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Khalil

M.Sc. Student, Division of Fruits and Horticultural Technology, ICAR-Indian Agricultural Research Institute, New Delhi, India

MK Verma

Principal Scientist, Division of Fruits and Horticultural Technology, ICAR-Indian Agricultural Research Institute, New Delhi, India

SK Singh

Principal Scientist, Division of Fruits and Horticultural Technology, ICAR-Indian Agricultural Research Institute, New Delhi, India

Madhubala Thakre

Scientist, Division of Fruits and Horticultural Technology, ICAR-Indian Agricultural Research Institute, New Delhi, India

Tanushree Sahoo

Ph.D. Scholar, Division of Fruits and Horticultural Technology, ICAR-Indian Agricultural Research Institute, New Delhi, India

Correspondence**Khalil**

M.Sc. Student, Division of Fruits and Horticultural Technology, ICAR-Indian Agricultural Research Institute, New Delhi, India

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Variability for bunch and berry characteristics in seeded and seedless grape genotypes evaluated under subtropical condition in India

Khalil, MK Verma, SK Singh, Madhubala Thakre and Tanushree Sahoo

Abstract

Forty-seven grape genotypes were evaluated under subtropical climatic conditions of Delhi, India from 2014-16. All the genotypes were mainly grouped under two categories i.e., seeded and seedless. Each category was further categorized in to white and coloured. These genotypes were consisted of mainly *Vitis vinifera* L., except *Vitis parviflora* genotype. The data were recorded for bunch and berry quality traits, important pomological traits usually taken into consideration for evaluation of grapes. Standard procedures were adopted for recording the observation. Results indicated that, greater variability existed among all the genotypes studied. The mean values among the different categories indicated that, larger size of the bunch in terms of weight and length was recorded in seedless white. Whereas, the maximum size of the berry in terms of weight was recorded in seedless white genotypes followed by seeded white, coloured seeded and minimum was recorded in seedless coloured genotypes. However, it is not the correct indicate of the traits but was mainly genotype dependent.

Keywords: Grape, genotype, variability, bunch, berry characteristics

Introduction

Grape (*Vitis vinifera* L) is a global fruit crop growing in all the continents. Due to wider adaptability, it is grown in East (Lalengkima, 2016) [7], West (Chanana and Gill, 2008; Sahoo *et al.*, 2017a; 2017b; 2018) [2, 9, 10], North (Bhat *et al.*, 2017, Dolkar *et al.*, 2018) [1, 4], South (NHB, 2017) [8]. covering temperate, subtropical and tropical climatic regions in India. The maximum grapes were produced during 2017 in China followed by Italy, USA, France, Spain, Turkey and India (FAO, 2017). In India, grape productivity has been the maximum in the world (21 t/ha) and annually production is about 2.74 million (NHB, 2017) [8]. Globally it is mainly used for wine making (80%) and rest is being processed for table, juice and resins. In contrast, India's produce is mainly used for table purpose and small quantity goes in to processing. Subtropical conditions of north India received monsoon rains during the berry ripening. Therefore, early maturing genotypes are suitable to grow under such conditions. Previous researchers also reported about the growing of grapes under subtropical conditions of north India. Chanana and Gill (2008) [2]. evaluated Perlette, Flame Seedless and Beauty Seedless and reported that they suffer from one or another drawback, like poor quality bunches, and berry size. Sahoo *et al.* (2018) [10]. also evaluated the grape genotypes for morphological and biochemical characteristics of grape (*Vitis vinifera* L.) hybrids were evaluated at ICAR-IARI, New Delhi. Hybrids of Pearl of Csaba × Beauty Seedless produced larger size of bunch, while hybrids of Banqui Abyad × Beauty Seedless harvested last and produced smaller size of bunch. Grape (*Vitis vinifera* L.) is one of the most popular and delicious fruits, and rich source of vitamins and minerals. Climate is one of the major factor affecting the development of grape bunch and berry size. Longer duration grape usually had larger size for both the traits as compared to grapes grown under shorter duration area like subtropical areas affected by monsoon rains. Hence, it is important to find out the genotypes, which is capable to produce the bunch and berry of desirable size under shorter berry development period conditions. Keeping the bunch and berry size importance and economic value of fruits, the present study was conducted to investigate the bunch and berry characteristics of grapes genotypes for evaluation and selection of promising cultivars.

Materials and Methods

Fruits of uniform colour and size, without injury were sorted out and used for this experiment. Four uniform bunches from each three different vines were used for taking observations. Grape berries were removed from each bunch. Randomly selected thirty berries from each genotype were chosen for recording the berry related observation. Four replicates for each cultivar were used. Bunch weight was determined using the Electronic precision balance (Citizen) in gram (g). Bunch length was determined by using measuring scale in centimeter (cm) as per the Bioversity International descriptor. Data were analyzed using univariate analysis of variances and means were compared using Duncan’s multiple range test. The statistical analysis software SPSS 12 was employed. A difference was considered statistically significant when the *p*-value was less than 0.05 (*p*<0.05). Correlation tests were done using SPSS 12.

Results and Discussion

The data presented in Table 1 indicated that, the maximum bunch weight was in case of genotypes ‘ER-R1P5’ (496.00 g) followed by ‘Pusa Trishar’ (471.25 g), ‘16/2A-R1P9’ (393.0 g), ‘Tas-a-Ganesh’ (343.25 g), ‘16/2A-R4P7’ (338.50 g), ‘Beauty Seedless’ (330.75 g), ‘16/2A-R1P14’ (311.0 g), ‘Perlette’ (299.75 g), ‘Flame Seedless’ (295.75 g) and ‘Hy.

BA x BS ‘(291.00 g). However, the minimum bunch weight was recorded in ‘16/2A-R3P10’ (62.10 g). The other genotypes had intermediate bunch weight. The differences among the genotypes were found to be highly significant. The average mean weight of all the 47 genotypes was 231.23 g. Among the groups based on seedlessness and colour, it was interesting to note that, the maximum bunch weight was recorded among seedless white genotypes (277.35 g) followed by seedless coloured (249.00 g), seeded white (219.16 g) and minimum among the seeded coloured genotypes (179.42 g). The significant differences were recorded among the genotypes under study in terms of bunch length (Fig. 1). It was ranged from 7.50 cm (‘Chardonnay’) to 24. 00 cm (‘16/2A-R1P9’). The maximum bunch length was recorded in genotype ‘16/2A-R1P9’ followed by ‘ER-R1P5’ (21.50 cm), ‘Pusa Aditi’ (20.6 cm), ‘16/2A-R15’ (19.50 cm), ‘ER-R1P16’ (19.00 cm), ‘Pusa Trishar’ (18.75 cm), ‘16/2A-R2P12’ (18.25 cm) and ‘Perlette’ (18.05 cm). However, the similar trend was noticed among the different groups for bunch weight as it is also for bunch length, wherein the maximum sized bunches were produced by seedless white genotypes (17.67 cm) followed coloured seedless (17.13 cm), seeded white (14.50 cm) and least under seeded coloured group of genotypes (13.69 cm).

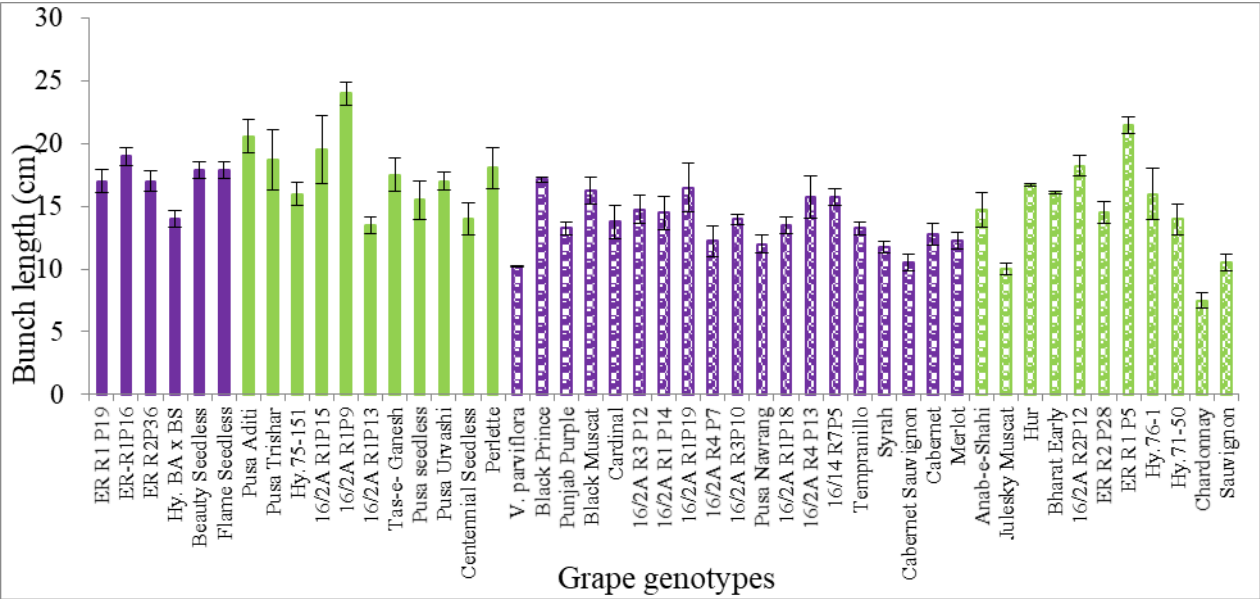


Fig 1: Variability among white and coloured genotypes for bunch length trait.

Table 1: Variability observed in term of bunch weight (g) coloured and white genotype of grapes

Seedless				Seeded			
Coloured (a)		Colourless (b)		Coloured (c)		Colourless (d)	
Genotype	Mean Bunch weight (g)	Genotype	Mean Bunch weight (g)	Genotype	Mean Bunch weight (g)	Genotype	Mean Bunch weight (g)
Hybrid ER R ₁ P ₁₉	143.75	Pusa Aditi	262.00	<i>V. parviflora</i>	220.25	Anab-e-Shahi	240.75
Hybrid ER-R ₁ P ₁₆	214.00	Pusa Trishar	471.25	Black Prince	220.12	Julesky Muscat	70.13
Hybrid ER R ₂ P ₃₆	218.75	Hybrid 75-151	191.50	Punjab Purple	171.00	Hur	202.67
Hybrid BA x BS	291.00	Hybrid 16/2A R ₁ P ₁₅	186.00	Black Muscat	249.00	Bharat Early	210.13
Beauty Seedless	330.75	Hybrid 16/2A R ₁ P ₉	393.00	Cardinal	142.25	Hybrid 16/2A R ₂ P ₁₂	300.75
Flame Seedless	295.75	Hybrid 16/2A R ₁ P ₁₃	192.38	Hybrid 16/2A R ₃ P ₁₂	190.50	Hybrid ER R ₂ P ₂₈	167.32

		Tas-e-Ganesh	343.25	Hybrid 16/2A R ₁ P ₁₄	311.00	Hybrid ER R ₁ P ₅	496.00
		Pusa Seedless	248.25	Hybrid 16/2A R ₁ P ₁₉	95.10	Hybrid 76-1	197.25
		Pusa Urvashi	284.50	Hybrid 16/2A R ₄ P ₇	338.50	Hybrid 71-50	284.50
		Centennial Seedless	179.00	Hybrid 16/2A R ₃ P ₁₀	62.10	Chardonnay	74.75
		Perlette	299.75	Pusa Navrang	125.00	Sauvignon	166.50
				Hybrid 16/2A R ₁ P ₁₈	185.75		
				Hybrid 16/2A R ₄ P ₁₃	100.75		
				Hybrid 16/14 R ₇ P ₅	240.50		
				Tempranillo	232.75		
				Syrah	153.75		
				Cabernet Sauvignon	138.50		
				Cabernet	130.25		
				Merlot	101.93		
Group mean	249.00	-	277.35	-	179.42	-	219.16
Mean of a, b, c, d,		231.23					
LSD (p ≤ 0.05)		50.41					

Table 2: Variability in degree of seedlessness among the coloured and white grape genotypes.

Seedless				Seeded			
Coloured (a)		Colourless (b)		Coloured (c)		Colourless (d)	
Genotype	Bunch type	Genotype	Bunch type	Genotype	Bunch type	Genotype	Bunch type
Hybrid ER R ₁ P ₁₉	C	Pusa Aditi	C	<i>V. parviflora</i>	L	Anab-e-Shahi	L
Hybrid ER-R ₁ P ₁₆	L	Pusa Trishar	SC	Black Prince	C	Julesky Muscat	SC
Hybrid ER R ₂ P ₃₆	SC	Hybrid 75-151	L	Punjab Purple	SC	Hur	SC
Hybrid BA x BS	C	Hybrid 16/2A R ₁ P ₁₅	L	Black Muscat	L	Bharat Early	SC
Beauty Seedless	C	Hybrid 16/2A R ₁ P ₉	L	Cardinal	L	Hybrid 16/2A R ₂ P ₁₂	L
Flame Seedless	SC	Hybrid 16/2A R ₁ P ₁₃	L	Hybrid 16/2A R ₃ P ₁₂	L	Hybrid ER R ₂ P ₂₈	L
		Tas-e-Ganesh	C	Hybrid 16/2A R ₁ P ₁₄	C	Hybrid ER R ₁ P ₅	L
		Pusa Seedless	C	Hybrid 16/2A R ₁ P ₁₉	C	Hybrid 76-1	L
		Pusa Urvashi	C	Hybrid 16/2A R ₄ P ₇	C	Hybrid 71-50	C
		Centennial Seedless	L	Hybrid 16/2A R ₃ P ₁₀	L	Chardonnay	C
		Perlette	C	Pusa Navrang	C	Sauvignon	L
				Hybrid 16/2A R ₁ P ₁₈	L		
				Hybrid 16/2A R ₄ P ₁₃	L		
				Hybrid 16/14 R ₇ P ₅	L		
				Tempranillo	C		
				Syrah	C		
				Cabernet Sauvignon	C		
				Cabernet	C		
				Merlot	C		

(C = compact; SC = semi compact; L = loose)

The texture of the grape bunch is very important. Therefore, bunches are usually classed in three groups-compact, loose and semi-loose bunch types (Table 3). Out of 47 genotypes, 43% were of compact, 43% loose and 14% were semi-compact type. Equal number of genotypes (20) were fall

under the compact and loose category and rest of 7 genotypes were of semi-compact bunches. As the trait is varietal specific and can be modified through thinning manually as well as by using bioregulators.

Table 3: Variability observed in term of berry weight (g) coloured and white genotype of grapes

Seedless				Seeded			
Coloured (a)		Colourless (b)		Coloured (c)		Colourless (d)	
Genotype	Mean	Genotype	Mean	Genotype	Mean	Genotype	Mean
Hybrid ER R ₁ P ₁₉	1.68	Pusa Aditi	2.65	<i>V. parviflora</i>	3.15	Anab-e-Shahi	4.28
Hybrid ER-R ₁ P ₁₆	1.55	Pusa Trishar	2.03	Black Prince	1.90	Julesky Muscat	2.25
Hybrid ER R ₂ P ₃₆	1.58	Hybrid 75-151	2.13	Punjab Purple	3.48	Hur	3.65
Hybrid BA x BS	0.95	Hybrid 16/2A R ₁ P ₁₅	4.50	Black Muscat	3.38	Bharat Early	2.70
Beauty Seedless	1.98	Hybrid 16/2A R ₁ P ₉	2.53	Cardinal	1.75	Hybrid 16/2A R ₂ P ₁₂	2.73
Flame Seedless	1.80	Hybrid 16/2A R ₁ P ₁₃	4.13	Hybrid 16/2A R ₃ P ₁₂	3.45	Hybrid ER R ₂ P ₂₈	2.10
		Tas-e-Ganesh	1.78	Hybrid 16/2A R ₁ P ₁₄	1.15	Hybrid ER R ₁ P ₅	2.65
		Pusa Seedless	2.55	Hybrid 16/2A R ₁ P ₁₉	2.63	Hybrid 76-1	4.68
		Pusa Urvashi	2.33	Hybrid 16/2A R ₄ P ₇	2.05	Hybrid 71-50	3.40
		Centennial Seedless	2.30	Hybrid 16/2A R ₃ P ₁₀	1.65	Chardonnay	0.93

		Perlette	1.35	Pusa Navrang	1.55	Sauvignon	1.50
				Hybrid 16/2A R ₁ P ₁₈	2.33		
				Hybrid 16/2A R ₄ P ₁₃	1.50		
				Hybrid 16/14 R ₇ P ₅	2.18		
				Tempranillo	1.83		
				Syrah	2.00		
				Cabernet Sauvignon	1.53		
				Cabernet	1.43		
				Merlot	1.20		
Group mean	1.59	-	2.75		2.17	-	2.68
Mean of a, b, c, d				2.30			
LSD (p ≤ 0.05)				0.41			

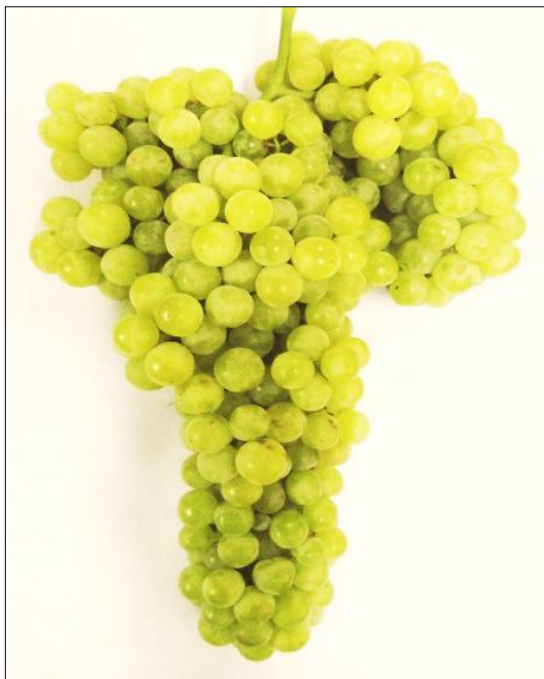


Plate 1: Pusa Trishar



Plate 2: Beauty Seedless

Berry weight is important parameter signifies the quality of grapes. Under subtropical climate growing period is very short is major limitation for larger berry development. Therefore, bold berry genotypes are better as compared to

small. It was studied among the genotypes under study and a significant variation ($p \leq 0.05$, $LSD = 0.41$) was observed for the berry weight (Table 3 and Fig. 1). The largest berry in terms of berry was noticed in genotypes 'Hy. 76-1' (4.68 g) followed by '16/2A-R1P5' (4.50 g), 'Anab-e-Shahi' (4.28 g), '16/2A-R1P14' (4.13 g), 'Hur' (3.65 g), 'Punjab Purple' (3.48 g), '16/2A-R3P12' (3.45 g) and 'Hy. 71-50' (3.40 g). However, the minimum berry weight was noticed in 'Chardonnay' followed by 'Hy. BA x BS', 'Perlette', 'Merlot', 'Pusa Navrang' and 'Black Prince'. Among the different groups of genotypes, the maximum berry weight was recorded in seedless white genotypes (2.75 g; n=11) followed by seeded white (2.68 g; n =11), seeded coloured (2.30 g; n=19) and least among seedless coloured genotypes (1.59 g; n = 6).

All genotypes exhibited significant variations in their bunch weight, bunch length, bunch compactness, and berry weight. In general, normal to loose bunch were found in coloured genotypes and white (light green) genotypes showed compact to very compact bunch. These findings are in agreement with the Khan *et al.* (2011)^[6]. and Jackson and Lombard (1993)^[5]. In the present study, berry weight was found maximum in genotype Hy. 76-1. Results suggested the best adaptability of 'Hy.76-1', 16/2A-R1P14 and 16/2A-R1P9 to sub-tropical climatic conditions of Delhi. This variation in the phenological stages of different genotypes is ascribed to the differences in phenotypic and genotypic expression under existing climatic conditions (Coombe, 1987)^[3]. Various physiological processes such as; cell division, growth and development, sugar metabolism, enzyme reactions, photosynthates assimilation and transportation are partially subjected to influence of temperature variation. Similar findings were also reported by Thakur *et al.* (2008)^[11]. and Thakur *et al.* (2008)^[11]. in grape varieties grown under subtropical conditions Punjab. They found the highest berry weight in Cardinal and it was at par with Banqui Abyad. The berry weight, length and diameter of Perlette and Beauty Seedless were found highly variable.

Conclusion

Bunch and berry size are qualitative traits and independently related to the genotypes. However, several factors also affect the growth and development like climate and orchard management practices. However, under subtropical climatic conditions of north India favoured the few genotypes and produced the bunch and berry of higher standards. These mainly include some cultivated varieties as well as some of the new hybrids developed. These are the potential genotypes suitable to grow successfully under such conditions.

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