

Evaluation of *Heliconia* Species Based on Agro-Morphological Traits

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Abstract

Wide variation was observed among the ten genotypes of *Heliconia* for vegetative and floral characteristics. An investigation on 'Floral biology' was carried with the objective of studying the floral biology of these ten *Heliconia* species and varieties for thirteen floral characters. The study revealed that under hot and humid situation prevailing over West-Bengal there was no uniformity in flowering behaviour of different species and varieties. *Heliconia rostrata*, *Heliconia stricta*, *Heliconia wagneriana*, *Heliconia humilis*, *Heliconia psittacorum* var. 'Lady di', *Heliconia psittacorum* var. 'Choconiana' observed to be ideal as cut flowers. Cultivar *Heliconia psittacorum* var. 'Golden Torch' was observed to flower profusely and exhibited perpetual blooming and hence ideal for the landscaping.

Highlights

- Dissimilitude in morphological and floral attributes of *Heliconia* sp. genotypes.
- Investigation of floral biology of 10 *Heliconia* species and varieties under West-Bengal condition.
- Evaluation of *Heliconia* genotypes for cut flowers and allied purpose was also attempted.

Keywords: *Heliconia*, floral biology, vegetative traits

Heliconia, is a rhizomatous, herbaceous perennial plant and commonly known as 'Lobster-claws', 'Wild plantains' or 'False bird of paradise'. The family Heliconiaceae comprises of single genus, *Heliconia* with about 250-300 species distributed primarily in Neotropical areas from the North of Mexico to the South of Brazil (Santos 1978, Dahlgren *et al.* 1985, Kress 1990). Some species of *Heliconia* are utilized as ornamental plants, usually being grown both as landscaping plants and as cut flowers (Castro 1993) owing to its colour and longer durability of its floral bracts. Wide variation in vegetative growth, size, shape and arrangement of bracts has been reported by different authors. Due to its unusual inflorescence *Heliconia* is categorized as 'Speciality Flower'. Cut flower is one important commodity of floriculture industry. Selection and introduction of ideal genotypes for supporting the production of cut flowers with quality is strategic for expanding the floral industry. Very few or no systematic work has been reported in this country on *Heliconia* with respect to evaluation and genetic amelioration. Also its commercial potential has

not been exploited. Hence, the present study was conducted with an objective of evaluating different *Heliconia* genotypes for vegetative and flowering traits for their suitability as cut flower or as landscape plant.

Materials and Methods

The experiment was carried out in the Agricultural Experimental Farm, University of Calcutta, situated at Baruipur, South 24 Paraganas, West Bengal, India. In this investigation 10 species, some with varieties were collected from different sources and were planted in the field. Five plots of each genotype were maintained. Different morphological and flowering parameters were recorded for consecutive two years viz. 2012-2013 and 2013-2014 and cumulative data presented.

The species along with varieties used were *Heliconia humilis*, *Heliconia metallica*, *Heliconia psittacorum* var. 'Golden torch', *Heliconia psittacorum* var. 'Choconiana', *Heliconia psittacorum* var. 'Lady di', *Heliconia rostrata*, *Heliconia wagneriana*, *Heliconia stricta*, *Heliconia humilis* var. 'Dwarf', and *Heliconia indica* var. 'Red'.



Rhizomes were planted at a distance of 1m × 1m and each plot having 20 plants and uniform cultural operations were practiced throughout their growth and flowering.

Two and half year old plants were used for taking observations on phenological, quantitative and qualitative characters. Rate of growth of inflorescence was recorded on the basis of spike, peduncle and bract length of the ten genotypes under study. Morphological characters of inflorescence were evaluated based on methodology of Castro C.E.F. (1997), describing stem length as short (<50 cm), medium (50.1-150cm) and long (>150cm) and inflorescence length as short (<10cm), medium (10.1-30cm), long (30.1-50cm) and very long (>50cm). Observations were recorded from the date of inflorescence just emerged and continued up to the date showing same value for five consecutive days. The daily mean increase in the spike, peduncle as well as the bract length was recorded. The qualitative characters like colour of bract including blended colours were recorded by visual observation, when the inflorescence was in right stage for cut flower use. Chlorophyll and anthocyanin content of leaves were estimated as suggested by Sadasivam and Manickam (2011). The data collected were subjected to the statistical analysis for testing the homogeneity of error variances and also to test the significance of genotypic differences among the different genotypes used. (Panse and Sukhatme, 1969).

Results and Discussion

The genotypes evaluated exhibited wide variation for vegetative and floral characters (Table 1 & 2). Maximum height was recorded in *Heliconia stricta* with 10.1 ft. followed by *Heliconia wagneriana* with 8.93 ft. In case of *Heliconia humilis* var. 'Dwarf', the lowest height was observed i.e. 1.48 ft. (Table 3).

Heliconia indica var. 'Red' exhibited maximum plant spreading with 63.41sq.ft. followed by *Heliconia wagneriana* with 34.36 sq.ft. In *Heliconia metallica* 30.11 sq.ft. plant spreading was noted which was on par with *Heliconia rostrata* (28.49 sq.ft.) and *Heliconia stricta* (28.19 sq.ft.). Minimum Plant spread was observed in *Heliconia humilis* var. 'Dwarf' (4.56 sq. ft.).

Significant variation was also noted in leaf blade length among the genotypes. Leaf blade length ranged from 121.72cm. and 27.80 cm. in *Heliconia indica* var. 'Red' and *Heliconia psittacorum* var. 'Lady di' respectively (Table 3). *Heliconia wagneriana* (106.56 cm.) and *Heliconia stricta* (101.36 cm.) were also at par with *Heliconia indica* var. 'Red'.

Maximum number of shoots per clump (10.33) (Table:3) were recorded in *Heliconia psittacorum* var. 'Choconiana' followed by *Heliconia humilis* var. 'Dwarf' and *Heliconia rostrata* (10 each), *Heliconia humilis* (6.66), *Heliconia wagneriana*, *Heliconia metallica* and *Heliconia psittacorum* var. 'Golden torch' (6), whereas, *Heliconia psittacorum* var. 'Lady di' and *Heliconia stricta* recorded minimum number of shoots per clump (5). Results are shown in Figure 1.

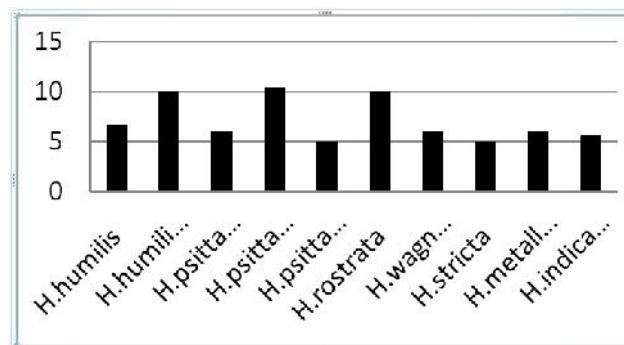


Fig. 1. No. of shoots per clump

Genotype *Heliconia stricta* produced maximum number of leaves per stem (7) followed by *Heliconia indica* var. 'Red', *Heliconia psittacorum* var. 'Lady di' (6) and *Heliconia humilis*, *Heliconia psittacorum* var. 'Golden torch', *Heliconia psittacorum* var. 'Choconiana', *Heliconia rostrata* (5) while minimum was recorded in *Heliconia wagneriana* (3) (Table 3).

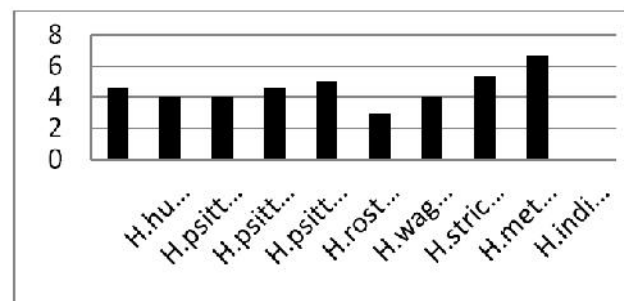


Fig. 2. No. of flowering stems per clump

Maximum stem length was observed in *Heliconia wagneriana* (152.42 cm.) (Table 3) which was similar to *Heliconia rostrata* (150.41 cm.) and *Heliconia stricta* (147.49 cm.). Shortest stem length was found in *Heliconia humilis* var. 'Dwarf' with 20.39cm.

Variation was observed in number of flowering stems per clump. Highest number of flowering stems per clump was noted in *Heliconia metallica* (6.66) followed by *Heliconia stricta* (5.33), *Heliconia psittacorum* var. 'Lady di' (5) *Heliconia humilis* (4.66) and *Heliconia psittacorum* var. 'Choconiana' (4.66) (Table 3). Besides this, in *Heliconia rostrata* least no. of flowering stems/



clump was recorded (3). In *Heliconia indica* var. 'Red', flowering stem (0) was absent, however it is valued for its beautiful foliage. Results are shown in Figure 2. This variability may be associated to adaptability to the climatic conditions (Costa *et al.* 2009).

Significant variation was observed among genotypes for flowering traits such as inflorescence length, number of open bracts, flowers per bract and number of bracts. Inflorescence length (with peduncle) was observed to be maximum in *Heliconia rostrata* (75.12 cm.), categorized under very long length. Genotypes *Heliconia psittacorum* var. 'Golden torch' (30.12 cm.), *Heliconia psittacorum* var. 'Choconiana' (48.34 cm.), *Heliconia psittacorum* var. 'Lady di' (30.44 cm.), *Heliconia wagneriana* (30.46 cm.) and *Heliconia metallica* (40.56 cm.) were grouped under long length inflorescence. Medium inflorescence length was recorded in genotypes *Heliconia humilis* var. 'Dwarf' (16.59 cm.) and *Heliconia humilis* (27.30 cm) (Table 3). Inflorescence of *Heliconia psittacorum* was having maximum length of 18.56 cm. and was synonymous to the findings of Lalrinawani and Talukdar (2000).

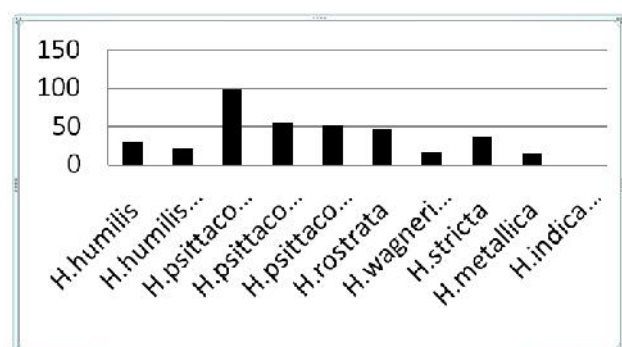


Fig. 3. No. of inflorescence per plant per year

A large no. of open bracts was observed in *Heliconia stricta* (13) and *Heliconia rostrata* (9) (Table 3). In *Heliconia wagneriana* and *Heliconia psittacorum* var. 'Golden torch', number of bracts were 7.66 and 6 respectively, while the remaining genotypes recorded lesser number of open bracts. Inflorescence with lesser number of open bracts at harvesting stage are preferred for their longer durability and ease in handling and packing (Costa *et al.* 2009).

Lowest number of flowers per bract, was observed for the genotypes *Heliconia humilis*, *Heliconia psittacorum* var. 'Golden torch' and *Heliconia rostrata* (5) and highest was observed for the genotype *Heliconia stricta* (14.66) (Table 3). In case of *Heliconia wagneriana*, number of opened bracts were quite high (12). Similarly, in *Heliconia psittacorum* var. 'Choconiana', *Heliconia psittacorum* var. 'Lady di' and *Heliconia metallica*,

number of flowers per bract were 8, 6.33 and 6 respectively.

Number of bracts ranged from 3-7.66 in *Heliconia psittacorum* var. 'Lady di' and *Heliconia wagneriana* respectively (Table 3) and the highest was observed in genotype *Heliconia rostrata* (14.33) which was more or less at par with *Heliconia stricta* (12.66).

The size of bract was highest in the genotype *Heliconia stricta* (62.26 cm²) which significantly differed from others. In case of *Heliconia humilis* (50.67 cm²) and *Heliconia wagneriana* (45.41 cm²) bract size were also larger. The lowest value for size of bract was for the genotype *Heliconia psittacorum* var. 'Choconiana' (5.39 cm²) which was at par with *Heliconia metallica* (7.65 cm²). In *Heliconia psittacorum* var. 'Lady di', bract size was 12.87 cm² and in *Heliconia psittacorum* var. 'Golden torch', *Heliconia humilis* var. 'Dwarf' and *Heliconia rostrata* bract size ranged from 29.63 cm² to 38.70 cm² (Table 3). *Heliconia wagneriana* had broader bracts arranged in compact manner than in *Heliconia humilis* var. 'Dwarf' where the distance between 2 bracts are quite less. In *Heliconia psittacorum* var. 'Golden torch' (long, boat shaped bract), *Heliconia stricta* (long, broad, boat shaped bract) and *Heliconia rostrata* (lobster-claw shaped bract), the bracts were arranged at wider spacing in the inflorescence rachis.

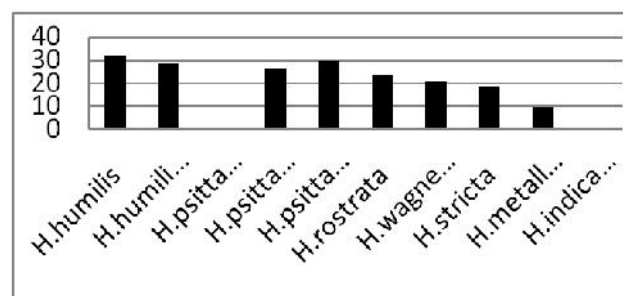


Fig. 4. Duration of male phase

The study revealed that under hot humid situation prevailing over here, there was no uniformity in flowering behavior of different varieties and species. Considering the flowering behavior some of the varieties showed continuous flowering throughout the year, whereas some were significantly seasonal. Our results showed that *Heliconia psittacorum* var. 'Golden torch' showed perpetual flowering and produced maximum number. of inflorescence per plant per year (98). In *Heliconia humilis* and *Heliconia rostrata*, there was no flower production during winter season, however peak flowering was noted during the month of April-July in both the species. The yield of inflorescence per plant per year was moderately high in *Heliconia psittacorum* var. 'Choconiana' (54.6), *Heliconia psittacorum* var. 'Lady

Table 1. Floral characteristics of selected varieties of *Heliconia* sp.

Genotypes	Bract	Rachis	Perianth	Ovary	Peduncle
<i>Heliconia humilis</i>	Vivid reddish orange bracts with dark green lip along the keel in shape of lobster claws, upright flower stalk.	Pale red with green tinge.	Whitish green almost completely concealed in spathes	Yellow, proximally green	Light green mottled with red
<i>Heliconia humilis</i> var. 'Dwarf'	Pale red bracts with light green lip along the keel, boat shaped bract, upright flower stalk.	Pale green mottled with light red.	Greenish yellow.	Light yellow.	Reddish green.
<i>Heliconia pittacorum</i> var. 'Golden torch'	Orange-yellow colored upright bract with light red patch at the base of cheek; basal bract with green keel.	Golden, often with small red areas at base.	Golden with faint green tip.	Golden on distal 1/3 and tip yellow below.	Yellow with green tint
<i>Heliconia pittacorum</i> var. 'Choconiana'	Strong orange yellow with pale red towards cheek.	Pale red.	Light orange yellow and dark green spots at tip	Yellow, proximally orange.	Light yellow or cream colored.
<i>Heliconia pittacorum</i> var. 'Lady di'	Cherry red bracts with pink tinge.	Deep reddish pink colored.	Faded yellow with dark green spots at the tip.	Faded yellow.	Faded green in color.
<i>Heliconia rostrata</i>	Hanging inflorescence of inverted, recurved, rose-red, yellow and green tipped, velvety texture.	Red colored, scalloped.	Yellow to whitish yellow.	Orange-yellow.	Red.
<i>Heliconia wagneriana</i>	Bracts are somewhat variable, bright red areas over most of the cheek and is surrounded by pale green along the lip of the keel and tip with light yellow.	Light red in color.	Dark green on distal 1/3 with light green tip, yellow on proximal part.	Light green.	Light green distally and cream proximally.
<i>Heliconia stricta</i>	Large stout inflorescence with solid red color.	Deep red.	Orange-yellow.	Orange.	Red.
<i>Heliconia metallica</i>	Small faded green colored, boat shaped, not attractive.	Light green.	Rosy pink in color with white tip.	Cream colored with dark green circle proximally.	Light green.

Table 2. Vegetative traits of selected *Heliconia* sp. genotypes

Genotypes	Plant habit	Plant density	Growth rate	Leaf texture	Leaf colour	Leaf fall characteristics	Leaf arrangements	Leaf type	Leaf margin	Blade shape	Leaf venation	Leaf type and persistence
<i>Heliconia humilis</i>	Upright	Open	Medium-slow	Smooth	Green with thin red edge.	Not showy	Distichus	Simple	Undulated	Oblong	Pinnate with parallel arching.	Evergreen
<i>Heliconia humilis</i> var. 'Dwarf'	Upright	Open	Fast	Smooth	Green	Not showy	Distichus	Simple	Undulated	Ovate	Do	Evergreen
<i>Heliconia psittacorum</i> var. 'Golden torch'	Upright	Open	Fast	Smooth	Green	Not showy	Distichus	Simple	Entire	Oblong	Do	Evergreen
<i>Heliconia psittacorum</i> var. 'Choconiana'	Upright	Open	Medium	Smooth	Green	Not showy	Distichus	Simple	Entire	Ovate	Do	Evergreen
<i>Heliconia psittacorum</i> var. 'Lady di'	Upright	Open	Medium	Smooth	Green	Not showy	Distichus	Simple	Entire	Ovate	Do	Evergreen
<i>Heliconia rostrata</i>	Upright	Open	Medium	Coarse	Green	Not showy	Distichus	Simple	Entire	Ovate	Do	Evergreen
<i>Heliconia wagneriana</i>	Upright	Open	Slow	Smooth	Green, midrib green at base and reddish towards apex.	Not showy	Distichus	Simple	Undulated	Oblong	Do	Evergreen
<i>Heliconia stricta</i>	Upright	Open	Medium	Coarse	Green with red edge	Not showy	Distichus	Simple	Entire	Oblong	Do	Evergreen
<i>Heliconia metallica</i>	Upright	Open	Fast	Satiny	Dorsal surface green coloured, ventral surface wine-purple coloured.	Not showy	Distichus	Simple	Entire	Ovate	Do	Evergreen
<i>Heliconia indica</i> var. 'Red'	Upright	Open	Medium	Smooth	Large leaves fully red coloured, greenish in age often noticed.	Not showy	Distichus	Simple	Undulated	Oblong	Do	Evergreen

Table 3. Evaluation of *Heliconia* genotypes for vegetative and flowering traits

Genotypes	1	2	3	4	5	6	7	8	9	10	11	12
<i>Heliconia humilis</i>	4.83	9.33	59.80	666	5	4.56	23.28	27.30	3	29.6	30.67	3.66
<i>Heliconia humilis</i> var. 'Dwarf'	1.48	4.56	30.60	10	4	4	20.39	16.59	3	23	28.70	4
<i>Heliconia psittacorum</i> var. 'Golden torch'	2.99	19.74	32.60	6	5	4	35.32	30.12	6	98	30.36	6
<i>Heliconia psittacorum</i> var. 'Choconian'	3.7	9.34	48.73	10.33	5	4.56	25.41	48.34	4	54.6	5.39	4
<i>Heliconia psittacorum</i> var. 'Lady di'	2.26	5.46	27.80	5	6	5	25.33	30.44	2.66	52.6	12.87	3
<i>Heliconia stricta</i>	5.83	28.49	93.93	10	5	3	150.41	75.12	9	48.6	29.63	14.33
<i>Heliconia wagneriana</i>	8.93	34.36	106.56	6	3	4	132.42	30.46	7.66	16.66	45.41	7.66
<i>Heliconia stricta</i>	10.1	28.19	101.36	5	7	5.33	147.49	58.4	13	37.33	62.26	12.66
<i>Heliconia metallica</i>	3.03	30.11	96.25	6	4.66	6.56	30.53	40.56	4	15.66	7.65	4
<i>Heliconia indica</i> var. 'Red'	5.93	63.41	121.72	5.66	6	0	66.11	0	0	0	0	0
Mean	4.91	23.30	71.92	7.06	5.06	4.13	70.66	35.73	5.23	37.60	28.29	55.71
F 9, 18	201.33**	6092.89**	18697.70**	22.27**	6.50**	25.87**	49634.82**	9176.31**	90.71**	2059.17**	6906.75**	162.78**
C.D. @ 5%	0.59	0.68	0.77	1.32	1.29	1.02	0.75	0.63	1.17	1.81	0.75	1.03

(Table Cont...)

Genotypes	13	14	15	16	17	18	19	20	21	22
<i>Heliconia humilis</i>	5	18.33	31.66	34.66	17	32	19.33	32.66	4.44	0
<i>Heliconia humilis</i> var. 'Dwarf'	5.66	22.66	23.33	30.66	14.66	28.66	17.33	29.66	1.36	0
<i>Heliconia psittacorum</i> var. 'Golden torch'	5	30	16.33	0	0	0	0	0	3.60	0
<i>Heliconia psittacorum</i> var. 'Choconian'	8	32	24.33	26.66	13.66	26.66	13.66	26.66	3.11	0
<i>Heliconia psittacorum</i> var. 'Lady di'	6.33	19	26.33	29.66	14.66	29.66	14.66	29.66	3.56	0
<i>Heliconia rostrata</i>	5	51.88	24.66	48	26	23.66	25.33	25.33	2.15	0
<i>Heliconia wagneriana</i>	12	92	40.66	42.66	23.33	20.66	25.66	21.33	4.22	0
<i>Heliconia stricta</i>	14.66	186	35.33	38.66	19.66	18.33	22	19.66	4.76	0
<i>Heliconia metallica</i>	6	24	19	21	10	9.33	12.33	8.66	0.68	9.84
<i>Heliconia indica</i> var. 'Red'	0	0	0	0	0	0	0	0	0.16	59.25
Mean	6.76	47.78	24.16	27.19	13.89	18.89	15.03	19.36	2.80	6.90
F 9, 18	312.05**	58963**	48596**	622.08**	231.33**	374.19**	86.62**	356.85**	35.67**	61.02**
C.D. @ 5%	0.32	0.95	0.81	1.25	1.56	0.78	1.85	0.27	1.42	0.11

Note: 1. Plant height (feet), 2. Plant spreading (sq. feet), 3. Leaf blade length (cm.), 4. Number of shoots per clump, 5. Number of leaves per stem, 6. Number of flowering stems per clump, 7. Stem length (cm.), 8. Inflorescence length (cm.), 9. Number of open bracts, 10. Number of inflorescence per plant per year, 11. Size of bract (cm²), 12. Number of bracts, 13. Number of flower per bract, 14. Number of flower per inflorescence, 15. Days from bud emergence to full unfurling of bracts, 16. Days from first to last flower opening, 17. Days from emergence to male phase, 18. Duration of male phase, 19. Days from emergence to female phase, 20. Duration of female phase, 21. Total Chlorophyll content of leaves (mg/gm tissue), 22. Anthocyanin content of leaves (mg/100gm tissue).



di' (52.6) and *Heliconia rostrata* (48.6) while lowest yield was recorded in *Heliconia metallica* (15.66) which was similar to *Heliconia wagneriana* (16.66) (Table 3). Results are represented in Figure 3.

In *Heliconia stricta*, number of flowers per inflorescence (186) was highest while in *Heliconia humilis* lowest number of flowers per inflorescence (18.33) were noticed (Table 3). In the remaining genotypes, number of flowers per inflorescence ranged from 19 to 92 which exhibited actually a wide variation.

The least number. of days from bud emergence to full unfurling of bracts was observed in the genotype *Heliconia psittacorum* var. 'Golden torch' (16.33 days) which was in abeyance to that of *Heliconia metallica* (19 days) (Table 3). The highest number of days were taken by the genotype *Heliconia wagneriana* (40.66 days) followed by *Heliconia stricta* (35.33 days) and *Heliconia humilis* (31.66 days).

The genotype *Heliconia metallica* recorded the lowest mean value of number of days from first to last flower opening (21 days) followed by *Heliconia psittacorum* var. 'Choconiana' (26.66 days) and *Heliconia psittacorum* var. 'Lady di' (29.66 days) (Table 3). The highest mean value was recorded in the genotype *Heliconia wagneriana* (42.66 days) followed by *Heliconia stricta* (38.66 days), *Heliconia humilis* (34.66 days) and *Heliconia humilis* var. 'Dwarf' (30.66 days).

In *Heliconia rostrata* the number of days from emergence to male phase was recorded high (26 days) followed by *Heliconia wagneriana* (23.33 days) and the least number of days from emergence to male phase was noted in *Heliconia metallica* (10 days) followed by *Heliconia psittacorum* var. 'Choconiana' (13.66 days) (Table 3). *Heliconia humilis* var. 'Dwarf' and *Heliconia psittacorum* var. 'Lady di' took 14.66 days for the above parameter. Surprisingly in case of *Heliconia psittacorum* var. 'Golden torch' not a single flower did open, due to which we were unable to record the time of initiation and termination male and female phase. It has been previously recorded that *Heliconia psittacorum* var. 'Golden torch' produce non-functional i.e sterile pollens which ultimately impede the seed production (Schleuning *et al.* 2010 and Matthew *et al.* 2015). Meiotic abnormalities resulting in malformed pollen are common in cv. Golden Torch and cv. Sassy which hardly produce any functional pollen (Temeles *et al.* 2010). For all the above mentioned varieties, the time of anthesis were found to be highly variable. This can be related to Croat's observations (1980) that process related to anthesis varied with species and environment. Also the early flower opening in rainy season could be due to the

rain splash on the perianth of the flower (Sanjeev *et al.* 2010).

Significant variation was observed among the genotypes for duration of male phase i.e., the period taken from production of fertile pollen upto the drying of anthers. *Heliconia humilis* and *Heliconia metallica* exhibited highest (32 days) and lowest (9.33 days) duration of male phase respectively. This suggests *Heliconia humilis* pollens remain viable for a good number of days, so there is immense chance of pollination than in *Heliconia metallica*. *Heliconia humilis* var. 'Dwarf' (28.66 days), *Heliconia psittacorum* var. 'Choconiana' (26.66 days), *Heliconia psittacorum* var. 'Lady di' (29.66 days), *Heliconia rostrata* (23.66 days) and *Heliconia wagneriana* (20.66 days) were at par (Table: 3). Results are shown in Figure 4.

In case of *Heliconia psittacorum* var. 'Choconiana' and *Heliconia psittacorum* var. 'Lady di', number of days (13.66 days and 14.66 days respectively) recorded from emergence to female phase were more or less same and similar to emergence to male phase (Table: 3). Apart from these two, other genotypes required additional 1-2 days for the above mentioned parameter. Stigma receptivity was highest when male phase and female phase coincided approximately for 30 days.

Chlorophyll content of the leaves were recorded to be high in genotype *Heliconia stricta* (4.76 mg/gm of tissue), which was at par with *Heliconia humilis* (4.44 mg/gm of tissue) and *Heliconia wagneriana* (4.22 mg/gm of tissue).

Anthocyanin content of leaves as measured showed higher values for the genotype *Heliconia indica* var. 'Red' (59.25 mg/100 gm of tissue) followed by *Heliconia metallica* (9.84 mg/100 gm of tissue).

Conclusion

The arrangement of bracts of the inflorescence has an important influence on handling and packing and on the number of inflorescences per commercial box. Inflorescences with bracts arrangement in one plane allows easier handling and packing and also more stems per box than spirally arranged bracts. For *Heliconia* cut flower industry, the characteristics of interest are: production of inflorescences during the whole year, longer stems (>80cm.), light flowering stems for ease of transportation, stems with diameter thick enough for better handling and inflorescence with less weight, with no wax and hair and bracts arranged in one plane for easier handling and packing (Srinivas *et al.* 2012).

Based on the results obtained, genotypes *Heliconia*



psittacorum var. 'Golden Torch' was found to be profusely flowering with perpetual blooming and hence ideal for landscaping. Genotypes *Heliconia metallica* and *Heliconia indica* var. 'Red' have showy, colourful foliages and so they can be used as foliage plant in landscaping. Genotypes *Heliconia rostrata*, *Heliconia stricta*, *Heliconia wagneriana*, *Heliconia humilis*, *Heliconia psittacorum* var. 'Lady di', *Heliconia psittacorum* var. 'Choconiana' were observed to be ideal as cut flowers. Genotype *Heliconia humilis* var. 'Dwarf' can be grown in pots and utilized for indoor purpose.

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