Indian J. Plant Genet. Resour. 34(3): 475–482 (2021)
DOI 10.5958/0976-1926.2021.00042.5

RESEARCH ARTICLE

Characterization of Peach [*Prunus persica* (L.) Batsch] Germplasm Using UPOV Test Gudielines

Akriti Chauhan*, Krishan Kumar, Dinesh Singh and RK Dogra
Department of Fruit Science, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan-173230, Himachal Pradesh, India

(Received: 08 June, 2021; Revised: 20 October, 2021; Accepted: 26 October, 2021)

Fifteen peach accessions namely July Elberta, Early Redhaven, Suncrest, Tropic Sweet, Paradelux, Saharanpur Prabhat, Earligrande, Flordaprince, Tropic Snow, Flordaglo, Vallegrande, Tropic Beauty, Pratap, Shan-i-Punjab and Glohaven were evaluated for their tree, foliage, floral and fruit characters using UPOV test guidelines. Varied serration was observed from crenate (4 accessions) to shallow serrate (6 accessions) to deep serrate (5 accessions). Nectaries (glands) were observed as globose in five accessions whereas in other accessions these were reniform. Mucron tip was present in seven accessions whereas absent in eight accessions. Shape of fruit varied from circular (8 accessions) to broad elliptic (5 accessions) to medium oblate (2 accessions). Flesh colour was observed as white in Saharanpur Prabhat, Flordaglo and Tropic Snow whereas yellow in all other accesssions under study. Adherence of stone to flesh was absent in nine accessions whereas, present in rest of the accessions. Ovary was pubescent in all the accessions studied. The present work has revealed considerable variation in majority of the characters studied and the descriptive database so developed will help in DUS testing and in multiplication of true-to-type planting material.

Key Words: Accessions, Biopiracy, DUS testing, Peach cultivars, *Prunus persica*

Introduction

Peach [*Prunus persica* (L.) Batsch] a member of family Rosaceae is an important fleshy stone fruit. This delicious fruit, a native of China got domesticated 4,000-5,000 years ago and has spread to various parts of the world used both fresh as well as processed products (Faust and Timon, 1995). Its cultivation extends from 10º N and 49º S latitude where strong light, clear skies, long seasons and warm temperature prevail mainly in low and mid hills within altitudinal range of the 1000-2000 m above mean sea level. Apart from its cultivation in temperate regions, peaches are also grown in warmer climates owing to availability of low chill requiring cultivars. In India, peach got introduced in early 20th century and is cultivated mostly in Himalayan region starting from Jammu & Kashmir and extending up to North - eastern hills.

Most of the peach cultivars require 500-1,000 or more chilling hours at or less than 7.2 °C to foliate and bloom normally in the spring (Hancock *et al*., 2008). The improvement work on peach taken up in different parts of India has resulted in the development of some varieties which are suitable only to local agro-climatic conditions (Devi *et al.,* 2012). Peach growing got a further boost with introduction of low chill cultivars requiring 100-300 hours at or less than 7.2 °C especially from Florida, USA which laid a foundation for peach cultivation in sub-tropical plains of North India (Singh *et al.,* 2014). In fact, all the commercial peach cultivars available in India are exotic introductions made from time to time and the process is continuing.

The existing peach gene pool comprising different cultivars and selections carry synonyms and local names over and above their original nomenclature and perhaps this happened due to lack of characterization and documentation which makes the identification and propagation of true-to-type material difficult. Characterization and evaluation of germplasm plays an important role in identifying the cultivars for their utilization either as a cultivar or to be used as a propagating material. Moreover, proper identification and specific characterization would also facilitate taxonomic description and identification (Wolfe and Strang, 2010). and in addressing the issues related to germplasm exchange and registration. Recent developments of peach DUS test guidelines by PPV&FRA (The Protection of

*Author for Correspondence: Email- chauhanakriti7@gmail.com

Plant Variety and Farmers Right Authority), New Delhi offer a new tool to identify and characterize peach genotypes on the basis of their morphological and fruiting characters and provide a checklist for defined characterization and evaluation. It will also serve as a quick reference guide when developing a new descriptor list for peaches. Keeping in view the above facts, the present study was undertaken with the objective to characterize 15 accessions of peach [*Prunus persica (*L.) Batsch] existing as a part of germplasm collection in the Experimental Block of Department of Fruit Science, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan with the objective to develop descriptive database for identification and characterization of the peach germplasm as well as to help in multiplication of true to type planting material.

Materials and Methods

The present investigation was carried out in Peach Experimental Blocks of Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh. A total of 15 peach varieties, namely July Elberta, Early Redhaven, Suncrest, Tropic Sweet, Paradelux, Saharanpur Prabhat, Earligrande, Flordaprince, Tropic Snow, Flordaglo, Vallegrande, Tropic Beauty, Pratap, Shan-i-Punjab and Glohaven were evaluated for their tree, foliage, floral and fruit characters in a Randomized Block Design with three replications. UPOV (The International Union for the Protection of New Varieties of Plants, 2014) Test guidelines were followed to assess and characterize accessions for morphological characters. In each accession, three bearing plants (6-7 years old) grafted on wild peach were taken to record the observations. The observations for the assessment of distinctiveness, uniformity and stability (DUS) were made on three plants from each variety. For foliage characters randomly picked fifteen mature leaves (five in each replication) were taken. Similarly, for fruit and stone characters, 15 representative fruit samples (five in each replication) were taken at optimum maturity. All colour characteristics were assessed using the Royal Horticultural Society (RHS) colour chart. Characters were categorized in different groups and notes were assigned as shown below:

- GH (Growth habit): Upright (3), upright-spreading (5), Spreading (7)
- TV (Tree Vigour): Strong (3), Medium (5)
- SC (Shape in cross section of leaf blade): Concave (3), Flat (5)
- LM (Leaf margin): Shallow Serrate (3), Deep Serrate (5), Crenate (7)
- AA (Angle at apex of leaf blade): Right Angled (3), Acute (5), Obtuse (7)
- AB (Angle at base of leaf blade): Acute (3), Obtuse (5), Right angled (7)
- LBC (Leaf blade colour): Green Group 137 A (3), Green Group 137 C (5), Green Group 137 B (7), Yellow Green Group 146 A (9)
- RM (Red mid vein on lower side): Present (3), Absent (5)
- PN (Shape of petiole nectaries): Reniform (3), Globose (5)
- PAC (Presence of anthocyanin colouration): Present (3), Absent (5)
- FSAC (Flowering shoot: Intensity of anthocyanin colouration): Medium (3), Weak (5)
- FB (Density of flower buds): Dense (3), Medium (5), Sparse (7)
- FT (Flower type): Rosette (3), Campanulate (5)
- CC (Corolla main colour): Medium Pink (3), Light Pink (5)
- PS (Petal shape): Medium Ovate (3), Circular (5)
- SPP (Stamen position compared to petal): Below (3), Above (5)
- SPA (Stamen position compared to anther): Below (3), Above (5)
- PO (Pollen): Present (3), Absent (5)
- OP (Ovary pubescence): Present (3), Absent (5)
- FS (Fruit shape): Circular (3), Broad elliptic (5), Medium Oblate (7)
- MT (Mucron tip at pistil end): Present (3), Absent (5)
- PMT (Shape of pistil end excluding mucron tip): Flat (3), Prominently Pointed (5), Weakly Depressed (7), Weakly Pointed (9)
- FSM (Fruit symmetry): Symmetric (3), Asymmetric (5)
- PSU (Prominence of suture): Weak (3), Strong (5), Medium (7)
- GC (Ground colour of skin): Greenish Yellow (3), Greenish White (5), Green (7)

- RAO (Relative area of over colour): Medium (3), Large (5), Absent (7)
- HC (Hue of over colour of skin): Dark Red (3), Orange Red (5), Pink Red (7), Pink (9), Medium Red (11)
- PC (Pattern of over colour of skin): Mottled (3), Solid Flush (5)
- PU (Pubescence of skin): Present (3), Absent (5)
- DPU (Density of pubescence): Medium (3), Dense (5), Sparse (7), Very Sparse (9)
- TS (Thickness of skin): Medium (3), Thin (5)
- AF (Adherence of skin to flesh): Strong (3), Medium (5), Weak (7)
- CC (Carotenoid colouration of flesh): Light Yellow (3), Orange Yellow (5), Greenish White (7), Cream White (9)
- ACFS (Anthocyanin colouration of flesh next to skin): Present (3), Absent (5)
- IAFS (Intensity of anthocyanin colouration of flesh next to skin): Weak (3), Strong (5)
- ACCF (Anthocyanin colouration of flesh in central part of flesh): Present (3), Absent (5)
- IACF (Intensity of anthocyanin colouration of flesh in central part of flesh: Weak (3), Strong (5)
- AFS (Anthocyanin colouration of flesh around stone): Present (3), Absent (5)
- IAFS (Intensity of anthocyanin colouration of flesh around stone): Weak (3), Strong (5)
- FF (Flesh fiber): Weak (3), Medium (5), Strong (7)
- SSI (Stone size in relation to fruit): Large (3), Medium (5), Small (7)
- SS (Stone shape): Circular (3), Obovate (5), Elliptic (7), Oblate (9)
- ACS (Stone anthocyanin colouration): Absent/Very weak (3), Medium (5), Strong (7)
- IBC (Stone intensity of brown colour): Medium (3), Dark (5), Light (7)
- ROS (Stone relief of surface): Equally pits and grooves (3), Prominently pits (5), Only grooves (7), Only pits (9)
- AF (Adherence to flesh): Present (3), Absent (5)
- DAF (Degree of adherence to flesh): Weak (3), Strong (5)

Results and Discussion

Considerable variations were recorded among 15 peach accessions for various morphological characters (Supplementary Table 1). Cultivars are known to exhibit substantial variation in growth and form of tree. In the present study most of these characters revealed significant differences except vigour which differed moderately. Such variation in growth characters has also been reported by previous workers (Bisla and Chitkara, 1980; Gautam *et al.,* 1986; Singh *et al.,* 2005; Saran *et al.,* 2010). Growth habit of the peach accessions was observed to be upright, spreading or upright-spreading (Supplementary Table 1, Fig.1). Similarly, PPV&FRA guidelines for DUS test, indicate growth habit to vary from upright to semi-spreading among different peach accessions (PPV&FRA, 2015). Upright nature of Suncrest, Earligrande, Flordaglo and Glohaven as observed in the present study suggests their suitability for high density planting, also contended by Gradziel and Beres (1993).Variation in growth parameters characterizing tree form has been observed earlier also (Bassi *et al.,* 1994; Tworkoski and Scorza, 2001; Frecon *et al.,* 2002; Scorza *et al.,* 2002; Scorza *et al.,* 2006; Jana, 2015).

Leaf characters are commonly used to distinguish and identify various fruit crop species and varieties. However, in the present study no marked variation was observed in respect of angle at base of leaf blade, angle at apex, red mid vein on lower side of the leaf, shape in cross section of leaf blade except for nectaries (glands) and leaf margins (Supplementary Table 1, Fig. 1). Leaf margin in the present study was observed to vary from crenate to shallow serrate to deep serrate which is in agreement with previous studies of Chalak *et al.* (2006) and UPOV (2014). Presence or absence and shape of petiole glands are an important feature for identification and characterization of peaches (Wolfe and Strang, 2010). Glands were observed in all the accessions under study whereas the shape of glands was globose in Vallegrande, Earligrande, Paradelux, Shan-i-Punjab, Pratap and reniform in remaining ten accessions (Supplementary Table 1) These findings are largely in line with reference varieties as per PPV&FRA guidelines for DUS test as they have reported round glands in Earligrande whereas reniform in Early Red June (PPV&FRA, 2015). Similar variation in leaf glands has been reported by Rouse and Byrne (1990) as globose in Vallegrande and Earligrande whereas reniform in Tropic

Beauty, Tropic Sweet, Flordagrande and Flordaprince. Variation in type of petiole glands has been reported by other workers also (Andersen *et al.,* 2001; Chalak *et al.,* 2006). Leaf blade colour in all the accessions fell in Green Group (137) and Yellow Green Group (146) however slight variation was observed in the shade of colour. Variation in leaf colour as an aid in identifying peach cultivars was also used by Wolfe and Strang (2010). Variation in leaf blade colour as greenish yellow in Redhaven, light yellow in Silver Fire, medium green in Robin and dark green in Fiesta Red peach is reported by UPOV (2014).

Similar to foliage characters, some floral characters also varied considerably among peach accessions, however flower type, number of petals, presence of anthocyanin colouration on flowering shoot, density of flower buds, stigma position compared to anther, stamen position compared to petals and pubescence of ovary did not show any significant variation (Supplementary Table 1, Fig. 2). The flower type was found to be rosette in all the peaches which is in support of PPV&FRA guidelines for DUS test except for 'July Elberta' where campanulate type of flowers are present (PPV&FRA, 2015). Significant differences among various fruit characters such as shape, colour of skin and flesh were observed in peach accessions under study (Supplementary Table 1, Fig. 3). These fruit characters are crucial in making any variety acceptable to the end user *i.e.* the consumer. Several researchers have worked on the physical aspects of peach fruits (Sherman *et al.,* 1984; Matta *et al.*, 1986) in the past and have reported considerable variation in fruits of different peach cultivars. The colour of fruit (flesh and skin) are important indices to differentiate between various peach cultivars and to some extent are considered as indices of fruit maturity. However, in the present study the peach accessions exhibited no significant variation in fruit skin colour except that slight variation was observed in the shade of the colour but the flesh colour varied from white to yellow and several studies conducted elsewhere has also reported similarly (Sherman and Lyrene, 1988; Andersen *et al.*, 2001; Chalak *et al.,* 2006). The shape of fruit varied from medium oblate to broad elliptic to circular (Supplementary Table 1, Fig. 3). Andersen *et al*. (2001) reported round to oblong fruit shape of peach. However Devi *et al.* (2012) found round, ovate, oblong and elongated fruit shapes in different varieties. Chalak *et al*. (2006) also reported similar fruit shape in Elberta as flat whereas round in Redhaven. Fruit shape has been defined as medium oblate in Earligrande, circular in Red Globe, broad elliptic in Nimla and medium elliptic in Peshawari and Southland as per PPVFRA guidelines (PPV&FRA, 2015). Shape of the pistil end excluding mucron tip was observed to be flat in July Elberta, Earligrande, Flordaglo, Saharanpur Prabhat; prominently pointed in two accessions; weakly depressed in 5 accesssions and weakly pointed in 4 accessions (Supplementary Table 1, Fig. 3).

Adherence of stone to flesh was observed as free, semi-free or clinged stone type (Supplementary Table 1, Figure 5). Such a variation in stone type was in accordance with UPOV (2014) guidelines. All the cultivars with melting flesh are genetically clingy because they ripen before pit and flesh has time to separate (Andersen *et al.,* 2001). Stone were observed as free in Early Redhaven, Glohaven, July Elberta, Pratap, Suncrest, Saharanpur Prabhat, Shan-i-Punjab, Tropic Snow and Tropic Sweet whereas semi free in remaining accessions. Bowen (1980**)** reported cv. Earligrande to be as semi-free stone type whereas stone adherence to flesh as semi-cling in Flordaprince was reported by Sherman *et al*. (1984). Variation in stone type has been reported by several earlier workers (Rouse and Bryne, 1990; Andersen *et al.,* 2001; Singh *et al.,* 2014; PPV&FRA, 2015). The relief of surface of stone was observed to vary from prominently pits to only grooves to only pit to equally pits and grooves (Supplementary Table 1, Fig. 5). Jana (2015) also categorized presence of grooves on stone as present or absent in six low chill peach cultivars. UPOV (2014) indicated similar categorization in peach accessions. This kind of work generates the reference database which could be utilized for comparison with new candidate varieties applied for protection through PPV&FRA as well as developing a new descriptor list for peaches.

Conclusion

Fifteen peach varieties namely July Elberta, Early Redhaven, Suncrest, Tropic Sweet, Paradelux, Saharanpur Prabhat, Earligrande, Flordaprince, Tropic Snow, Flordaglo, Vallegrande, Tropic Beauty, Pratap, Shan-i-Punjab and Glohaven studied here recorded variation for characters like, tree vigor, growth habit, serration of the leaf, nectaries, petal shape, fruit shape, flesh colour, mucron tip at pistil end of fruit, redness towards pit, stone adherence to flesh. The descriptive database so developed will help in DUS testing and

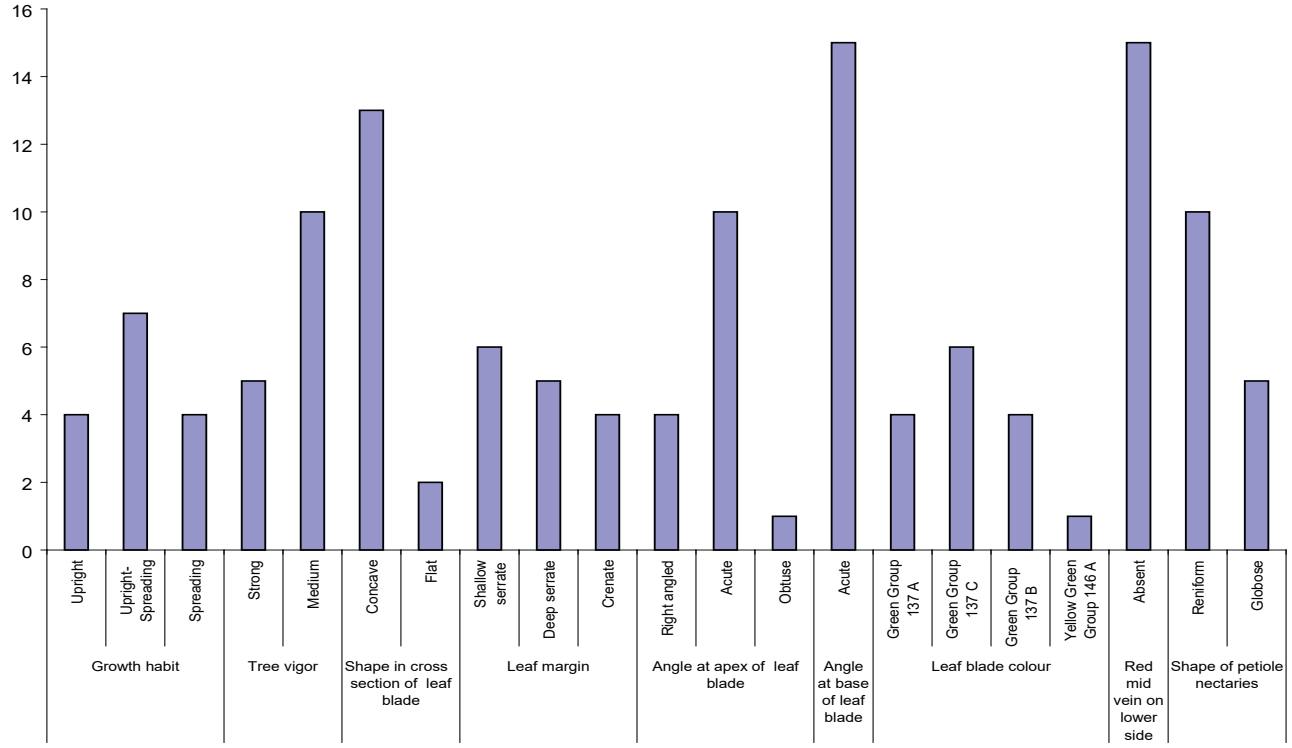

Fig. 1. Frequency distribution of 15 peach varieties based on tree and leaf characters

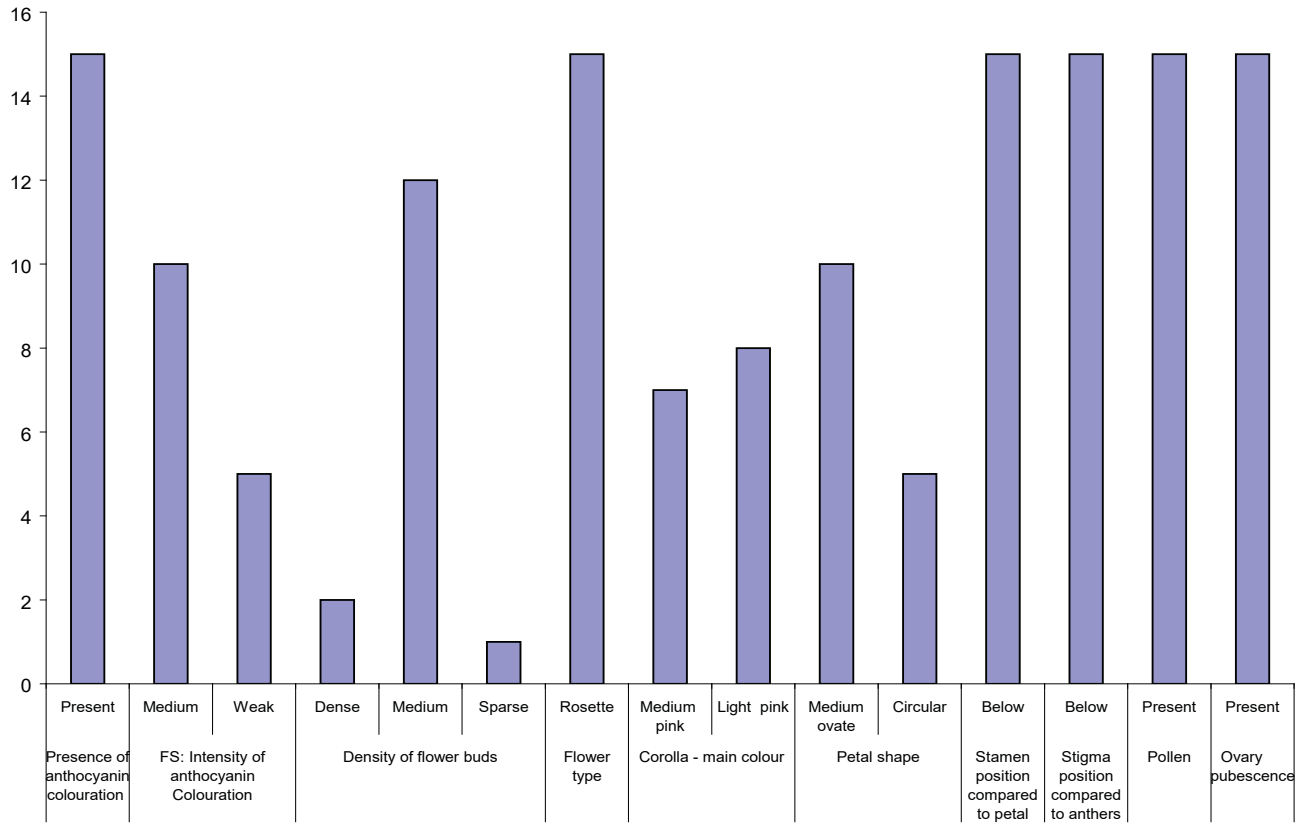

Fig. 2. Frequency distribution of 15 peach varieties based on floral characters

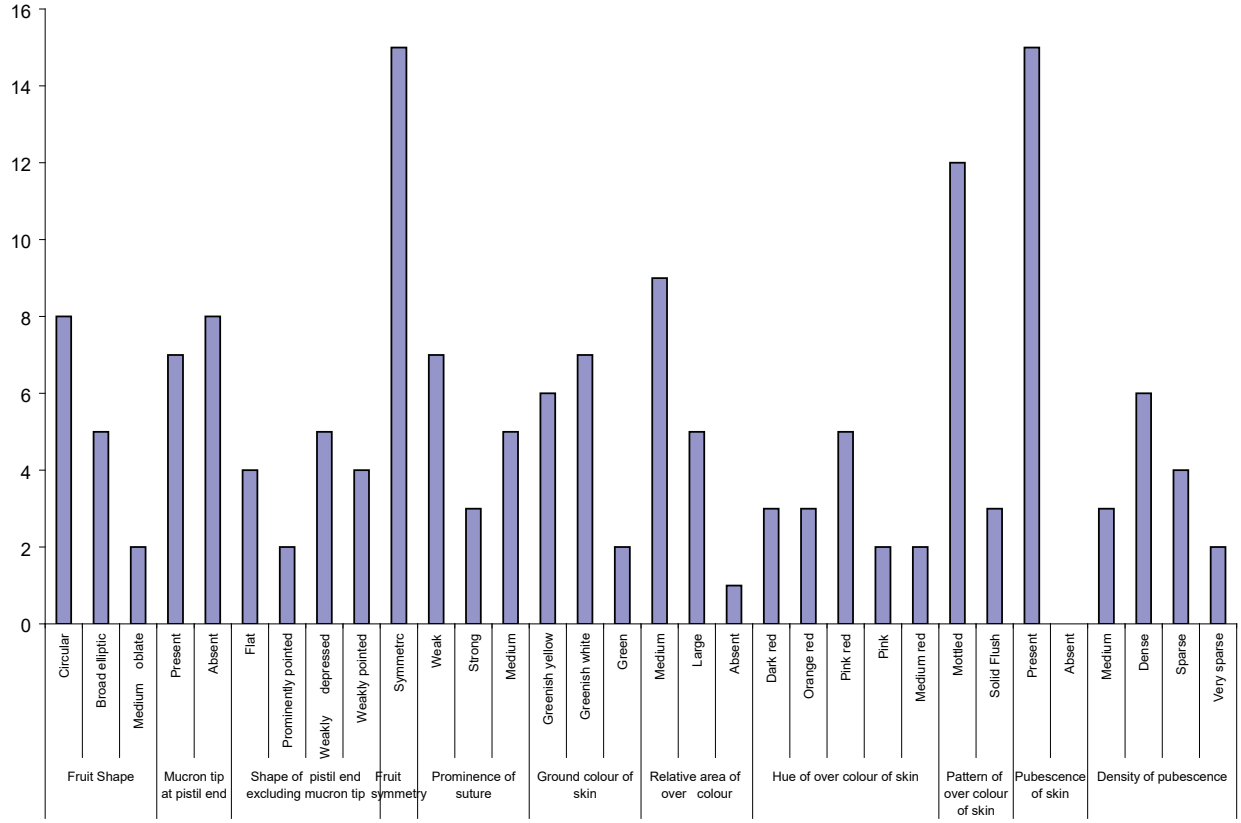

Fig. 3. Frequency distribution of 15 peach varieties based on fruit characters

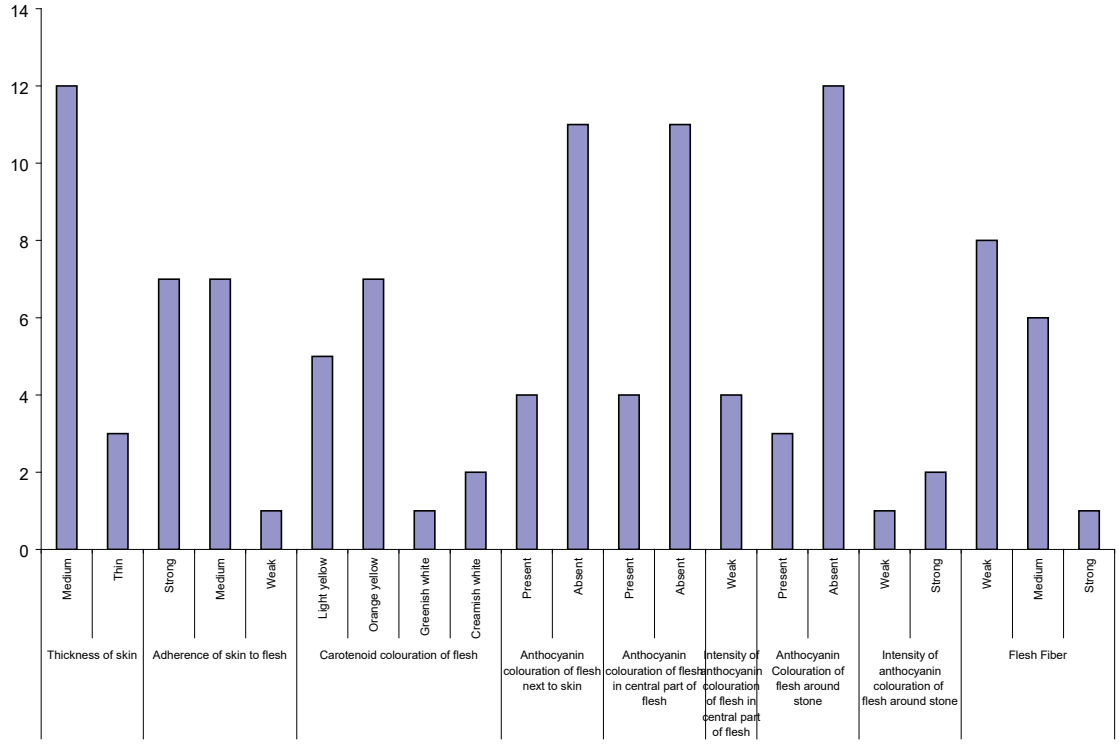

Fig. 4. Frequency distribution of 15 peach varieties based on fruit characters

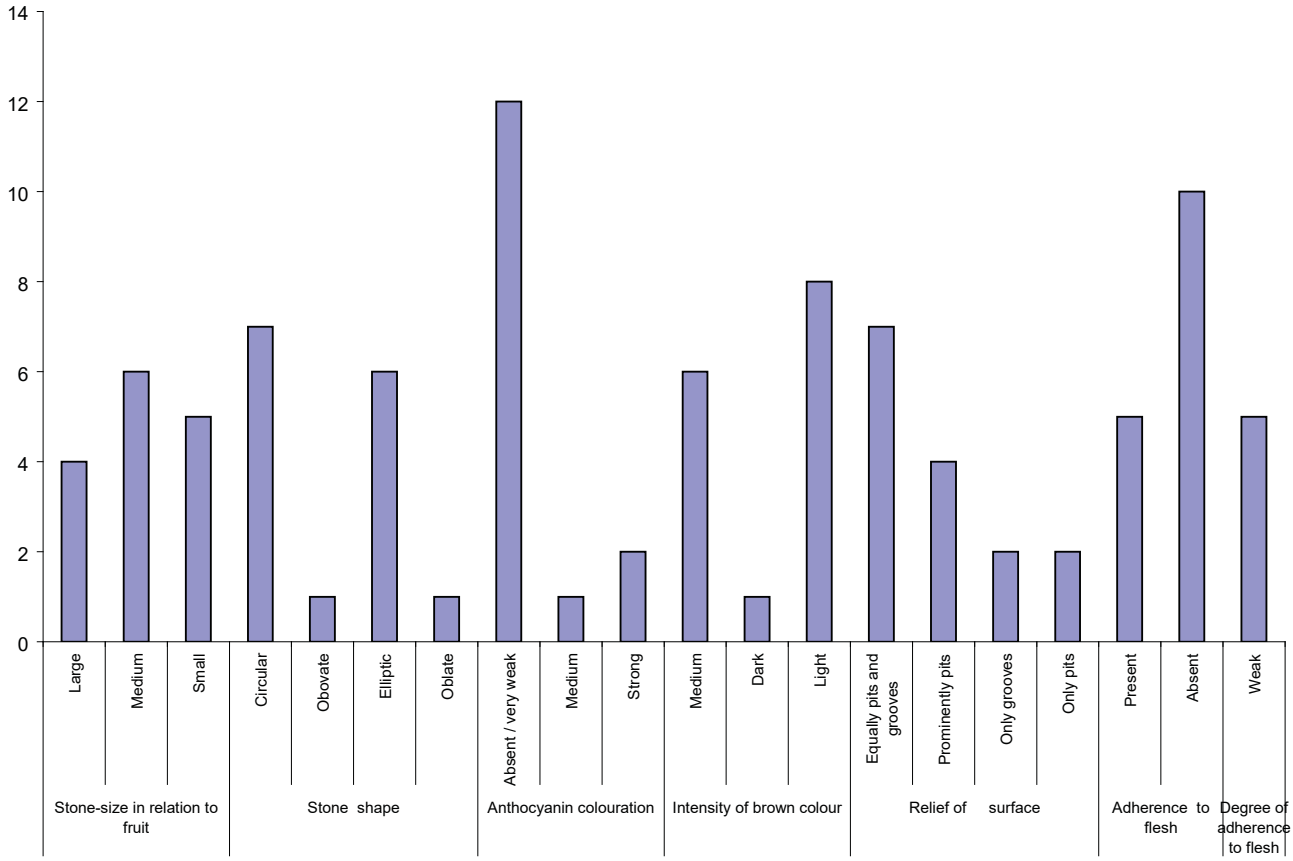

Fig. 5. Frequency distribution of 15 peach varieties based on stone characters

would also facilitate in multiplication of true-to-type planting material and help in checking bio-piracy besides authenticating the claims over newly developed peach genotypes for registration/protection.

Acknowledgements

The authors acknowledge with thanks the facilities and support provided by the Professor and the Head, Department of Fruit Science, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan (H.P).

*Supplementary Table or Figure mentioned in the article are available in the online version.

References

Andersen PC, WB Sherman and JG Williamson (2001) Low chill peach and nectarine cultivars from University of Florida breeding programme: 50 years of progress. *Proc. Fla. State Hort. Soc.* **114**: 33-36.

Bassi D, A Dima and R Scorza (1994) Tree structure and pruning response of six peach growth forms. *J. Am. Soc. Hortic.* **119**: 378-382.

Bisla SS and SD Chitkara (1980) Varietal variations in growth yield and quality of fruit in subtropical peach cultivars. *Haryana J. Hort. Sci.* **9**: 1-6.

Bowen HH (1980) 'EarliGrande' peach. *Hort Sci.* **15**: 207-208.

Chalak L, A Chehade, A Elbitar, P Cosson, A Zanetto, E Dirlewanger and F Laigret (2006) Morphological and molecular characterization of peach accessions [*Prunus persica* (L.) Batsch] cultivated in Lebanon. *Leban. Sci. J.* **7**: 23-31.

Devi YI, SD Sharma and SS Roy (2012) Variation in physical characters of fruit in F_1 hybrids of peach [*Prunus persica* (L.) Batsch]. *J. Crop Weed* **8**: 34-39.

Faust M and B Timon (1995) Origin and dissemination of peach. *Hortic. Rev.***17**: 331-379.

Frecon JL, R Belding and G Lokaj (2002) Evaluation of white fleshed peach and nectarine varieties in New Jersey. *Acta Hortic.* **592**: 467-477.

Gautam DR, JS Chauhan and TR Chadha (1986) Evaluation of peach germplasm. *In:* TR Chadha, VP Bhutani and JL Kaul (Eds.) Advances in Research on Temperate Fruits. Dr YS Parmar University of Horticulture and Forestry, Solan, pp. 19-30.

Gradziel TM and W Beres (1993) Semi dwarf growth habit in clingstone peach with desirable tree and fruit qualities. *Hort. Sci.* **28**:1045-1047.

Hancock JF, R Scorza and GA Lobos (2008) Peaches. In: Hancock JF (ed.). *Temperate Fruit Crop Breeding*. Springer, USA, pp. 265-298.

Jana BR (2015) Performance of some low chill peach [*Prunus persica* (L.) Batsch] under eastern plateau regions of India. *Int. J. Curr. Microbiol. Appl. Sci.* **4**: 752-757.

Matta BF, ML Allison, J Silva and JP Overcash (1986) Evaluation of peach cultivars for northern Mississippi. Department of Horticulture, Mississippi State University, pp. 1-7.

PPV&FRA (2015) *Guidelines for the conduct of test for distinctiveness, uniformity and stability on peach* [*Prunus persica* (L.) Batsch]. Protection of Plant varieties and Farmer's Rights Authority, Government of India, New Delhi, pp.1-10.

Rouse RE and DH Byrne (1990) "Vallegrande"- an early maturing low chilling peach for subtropical climate. *Hort Sci.***25**: 714-715.

Saran PL, AK Godara and SK Sehrawat (2010) Morphological variability among low chilling peach genotypes under Dehradun conditions. *Indian J. Hortic.* **67:** 30-33.

Scorza R, D Bassi and A Liverani (2002) Genetic interactions of pillar (columnar), compact and dwarf peach tree genotypes. *J. Am. Soc. Hortic.* **127**: 254-261.

Scorza R, S Miller, DM Glen, WR Okier and T Tworkoski (2006) Developing peach cultivars with novel tree growth habits. *Acta Hortic.* **713**: 61-64.

Sherman WB, J Rodriguez and EP Miller (1984) Progress in low chill peaches and nectarines from Florida. *Proc. Fla. State Hort. Soc.* **97:** 320-322.

Sherman WB and PM Lyrene (1988) Flordaglo, a white flesh peach for central Florida. *Fla. Agric. Exp. Stn. Circular.* S-345.

Singh AL, RM Sharma, R Kher and A Jasrotia (2005) Introduction and evaluation of pear and peach cultivars under subtropics of Jammu region. *Acta Hortic.* **696**: 25-29.

Singh D, G Yepthomi and K Kumar (2014) Performance of some low chill peach [*Prunus persica* (L.) Batsch] germplasm accessions for fruit quality traits in Himachal Pradesh. *Int. J. Farm Sci.* **4**: 72-80.

Tworkoski T and R Scorza (2001) Root and shoot characteristics of peach trees with different growth habits. *J. Am. Soc. Hortic.* **126**: 785-790.

UPOV (2014) Peach [*Prunus persica* (L.) Batsch] International Union for Protection of new Varieties of Plants, Geneva, TG/1/3/1, pp. 48.

Wolfe D and J Strang (2010) Peach cultivar performance. University of Kentucky, Cooperative Extension Service HO-6. Available from http://www.ca.wky.edu.