and yield components. Six generation of three crosses were evaluated at Botany Section Farm, College of Agriculture, Dhule during *Kharif*, 2019. The field experiment was arranged in a randomized block design (RBD) with non-replicated fashion. In most of the transgressive segregants, the 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 (29), followed by plant height (26), 100-grain weight (24), number of pods per plant (14), number of seeds per pod (12) and number of primary branches (2). The most promising transgressive segregants observed in F_2 generation of this cross was plant no. 475, which yielded 151.22% more than its increasing parents. Phenotypic correlation of grain yield per plant with nine other characters studied in F_2 generation of this cross indicated, significant and positive correlations with three characters, *viz.*, number of primary branches per plant, number of pods per plant, and number of seeds per pod. These characters also showed significant and positive correlation among themselves uniformly. From the above observations the improvement in grain yield of soybean appears to be possible by making selection through aforesaid characters.

Introduction

Soybean is economically the most important legume in the world. In USA next to maize and wheat it is the most important crop. It is currently vital for the sustenance of many people and it will play an integral role in future attempts to relieve world hunger. Soybean has long history as food stuff in the orient and is bestowed with high quality and quantity of protein oil and some of the essential vitamins (A, B and D).

Traditional and unfermented food uses of soybeans include soy milk, from which tofu and tofu skin are made. Fermented soy foods include soy sauce, fermented bean paste, natto, and tempeh. Fat free (defatted) soybean meal is a significant and cheap source of protein for animal feeds many packaged

meals. For example, soybean products, such as textured vegetable protein (TVP), are ingredients in many meat and dairy substitutes.

Soybeans contain significant amounts of phytic acid, dietary minerals and B vitamins. Soy vegetable oil, used in food and industrial application, is another product of processing the soybean crop. Soybean is the most important protein source for feed farm animals (that in turn yields animal protein for human consumption)

It is used in manufacture of margarine, vegetable ghee etc. It is also useful in the manufacture of paints, varnishes, linoleum, water proof goods, paper umbrellas, printing inks, celluloid goods, glycerin, rubber substitutes, fireworks and explosives. The oil of soybean contains lycethin and resembles butter in its properties. When there is shortage of olive oil in the world market, soybean is substituted for it. It is edible oil and is used by the people in China and Japan for cooking purposes. It is also used in lubricating machinery.

Soya flour is of great importance in diabetic dietary. Its starch contents being quite negligible and its saccharides low, so it is most suited to diabetic patients. Its carbohydrates are mainly such as to give energy without appearance of sugar in the urine. This is why the medical practitioners prescribe soybean flour in diabetic dietary.

In Maharashtra area under soybean crop is 39.292 lakh hectare and production 45.131 lakh tone, having productivity 1084kg/ha (Anon.,2020).

Materials and Methods

The field experiment was conducted at Botany Section Farm, College of Agriculture, Dhule (India), The single direct cross was effected by using two diverce parents MACS-1281 and DHS-1 during kharif-2018 and F_1's was grown to obtain F_2 seeds during Summer-2019. The experimental material were evaluated in randomized block design with non-replicated fashion. Recommended doses of fertilizers and cultural practices were adopted. Two rows for parents and twenty five rows for F_2 generation of 4m length and 45cm apart accommodating 600 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 25 rows for F_2 generation of a cross. At random 600 plant from F_2 generation and 10 plants from parent plot were tagged for recording observations on ten characters *viz.*, days to 50% flowering, days to maturity, plant height, number of primary branches per plant, number of pods per plant, number of seeds per pod, 100 grain weight, oil content (%), protein content (%) and grain yield per plant. For understanding the association among the yield and yield contributing character, correlation coefficients were worked out by using the data of 600 F_2 plants, as per the procedure of Dewey and Lu (1959), Transgressive segregants was estimated by calculating threshold value as per the procedure given by Panse and Sukhatme in (1995).

$$. rPxy = \frac{Cov.xy}{\sqrt{Vx.Vy}}$$

Where,

Cov.xy = Covariance between the characters x and y

Vx = Variance of the character x
Vy = Variance of the character y

Threshold Value (T.V.) = $P^{(+)} + 1.96 \times \sigma P^{(+).}$

Where,

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

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

Results and Discussion

The conventional idea of hybridization is to recombine the desirable characteristics in a new hybrid derivative, already observed in two parents involved in hybridization. The occurrence of transgressive segregants in segregating generation suggests that, the concept of transgressive segregation can be used as positive tool in plant breeding.

The studies on transgressive segregation in the segregating generation, suggest that parent do not represent the extremes in terms of intensities of desired characters. If some genes for enhanced expression of a character are lacking in the genotype of the increasing parent but are present in donar parent, some individuals among the hybrid derivatives, emanating from the cross of these parents, might receive a fortuitous gene combination showing a larger effect than produced by either of the parents (Gardner, 1968).

It is instresting to note that, in present study, transgressant were recorded in F_2 generation this cross for all the six character (Table 1). In case of grain yield per plant 4.83 percent individuals transgressed beyond the increasing parent. Transgressive segregants were 4.33 per cent for plant height, 0.33 per cent for number of primary branches per plant, 2.33 per cent for number of pods per plant, 2.0 per cent for number of seeds per pod and 4 per cent for 100-grain weight.

Mansur *et al* (1996) 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 soybean. Haddad (1979) isolated transgessants in lentil in term of earliness, tallness, erectness, high pod number and high yield.

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) and Deokar *et al., (*2019) reported transgressive segregants in 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. Girase and Deshmukh (2002) 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 of all the three crosses.

If we consider transgressive segregants for grain yield per plant in the cross MACS-1281 x DHS-1, plant No.475 was found to be most promising as it has given 151.22 per cent more grain yield per plant in addition to higher expression for number of primary branches, number of pods per plant, than the increasing parent (Table 2).

From this investigation, it can be suggested that the most promising transgressive segregants listed in (Table 2) need to be evaluated further. If they confirm their 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.

Table.1 Threshold value, frequency, range in values of transgressives segregants for six characters in F_2 generation of cross MACS-1281 x DHS-1

Sr No.	Characters	Transgrassive segregation F2 generation			
		Threshold value	N.D value	Frequency	Range
1.	Plant height (cm)	65.07	1.34	26 (4.33)	66.00-75.00
2.	Number of primary branches	6.70	3.01	2 (0.33)	06.80-7.00
3.	Number of pods per plant	82.18	2.16	14 (2.33)	84.00-146.00
4.	Number of seeds per pod	2.46	2.38	12 (2)	02.50-02.70
5.	100 grain weight (g)	19.00	0.63	24 (4)	19.02-19.81
6.	Grain yield per plant (g)	29.42	2.17	29 (4.83)	29.56- 45.07

Table.2 Promising transgressive segreagants having combinations of desirable attributes in F_2 generation of cross MACS-1281 x DHS-1

Characters	Plant No	PLH (cm)	PBP	PPP	SPP	GWT	GRY	%yield increased over increasing parent
Cross- 3: MACS-1281 x DHS-1								
F_2	475	53	5^+	117^+	2.0	15.12	45.07^+	151.22
MACS-1281		57	4	68	2.2	15.57	17.94	
DHS-1		53	4	60	2.2	13.67	16.74	

Table.3 The uppermost limits achieved by transgressives segregants over their increasing parents in respect of various characters in F_2 generation

Sr no	Charecters	Highest intensity of characters expression in three crosses
		MACS-1281 x DHS-1
1	Plant height (cm)	75 (57.5)
2	Number of primary branches	7 (4.6)
3	Number of pods per pod	146 (68.1)
4	Number of seeds per pod	2.7 (2.22)
5	100-grain weight (g)	13.21 (15.57)
6	Grain yield per plant (g)	45.07 (17.94)

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

Table.4 Correlation coefficients between different pairs of characters in F_2 generation of cross MACS-1281 X DHS-1

Characters	Days to 50% flowering	Days to Maturity	Plant height	Primary branches/ plant	No. of pods/ plant	No. of seeds/pod	100-grain weight	Oil content (%)	Protein Content (%)	Grain yield/plant
Days to 50% flowering	-	0.1247**	0.0185	0.0414	0.0260	0.0115	-0.0545	0.3252	0.0870	**0.0408**
Days to maturity		-	0.0619	0.0557	0.0295	-0.0247	0.0608	0.0045	-0.0181	**0.0544**
Plant height (cm)			-	0.1235**	0.1482**	0.0766	-0.0319	0.1852	0.1674	**0.0319**
Number of primary branches				-	0.5674**	0.0313	0.1604**	-0.0991	-0.1311	**0.2257****
Number of pods per plant					-	-0.0020	0.0518	-0.0408	-0.3603	**0.3417****
Number of seeds per pod						-	0.0636	0.1024	0.4982**	**0.0494**
100-grain weight(g)							-	-0.2880	-0.2566**	**0.0093**
Oil content (%)								-	0.4118**	**0.1168***
Protein content (%)									-	**-0.4297****
***, ** Significant at 5% and 1%, level, respectively**										

Apart from the frequency of transgressants, it will be of great interest to examine the intensities of the characters expression achieved in the transgressants in this cross (Table 3). The character expression achieved by transgressive segregants were66 to 75cm plant height, 6.0 to 7.0 primary branches per plant, 84 to 146 pods per plant, 19.02 to 19.81g 100 grain weight, and 29.56 to 45.07g grain yield per plant. 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 of this cross produced 45.07 g grain yield per plant, as against 17.94 g per plant, produced by their respective increasing parents. This intensities for grain yield per plant were 151.22 per cent higher than those of their respective increasing parents.

From this data it is evident that, when the desired intensity of a character is not available in the parents, transgressive breeding can be employed to extend the limit of expression of character. It is therefore, concluded that transgressive breeding is effective for extending the limit of character expression, if plant breeder is interested in isolating the rare genotypes. In this method we impose more selection pressure which result in the highest recovery of characters than that of other breeding approaches.

Among the phenotypic correlation of grain yield per plant with nine other characters studied in F_2 generation of this cross positive correlations were observed with all the characters except, protein content. The grain yield exhibited significant positive correlation with primary branches per plant (0.2257), number of pods per plant (0.3417) and oil content (0.1168). However, correlation between grain yield and protein content was significantly negative. These characters also showed positive and significant correlation among themselves uniformly in F_2 generation. Among these association consistent and high value of correlation coefficient were obtained between days to 50% flowering and days to maturity(0.1247), plant height and primary branches per plant (0.1235), primary branches and pods per plant (0.5674), primary branches and 100-seed weight91604) seeds per pod and oil content (0.1024). The protein and oil content bears significant positive association between them (Table 4). Significant association of these traits with grain yield have been previously reported by Painkra *et al.*(2018). She reported significant positive correlation among yield contributing characters like number of primary branches, number of pods per plant and number of seeds per pod as observed in present study.

In this cross there is the positive and significant correlation between grain yield per plant with primary branches, pods per plant and 100-seed weight. These result are in accordance with those obtained by Girase and Deshmukh (2002); Malik *et al.,* (2006), Haghi *et al* (2012), Dubey *et al.,* (2015), Chavan *et al.,* (2016) and Balla and Ibrahim(2017). Painkra *et al.,* (2018) showed grain yield per plant had highly significant positive correlation with number of primary branches per plant, number of pods per plant and number of seeds per pod. Haghi *et al.,* (2012) reported negative correlation of oil and protein content with grain yield.

The existence of transgressive segregants for yield and yield components and significant positive association among them, indicated the feasibility and possibility for funneling desirable recombinant in soybean.

References

Anonymous. 2020. Area & Production Estimates of Soybean [*Glycine max* (L.) Merrill] in Maharashtra. Kharif 2019 -

20. Crop survey conducted by SOPA.

Ball M.Y., Ibrahim S. E. Genotypic correlation and path coefficient Analysis of Soybean [*Glycine max* (L.) Merr.] For yield and its components. Agric Res &Tech: Open Access J.2017; 7 (3); 555715. DOI: DOI: 10.19080 / ARTOAJ. 2017. 07. 555715

Chavan B. H., D.V. Dahat, H.J. Rajaput., M. P. Deshmukh and S.L. Diwane (2016) Correlation and Path Analysis in Soybean. International Research Journal of Multidiciplinary Studies.Vol 2 ISSN (online) : 2454 - 8499

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

Dubey N., Shrivasthava A. N., Avinashe H. A. and Samidha J. 2015.Genetic diversity, correlation and path analysis for yield and yield contributing characters in soybean (*Glycine max* L.). *Electronic Journal Plant Breeding* 6(1): 318-325.

Gardner, E. J. 1968. Principle of Genetics. John Wiley and sons, New York, pp. 405.

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

Haghi Y., Boroomandan P., Mordin M., Hassankhali M., Farhadi P., Farsaei F. and Dabiri S. 2012. Correlation and path analysis for yield, oil and protein content of soybean genotypes under diffrent levels of nitrogen starter and plant density. *Biharian Bio*., 6 (1): pp. 32-37.

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

Malik M. F. A., Qureshi A. S., Muhammad A. and Ghafoor A. 2006.Genetic Variability of the Main Yield Related Characters in Soybean. *Int. J. Agric. Biol*., 8 (3): 815-819.

Painkara P., R. Shrivastava.,S.K. Nag and I. Kute. 2018. Correlation analysis for seed yield and Its Attributing Traits in soybean (*glycine max* L. Merill). *International Journal of Current Microbiology and Applied Sciences*. 7(4): 2034-2040

Panse, V. G. and P. V. Sukhatme. 1967. Statistical methods for Agricultural Workers. ICAR, New Delhi, pp. 359.

Sabale V. B. and V. S. Girase. 2018. Transgressive segegation analysis in mungbean (*Vigna radiata* (L) wilczek.). *Contemporary Research in India*, 5: 310-313.

Sujata B. and G.T. Basavaraja. 2011. Genetic variability and correlation studies in segregating generation of soybean [*Glycine max* (L.) Merrill]. *Crop improv.* 38(1): 77-87.

Ugale, S. D. and P. N.Bhal.(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.

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