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Research Article

CORRELATION STUDIES AMONG VEGETATIVE, FRUIT PHYSICO–CHEMICAL CHARACTERS OF GUAVA (*Psidium guajava* L.)

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Abstract- The present study was conducted to determine correlation among vegetative growth, fruit physico–chemical parameters of 22 genotypes of *Psidium guajava* and two species, *P. friedrichsthalianum* and *P. pumilum*. The coefficient of correlation was estimated for nineteen morphological characters, which included Plant height, canopy volume, leaf, fruit parameters (Trunk diameter, Plant spread, No. of. flowers, Flowering duration, Petiole length, Internodal length, Leaf shape, Shape of leaf apex, Shape of leaf base, Leaf length, Leaf width, Leaf area, Leaf lamina pubescence, Young leaf anthocyanin, Coloration, Intensity of anthocyanin coloration in young leaf, Fruit weight, Fruit length, Fruit width, Fruit index, Fruiting habit, Shape of fruit Colour of pulp, Colour of fruit skin) and eight fruit biochemical characters. Correlation studies among different horticultural traits indicated that plant height was highly correlated with the plant spread as well as canopy volume. Leaf length and breadth was highly correlated with leaf area, whereas they were negatively correlated with stomata number. Fruit weight was highly correlated with fruit core diameter and seed number. Plant height showed significant positive correlation with plant spread (N-S and E-W) 0.970 and 0.957 as well as canopy volume (0.985). The petiole length was highly correlated with leaf area (0.64) and negatively correlated with a number of stomata (-0.529). Fruit weight had a highly significant positive correlation with relation to fruit length (0.896), fruit width (0.941), and fruit core diameter (0.759), the number of seeds per fruit (0.571) and also with seed weight. Total chlorophyll had a positive correlation with vitamin-C content (0.443).

Keywords- Guava, Correlation analysis, Vegetative growth, Physicochemical.

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Introduction

Guava (*Psidium guajava* L.) belongs to the *Myrtaceae* family, is most important commercial fruit crop grown in sub-tropical region of the Indian subcontinent popularly known as "poor man's fruit" or "apple of tropics" [1, 2]. It is the fifth most important fruit crop of India occupying 3.38 % of the total area under fruit cultivation [3]. It has gained considerable prominence on account of its high nutritive value, cheap and easily availability at affordable price. Guava represents an excellent source of vitamins A, B and C (150-200 mg/100 g of pulp), as well as calcium, zinc, phosphorus and iron [4]. Guava populations of seedling origin which are having variability in fruit colour (both pulp and peel), pulp thickness, numbers of seed and other morphological and quality characters are also reported from different regions. The basic information which a fruit breeder usually needs for improvement in a particular crop species is the nature and magnitude of genetic variation present in the available germplasm and an extent to which the desirable characters are heritable. The knowledge of association of characters among themselves is important for selection and genetic improvement programme in guava. Improvement of the fruit quality is the foremost goal of varietal improvement programme [5]. In order to incorporate desirable characters to maximize qualitative and quantitative traits, the information on the nature and extent of genetic variability attained in guava for desirable characters and relative contribution to qualitative improvement constitutes the basic requirements. The present study was therefore undertaken to study correlations among the morphological, fruit physico-chemical parameters.

Materials and Methods

Plant materials

The study was carried out at the Division of Fruits and Horticultural Technology, during 2013-14. The Research Farm of Indian Agricultural Research Institute, New Delhi is situated at the altitude of 228 m above mean sea level with 280 40' N latitude and 770 13' E longitudes. The area has a sub-tropical climate with alluvial soil which is slightly alkaline with clay loam texture and low organic matter. A total of 22 genotypes of *Psidium guajava* and two species of *Psidium* were selected from the experimental orchard of the division of Fruits and Horticultural Technology, IARI, New Delhi, were used for correlation study. The experiment was laid out in Randomized Block Design (RBD) with three replications as per the procedure outlined by Panse and Sukhatme [6].

Correlation studies among vegetative characters

Total twenty-six morphological parameters included Plant height, canopy volume and twenty- four plants, leaf, fruit parameter (Trunk diameter, Plant spread, No. of. Flowers, Flowering duration, Petiole length, Internodal length, Leaf shape, Shape of leaf apex, Shape of leaf base, Leaf length, Leaf width, Leaf area, Leaf lamina pubescence, Young leaf anthocyanin, Coloration, Intensity of anthocyanin coloration in young leaf, Fruit weight, Fruit length, Fruit width, Fruit index, Fruiting habit, Shape of fruit Colour of pulp, Colour of fruit skin) were evaluated. Rating of various characters was done in accordance with 'Guava Descriptor' published by All India Coordinated Research Project on Subtropical Fruits (AICRP-STF), CISH,

Lucknow in the year 2011. Tree habit was observed visually as per the NBPGR guide book. Observation on vegetative growth and leaf attributes were subjected to analysis using standard statistical package and mean the difference between treatments will be separated using Randomized Block Design (RBD).On line OP Stat software accessed from the following web page was used for analysis of ANOVA http://14.139.232.166/opstat/default.asp

Correlation studies among physicochemical characters

All observations on the fruit and its related parts were made at the matured to the optimum ripening stage. Fruit characteristics were observed on five fruits per each tree. The physical observations on fruit shape, fruit surface, fruit diameter, fruit length, fruit weight, pulp colour and fruit colour were recorded. The fruiting habit was visually recorded after flowering. It was classified as (solitary and cluster). Rating of various characters was done in accordance with 'Guava Descriptor' published by All India Coordinated Research Project on Subtropical Fruits (AICRP-STF), CISH, Lucknow in the year 2011. The experiments were laid out in a randomized block design (RBD). The data on different parameters were analyzed by using analysis of variance (ANOVA) by using Statistical Package for Agricultural Workers (STAT OP Sheoran). Valid conclusions were drawn only on significant differences between the treatment mean at 0.05 level of probability. In order to compare treatment means, critical differences were calculated.

Results and discussion

Data on correlation studies among vegetative and physico-chemical characters of guava has been presented in [Table-1, 2, 3 and 4]. The correlation studies among different vegetative growth, fruits characteristics and physico-chemical characters of guava genotypes would certainly provide an idea, which might be utilized for selection of desirable parameters for future breeding programmes in guava. The highly significant positive correlation between desirable characters is favourable to a plant breeder because it might help in simultaneous improvement of both the characters. On the other hand, the negative correlation would hinder the synchronized expression of both the characters. In such a situation, it would require to making some compromise including economic ones. Plant height showed significant positive correlation with plant spread (N-S and E-W) 0.970 and 0.957 as well as canopy volume (0.985) [Table-1]. Leaf length had a highly positive correlation with leaf breath (0.791), as well as with petiole length (0.556) and leaf area (0.957) [Table-2]. The petiole length was highly correlated with leaf area (0.64) and negatively correlated with a number of stomata (-0.529). Similarly, leaf area is negatively correlated with a number of stomata. Fruit weight had highly significant positive correlation with relation to fruit length (0.896), fruit width (0.941), and fruit core diameter (0.759), the number of seed per fruit (0.571) and also with seed weight. Whereas fruit width had a negative correlation with fruit index (-0.583), as well as fruit index had a negative correlation with fruit core diameter (0.468)[Table-3]. Total chlorophyll had a positive correlation with vitamin-C content (0.443). At the same time anthocyanin had a negative correlation with antioxidant content (-0.435) [Table-4]. Vegetative growth characters like plant height, canopy volume, intermodal length and were positively correlated with each other. Leaf area showed a positive correlation with leaf length and breadth, whereas negatively correlated with a number of stomata. Certainly, larger leaf area must have resulted in more synthesis of photosynthates and their accumulation, which might be responsible for better growth. The breeders should rely upon these characters for selecting plants for high yield. Significant positive correlations between vegetative characters and yield were also reported by Pandey *et al.* [7]. Among various physical characters of fruits, *viz.,* size and weight, were positively correlated with leaf length and leaf breadth. Therefore, large the leaf sizes the larger might the fruit or vice versa. Numbers of seeds were highly correlated to seed weight (0.986), as well with fruit length, breadth weight and core diameter. The results pertaining to the correlations among physical characters of fruits were in corroboration with the findings of Singh [8], Aulukh [9] Gohil *et al.* [10] and Biradar and Mukunda [11].On contrast, TSS, titrable acidity and ascorbic acid content did not show any significant correlation with each other, various correlations mentioned above would certainly have great significance for guava improvement programmes in future. The correlation studies revealed that parameters like canopy volume, leaf area and fruit character had an important correlation. Moreover, in guava improvement programmes the positively correlated desirable characters would aid in increasing the breeding efficiency.

Table-1 *Correlation among vegetative growth of guava genotypes*

Sl no	Parameter	Plant height (cm)	Trunk circumference (cm)	Plant spread (E-W)	Plant spread (N-S)	Canopy volume (M^3)	Inter nodal length (cm)
1	Plant height (cm)	1	0.283	0.970**	0.957**	0.985**	0.128
2	Trunk circumference (cm)		1	0.302	0.318	0.316	0.255
3	Plant spread (E-W)			1	0.993**	0.979**	0.153
4	Plant spread (N-S)				1	0.968**	0.150
5	Canopy volume (M^3)					1	0.129
6	Inter nodal length (cm)						1

Critical values for Pearson's correlation coefficient of two tailed test: *and ** indicate significance of values at P = 0.05 and 0.01, respectively,

Table-2 *Correlation among leaf parameter of guava genotypes*

Sl no	Parameter	Leaf length (cm)	Leaf breadth (cm)	Petiole length (cm)	Leaf area (cm^2)	Length / breadth ratio	No. of stomata
1	Leaf length (cm)	1	0.791**	0.566**	0.957**	-0.004	-0.613**
2	Leaf breadth (cm)		1	0.664**	0.776**	-0.576**	-0.648**
3	Petiole length (cm)			1	0.641**	-0.333	-0.529**
4	Leaf area (cm^2)				1	-0.035	-0.615**
5	Length breadth ratio					1	0.363
6	No. of stomata						1

Critical values for Pearson's correlation coefficient of two tailed test: *and ** indicate significance of values at P = 0.05 and 0.01, respectively,

Table-3 *Correlation among fruit characters of guava genotypes*

Sl no	Parameter	Fruit weight (g)	Fruit length(cm)	Fruit width (cm)	Fruit index (length / width)	Fruit core diameter (cm)	No. of Seeds/fruit	Seed weight (g)
1	Fruit weight (g)	1	0.896**	0.941**	-0.451*	0.759**	0.571**	0.621**
2	Fruit length (cm)		1	0.939**	-0.371	0.797**	0.650**	0.676**
3	Fruit width (cm)			1	-0.583**	0.815**	0.557**	0.591**
4	Fruit index (length / width)				1	0.468*	-0.229	0.254
5	Fruit core diameter					1	0.617**	0.719**
6	No. of seeds/fruit						1	0.986**
7	Seed weight(g)							1

*Critical values for Pearson's correlation coefficient of two tailed test: *and ** indicate significance of values at P = 0.05 and 0.01, respectively,*

Table-4 *Correlation among biochemical characters leaf and fruits of guava genotypes.*

Sl no	Parameter	TCC (mg/g)	TPC (mg/g)	Carotenoid (mg/g)	Anthocyanin (mg/g)	TSS (⁰Brix)	TA (%)	Vit-C (mg/g)	Antioxidant (mmol/g TROLOX)
1	TCC (mg/g)	1	0.088	-0.043	-0.150	0.250	-0.364	0.443*	0.230
2	TPC mg/g)		1	0.142	0.059	-0.081	0.166	0.223	0.162
3	Carotenoid (mg/g)			1	0.268	0.216	0.178	-0.120	0.076
4	Anthocyanin (mg/g)				1	-0.081	-0.042	-0.237	-0.435*
5	TSS (⁰Brix)					1	0.195	0.055	0.355
6	TA (%)						1	-0.094	-0.023
7	Vit-C (mg/g)							1	0.082
8	Antioxidant (mmol/g TROLOX)								1

Critical values for Pearson's correlation coefficient of two tailed test: *and ** indicate significance of values at P = 0.05 and 0.01, respectively,
TCC- Total chlorophyll content, TPC-Total phenolic content, TSS-Total soluble solid, TA-Titrable acidity

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Abbreviations: RBD- Randomized Block Design, ANOVA- Analysis of variance, TCC- Total chlorophyll content, TPC-Total phenolic content, TSS-Total soluble solid, TA-Titrable acidity.

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Conflict of Interest: None declared

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