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Genetic variability heritability and genetic advance in tomato

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Abstract
Studies on genetic variability and component analysis were under taken in tomato in a 10x10 diallel. High value of phenotypic and genotypic coefficient of variation for number of locules per fruit and fruit yield per plant was observed. The magnitude of heritability in conjunction with genetic advance was observed for number of seeds per fruit.

Keywords: Variability, tomato, heritabililty and yield

Introduction
Tomato (*Lycopersicon esculentum*) is one of the most important vegetable plants in the world. The pulp and juice of fruit are easily digestible; a promoter of gastric secretion and it is an excellent blood purifier. It also reduces fats and cures many diseases. Variability is the basis of plant breeding. Creation of genetic variability and selection for important is crucial activities that any plant breeder should apply to achieve better yield and other desirable agronomic traits. However, to carry out effective selection, the information on available genetic variation among tomato genotypes, the nature of component traits on which selection would be effective and the influence of environmental factors on each trait need to be known. Thus, effective selection not only depends on estimation of genetic variation among genotypes but also on the proportion of heritable variation and the expected genetic gain that would be obtained.

Materials and Methods
The experimental material comprised ten tomato varieties namely; Pant T-3, Navodaya, Pusa Sheetal, Pusa-120, Pant T-4, PED, Roma, Labonita, Anand T-1 and NDT-9. These varieties were grown during Rabi season 2009 in crossing block. Parents were crossed in half diallel fashion to produce seeds of 45 F_1's and parents were maintained through selfing. Next year 45 F_1's and 10 parents were grown in a Randomized Block Design with three replications. The seedlings were transplanted with 5m row and with spacing of 50x50 cm.
The variance components, genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), Heritability in broad sense (H), and genetic advance (GA) was computed as suggested by Allard (1960) [1].

Results and discussion
The analysis of variance showed significant difference between genotypes for ten quantitative characters of tomato. The mean square due to genotypes was highly significant for almost all the characters. Days to flowering initiation ranged from 27.73 to 37.13 days, with mean values of 33.22 days. The phenotypic and genotypic coefficients of variation were 5.654% and 4.636% respectively. The mean value of variation was 52.23 cm for plant height at maturity which ranged from 45.10 to 59.04 cm. The phenotypic and genotypic coefficients of variation were 12.732% and 4.636% respectively. The range of variation for number of primary branches per plant was 4.16 to 6.59 with mean value of 5.31. The phenotypic and genotypic coefficients of variation were 12.732% and 12.204% respectively. Number of fruits per plant was ranged from 15.40 to 25.83 with mean value of variation of 17.82 and phenotypic and genotypic coefficients of variation of 10.197% and 9.925% respectively.
The phenotypic and genotypic coefficients of variation for days to first repining were 2.356% and 1.997% respectively whereas, it ranged from 58.69 days to 64.67 days with 62.14 days as the mean value of variation. Reproductive period ranged from 29.19-36.57 days with mean value of variation of 33.27. The phenotypic and genotypic coefficients of variation were 5.800% and 4.683% respectively. Number of locules per fruits was varied from 4.14 to 6.46 with 4.97 as the mean value of variation.

The Phenotypic and genotypic coefficients of variation were 14.392%and 14.110% respectively. The fruit size per plant ranged from 4.60 to 6.07 with 5.19 as the mean value of variation. The phenotypic and genotypic coefficients of variation were 7.398% and 6.805% respectively. Number of seeds per fruit varied from 92.03 to 128.09 seeds around the mean of 111.18 seeds. The phenotypic and genotypic coefficients of variation were 8.345% and 7.974% respectively.

Fruit yield per plant ranged from 1.75 to 3.14 with 2.30 mean value of variation. Phenotypic and genotypic coefficients of variation were 12.895% and 12.331% respectively. The close correspondence and higher magnitude of phenotypic as well as genotypic coefficients of variation showed that genotypes evaluated had sufficient variability to general transgressive segregants for seed yield and other key components.

Maximum heritability estimate was observed for plant height at maturity (96.32%) followed by total number of locules per fruit (96.12%), number of fruits per plant (94.74%), Primary branches per plant (91.87%) , fruit yield per plant (91.45%), number of seeds per fruit (91.30%), fruit size per plant (84.62%), days to first repining (71.85%), days to flower initiation (67.23%) and minimum for reproductive period (65.19%), are in agreement with Saeed *et al* (2007) [9]. High heritability estimates were also reported for these characters by Giberel *et al* (1982) [4]. The higher value of heritability (>60%) for all characters studied indicated the ample opportunities for selection to be effective in the pool of material examined. The highest estimates of genetic advance observed for number of seeds per fruit (17.45) followed by plant height at maturity (6.90), number of fruits per plant (3.54), days to flower initiation (2.60), reproductive period (2.59), days to first ripening (2.16), number of locules per fruit (1.41), primary branches per plant (1.28), fruit size per plant (0.669) and lowest for fruit yield per plant (0.59), are in agreement with Brar *et al* (1998) [2]. The estimates of heritability in conjunction with genetic advance are generally regarded to be more useful in predicting the gain through selection (Johson 1955).The character which showed higher estimates of genetic advance % (>10%) coupled with higher estimates of heritability (>75%) was only number of seeds per fruit, is in agreement with Mishra *et al* (1990) [8].

Conclusion

The present study clearly demonstrates that there is significant difference between genotypes for ten quantitative characters of tomato. The genotypes evaluated had showed sufficient variability to general transgressive segregants for seed yield and other key components.

Table 1: Range, Mean, Coefficient of variation, Heritability and Expected Genetic Advance for different Quantitative Characters in tomato

S. No	Characters	Range	Mean	SE_m	PCV	GCV	Heritability (%)	Expected Genetic Advance
1.	Days to flower initiation	27.73-37.13	33.22	0.620	5.654	4.636	0.672	2.602
2.	Plant height at maturity	45.10-59.04	52.23	0.385	12.732	4.636	0.963	2.602
3.	Primary branches per plant	4.16-6.59	5.31	0.111	12.732	12.204	0.918	1.280
4.	Days to first ripening	58.69-64.67	62.14	0.448	2.356	1.997	0.718	2.167
5.	Number of fruits per plant	15.40-25.83	17.82	0.240	10.197	9.925	0.947	3.547
6.	Reproductive period	29.19-36.57	33.27	0.657	5.800	4.683	0.651	2.592
7.	Number of locules per fruit	4.14-6.46	4.97	0.081	14.392	14.110	0.961	1.418
8.	Fruit size per plant	4.60-6.07	5.19	0.086	7.398	6.805	0.846	0.669
9.	Seeds per fruit	92.03-128.09	111.18	1.580	8.345	7.974	0.913	17.452
10.	Fruit yield per plant	1.75-3.14	2.30	0.050	12.895	12.331	0.914	0.560

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