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Studies on genetic variability, heritability and genetic advance for yield and yield components in F_2 segregating population of tomato (*Solanum lycopersicon* L.)*

Tomato (*Solanum lycopersicon* L.) is one of the most popular and widely consumed vegetable crops throughout the world, both for the fresh fruit market and the processed food industry. Its adaptation to fit many diverse uses and environments is a reflection of the great wealth of genetic variability existing in the genus *Solanum,* which can be exploited in applied breeding programs (Tigchelaar and Basset, 1986). Systematic study and evaluation of tomato germplasm is of great importance for current and future agronomic and genetic improvement of the crop. Furthermore, if an improvement program is to be carried out, evaluation of germplasm is imperative, in order to understand the genetic background and the breeding value of the available germplasm (Agong *et al.,* 2000). The genetic variance of any quantitative trait is composed of additive variance (heritable) and non-additive variance and include dominance and epitasis (non-allelic interaction). Therefore, it becomes necessary to partition the observed phenotypic variability into its heritable and non-heritable components with suitable parameters such as phenotypic and genotypic coefficient of variation, heritability and genetic advance. So, proper evaluation of genetic resources is essential to understand and estimate the genetic variability and heritability. Hence, the present study was conducted to study the genetic variability, heritability and genetic advance for yield and yield components in F_2 segregating population of tomato.

The experiment was conducted in the botanical garden, Department of Genetics and Plant Breeding, University of Agricultural Sciences, Dharwad. Totally 284 F_2 tomato plants derived from crossing between susceptible female parent (Pusa Ruby) and resistant male parent (CLN 2768A) were evaluated for yield and yield components during *kharif* 2011-12.

The F_2 progenies were grown in nursery bed. The seeds were treated with Capton @ 0.1 per cent before sowing to prevent damping-off disease as a precautionary measure, which is usually prevalent in *kharif* season and the seeds were sown in beds of 2 m x 1.2 m x 15 cm length, width and height, respectively.

All nursery package of practices were followed. The main field was brought to a fine tilth and FYM at the rate of 25 tonnes per hectare was mixed well in soil at the time of land preparation. Ridges and furrows were prepared at 60 cm spacing. Fertilizer dose at the rate of 60 kg N, 80 kg P_2O_5 and 50 kg K_2O per hectare was applied at the time of planting. Thirty days old seedlings were transplanted in the main field with a spacing of 60 x 60 cm in June, 2012 and required agronomic practices were followed to raise a good crop. Each plants were tagged for recording quantitative characters, which included days to 50 per cent flowering, plant height, number of primary branches per plant, number of inflorescence per plant, number of flowers per plant, number of fruits per plant, average fruit weight and fruit yield per plant. Genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability in broad sense (h^2 bs), genetic advance (GA) and genetic advance as percentage over mean were analyzed following the formula illustrated by Singh and Chaudhary (1977).

The Estimates of different genetic variability parameters are presented in Table 1. Results showed that the genotypic coefficient of variation was the highest for number of fruits per plant (0.7171), followed by number of flowers per plant (0.5525), average fruit weight (0.3767), number of inflorescence per plant (0.3535), and fruit yield per plant (0.2058), whereas the lowest GCV was found for days to 50 per cent flowering (0.0516), followed by plant height (0.1235), number of primary branches per plant (0.1889), The highest phenotypic coefficient of variation was recorded for number of fruits per plant (0.7263), followed by number of flowers per plant (0.5782), number of inflorescence per plant (0.4853), average fruit weight (0.4049), number of primary branches per plant (0.3197), and fruit yield per plant (0.2586), whereas the lowest PCV was recorded for days to 50 per cent flowering (0.1257) and plant height (0.1628). Similarly, the highest GCV and PCV values were reported for number of fruits per plant by Firas Al-Aysh *et al.* (2012) and lowest GCV and PCV values were reported for days to 50 per cent flowering by Aradhana and Singh (2003) and Mohamed *et al.* (2012). Genotypic coefficient of variation, which is the true indicator of the extent of genetic variability in a population, was high for all the characters, except days to 50 per cent

Table 1. Mean, Range and genetic parameters for eight quantitative traits in F_2 population of the cross Pusa Ruby x CLN 2768A in tomato

Characters	Mean	Range		PCV (%)	GCV (%)	h^2 (bs) (%)	Genetic advance	Genetic advance over mean (%)
		Min	Max					
Days to 50 per cent flowering	38.16	30.00	44.00	12.57	5.16	16.86	1.67	4.37
Plant height (cm)	88.01	30.00	106.00	16.28	12.35	57.60	17.00	19.31
No. of primary branches/plant	4.59	2.00	9.00	31.97	18.89	34.92	1.06	23.00
No. of inflorescence/plant	4.25	4.00	11.00	48.53	35.35	53.06	2.26	53.04
No. of flowers/plant	27.71	35.00	110.00	57.82	55.25	92.99	30.69	110.75
No. of fruits/plant	20.71	22.00	94.00	72.63	71.71	96.02	29.75	143.66
Average fruit weight (g)	68.12	60.00	226.00	40.49	37.67	86.56	49.18	72.19
Fruit yield/plant (g)	1347.93	480.00	5196.00	25.86	20.58	48.96	150.25	151.86

GCV- Genotypic coefficient of variation, PCV- Phenotypic coefficient of variation, h^2 (bs) - Heritability

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flowering. In general, higher PCV values than GCV were obtained for all tested traits.

The highest heritability was recorded on number of fruits per plant (96.02%) with an expected genetic advance over percentage of mean of 143.66% followed by number of flowers per plant (92.99%) with an expected genetic advance over percentage of mean of 110.75 per cent, and average fruit weight (86.56%) with an expected genetic advance over percentage of mean of 72.19 per cent, while the lowest heritability was that of days to 50 per cent flowering (16.86%) with an expected genetic advance over percentage of mean of 4.3. All the tested characters have high heritability estimates illustrated that they will be affected by environmental condition.

Higher GCV and PCV were recorded for characters like number of fruits per plant, number of flowers per plant, average fruit weight, number of inflorescence per plant, and fruit yield per plant indicating higher magnitude of variability for these characters. The results are in conformity with the findings of Firas Al-Aysh *et al.* (2012).

Heritability (bs) was observed for the characters like number of fruits per plant, number of flowers per plant, and average fruit weight, indicating that these traits are controlled by additive gene action which is very useful in selection. Similar results were noticed by Shashikanth *et al.* (2010) and Pujari *et al.* (1995) and Parvinder *et al.* (2002). The estimates of heritability alone fail to indicate the response to selection. Therefore, heritability estimates appear to be more meaningful when accompanied by estimates of genetic advance and genetic advance as percentage over mean.

High estimates of heritability and genetic advance as per cent over mean were noticed for number of flowers per plant, number of fruits per plant, and average fruit weight which might be assigned to additive gene effects governing their inheritance and phenotypic selection for their improvement could be achieved by simple breeding methods. So, the findings suggested that for getting higher yield, selection should be practiced for yield related traits giving equal importance to number of flowers per plant, number of fruits per plants and fruit weight.

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