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Variability in avocado accessions based for tree and leaf characters

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Abstract
Fifty two avocado accessions maintained at ICAR – IIHR – Central Horticultural Experiment Station, Hirehalli were studied for their genetic diversity. Characterization was done based on tree and leaf characters using the plant descriptors outlined in IPGRI publication, Descriptors for Avocado. The study revealed that avocado accessions showed wide variability for the characters under study. With respect to tree characters most the accessions exhibited circular tree shape, rough trunk surface, irregular branch distribution and acute crotch angle of main branch to trunk. Among the leaf characters under study oval leaf shape, intermediate leaf apex shape, acute leaf base shape and entire leaf margin were found to be dominant.

Keywords: Variability, avocado, tree, characters, characters

Introduction
Avocado (*Persea americana* Mill.) belongs to the family Lauraceae and order Laurales with chromosome number 2n= 24. It is believed to have been originated from Mexico and Central America (Rohwer *et al*., 1999) [12], possibly from more than one wild species. Avocado plants consist of 3 types of races Mexican (*Persea americana* var. *drymifolia*), Guatemalan (*Persea americana* var. g*uatemalensis*) and West Indian (*Persea americana* var. *americana*). The West Indian race is suitable for planting in tropical areas, while the Mexican and Guatemalan races are suitable for planting in subtropical regions (Bergh, 1996) [3]. Most commercial varieties of avocado are interracial hybrids developed from the exchange of materials between different races.

Owing to its high nutritive value, avocado fruit is considered as the most important contribution of the New World to human diet. Avocado is a low sugar fruit with high protein, fibre and vitamins A, B, C and E. It includes mono-unsaturated fatty acids that effectively lower blood levels of low density lipoproteins, preventing coronary heart disease. It is a great provider of potassium and phosphorus (Subha and Anitha, 2018). Depending on the cultivar, season and growth conditions, the lipid content can make up 15–30% of the fruit's fresh weight (Meyer and Terry, 2008) [8].

Due to its beneficial heath properties, avocado has gained popularity in recent years and its consumption is increasing globally. Considering the importance of this crop, there is a great need for the genetic improvement of avocado which is suitable for cultivation under different cropping systems. So, the present study was conducted to estimate the genetic diversity among the avocado accessions using morphological characters.

Materials and Methods
The accessions maintained at experimental farms of ICAR – IIHR – Central Horticultural Experiment Station, Hirehalli were characterized for morphological characters during 2020-2022. All the fifty two avocado accessions were characterized for tree and leaf characters as per the descriptors developed for avocado by Bioversity International (IPGRI, 1995) [6]. Tree and leaf characters such as tree shape, trunk surface, crotch angle of the main branch, distribution of branches, leaf shape, leaf base shape, leaf apex shape, crotch angle of leaf petiole and leaf margin were observed visually and recorded as the IPGRI descriptors.

Results and Discussion

Tree characters

All the fifty two avocado accessions under study were of seedling origin. Variability for tree shape was found to be polymorphic in evaluated accessions. Among 52 accessions under study twenty accessions exhibited circular tree shape, eleven accessions exhibited pyramidal shape, nine accessions exhibited semi-circular shape, nine accessions exhibited irregular shape and three accessions exhibited rectangular shape. These results are in close agreement with Ranjitha *et al.* (2021) [11] and Lestari *et al.* (2016) [7] who observed five and six different tree shapes of avocado respectively. Trunk surface was observed visually and recorded as smooth, rough and very rough. Majority of the accessions (46) exhibited rough surface. Four accessions have very rough surface and two accessions have smooth surface. The results are in line with the finding of Juma *et al.* (2020) [4] and Ismadi *et al.* (2017) [5] who observed rough surface in 66.67% of the accessions and very rough trunk surface in the remaining accessions. According to Bergh (1992) [2], the tree bark of the Guatemalan and Mexican avocado races are less rough, while those of the West Indian race are rougher. The older plants have a rougher trunk surface as they develop and the skin surface becomes wider leading the surface of the trunk to become rough. The differences in the trunk surface and color are caused by the age and planted seeds that come from different species. In essence, avocado trees have various branching systems and branch counts. The main trunk and the branches often make a specific angle. Among 52 accessions under study thirty four were observed to have irregular distribution of branches, nine accessions verticillate, six accessions horizontal and remaining three accessions showed axial branch distribution. The results are in accordance to the findings of Ismadi *et al.* (2017) [5] and Abraham *et al.* (2018) [1]. Phenotypic variation was observed for crotch angle of main branches in avocado accessions and was recorded as acute (<90°) or obtuse (> 90°) type. Almost all the accessions (50) exhibited acute angle, remaining 2 accessions exhibited obtuse crotch angle. The results are in line with the findings of Ismadi *et al.* 2017 [5] who observed the predominance of acute crotch angle of the main branch of avocado trees.

Leaf characters

The leaves could be of several shapes including lanceolate, elliptic, oval, ovate or obovate (Morton, 1987; Schaffer *et al.*, 2013) [9, 13]. Five types of leaf shapes were observed in the avocado accessions under study (Table 1). Thirty three accessions had oval leaf shape, seven accessions accessions had oblong-lanceolate, five accessions had obovate, five accessions had lanceolate and two accessions had roundish leaf shape. The results are in accordance to the findings of Nkansah *et al.* (2013) [10] who reported five leaf shapes and Abraham *et al.* (2018) [1] who reported a total of seven leaf shapes.

Two different variants of leaf base shape were observed among the avocado accessions studied. Forty nine accessions were observed to have acute leaf base shape and the remaining three accessions were observed to have obtuse leaf base shape. Three different variants were noticed for leaf apex shape for the accessions under study. Twenty six accessions exhibited intermediate leaf apex shape, twenty one exhibited acute leaf apex shape and five accessions exhibited obtuse leaf apex shape. Leaf margin was checked for to be entire or wavy visually. Twenty nine accessions exhibited entire leaf margin while the remaining twenty three accessions exhibited wavy leaf margin**.** Crotch angle of the leaf petiole in avocado accessions was recorded as acute or obtuse type. Twenty two accessions were found to have acute angle and thirty accessions have obtuse angle. The observations are similar to the findings of Abraham *et al.* (2018) [1] and Ismadi *et al.* (2017) [5] Nkansah *et al.* (2013) [10]. The diversity of plant appearance might be due to genetic makeup.

Table 1: Variability for qualitative tree and leaf characteristics of avocado accessions.

	Tree Shape	Trunk Surface	Distribution of branches	Crotch angle of main branches	Leaf Shape	Leaf base Shape	Leaf apex shape	Crotch angle of leaf petiole	Leaf margin
I/1	Pyramidal	Rough	Irregular	Acute	Oval	Acute	Acute	Acute	Entire
I/2	Pyramidal	Rough	Verticillate	Acute	Oval	Acute	Acute	Acute	Entire
I/3	Semi circular	Rough	Verticillate	Acute	Oval	Acute	Acute	Acute	Entire
I/5	Obovate	Rough	Irregular	Acute	Oval	Acute	Acute	Acute	Entire
I/6	Rectangular	Rough	Irregular	Acute	Roundish	Obtuse	Acute	Acute	Entire
I/8	Semi circular	Rough	Irregular	Obtuse	Roundish	Obtuse	Acute	Obtuse	Entire
I/9	Semi circular	Rough	Irregular	Obtuse	Lanceolate	Acute	Acute	Obtuse	Wavy
I/10	Semi circular	Rough	Irregular	Acute	Oval	Acute	Acute	Obtuse	Wavy
I/11	Pyramidal	Rough	Irregular	Acute	Oval	Acute	Acute	Obtuse	Wavy
I/12	Circular	Rough	Irregular	Acute	Oval	Acute	Acute	Acute	Entire
II/1	Circular	Rough	Irregular	Acute	Oblong Lanceolate	Acute	Acute	Acute	Entire
II/2	Circular	Very Rough	Horizontal	Acute	Lanceolate	obtuse	Acute	Obtuse	Entire
II/3	Semi circular	Very Rough	Axial	Acute	Oval	Acute	Intermediate	Acute	Wavy
II/4	Irregular	Rough	Axial	Acute	Lanceolate	Acute	Acute	Obtuse	Wavy
II/5	Obovate	Rough	Verticillate	Acute	Obovate	Acute	Obtuse	Obtuse	Wavy
II/8	Semi circular	Rough	Horizontal	Acute	Oblong lanceolate	Acute	Acute	Acute	Wavy
II/9	Circular	Rough	Horizontal	Acute	Oval	Acute	Intermediate	Obtuse	Wavy
III/1	Semi circular	Very Rough	Irregular	Acute	Oval	Acute	Intermediate	Obtuse	Entire
III/3	Semi elliptic	Rough	Horizontal	Acute	Oblong lanceolate	Acute	Intermediate	Obtuse	Entire
III/4	Circular	Rough	Verticillate	Acute	Oval	Acute	Intermediate	Acute	Entire
III/5	Pyramidal	Rough	Verticillate	Acute	Oval	Acute	Intermediate	Obtuse	Wavy
III/10	Pyramidal	Rough	Irregular	Acute	Oblong lanceolate	Acute	Intermediate	Acute	Entire
IV/2	Semi elliptic	Rough	Irregular	Acute	Oval	Acute	Intermediate	Obtuse	Entire
IV/3	Irregular	Rough	Irregular	Acute	Oval	Acute	Intermediate	Acute	Wavy

IV/4	Circular	Rough	Irregular	Acute	Oval	Acute	Acute	Obtuse	Wavy
IV/7	Pyramidal	Rough	Irregular	Acute	Oval	Acute	Acute	Obtuse	Entire
IV/9	Obovate	Rough	Verticillate	Acute	Oval	Acute	Acute	Obtuse	Wavy
IV/10	Semi circular	Rough	Irregular	Acute	Oval	Acute	Acute	Acute	Entire
V/1	Circular	Smooth	Irregular	Acute	Lanceolate	Acute	Acute	Obtuse	Entire
V/2	Obovate	Rough	Irregular	Acute	Oval	Acute	Intermediate	Obtuse	Entire
V/3	Circular	Smooth	Irregular	Acute	Lanceolate	Acute	Acute	Obtuse	Entire
V/5	Pyramidal	Rough	Irregular	Acute	Oval	Acute	Intermediate	Obtuse	Entire
V/6	Circular	Rough	Irregular	Acute	Obovate	Acute	obtuse	Acute	Entire
V/7	Circular	Rough	Horizontal	Acute	Oval	Acute	Intermediate	Obtuse	Wavy
V/8	Circular	Rough	Irregular	Acute	Oval	Acute	Intermediate	Acute	Entire
VI/2	Circular	Rough	Verticillate	Acute	Oval	Acute	Intermediate	Acute	Wavy
VI/4	Rectangular	Rough	Irregular	Acute	Oval	Acute	Intermediate	Obtuse	Wavy
VI/5	Pyramidal	Rough	Irregular	Acute	Oval	Acute	Intermediate	Obtuse	Wavy
VII/1	Circular	Rough	Verticillate	Acute	Oval	Acute	Intermediate	Obtuse	Entire
VII/2	Circular	Rough	Irregular	Acute	Oval	Acute	Intermediate	Obtuse	Wavy
VII/3	Circular	Rough	Irregular	Acute	Oval	Acute	Intermediate	Obtuse	Wavy
VII/4	Circular	Rough	Irregular	Acute	Oval	Acute	Intermediate	Obtuse	Wavy
VII/5	Circular	Rough	Irregular	Acute	Oval	Acute	Intermediate	Obtuse	Entire
VII/8	Semi circular	Rough	Irregular	Acute	Oblong lanceolate	Acute	Acute	Acute	Entire
VIII/1	Circular	Rough	Irregular	Acute	Oval	Acute	Intermediate	Obtuse	Wavy
VIII/8	Circular	Rough	Irregular	Acute	Oval	Acute	Intermediate	Acute	Entire
IX/7	Circular	Rough	Horizontal	Acute	Oval	Acute	Intermediate	Obtuse	Entire
X/6	Pyramidal	Rough	Irregular	Acute	Obovate	Acute	Obtuse	Acute	Wavy
X/7	Pyramidal	Rough	Irregular	Acute	Obovate	Acute	Obtuse	Acute	Wavy
X/8	Pyramidal	Rough	Irregular	Acute	Obovate	Acute	Obtuse	Obtuse	Wavy
6	Semi elliptic	Very Rough	Verticillate	Acute	Oblong lanceolate	Acute	Intermediate	Acute	Entire
7	Columnar	Rough	Axial	Acute	Oblong lanceolate	Acute	Intermediate	Acute	Entire

Conclusion

Avocado trees maintained at ICAR – IIHR – Central Horticultural Experiment Station, Hirehalli exhibited wide diversity for vegetative morphological traits *viz.*, trunk, canopy, and leaves. The variation among the accessions might be due to the genetic makeup of the tree, environment or interaction of the genotype with environment (G × E). Further the diversity among the accessions can be studied using morphological and biochemical fruit characters.

References

1. Abraham JD, Abraham J, Takrama JF. Morphological characteristics of avocado (*Persea americana* Mill.) in Ghana. African Journal of Plant Science. 2018;12(4):88-97.
2. Bergh B. The origin, nature and genetic improvement of the avocado. California Avocado Society Yearbook. 1992;76:61-75.
3. Bergh BO, Lahav E. Avocados. Fruit Breeding: Tree and Tropical Fruits Janick Jand Moore J N (Eds). A Wiley-Interscience Publication, New York; c1996 p. 113-66.
4. Juma I, Geleta M, Nyomora A, Saripella GV, Hovmalm HP, Carlsson AS, *et al*. Genetic diversity of avocado from the southern highlands of Tanzania as revealed by microsatellite markers. Hereditas. 2020;157:1-12.
5. Ismadi Y, Handayani RS, Hafifah H, Fahrezi I. Exploration and morphological characterization of vegetative part of avocado at *Bebesan subdistrict* central Aceh district, Indonesia. In Proceedings of MICoMS. Emerald Publishing Limited. 2017;1:69-73.
6. International Plant Genetic Resources Institute. Descriptors for Avocado (*Persea* spp.). International Plant Genetic Resources Institute, Rome, Italy; c1995. p. 52.
7. Lestari R, Sukamto LA, Aprilianti P, Wahyuni S, Putri WU. Selection of Avocado Plants Based on Fruit Characters, Fat content, and Continual Harvest along the year in West Java-Indonesia. International Journal on Advanced Science, Engineering and Information Technology. 2016;6(1):77-83.
8. Meyer MD, Terry LA. Development of a rapid method for the sequential extraction and subsequent quantification of fatty acids and sugars from avocado mesocarp tissue. Journal of Agricultural Food Chemistry. 2008;56:7439-7445.
9. Morton JF. Fruits of warm climates. Julia F. Morton, Miami, Florida; c1987. p. 505.
10. Nkansah GO, Ofosu-Budu KG, Ayarna AW. Genetic diversity among local and introduced avocado germplasm based on morpho-agronomic traits. International Journal of Plant Breeding and Genetics. 2013;7(2):76-91.
11. Ranjitha V, Chaitanya HS, Ravi CS, Shivakumar BS, Naveen NE. Morphological characterization of avocado (*Persea americana* Mill.) accessions explored from hill zone taluks of Chikkamagaluru district, Karnataka state. Journal of Pharmacognosy and Phytochemistry. 2021;10(2): 310-18.
12. Rohwer JG, Kubitzki K, Rrohwer J, Bittrich V. The families and genera of flowering plants. Springer, Berlin. 1999;75(3):426-437.
13. Schaffer B, Wolstenholme BN, Whiley AW. The avocado: botany, production and uses. CABI; c2013. p. 560. https://www.cabi.org/cabebooks/ebook/20133051561.
14. Subha SN, Anitha C. Nutrient composition of avocado fruits of selected cultivars grown in Kerala. International Journal of Food Science and Nutrition. 2018;3(3):65-67.