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Studies on Variability and Association of Characters in Tomato*

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The phenotypic and genotypic variability, heritability and association of characters were worked out in 55 tomato varieties. The results revealed that the varietal differences in respect of height of plant, number and spread of branches, girth of main stem, weight of fruit, number of fruits, ascorbic acid content, fruit firmness, locules, duration, yield, acidity and total soluble solids were significant. The genetic coefficient of variation was very high for ascorbic acid content followed by weight of fruit, Number of fruits, locules yield and plant height indicating high degree of genetic variability. The heritability estimates and genetic advance for yield components namely number and spread of branches, weight of fruit and number of fruits were high denoting their utility as reliable indices for selection. Yield was positively associated with spread and number of branches and weight of fruit.

Tomato offers a fairly large number of well defined quantitative characters for genetical analysis since it lends very well to the controlled pollination resulting in a high degree of homogeniety (Rick and Butler, 1956). Yield in tomato is a comlex and quantitatively inherited polygenic character influenced by environmental fluctuations. The programme of breeding is primarily conditioned by the magnitude, nature and interaction of genotype and environment. The primary aim in crop improvement is to isolate genetically distinct superior genotypes. The effectiveness of selection will be increased if indices of selection are formulated partitioning the heritable and non-heritable portion of variations. With these objectives, the tomato cultivars assembled from different agro-climatic regions of India and other countries were evaluated. The studies on variability of the economic traits and the association among themselves and the yield were undertaken.

MATERIAL AND METHODS

Fifty five varieties of tomato collected from different geographical regions were grown in Randomised Blocks design with two replications. Each plot had 50 plants sown in a spacing of 75 cm x 60 cm. Observations were recorded on ten plants randomly selected from each plot for height of plants, number of branches, spread of branches, girth of mainstem, weight of fruit, number of fruit per plant, ascorbic acid content of fruit, firmness of fruit, flesh thickness, acidity, T.S.S. and no. of locules. The firmness of the fruit was measured as suggested by Hamson (1952)

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with a pressure tester specially designed for this purpose. The ascorbic acid was estimated by indophenol method (Bassey, 1942) and T.S.S. by AOAC (1960) method.

The varience, correlation coefficients and linear regression were calculated according to Panse and Sukhatme (1954). Genetic coefficients of variance were computed as suggested by Burton (1952). Heritability was calculated in the broadsense by the formula suggested by Hanson, Robinson and Comstock (1956). The expected genetic advance was calculated as suggested by Lush (1949) and Johnson, Robinson and Comstock (1955).

RESULTS AND DISCUSSION

The mean performance of the varieties for all the characters are presented in Table I.

The differences among the varieties were significant for all the characters observed except flesh thickness. A vide range of variation was observed with reference to the height, number and spread of branches, weight of fruit, number of fruit per plant, ascorbic acid content and number of locules, while girth of main stem, firmness of fruits, acidity, yield and duration had a narrow range.

The phenotypic and genotypic variance, genotypic coefficient of variability, heritability, genetic advance and genetic advance expressed as percentage of mean are presented in Table II.

Genotypic coefficient of variation measures the range of genetic variability in the traits, It ranged from 7.90 for total soluble solids to 64.70 for ascorbic acid content. The genetic coefficient of variation was very high in ascorbic acid content (64.70) followed by weight of fruit (40.70), number of fruits (37.20), number of locules (36.0), yield (29.4) and height (23.2) indicating

TABLE I. Phenotypic variation

Characters	Range	Mean	SED	CD (P=0.05)
Height (cm)	44—141	81.60	14.30	28.70
Number of branches	5.5—29	12.80	1.53	3.07
Spread of branches	39.5—79	59.60	6.19	12.41
Girth of main stem (cm)	1.17—1.80	1.39	0.17	0.34
Weight of fruit (g)	7—102	37.70	6.53	13.09
Number of fruits/plant	6.2—138.4	48.90	7.23	14.50
Firmness of fruit	1—3	1.770	0.347	0.695
Flesh thickness (cm)	0.2—0.66	0.30	NS	NS
Number of locules	2—10	3.8	0.792	1.600
Ascorbic acid (mg/100 gm)	4.29—28.6	13.03	3.84	7.6
Acidity	0.300—1.088	0.596	0.017	0.034
T.S.S. %	3.2—7.4	5.5	0.354	0.710
Yield (Kg)	0.554—2.134	1.243	0 230	0.460
Duration	135—152	148.80	6.64	13.30

TABLE II. Variance, coefficient of variation, heritability and genetic advance in tomato

Characters	Phenotypic variance	Genotypic variance	G.C.V. (Genetic coefficient of variance	Heritability	G.A. (Genetic advance	Genetic advance expressed as %of mean
Height	461.660	359.400	23.2	78	34.46	43.22
Number of branches	6.640	5.350	18.04	83	4.34	33.91
Spread of branches	50.850	31.651	9.42	62	9.15	15.35
Girth of main stem	0.045	0.031	12.61	68	0.30	21.58
Weight of fruit	257.000	235.600	40.70	92	30.27	80.29
Number of fruits/plant	357 150	331.020	37.20	93	36.07	73.76
Ascorbic acid	78.790	71.390	64 70	91	16.57	27.17
Firmness of fruit	0.110	0.053	12.90	46	0.33	18.04
Acidity	0.020	0.009	15.70	41	0.13	21.81
T.S.S	0.260	0.193	7.90	75	0.79	14 36
Number of locules	2.200	1.880	36.0	85	2.60	68.43
Duration	191.800	169.700	8.75	88	25.23	16.56
Yield	0.157	1.131	29.04	83	0.68	54.71

high degree of genetic variability for these characters. Padda *et al*. (1971) reported high genetic variation for ascorbic acid content, in tomato. High genetic variation for number of fruits and number of locules was respected by Saini and Sood,(1971)and Nandpuri *et al*. (1973). High genetic variability and moderate genetic coefficient of variation were observed for plant height.

Genetic variability for number and spread of branches, girth of stem, T.S.S. acidity firmness of fruits and duration was comparatively low as indicated by genetic coefficient of variation. It could be inferred that these traits are influenced more by environment and as such it may not be possible to effect futher improvement as reported by Srivastava and Sachan(1973) in brinjal. On the contrary high genetic variability for acidity was observed in tomato by Padda *et.al* (1971).

The genetic coefficient of variation together with the heritability estimates would give the best picture of the extent of advance to be expected from selection (Burton, 1952). Heritability in broadsense was high for number of fruits (95%), (Nandpuri *et al* 1971) weight of fruits (92 per cent)ascorbic acid content 91 per cent) (Padda *et al* 1971) duration (88 per cent), number of locules(85 percent) (Chaudhary and Khanna 1971) yield (83 per cent) (Srivastava and Sachan 1973) and branches (83 per cent) offering greater scope for selection.

But a morderate heritability estimates for height, T.S.S., girth and spread of branches was observed. Low heritability was recorded for acidity and firmness in this study. In the present investigation through the heritability was high for number and weight of fruit, ascorbic acid content, duration, number of locules yield and branches genetic advance vary between these characters.

A high heritability coupled with high genetic advance as percentage of mean were observed in ascorbic acid content,

weight of fruit, number of fruits and fruit locule indicating additive gene effect of these characters (Panse, 1957) and hence selection for these characters would be more effective and realistic. Since fruit size is determined by locules (Rick aud Butler, 1956) the selection for ocules number indirectly aids the selection for large sized fruits, Characters ike duration with high heritability did not show greater genetic advance which is due to non-genetic factors.

Correlation : The correlation for yield and its components are presented in Table III.

TABLE III Correlation coefficients between quantitative characters

Characters	'r' value	
Height Vs yield	0.016	NS
Number of branches Vs yield	0.275	*
Girth Vs yield	0.012	NS
Spread Vs yield	0.351	**
Weight of fruits Vs number of fruits	0.554	**
Weight of fruit Vs yield	0.400	**
Number of seeds Vs weight of fruit	0.660	**
Yield Vs duration	0.236	NS
Weight of fruit Vs Number of lacules	0.315	*
Flesh thickness Vs Firmness	−0.521	**

* Significant at 5 per cent

** Significant at 1 per cent

NS Not significant

There was a significant positive correlation between the yield and number of fruits, spread of branches, number and weight of individual fruits. A negative correlation between the weight of individual fruit and number of fruits and a positive correlation between the weight of fruit and number of locules was also observed indicating the close association between these characters.

Based on the studies it was clear that the ascorbic acid content, number of fruits, weight of individual fruits, fruit locules and yield registering a high heritability 83-93 per cent and moderate to high genetic advance (54.71 - 127.17) proved to be useful indices for selection in the genetic improvement of tomato.

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