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Genetic analysis for yield components in tomato land races

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ABSTRACT: The PCV and GCV were high for fruit weight, number of fruits per plant, fruit yield per plant, number of fruits per cluster and number of seeds per fruits. High estimates of heritability along with genetic advance as percentage of mean for fruit weight followed by number of fruits per plant fruit yield per plant, number of fruits per cluster and seeds per fruits indicated that the role of additive gene action for these traits. Correlation studies revealed significant positive correlations between fruit yield and fruit weight and that of fruit weight with fruit diameter and length at phenotypic level indicating mutual association of these traits. The genotypic correlation coefficients for all the combinations of the traits were higher or quite close to respective phenotypic values, this indicated strong inherent potential as well, therefore, selection on the basis of phenotypic could be quite effective for getting the desired combination of traits.

Keywords: Tomato, correlation, PCV & GCV.

Tomato fruit yield is very low due to extremes of environmental constraints (high temperature from April to October and low temperature from mid December to mid February), thereby upsetting the economy of the crop (Arora et al). The present investigation was, therefore, carried out to generate information on various aspects of genetic parameters in tomato landraces in order to identify desirable genotypes and to select promising donors for combination breeding under hot arid environment.

MATERIALS AND METHODS

The investigation was carried out at the Central Institute for Arid Horticulture, Bikaner during 2002-03 under hot arid agro-climatic conditions. The material comprised of 14 tomato landraces collected from tribal dominating areas of Gujarat and one adopted cultivar. The experiment was laid out in randomized block design with three replications. Forty days old seedlings were transplanted on 05 July 2002 in furrows of five meters length at 60 x 45 cm spacing accommodating 11 plants per genotype in each replication. The crop was retained in the field for seven months (July to January) as a rainy autumn season crop to evaluate the landraces. For quantitative analysis, observations were recorded for flowering, fruit set and yield characteristics from five competitive plants of each genotypes were selected at random in each replication. Replication wise genotypic mean values obtained were used for statistical analysis as per standard methods.

RESULTS AND DISCUSSION

Analysis of variance revealed a wide range of variability and highly significant differences among the tomato landraces for all the characters studied (Table 1). The genotypic and phenotypic coefficient of variations (GCV and PCV) was high for fruit yield component characters. The GCV which gives a picture of the extent of genetic variability in the population ranged from 3.09 % in days to first harvest to fruit weight (58.01 %). The GCV estimates were considerably high for fruit weight, number of fruits per cluster, number of fruits per plant and fruit yield per plant, and thus have better scope of improvement through selection. The differences between the magnitude of GCV and PCV were very less indicating little influence of environmental factors on the expression of the traits under observation. In such a situation, selection can be effective on the basis of the phenotypic alone with equal probability of success. Similar projections have been made by Reddy and Lal (6), Nair and Thamburaj (4) and Singh *et al.*(7) in tomato.

Wide range of variation for the characters studied and on the basis of *per se* performance and general mean of fruit yield contributing traits, two tomato land races (KSB 29 and KSB 76) were found to be most potential. The genotype KSB 29 was found to have maximum fruit weight (122.4 g) as compared to general mean (51.6 g). The genotype KSB 76 (5.82 kg) out yielded all the landraces for total fruit yield followed by KSB 29 (5.14 kg) with general mean value of 2.85 kg. The closeness in the values of range (102.2 – 114.8) and general mean (109.6) for days to first harvest of red ripe fruits might be an indication of responsiveness (susceptibility) of the genotypes towards extremes of high temperature in September – October which affected fruit ripening in early fruit set.

In the present study, all the characters exhibited high heritability. The highest genetic advance expressed as percentage of mean was predicted for fruit weight (119.42) followed by number of fruits per plant (102.5), fruit yield per plant (99.2) and number of fruits per cluster(86.1). These findings are in line with those of Reddy and Lal (6), Kurian and Peter (3) and Singh *et al.* (7). In the present study, fruit weight was found to be highly variable and important character which might be responsible for the wide range of variation in yield potential. Based upon variability and heritability estimates it is concluded that improvement by direct selection in tomato is possible for traits like fruit weight, number of fruits per plant, fruit yield per plant and fruits per cluster. In general, the characters, which showed high heritability with high genetic advance as percent of mean, are genetically controlled by additive gene action (Panse and Sukhatme, 5) and can be improved through progeny, family or any modified selection procedures. Where as, the characters showed high heritability with moderate or low genetic advance as percent of mean, can be improved by intermitting superior genotypes of segregating population

Table 1: Parameters of genetic variability for different characters in tomato land races.

Characters	Range		General Mean	F ratio	CD (5 %)	SE±	GCV (%)	PCV (%)	Heritability (h^2 broad sense)	Genetic advance	Genetic gain	Promising genotypes	
	Minimum	Maximum										KSB-29	KSB-76
DFF	39.7	54.5	45.7	55.4 **	1.65	0.57	9.22	9.30	98.2	[illegible]	15.8	45.3	42.5
D50F	52.1	67.1	58.9	54.4 **	1.64	0.56	7.05	7.12	98.2	8.49	14.4	55.4	55.6
DFH	102.2	114.8	109.6	7.4 **	3.87	1.33	3.09	3.32	86.6	6.49	5.9	111.0	111.7
NF/C	1.48	4.51	2.45	620.8 **	0.11	0.04	41.83	41.86	99.8	2.11	86.1	1.4	2.5
NF/P	24.6	123.9	67.7	516.5 **	4.30	1.48	49.83	49.87	99.8	69.45	102.5	43.3	123.9
FW	19.4	122.4	51.6	773.1 **	3.12	1.07	58.01	58.04	99.9	61.63	119.4	122.4	47.5
FL	3.1	5.9	3.92	149.2 **	0.19	0.06	21.17	21.19	99.3	1.70	43.3	5.2	3.8
FD	3.26	6.66	4.64	491.6 **	0.13	0.04	22.14	22.16	99.8	2.11	45.5	6.6	4.3
NS/F	81.9	262.8	172.3	392.3 **	8.86	3.06	35.13	35.18	99.7	124.55	72.3	165.7	152.7
FY/P	1.47	5.82	2.85	491.7 **	0.18	0.06	48.21	48.25	99.8	2.83	99.2	5.1	5.8
PH	62.3	124.8	86.4	271.1 **	4.01	1.38	26.36	26.41	99.6	46.85	54.2	86.1	121.4
NB/P	5.3	9.4	7.75	113.7 **	0.32	0.11	15.51	15.58	99.1	2.46	31.8	8.4	8.2

Table 2: Genotypic (G) and phenotypic (P) correlation coefficients among the characters of tomato landraces

Characters		DFF	D50F	DFH	NF/C	NF/P	FW	FL	FD	NS/F	FY/P	PH	NB/P
DFF	G	—	0.875	0.762	-0.306	-0.436	-0.107	0.025	-0.013	0.401	-0.422	-0.496	-0.621
	P	—	0.857**	0.682**	-0.304	-0.432	-0.107	0.026	-0.011	0.394	-0.418	-0.491	-0.618*
D50F	G		—	0.701	-0.282	-0.341	-0.186	0.045	-0.056	0.404	-0.462	-0.344	-0.568
	P		—	0.654**	-0.277	-0.338	-0.185	0.049	-0.057	0.399	-0.455	-0.340	-0.558*
DFH	G			—	-0.224	-0.403	0.107	0.215	0.138	0.419	-0.160	-0.061	-0.291
	P			—	-0.205	-0.377	0.102	0.196	0.131	0.393	-0.150	-0.059	-0.267
NF/C	G				—	0.424	-0.573	-0.596	-0.420	-0.175	-0.304	0.232	0.254
	P				—	0.423	-0.572*	-0.593*	-0.420	-0.174	-0.304	0.231	0.254
NF/P	G					—	-0.611	-0.606	-0.575	-0.409	0.276	0.734	0.478
	P					—	-0.611*	-0.604*	-0.573*	-0.407	0.275	0.732**	0.475
FW	G						—	0.836	0.865	0.269	0.517	-0.267	-0.188
	P						—	0.833**	0.864**	0.268	0.516*	-0.267	-0.173
FL	G							—	0.540	0.396	0.294	-0.333	-0.295
	P							—	0.537*	0.392	0.293	-0.331	-0.291
FD	G								—	0.238	0.475	-0.300	-0.218
	P								—	0.238	0.475	-0.299	-0.218
NS/F	G									—	0.058	-0.253	-0.313
	P									—	0.057	-0.253	-0.311
FY/P	G										—	0.432	0.297
	P										—	0.431	0.296
PH	G											—	0.726
	P											—	0.721**
NB/P	G												—
	P												—

Significant ** (1 %) and * (5 %), respectively.

developed from multiple crosses and the desirable genes can be accumulated in the lines or through heterosis breeding.

The genotypic coefficients of correlation, in general were higher in magnitude than the corresponding phenotypic ones (Table 2), indicating that there was an inherent association among the various characters studied. These results corroborate the views of Dudi and Kalloo (2) and Singh *et al.* (7). Significant positive correlations were observed between fruit yield and fruit weight and fruit weight with fruit diameter and length at phenotypic level indicating mutual association of these traits. Non-significant but positive association was observed between fruit yield per plant and number of fruits per plant, fruit length and diameter, and also between number of fruits per plant and number of fruits per cluster. Significant high positive correlation between days to first flower and days to 50 per cent flowering with days to first harvest also indicated mutual association of these traits. It could be suggested from correlation estimate that early flowering plants give fruits early but negatively correlated, though non significant with fruit yield per plant. therefore, a judicious decision is required to realize maximum yield.

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