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Metroglyph Analysis of Coloured and Seeded Grape Genotypes

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ABSTRACT

The knowledge of genetic variation existing in germplasm is an important aspect for initiating any crop breeding program. Metroglyph analysis is a simple technique used for preliminary grouping of germplasms and to study the pattern of morphological variation in crop specie). In the present investigation Metroglyph analysis of 31 coloured and seeded grape genotypes was carried out. Total nine groups were formed using two most variable characters i.e. yield/vine and bunch weight as X and Y co-ordinates respectively. All genotypes occupied their relative position in seven groups only. The study revealed that the grape genotypes from Group VI, VIII and IX had desirable traits and they can be used as potential parents in table grape breeding programme.

Key words: *Vitis vinifera,* Grape, Metroglyph, Genetic variability, Index score

Grape (*Vitis vinifera* L.) is a temperate fruit crop which has got adapted to sub-tropical climate of peninsular India. Grape cultivation on commercial basis is about six-decade old India and now considered as most remunerative amongst all fruit cultivation in the country. ICAR-National Research Centre for Grapes, Pune is a leading institute in the country working exclusively for grape improvement. Being a National Active Germplasm Site (NAGS) the centre has 481 accessions of table, wine, raisin and juice grape genotypes maintained in its field bank. Out of 481 genotypes, total 31 accessions are coloured and seeded table grape genotypes.

The knowledge of genetic variation present in the germplasm is an important and essential aspect for initiating any crop breeding program because hybrids between genotypes of diverse origin generally display greater heterosis than those between closely related parents. Metroglyph analysis given by Anderson (1957) is a useful and simple technique used for assessing morphological variation present in genepool and for preliminary grouping of accessions. This technique was used for preliminary grouping of genotypes by various workers in variety of crop species like Dewan *et al*. (1992) studied diversity of Indian mustard; Chandra *et al.* (1997) classified turmeric genotypes; Laiju *et al.* (2002) analyzed the genetic variability of two *Hordeum* species; Ghafoor and Ahmad (2005) studied diversity in black gram; Khan *et al.* (2007) studied morphological variation of seven cotton cultivars; Rashid *et al.* (2007) used this method to group basmati rice mutants; Bhargava *et al.* (2009) used this method for accessing the variability in *Chenopodium*; Punitha *et al.* (2010) used it in sorghum for assessing morphological variation, Jha *et al.* (2011) studied variability pattern in chickpea; Kang *et al.* (2013) used it for grouping sugarcane cultivars, Datta *et al.* (2013) used it for preliminary classification and group constellation of maize inbreds and Moghny *et al.* (2015) used to study genetic divergence in cotton genotypes. With this technique one can predict genotypes that have high index scores and those fall into different clusters to be crossed to produce maximum variability of good combinations of characteristics. The present investigation was planned to study the pattern of morphological variation present in 31 grape genotypes for eight quantitative characters using Metroglyph analysis.

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MATERIALS AND METHODS

The present investigation was carried out during 2018-*19* using 31 coloured and seeded grape genotypes maintain at the centre (Table 1).

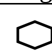
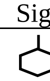
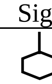
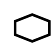
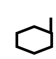
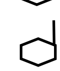
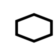
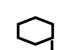
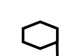
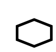
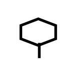
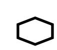
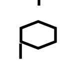
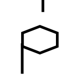
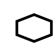
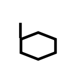
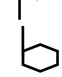
Five vines of each genotype were randomly selected for recording observations. Data were recorded on 10 bunches harvested from each vine on eight quantitative characters viz. berry diameter (mm), berry length (mm), average berry weight (g), 100 seed weight (g), bunch length (cm), bunch weight (gm), yield/vine (kg) and maturity period (days).

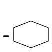
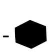
Table 1 Coloured and seeded grape genotypes used for

S. No.	Variety name	S. No.	Variety name
1	Alden	17	Alamwick
2	Alicante Bouschet	18	Amber Queen
3	Bangalore Purple	19	Country Bangalore
4	Benizuiho	20	Ruby Red
5	Catawba	21	Muscat
6	Manjari Medika	22	Christmas Rose
7	Pusa Navrang	23	Black Prince
8	Champion	24	Rizamat
9	Black Champa	25	Black Muscat
10	Concord	26	Rose of Peru
11	Red Prince	27	Saperavi
12	Barbarossa	28	Red Globe
13	Gulabi	29	Black Hamburg
14	Angoor Kalan	30	Malbec
15	Kali Sahebi	31	Isabella
16	Castiza		

In present study; glyph and rays positions were used to assess the variability pattern and correlated traits for assessment of their divergent groups. Each genotype was represented as a glyph which was the intersection point of mean values of X and Y co-ordinates. Two most variable characters viz. average bunch weight (g) and fruit yield/vine (kg) were selected for X and Y axis, respectively. 'X' co-ordinate for each glyph being the average bunch weight (g) and 'Y' co-ordinate for each glyph being the fruit yield/vine (kg). Remaining six characters have been represented by the rays with variable length at different positions on the glyph i.e., low value with no ray, medium value with short ray and high value with long ray. Coloured grape genotypes without flesh anthocyanin pigmentation were represented by the hollow glyph, whereas tenturier grape genotypes (i.e. with flesh anthocyanin pigmentation) by solid glyph.

Table 2 Index score and the ray position on glyph used to denote the expression of different characters

Characteristic	Mean	Range	Score I			Score II			Score III		
			From	To	Sign	From	To	Sign	From	To	Sign
Berry diameter (mm)	16.55	11.00-22.67	10	15		15	20		20	25	
Berry length (mm)	18.95	11.20-25.20	10	15		15	20		20	25	
Avg. berry weight (g)	2.82	1.02-5.84	0	2		2	4		4	6	
100 seed weight (g)	5.64	3.36-7.80	0	3		3	6		6	9	
Bunch length (cm)	11.67	7.32-19.90	5	10		10	15		15	20	
Maturity period (days)	133.10	119-151	100	120		120	140		140	160	
Bunch weight (gm)	252.72	75.40-614.79	50	250	X axis	250	450	X axis	450	650	X axis
Yield/Vine (Kg)	3.98	1.03-7.88	0	3	Y axis	3	6	Y axis	6	9	Y axis

#Grape genotpye without flesh anthocynin pigmentation -  ; Tenturier genotype - 

The Index scores and signs used for eight characters for Metroglyph analysis presented in (Table 2). The index values were divided into three classes i.e. 1- no ray, 2- short ray and 3- long ray. The total index values were taken by adding up the index scores of all the eight characters studied (Fig 1). The minimum and maximum scores that an individual could get was n x 1 and n x 3 respectively, where 'n' was the total number of characters considered.

RESULTS AND DISCUSSION

The frequency diagram illustrated the index score values for all eight characters (Fig 1). The index score was in the range of 9 to 23. Total seven entries has score index score more than 20 wherein Red Globe has scored highest (23) amongst all entries and immediately followed by Benizuiho, Bangalore Purple and Angoor Kalan (each with total index score-22).

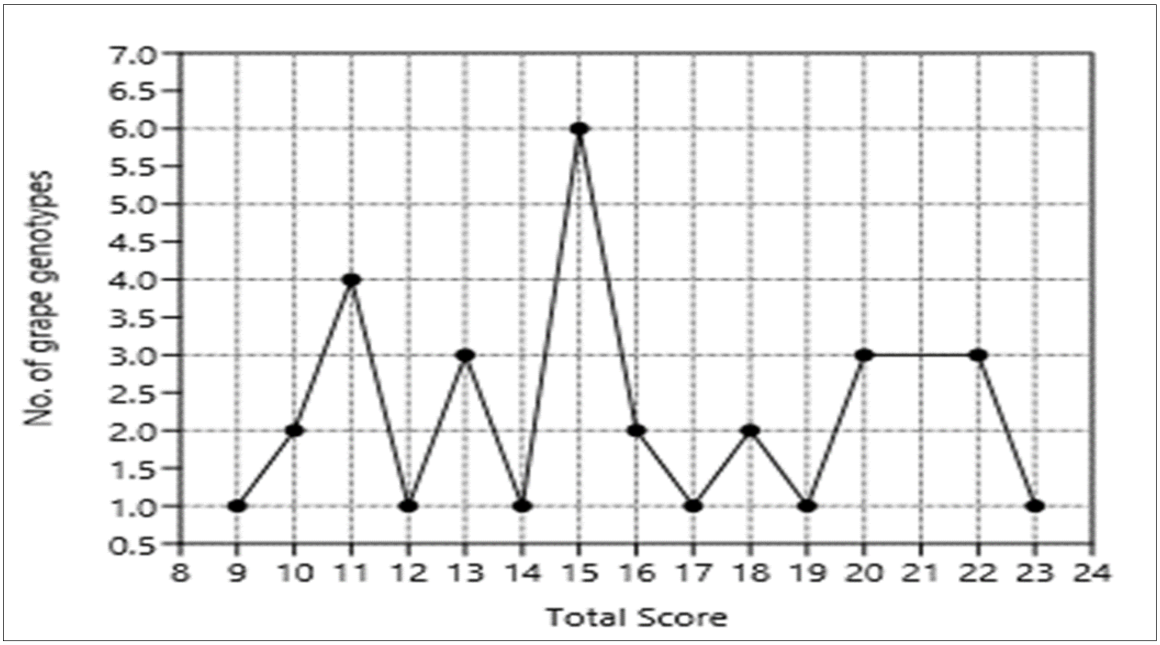


Fig 1 Frequency distribution of 31 grape genotypes for total index score

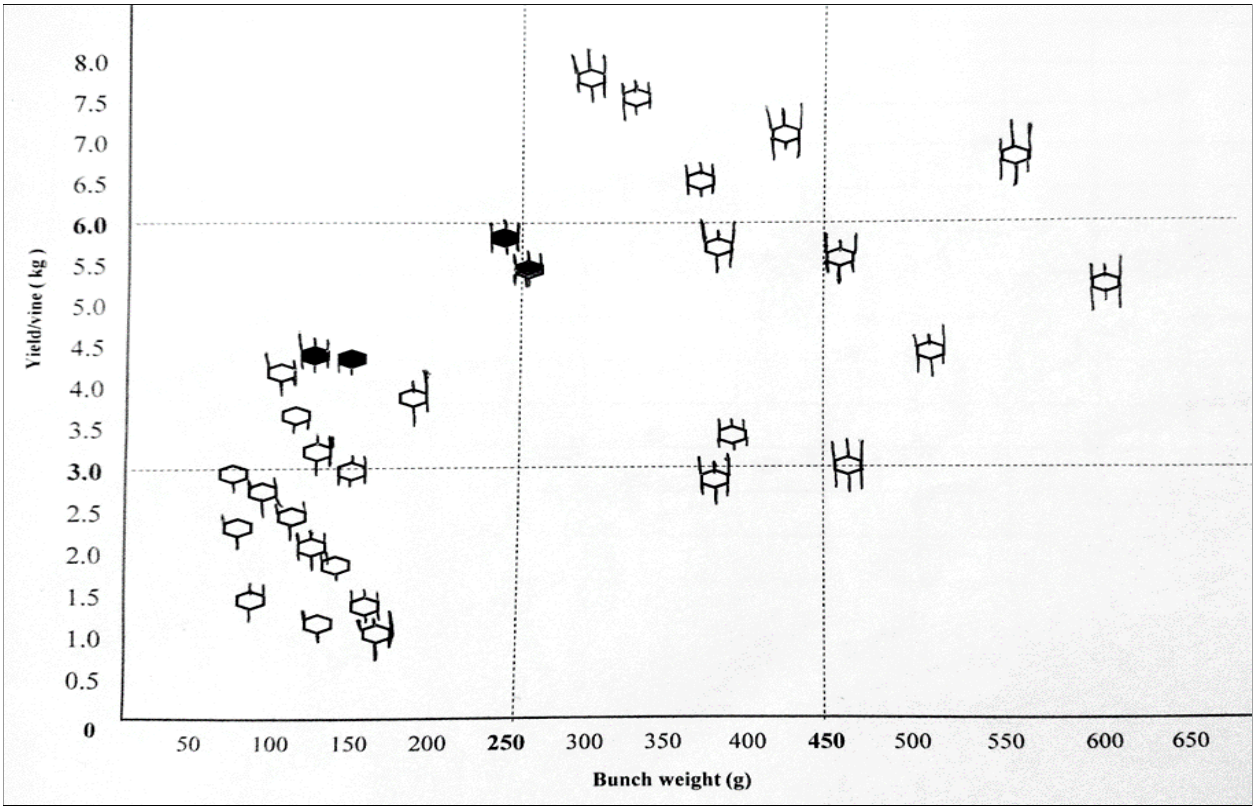


Fig 2 Metroglyph analysis representing variability of 31 grape genotypes for eight characters

On the basis two most variable characters i.e. yield/vine and bunch weight; total nine groups could be possible i.e. Group I : low bunch weight and low yield; Group II: low bunch weight and medium yield; Group III: low bunch weight and high yield; Group IV: Medium bunch weight and low yield; Group V: medium bunch weight and medium yield; Group VI: medium bunch weight and high yield; Group VII: high bunch weight and low yield; Group VIII: high bunch weight and medium yield and Group IX: high bunch weight and high yield. For preparing groups; fruit yield per vine was categorized as low (below 3kg), medium (3-6kg) and high (≥ 6kg) whereas bunch weight was considered as low (below 250g), medium (250-450g) and high (≥ 450g).

The scatter diagram revealed that 31 genotypes occupied their relative position in seven groups on the basis of morphological variation shown by them (Fig 2). The Group I was characterized by low yield/vine (below 3.0 kg) and low bunch weight (below 200 g). This group was comprised of ten genotypes viz. Barbarossa, Champion, Saperavi, Rose of Peru, Black Muscut, Isabella, Gulabi, Malbec, Black Prince and Black Hamburg. In the Group II seven entries were positioned having low bunch weight and medium fruit yield (3 to 6 kg/vine). Those entries were Red prince, Concord, Muscat, Catawba, Ruby Red, Pusa Navarang, Alicante Bouschet and Black Champa. Out of these three entries were tenturier ones viz., Pusa Navarang, Ruby Red and Alicante Bouschet. Alamwick was the only entry in Group IV with low yield and medium bunch size. No entry was fallen either in Group III or Group VII.

Group V comprised of three entries namely Manjari Medika, Rizamat and Alden. Amongst the four tenturier grape entries the Alicante Bouschet and Manjari Medika (juice variety) had similar bunch weight as well as fruit yield. These two genotypes had also shown similar performance for six remaining traits (Ghafoor and Ahmad 2005). Group VI had four genotypes like Benizuhio, Amber Queen, Castiza and Bangalore Purple. Those were high yielding genotypes among the all entries under study. Group VIII had four entries namely Red Globe, Christmas Rose, Country Bangalore and Kali Sahebi. These entries were having fruit yield per vine above 4.44 kg and bunch weight in the range of 465-615g. Angoor Kalan was the only representative of group IX having fruit yield 6.81 kg/vine and bunch weight 567.56 g (Kang *et al*. 2013).

The grape genotypes covered in the Group VI, VIII and IX looked suitable as the potential parents for table grape breeding programme owing to their premium fruit quality traits like bold berry size ≥ 18mm, berry weight ≥ 4g, desirable bunch weight in the range of 300-600g and yielding potential (> 5.75 kg /vine). Out of these Red Globe and Christmas Rose were already included in ongoing grape breeding programme of the institute. Owing to tenturier nature and better yielding potential; Manjari Medika and Alicante Bouschet can be included in breeding programme for developing juice cultivars.

The information generated from this study suggested that involvement of the genotypes from Group VI, VIII and IX in a hybridization program as parents will be useful for the development of future varieties of coloured grape.

LITERATURE CITED

Abd El-Moghny A M, Max Mariz S and Gibely Reham H A. 2015. Nature of genetic divergence among some cotton genotypes. *The Journal of Cotton Science* **19**: 368-374.

Anderson E. 1957. A semi-graphical method for the analysis of complex problems. Proceedings of National Academy of Sciences, Washington, USA. **43**: 923-927.

Bhargava A, Shukla S, Kumar R and Ohri D. 2009. Metroglyph Analysis of Morphological Variation in *Chenopodium* spp. *World Journal of Agricultural Sciences* **5**: 117-120.

Chandra R, Desai A R, Govind S and Gupta P. N. 1997. Metroglyph analysis in turmeric (*Curcuma longa* L.) germplasm in India. *Scientia Horticulturae* **70**: 211-222.

Chandra S. 1976. Comparison of mahalanobis's methods and metroglyph technique in the study of genetic divergence in *Linum usitatissimum* L. germplasm collection. *Euphytica* **26**: 141-148.

Datta D, Mukherjee B K, Barua N S and Das S P. 2013. Metroglyph analysis of maize (Z*ea mays* L.) inbreds for preliminary classification and group constellation. *African Journal of Agricultural Research* **8**(45): 5659-5663.

Dewan D B, Islam M A and Khaleque M A. 1992. Metroglyph analysis of morphological variation in Indian mustard (*Brassica juncea* L.). *Agricultural Science* **62**: 766-777.

Ghafoor A and Ahmad Z. 2005. Diversity in black gram (*Vigna mungo* L. Hepper) for agronomic traits and total seed proteins analysis. *Acta Biologica Cracoviensia Series Botanica* **47**: 1-7.

Jha U C, Singh D P, Paul P J and Lavanya G R. 2011. Metroglyph analysis for morphological variation in chickpea (*Cicer arietinum* L.). *Madras Agriculture Journal* **98**(4/6): 121-123.

Kang S A, Muhammad N, Farooq A K and Frasat S. 2013. Divergence analysis and association of some economical characters of sugarcane (*Saccharum officinarum* L.). *Journal of Plant Breeding and Genetics* **1**: 1-6.

Khan M R, Samad A, Begum S, Khaleda S, Alam A K M S, Chowdhury A N and Rahman M Z. 2007. Metroglyph analysis in cotton (*Gossypium* Sp.). *Bangladesh Journal of Scientific and Industrial Research* **42**(4): 449-454.

Laiju N M, Islam M J, Hasanuzzaman M, Mondol M A S and Kabir G. 2002. Metroglyph analysis in two species of *Hordeum*. *Pakistan Journal of Biological Science* **5**: 1217-1219.

Punitha D, Ganesamurthy K and Rajarathinam S. 2010. Metroglyph analysis of morphological variations in sorghum germplasm collections. *Electronic Journal of Plant Breeding* **1**(4): 536-541.

Rashid M, Cheema A A and Asraf M. 2007. Clustering of basmati rice mutants by Metroglyph analysis. *Pakistan Journal of Botany* **39**: 2043-2049.