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Establishment and evaluation of difference heliconia genotypes under Prayagraj agro-climatic condition

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Abstract
The present investigation "Establishment and evaluation of different heliconia genotypes under Prayagraj agro-climatic conditions" was carried under naturally ventilated polyhouse in the Department of Horticulture, SHUATS, Prayagraj, from September, 2024 - June, 2025. The experiment was laid out in Completely Randomized Design (CRD) and replicated thrice. The results revealed significant variation among all the genotypes for all the parameters studied. The results obtained showed that genotype G_2 (Petra) recorded fewer days (9 days) to first sprouting before dormancy as well as after dormancy (154 days). Genotype G_4 (Golden Torch) recorded significantly better plant height (39.8 cm), pseudostem diameter (44.53 mm), more number of shoots per clump (2.6), more number of sprouts per rhizomes (3), more number of leaves (3.9), better in leaf length (17.7 cm) and better in leaf width (4.1 cm), better in pseudostem length and leaf length (4 cm). Thus the heliconia genotype Golden Torch demonstrated superior performance in growth and development under the agro-climatic conditions of Prayagraj.

Keywords: Heliconia genotypes, growth performance, agro- climatic evaluation

Introduction

Ornamental plants serve as a fundamental element of the floriculture sector, appreciated for their visual attractiveness and substantial economic impact through landscaping, garden design, and interior decoration. Their cultivation includes a diverse array of plant types—flowering species, shrubs, climbers, and ornamental trees—all of which are affected by environmental factors such as temperature, humidity, sunlight, and rainfall. These conditions influence critical developmental characteristics like growth rate, flowering cycles, coloration, and post-harvest longevity, making adaptability to various climates crucial for commercial viability. Among ornamental plants, Heliconia is particularly notable for its striking, tropical appearance, vivid colors, and uniquely shaped flowers that resemble lobster claws or parrot beaks (Lamas 2020) [17]. Indigenous to tropical areas of the Americas, Africa, and the Pacific Islands, heliconias thrive in warm, humid environments and are highly appealing to pollinators like hummingbirds and butterflies (Kress and Betancur, 2009) [13]. Their extended vase life, durability during transport, and exotic allure have led to their growing popularity in the global cut-flower market, particularly for events and decorative displays. The assessment of Heliconia varieties involves criteria such as flower color, shape, size, plant health, fragrance, longevity, growth adaptability, reproductive success, and overall commercial value (Carrera-Alvarado *et al.* 2021) [4]. These evaluations are performed by horticulturists, florists, botanists, and plant breeders to pinpoint superior genotypes that are well-suited for specific climates and market needs, thereby promoting both sustainable cultivation and economic growth in tropical and subtropical areas.

Materials and methods

Studies on establishment and evaluation of different Heliconia genotypes under agro-climatic condition of Prayagraj was carried out under naturally ventilated polyhouse in the Department of Horticulture, SHUATS, Prayagraj, during September, 2024 - June, 2025. Ten genotypes G_1 (Pearl), G_2 (Petra), G_3 (St. Vincent), G_4 (Golden Torch), G_5 (Lady Di), G_6 (Lillian), G_7 (Lenova), G_8 (Sassy), G_9 (Red Torch), G_{10} (Fire Flash) were evaluated in a Complete Randomized Block (CRB) with three replications. The genotypes were planted in polybags filled with a growing medium composed of garden soil, cocopeat and vermicompost (1:1:1 v/v) for initial establishment. Observations were recorded on plants and leaf parameters and analyzed statistically using ANOVA. Critical difference at 5% significance level was used to compared treatment means.

Result and discussion
The data of different parameters of different heliconia genotypes are presented in Table No.1 and 2 and graphically illustrated in Fig No. 1 and 2

1. Days taken to first sprouting
Among all the genotypes, lesser days (9 days) to first sprouting, before dormancy was recorded in genotype G_2 (Petra) followed by G_3 (St. Vincent, 11 days) while more number of days (46 days) was observed in genotype G_4 (Golden Torch). Lesser days (154 days) to first sprouting after dormancy, was recorded in genotype G_2 (Petra) followed by G_7 (Lenova, 155 days) while more number of days (211 days) was observed in genotype G_8 (Sassy). Variation in days taken to first sprouting behavior is likely governed by genetic makeup, rhizome physiology, and responsiveness to different agro-climatic conditions. The adaptability of genotypes to specific agro-climatic conditions play a key role in performance, with well-adapted genotypes exhibiting enhanced growth and poorly adapted ones showing reduced performance. similar result variation in different heliconia genotypes were also observed by (Silva *et al*. 2019) [32].

2. Plant height
Among all the genotypes, taller plant (39.8 cm) was observed in G_4 (Golden Torch) followed by G_8 (Sassy, 30.4 cm) whereas shorter plant size (5 cm) was observed in G_2 (Petra). Plant height is a genetically controlled factor due to which plant height might have varied among the different genotypes due to the genetic makeup and environmental effect Srinivas *et al.* (2012) [36]. The adaptability of genotypes to specific agro-climatic conditions played a key role in their performance, with well-adapted genotypes exhibiting enhanced growth and poorly adapted ones showed reduced performance. These findings align with the results reported by Shriram *et al.* (2018) [31] in anthurium.

3. Pseudostem length
Among all the genotypes, taller pseudostem (18.9cm) was observed in genotype G_{10} (Fire Flash) which was found to be at par with G_4 (Golden Torch, 18.5 cm) whereas shorter pseudostem (3.2 cm) was observed in genotype G_2 (Petra). The length of the variation pseudostem is greatly affected by both genetic potential and environmental factors, indicating that certain cultivars demonstrate improved pseudostem elongation in optimal climates. The ability of genotypes to adapt to particular agro-climatic conditions was crucial for their performance, with well-suited genotypes showing increased growth while those poorly adapted exhibited diminished performance. Comparable findings regarding the variation in pseudostem length across different heliconia genotypes were also reported by Srinivas *et al.* (2012) [36] in heliconia.

4. Pseudostem diameter
Among all the genotypes, bigger pseudostem size (44.53 mm) was observed in genotype G_4 (Golden Torch) which was found to be at par with genotype G_8 (Sassy, 43.63 mm) whereas smaller Pseudostem size (12.22 mm) was observed in genotype G_2 (Petra). Differences in pseudostem diameter across genotypes can be linked to genetic variations and their varying responses to local agro-climatic conditions. The ability of genotypes to adapt to particular agro-climatic environments significantly influenced their performance, where well-adapted genotypes demonstrated improved growth, while those that were poorly adapted exhibited diminished performance. Avendaño-Arrazate *et al.* (2017) [2] in heliconia, also reported comparable findings regarding the variation in pseudostem diameter among different heliconia genotypes.

5. No. of shoots per clump
Among all the genotypes, more number of shoots per clump (2.6) was recorded in the genotype G_4 (Golden Torch) which was significantly superior over all the genotypes followed by genotype G_8 (Sassy, 1.8) while less number of shoots (0.4) was observed in genotype G_2 (Petra). The observed genotypic variations in shoot production can be ascribed to both genetic determinants and environmental factors. The genetic potential dictates the fundamental ability of a genotype to generate shoots, whereas environmental elements—especially temperature, soil moisture, and photoperiod—affect the manifestation of this characteristic. The moderate temperatures and well-drained loamy soils that are common in the study area may have contributed to the increased shoot count. Research indicates that shoot development is enhanced by cytokinin concentrations and corm vigor, both of which are influenced by the interaction between genotype and environment Kujur *et al*., (2016) [14] and Swetha *et al*., (2020) [37].

6. No. of sprouts per rhizome
Among all the genotypes, more number of sprouts per rhizomes (3) was recorded in the genotype G_4 (Golden Torch) followed by genotype G_8 (Sassy, 2.1) while less number of sprouts (0.6) was observed in genotype G_2 (Petra). Variation in the number of sprouts observed among the grnotypes can be attributed to genetic differences and possibly environmental factors. Genotype G_4 (Golden Torch) showed the highest number of sprouts indicating genetic traits that promote prolific sprouting followed by G_8 (Sassy), suggesting genetic characteristics conducive to multiple sprout formation. Environmental conditions such as temperature, light, and soil nutrients also influence sprouting behavior (Shiva and Nair, 2008) [30]. Genotypes adapted to specific environmental conditions may show variations in sprouting patterns. Additionally, the stage of plant development at which sprouts are counted can impact the results, with some genotypes initiating sprouts earlier or later in their growth cycle. Similar variations was reported in different varieties by Srinivasa and Reddy (2005) [35] and Rajeevan *et al*. (2007) [25] in anthurium.

7. No. of leaves
Among all the genotypes, more number of leaves (3.9) was recorded in the genotype G_4 (Golden Torch) followed by genotype G_8 (Sassy, 3.2) while less number of leaves (1.3) was observed in genotype G_2 (Petra), Variation in number of leaves among the different heliconia genotypes is driven by differences in the rate of vegetative growth among the genotypes. This variation is due to genetic makeup and may

also have been influenced by agro-climatic conditions. These findings align with the result reported by Srinivasa (2006) [34] in anthurium.

8. Leaf length

Among all the genotypes, longer leaf length (17.7 cm) was recorded in the genotype G_4 (Golden Torch) which was found to be at par with genotype G_{10} (Fire Flash, 17cm) while less number of leaves (3 cm) was observed in genotype G_2 (Petra). Variation in leaf length (cm) is genetically controlled factor, it varied among the different genotypes due to the genetic makeup and environmental effect Srinivas *et al.* (2012) [36]. Environmental conditions, such as temperature, light and nutrient availability also play a significant role in determining the pace of leaf development. These findings are in consistent with the findings of Agasimani *et al.* 2011 [11] and Islam *et al.* 2013 [12] in anthurium.

9. Leaf width

Among all the genotypes, longer leaf width (4.1 cm) was recorded in the genotype G_4 (Golden Torch) followed by genotype G_{10} (Fire Flash, 3.6 cm) while less number of leaves (0.6 cm) was observed in genotype G_2 (Petra). The variation in leaf width (cm) is a genetically controlled factor, which differs among various genotypes due to their genetic composition and environmental influences, as noted by Srinivas *et al.* (2012) [36]. Factors such as temperature, light, and nutrient availability are crucial in shaping the rate of leaf development. These conclusions are consistent with the research conducted by Agasimani *et al.* (2011) [1] and Islam *et al*. (2013) [12] on anthurium.

10. Pseudostem length and leaf length ratio

Among all the genotypes, higher ratio of pseudostem length and leaf length (4 cm) was observed in the genotype G_4 (Golden Torch) followed by genotype G_8 (Sassy, 3.3 cm) whereas lowest ratio (0.3 cm) was observed in genotype G_2 (Petra). The differences in pseudostem length and the ratio of leaf length among heliconia genotypes can be ascribed to intrinsic genetic variations, which affect growth patterns and structural development, while also being influenced by environmental factors. The ability of genotypes to adapt to particular agro-climatic conditions significantly impacted their performance, with those that were well-adapted demonstrating improved growth, whereas poorly adapted genotypes exhibited diminished performance. Comparable findings regarding the variation in leaf width were reported by Srinivas *et al*. (2012) [36] in heliconia.

Table 1: Plant parameters of different heliconia genotypes.

Notation	Genotypes	Days taken to first sprouting (before dormancy)	Days taken to first sprouting (after dormancy)	Plant Height	Pseudostem length	Pseudostem Diameter	No. of shoots per clump	No. of sprouts per rhizomes
G_1	Pearl	27	113	17.7	11.0	31.7	1.4	1.6
G_2	Petra	9	59	5	3.2	12.2	0.4	0.6
G_3	St. Vincent	11	-	-	-	-	-	-
G_4	Golden Torch	46	181	39.8	18.5	44.53	2.6	3.0
G_5	Lady Di	18	102	18.9	8.2	24.7	0.9	1.1
G_6	Lillian	33	117	18.4	8.0	23.36	1.2	1.4
G_7	Lenova	15	76	23.2	12.4	33.73	1.6	2
G_8	Sassy	26	211	30.4	16.0	43.63	1.8	2.1
G_9	Red Torch	41	164	28	16.3	36.96	1.5	1.8
G_{10}	Fire Flash	34	175	29.9	18.9	32.5	1.8	2.0
	F-TEST	S	S	S	S	S	S	S
	$CD_{0.05}$	0.791	3.176	1.155	0.426	1.120	0.370	0.292
	SE(d)±	0.374	1.500	0.545	0.201	0.529	0.175	0.138
	CV (%)	1.806	1.375	2.841	1.965	2.058	14.182	9.9559

Table 2: Leaf parameters of different heliconia genotypes.

Notation	Genotypes	No. of leaves	Leaf length	Leaf width	Pseudostem length and leaf length ratio
G_1	Pearl	2.2	10.7	2.5	1.1
G_2	Petra	1.3	3.0	0.6	0.3
G_3	St. Vincent	-	-	-	-
G_4	Golden Torch	3.9	17.7	4.1	4.0
G_5	Lady Di	1.9	6.9	1.5	1.2
G_6	Lillian	1.4	9.2	2.0	0.7
G_7	Lenova	2.3	12.3	3.2	2.4
G_8	Sassy	3.2	15.2	3.3	3.3
G_9	Red Torch	2.4	13.9	3.3	2.9
G_{10}	Fire Flash	2.5	17	3.6	2.6
	F-TEST	**S**	**S**	**S**	**S**
	$CD_{0.05}$	0.454	0.406	0.387	0.296
	SE(d)±	0.214	0.192	0.183	0.140
	CV (%)	11.021	1.990	8.248	8.128

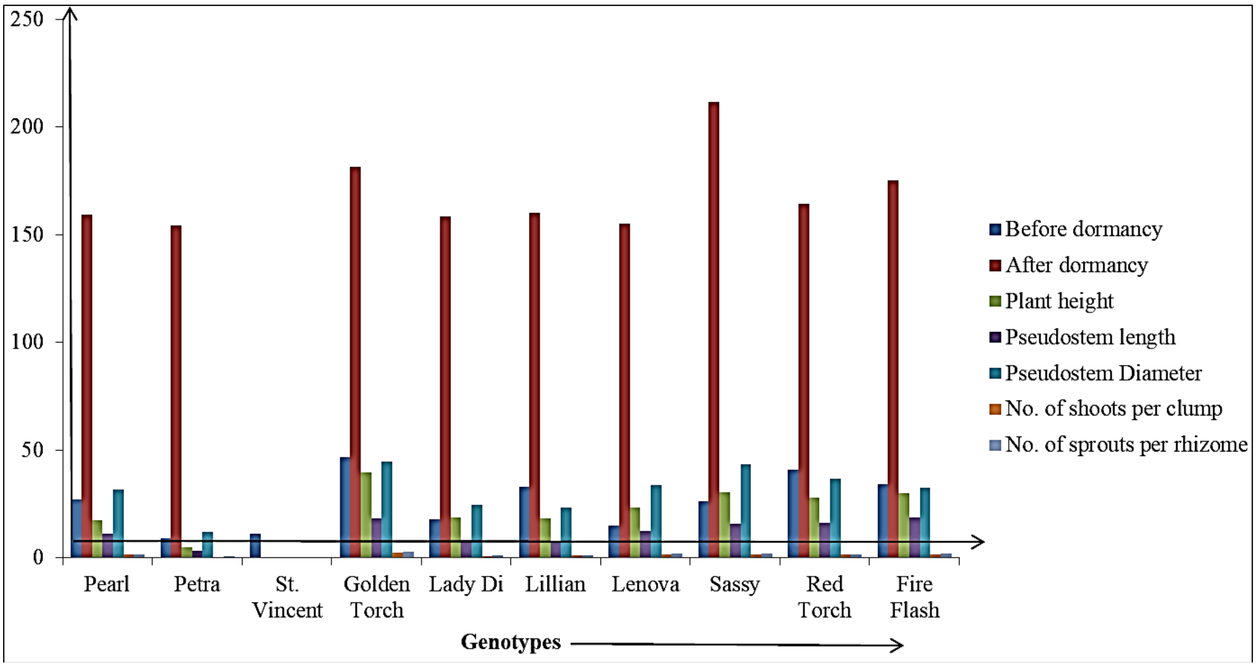

Fig 1: Plant parameters of different heliconia genotypes.

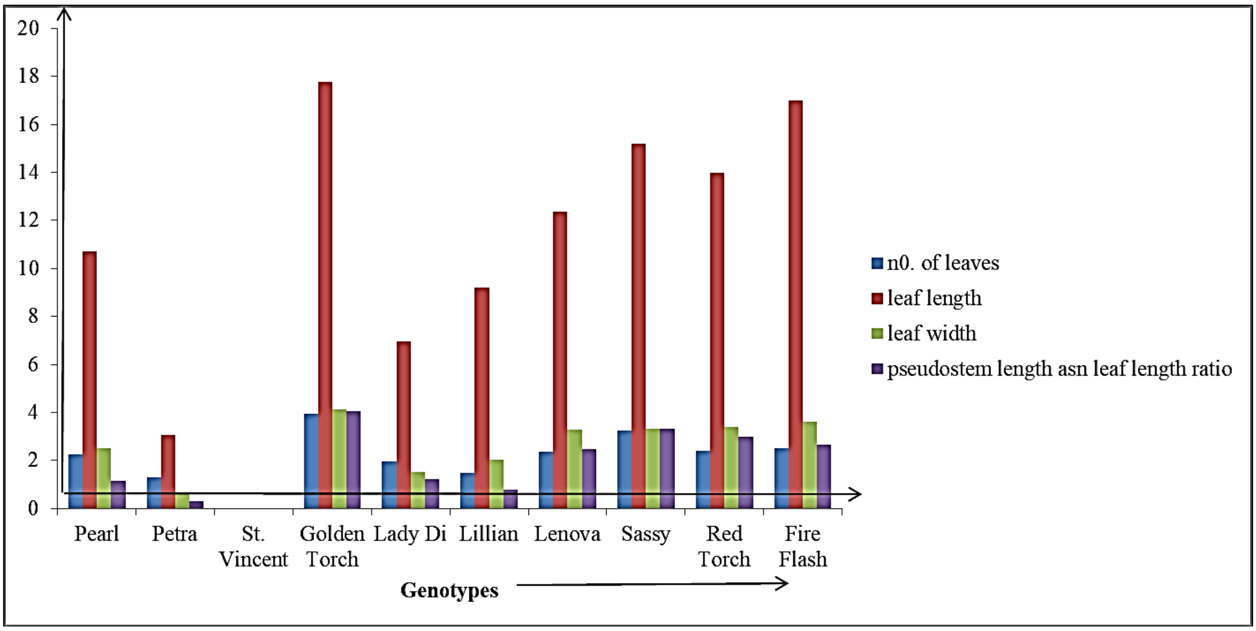

Fig 2: Leaf parameters of different heliconia genotypes.

Conclusion

From the present investigation it is concluded that 10 genotypes of heliconia under the study showed significant variation in all the parameters studied. Genotype G_4 (Golden Torch) performed significantly better in parameters like plant height, pseudostem length, pseudostem diameter, number of shoots per clump, number of sprouts per rhizome was at par with genotypes G_8 (Sassy) and G_{10} (Fire Flash) while genotype G_3 (St. Vincent), G_2 (Petra), G_6 (Lillian) and G_1 (Pearl) recorded poor performance. Genotype G_4 (Golden Torch) perform significantly better in number of leaves, pseudostem length and leaf lenth ratio, leaf length and leaf width. Hence, amongst all the genotypes, G_4 (Golden Torch) outperformed in all aspects. Therefore, such findings highlight the importance of systematic evaluation in identifying genotypes which are adaptable to Prayagraj.

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