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CHARACTERIZATION AND EVALUATION OF SOME PEACH [*PRUNUS PERSICA* (L.) BATSCH.] ACCESSIONS FOR FRUIT QUALITY TRAITS

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ABSTRACT
The present investigation entitled "Characterization and evaluation of some peach [*Prunus persica* (L.) Batsch.] accessions for fruit quality traits" was carried out in the field gene bank of National Bureau of Plant Genetic Resources, Regional Station Phagli, Shimla during 2017-2018. Sixteen peach genotypes namely Shan-i-Punjab, Kanto-5, Fertilia, Yum Yong, Flordasun, Summerglo, Suncoast, FlordaBelle, Ambri, Early Redhaven, Okubo, Early Amber, Fire Prince, Belle of Georgia, Hale Haven and Nishiki were evaluated for their fruit characters. Maximum fruit length (96.95 mm) and fruit diameter (88.45 mm) was recorded in Summerglo, whereas minimum fruit length (53.36 mm) and fruit diameter (56.00 mm) was recorded in Shan-i-Punjab and Nishiki respectively. Heaviest fruits were found in Suncoast (203.83 g) and lightest fruits were observed in Ambri (72.33 g). Fruit firmness varied from 2.05 kg/cm^2 in Shan-i-Punjab to 6.56 kg/cm^2 in Hale Haven. Maximum pulp/stone ratio (43.39) was found in Flordasun and minimum (8.87) in Hale Haven. TSS content of fruit was maximum (13.43°B) in FlordaBelle and minimum (8.10°B) in Ambri. Titratable acidity was maximum (1.64%) in Summerglo and minimum (0.20%) in Belle of Georgia. Total sugars were maximum (10.53%) in Fertilia and minimum (6.25%) in Belle of Georgia.

INTRODUCTION

Peach [*Prunus persica* (L.) Batsch.] is an important fruit crop of Himachal Pradesh valued for its fresh and canned fruits. The fruits of peach are attractive, delicious and highly nutritious. They are very rich source of potassium, iron, fiber, vitamin A, vitamin C and also contains high concentrations of phytochemicals such as carotenoides, flavonols and anthocyanins (Hancock and Scorza, 2008; Byrne, 2002). The total area under peach cultivation in Himachal Pradesh 5076 hectares (ha) with the production of 4097 metric tonnes (MT) during 2017-2018 (Anonymous, 2018).

Peaches have relatively performed well at an altitude ranging between 1200-1500 m amsl and 'July Elberta', 'Redhaven' and 'Sunhaven' Suncrest and Glohaven are popular cultivars. Although, peach is a temperate zone fruit, low chilling peach cultivars have been developed and found suitable for subtropical region (Kunden *et al.*, 2004). It has ushered economic prosperity in the hilly regions of the state, which were completely deprived of modern development practices. Unfortunately, due to monoculture of peach, the pace of development through peach based farming system is stumbling down. Consequently, the profit out of this fruit have started declining due to various factors viz. susceptibility to insect, pests and diseases, climatic vagaries leading to low fruit production, post harvest losses, costly management practices thereby increasing the cost of production.

Moreover, with the sudden upsurge of global warming, standard cultivars of peach because of their inability to meet the requisite chilling requirement in wet temperate region of HP posing the risk of crop failure. Besides, the over dominance of few peach cultivar in peach growing pockets of HP has at times, led to a glut in the market resulting in colossal economic loss to the farmers. This situation may only be countered by broadening the base of germplasm through introduction and evaluation of new varieties of peaches. The development of new fruit cultivars has generally been based on genetic resources (Wani *et al.*, 2014). Germplasm collection and characterization are essential stages of breeding programs. Main germplasm collection and characterization performed by describing phenological, pomological and morphological characteristics such as tree vigour and growth habit, fruit quality features, leaf, stone, flower, stigma and style, pollen blooming and harvest time (Yilmaz *et al.* 2009). Besides, the descriptors so developed are important for the proper identification and characterization of the variety to maintain trueness and check biopiracy. To make use of the existing variability, the selection of superior genotypes with desirable traits will be of paramount importance in expansion of fruit cultivation in the country (Sharma *et al.*, 2016).

Keeping in mind the above and to provide an array of varieties, the present study was carried out on some peach germplasm accessions available in the field genebank of NBPGR, Regional Station Phagli, Shimla to describe and evaluate peach

germplasm for fruit characteristics.

MATERIALS AND METHODS

The present investigation was carried out in the field gene bank of National Bureau of Plant Genetic Resources, Regional Station Phagli, Shimla at an elevation of 1924 m amsl during the year 2017-2018. The climate of location is wet temperate. The peach germplasm accessions undertaken for studies were: Ambri, Belle of Georgia, Early Amber, Kanto-5, Yum Yong, Fertilia, Flordasun, Summerglo, Hale Haven, Suncoast, Shan-i-Punjab, Early Redhaven, FlordaBelle, Fire Prince, Okubo, Nishiki. Three plants of each of the accession were selected for various observations. These plants are 15-18 year old and are grafted on wild peach rootstock.

Standard analytical procedures and UPOV guidelines (2010) were followed to record data on various morphological and physico-chemical characters.

Morpho-physical fruit characteristics

To study fruit characters, 15 representative fruit samples (five in each replication) were taken at optimum maturity. The average length and breadth were measured with the help of a digital Vernier Callipers (Model No. CD-6"CS, Mitutoyo Corp. Japan). The weight of five fruits under three replicates of each genotype was recorded and the average weight per fruit was calculated. The shape of fruit, mucron tip at pistil end, shape of the pistil excluding mucron tip and prominence of suture was observed visually. The symmetry of fruit was viewed from pistil end and classified as symmetric or asymmetric. The surface colour, fruit skin colour and fruit flesh colour was observed by comparing it with the colour charts of the Royal Horticultural Society, London. Fruit firmness was measured with the help of penetrometer (kg/cm^2). Time of harvesting was estimated as the date on which fruits were harvested from plant. Number of days was counted from the date of full bloom to the date of harvest.

The stone size was recorded by measuring the length, breadth and thickness with the help of digital Vernier Callipers. The weight of ten stones under three replicates of each genotype was recorded and the average weight per stone was calculated. The shape, anthocyanin coloration of stone was determined visually. Adherence of flesh to stone was observed visually in each genotype and classified as clingstone and freestone. Pulp/stone was worked out by dividing the weight of the fruit pulp by the weight of stone. Grooves/pits and shape of apex was observed visually in each genotype.

Biochemical fruit character

The biochemical characteristics of fruit will be determined as per the standard procedures given by Ranganna (1986). The total soluble solid content of fruits was determined with digital pocket refractometer (Pal-Atago, Japan). Acidity and sugars were estimated as per the standard procedures (A.O.A.C., 1980). Sugar/acid ratio was worked out by dividing per cent total sugar with per cent titratable acidity.

Statistical analysis

The statistical analysis for each character was carried out on mean values. The data were subjected to the analysis of various traits as described by Gomez and Gomez (1984) for Randomized complete Block Design. The parameters under studies were replicated three times.

RESULTS AND DISCUSSION

Morpho-physical fruit characters

The observations recorded on various fruit characters were presented in Table 1. Maximum fruit length (96.95 mm) and fruit diameter (88.45 mm) was recorded in Summerglo, whereas minimum fruit length (53.36 mm) and fruit diameter (56.00 mm) was recorded in Shan-i-Punjab and Nishiki respectively. Heaviest fruits were found in Suncoast (203.83 g) and lightest fruits were observed in Ambri (72.33 g). Mucron tip at pistil end was present in all the genotypes, except FlordaBelle, Early Redhaven, Early Amber, Fire Prince and Hale Haven. Shape of the pistil end (excluding mucron tip) was weakly pointed in most of the genotypes, except Kanto-5 and Nishiki (Prominently pointed); Flordasun and FlordaBelle (Weakly depressed); Early Amber, Fire Prince and Hale Haven (Flat). The fruits from pistil end were symmetric in Shan-i-Punjab, Yum Yong, Summerglo, Suncoast, Ambri, Early Amber, Okubo, Early Redhaven and Nishiki. The genotypes Kanto-5, Fertilia, Flordasun, FlordaBelle, Fire Prince, Belle of Georgia and Hale Haven had asymmetric fruits, while viewed from pistil end.

The prominence of suture was medium in most of the genotypes, except Summerglo, Early Redhaven, Okubo and Hale Haven (Strong); Suncoast and Fire Prince (Weak).

The fruit skin colour was observed to be in Yellow Green Group (145 A) in Fertilia and FlordaBelle, (145 B) in Yum Yong, Hale Haven and Early Amber, (150 A) in Nishiki; Yellow Orange Group (17 A) in Summerglo, (20 A) Suncoast; Yellow Group (11 A) in Okubo; Orange Group (28 A) in Shan-i-Punjab; Orang Red Group (33 A) in Kanto-5 and Ambri, (34 A) in Flordasun and Early Redhaven; Red Group (142 A) in Belle of Georgia, (147 A) in Fire Prince. The fruit flesh colour was observed to be in Yellow Group (4 A) in Nishiki and (4 D) in Early Amber, (9 A) in Early Redhaven, FloradBelle and Kanto-5, (11 D) Okubo, (12 A) in Fertilia and Ambri; Yellow Green Group (145 B) in Fire Prince, (145 D) in Yum Yong; Yellow Orange Group (13 A) in Summerglo, (14 A) in Flordasun, (15 A) in Hale Haven, (16 A) in Belle of Georgia, (19 A) Suncoast and (28 A) in Shan-i-Punjab.

Fruit firmness ranged from 2.05 (Shan-i-Punjab) to 6.56 kg/cm^2 (Hale Haven). This is an important factor taken into consideration where the fruit has to be transported over distances and local markets are not available.

Time of maturity of fruit ranged from fourth week of May in Shan-i-Punjab and Flordasun to second week of July in Kanto-5. Number of days from full bloom to harvest ranged from 103 days in Nishiki and Fire Prince to 135 days in FlordaBelle (Table 2). Peach genotypes maturing in May holds promise due to non-availability of fruits in the market in the mid hill areas, further so the fruit quality is considerably better than those are in the markets during the same time. Several workers have worked on the physical aspect of peach fruits (Dumitru *et al.*, 2007 and Topp *et al.*, 2012) in the past and have reported

Table 1: Morpho-physical characteristics of some peach accessions

Accession	Fruit length (mm)	Fruit diameter (mm)	Fruit weight (g)	Fruit shape	Mucron tip at pistil end	Shape of pistil end	Fruit symmetry	Prominence of suture	Fruit skin colour	Fruit flesh colour	Fruit firmness (Kg/cm^2)
Shan-i-Punjab	53.36	56.20	125.83	Round	Present	Weakly pointed	Symmetric	Medium	*O Group 28 A	YO Group 28A	2.05
Kanto-5	62.20	87.60	199.53	Elliptic	Present	Prominently pointed	Asymmetric	Medium	*****OR Group 33A	Y Group 9A	6.50
Fertilia	75.64	76.58	121.50	Elliptic	Present	Weakly pointed	Asymmetric	Medium	**YG Group 145A	Y Group 12A	4.06
Yum Yong	71.70	64.73	108.00	Ovate	Present	Weakly pointed	Symmetric	Medium	YG Group 145 B	YG Group 145D	2.84
Flordasun	58.13	60.39	87.66	Oblate	Present	Weakly depressed	Asymmetric	Medium	OR Group 34 A	YO Group 14A	2.79
Summerglo	96.95	88.45	202.83	Ovate	Present	Weakly pointed	Symmetric	Strong	***YO Group 17A	YO Group 13A	2.93
Suncoast	90.17	84.49	203.83	Round	Present	Weakly pointed	Symmetric	Weak	YO Group 20A	YO Group 19A	4.65
FlordaBelle	77.13	80.45	134.16	Oblate	Absent	Weakly depressed	Asymmetric	Medium	YG Group 145A	Y Group 9A	5.90
Ambri	66.67	68.25	72.33	Elleptic	Present	Weakly pointed	Symmetric	Medium	OR Group 33A	Y Group 12A	6.11
Early Redhaven	77.94	72.45	124.33	Elleptic	Absent	Weakly pointed	Symmetric	strong	OR Group 34A	Y Group 9A	6.43
Okubo	90.95	82.65	198.65	Ovate	Present	Weakly pointed	Symmetric	Strong	****Y Group 11 A	Y Group 11D	4.64
Early Amber	69.27	70.04	100.33	Ovate	Absent	Flat	Symmetric	Medium	YG Group 145B	Y Group 4D	3.73
Fire Prince	77.42	72.80	132.16	Round	Absent	Flat	Asymmetric	Weak	******R Group 147A	YG Group 145 B	4.84
Belle of Georgia	75.74	79.85	138.50	Round	Present	Weakly Pointed	Asymmetric	Medium	R Group 142A	YO Group 16A	6.45
Hale Haven	73.99	69.06	88.16	Ovate	Absent	Flat	Asymmetric	Strong	YG Group 145B	YO Group 15A	6.56
Nishiki	65.66	56.00	85.93	Ovate	Present	Prominently pointed	Symmetric	Medium	YG Group 150A	Y Group 4A	4.13
Mean	73.93	73.12	132.74								4.67
$CD_{0.05}$	12.97	1.92	50.88								1.34

* O- Orange, ** YG- Yellow Green, ***YO- Yellow Orange, ****Y- Yellow, *****OR- Orange Red, ******R-Red

Table 2: Days from full bloom to harvesting and time of harvesting of some peach accessions

Accession	Time of Harvesting	No. of days from full bloom to harvest
Shan-i-Punjab	31th May	114
Kanto-5	10th July	120
Fertilia	8th July	109
Yum Yong	25th June	106
Flordasun	31th May	115
Summerglo	30th June	124
Suncoast	30th June	111
FlordaBelle	14th June	135
Ambri	27th June	103
Early Redhaven	25th June	104
Okubo	30th June	105
Early Amber	30th June	117
Fire Prince	30th June	103
Belle of Georgia	30th June	110
Hale Haven	3rd July	105
Nishiki	23rd June	103

Table 3: Stone characters of some peach accessions

Accession	Stone size (mm) Length	Breadth	Stone weight	Pulp/ Stone ratio	Stone shape	Anthocyanin colouration of stone	Adherence of flesh to stone	Presence of grooves/Pits	Shape of apex
Shan-i-Punjab	41.10	34.66	6.00	19.89	Elliptic	Weak	Freestone	Present	Pointed
Kanto-5	52.27	39.50	11.00	17.21	Obovate	Medium	Clingstone	Present	Round
Fertilia	49.22	35.07	4.50	26.02	Elliptic	Weak	Clingstone	Present	Round
Yum Yong	50.60	35.31	6.53	15.50	Elliptic	Weak	Freestone	Present	Round
Flordasun	40.72	31.34	2.00	43.39	Obovate	Weak	Freestone	Present	Pointed
Summerglo	53.50	36.07	6.53	30.24	Elliptic	Medium	Freestone	Present	Round
Suncoast	55.50	37.00	4.96	39.86	Obovate	Medium	Freestone	Present	Pointed
FlordaBelle	47.09	39.03	9.00	13.88	Obovate	Weak	Freestone	Present	Pointed
Ambri	47.63	34.87	4.00	17.05	Elliptic	Weak	Clingstone	Present	Pointed
Early Redhaven	55.80	39.17	11.00	10.44	Elliptic	Weak	Clingstone	Present	Pointed
Okubo	56.13	39.13	9.50	19.97	Elliptic	Medium	Freestone	Present	Pointed
Early Amber	46.17	32.07	4.56	21.26	Circular	Weak	Freestone	Present	Round
Fire Prince	55.43	36.83	7.00	17.84	Elliptic	Medium	Freestone	Present	Round
Belle of Georgia	50.35	35.55	7.50	17.45	Elliptic	Strong	Freestone	Present	Round
Hale Haven	51.30	36.20	9.00	8.87	Elliptic	Strong	Clingstone	Present	Round
Nishiki	48.37	34.67	8.56	9.03	Obovate	Weak	Clingstone	Present	Pointed
Mean	50.64	36.26	6.79	20.50					
$CD_{0.05}$	1.09	1.23	0.93	9.93					

Table 4: Biochemical characteristics of some peach accessions

Accession	Total soluble solids (°B)	Titratable acidity (%)	Total sugars (%)	Reducing sugars (%)	Non-reducing sugars (%)	Sugar/acid ratio
Shan-i-Punjab	12.00	0.87	9.20	2.60	6.27	10.64
Kanto-5	8.73	0.69	6.34	2.90	3.28	9.37
Fertilia	13.13	0.67	10.53	2.70	7.44	15.72
Yum Yong	12.43	0.33	9.06	4.26	4.56	27.89
Flordasun	10.23	0.80	7.36	3.30	3.85	9.15
Summerglo	9.76	1.64	7.16	3.00	3.95	3.93
Suncoast	10.40	1.47	7.36	1.48	5.59	5.48
FlordaBelle	13.43	1.05	9.23	4.24	4.75	9.23
Ambri	8.10	0.44	7.06	3.07	3.79	16.17
EarlyRedhaven	11.70	0.43	8.53	3.63	4.66	20.68
Okubo	9.93	0.60	7.06	3.20	3.67	11.74
Early Amber	9.70	1.00	6.56	1.77	4.56	6.56
Fire Prince	10.46	0.60	6.90	2.58	4.11	11.85
Belle of Georgia	9.00	0.20	6.25	2.06	3.98	37.91
Hale Haven	9.70	0.91	6.78	1.06	5.44	7.46
Nishiki	8.96	0.94	6.61	2.12	4.27	7.08
Mean	10.48	0.79	7.63	2.77	4.62	13.21
$CD_{0.05}$	1.91	0.29	0.89	0.43	0.91	10.54

considerable variation fruits of different peach varieties.

Most of the genotypes had elliptic stone shape, except Early Amber (Circular); Kanto-5, Flordasun, Suncoast, FlordaBelle, and Nishiki (Obovate) Table 3. Average stone length ranged from 40.72 mm in Floradsun to 56.13 mm in Okubo. The average breadth of stone was maximum (39.50 mm) in Kanto-5 and minimum (31.34 mm) in Flordasun. Stone weight was maximum (11.00 g) in Kanto-5 and Early Redhaven and minimum (2.00 g) in Flordasun. Pulp/stone ratio is an important criterion to judge the quality of peach fruits. Maximum pulp/stone ratio (43.39) was found in Flordasun followed by Suncoast (39.86) and minimum (8.87) in Hale Haven. The similar type of variation was observed by Singh *et al.* (2014), Chaurasiya and Mishra (2017) in the different sets of varieties.

Most of the genotypes were freestone except Kanto-5, Fertilia, Ambri, Early Redhaven, Hale Haven and Nishiki which were of clingstone type. The colour of fruit (flesh and skin) as well as the adherence of stone to pulp are also important indices to differentiation between various peach cultivars and to some extent are considered as indices of maturity. Morettini (1962) reported the use of pulp colour in the identification of peach cultivars. All the sixteen genotypes were found to have both grooves and pits on the stone surface. The shape of the apex was found to be rounded in Kanto-5, Fertilia, Yum Yong, Early Amber, Fire Prince, Belle of Georgia and Hale Haven, whereas, pointed in Shan-i-Punjab, Flordasun, Suncoast, FlordaBelle, Ambri, Early Redhaven, Okubo and Nishiki.

However, in the present study the peach accessions exhibited no significant variation in fruit skin and flesh colour, except the slight variation was observed in the shade of colour. Significant differences in various fruit characters such as size, weight, colour of skin and flesh were observed in peach genotypes studied (Table 1). These characters are determinant in making any variety acceptable to the end user i.e. the consumer. In general the domestic market has a likeness towards peach fruit which are large in size, sweet in taste, less acidic, juicy and flesh is easily separable from the stone. Several workers have worked on the physical aspect of peach fruits (Chahill *et al.,* 1997; Dumitru *et al.,* 2007; Tandon, 2016; Taheri and Hajnajari, 2010 and Topp *et al.,* 2012) in the past and have reported considerable variation fruits of different peach varieties.

Biochemical characteristics

The TSS content in fruits was found to be ranging between 8.10°B in Ambri and 13.43°B in FlordaBelle. It was revealed from the Table 4 that highest titratable acidity (1.64%) was in Summerglo followed by Suncoast (1.47%) and lowest (0.20%) in Belle of Georgia. Whereas, according to Kaul (2002) TSS content varied from 13.40°B in Shan-i-Punjab to 13.80°B in Flordasun. The titratable acidity was maximum in Pratap and minimum Shan-i-Punjab. Total sugars was highest in Fertilia (10.53%) and lowest (6.25%) in Belle of Georgia. Reducing sugars was varied from (1.06%) in Hale Haven to (4.26%) in Yum Yong. Non-reducing sugars was highest (7.44%) in Fertilia and lowest (3.28%) in Kanto-5. The Sugar acid ratio was maximum (37.91) in Belle of Georgia and minimum (3.93) in Summerglo. These types of variability in peach genotypes were recorded by Sharma and Verma, 2014; Jana 2015; Kishore *et al.* 2017; Chaurasiya and Mishra, 2017. Such variations may be due to the different agroclimatic conditions influencing synthesis of biochemical constituents in the developing fruits and the duration of fruit development period. The variation observed in the TSS, sugars and acidity of the fruits in the present study as compared to others, can be due to the differences in the maturity levels of the fruits at the time of harvest besides the edaphic (nutritional status of soil) and climatic factors .

From the foregoing discussion, it is concluded that some of these genotypes do possess one or more horticulturally desirable characteristics like large fruit and free stone in Summerglo; high TSS and free stone in FlordaBelle; early maturing, high pulp/stone ratio and free stone in Flordasun; Firm fleshed in Hale Haven and free stone, high TSS and high sugar/acid ratio in Yum Yong. Thus these genotypes can be recommended for commercial cultivation and used for the improvement of existing varieties in future breeding

programmes.

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