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Genetic variability studies in tomato (*Solanum lycopersicum* L.)

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ABSTRACT
Twenty four tomato genotypes were evaluated in randomized block design with three replications. The experiment was done in the Vegetable Research Farm of Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar during Rabi season 2015-16. The purpose of the study was to reveal the genetic variability among the yield and yield attributing traits were studied on 24 tomato genotypes. Significant differences among genotypes were observed in all characters. The genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were high for average fruit weight, number of fruits per plant, fruit yield per plant, number of primary branches per plant and plant height at maturity. All characters were highly heritable in broad sense. All the characters had showed high heritability coupled with high genetic advance as per cent of mean except number of days to flower initiation and number of days to fruit initiation indicating the presence of additive gene effects which may be utilized for improvement through phenotypic selection for yield improvement.
Key words: *Variability, Heritability, Genetic advance as per cent of mean*

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INTRODUCTION

Tomato (*Solanum lycopersicum* L., 2n=2x=24) is one of the most important and popular vegetables in the world because of its wider adaptability, high yielding potential and suitability for variety of uses in fresh as well as processed food industries (He *et al*., 2003; Nwosu *et al*., 2014). It belongs to the family Solanaceae and is native of Peru Equador region (Jenkins, 1948; Rick, 1969) and is normally a self-pollinated crop. In India, tomato occupies an area of 0.88 mha having the production of 18.26 mt. However, the productivity is only 21.2 MT/ha (Anonymous, 2014). As a cash crop, it has great demand in the international market (Hannan *et al*., 2007a; Solieman *et al*., 2013). Tomatoes are an excellent source of minerals and vitamins (Akinfasoy *et al*., 2011). Its vitamin C content is particularly high (Kanyomeka & Shivute, 2005). Tomato's fruit is consumed in providing salads and cookies. In addition, it is used to can, paste, ketchup, sauce, puree and fruit juice (Maitidevi & Kathmandu, 2008). Tomato soup is good remedy for patients suffering from constipation and very good appetizer (Kalloo *et al*., 2001). During ripening, there is a 500 fold increase in the level of lycopene in tomato fruit (Bai & Lindhot, 2007). Increased lycopene has proven nutritional value as an antioxidant that is associated with a low incidence of certain forms of human cancer (Giovannucci *et al*., 2002; Bai & Lindhot, 2007). Tomato is grown as an annual or short lived perennial herbaceous plant. It has tap root and growth habit of the plant is determinate, semi-determinate and indeterminate (Reddy *et al*., 2013).

An improvement in yield and quality in self pollinated crops like tomato is normally achieved by selecting the genotypes with desirable character combinations existing in nature or by hybridization .The success of hybridization programme depends upon selection of suitable parents of diverse origin (Sekhar *et al*., 2008). Genetic variability is essentially the first step of plant breeding for crop improvement which is immediately available from germplasm.

MATERIALS AND METHODS

The present investigation was carried out in the Vegetable Research Farm, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar. The twenty four genotypes were planted during *Rabi*

season 2015-16 in a Randomized Block Design with three replication. They were evaluated for yield and yield attributing traits.

Observations were taken from five randomly selected plants from each treatment and each replication. Data on various yield and yield attributing characters were recorded. The arithmetic mean of the observations taken on the random plants was used as the mean data for each character. The genetic parameters in tomato based on quantitative traits (yield and its attributes) were statistically analyzed through OPSTAT (Statistics Analytical Software) developed by Department of Statistics, Chaudhary Charan Singh Haryana Agricultural University, Hisar.

RESULTS AND DISCUSSIONS

The mean sum of square due to treatment for morphological traits viz; plant height at maturity, number of primary branches per plant, number of days to flower initiation, number of days to fruit initiation, fruit length, fruit diameter, number of fruits per plant, average fruit weight and fruit yield per plant was highly significant at 1% level of significance indicating the presence of significant differences among the genotypes for all the studied characters. Similar result for these morphological traits were also reported by Pradeepkumar *et al*. (2001) and Mohamed *et al*. (2012).

Generally, the PCV values were slightly higher than the respective GCV for all the characters denoting little environment factors influencing expression of these traits and they could be improved by following different phenotypic selection like directional, disruptive and stabilized selections. The PCV ranged from 8.471 for number of days to fruit initiation to 48.639 for average fruit weight (Table 1). Similarly GCV ranged from 6.193 for number of days to fruit initiation to 48.004 for average fruit weight. High PCV and GCV values which was observed in average fruit weight (48.639 and 48.004), number of fruits per plant (47.556 and 46.839) and number of primary branches per plant (27.575 and 26.525) suggested that these characters account for the highest variation in tomato. This also agreed with the report of Denton and Nwangburuka (2011), Shankar *et al*. (2013) and Meitei *et al*. (2014).

The estimates of broad sense heritability among the characters varied from moderate to high. For plant height at maturity (86.00), number of primary branches per plant (92.50), number of days to flower initiation (55.10), number of days to fruit initiation (53.50), fruit length (78.90), fruit diameter (81.00), number of fruits per plant (97.00), average fruit weight (97.41) and fruit yield per plant (83.80). This indicates that these characters are under the influence of additive gene effect and therefore suggests that any selection in tomato based on phenotype of these characters will be effective in fruit yield. This agreed with the report of Mohamed *et al*. (2012) and Ahirwar *et al.* (2013).the highest value of heritability was observed for average fruit weight (97.41) followed by number of fruits per plant (97.00) and number of primary branches per plant (92.5), while the lowest value was found for number of days to fruit initiation (53.50) (Table 1). Although high heritability estimates have been found to be helpful in making selection of superior genotypes on the basis of phenotypic performance, Johnson *et al*. (1955) suggested that heritability estimates along with genetic gain were more useful in predicting selection of the best individual. High heritability estimates along with high genetic advance as percent of mean for plant height at maturity (, number of primary branches per plant, fruit length, fruit diameter, number of fruits per plant, average fruit weight and fruit yield per plant were obtained suggesting a wide scope for improvement through selecting of these traits. Similar results were obtained by Mehta and Asati (2008), Singh *et al.* (2008), Mohamed *et al.* (2012) and Ahirwar *et al*. (2013).

Table 1. Estimates of genetic parameters in tomato

Sl. No.	Characters	σ^2_g	σ^2_p	GCV	PCV	h^2 (Broad sense) %	GA as % of Mean
1	Plant height at maturity (cm)	386.92	449.90	22.33	24.08	86.00	42.67
2	No. of primary branches/plant	2.97	3.21	26.53	27.57	92.50	52.56
3	No. of Days to flower initiation	31.39	57.01	9.01	12.14	55.10	13.77
4	No. of Days to fruit initiation	24.28	45.43	6.19	8.47	53.50	9.33
5	Fruit length	0.41	0.52	16.61	18.71	78.90	30.40
6	Fruit diameter	0.42	0.51	17.02	18.91	81.00	31.55
7	Number of fruits per plant	207.50	213.91	46.84	47.56	97.00	95.03
8	Average fruit weight	464.31	476.66	48.00	48.64	0.97	97.60
9	Fruit yield per plant	0.19	0.23	36.87	40.28	83.80	69.54

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