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Transgressive segregation in cross 3x6 of F_2 generation of tomato (*Solanum lycopersicum* L.)

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Abstract
The present investigation was undertaken during Rabi 2018 - 2019 with an objective to study transgressive segregation in F_2 generation to introgress into genotypes of the selfed progeny derivatives of tomato. The investigation comprised of evaluation of F_2 generation for transgressive segregation for important quantitative traits in cross, 3 x 6 (C_2) and their parents. These studies helped to find out the percent of transgressive segregation in F_2 generation. In most of the segregation of cross 3 x 6 in F_2 generation the yield per plant of better parent was found to be transgreed simultaneously with transgression of one or more other yield contributing character. The data on ten quantitative characters were used for studying transgressive segregation of cross 3x6 in F_2 generation. Mean standard deviation were calculated to determine transgressive segregation for characters under investigation. Desirable transgressive segregation was observed for all ten characters except number of locules in fruits. The highest transgressive segregation were observed in plant height (24.74%), followed by number of fruits per plant (23.68%), polar diameter (23.16%), equatorial diameter of fruit (22.90%) and yield per plant (20.68%) in cross 3 x 6 (C_2) of F_2 generation.

Keywords: Tomato, transgressive segregation, quantitative character, yield

Introduction
Tomato (*Solanum lycopersicum*, L.) is one of the most widely grown vegetable in India and has become popular from the last six decades. It is grown in small home gardens and market gardens for fresh consumption as well as processing purposes. It has become one of the most popular and widely consumed vegetable. The centre of origin is Peru and Mexico in Central and South America. It was domesticated in Europe where exclusive pressure was applied on stigma position within anther cone to become self-pollinated crop and also on red fruit colour than that of original orange fruit (Kallo, 1991) [2]. Tomato has been introduced in India during 19th century from Europe. Tomato is considered as "Poor Man´s orange" in India. Its World´s largest vegetable crop cultivated after potato and sweet potato. Most important tomato growing State Andhra Pradesh (17.9%). Leading tomato producing states are Andhra Pradesh, Karnataka and Madhya Pradesh in India. Karnataka (33t/ha) have a highest productivity. In India tomato is cultivated almost all parts occupying an area of about 814 thousand hectares with the production of 20515 thousand metric tonnes. It is cultivated in Bihar, Karnataka, Uttar Pradesh, Orissa, Andhra Pradesh, Maharashtra, Madhya Pradesh and Assam. In Maharashtra tomato is cultivated on an area about 32.2 thousand hectares with the production of 715.3 thousand tonnes. In Maharashtra it is grown in Nashik, Pune, Ahmednagar, Satara, Sangli and Nagpur district. Transgressive segregation refers to appearance of individuals, in the progeny from a hybrid which exceed either of the two parents of the hybrid with the respect to one or more characters.

Materials and Methods
The present investigation entitled studies on transgressive segregation in F_2 generation in tomato (*Solanum lycopersicum* L.) was conducted at Tomato Improvement Scheme, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra State, India during Rabi 2018-19. There are 40 plants per plot and the seed of five F_2 plant progenies i.e. five F_2 progenies from cross (3 x 6) along their parents 3 and 6

were obtained from work carried out. F_2 progenies from cross 3 x 6 were selected on the basis of yield per plant and PDI at 75 DAT. Initially five F_2 families along with their two parents were evaluated. Thus, seven genotypes were evaluated in the plant spacing 90 x 30 cm with the plot size 2.7 x 3.6 m^2 subsequent F_2 generations. The experimental material in F_2 generation consisted 5 progenies and two parents. Initially five F_2 population along with their two parents were evaluated during Rabi 2018-19.

All the genotypes of F_2 populations were evaluated in randomized block design with two replications. In F_2 about 200 plant populations, respectively for each progeny of this cross and their parents were taken for observation and selected to study the transgressive segregation for various yield contributing traits. The data on individual plants for each character was obtained to calculated means, standard deviations and standard error of means, variances (Panse and Sukhatme, 1985) [4].

Results and Discussion

The present experimental work was undertaken to study the assessment of transgressive segregation of tomato cultivar. The observations on genetical parameters of tomato like plant height (cm), average number of branches per plant, days to first flowering, average fruit weight (g), polar diameter of fruit (cm), equatorial diameter of fruit (cm), pericarp thickness (mm), number of locules per fruit, number of fruits per plant and yield per plant (kg) etc. Means, standard deviation frequency distribution of desirable transgressive segregants of cross 3x6 (C_1) for 10 characters in F_2 generation have been recorded.

Even though desirable transgressive segregants were observed in all ten traits under study, comparatively lower transgressive segregants were recorded in character such as polar diameter (23.16%), days to first flowering (18.68%) and average fruit weight (18.42) indicating more precise attention while selecting F_2 segregants. The highest percent transgressive segregants were observed in plant height (24.74%), followed by fruit yield plant (20.79%) number of fruits/plant (23.68%) average no of branches (20.79%) equatorial diameter (22.90%) and pericarp thickness (19.47%). The higher transgressive segregants were observed for plant height followed by number of fruits, equatorial diameter fruit and *yield* per plant in cross 3x6 of F_2 generation (Table 1). The success in obtaining the desired transgressive segregants depend upon the genetic recontinuation both linked and unlinked alleles (Briggs and Allard, 1953) [1].

The simultaneous transgressive segregants for yield per plant in contribution with other quantitative characters has been observed for plant height (15.53%) followed by number of fruits per plant (16.05%) and average number of branches (11.32%). (Table 2). Thus, all these characters were improved beyond capacity of their parental genotypes on the basis of high values of transgressive segregants. It was concluded that, when desired intensity (i.e. percent improvement) of a character is not available in the parent, transgressive breeding may be successfully used to extend the limit of expression of a character in particular cross combination.

The result are in conformity with Radkov (1980) [5] he studied yield related characters in French bean during F_2 and F_3 generation and found transgressive segregation for important traits like pod and seed weight per plant. Stommel (2001) [7] developed three tomato breeding line by advancing hybrid derivatives up to F_3 generation. Uma and Slimath (2003) [8] investigated the extent of transgressive sergeants for the yield and its major component traits in segregating population of cowpea. They observed that extent of transgressive segregation is the character specific and the extent of transgressive segregation in the seed yield depends on the extent of transgressive segregation in the both the character, *viz*., pod number and seed weight. This result is in conformity with results reported by Shirkole (2006) [6] observed 18.00% transgressive segregents in F_2 generation of the cross-DH x NBC in tomato. This result are also in conformity with the results reported by Kshirsagar *et al*. (2013) [3]. They observed 10.66% and 11.50% transgressive segregents for cross M-3-1x H-36 in F_3 generation for cross M-3-1x 18-1-1 of F_4 generation respectively.

Table 1: Threshold value, frequency and range of values of transgressive segregants for ten quantitative characters in F_2 generation of the cross 3x6.

S. No.	Characters	Threshold value (T.S.)	N.D. value	Transgressive segregants		
				Frequency		Range
				Number	Percent	
1.	Plant height (cm)	75.04	0.74	94	24.74	50-108
2.	Average number of branches /plants	4.76	1.44	79	20.79	4-7
3.	Days to first flowering	34.76	0.19	71	18.68	36-32
4.	Average fruit weight (g)	70.42	0.74	70	18.42	46-104
5.	Polar diameter of fruit (cm)	5.26	0.73	88	23.16	4.44-7.44
6.	Equatorial diameter of fruit (cm)	4.50	0.74	87	22.90	4.10-5.35
7.	Pericarp thickness (mm)	4.98	0.86	74	19.47	4.79-3.07
8.	Number of locules	2.41	0.57	0	0.00	0
9.	Number of fruits /plants	21.70	1.26	90	23.68	10-39
10.	Yield / plant	1.48	0.26	79	20.79	1.32-3.27

* Percent transgressive segregants were calculated on total 380 plants in F_2 generation.

Table 2: Frequency and percent simultaneous transgressive segregants for yield per plant in combination with other ten quantitative character in cross 3x6

Sr. No.	Characters combination	Transgressive segregants	
	Yield per plant with (Kg)	F_2 generation	
		Frequency	Percent
1.	Plant height (cm)	49	15.53
2.	Average number of branches /plants	43	11.32
3.	Days to first flowering	54	14.21
4.	Average fruit weight (g)	51	13.42
5.	Polar diameter of fruit (cm)	51	13.42
6.	Equatorial diameter of fruit (cm)	51	13.42
7.	Pericarp thickness (mm)	55	14.47
8.	Number of fruits /plants	61	16.05

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