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RESEARCH ARTICLE

STUDIES ON MORPHOLOGICAL CHARACTERIZATION OF GLADIOLUS GENOTYPES UNDER SHADE NET CONDITIONS

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Abstract: The current investigation was carried out at the Department of Floriculture and Landscape Architecture, Tamil Nadu Agricultural University, Coimbatore during 2021-2022 to evaluate the performance of Heliconia genotypes under shadenet condition. Twelve Heliconia genotypes were gathered from various geographic locations of Tamil Nadu and Kerala and characterised morphologically for growth and flowering attributes. The experiment was laid out in a Completely Randomized Design (CRD) with three replications. Five (46.66 per cent) out of twelve genotypes studied, showed quick growth, and all of the genotypes possessed open plant density, upright growth, and evergreen leaf persistence. Seven genotypes (58.33 per cent) had leaves that were noticeably green, compared to five genotypes (41.66 per cent) with moderately green leaves. Leaf blades of Six genotypes (50 per cent) had oblong shape, while six genotypes (50 per cent) had ovate shapes. All the 12 genotypes exhibited erect inflorescences, while the bract and floret colours varied differently. Among the twelve genotypes observed, the genotype G_1 (*H. psittacorum* cv. Golden Torch) exhibited earliness in flowering ((139.33 days), greater number of stalks per plant ((3.30), highest length of the flower spike (15.67 cm) and no. of bracts/ spike (4.44), While the genotype G_7 (*H. psittacorum* cv. Lady Di) recorded the highest no. of florets / bract (6.17)

Keywords: Heliconia, genotypes, morphological traits, evaluation, growth and flowering

INTRODUCTION

The genus Heliconia has more than 350 different species and is linked to some of the most beautiful tropical flowers. The bracts of heliconia flowers, which exhibit a variety of colours including red, orange, yellow, pink, and green, are quite attractive. Kerala, southern regions of Tamil Nadu, Karnataka, Maharashtra, West Bengal, and the North-Eastern area of India are among the states where heliconia is a common decorative plant. It may be grown up to an elevation of 3000–4000 feet above mean sea level and is well adapted to all of the country's main agroclimatic zones (Fisher, 1976). Variable species and cultivars have different flowering times depending on the habitat. In Hawaii, *Heliconia psittacorum* blooms and grows all year long. However, it would seem that summer would be more amenable for shoot and flower production (Manarangi *et al*., 1988). Heliconia's unique, peculiar inflorescence has earned it the designation of "Speciality flower." The phrase "tropical flowers" is most frequently used to describe floral products that are indigenous to tropical areas of the world and have grown in popularity among consumers in a number of countries over the past ten or so years. Growing Heliconias has a significant potential to boost competition in the floriculture business and function as an exporter of flowers because to the extended flowering season, brilliant colours, larger flower size, and superior quality of these commodities (Loges *et al*., 2006). The recent cut flower market strategy has made them an important player in the global market. For commercial farmers, the creation of new or enhanced cultivars is a top priority. Hence evaluation for growth and flower characters of Heliconia is important and helps for future research works.

MATERIALS AND METHODS

The experiment was carried out from 2021-2022 under shade net condition (25%) at the Department of Floriculture and Landscape Architecture, HC & RI, Tamil Nadu Agricultural University, Coimbatore. The research was carried out with 12 Heliconia genotypes collected from different geographical locations. The species of collections included *H. psittacorum* (cultivars such as Golden Torch, Lady Di, Golden Torch Andrian, Sherbert, Sassy Pink, Rubra Red, Kenea Red, Red devil, Petranova, Tropics, St. Vincent Red) and *H. densiflora* cv. Fire Flash. The experimental design was Completely Randomized Design (CRD) with three replications. The experiment was carried out in the growbags of

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size 45× 45× 45 cm filled with the medium containing the mixture of soil (Red loamy), vermicompost and cocopeat perlite mixture (1:1), FYM in the ratio of 2:1:1 and the bags were arranged with the spacing of 45×45 cm inside the shade house. Suckers ranged in weight from 38 to 45 grams. Before planting, suckers were given a Bavistin 8g/l treatment. After planting, a limited amount of watering was given, and the first establishment process took up to 50 days. After the establishment of the suckers, NPK @ 4g plant-1was administered. Later NPK @ 6g plant-1 was applied before and after bloom emergence at monthly intervals. For improved nutrient uptake by the medium, foliar spray with micronutrients was also provided. Depending on status of the plants, irrigation was provided twice a week. The growth and flowering parameters taken after 180 days after planting (DAP). The data recorded on various observations were analysed using Fisher's method of analysis of variance and the level of significance employed in F tests was (P = 0.05).

RESULTS AND DISCUSSION

Morphological Characterization of Heliconia genotypes

The variations that existed morphologically among 12 Heliconia genotypes by visual appearance related to growth and flowering characters are presented in the Table 4. All 12 genotypes showed upright growth in terms of plant habit, and exhibited open plant densities. Five genotypes (46.66 per cent) of the 12 genotypes showed fast growth, five genotypes (46.66 per cent) showed medium growth, and two genotypes (16.66 per cent) displayed slower growth. Regarding leaf colour, five genotypes (41.66 per cent) showed moderate green leaves, while seven genotypes (58.33 per cent) had highly green leaves. All genotypes displayed a musoid-like arrangement of leaves, with simple and entire leaf types and leaf margins. Regarding blade shape, six genotypes (50 per cent) were observed with an oblong shape, and six genotypes (50 per cent) were observed with an ovate shape. All 12 genotypes were determined to have an evergreen leaf persistence character. Regarding flower characteristics, it was noted that all 12 genotypes had upright inflorescences. Additionally, each genotype's bract and floret colours varied, as shown in Table 1. The results are in line stated that "Characterization can be made through some morphological markers which are observed primarily when identifying, classifying and distinguishing phenotypes". Morphological characterization has been utilized to distinguish interspecific cultivars and hybrids within the *Heliconia* genera (Berry and Kress, 1991).

Flowering parameters

Number of days taken for first flowering

The data showed significant differences among 12 genotypes with days taken for first flowering depicted in Table 2. Among the genotypes studied, earliness in flowering was observed in the genotype G_1 (*H. psittacorum* cv. Golden Torch) (139.33 days) followed by G_4 (*H. densiflora* cv. Fire Flash) (142.67 days). More number of days taken for first flowering (178.67 days) was noticed in G_{10} (*H. psittacorum* cv. Kenea Red) followed by G_3 (*H. psittacorum* cv. Tropics) (175 days). Similar findings were quoted by Catley and Brooking (1996) as he reported that Golden Torch cultivar initiated flowering at 140-146 days after planting. Most *Heliconiapsittacorum* species were used as container plants due to their profuse flowering viz., *H. psittacorum* cv. Golden torch suggested as a choice for container plants by Goel (2004).

Number of stalks per plant

The number of flowering shoots is a crucial component of the cut flower output potential. In general, it has been noted that the H. psittacorum cultivars produced more flowering shoots every year and started to flower earlier. The data corresponding to number of stalks per plant varied significantly with other genotypes and represented in Table 2. Among the genotypes studied, a greater number of stalks per plant was noticed in the genotype G_1 (*H. psittacorum* cv. Golden Torch) (3.30) which was on par with the genotype G_2 (*H. psittacorum* cv. Sassy Pink) (3.2). Similar findings were reported by Naik *et al*. (2019) where higher of spikes per clump were produced by G_6, *H. rostrata* (38.03) among the genotypes taken in their study.

Length of the flower spike

The length of the flower spike and length of the flower stalk is a significant quality attribute that determines the quality of Heliconia cut flowers for marketing as well as how long they will last in vases after being harvested (Naik*et al*., 2019). The genotype G_1 (*H. psittacorum* cv. Golden Torch) recorded the highest length of the flower spike (15.67 cm) followed by the genotype G_7 (*H. psittacorum* cv. Lady Di) (15.06 cm) and the data related to the length of the flower spike was shown in Table 2 and they significantly differ with all genotypes. In pertinence to seven flowering parameters, the performance of G_1 (*H. psittacorum* cv. Golden Torch) was found best in majority of flowering among other genotypes.

Bract characters

Data on performance of 12 genotypes with respect to number of bracts per spike was statistically analysed and the result is presented in Table 3. The genotype G_1 (*H. psittacorum* cv. Golden Torch) (4.44) noticed to give the greater number of bracts per spike which is as same as the genotype G_3 (*H. psittacorum* cv. Tropics) (4.31). The mean value of lowest number of bracts per spike was noticed in the genotype G_4 (*H. densiflora* cv. Fire Flash) (2.23). The genotypes taken in study significantly varied among each other

with respect to the character number of bracts per spike. These findings are corresponding with the work done by Sultana et al (2008) in Heliconia.

The length of the bract was found to be highest for the genotype G_7 (*H. psittacorum* cv. Lady Di) (13.67 cm) which proportionate with the genotype G_1 (*H. psittacorum* cv. Golden Torch) (11.11 cm). The lowest length of bract was observed with the genotype G_4 (*H. densiflora* cv. Fire Flash) which is 3.54 cm. The genotype G_2 (*H. psittacorum* cv. Sassy Pink) recorded the highest mean bract breadth as 2.79 cm which was on aprwith the genotype G_1 (*H. psittacorum* cv. Golden Torch) (2.65 cm). All genotypes taken in study varied significantly with each other where the highest number of florets per bract was observed in the genotype G_7 (*H. psittacorum* cv. Lady Di) (6.17) and the second highest number of florets per bract was noticed in the genotype G_1 (*H. psittacorum* cv. Golden Torch) (6.12). The results of variations in spike yield are inconformity with the findings of Ramachandrudu and Thangam (2012) and andSankari et al. (2016) in Heliconia on evaluation of various genotype performances.

These variations in flowering parameters might be due to flowering cycle, probably related to the seasonality and genetic makeup of individual genotypes of Heliconia. The increase in spike yield might be attributed to the early flower initiation, greater production of suckers with more clumping area as well as more chlorophyll might have resulted the production of more number of spikes with best quality.

CONCLUSION

From the investigation on evaluation of 12 *Heliconia* genotypes studied, it is concluded that the genotypes G_1 (*H. psittacorum* cv. Golden Torch) and G_2 (*H. psittacorum* cv. Sassy Pink) were better performing genotypes in terms of growth and flowering and they can be used for cultivation as cut flowers, potted plant in landscaping and interior gardening.

Table 1. Morphological characterisation of 12 *Heliconia* genotypes

Genotypes	PH	PD	GR	LC	LA	LT	LM	BS	LP	IT	BC	FC
G_1	Upright	Open	Fast	Green	Musoid	Simple	Entire	Oblong	Evergreen	Erect	Yellow orange	Yellow
G_2	Upright	Open	Medium	Green	Musoid	Simple	Entire	Oblong	Evergreen	Erect	Cream colour; pink distally	Orange with black tip
G_3	Upright	Open	Slow	Green	Musoid	Simple	Entire	Ovate	Evergreen	Erect	Orange; pinkish red distally	Yellow
G_4	Upright	Open	Medium	Moderate green	Musoid	Simple	Entire	Oblong	Evergreen	Erect	Bright reddish orange	Yellow with green tip
G_5	Upright	Open	Fast	Green	Musoid	Simple	Entire	Oblong	Evergreen	Erect	Dark red; yellow distally	Yellow
G_6	Upright	Open	Medium	Moderate green	Musoid	Simple	Entire	Ovate	Evergreen	Erect	Strong orange	Orange with black tip
G_7	Upright	Open	Fast	Green	Musoid	Simple	Entire	Oblong	Evergreen	Erect	Strong red	Light yellowwith black tip
G_8	Upright	Open	Slow	Moderate green	Musoid	Simple	Entire	Ovate	Evergreen	Erect	Red	Orange with black tip
G_9	Upright	Open	Medium	Moderate green	Musoid	Simple	Entire	Ovate	Evergreen	Erect	Deep red	Orange with black tip
G_{10}	Upright	Open	Fast	Green	Musoid	Simple	Entire	Ovate	Evergreen	Erect	Bright orange; red distally	Yellow
G_{11}	Upright	Open	Medium	Moderate green	Musoid	Simple	Entire	Ovate	Evergreen	Erect	Vivid reddish orange	Yellow with black tip
G_{12}	Upright	Open	Fast	Green	Musoid	Simple	Entire	Oblong	Evergreen	Erect	Bright orange; orange proximally	Orange withblack tip

PH : Plant habit, PD : Plant density, GR : Growth rate, LC : Leaf colour, LA : Leaf arrangements, LT : Leaf type, LM : Leaf margin, BS : Blade shape, LP : Leaf persistence, IT : Inflorescence type, BC : Bract colour, FC : Floret Colour

G_1 - *H. psittacorum* cv. Golden Torch,G_2 - *H. psittacorum* cv. Sassy Pink,G_3 - *H. psittacorum* cv. Tropics,G_4 - *H. densiflora* cv. Fire Flash, G_5-*H. psittacorum* cv. Golden Torch Andrian, G_6 -*H. psittacorum* cv. Sherbert, G_7 - *H. psittacorum* cv. Lady Di, G_8 -*H. psittacorum* cv. Rubra Red, G_9 -*H. psittacorum* cv. Petranova, G_{10} -*H. psittacorum* cv. Kenea Red, G_{11}- *H. psittacorum* cv. Red Devil,G_{12} - *H. psittacorum* cv. St. Vincent Red

Table 2. Flower characters of different *Heliconia* genotypes

Genotypes	Days taken for first flowering	Number of stalks per plant	Length of the flower stalk (cm)	Length of the flower spike (cm)
G_1 - *H. psittacorum* cv. Golden Torch	139.33	3.30	40.47	15.67
G_2 - *H. psittacorum* cv. Sassy Pink	166.33	3.20	51.84	10.18
G_3 - *H. psittacorum* cv. Tropics	175.00	1.42	42.47	9.44
G_4 - *H. densiflora* cv. Fire Flash	142.67	1.82	20.51	5.34
G_5 - *H. psittacorum* cv. Golden Torch Andrian	161.67	1.24	24.72	10.67
G_6 - *H. psittacorum* cv. Sherbert	161.33	2.32	33.89	6.72
G_7 - *H. psittacorum* cv. Lady Di	160.33	3.11	40.52	15.06
G_8 - *H. psittacorum* cv. Rubra Red	147.33	1.22	28.63	11.30
G_9 - *H. psittacorum* cv. Petranova	155.33	1.80	33.66	8.56
G_{10} - *H. psittacorum* cv. Kenea Red	178.67	0.78	25.21	12.71
G_{11}- *H. psittacorum* cv. Red Devil	154.00	1.68	25.15	10.46
G_{12} - *H. psittacorum* cv. St. Vincent Red	159.00	2.89	32.79	13.17
Mean	158.47	2.07	33.32	10.77
SE(d)	5.228	0.33	2.30	1.66
CD (5%)	10.79	0.67	4.76	3.43

Table 3. Bract characters of different *Heliconia* genotypes

Genotypes	Number of bracts per spike	Bract length (cm)	Bract breadth (cm)	Number of florets per bract
G_1 - *H. psittacorum* cv. Golden Torch	4.44	11.11	2.65	6.12
G_2 - *H. psittacorum* cv. Sassy Pink	3.69	9.78	2.79	5.90
G_3 - *H. psittacorum* cv. Tropics	4.31	6.05	1.90	4.53
G_4 - *H. densiflora* cv. Fire Flash	2.23	3.54	1.37	3.82
G_5 - *H. psittacorum* cv. Golden Torch Andrian	3.13	9.38	2.23	3.94
G_6 - *H. psittacorum* cv. Sherbert	3.15	6.21	1.22	3.82
G_7 - *H. psittacorum* cv. Lady Di	4.15	13.67	2.43	6.17
G_8 - *H. psittacorum* cv. Rubra Red	3.21	8.62	1.26	3.61
G_9 - *H. psittacorum* cv. Petranova	3.24	6.30	1.60	3.80
G_{10} - *H. psittacorum* cv. Kenea Red	4.21	10.71	2.41	4.37
G_{11}- *H. psittacorum* cv. Red Devil	4.18	7.13	2.43	5.11
G_{12} - *H. psittacorum* cv. St. Vincent Red	3.25	7.69	2.85	5.75
Mean	3.60	8.35	2.10	4.75
SE(d)	0.28	0.97	0.30	0.35
CD (5%)	0.58	2.00	0.61	0.72

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