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Evaluation of coloured grape genotypes under sub-tropical climate for quality traits

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Abstract
Twenty-five coloured grape genotypes were evaluated for subtropical monsoon climatic Zone at ICAR-Indian Agricultural Research Institute, New Delhi. The experiment was conducted from 20014-15 for fruit quality traits. Based on juice recovery, total soluble solid/titratable acidity ration, titratable acidity, ascorbic acid and pH. Based on these morpho-physical and biochemical characteristics, genotypes '16/2A-R_3P_{10}', Black Muscat, Cardinal and Hy. 'ER-R2P26' was found promising.

Keywords: Grape genotypes, juice, total soluble sugar, acidity, pH

Introduction
Grape is one of the most important fruit crop and versatile in adaptation, therefore, widely grown in varied climatic conditions. However the commercial cultivation is practiced in the area that provide optimum situations to produce high quality grapes (De Blij, 1983) [2]. Most of the world's viticulture regions are located between latitudes of 40° and 50°N in northern hemisphere and between latitudes of 30° and 40°S in the southern hemisphere called as temperate climatic belt (Iland *et al*., 2009) [6]. Grapes growing in tropical regions have been performed commercially since approximately 50 years (Jogaiah *et al*., 2013) [8]. In subtropical parts, Punjab was 1st state stated comprehensive introductions and trials for adaptability testing at Lyallpur (West Pakistan) in 1928 under the Leadership of Sh. Lal Singh (Head, Deptt of Hort). He introduced about 166 varieties from USA, Australia, Afghanistan, and Russia at Lyallpur.

In India, grapes are grown under tropical and semi-arid irrigated regions in North India condition as well as in Central, Southern and Coastal Tropical Regions. Subtropical part experiences very high temperature during summers and accelerates the berry ripening. However, there is a limited period available after spring season to and before onset on monsoon showers. Subtropical part of India offers added advantage to supply the grapes in peak summers, when the grape harvesting ends from major grape growing areas southern and central part of India (tropical grapes). The maximum temperature during summer reaches from 38-42 °C in May month for few days. The rainy season starts form mid of the June to the middle of September. Some pre-monsoon showers also occur in first week of June. Most of the rain falls during the southwest monsoon spell. Delhi received 610 mm of rainfall. Winter are cool and temperature reaches up to 5 degree Celsius, sufficient to grapevine in dormancy. Grapevines, therefore experiences bud dormancy from 2-3 months (December to February). These conditions are favorable for growing coloured varieties of grapes in region because the hot day and cold nights are help to developing colour pigments like anthocyanin (Romeyer *et al*. 1983 and Jackson and Lombard 1993) [14, 7]. The optimal temperatures for anthocyanin accumulation in grapes berries are in the range 15-25 °C during the date day time and the night temperature 10-20 ºC (Kliewer and Toores 1972) [10]. With the above mentioned facts an experiment conducted to study the evaluation and characterization of coloured grapes varieties under subtropical conditions of New Delhi.

Material and Methods
The experiment of coloured grapes genotypes were evaluated during the year 2014-15 at ICAR- Indian Agricultural Research Institute, New Delhi. The data was analyzed with Randomized Block Design with twenty five genotypes and four replications. Data were collected for following variables and statistically analyzed for bunch weight, juice recovery, total titratable acidity, TSS/TA ratio, pH and ascorbic acid content. Bunch weight was determined using the Electronic precision balance (Citizen) in gram (g).

Juice recovery is measured by extraction of juice excluding seed and peel by weight basis. The TSS of grape juice were recorded with the help of by a digital refractometer (HI 96801, Hanna, Romania). Data was expressed as equivalent Brix. The pH of the juice was measured by digital pH meter after standardizing it with buffer of pH 4.00, 7.00 and 9.00. The titratable acidity of the juice present in all the genotypes was determined by titration against 0.1N NaOH solution using a 1-2 drop of phenolphthalein as indicator. The titratable acidity of sample was expressed as percent tartaric acid (AOAC, 2000) [1]. The ascorbic acid content was also determined by titration of known weight of sample with 2, 6-dichlorophenol indophenol dye using metaphosphoric acid as a stabilizing agent. The content of the ascorbic acid present in the samples was expressed in mg/100 ml of juice (AOAC, 2000) [1].

Results and Discussion

Bunch size in terms of weight varied widely the genotypes and ranged from 62.1 to 338.5 g (Fig. 1). The maximum bunch weight was observed in genotypes 16/2A-R_4P_7 (338.50 g), Beauty Seedless (330.75 g), 16/2A-R_1P_{14} (311.0 g), Flame Seedless (295.75 g) and Hy. BA x BS (291.00 g). The differences among the genotypes were found to highly significant. The average mean weight of all the 25 genotypes was 196.12 g. However, seedless genotypes observed with higher bunch weight over seeded.

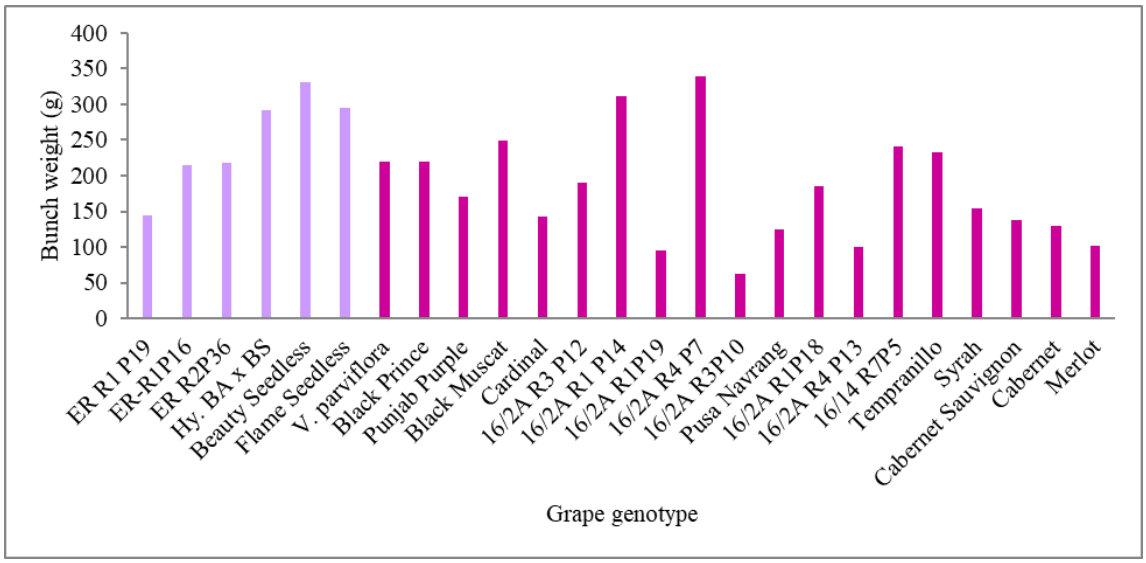

Fig 1: Bunch weight (g) in different coloured genotype of grapes. Light coloured histogram represents seedless genotypes and dark coloured are seeded.

The recovery of the juice content was ranged in grape genotypes from 49.18 (*V. parviflora*) to 69.57% ('Black Prince') and found statistically significant (Fig. 2). In general, higher juice recovery was recorded in seedless coloured genotypes (63.78) as compared to seeded (6197). Among all the genotypes, the maximum juice recovery was recorded in seeded genotype Black Prince (69.57%), '16/2A-R_3P_{10}' (69.44), followed by 'Cardinal' (68.92) and 'ER-R_2P_{36}' (68.48%).

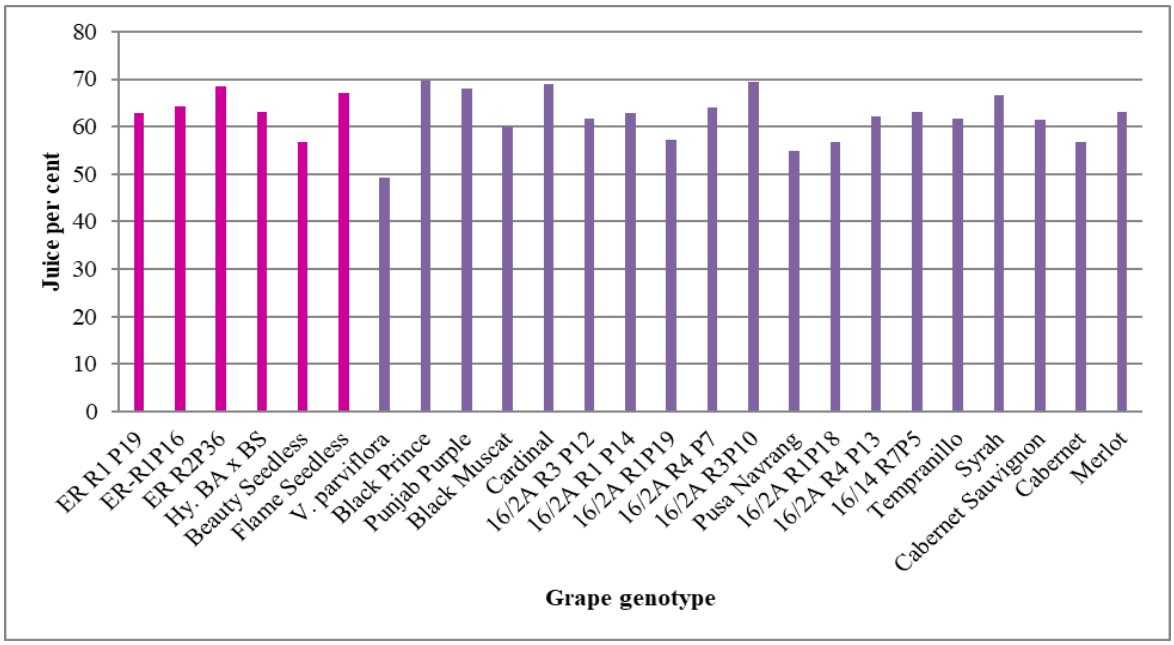

Fig 2: Juice recovery (%) in different coloured genotype of grapes. Light coloured histogram represents seedless genotypes and dark coloured are seeded.

The berry juice titratable acidity ranged from 0.58% to 1.09% (Cabernet Sauvignon). The minimum acidity value of 0.58% was recorded in two genotypes 'Flame Seedless'. Whereas, the maximum acidity was found in 'Cabernet Sauvignon' (1.09%) followed by '16/2A-R_3P_{12}', '16/2A-R_1P_{19}' (1.05% each), 'Merlot' and 'Sauvignon' (1.00%). Other had intermediate juice acidity (Fig. 3). On an average basis, higher acidity was recorded among seeded genotypes as compared to seedless.

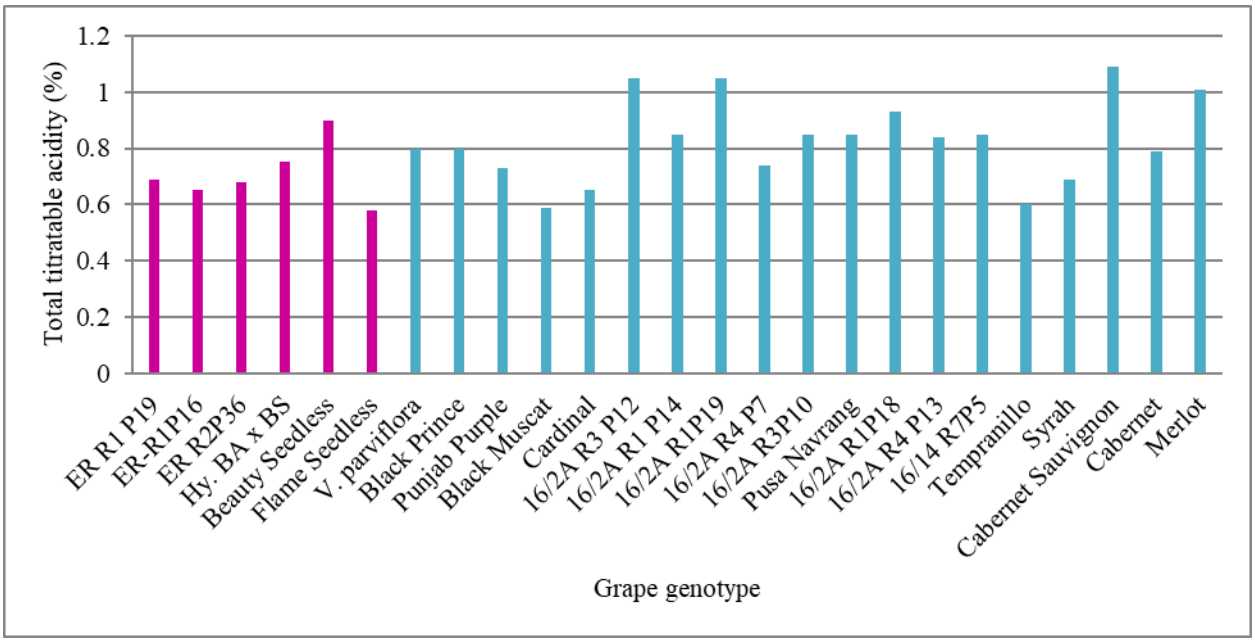

Fig 3: Total titratable acidity (%) in different coloured genotypes of grapes. Purple coloured histogram represents seedless genotypes and blue coloured are seeded.

The total soluble solid to titratable acidity showed highly significant differences (Fig. 4). It was ranged from 13.26 ('Syrah') to 31.25 ('ER-R2P36'). In general, higher ratio was recorded in seedless as compared to seeded genotypes. However, among genotypes, the maximum TSS/TA ratio was recorded in 'ER-R_2P_{36}' (31-25) followed by 'Black Muscat' (28.39). The minimum TSS/TA ratio was recorded in genotype 'Cabernet Sauvignon' (13.26) followed by '16/2A-R_1P_{19}' (17.03), '*V. parviflora*' (17.94), and '16/14-R_7P_5' (18.94).

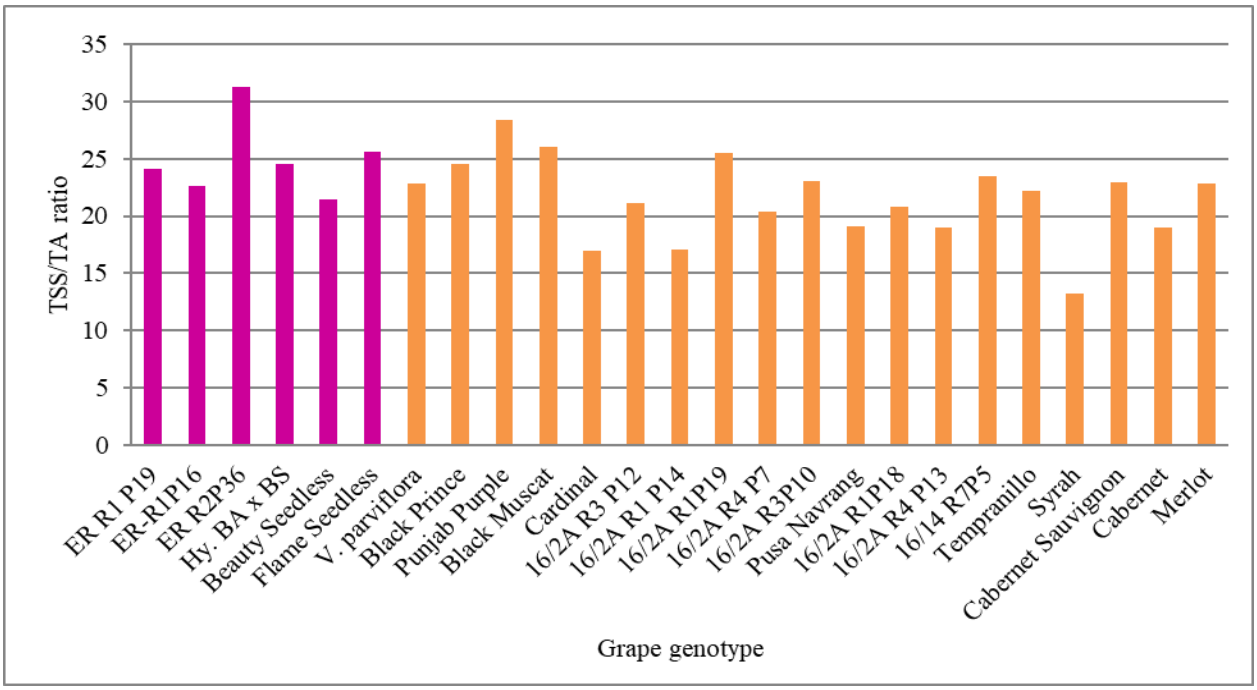

Fig 4: Total soluble solid/Titratable acidity in different coloured genotypes of grapes. Purple coloured histogram represents seedless genotypes and orange coloured are seeded.

The pH of the juice extracted from grape genotypes was analyzed and data presented in Fig. 5. The pH of juice differed slightly among all the genotypes which were ranged from 3.0 ('Beauty Seedless') to 4.00 ('Pusa Navrang'). The maximum pH was recorded in genotype 'Pusa Navrang' (4.00), 'ER-R_2P_{36}' (3.90), 'Flame Seedless' (3.90) and '16/2A-R_1P_{14}' (3.90). In other genotypes it was recorded in intermediate range.

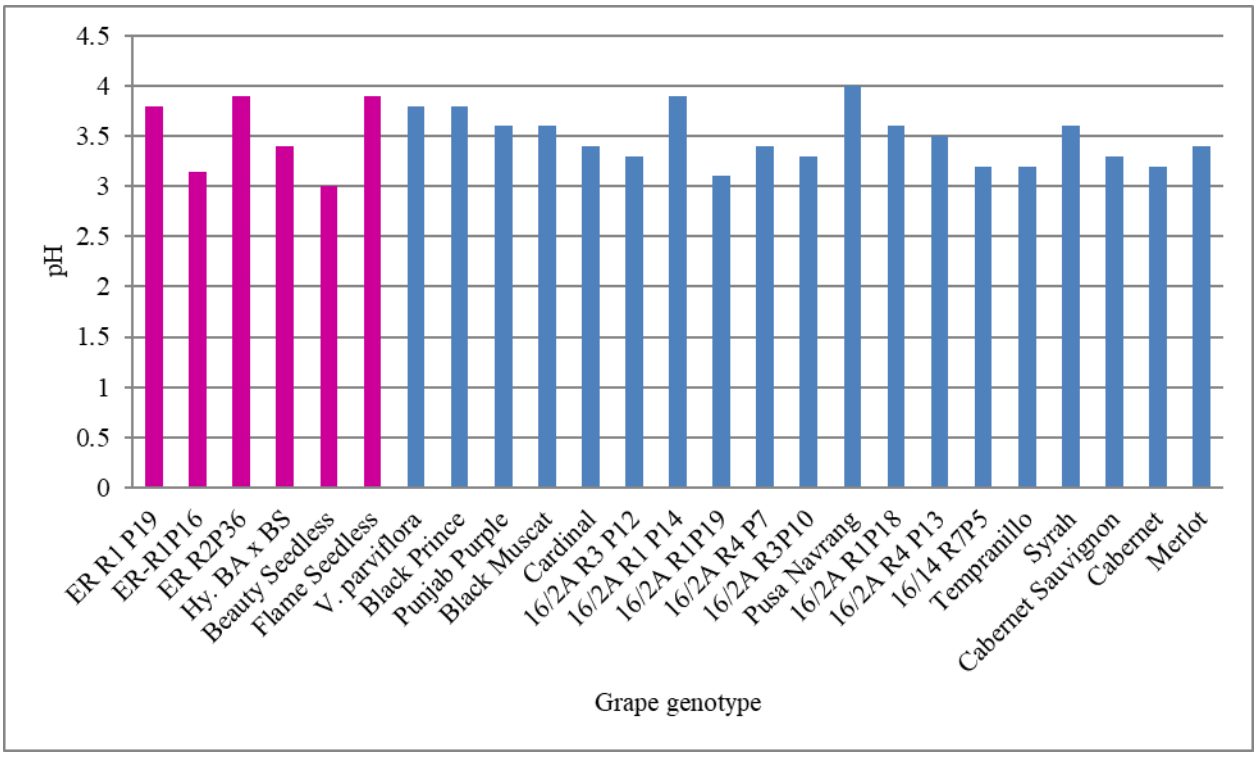

Fig 5: Juice pH in different coloured genotype of grapes. Purple coloured histogram represents seedless genotypes and blue coloured are seeded.

The grape genotypes under study showed significant variation in ascorbic acid (Fig. 6). The maximum ascorbic acid content was observed in 'Syrah' (7.80 mg/100g). Whereas, the minimum ascorbic acid content was found 2.38 mg/100 g in 'ER-R_1P_{16}', and 'ER-R_2P_{36}'. Other genotypes showed intermediate ascorbic acid content. However, it was interested to note that the seeded coloured genotypes was found superior in terms of higher ascorbic content (5.03 mg/100g) as compared to seedless coloured (3.17 mg/100g) genotypes.

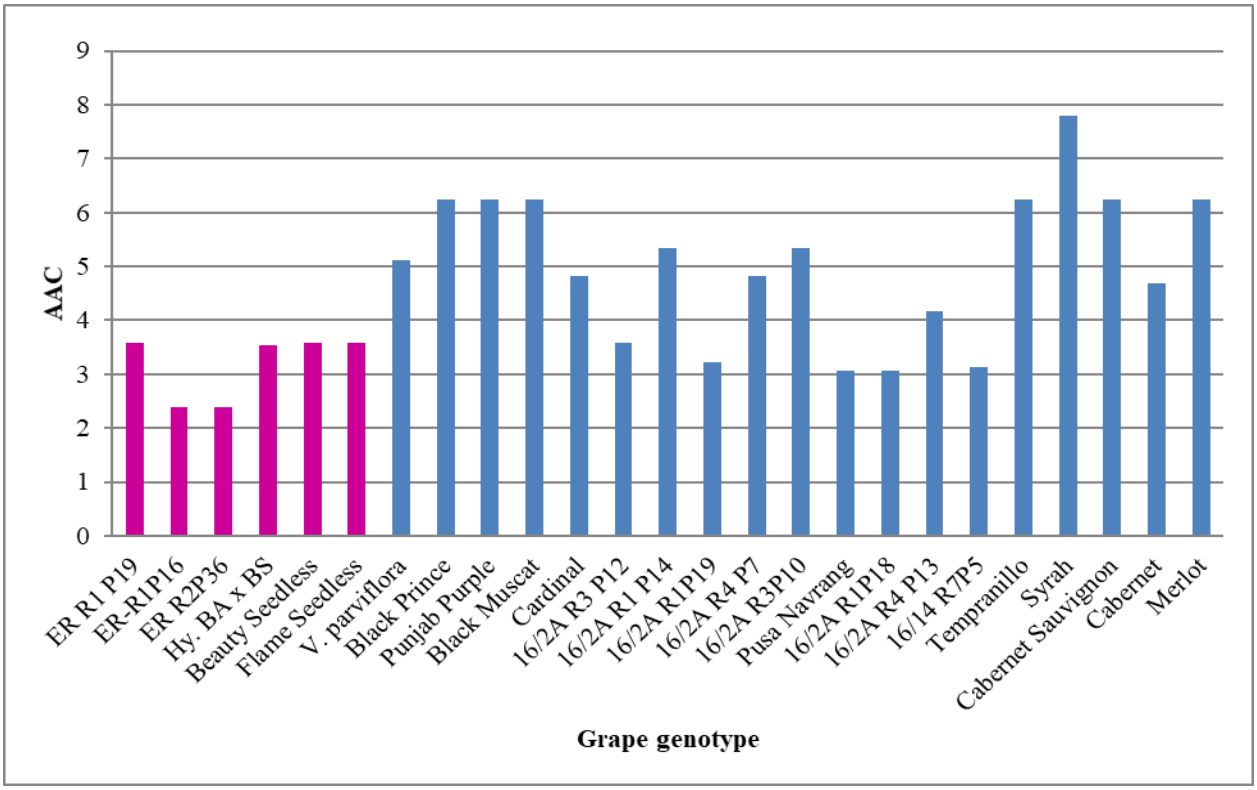

Fig 6: Ascorbic acid content (mg/100 ml juice) in different coloured genotype of grapes. Purple coloured histogram represents seedless genotypes and blue coloured are seeded.

The TSS/TA of medium to large berries was higher as compared to smaller size genotypes. The similar findings about TSS and acidity were reported by Thakur *et al*. (2008) [15] in grape grown under Punjab conditions. However, these reports are in contradictory to Khan *et al* (2011) [9]. However, the TSS/TA ratio is primarily governed by genetical and phenotypical factors and temperature of day and night favours the accumulation of solutes. Therefore, it may be responsible

for berry size development as well as solute accumulations. The maturity index (MI) is the ratio between the TSS (ºBrix) and TA (mg tartaric acid 100 ml^{-1} juice), which represents a balance between sugar and acid, important to the general quality (Liu *et al*., 2006; Mota *et al*., 2006) [11]. For all genotypes the MI was satisfactory, indicating a good maturity of the grapes. There were little variation was recorded in the pH of berry juice among the 25 genotype. However, high pH was recorded in early maturing grapes compared to late maturing. Ascorbic acid content was found higher in mid to late maturing genotypes as compared to early and very late maturing genotypes. However, vitamin C rich genotype 'Syrah') were differed significantly with low content genotypes ('ER-R_2P_{36}' and 'ER-R_1P_{16}'). These differences are supposed to be due to differential genetic makeup and also because of the differences in the berry development period and time of maturity. The variation in the ascorbic acid content was also reported in kiwifruit (Nishiyama *et al*., 2004) and grape (Guoa *et al*., 2003) [5]. The low amount of ascorbic acid in grape genotypes is the crop specific traits and also it be due to the fact that the ascorbic acid is a colourless and water soluble compound which has highly sensitive to heat and light and goes lost during the process of ripening when produce is subjected to ripen under hot dry summers (Davey *et al*., 2000) [4].

Conclusion

Among the twenty five coloured grape genotypes several genotypes were found potential for juice making in terms of juice recovery, TSS/TA ration, titratable acidity, ascorbic acid and pH. Based on these morpho-physical and biochemical characteristics, genotypes '16/2A-R3P10', Black Muscat, Cardinal and Hy. 'ER-R2P26' was found promising. However, further studies are required about chromatic properties and phenolic composition of these genotypes for identification of suitable varieties to grow under subtropical conditions and processing for juice making.

Acknowledgements

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