Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2021; 10(1): 2290-2292
Received: 02-01-2021
Accepted: 28-01-2021

Jitendra Kumar
Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, Uttar Pradesh, India

Pooshpendra Singh Dixit
Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, Uttar Pradesh, India

Lalit Yadav
Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, Uttar Pradesh, India

Manoj Kumar
Department of Fruit Science, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, Uttar Pradesh, India

Budhesh Pratap Singh
Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, Uttar Pradesh, India

Saurabh Tomar
Ph.D Scholar,
Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, Uttar Pradesh, India

Corresponding Author:
Saurabh Tomar
Ph.D Scholar,
Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, Uttar Pradesh, India

Studies about genetic divergence in 40 genotypes of Tomato (*Solanum lycopersicum* L.)

Jitendra Kumar, Pooshpendra Singh Dixit, Lalit Yadav, Manoj Kumar, Budhesh Pratap Singh and Saurabh Tomar

Abstract
Present investigation was carried out at Vegetable Research Farm, Kalyanpur, Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur during *Rabi* season of 2019 -2020. Forty genotypes were evaluated for 10 growth and yield traits which were grouped into five clusters. Cluster III and V had maximum (10) genotypes followed by cluster II (9), cluster I (7), cluster IV (4). Cluster I and cluster IV, exhibited high degree of genetic diversity due to maximum inter cluster distance between them. It indicating these genotypes may be utilized under inter varietal hybridization programme (transgressive breeding) for getting high yielding recombinants. Cluster IV has shown maximum mean days to flowering, plant height (cm), number of locule, fruit length (cm) Therefore, selection of parents from this cluster for these traits would be effective. Maximum contribution towards genetic divergence was obtained by number of fruits per plant (62.31 per cent) and plant heights (21.67 per cent).

Keywords: genetic divergence, breeding, tomato, variance, growth, genotype, cluster, fruit

Introduction
The cultivated tomato, *Solanum lycopersicum* L., is the world's largest grown vegetable crop after potato and sweet potato. It is one of the highly consumed vegetable due to its status as a basic ingredient in a large variety of raw, cooked or processed foods. It belongs to the nightshade family Solanaceae, which includes several other commercially important species. Tomato is grown worldwide for local use or as an export crop. In 2018, the global area cultivated under tomato was 7.8 million hectares with a production of 193 million tonnes. India is the second largest producer of tomato in the world after China with an area of 7.8 lakh hectare and production of 19.7 million tonnes. (FAOSTAT, 2018) [1]. In India the leading state in tomato production is Andhra Pradesh followed by MP and KN. In Uttar Pradesh tomato is grown in 12.8-thousand-hectare area with a production of 8.4 lakh tonnes (NHB, 2017-18) [5].
Tournefort (1694) [7] was the first to name cultivated tomatoes as *Lycopersicon* ("wolf peach" in Greek). Linnaeus (1753) placed the tomato in the genus Solanum as *Solanum lycopersicum*, on the other hand Miller (1754) [4] proposed the genus name *Lycopersicon* (Latin-Wolf Peach) and afterward proposed the name as *Lycopersicon esculentum* for cultivated tomato and *Lycopersicon pimpinellifolium* for wild tomato (Miller, 1768) [3]. While many other classifications systems have been proposed since then Terrell *et al*., (1983) suggested that the Miller classification turn out to be the standard due to its common usage. A number of classical and modern authors recognized tomatoes under *Lycopersicon*, but other taxonomists included tomatoes in *Solanum*. Today, based on evidence from phytogenetic studies using DNA sequences and more in-depth studies of plant morphology and distribution, there is general acceptance of the treatment of tomatoes in the genus *Solanum* by both taxonomists and breeders alike.
Tomato is a diploid plant (2n=2x=24) with a basic chromosome number of 12. Among geneticists, tomato is considered an ideal model crop plant for both basic and applied plant research. The genome size of tomato is 950 Mbp which was sequenced in 2012, culminating years of work by the Tomato Genome Consortium.D^2 statistics developed by Mahalanobis (1936) [2] provides a measure of magnitude for divergence between two genotypes under comparison. It considers the variation produced by any character and their consequent effect that it bears on other characters. This technique has been applied in several crops to select genotypes for further breeding programmes. Grouping of genotypes based on D^2 analysis will be useful in choosing suitable parental lines for heterosis breeding.

Materials and Methods

The field experiment of this investigation was conducted at Vegetable Research Farm, Kalyanpur, Department of Vegetable Science, C. S. Azad University of Agriculture & Technology, Kanpur during Rabi season of 2019-20. The experimental materials consisted of forty (40) genotypes of tomato. These genotypes were selected out of the germplasm collection being maintained in Department of Vegetable Science, C.S. Azad University of Agriculture & Technology, Kanpur. The observations were recorded on five randomly selected plants from each treatment and each replication for the characters such as Plant height (cm), Number of primary branches per plant, Number of days to flower initiation, Number of fruits per cluster, Number of days to first fruit maturity, Polar diameter of fruit (cm), Equilateral diameter of fruit (cm) Number of locules per fruit, Number of fruits per plant and Fruit yield per plant (kg). Mahalonobis (1936) [2] D^2 statics was used for assessing the genetic divergence between populations comprising 40 tomato genotypes. Taking D^2 value as measure of generalized distance between the two genotypes, the genotype formation suggested by Tocher's started with two closely associated genotypes whose distance was the least and found third genotype which had the next least average D^2 from the first two. Similarly, the fourth was chosen in which there was the smallest average D^2 from the first three and so on (Rao, 1952) [6].

Result and Discussion

The forty genotypes were grouped into five cluster (Table 2). Cluster-V (10) having highest number of genotypes followed by cluster-III (10), cluster-II (9), cluster-I (7) and cluster-IV (4). The genotypes falling in a cluster are less divergent than the ones, which are placed in different clusters. Maximum intra cluster distance observed in I and IV, followed by III and IV, followed by II and III (Table 4). Maximum intra cluster distance indicates diversity among genotype falling in those clusters. It clearly indicates that crossing between maximum diverse genotypes would result better heterosis or better yield. The result pertaining to the contribution of each character toward total divergence are presented in table 1. For all combinations (i.e., 780) each character was ranked on the basis of its percent contribution towards total divergence. Number of fruits per plant showed maximum contribution (62.31%), followed by plant height (cm) (21.67%), fruit length (cm) (5.26%), number of locule per fruit (3.20), fruit weight per plant (kg) (3.08), fruit width (cm) (2.69%), number of primary branches Per plant (0.64%), number of fruit cluster (0.64%), days to maturity (0.38%). The minimum contribution in divergence was contributed by days to flowering (0.13%). Studies on genetic divergence suggested that the parent for hybridization can be selected from cluster I and IV.

Table 1: Mean value of 10 characters in tomato and contribution towards total divergence

S. No.	Characters	Contribution towards total divergence
1.	Days to flowering	0.13
2.	Days to maturity	0.38
3.	Plant height (cm)	21.67
4.	Number of primary branches per plant	0.64
5.	Number of fruit cluster per plant	0.64
6.	Fruit length (cm)	5.26
7.	Fruit width (cm)	2.69
8.	Number of locule /fruit	3.20
9.	Number of fruit/plants	62.31
10.	Fruit weight per plant (kg)	3.08
	Total	100

Table 2: Grouping of forty genotypes of tomato in five clusters

S. No.	Genotypes										
I	5193,	5414,	6040,	7009,	7045,	7081,	8308				7
II	5515,	5906,	6031,	6602,	6904,	7017,	7033,	7701,	8201		9
III	5901,	6516,	6802,	6901,	7036,	7038,	7060,	7063,	7094,	8514	10
IV	7049,	7070,	8104,	8402							4
V	5048,	51134,	53106,	6132,	6303,	6519,	7012,	8102,	8306,	8314	10
	Total										40

Table 3: Cluster mean of different cluster for 10 quantitative traits in tomato

S. No.	Characters/clusters	I	II	III	IV	V
1.	Days to flowering	16.00*	21.78	17.40	24.00**	16.50
2.	Days to maturity	69.57	81.00	69.40*	81.00**	71.10
3.	Plant height (cm)	158.71*	174.78	162.80	207.00**	182.70
4.	Number of primary branches per plant	11.59*	12.09	11.26	12.55	13.30**
5.	Number of fruit cluster per plant	7.71	7.82**	6.26*	6.85	7.04
6.	Fruit length (cm)	2.60*	3.29	3.58	3.66**	3.39
7.	Fruit width (cm)	3.42	3.62**	2.84*	3.18	3.22
8.	Number of locule per fruit	2.21	2.21	2.53	3.33**	2.16*
9.	Number of fruits per plant	175.71	159.11*	181.20	159.25	249.10**
10.	Fruit weight per plant (kg)	2.29*	2.52	2.33	2.73	3.53**

Table 4: Intra and Inter cluster distances of genotypes for five clusters

	I	II	III	IV	V
I	4.66	6.60	6.86	19.44	9.73
II	-	6.20	9.54	8.70	9.79
III	-	-	5.47	9.79	8.46
IV	-	-	-	4.32	14.59
V	-	-	-	-	6.70

Conclusions

Studies on genetic divergence suggested that the parent for hybridization can be selected from cluster I and IV.

References

1. FAO. FAOSTAT statistical database 2018. [Rome]http://www.fao.org/faostat/en/
2. Mahalanobis PC. On the generalized distance in statistics. Proceedings of National Academic Science, India 1936;2:79-85.
3. Miller P. The gardener's dictionary, Abridged 8th ed. London 1768.
4. Miller P. The gardener's dictionary, Abridged 4th ed. London: John and James Rivington 1754.
5. NHB. Estimated Area and Production for Horticulture Crops for 2018-2019. http://www.nhb.gov.in/area%20_production.html. National Horticulture Board, Gurgaon.
6. Rao CR. Advanced Statistical Methods in Biometrical Research. John Willey and sons Inc., New York 1952, 357-363.
7. Tournefort JP de. Elemens de Botanique. Paris: Imprimerie Royale 1694.
8. Wright S. Correlation and causation. Journal of Agricultural Resources 1921;66(4):557-585.