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Study on Morphological Tree Characteristics of Half-Sib Seedling Genotypes of Mango Hybrid Sonpari

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present study was carried out at Agriculture Experimental Station, Navsari Agricultural University, Paria, Gujarat, India, during year 2023 & 2024 with 40 half sib seedling genotypes of mango hybrid variety Sonpari (Alphanso × Baneshan) which were evaluated and compared using morphological characters like tree height, trunk circumference, crown diameter, crown shape and

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descriptive statistics analysis was done. Mango hybrid Sonpari was taken as check variety. Among the half-sibs studied, genotypes SHS-61, SHS-123 and Sonpari were medium heighted (6.1-9.0 m) and remaining selected cultivars were short heighted ((≤6.0 m). Highest tree circumference (99.61 cm) and crown diameter (6.17 m) were recorded in genotypes SHS-46 and SHS-146 respectively. Among the selected half-sib genotypes, nineteen genotypes had oblong crown shape while semi-circular crown shape was observed in eight genotypes. The spherical crown shape was observed in eleven genotypes however three genotypes had broadly pyramidal crown shape. Thirty-two genotypes had spreading tree growth habit whereas, remaining nine genotypes had erect tree growth habit.

Keywords: Mango; half-sib; Sonpari; morphological; SHS.

1. INTRODUCTION

Mango (*Mangifera indica* L.) a member of the family Anacardiaceae, considered to be an allopolyploid, most probably amphidiploid and outbreeding species having chromosome number 2n=40 (Mukherjee, 1972). Mango has been in cultivation in the Indian subcontinent from 4000 years ago (Candole, 1984). Mango has an origin from the Indo-Myanmar region, especially the North-Eastern part of India (Iyre, 1991). The genus *Mangifera* contains several species that bear edible fruit. However, the trees which commonly known as mango belong to the species *Mangifera indica*. The other edible *Mangifera* species generally have inferior quality fruit and are commonly referred to as wild mango. In India, Andhra Pradesh leads in area of mango cultivation occupying 3.76 lakh hectare followed by Uttar Pradesh occupying 2.79 lakh hectare area whereas Uttar Pradesh leads in production 4.806 Lakh MT followed by Andhra Pradesh producing 4.517 lakh MT. Gujarat produces 997.83 MT mango from an area of 1. 68 lakh hectares (Anonymous, 2021). It is highly heterozygous tree and considered to be a difficult plant species to improve by breeding as a result of several intrinsic biological factors which includes a high level of heterozygosity and unpredictable outcomes in crossing, long juvenile phase, only one seed per fruit, heavy fruit drop, polyembryony in many cultivars and a large area required for proper assessment of progeny (Iyer & Schnell, 2009).

The world needs to increase crop productivity for the development of the valuable varieties to changing environmental and biological challenges that meets to evolve the needs of local communities. To meet these needs and challenges, farmers and scientists not only must have access to a wide range of plant genetic resources but also must have access to the essential information about those plant genetic resources that will allow effective used. Phenotypic characters are visually evaluated in most cases and are thereby subjective morphological characteristics that can improve characterizations for defining the potential use of any genotype. These traits have long been the means of studying variability among populations in fruit crops. In this experiment, the morphological variability of 40 mango half sib seedling genotypes of Sonpari including check variety Sonpari was assessed and compared using morphological characteristics.

2. MATERIALS AND METHODS

The present investigation entitled studies on morphological characterization half sib seedling genotypes of mango hybrid Sonpari was carried out during the years 2023 and 2024 at Agriculture Experimental Station, Navsari Agricultural University, Paria, (Gujarat). Total 40 half-sib seedling genotypes of mango hybrid Sonpari were raised and planted in field during year 2015-16 to 2017-18 and assessed for various morphological characters like tree height, trunk circumference, crown diameter, crown shape and tree growth habit during years 2023 and 2024. All the observation will be recorded as per the mango descriptors (IPGRI, 2006). Descriptive statistics like mean, range and CV % will be calculated for quantitative traits of mango genotypes.

3. RESULTS AND DISCUSSION

3.1 Tree Height

Results revealed in (Table 1) that during two consecutive years the average height of tree of half sib genotypes of mango hybrid Sonpari was recorded according to short (≤6.0 m), medium (6.1 – 9.0 m), tall (9.1 – 12.0 m) and very tall (>12.0 m). Observations for tree height was recorded that mango genotypes SHS-3, SHS-15, SHS-16, SHS-33, SHS-37, SHS-46, SHS-49,

SHS-55, SHS-56, SHS-58, SHS-63, SHS-64, SHS-71, SHS-74, SHS-80, SHS-82, SHS- 95, SHS-96, SHS-97, SHS-113, SHS-114, SHS-128, SHS-144, 145, SHS-146, SHS-150, SHS-156, SHS-174, SHS-76, SHS-192, SHS-193, SHS-194, SHS-197, SHS-225, SHS-242, SHS-266, and SHS-294 had short height (≤ 6.0 m) while, mango genotypes SHS-61, SHS-123 and Sonpari were medium heighted (6.1-9.0 m). The height of plant is one of the most important quality parameters which reflect the growth and quality of mango tree. Different cultivars of mango varied in their performance and these differences are governed by various genetic, cultural and environmental factors. The varietal interactions with agro-climatic conditions could possibly explain the differences in tree height between genotypes (Barua et al. 2023).

Table 1. Morphological variability in tree height, crown shape and tree growth habit flowers of half-sib seedling genotypes of mango hybrid Sonpari

Sr. No.	Code of Genotypes	Tree height	Crown shape	Tree growth habit
1	SHS-3	Short (≤ 6.0 m)	Oblong	Spreading
2	SHS-15	Short (≤ 6.0 m)	Broadly pyramidal	Spreading
3	SHS-16	Short (≤ 6.0 m)	Semi circular	Spreading
4	SHS-33	Short (≤ 6.0 m)	Spherical	Spreading
5	SHS-37	Short (≤ 6.0 m)	Oblong	Erect
6	SHS-46	Short (≤ 6.0 m)	Oblong	Erect
7	SHS-49	Short (≤ 6.0 m)	Semi circular	Spreading
8	SHS-55	Short (≤ 6.0 m)	Semi circular	Spreading
9	SHS-56	Short (≤ 6.0 m)	Spherical	Spreading
10	SHS-58	Short (≤ 6.0 m)	Semi circular	Spreading
11	SHS-61	Medium (6.1-9.0 m)	Oblong	Erect
12	SHS-63	Short (≤ 6.0 m)	Oblong	Spreading
13	SHS-64	Short (≤ 6.0 m)	Oblong	Spreading
14	SHS-71	Short (≤ 6.0 m)	Spherical	Spreading
15	SHS-74	Short (≤ 6.0 m)	Spherical	Spreading
16	SHS-80	Short (≤ 6.0 m)	Spherical	Erect
17	SHS-82	Short (≤ 6.0 m)	Spherical	Spreading
18	SHS-95	Short (≤ 6.0 m)	Oblong	Spreading
19	SHS-96	Short (≤ 6.0 m)	Oblong	Spreading
20	SHS-97	Short (≤ 6.0 m)	Oblong	Erect
21	SHS-113	Short (≤ 6.0 m)	Spherical	Spreading
22	SHS-114	Short (≤ 6.0 m)	Broadly pyramidal	Spreading
23	SHS-115	Short (≤ 6.0 m)	Oblong	Spreading
24	SHS-123	Short (≤ 6.0 m)	Spherical	Spreading
25	SHS-128	Medium (6.1-9.0 m)	Oblong	Spreading
26	SHS-144	Short (≤ 6.0 m)	Semi circular	Spreading
27	SHS-145	Short (≤ 6.0 m)	Semi circular	Spreading
28	SHS-146	Short (≤ 6.0 m)	Spherical	Spreading
29	SHS-150	Short (≤ 6.0 m)	Semi circular	Spreading
30	SHS-156	Short (≤ 6.0 m)	Oblong	Erect
31	SHS-174	Short (≤ 6.0 m)	Spherical	Spreading
32	SHS-176	Short (≤ 6.0 m)	Oblong	Erect
33	SHS-192	Short (≤ 6.0 m)	Oblong	Spreading
34	SHS-193	Short (≤ 6.0 m)	Oblong	Erect
35	SHS-194	Short (≤ 6.0 m)	Oblong	Spreading
36	SHS-197	Short (≤ 6.0 m)	Semi circular	Spreading
37	SHS-225	Short (≤ 6.0 m)	Spherical	Spreading
38	SHS-242	Short (≤ 6.0 m)	Oblong	Spreading
39	SHS-266	Short (≤ 6.0 m)	Broadly pyramidal	Spreading
40	SHS-294	Short (≤ 6.0 m)	Oblong	Erect
41	Sonpari	Medium (6.1-9.0 m)	Oblong	Spreading

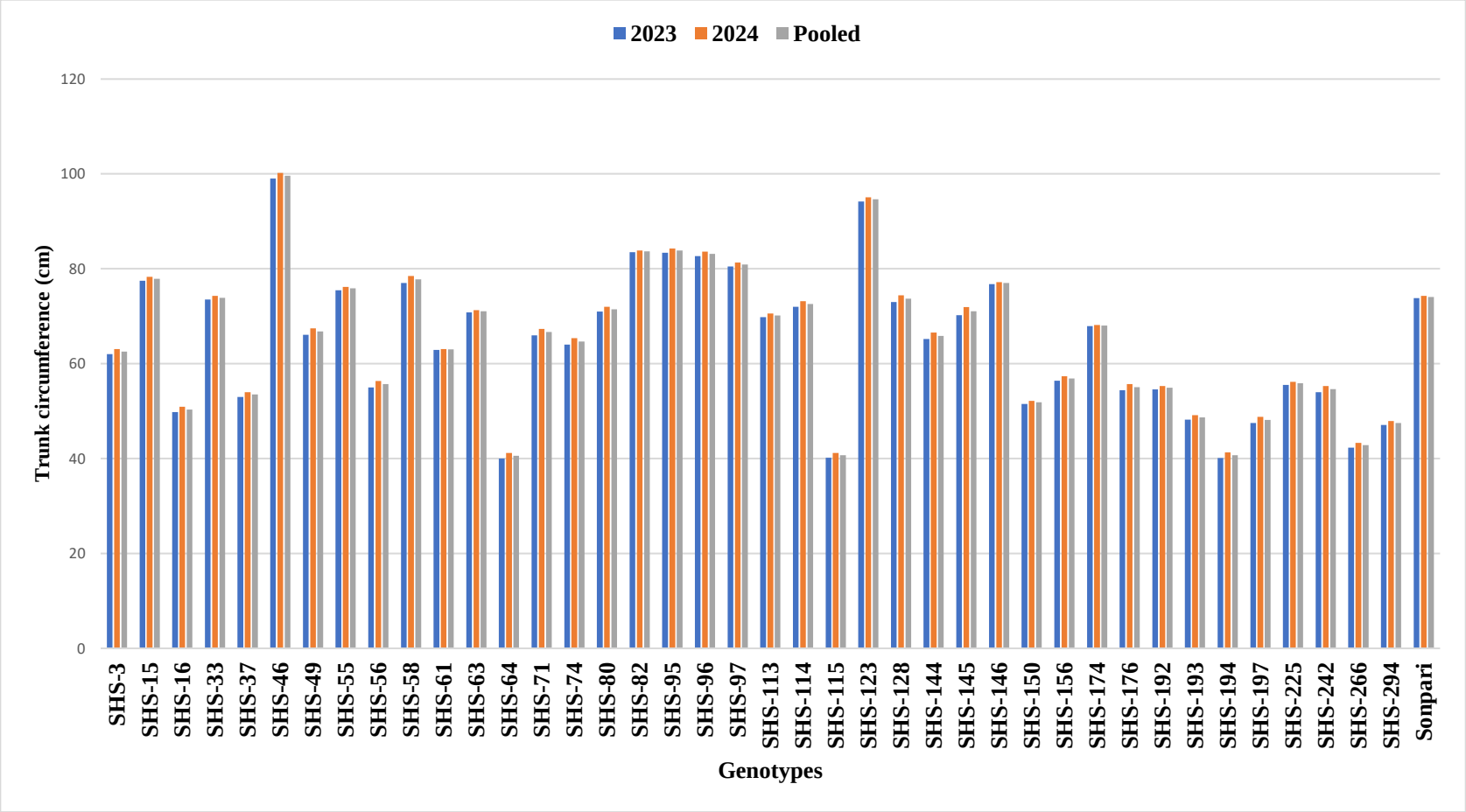

Fig. 1. Morphological variation in trunk circumference (cm) of half-sib seedlings genotypes of mango hybrid Sonpari

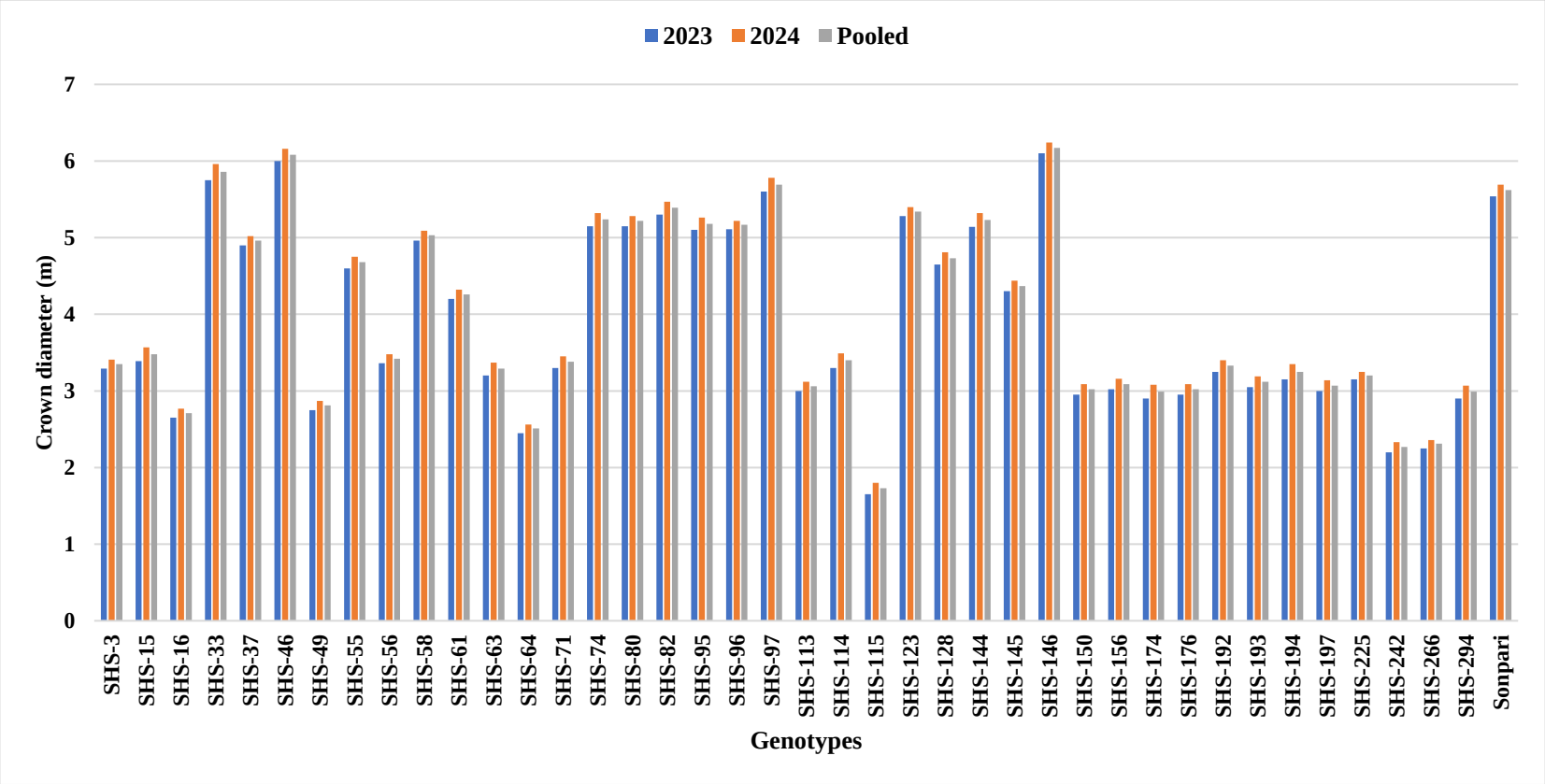

Fig. 2. Morphological variation in crown diameter (m) of half-sib seedling genotypes mango hybrid Sonpari

3.2 Trunk circumference

The observations recoded for trunk circumference was found to exhibit variability among half-sib seedling genotypes of mango hybrid Sonpari tabulated in Table 1 and Fig. 1. Trunk circumference during the year 2023 ranged from 40 to 99 cm with an average mean of 64.68 cm. During the year 2024, trunk circumference ranged from 41.16 to 100.21 cm with an average of 65.56 cm. However, the pooled data of two years (2023 and 2024) showed the range of 40.58 to 99.61 cm and average mean of 65.07 cm for trunk circumference. Thus, the significantly higher and lower trunk circumference were observed in the mango genotypes like SHS-46 (99.61 cm) and SHS-64 (40.58 cm), respectively. It is apparent from the data that tree character like trunk circumference showed remarkable variations in the genotypes studied which may be due to seedlings of heterozygous nature besides environmental influence.Similar trend of results have also been reported by Sanjana et al. (2023) and Kaur et al. (2014).

3.3 Crown Diameter

The recorded observations revealed variations for crown diameter among half-sib seedling genotypes of mango hybrid Sonpari were presented in Table 2 and Fig. 2. The crown diameter varied from 1.65 to 6.10 m with an average mean of 3.90 m during the year 2023, while, in year 2024 crown diameter ranged from 1.8 to 6.24 m with an average of mean 4.05 m. In pooled analysis, crown diameter ranged from 1.73 to 6.17 m with an average mean of 3.97 m. Hence, the significantly maximum and minimum crown diameter were observed in the mango genotypes like SHS-146 (6.17 m) and SHS-115 (1.73 m), respectively. These results are in close confirmation with results presented by Rai et al. (2023) and Kaur et al. (2014).

Table 2. Descriptive statistics for extent of variability in trunk circumference and crown diameter belonging to half-sib seedling genotypes of mango hybrid Sonpari

Sr. No.	Code of Genotypes	Trunk circumference (cm)			Crown diameter (m)		
		2023	2024	Pooled	2023	2024	Pooled
1	SHS-3	62.00	63.10	62.55	3.29	3.41	3.35
2	SHS-15	77.50	78.32	77.91	3.39	3.57	3.48
3	SHS-16	49.80	50.92	50.36	2.65	2.77	2.71
4	SHS-33	73.50	74.28	73.89	5.75	5.96	5.86
5	SHS-37	53.00	53.98	53.49	4.90	5.02	4.96
6	SHS-46	99.00	100.21	99.61	6.00	6.16	6.08
7	SHS-49	66.10	67.45	66.78	2.75	2.87	2.81
8	SHS-55	75.50	76.21	75.86	4.60	4.75	4.68
9	SHS-56	55.00	56.38	55.69	3.36	3.48	3.42
10	SHS-58	77.00	78.49	77.75	4.96	5.09	5.03
11	SHS-61	62.90	63.10	63.00	4.20	4.32	4.26
12	SHS-63	70.80	71.30	71.05	3.20	3.37	3.29
13	SHS-64	40.00	41.16	40.58	2.45	2.56	2.51
14	SHS-71	66.00	67.32	66.66	3.30	3.45	3.38
15	SHS-74	64.00	65.38	64.69	5.15	5.32	5.24
16	SHS-80	71.00	71.98	71.49	5.15	5.28	5.22
17	SHS-82	83.50	83.87	83.69	5.30	5.47	5.39
18	SHS-95	83.40	84.29	83.85	5.10	5.26	5.18
19	SHS-96	82.70	83.64	83.17	5.11	5.22	5.17
20	SHS-97	80.50	81.29	80.90	5.60	5.78	5.69
21	SHS-113	69.80	70.58	70.19	3.00	3.12	3.06
22	SHS-114	72.00	73.20	72.60	3.30	3.49	3.40
23	SHS-115	40.20	41.20	40.70	1.65	1.80	1.73
24	SHS-123	94.20	95.09	94.65	5.28	5.40	5.34
25	SHS-128	73.00	74.39	73.70	4.65	4.81	4.73
26	SHS-144	65.20	66.56	65.88	5.14	5.32	5.23
27	SHS-145	70.20	71.93	71.07	4.30	4.44	4.37
28	SHS-146	76.80	77.20	77.00	6.10	6.24	6.17
29	SHS-150	51.50	52.17	51.84	2.95	3.09	3.02

Sr. No.	Code of Genotypes	Trunk circumference (cm)			Crown diameter (m)		
		2023	2024	Pooled	2023	2024	Pooled
30	SHS-156	56.40	57.36	56.88	3.02	3.16	3.09
31	SHS-174	67.90	68.18	68.04	2.90	3.08	2.99
32	SHS-176	54.40	55.72	55.06	2.95	3.09	3.02
33	SHS-192	54.60	55.29	54.95	3.25	3.40	3.33
34	SHS-193	48.20	49.16	48.68	3.05	3.19	3.12
35	SHS-194	40.10	41.29	40.70	3.15	3.35	3.25
36	SHS-197	47.50	48.80	48.15	3.00	3.14	3.07
37	SHS-225	55.50	56.20	55.85	3.15	3.25	3.20
38	SHS-242	54.00	55.27	54.64	2.20	2.33	2.27
39	SHS-266	42.30	43.33	42.82	2.25	2.36	2.31
40	SHS-294	47.10	47.90	47.50	2.90	3.07	2.99
41	Sonpari	73.80	74.30	74.05	5.54	5.69	5.62
Mean		64.58	65.56	65.07	3.90	4.05	3.97
Range		40.00-99.00	41.16-100.21	40.58-99.61	1.65-6.10	1.8-6.24	1.73-6.17
Standard Deviation		14.70	14.64	14.67	1.22	1.23	1.22
Variance		216.01	214.40	215.17	1.48	1.50	1.49
C.V. %		22.76	22.34	22.54	31.23	30.28	30.74

SHS-Sonpari half-sib

3.4 Crown Shape

The crown shape of different half-sib seedling genotypes of mango hybrid Sonpari was presented in Table 1. The oblong crown shape was observed in the genotypes such as SHS-3, SHS-37, SHS-46, SHS-61, SHS- 63, SHS-64, SHS- 95, SHS-96, SHS-97, SHS-115, SHS-128, SHS-156, SHS-176, SHS-192,SHS-193, SHS-194, SHS-242, SHS-294 and Sonpari while, semi-circular shape was observed in genotype SHS-16, SHS-49, SHS-55, SHS-58, SHS-144, SHS-145, SHS-150 and SHS-197. The spherical crown shape was observed in mango genotypes SHS-33, SHS-56, SHS-71, SHS-74, SHS-80, SHS-82, SHS-113, SHS-123, SHS-146, SHS-174 and SHS-225 while, in mango genotypes SHS-15, SHS-114 and SHS-266 broadly pyramidal crown shape was observed. These results are in close confirmation with results presented by Sridhar et al. (2022).

3.5 Tree Growth Habit

The observations recorded for the tree growth habit (Table 1) revealed the variation among the half-sib seedling genotypes of mango hybrid Sonpari. The spreading growth habit was observed in genotypes SHS-3, SHS-15 SHS-16, SHS-33, SHS-49, SHS-55, SHS-56, SHS-58, SHS-63, SHS-64, SHS-71, SHS-74, SHS-82, SHS-95, SHS-96, SHS-113, SHS-114, SHS-115, SHS-123, SHS-128, SHS-144, SHS-145, SHS-146, SHS-150, SHS-174, SHS-192,SHS-194, SHS-197, SHS-225, SHS-242 , SHS-266 and Sonpari while, erect growth habit was observed in genotype SHS-37, SHS-46, SHS-61, SHS-80, SHS-97, SHS-156, SHS-176, SHS-193 and SHS-294. Aaccording to Ribeiro et al. (2013) revealed that selected plants had semi-veritical growth habit. These results are in line with findings of Rajwana et al. (2011).

4. CONCLUSION

Different half-sib genotypes of mango hybrid sonpari varied in their performance with respect to the studied morphological characters like tree height, trunk circumference, crown diameter, tree crown shape and tree growth habit. Overall height of selected trees except genotypes SHS-61 and SHS-128 were (≤ 6.0 m). The morphological information obtained in the present study is the most comprehensive for half-sib seedling genotypes of mango hybrid Sonpari, in this way may be of help in various genetic breeding programs for mango cultivars

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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