Morphological Characterization, Evaluation and Selection of Hibiscus (Hibiscus rosa-sinensis L) genotypes for high yield

Abstract

An experiment was conducted at Department of Floriculture and Landscaping, TNAU, Coimbatore with the objectives *viz*., i) to study the morphological, flowering, yield parameters of different hibiscus accessions and (ii) to identify the accession with high flower yield with attractive colour. In this experiment, 14 hibiscus genotypes were collected from different places of Tamil Nadu and also from Thrissur, Kerala and these genotypes were evaluated continuously from June, 2014 to Sep, 2019. Among the different accessions the highest plant height was observed in Acc 1 (170.58 cm and the highest number of branches was observed in Acc 3 (14.00) 360 days after pruning. The highest leaf length was observed in Acc 10 (9.00 cm) while the highest bud length was recorded by Acc 1 (4.50 cm) and Acc 4 (4.62 cm). The highest single flower weight was observed in Acc 1 (10.60 g) and the highest flower diameter was observed in Acc 13 (12.37 cm) which was on par with Acc 1 (12.17 cm). Acc. 1(THR 1) was identified for high flower yield (2.10 kg/plant/year).

Key words : Hibiscus, genotype, evaluation, flower yield.

Introduction

Hibiscus rosa-sinensis is one such plant and belongs to the family Malvaceae. It is a species of tropical Hibiscus in the Hibisceae tribe. It is considered native to East Asia **(Vyas, 2012).** Although the plant is not related to the true roses, the term 'Rosa sinensis' literally means 'rose of China' in Latin. It was first named by Carolus Linnaeus (Oguntoye, 2014). It is abundant in the sub-tropical and tropical regions and is cultivated extensively as an ornamental plant. This plant bears large flowers on the bushy hedges. The flowers are dark red in colour and are not usually fragrant (Kumar, 2012). They are grown in different regions of the Asian continent and are colloquially known as Chinese hibiscus, China rose, Hawaiian hibiscus and shoeblack plant (Vyas, 2012). The plant exhibits the genetic characteristic of polyploidy. Here, the plant bears more than two complete sets of chromosomes. The side effect of this genetic characteristic is a condition in which the phenotype of the offspring may be quite different from the parent, or any other ancestor, allowing possible random expression of all or any of the previous generations (Munirajappa, 1980; Rani, 2012). This plant has a wide range of applications. Parts of the flowerare used to make a popular drink in Egypt and are also used to

formulate medicines. Various parts of the plant are also used in the preparation of jams, spices, soups, and sauces (Baranova, 2011). Hibiscus oil is extracted from the hibiscus plant and is considered as an essential oil. It has a wide variety of practical applications, ranging from aromatherapy to skin and hair care. There are many other benefits of using hibiscus oil on the skin. It acts as an excellent moisturizer for dry skin, and it also helps to heal lesions caused by skin infections such as psoriasis or eczema (Aldouri, 2000). This oil is also found to preserve the flexibility and elastic nature of the skin and reduces the effect of aging when used on a regular basis. It also has anti inflammatory (Yazan, 2011) and astringent properties. One of the most popular applications of hibiscus oil is in the field of hair care. Hibiscus oil is obtained from its flowers, and may be used alone or added to various hair care products such as shampoos and conditioners,to improve the overall condition of the hair.

‘

This paper seeks to show some morphological and yield characteristics of some *Hibiscus rosa-sinensis* genotypes being grown in the various regions of Tamil Nadu and Kerala to identify and assess accession(s) with superior agronomic performance suitable for adoption by *Hibiscus rosa-sinensis* growing farmers and also the accessions with unique features useful for the *Hibiscus rosa-sinensis* breeding programme in India.

Materials and Methods

The experiment was conducted at the Botanical Garden, Department of Floriculture and Landscape Architecture, Coimbatore, Tamil Nadu located at 11 0 02’ N latitude and 76 0 57’ E longitude at an altitude of 426.76 m above MSL during 2014 to Sep, 2019.Totally, 14 accessions of *Hibiscus rosa-sinensis* plants were sourced from different parts of Tamil Nadu and Kerala. The plants were propagated using semi hard wood cuttings. Six months old plants were used for planting. The list of accessions and place of collection are listed in the following table.

Chart 1 : Accessions of *Hibiscus rosa-sinensis* collected

S.No.	Place of collection	Accession name	Flower colour
1.	Trichy	THR 1	Red -single
2.	Coimbatore	CHR 2	Red - single -white variegated leaf
3.	Bangalore	BHR 3	Red - single -red variegated leaf
4.	Coimbatore	CHR 4	Red – single- wider petals
5.	Thrissur	TrHR 5	Red- single - small flower
6.	Coimbatore	CHR 6	Red multi petals
7.	Thrissur	TrHR 7	Red - double
8.	Madurai	MHS 8	Red – Fringed petals
9.	Thrissur	TrHR 9	Yellow – single – small flower
10.	Coimbatore	CHR 10	Yellow – single – red throat
11.	Palladam	PaHR 11	Orange-single-red throat
12.	Coimbatore	CHR 12	Orange-double
13.	Periyakulam	PkHR 13	Pink-single
14.	Periyakulam	PkHR 14	White-single

Experimental design adopted for this study was RBD and replicated thrice and in each replication five plants were planted. Three uniformly sized plants per replications were tagged for recording observations. Growth characters recorded were, plant height, Number of branches per plant, Leaf length & width, Leaf area. Similarly, flower characters viz. bud length, bud width, pedicel length, flower .

Result and Discussion

(i) Growth and morphological parameters

A significant difference in the plant height was observed in the different accessions of *Hibiscus rosa-sinensis*. Among the different accessions, at 360 days after pruning, the highest plant height was observed in Acc No. 1 (170.58 cm), the lowest plant height was observed in in Acc No. 5 (86.33 cm). This is similar to the ranges (116 to 169 cm) observed by Sanoussi et al. (2011) in H.sabdariffa on different roselle accessions obtained in Niger republic. Although Amir et al. (2008) and Mahadevan et al. (2009) said that roselle plant is about 3.5 m tall. Although, Anonymous (2000) also opined that the plant can reach heights between 1 and 3 m depending on cultivation conditions at the site.

the highest number of primary branches were observed in Acc 3 (14.00). It was followed by Acc 13(13.30). The highest leaf area was observed in Acc 1 (50.57 cm^2). It was followed by Acc 10 (42.1 cm^2). The lowest leaf area was observed in Acc. 12 (7.90 cm^2). Mostofa et al. (2002) also observed variation in number of branches of plant in different growing season; however the variations were sometimes significant and sometimes non-significant. The range of value obtained in the present study is also similar to the work of Sanoussi et al. (2011)

(ii) Flowering and Yield parameters

Flowering parameters *viz*., bud length, bud width, pedicel length, single flower weight, flower diameter, flower longevity, petal/throat colour and flower yield were recorded after 360 DAP in different accessions of hibiscus.The highest bud length was observed in Acc 10 (4.63 cm) followed by, in Acc 4 (4.62 cm) and Acc 1 (4.50 cm). The lowest bud length was observed in Acc 13 (2.87 cm). The highest single flower weight was observed in Acc 1 (10.60 g) and was followed by Acc 4 (10.40 g), Acc 10 (10.57 g) and Acc 9 (10.10 g) and they were found onpar with each other. The lowest single flower weight was observed in Acc 6 (2.63 g).The highest flower diameter was observed in Acc 13 (12.37 cm) which was on par with Acc 1 (12.17 cm) and Acc 11 (11.50 cm). The highest flower yield was observed in Acc. No.1 (2.10 kg/plant), followed by 1.74 kg /plant in Acc.No.10. The lowest flower yield plant 0.38 kg/ plant was recorded in Acc.No.5.(Table 1.)

The differences in yield parameters might be recorded for environmental influences as reported by Falusi et al. (2012) in okra while non-significant differences indicate that genetic components of the accessions are still intact as reported by Akinyele and Osekita (2006) also in okra. No significant difference in the flower retention on flower or longevity of flower was observed among the accessions of *Hibiscus rosa-sinensis.* The longevity of the Hibiscus flowers in all accessions was recorded as one day. The colour of the petals characterised using RHS colour chart revealed that nine accessions belonged to red group while two each belonged to yellow and orange group and one in white group. The throat colour of the flowers were also characterised and the colour code recorded (Table 2.).

The finding in this work has brought to light some important and unique morphological features as well as superior yield characters of some selected *Hibiscus rosa-sinensis* accessions. It is believed that this information, as thoroughly researched, would be of great value to agronomists and breeders alike in their improvement programmes in India and beyond, which would go a long way to help the ornamental and medicinal crop industry.

Table 1. Performance of different hibiscus for growth and yield characters

Accession Number	Plant height (cm)	No. of branches	Leaf area (cm^2)	Bud length (cm)	Single flower weight (g)	Flower diameter (cm)	Flower yield (kg/plant/ year)
Acc.No.1	170.58	8.00	50.57	4.50	10.60	12.17	2.10
Acc.No.2	114.33	12.67	24.96	4.00	9.27	9.83	0.75
Acc.No.3	122.00	14.00	20.79	3.12	9.73	9.60	0.95
Acc.No.4	150.67	8.67	37.10	4.62	10.40	10.47	1.63
Acc.No.5	86.33	10.67	19.19	3.93	6.03	7.87	0.38
Acc.No.6	120.21	8.33	30.89	2.96	2.63	7.40	0.44
Acc.No.7	147.35	8.00	28.23	4.48	5.60	10.27	0.76
Acc.No.8	151.57	8.10	34.67	4.37	9.00	10.17	1.40
Acc.No.9	128.00	9.30	24.58	3.73	10.10	10.99	1.42
Acc.No.10	144.67	8.00	42.14	4.63	10.57	11.20	1.74
Acc.No.11	144.67	9.00	30.22	4.40	5.70	11.50	1.41
Acc.No.12	108.00	10.20	7.90	3.83	9.23	9.70	0.90
Acc.No.13	118.37	13.30	35.72	2.87	5.60	12.37	0.42
Acc.No.14	104.33	10.30	8.56	2.73	8.97	9.53	0.80
Grand mean	126.75	9.66	27.89	4.04	7.98	9.13	1.07
S. Ed	11.89	1.17	3.79	0.56	0.41	0.53	0.40
CD (0.05)	23.78	2.34	7.58	1.13	0.83	1.06	0.89

Table 2. Flower longevity, petal colour and throat colour of different accessions of hibiscus

Acc. No.	Flower Longevity (days)	Petal colour (RHS)	Throat colour (RHS)
Acc.No.1	1	Red group 45 vivid red A	Red group 53 Deep red A
Acc.No.2	1	Red group 45 strong red D	Red group 46 Strong red A
Acc.No.3	1	Red group 45 vivid red C	Red group 46 Strong red A
Acc.No.4	1	Red group 45 vivid red D	Red group N45 Moderate red A
Acc.No.5	1	Red group 51 strong red A	Red group N45 Moderate red A
Acc.No.6	1	Red group N45 Moderate red B	Red group 53 deep red A
Acc.No.7	1	Red group 46 Vivid red B	Red group 53 deep red A
Acc.No.8	1	Yellow Orange group 18 Light Yellow B	Orange red group N34 Moderate red C
Acc.No.9	1	Yellow Ora nge group 17 Light Yellow D	Orange red group N34 Moderate red A
Acc.No.10	1	Orange group 28 Light orange C	Red group 45 Vivid red B
Acc.No.11	1	Orange group 28 Light orange C	Red group 53 Deep red A
Acc.No.12	1	Red group 55 Strong purplish pink B	Red group 54 Deep purplish pink B
Acc.No.13	1	Red group NN 55 Yellowish white A	White group NN 55 Yellowish white A
Acc.No.14	1	White group NN 55 Yellowish white A	White group NN 55 Yellowish white A

References

Akinyele BO, Osekita OS (2006). Correlation and Path Coefficient Analysis of seed yield attributes in Okra (Abelmoschus esculentus). Afr. J. Biotechnol. 5(14):1330-1336

Aldouri NA, A survey of medicinal plants and their traditional uses in Iraq, Pharmaceutical Biology, 38, 2000, 74

Amir I, Emmy H, Khairu I, Halimatul S, Mohamed N (2008). Roselle (Hibiscus sabdariffa L.) Seeds-Nutritional Composition, Protien Quality and Health Benefits. Global science books. Bailiere Tinall Ltd., London.

Baranova VS, Rusina IF, Guseva DA, Prozorovskaia NN, Ipatova OM, Kasaikina OT, The antiradical activity of plant extracts and healthful preventive combinations of these exrtacts with the phospholipid complex, Biomeditsinskaia Khimiia, 58, 2011, 712.

Falusi OA (2007). Cultivation and Use of Roselle (Hibiscus sabdariffa L) in Nigeria. PAT. 3(2):129-134

Kumar A, Singh A, Review on Hibiscus Rosa sinensis, International Journal of Research in Pharmaceutical and Biomedical Sciences, 3, 2012, 534.

Mahadevan N, Shivali, OE, Pradeep K (2009). Hibiscus sabdariffa L. An overview. Nat. Prod. Rad. 8(1):77-83.

Mostofa MG, Islam MR, Alam, ATM, Mahbub SM, Molla MAF (2002).Genetic variability, heritability and correlation studies in kenaf. Online J. Biol. Sci. 2:422-424.

Munirajappa L, Krishnappa DG, Chromosome number reports LXVIII, Taxon, 29, 1980, 533-547.

Oguntoye SG, Adefule AK, Popoola OB, Akinyem RA, Huthman IO, Effects of mishenland and anti-diabetic herb on kidney of streptozotocin induced diabetic adult Wistar rats, International Journal of Pharmaceuticals and Drug Analysis, 2, 2014, 138.

Rani S, Gupta RC, Kumari S, Meiotic studies in some polypetalous species from District Kangra (Himachal Pradesh), India, Cytologia, 77, 2012, 197.

Sanoussi A, Hadiara HS, Yacoubou B, Benoît S, Issaka L, Mahamane S (2011). Yield character variability in Roselle (*Hibiscus sabdariffa* L.). Afr. J. Agric. Res. 6(6):1371-1377.

Vyas A, Shukla SS, Pandey R, Jain V, Joshi V, Gidwani B, Chervil: A multifunctional miraculous nutritional herb,Asian Journal of Plant Sciences, 11, 2012, 163.

Yazan LS, Foo JB, Ghafar SAA, Chan KW, Tahir PM, Ismail M, Effect of kenaf seed oil from different ways of extraction towards ovarian cancer cells, Food and Bioproducts Processing, 89, 2011, 328.