International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; SP-8(4): 481-483

Received: 25-05-2020
Accepted: 27-07-2020

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Assessment of genetic variability, heritability and genetic advance in Tomato

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DOI: https://doi.org/10.22271/chemi.2020.v8.i4h.10319

Abstract
Genetic variability studies provide the basic information on genetic properties of the population based on which breeding methods could be formulated for further improvement of the crop. Hence the variability, heritability and genetic advance were studied for fruit yield and its 14 component traits in 40 advance lines of tomato at Regional Research Station, Semiliguda, Koraput during kharif season, 2017. The results showed significant differences indicating the presence of high genetic variability among the genotypes. PCV and GCV were high for total chlorophyll content, total fruit yield and root volume. High degree of heritability estimates were obtained in case of total chlorophyll content, total fruit yield, root volume, pericarp thickness, plant height and number of fruits per plant. Genetic advance was highest for total chlorophyll content, number of fruit per plant and total fruit yield. Therefore, total chlorophyll content and number of fruits were the important components and could be utilized for achieving maximum fruit yield.

Keywords: Variability, genetic advance, heritability, selection, tomato.

Introduction
Tomato (*Solanum lycopersicum* L.) is the most popular and widely grown vegetable in India and abroad. It is considered as a 'protective food' due to its nutritive values and antioxidant properties with the presence of lycopene and flavonoids (Sepat *et al.*, 2013) [9]. But the production and productivity of this crop in India is far below compared to the global scenario. The magnitude of variability and heritability present in germplasm is most important to plant breeder for starting a plant breeding programme. Therefore in the present study, an attempt was made to study the genetic variability, heritability and genetic advance among different genotypes of tomato to increase the efficacy of selection.

Materials and Methods
The experimental material consisted of 40 genotypes of tomato were evaluated at the RRTTS, Semiliguda, Koraput during kharif season, 2017 in a randomized block design with two replications maintaining a spacing of 60cm x 40cm. The plot size was 3.0m x 2.8m. The observations on 15 morpho-physiological characters were taken (Table-1).The mean data were used for analysis of variance (Panse and Sukhatme, 1967) [7]. From the variance components, coefficients of variation at phenotypic (PCV) and at genotypic (GCV) levels (Burton, 1952) [1], heritability in broad sense (Lush, 1940) [5] and expected genetic advance (GA) (Johnson *et al.*, 1955) [3] were computed.

Results and Discussion
The analysis of variance revealed highly significant differences among the genotypes for all the traits except days to 50% fiowering (Table 1).The performance of genotypes revealed a wide range of variation in different traits indicating a greater scope for improvement through selection. Similar type of results were also observed by Mehta and Asati (2008) [6], Sharma *et al*. (2009) [10], Dar *et al*. (2012) [2] and Kumar *et al.* (2013) [4] in tomato. The estimates of phenotypic (PCV) and genotypic (GCV) coefficients of variation for plant height, fruits/plant, fruit girth, fruit pericarp thickness, root volume, total chlorophyll content and total fruit yield/ha showed very little difference indicating less influence of environment on these traits

And suggested the presence of sufficient genetic variability, hence ample scope for effective selection. The highest and lowest values of PCV and GCV were for total chlorophyll content and days to 50% flowering, respectively (Table 2). Heritability in broad sense (H) and genetic advance (GA) for different characters varied considerably. High H indicates that effectiveness of selection for phenotypic performance is good, but it does not necessarily mean a high genetic gain for a particular character. However, high H estimates along with high genetic gain became more useful (Johnson et. Al., 1955) [3]. Total chlorophyll content showed highest H as well as highest GA; therefore selection based on phenotypic performance for this trait would be useful for achieving desired results. Root volume, total yield and No. of fruits/plant also showed high H coupled with high GA. Plant height, fruit girth and fruit pericarp thickness showed high H but the GA was low. Ramanujam and Tirumalachar (1967) [8] also reported high heritability along with high genetic advance resulted better reliable selection than only with high heritability. Hence, the present study of genetic variability parameters showed that root volume, total chlorophyll content and number of fruits/plant were the dependable components for getting higher fruit yield and the selection based on phenotypic performance of these characters would be effective.

Table 1: Analysis of variance for yield, yield contributing and quality characters in tomato

Mean sum of square									
Sources of variation	**Df**	**Days to 50% flowering**	**Plant height (cm)**	**Number of branches per plant**	**Number of clusters per plant**	**Number of flower per cluster**	**Number of fruit per cluster**	**Number of fruit per plant**	**Polar diameter of fruit (mm)**
Replication	1	1051.262	146.194	23.392	20.381	4.753	1.260	1.855	50.956
Treatment	39	66.046	528.393**	5.569**	19.351**	2.544**	3.287**	56.656**	82.317**
Error	39	49.198	18.608	1.005	3.581	0.288	0.447	1.928	13.821

Mean sum of square								
Sources of variation	**Df**	**Equatorial diameter of fruit (mm)**	**Pericarp thickness (mm)**	**Average fruit weight (gm)**	**Root volume (cc)**	**Leaf area index**	**Total chlorophyll content (µg/ml)**	**Total yield (q/ha)**
Replication	1	44.706	1.300	13.906	48.833	5.392	2.136	3.887
Treatment	39	91.734**	2.818**	558.623**	424.689**	1.558**	10.804**	83.336**
Error	39	5.021	0.079	74.325	3.443	0.530	0.052	2.141

Table 2: Mean, Range, PCV, GCV, H and GA estimates for 15 characters of 40 genotypses of tomato.

Character	Mean	Range	PCV	GCV	Heritability(H)	Genetic advance(GA)	GA as % of mean
Days to 50% flowering	85.95	73.50-96.00	6.69	3.38	25.51	2.58	3.00
Height of plant(cm)	64.64	35.01-94.32	25.15	24.70	96.48	27.60	42.70
Number of branches per plant	6.94	3.77-10.99	24.03	21.75	81.95	2.41	34.66
Number of cluster per plant	11.08	5375-20.40	28.07	25.34	81.50	4.46	40.27
Number of flower per cluster	4.03	1.84-7.80	27.99	26.36	88.66	1.76	43.68
Number of fruit per cluster	3.25	1.00-5.34	39.48	36.70	86.42	1.95	60.05
Number of fruit per plant	6.65	1.03-20.97	79.98	78.61	96.60	9.05	135.97
Polar diameter of fruit(mm)	33.61	23.70-48.10	19.09	17.41	83.21	9.40	27.95
Equatorial diameter of fruit (mm)	33.89	20.25-46.80	19.99	19.43	94.53	11.27	33.25
Pericarp thickness of fruit (mm)	4.51	2.70-6.75	26.30	25.93	97.21	2.03	45.00
Average fruit weight (gm)	63.67	37.62-120.10	26.25	24.44	86.70	25.50	40.05
Root volume (cc)	27.83	8.00-75.50	52.36	52.15	99.19	25.44	91.40
Leaf area index	1.85	0.31-6.25	47.62	38.68	66.00	1.03	55.31
Total chlorophyll content (µg/ml)	2.64	0.23-8.84	88.17	87.95	99.52	4.07	154.43
Total yield (q/ha)	86.30	13.24-216.31	69.28	68.39	97.42	11.07	118.80

Acknowledgement
The authors are grateful to the Department of Science and Technology, Government of Odisha for providing financial help during the investigation in the form of Biju Patnaik Fellowship to the senior author.

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