

## Genotypic and phenotypic variability in fig (*Ficus carica* L.)

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### ABSTRACT

The 290 plants of fig from two orchards of Pune district area were studied for 15 characters. The genotypes exhibited significant variability in growth habit, bearing potential, fruit shape, pulp colour, pedicel length, leaf area, days to first harvest. The magnitude of PCV was slightly more than GCV for all the characters in both orchard. In orchard-I, the GCV and PCV ranged from 25 to 46 per cent in case of spread, non reducing sugar, number of fruits per plant, total weight of fruits plant<sup>-1</sup> and more than 55 per cent for tree volume (tree size). The magnitude of PCV was more for acidity (65-79), while in orchard-2, GCV and PCV ranged from 34 to 56 per cent in case of acidity, number of lobes, volume of the tree and non reducing sugar. Heritability in orchard-1 was very high (> 80%) in case of number of secondary branches, spread, volume, number of fruits plant<sup>-1</sup>, total weight of fruit plant<sup>-1</sup>, TSS, while in orchard-2 heritability was very high in case of height, spread, volume, number of main branches and secondary branches. While genetic advance in terms of percentage was highest for volume (119.10) followed by total weight of fruits plant<sup>-1</sup>, spread and number of fruits plant<sup>-1</sup> in orchard-1 and in orchard-2, it was also highest for volume (66.78%) followed by number of secondary branches, number of main branches and spread. These estimates indicate the scope of fig improvement.

**Key words :** Genotypic variability, Phenotypic variability, Heritability.

### INTRODUCTION

Fig (*Ficus carica* L.) is a small or moderate sized deciduous tree. The total mineral content in fruit is two or four times that of most other fresh fruits. Fig is rich in proteins, calcium, iron and vitamin 'A' and good source of sugars, copper etc. The common fig is the only type grown in India and are named after the locality and exhibit no special distinction to warrant varietal names. The area under fig crop is decreasing day by day as no promising varieties of this crop have been released. Study of variability in a population is a prerequisite for existing selection because of a wide range of variability always produces more possibility of selecting desired types. Therefore, the present investigation was carried out to assess and evaluate critically the plants from two different orchard with an intention to judge whether there are any better genotypes than local cultivated variety for yield and yield contributing characters with quality. The objective of investigation was to study the natural variability existing for various characters in fig germplasm and to locate some desirable types to exploit them as commercially potential cultivars.

### MATERIALS AND METHODS

Through intensive survey, two orchards were selected for the study consists of 290 plants of fig cv. Poona fig, comprised of vegetatively propagated fig genotypes. The detail observations for various characters of these 290 plants were recorded for different

quantitative and qualitative characters viz. height of tree (m), spread (m), size, number of main branches, number of secondary branches, days to first harvest, leaf area, number of lobe, weight of fruit, length of pedicel, TSS, acidity, reducing sugar, non reducing sugars, total sugar, incidence of disease, total weight of fruit plant<sup>-1</sup>, number of fruit plant<sup>-1</sup> etc.

The analysis of variance was done as per method suggested by Panse and Sukhatme (1967). The data were further analyzed for GCV and PCV as per the formula given by Burton and De Vane (1953), while heritability was worked by using formula suggested by Hanson *et. al.*, (1956) and genetic advance calculated by Johnson *et. al.*, (1956 a).

### RESULTS AND DISCUSSION

The magnitude for PCV was slightly more than GCV for all the characters in case of orchard-1 (Table 1) and orchard -2 (Table 2) which indicated that there is further scope to improve upon through selection. It was noted that the PCV (65.22) and GCV (61.41) were more than 50 per cent for volume of tree size in orchard-1. In this orchard -1, the magnitude of phenotypic variance was greater than genotypic variance for all the characters. The magnitude of PCV was more for acidity (65-79). The GCV and PCV ranged from 25 to 46 per cent in case of spread (E to W and N to S), non reducing sugar, number of fruits plant<sup>-1</sup> and total weight of fruits Plant<sup>-1</sup>. While very little difference in magnitude of PCV and GCV

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Table 1 : Range, Mean and Genetic parameters of various characters of fig in orchard-1.

Character	Range	Granc Mean	Genotypic variance	Environmental variance	Phenotypic variance	G.C.V.	P.C.V.	Heritability	Genetic Advance	GA% as mean
Height	2.20-4.00	3.1205	0.1383	0.1042	0.2425	11.9194	15.7810	0.5705	0.5787	18.5456
Volume	3.22-128.39	44.4794	746.1058	95.5556	841.0614	61.4103	65.2243	0.8865	52.9784	119.076
Spread E to W	1.38-6.45	3.3872	0.9590	0.1654	1.1244	26.5589	28.7576	0.8529	1.8631	50.5279
Spread N to S	1.60-6.65	3.7294	1.1377	0.1511	1.2908	20.6005	30.4403	0.8828	2.0645	55.3562
No of main branches	4.11	6.7444	1.5521	0.2020	1.7541	18.4780	19.6370	0.8848	2.4141	37.7938
No. of secondary branches	23-49	36.0333	40.0020	1.0050	41.0070	17.5524	17.7715	0.9755	12.8683	37.7121
Days to l harvest	85-133	110.2111	42.0047	74.5411	166.5458	5.8806	9.7954	0.3604	8.0153	7.2726
Leaf area	129.35-148.55	137.9422	2.9914	29.2840	32.2754	1.258	4.1185	0.0927	5.0847	0.7863
No. of lobes	3-4	3.5778	0.1648	0.1121	0.2769	11.0378	14.3080	0.5951	0.6451	17.5411
Wt. Of fruit	20.50-49.15	30.2144	22.0248	20.1838	42.2086	15.5325	21.5023	0.5218	6.9836	23.134
Length of pedicel	1.15-2.40	1.5794	0.0572	0.0608	0.1180	15.1488	21.7505	0.4851	0.3433	21.7348
TSS	14.15-22.40	17.8694	1.6071	0.4215	2.0566	7.0944	7.9705	0.7922	2.3245	13.0081
Acidity	0.13-0.50	0.2432	0.0049	0.0207	0.0256	28.6632	65.7982	0.1898	0.0625	25.7219
Reducing sugar	9.50-15.20	11.4074	0.3626	1.5343	1.8968	5.2784	12.0734	0.1911	0.5423	4.7539
Non R.S.	1.13-7.90	3.9969	0.2989	2.9954	3.2943	14.0294	46.5756	0.0907	0.3392	8.7051
Total weight of fruit/plant	13.20-50.20	579.0889	46221.9570	7091.2351	53313.1914	37.1261	39.8721	0.8670	412.3806	71.2120
No. of fruit/plant	225.50-1030.50	27.5139	40.7871	9.7449	505319	23.1278	25.7428	0.8072	11.8197	42.8035

was observed in case of number of secondary branches, TSS. For the remaining characters these estimates were less than 25 percent.

In orchard-2, magnitude of PCV was more for acidity (56.18), number of lobe (39.02), volume (36.70), non reducing sugar (34.22) and GCV was more in volume 34.49, while for remaining characters it was very less.

Although the GCV and PCV are measures the genetic variability the amount of genetic gain can be determined from estimate of GCV and PCV alone with heritability. Swamp and Chougule (1962) suggested that GCV effects alone was not sufficient to quantify the amount of variation. Burton and De Vane (1953) inferred that GCA effects together with heritability estimates would furnish more reliable information.

In Orchard-1, the heritability was very high in case of number of secondary branches, spread, volume, number of fruits plant<sup>-1</sup>, total weight of fruits plant<sup>-1</sup>, days to 1<sup>st</sup> harvest, number of lobes, polar and equatorial diameter and length of pedicel and for remaining characters it estimates were low.

In orchard-2, it was very high in case of height, spread, volume and number of main and secondary branches, It ranged from 30 to 60 per cent in number of fruits plant<sup>-1</sup>, total weight of fruits plant<sup>-1</sup>, equatorial diameter, TSS, length of pedicel, days to 1<sup>st</sup> harvest and leaf area. Higher h<sup>2</sup> values indicates the effectiveness of selection based on phenotypic performance but does not necessarily mean higher genetic advance for particular character. Heritability (h<sup>2</sup>) and genetic advance aid in referring valuable conclusion for effective selection based on the PCV as expressed by Johnson *et al.* (1955).

Genetic advance from selection would reveal the genetic potentiality of a character under selection and also the effectiveness of selection.

The genetic advance was highest (119.10) in case of volume of the tree in orchard-1. The other characters which showed the high genetic advance were total weight of fruits plant<sup>-1</sup> (71.21%), spread,

Table 2 : Range, Mean and Genetic parameters of various characters of fig in orchard-2.

Character	Range	Grand Mean	Genotypic variance	Environmental variance	Phenotypic variance	G.C.V.	P.C.V.	Heritability	Genetic Advance	GA% as mean
Height	2.97-4.65	3.5232	0.1648	0.0261	0.1910	11.5240	12.4033	0.8632	0.7771	22.0564
Volume	17.91-131.04	58.0979	401.6223	53.0662	454.6886	34.9944	36.7026	0.8833	38.7997	66.7832
Spread E to W	2.40-6.15	3.8864	0.4580	0.0490	0.5069	17.4127	18.3203	0.9034	1.3250	34.0931
Spread N to S	2.30-6.75	4.0763	0.5333	0.0463	0.5796	19.9156	18.6771	0.9201	1.4431	35.4012
No. of main branches	3-9	6.5750	1.8557	0.6542	2.5099	20.7184	24.0953	0.7393	2.4129	36.6983
No. of secondary branches	30-74	50.8275	119.3134	3.2156	122.5289	21.4905	21.7781	0.9738	22.2043	43.6856
Days to l harvest	91-140	199.5550	42.4113	75.1222	117.5335	5.4472	9.0680	0.3608	0.587	6.7406
Leaf area	126.80-150.20	142.3417	21.8354	11.9373	33.7727	3.2828	4.0827	0.6465	7.7401	5.4377
No. of lobes		3.5800	0.4892	1.4631	1.9524	19.5380	39.0299	0.2506	0.7213	20.1480
Wt. Of fruit	25.50-51.65	38.1677	7.9988	21.2671	29.2659	7.4100	14.1737	0.2733	3.0459	7.9802
Length of pedicel	1.00-1.85	1.3205	0.1316	0.0271	0.0586	13.4527	18.3345	0.5383	0.2685	20.3335
TSS	15.20-22.30	17.8637	0.7878	1.4110	2.1988	4.9687	8.3008	0.3583	1.09045	6.1267
Acidity	0.04-0.38	0.1726	0.0010	0.0084	0.0094	18.5068	56.1862	0.1085	0.0217	12.5575
Reducing sugar	14.15-14.60	14.1833	0.0415	0.8546	0.8961	1.4361	6.6741	0.0463	0.0903	0.6366
Non R.S.	1.45-4.75	2.74831	0.1592	0.7256	0.8848	14.5166	34.2265	0.1799	0.3486	12.6834
Total weight of fruit/plant	18.15-51.85	832.2575	4265.5645	7139.2222	11404.7671	7.8475	12.8317	0.3740	82.2611	9.8665
No. of fruit/plant	104.50-1039.50	30.7295	17.0777	20.6250	37.7027	13.4481	19.8916	0.4530	5.7294	18.6447

number of fruits plant<sup>-1</sup> (42.80 %). For remaining characters it was less than 40%. In orchard -2, it was also highest in case of volume of the tree (66.78%). The other characters showed the high genetic advance were number of secondary branches (43.68 %). number of main branches (36.69) and spread and for remaining characters these estimates were low. The selection based on higher genetic gain may be desirable particularly in case of directional selection, when the main aim of the selection is to change the mean value of a character to a better standard. Selection for characters with high heritability and high genetic advance will be useful. Whereas low genetic gain will not be useful.

The higher genetic gain was not necessary due to high heritability. Panse (1957) opined that high genetic advance would obtained when heritability is chiefly due to dominance and epistasis, the genetic advance would be low. These results are in uniformity with earlier reports by Barua and Sharma (2002), Dayarani *et. al.*, (2000), Roger *et. al.* (2003) and Sawant *et. al.*, (2002).

Moderate values of GCV, heritability and genetic advance in case of volume of the tree, total weight of fruits per tree, number of fruits plant<sup>-1</sup>, acidity, spread, number of main and secondary branches in both orchards indicated that, it- is easy to select promising types for these characters among the populations. This reveals that on overall performance and quality aspects, the genotypes from orchard-1 GF4, GF5, GF38, GF46 and from orchard-2, SF10, SF39, SF 125, SF185 were most promising. They should be tested for exploiting them as new cultivar for commercial cultivation.

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