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Performance of *Heliconia* genotypes for vegetative and flowering traits under shadehouse condition

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Abstract

An experiment was conducted at Hi-tech Horticulture, Seed Unit, University of Agricultural Sciences, Dharwad during 2015-17 to evaluate the performance of *Heliconia* genotypes under shadehouse condition. Sixteen genotypes studied were found significant difference for most of the characters. Among the genotypes, maximum plant height (340.38 cm), plant spread, (328.37 cm), leaf area (4699.40 cm²), length of spike (57.10 cm) and number of florets per bract (13.92) were found in *H. collinsiana* 'Pendula' whereas, number of suckers (66.40) were higher in *H. psittacorum* x *H. spathocircinata* 'Golden Torch' and comparatively more number of leaves were noticed in the genotype *H. stricta* 'Iris Bannochie' (7.89). The genotype *H. latispatha* 'Orange' was earlier to show its first flower by taking 110.88 days with increased number of spikes per clump (43.89). Stalk length was recorded more in *H. psittacorum* x *H. spathocircinata* 'Alan Carle' (83.31 cm) and maximum number of bracts per spike (11.63) were recorded in the genotype *H. chartacea* x *H. bihai* 'Lobster Claw-II'.

Keywords: *Heliconia*, Genotypes, Shadehouse, Spikes, Clump

Introduction

Heliconia is newly identified emerging exotic cut flower becoming popular in all metropolitan cities of India. It is a tropical plant belongs to the family Heliconiaceae which comprises of a single genus, *Heliconia* with 250-300 species. It is distributed primarily in Neotropical areas from the North of Mexico to the South of Brazil (Kress, 1990) [3]. *Heliconia* is mostly grown for beautifying the garden, now growing as cut flower because of its brilliant colour, exotic form, long straight peduncles and excellent post-harvest characteristics. These all features made it an outstanding flower for the florist (Lalrinawmi and Talukdar, 2004) [5]. It likes warm and humid conditions and can grow well even under partial shade. *Heliconia* assures handsome income to the farmer with minimum investment and care. Both the spikes and leaves of *Heliconia* are used for various purposes in different occasions. Selection of ideal genotypes for supporting the production of cut flowers with quality is strategic for expanding the floral industry. Hence, there is vast scope for expansion of the crop on a commercial scale to meet the local as well as outside demand.

With this backdrop, the present investigation was conducted to evaluate the performance of *Heliconia* genotypes for growth, yield and quality under shadehouse condition.

Material and Methods

The experiment was carried out from 2015 to 2017 under shadehouse condition at Hi-Tech Horticulture, Seed Unit, University of Agricultural Sciences, Dharwad. *Heliconia* genotypes were collected from Navasari Agricultural University, Navasari, Gujarat. Treatments consisted of sixteen genotypes viz., *H. psittacorum* x *H. stricta* 'Nickerensis', *H. rostrata* 'Parrot Beak', *H. stricta* 'Iris Bannochie', *H. chartacea* x *H. bihai* 'Lobster Claw-III', *H. psittacorum* x *H. spathocircinata* 'Golden Torch', *H. collinsiana* 'Pendula', *H. psittacorum* x *H. stricta* 'Tropica', *H. latispatha* 'Orange', *H. wagneriana* 'Rainbow', *H. psittacorum* 'Red Torch', *H. psittacorum* x *H. spathocircinata* 'Alan Carle', *H. wagneriana* 'Red', *H. psittacorum* 'Kenea Red', *H. caribaea*, *H. chartacea* x *H. bihai* 'Lobster Claw-II' and *H. latispatha* 'Red' with two replications. Initially, two kilo grams of farm yard manure per meter square was added and suckers were treated with carbendazim (0.2 %), then these genotypes were planted in one meter wide bed at a distance of one meter and fifty centimeter path was maintained between two beds. Uniform cultural operations were carried out throughout the experiment. Observations were recorded on various vegetative and flowering traits.

Results and Discussion

Vegetative growth is measured in terms of plant height, number of suckers per clump, number

of leaves per shoot, leaf length, leaf width and plant spread (Table 1). These factors are significantly important as they play a key role in deciding the good crop yield. *Heliconia* genotypes were exhibited wide variation for vegetative characters. Maximum plant height (340.38 cm) was obtained in the genotype *H. collinsiana* 'Pendula' minimum (117.41 cm) in *H. latispatha* 'Orange'. Number of suckers per clump were found higher (66.40) in *H. psittacorum* x *H. spathocircinata* 'Golden Torch' whereas, minimum (26.62) in *H. wagneriana* 'Red'. Comparatively more number of leaves (7.89) were observed in the genotype *H. stricta* 'Iris Bannochie' whereas, the genotype *H. chartacea* x *H. bihai* 'Lobster Claw-II' recorded minimum number of leaves (5.81). Maximum plant spread (328.37 cm) with leaf area (4699.40 cm²) was found in the genotype *H. collinsiana* 'Pendula' whereas, they found minimum as 131.46 cm and 841.93 cm², respectively in *H. latispatha* 'Orange'.

Such variations with respect to plant height and number of leaves among the genotypes could be attributed mainly because of genetic makeup of the genotype. The results demonstrated high variability for the number of suckers per clump, which may be due to ploidy levels, genomic constitution, more aeration and light due to suckering nature of genotypes. The variation in plant spread and leaf area might be due to increase in length of leaf and petiole, width of leaf and number of leaves among the different genotypes. These results are in agreement with studies of Sheela *et al.* (2007) [11] where, the maximum plant height (160.20 cm) was recorded in *H. latispatha*, more number of leaves (6.60) were found in *H. psittacorum* x *H. spathocircinata* cv. Alan Carle and maximum leaf area (2316.3 cm²) was found in *H. bourgenia* x *H. collinsiana* cv. Pedro Ortiz. Similar variations were also reported by Beckmann-Cavalcante (2011) [1] reported that, the *H. psittacorum* L. recorded more height (28.19 cm) with 3.10 number of leaves. Kumar *et al.* (2011) [4] recorded 302.50 cm of plant height with 6.30 leaves per shoot in the genotype Kawawuchi. Thangam *et al.* (2014) [13] observed 41.09 number of suckers in *Heliconia* cv. Golden Torch. Malakar *et al.* (2015) [6] recorded 307.84 cm of plant height with seven leaves in *H. stricta* and maximum plant spread (1932.73 cm) was observed in *H. indica* var. Red. Souza *et al.* (2016) [12] reported the highest leaf area (1519.80 cm²) in the genotype *H. bihai* cv. Humilis as compared to *H. psittacorum* cv. Golden Torch (885.2 cm²).

Significant differences were observed among different *Heliconia* genotypes for the flowering traits (Table 2). The genotype *H. latispatha* 'Orange' was shown its first visible flower in 110.88 days whereas, the genotypes *H. wagneriana* 'Red' was late to initiate the flower (316.50 days). Flower stalk length is very important quality trait which decides the quality of *Heliconia* cut flowers and also plays an important role in the vase life by extending their post-harvest life. The

maximum length of stalk (83.31 cm) was found in *H. psittacorum* x *H. spathocircinata* 'Alan Carle' and recorded minimum (56.22 cm) in *H. chartacea* x *H. bihai* 'Lobster Claw-III'. More length of spike (57.10 cm) was recorded in *H. collinsiana* 'Pendula' whereas, minimum was observed in the genotype *H. psittacorum* 'Red Torch' (14.91 cm). The genotype *H. chartacea* x *H. bihai* 'Lobster Claw-II' was recorded maximum number of bracts per spike (11.63) whereas, minimum in the genotype *H. psittacorum* x *H. spathocircinata* 'Golden Torch' (4.77). Increased number of florets (12.62) were observed in the genotype *H. latispatha* 'Red' whereas, lesser in *H. psittacorum* 'Kenea Red' (7.26). The similar findings with different *Heliconia* genotypes were reported by Ramachandrudu and Thangam (2012) [9] in the *Heliconia* genotype Choconiana for days to emergence of spike (120.00 days), stalk length (94.18 cm), spike length (21.50 cm), bracts per spike (6.97). Thangam *et al.* (2014) [13] reported the earlier days to flowering in *Choconiana* (124 days) and late flower initiation (445 days) was noticed in the genotype Sexy Pink while, spike and stalk lengths were recorded more in Sexy Pink (108.15 and 153.18 cm, respectively).

Flower yield is an important parameter which decides the significance of suitability of the particular genotypes for commercial production, which ultimately reflects on cost of cultivation. The genotype *H. latispatha* 'Orange' produced maximum number of spikes per clump (43.89) followed by *H. psittacorum* x *H. spathocircinata* 'Golden Torch' (40.64), *H. psittacorum* 'Kenea Red' (36.13) and *H. psittacorum* x *H. stricta* 'Tropica' (32.11) whereas, minimum spikes per clump (18.05) were recorded in *H. collinsiana* 'Pendula', *H. wagneriana* 'Red' (18.94) and *H. psittacorum* x *H. spathocircinata* 'Alan Carle' (19.48). The results of variations in spike yield are inconformity with the findings of Ramachandrudu and Thangam (2012) [9], Meenakshi *et al.* (2012) [8], Malakar *et al.* (2015) [6] and Sankari *et al.* (2016) [10].

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.

On other hand, the genotype *H. wagneriana* 'Rainbow' did not produce flowers during the study period. This failure in flower induction could be caused by genetic makeup and acclimatization of genotype as reported for hybrids of Arabidopsis (Martienssen, 2010) [7]. This finding is in accordance with the report of Costa *et al.* (2009) [2] in *H. pendula*, where, it had not begun its flowering stage up to 18 months of observation.

Table 1: Performance of *Heliconia* genotypes for vegetative traits under shadehouse condition

| Genotype | Plant height (cm) | Number of suckers/ clump | Number of leaves/ shoot | Plant spread (cm) | Leaf Area (cm ²) |
|---|-------------------|--------------------------|-------------------------|-------------------|------------------------------|
| G ₁ <i>H. psittacorum</i> x <i>H. stricta</i> 'Nickerensis' | 182.16 | 27.72 | 7.32 | 179.03 | 1231.12 |
| G ₂ <i>H. rostrata</i> 'Parrot Beak' | 298.13 | 26.01 | 6.75 | 180.92 | 1248.73 |
| G ₃ <i>H. stricta</i> 'Iris Bannochie' | 217.61 | 31.85 | 7.89 | 299.58 | 3108.16 |
| G ₄ <i>H. chartacea</i> x <i>H. bihai</i> 'Lobster Claw-III' | 225.70 | 49.61 | 6.75 | 224.60 | 1714.51 |
| G ₅ <i>H. psittacorum</i> x <i>H. spathocircinata</i> 'Golden Torch' | 189.86 | 66.40 | 6.02 | 169.99 | 1288.92 |
| G ₆ <i>H. collinsiana</i> 'Pendula' | 340.38 | 38.28 | 6.85 | 328.37 | 4699.40 |
| G ₇ <i>H. psittacorum</i> x <i>H. stricta</i> 'Tropica' | 225.84 | 42.23 | 6.34 | 213.61 | 1564.65 |
| G ₈ <i>H. latispatha</i> 'Orange' | 117.41 | 61.96 | 6.75 | 131.46 | 841.93 |
| G ₉ <i>H. wagneriana</i> 'Rainbow' | 268.15 | 44.00 | 5.96 | 286.74 | 3225.22 |

| | | | | | | |
|-----------------|--|--------|-------|------|--------|---------|
| G ₁₀ | <i>H. psittacorum</i> 'Red Torch' | 137.19 | 40.64 | 5.60 | 139.08 | 935.85 |
| G ₁₁ | <i>H. psittacorum</i> x <i>H. spathocircinata</i> 'Alan Carle' | 213.17 | 49.16 | 7.82 | 212.61 | 1363.76 |
| G ₁₂ | <i>H. wagneriana</i> 'Red' | 249.35 | 26.62 | 5.93 | 279.73 | 2995.40 |
| G ₁₃ | <i>H. psittacorum</i> 'Kenea Red' | 180.37 | 48.57 | 6.17 | 176.88 | 1154.70 |
| G ₁₄ | <i>H. caribaea</i> | 242.05 | 42.64 | 5.96 | 266.95 | 2935.71 |
| G ₁₅ | <i>H. chartacea</i> x <i>H. bihai</i> 'Lobster Claw-II' | 184.56 | 61.78 | 5.81 | 198.70 | 2076.39 |
| G ₁₆ | <i>H. latispatha</i> 'Red' | 254.94 | 33.34 | 7.53 | 194.74 | 2026.47 |
| | S. Em. ± | 8.12 | 2.01 | 0.36 | 4.60 | 51.81 |
| | C.D. (p=0.05) | 24.48 | 6.07 | 1.10 | 13.86 | 156.18 |

Table 2: Performance of *Heliconia* genotypes for flowering traits under shadehouse condition

| Genotype | | Days to First flowering | Length of stalk (cm) | Length of spike (cm) | Number of bracts/ spike | Number of florets/ bracts | Number of spikes/ clump |
|-----------------|--|-------------------------|----------------------|----------------------|-------------------------|---------------------------|-------------------------|
| G ₁ | <i>H. psittacorum</i> x <i>H. stricta</i> 'Nickerensis' | 152.06 (12.33) | 56.22 (7.50) | 17.01 (4.12) | 5.47 (2.34) | 8.45 (2.91) | 28.95 (5.38) |
| G ₂ | <i>H. rostrata</i> 'Parrot Beak' | 194.12 (13.87) | 60.24 (7.76) | 31.70 (5.63) | 11.49 (3.39) | 8.31 (2.88) | 33.69 (5.80) |
| G ₃ | <i>H. stricta</i> 'Iris Bannochie' | 201.94 (14.22) | 65.26 (8.08) | 26.06 (5.10) | 7.46 (2.73) | 9.83 (3.14) | 28.48 (5.34) |
| G ₄ | <i>H. chartacea</i> x <i>H. bihai</i> 'Lobster Claw-III' | 310.68 (17.64) | 56.22 (7.50) | 28.80 (5.37) | 8.45 (2.91) | 7.68 (2.77) | 26.60 (5.16) |
| G ₅ | <i>H. psittacorum</i> x <i>H. spathocircinata</i> 'Golden Torch' | 181.13 (13.47) | 60.24 (7.76) | 19.88 (4.46) | 4.77 (2.18) | 9.44 (3.07) | 40.64 (6.37) |
| G ₆ | <i>H. collinsiana</i> 'Pendula' | 276.72 (16.63) | 80.60 (8.98) | 57.10 (7.56) | 8.13 (2.85) | 13.92 (3.73) | 18.05 (4.25) |
| G ₇ | <i>H. psittacorum</i> x <i>H. stricta</i> 'Tropica' | 163.87 (12.58) | 70.34 (8.38) | 27.83 (5.28) | 5.40 (2.32) | 7.96 (2.82) | 32.11 (5.67) |
| G ₈ | <i>H. latispatha</i> 'Orange' | 110.88 (10.39) | 63.00 (7.94) | 20.87 (4.52) | 6.46 (2.54) | 9.24 (3.04) | 43.89 (6.62) |
| G ₉ | <i>H. wagneriana</i> 'Rainbow' | 0.00 (0.70) | 0.00 (0.70) | 0.00 (0.70) | 0.00 (0.70) | 0.00 (0.70) | 0.00 (0.70) |
| G ₁₀ | <i>H. psittacorum</i> 'Red Torch' | 141.87 (11.93) | 73.00 (8.54) | 14.91 (3.86) | 4.85 (2.20) | 9.48 (3.08) | 25.41 (5.04) |
| G ₁₁ | <i>H. psittacorum</i> x <i>H. spathocircinata</i> 'Alan Carle' | 248.83 (15.56) | 83.31 (9.13) | 40.75 (6.38) | 5.46 (2.34) | 8.17 (2.86) | 19.48 (4.41) |
| G ₁₂ | <i>H. wagneriana</i> 'Red' | 316.50 (17.80) | 62.25 (7.89) | 36.10 (6.01) | 6.68 (2.58) | 9.74 (3.12) | 18.94 (4.35) |
| G ₁₃ | <i>H. psittacorum</i> 'Kenea Red' | 180.97 (13.35) | 58.23 (7.63) | 19.88 (4.46) | 5.47 (2.34) | 7.26 (2.71) | 36.13 (6.01) |
| G ₁₄ | <i>H. caribaea</i> | 230.05 (15.18) | 60.29 (7.76) | 42.05 (6.48) | 6.79 (2.61) | 8.65 (2.94) | 28.85 (5.37) |
| G ₁₅ | <i>H. chartacea</i> x <i>H. bihai</i> 'Lobster Claw-II' | 268.32 (16.36) | 57.21 (7.56) | 37.74 (6.14) | 11.63 (3.41) | 9.44 (3.07) | 26.14 (5.11) |
| G ₁₆ | <i>H. latispatha</i> 'Red' | 265.94 (16.65) | 82.34 (9.07) | 36.86 (6.07) | 8.45 (2.91) | 12.62 (3.55) | 22.35 (4.73) |
| | S. Em. ± | 0.19 | 0.14 | 0.12 | 0.06 | 0.14 | 0.13 |
| | C.D.(p=0.05) | 0.58 | 0.43 | 0.37 | 0.18 | 0.43 | 0.39 |

* Values in parenthesis are in Square root transformed

Conclusion

In the present investigation, the genotypes *H. latispatha* 'Orange', *H. psittacorum* x *H. spathocircinata* 'Golden Torch', *H. psittacorum* 'Kenea Red' and *H. psittacorum* x *H. stricta* 'Tropica' produced maximum number of spikes with excellent visual appearance and good vase life. These genotypes are suitable for commercial production under shadehouse condition.

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