

GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE FOR YIELD AND PROCESSING CHARACTERISTICS IN TOMATO

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Abstract: Genetic variability and heritability were studied in 64 tomato lines during September 1986 to January 1987. Significant difference was observed for all the characters studied. Index to earliness and fruit cracking showed high genotypic coefficient of variation. High heritability coupled with high genetic advance was recorded for insoluble solids and storage life.

Key words: Genetic advance, genetic variability, heritability, tomato.

INTRODUCTION

Evaluation of plant genotypes and estimation of genetic variability, heritability and genetic advance are primary pre-requisites for crop improvement programmes. High heritability coupled with high genetic advance would be a better estimate for selection than heritability alone. The present investigation was undertaken to estimate the extent of variability, heritability and genetic advance in diverse tomato lines including exotic processing types.

MATERIALS AND METHODS

Sixty four tomato lines which included exotic processing lines and popular lines in India were studied. The lines were grown in pots maintaining twelve pots for each entry. Observations on biometric characters were recorded from five randomly selected plants. The chemical composition of tomato fruits were determined following method described by AOAC (1980) except for lycopene (Adsule and Dan, 1976) and consistency (Takada and Nelson, 1983). Variability for quantitative characters was estimated as per Burton (1952). The genetic advance was calculated according to Johnson *et al.* (1955).

RESULTS AND DISCUSSION

The extent of variability in 64 tomato lines was measured in terms of range, mean, phenotypic and genotypic coefficient of variation (Table 1 and 2). Significant difference was observed for all the characters studied. The

observed variation is quite rational in a population from diversified geographical areas bred for specific management and end uses.

Index to earliness showed maximum variability followed by fruit cracking. Index to earliness, which is an indication of economic earliness, showed that known processing tomatoes were late indicated by low index values. Fruit shape index also showed wide variation. Fruits having shape index >1 is characterised by oblong shape, fewer locules, high pericarp thickness and increased firmness. The firm fruited cultivars had high level of crack resistance and prolonged shelf life also. Tomato lines with high pericarp thickness had increased total solids and insoluble solids but low content of reducing sugars and acidity. This observation corroborates the reported variation in solids, sugars and acidity in the pericarp and locular tissue (Stevens *et al.*, 1977; Zhou and Xu, 1984).

High genotypic coefficient of variation was shown by index to earliness (70.85) and fruit cracking (63.22) but the environmental coefficient of variation was higher than *gcv* indicating that environment accounted for major part of the variability. Days to harvest, juice yield and pH showed minimum variability as evidenced by low values of genotypic coefficient of variation. This indicates limited scope for the improvement of these characters by selection.

Heritability was high for fruit shape index (0.95) followed by insoluble solids (0.93)

Table 1. Range, mean and standard error for different characters

Characters	Range	Mean	Standard error
Plant height, cm	60.60 - 136.80	91.90	5.27
Days to flower	57.80 - 76.80	67.51	1.21
Days to harvest	91.20 - 110.40	99.83	1.93
Index to earliness	0.01 - 1.32	0.35	0.13
Fruits/plant	6.00 - 59.00	24.76	4.23
Fruit yield/plant, g	256.56 - 258.98	769.42	83.95
Average fruit weight, g	12.17 - 103.22	38.25	6.34
Fruit shape index	0.71 - 2.02	1.10	0.03
Locules/fruit	2.00 - 6.20	1.78	0.08
Pericarp thickness, mm	2.70 - 7.46	5.22	0.30
Fruit cracking, %	0.00 - 54.29	2.10	0.49
Storage life, days	4.60 -33.20	18.71	1.18
Juice yield, %	66.40 - 87.20	78.80	1.83
TSS, %	3.90 - 6.60	4.92	0.22
Total solids, %	4.49 - 8.03	6.11	0.23
Insoluble solids, %	0.39 - 1.21	0.69	0.03
Reducing sugar, %	2.35 - 4.47	3.19	0.22
Acidity, %	0.28 - 0.74	0.45	0.04
pH	3.84 - 4.82	4.23	0.05
Pulp content, %	14.31 - 34.84	23.83	1.72
Lycopene mg/100g	2.31 - 6.36	3.94	0.34
Carotene (μ g/100g)	204.03 - 580.37	387.96	21.24
Ascorbic acid (mg/100g)	10.65 - 43.50	24.63	2.47

(Table 3). High heritability coupled with high genetic advance as per cent of mean was

shown by insoluble solids and storage life indicating predominance of additive gene effects.

Table 2. Phenotypic, genotypic and environmental coefficient of variation for different characters

Characters	PCV	GCV	ECV
Plant height, cm	22.59	18.59	12.83
Days to flower	7.38	6.19	4.02
Days to harvest	6.49	4.84	4.32
Index to earliness	106.51	70.85	79.10
Fruits/plant	53.85	37.93	38.23
Fruit yield/plant, g	38.37	29.62	24.40
Average fruit weight, g	58.94	45.84	36.58
Fruit shape index	24.39	23.76	5.00
Locules/fruit	18.27	15.47	9.58
Pericarp thickness, mm	23.75	20.00	12.80
Fruit cracking, %	82.20	63.22	76.21
Storage life, days	40.08	37.53	14.08
Juice yield, %	7.34	5.18	5.20
TSS, %	14.94	11.28	9.79
Total solids, %	13.80	12.18	6.48
Insoluble solids, %	33.40	32.29	9.76
Reducing sugar, %	18.68	14.26	12.03
Acidity, %	27.88	22.44	17.07
PH	5.97	5.31	2.80
Pulp content, %	24.70	21.30	12.51
Lycopene mg/100g	27.51	23.15	14.86
Carotene ($\mu\text{g}/100\text{g}$)	23.73	21.74	9.49
Ascorbic acid (mg/100g)	27.74	21.62	17.38

Table 3. Heritability, genetic advance (GA) per cent/mean

Characters	Heritability	GA	GA as % of mean
Plant height, cm	0.68	28.97	31.52
Days to flower	0.70	7.22	10.70
Days to harvest	0.56	7.42	7.43
Index to earliness	0.44	0.34	97.10
Fruits/plant	0.50	13.62	55.03
Fruit yield/plant, g	0.60	362.32	47.09
Average fruit weight, g	0.61	28.09	73.45
Fruit shape index	0.95	0.52	47.67
Locules/fruit	0.72	0.48	26.98
Pericarp thickness, mm	0.71	1.81	34.70
Fruit cracking, %	0.59	2.11	100.17
Storage life, days	0.88	13.54	72.38
Juice yield, %	0.50	5.94	7.53
TSS, %	0.57	0.86	17.56
Total solids, %	0.78	1.35	22.15
Insoluble solids, %	0.93	0.44	64.30
Reducing sugar, %	0.58	0.72	22.43
Acidity, %	0.65	0.17	37.21
pH	0.79	0.41	9.73
Pulp content, %	0.74	9.02	37.83
Lycopene mg/100g	0.71	1.58	40.14
Carotene ($\mu\text{g}/100\text{g}$)	0.84	159.09	41.05
Ascorbic acid (mg/100g)	0.61	8.55	34.71

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