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Variability pattern in different morphological characters of pomegranate under karewa belts of Kashmir

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ABSTRACT

Ten diverse cultivars/genotypes were grown in karewa belts of Kashmir in randomized block design (RBD) replicated thrice. The range of variability was high for plant height (cm), plant spread (cm), duration of flowering (days), fruit weight (g), fruit volume (cm^3), number of seeds per fruit and cracking per cent. Phenotypic coefficient of variation was higher than genotypic coefficient of variation for all the characters under test. High heritability and high magnitude of genetic advance was recorded for plant height (cm), fruit weight (g), number of seeds per fruit and fruit set percentage. Whereas, low heritability was recorded in days taken from flower opening to fruitlet development, ascorbic acid (mg/ 100ml), juice content (%), number of fruits per plant and anar butterfly incidence (%).

Key words: Pomegranate, variability, karewa belt, morphology.

INTRODUCTION

Pomegranate (*Punica granatum* L.) is one of the important fruits of tropical and subtropical regions. The identification of genotypes with high variability and heritability for different morphological characters is the pre-requisite of breeding programme for selection of desirable traits. The assessment of variability is therefore, the first step in the breeding programme. Since, most of the characters of economic importance are polygenic in nature and are highly influenced by environmental fluctuations, it is difficult to judge whether the observed variability is heritable or due to environment. This suggests the imperative need of partioning the phenotypic variation into its heritable and non-heritable components. Therefore, the present investigation was carried out to gather information on magnitude of variability in pomegranate fruit.

MATERIALS AND METHODS

The experiment was conducted at Central Institute of Temperate Horticulture, Srinagar during the year 2004. Ten diverse genotypes of pomegranate already established at the research farm were taken for the study in a randomized block design with three replications. These genotypes were Kabuli Kandhari, Chawla, Ganesh, Mridula, Jyoti, G-137, Dholka, Bedana, Kandhari and Local check. The selected plants received uniform cultural treatments and care. Detailed observations were recorded for various morphological characters. The data were analyzed for each character by the analysis of variance method, Panse and Sukhatme (9) from which different variance components were estimated. Heritable estimates (broad sense) were made by the formula suggested by Hanson *et al.* (2). The coefficient of variation were estimated by the method described by Burton (1). The expected genetic advance resulting from selection of 5 per cent individuals from the population was computed by the formula suggested by Johnson *et al*. (3).

RESULTS AND DISCUSSION

Analysis of variance showed significant difference for most of characters. A wide range of variability for different characters were observed particularly in plant height and spread; duration of flowering, fruit weight and volume; rind weight, number of seeds per fruit, cracking per cent, total soluble solids /acid ratio, anthocyanin content, juice content, fruit set and number of fruits per plant (Table 1). Wide range of variability was also reported for various traits in pomegranate by Manohar *et al*. (4); Pandey and Bist (8). The phenotypic component of variance was greater than the genotypic variance. Both genotypic and phenotypic variances were high for characters viz. plant height and spread, duration of flowering, fruit volume, number of seeds per fruit and fruit set percentage. The results suggest that for most of the characters phenotypic variability is a reliable

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Table 1. Variability in phenotypic expression for different morphological characters in pomegranate.

Character	Range	General mean	Genotypic variance	Phenotypic variance	Environmental variance
Plant height (cm)	69.00-163.66	106.10	853.51	862.17	8.66
Plant spread (cm)	73.44-101.22	94.57	96.93	108.09	11.16
Number of suckers plant^{-1}	1.88-3.33	3.63	0.668	0.833	0.165
Days to first flower opening	49.33-76.00	58.20	62.08	66.59	4.51
Duration of flowering (days)	68.22-107.55	90.26	248.01	254.52	6.51
Days taken from flower opening to fruitlet development	10.33-13.10	12.04	0.98	1.43	0.45
Fruit weight (g)	110.28-232.12	180.61	1376.85	1508.21	131.36
Fruit diameter (cm)	5.76-7.68	6.88	0.338	0.342	0.004
Fruit volume (cm^3)	100.28-237.62	174.30	1791.95	1817.56	25.60
Specific gravity	0.956-1.036	0.97	0.0006	0.0009	0.0003
Rind thickness (mm)	2.92-4.95	3.76	0.355	0.456	0.101
Rind weight (g)	50.41-75.15	64.95	88.68	122.36	33.68
Number of seeds fruit^{-1}	275.88-546.94	449.95	5101.23	5339.57	238.34
Aril weight (g)	0.210-0.316	0.255	0.0013	0.0014	0.0001
Cracking (%)	6.32-31.40	20.33	44.18	45.10	0.918
Total soluble solids (%)	13.56-15.77	14.95	0.727	0.850	0.123
Total sugars (%)	7.81-9.75	8.53	0.397	0.451	0.054
Acidity (%)	0.43-0.81	0.55	0.020	0.021	0.0006
TSS/ Acid ratio	19.48-38.12	28.65	31.69	38.51	6.82
Ascorbic acid (mg 100^{-1} ml)	9.40-13.36	11.62	2.05	2.88	0.83
Anthocyanin (mg 100^{-1} g)	10.34-20.30	15.30	10.38	12.31	1.93
Juice content (%)	41.70-50.83	48.13	7.75	9.48	1.73
Fruit set (%)	22.82-59.40	35.74	169.72	185.35	15.63
Number of fruits plant^{-1}	7.10-17.77	11.76	8.80	14.35	5.55
Marketable produce (kg plant^{-1})	0.82-3.46	1.98	0.742	0.914	0.172
Gross fruit yield (kg plant^{-1})	0.88-3.84	2.20	0.895	1.109	0.214
Anar butterfly incidence (%)	8.33-12.49	10.30	2.288	2.864	0.576
Leaf curl incidence (%)	0.00-60.00	26.00	433.00	463.33	30.33

measure of genotypic variability. The difference in variances in pomegranate has also been reported by Manohar *et al*. (4).

In the present study, it was observed that the phenotypic coefficient of variation (PCV) were higher than their corresponding genotypic coefficient of variation (GCV) for all the traits. A high magnitude of coefficient of variability (phenotypic and genotypic) was observed for plant height, number of suckers per plant, cracking per cent, fruit set percentage, number of fruits per plant, marketable produce per plant, gross fruit yield per plant and leaf curl incidence. The increase in variability of some of the characters has also coincide with the findings of Mir *et al.* (6). Whereas, the remaining characters exhibited low to medium genotypic coefficient of variation. These results indicated that higher magnitude of genotypic coefficient of variations for the above traits offer a better opportunity for improvement through selection. Wide range of variability in tree and fruit characters have also been reported by Meena *et al.* (5) and Singh *et al.* (10) in pomegranate.

Estimates of heritability in broad sense were higher (>90 per cent) for plant height, days taken to first flower opening, duration of flowering, fruit weight, fruit diameter, fruit volume, number of seeds per fruit, aril weight, cracking per cent, acidity, fruit set percentage and leaf curl incidence. Moderate value of heritability was noticed for plant spread, number of suckers per plant, rind thickness, rind weight, total soluble solids, total sugars, total soluble solids/ acid ratio, ascorbic acid, anthocyanin content, marketable produce and gross fruit yield. Mir *et al.* (6) found high heritability for plant height, fruit volume, fruit set percentage, acidity, gross fruit yield, rind weight and number of fruits/ plant. The results

obtained are also in close agreement with findings of Meena *et al*. (5); Pandey and Bist (8). The high estimates of heritability have been helpful to the plant breeders as it enables to base the selection programme on phenotypic performance. Johnson *et al.* (3) have suggested that heritability estimates in conjunction with genetic advance are usually more helpful in predicting its resultant effect from selecting the best individuals.

The genetic advance expressed in percentage of mean range from 10.00 per cent (total soluble solids) to 158.84 per cent (leaf curl incidence). In the present study, high heritability was associated with high genotypic advance for most of the characters. The traits having high heritability coupled with high genetic gain was revealed by plant height, plant spread, duration of flowering, fruit weight, fruit volume, number of seeds/ fruit, cracking per cent, acidity, anthocyanin content, fruit set percentage, number of fruits/plant, marketable produce/plant, gross fruit yield/plant and leaf curl incidence. High heritability coupled with high genetic advances have also been reported by Navjot *et al*. (7) in ber in traits like fruit weight, pulp stone ratio, total soluble solids and fruit yield per plant. Panse and Sukhatme (9) expressed that if character is governed by additive gene action, both heritability and genetic advances would be high. The other characters exhibited comparatively lower heritability accompanied by low genetic advance indicating the dominance or epistatic effects are of considerable value for these characters and hence little improvement in these characters is possible through selection.

Table 2. Estimate of coefficient of variation (phenotypic and genotypic), heritability, genetic advance and expected genetic gain for different morphological characters of pomegranate cultivars.

Character	Phenotypic coefficient of variation (PCV)	Genotypic coefficient of variation (GCV)	Heritability (broad sense)	Genetic advance	Expected genetic gain (% of mean)
Plant height (cm)	27.67	27.53	0.990	59.88	56.43
Plant spread (cm)	10.99	10.41	0.897	19.21	20.31
Number of suckers plant^{-1}	25.15	22.52	0.802	1.51	41.59
Days taken to first flower opening	14.02	13.54	0.932	15.67	26.92
Duration of flowering (days)	17.67	17.45	0.974	32.02	35.47
Days taken from flower opening to fruitletdevelopment	9.97	8.23	0.681	1.68	13.95
Fruit weight (g)	21.50	20.54	0.913	73.03	40.43
Fruit diameter (cm)	8.53	8.48	0.987	1.19	17.29
Fruit volume (cm^3)	24.46	24.29	0.986	86.59	49.67
Specific gravity	2.94	2.20	0.562	0.03	3.06
Rind thickness (mm)	17.97	15.86	0.779	1.08	28.72
Rind weight (g)	17.03	14.50	0.725	16.51	25.41
Number of seeds fruit^{-1}	16.24	15.87	0.955	143.81	31.96
Aril weight (g)	16.00	15.48	0.936	0.08	31.33
Cracking (%)	33.03	32.69	0.980	13.55	66.65
Total soluble solids (%)	6.17	5.70	0.855	1.62	10.83
Total sugar (%)	7.88	7.39	0.879	1.22	14.29
Acidity (%)	26.26	25.82	0.967	0.29	52.72
TSS/ Acid ratio	21.66	19.64	0.823	10.52	36.70
Ascorbic acid (mg 100^{-1} ml)	14.63	12.34	0.711	2.49	21.41
Anthocyanin (mg 100^{-1} g)	22.93	21.06	0.843	6.09	39.79
Juice content (%)	6.40	5.78	0.817	5.19	10.78
Fruit set (%)	38.09	36.45	0.916	25.68	71.85
Number of fruits plant^{-1}	32.21	25.22	0.613	4.79	40.72
Marketable produce (kg plant^{-1})	48.18	43.40	0.811	1.60	80.59
Gross fruit yield (kg plant^{-1})	47.66	42.81	0.807	1.75	79.18
Anar butterfly incidence (%)	16.43	14.68	0.799	2.79	27.07
Leaf curl incidence (%)	82.51	79.76	0.935	41.44	158.84

Therefore in the present study, the value of genetic parameters were comparatively higher for plant height, fruit volume, cracking per cent, acidity, fruit set per cent, marketable produce/plant, gross fruit yield/plant and leaf curl incidence indicating the possibility of effective selection for these characters in pomegranate. Hence, it can be concluded that Dholka, Bedana and Kandhari showed good response in terms of plant height, fruit set per cent, fruit volume and marketable produce and thus these genotypes can be used for further breeding programme.

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