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Studies on variability, heritability and genetic advance in tomato hybrids

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Abstract

The present investigation was conducted at the Vegetable Research Farm Maharajpur, JNKVV, Jabalpur during Rabi season 2017. The experimental material consisted of twenty five tomato hybrids. The experiment was conducted in randomized block design with three replications. The plot size was kept at 3.0 X 2.5 m, each plot consisted of 5 rows with 5 plants in one row spaced at 60 X 50 cm apart. Traits in the present investigation showed considerable genetic variability with regard to heritability, genetic advance and correlation coefficient mean value for all the characters had a wide range of variability. The present investigation revealed that the phenotypic coefficient of variation was higher than the corresponding genotypic coefficient of variation for all the traits. High phenotypic and genotypic coefficient of variation was recorded for fruit yield/ plant (kg) (29.18 and 26.23 %) followed by number of fruit /plant (24.26 and 23.55 %), number of flower/cluster (20.25 and 18.44 %), number of flower clusters/plant (17.20 and 16.53 %), number of fruit/ cluster (16.81 and 15.44 %). High heritability coupled with high genetic advance as percentage of mean was recorded for number of fruit/plant (94.23 and 47.10 %), and fruit yield/ plant (80.81 and 48.58 %).

Keywords: tomato, hybrids, Jabalpur

Introduction

Tomato (*Lycopersicon esculentum* Mill.) is the native of tropical America and it is the important vegetable amongst the Solanaceous group. It is one of the most important protective fruit vegetables for both health and wealth because of its special nutritive value and wide spread production. The area under tomato in M.P. was about 20.4 thousand hectare with production of 306.70 thousand tonnes and productivity of 15 tonnes per hectare.

Presence of genetic variability in a population is of prime importance for any successful breeding programmes. Greater variability in crop plants provides an opportunity for selecting desirable type. Selection is said to be effective in a population having high heritability.

The knowledge of pattern of inheritance of various characters are important consideration while determining the most appropriate breeding procedure. Selection may not be effective in population without genetic variability.

Heritability is an index of transmissibility of characters from one generation to other generation for assessing the magnitude of genetic portion of total variability and an aid to mark improvement in a crop by selection for various characters. But heritability alone dose not give true picture of genetic improvement to be affected by selection, therefore, crop improvement by various schemes of selection is essential to study the extent of heritability along with genetic advance.

Material and Methods

The experiment was conducted at Vegetable Research Farm, Department of Horticulture, Maharajpur, JNKVV, Jabalpur (M.P.). Jabalpur is situated on Satpura hills and Kaymore plateau agro-climatic region of Madhya Pradesh. The topography of experimental field was uniform with good irrigation facilities. The experimental material included 25 hybrids of tomato collected from different states of India. Statistical procedure adopted is as follows:

Mean

The mean of all the observations in each replication was worked out as follows:

$$Mean(\bar{X}) = \frac{\sum_{i=1}^N X_i}{N}$$

Where,

$\sum x_i$ = the sum of all the observations

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N= Number of observations

Genotypic coefficient of variation (GCV)

Genotypic coefficient of variation was computed as per the method suggested by Burton (1952).

$$GCV = \sqrt{\frac{\sigma_g^2}{\bar{X}}} \times 100$$

Phenotypic coefficient of variation (PCV)

Phenotypic coefficient of variation was computed by dividing the square root of phenotypic variance by population mean and multiplying by 100.

$$PCV = \sqrt{\frac{\sigma_p^2}{\bar{X}}} \times 100$$

Heritability (broad sense)

Heritability of a character on the other hand is an index of its transmissibility. In broad sense, it may be defined as the proportion of genotypic variance to phenotypic variance and is calculated by the formula suggested by Hanson *et al.* (1956).

$$h_{bs}^2 = \frac{\sigma_g^2}{\sigma_p^2} \times 100$$

Genetic advance as percent of mean

$$GA(\%) = \frac{\text{Genetic advance}}{\bar{x}} \times 100$$

Results and Discussion

Coefficient of variation

The genotypic coefficient of variation ranged from 3.83% to 26.23 % for different characters under study. High genotypic coefficients of variation was observed for fruit yield/ plant (26.23%) followed by number of fruits/ plant (23.55%), number of flower/ cluster (18.44%), number of flower cluster/ plant (16.53%), No. of fruit/ cluster (15.44%), weight/fruit (12.66%), length of fruit (12.51%), girth of fruit (10.72%), number of primary branches (9.06%).

It is revealed from the table: 1 that phenotypic coefficient of variation was recorded from 4.88% to 29.18% for different characters under study.

Highest phenotypic coefficient of variation was observed for the character viz., fruit yield/ plant (29.18%) followed by number of fruits/ plant (24.26%), number of flower/ cluster (20.25%), number of flower cluster/plant (17.14%), length of fruit/cluster (16.81%), girth of fruit (14.77%), weight/fruit (14.30%).

Similar result were reported by Reddy and Reddy (1992) [7], Singh *et al.* (2004) [10], Mayavel *et al.*, (2005) [4], Rajesh Kumar (2006) [6] and Shashikala *et al.* (2002) [8].

Heritability (h²)

Result presented in table: 1 revealed that the heritability estimates ranged from 32.65 to 94.23% for the different characters under study.

High heritability was recorded for number of fruit/ plant (94.23%), followed by number of flower cluster per plant (88.53%), number of fruit per cluster (84.37%), number of flower per cluster (82.94%), fruit yield per plant (80.81%), weight of fruit (78.37%), days taken to first picking (64.36%), days taken to first fruit setting (61.72%), length of fruit (53.25%), girth of fruit (52.76%), days to 50% flowering (46.82%), moderate values were noted for plant height at final picking (37.57%), number of primary branches per plant (32.65%).

Similar results were reported by Vikram and Kohli (1998) [11], Munshi and Behera (2000) [5], Singh and Cheema (2005) [9] and Rajesh Kumar (2006) [6].

Genetic advance

It is evident from the table: 1 that the genetic advance in percent of mean varies from 6.21% to 48.58% for different characters. Highest genetic advance was observed for the character fruit yield per plant (48.58%), followed by number of fruit per plant (47.10%), number of flower per cluster (34.60%), number of flower cluster per plant (33.33%), number of fruit per cluster (29.23%), weight of fruit (23.09%), length of fruit (18.80%), girth of fruit (16.05%), number of primary branches per plant (10.66%), days to 50% flowering (9.34%), however, low genetic advance were observed for plant height at final picking (7.40%), days taken to first picking (7.24%), days taken to first fruit setting (6.21%).

These findings are in agreement with Vikram and Kohli (1998) [11], Das *et al* (1998) [2], Munshi and Behera (2000) [5].

Table 1: Genetic parameters of yield and its components in Tomato

Characters	Grand Mean	Range		PCV (%)	GCV (%)	Heritability (BS)	Genetic advance as (%) of means
		Min.	Max.				
Plant Height (at final picking)	71.09	62.21	90.20	9.56	5.86	37.57	7.40
No. of primary branches	8.38	6.34	11.01	15.86	9.06	32.65	10.66
Days to 50% flowering	41.05	35.67	47.00	9.69	6.63	46.82	9.34
Days to first fruit setting	53.49	47.33	59.33	4.88	3.83	61.72	6.21
Days to first picking	95.76	88.33	109.00	5.46	4.38	64.36	7.24
No. of flower cluster/plant	39.12	25.0	51.33	17.20	8.53	88.53	33.33
No of flower/ cluster	5.27	3.00	7.66	20.25	18.44	82.94	34.60
No. of fruit/cluster	4.69	3.00	6.22	16.81	15.44	84.37	29.23
No. of fruit/plant	37.02	22.70	57.80	24.26	23.55	94.23	47.10
Length of fruit (cm)	5.93	4.60	8.23	17.14	12.51	53.25	18.80
Girth of fruit (cm)	9.50	6.33	12.57	14.77	10.72	52.76	16.05
Weight/fruit	44.92	35.73	63.89	14.30	12.66	78.37	23.09
Fruit yield/plant	0.751	0.388	1.52	29.18	26.23	80.81	48.58

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