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Evaluation of different genotypes of crossandra

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Abstract
The genus *Crossandra* of family Acanthaceae consists of beautiful flowering shrubs, native to South India and Sri Lanka. It can be used as a potted flowering or landscape plant, as it is small in size and sports attractive flowers. The research program was conducted with the objectives to develop new cultivar of crossandra by evaluating the different genotypes of crossandra for quantitative and qualitative characters by considering the need of commercial growers and to popularize the crossandra crop in Maharashtra. The seven genotypes were evaluated for qualitative and quantitative characters and it shows significant variation. Among seven genotypes under studied, cultivar Arka Shrvya was found superior over all genotypes in different characters *viz.*, number of flower per spike, number of flowers per picking, weight of flowers per picking, yield per plant, least days for opening of first flower.

Keywords: Crossandra, growth, flower, yield

Introduction
Crossandra (*Crossandra spp.*) is an important commercial flower, which belongs to the family Acanthaceae, mainly grown in India, Tropical Africa and Madagascar. There are 20-25 species but only few like *Crossandra infundibuliformis, Crossandra undulaefolia, Crossandra guineensis, Crossandra mucronata and Crossandra subacaulis* are cultivated.
The crossandra species grown for commercial flower production is *Crossandra undulaefolia Salisb*. These are small, evergreen shrubs freely producing flowers in dense sessile spikes. The flowers are commonly used for hair adornment. Though not fragrant, flowers are very popular because of its attractive bright colour, light weight. These are used for making garland, either along or in combination with jasmine flowers. Using crossandra flowers in combination with jasmine is becoming increasingly popular in India, particularly in southern parts, because the jasmine flowers provide colour contrast and the desired fragrance.
The selection of suitable cultivars depends on purpose for which crop has to be grown i.e. use for loose flowers, cut flowers, extraction of concrete, pot culture and also adaptability to specific growing places. Due to advent of cut flowers and impact of Western culture, the demand and popularity for traditional flowers is growing up. So, for commercialization of crossandra crop in Maharashtra there is necessity to identify suitable cultivars for loose flowers, cut flowers and for pot culture. Hence present study on evaluation of crossandra genotypes for growth, yield and quality was undertaken.

Material and Methods
The experiment was conducted at the National Agricultural Research Project Ganeshkhind, Pune-7, MPKV; Rahuri, during 2015-2016 in randomized block design with three replications and seven treatments. The rooted plants of four varieties of crossandra were collected from the IIHR, Hessarghatta and Bangalore. The remaining three local genotypes were collected from Pune region and planted at 60 cm X 60 cm spacing. Well decomposed FYM was spread evenly @ 25tonnes per hectare before last harrowing. The first application of fertilizers was done in 50-60 days after planting.
The dose of P_2O_5 and K_2O (100 and 60 Kg respectively) applied twice at an interval of 6 months except in the rainy season. Standard cultural practices were followed throughout experimentation. The four plants per plot from each treatment and replication was selected tagged for the recording the following observations of vegetation, flower characters. The flower colour was recorded by using RHS colour chart for flower of selected observational The dose observational plant flower.

Results and Discussion

Growth characters

The considerable variation in plant height was exhibited by the genotypes during different growth stages. The significantly highest plant height at 60 DAP was recorded in genotype Arka Ambara and less in Arka Shreeya than other genotypes. Whereas, plant height at 120 DAP was highest in Local-2 and least in Local-1. At 180 DAP, highest plant height in Local-2 genotype. Whereas Arka Shreeya was recorded minimum plant height. This result was found similar in agreement with Ramchandrudu and Thangam (2010) in crossandra [6]. The numbers of branches per plant at 60 DAP were produced more in genotype Local-1and less in Local-3genotype.120 DAP more number of branches per plant was recorded in genotype Arka Kanaka and minimum in Arka Ambara genotype. Whereas, maximum number of branches per plant at 180 DAP was recorded in genotype Local-1and minimum in Arka Ambara. These findings were confounded by Aswath (2007) in crossandra [2]. Spread of plant in South to North direction is significantly more in genotype Local-1and minimum in Arka Ambara at 60 DAP. The plant spread (S-N) at 120 DAP more in Local-1 and less in Arka Ambara genotype. Whereas the more plant spread in (S-N) direction recorded in genotype Local-1and less in Local-2 and in East to West direction the maximum plant spread recorded in genotype Local-1 and minimum in Local-3 at 60 DAP. The plant spread at 120 DAP more in Local-1and less in Arka Ambara in at 180 DAP more in genotype Local-1 and less in Local-3 genotype.

Flowering character

The minimum days required for flower initiation was recorded in genotype Arka Shrvya (62.67 days) whereas maximum days was required by genotype Local-3 (73.59 days).the results are in line the finding reported by Ramchandrudu and Thangam (2010) [6] Arka Shrvya recorded significantly maximum rachis length (7.01cm) amongst seven genotypes under study whereas minimum rachis length recorded in Local-3. Similar result was obtained by Ranchana (2013) in double type tuberose.

The significantly longest spike was recorded in genotype Arka Shrvya (16.05cm) and shortest in genotype Local-3(9.47cm). The significantly maximum number of flower per spike and number of flowers per spike recorded highest in the genotype Arka Shrvya (34.67). However the minimum numbers of flowers per spike recorded in genotype Local-3(15.33). These finding were cofounded by Ramchandrudu and thangam (2010). The significantly maximum flower width (3.50 cm) was recorded in the genotype Arka Ambara and the minimum flower width was recorded in Local-1(2.51cm) genotype. This variation may be due to difference in the genetic makeup of cultivars. Significantly maximum flower length was observed in genotype Arka Ambara (4.41cm) genotype Local-1 recorded significantly minimum flower length (3.51cm). These finding are accordance with Radhakrishn (2012) in tuberose. Duration of flowering was recorded more in Arka Shrvya and minimum in Local-1.

Yield characters

The number of flowers per picking was recorded more by genotype Arka Shrvya (192.33) which was significantly superior over other genotypes. While, minimum flowers per picking was recorded in genotype Local-3 (30.88). The variation in flower per picking may be due to genetic variability, disparity in storage of among different cultivars and prevailing environmental conditions. Significantly maximum weight of flowers per picking was recorded in the genotype Arka Shrvya (12.62g) with weight of flowers per picking. The minimum weight of flowers per picking was recorded by the genotype Local 3(1.31g). The significantly maximum weight of 100 flowers was recorded by genotype Arka Shreeya (9.30g) and the minimum weight of 100 flowers was recorded in genotype Local 3 (4.23g). Similar finding also reported by Agale (2010) in Gaillardia. The genotype Arka Shrvya (86.33g) was significantly higher in respect of yield of flowers per plant. While, minimum flower yield per plant was recorded by the genotype Local 3(5.00g).Similarly, Ramchandrudu and thangam (2010) in crossandra crop.

Flower Colour

The Nasturtium orange flower colour was observed in Arka Kanaka and Local 2 genotypes. The Mars orange flower colour was observed in Arka Ambara and Local 3 genotypes. Burnt orange colour observed in Arka Shrvya genotype whereas rhodonite red and jasper pink colour observed in Local-1 and Arka Shreeya respectively.

Table 1 Performance of different crossandra genotypes on growth characters

Genotypes	Plant Height (cm)			Number of branches per plant			Plant Spread (N-S) (cm)			Plant Spread (E-W) (cm)		
	60 DAP	120 DAP	180 DAP	60 DAP	120 DAP	180 DAP	60 DAP	120 DAP	180 DAP	60 DAP	120 DAP	180 DAP
Arka Ambara	29.67	36.13	62.33	6.25	10.25	18.67	14.68	25.98	58.30	15.51	31.06	51.23
Arka Kanaka	22.65	37.91	54.07	8.00	16.78	26.01	20.66	37.44	65.18	17.42	33.30	56.57
Arka Shreeya	14.25	33.27	44.06	8.00	13.33	19.63	16.89	34.27	67.19	13.38	36.31	58.00
Arka Shrvya	21.80	33.52	59.61	4.67	14.50	22.48	22.25	36.14	72.72	23.06	39.79	69.70
Local-1	24.25	31.95	56.85	8.18	16.42	32.15	22.88	41.07	76.60	24.46	44.76	76.39
Local-2	17.00	41.33	68.78	7.25	14.89	28.60	17.23	36.09	55.55	19.36	35.43	55.93
Local-3	21.42	34.73	52.27	4.75	11.75	18.81	18.17	29.29	57.51	14.09	33.25	46.78
SE(m) ±	2.02	1.40	2.97	0.63	1.04	2.27	0.88	1.32	1.36	1.44	2.31	2.11
C.D.at 5%	6.30	4.36	9.24	1.98	3.25	7.08	2.74	4.12	4.25	4.50	7.19	6.58

Table 2: Performance of different crossandra genotype on flowering characters

Genotypes	Days to flower initiation	Rachis Length (cm)	Spike length (cm)	Flower width (cm)	Flower length (cm)
ArkaAmbara	71.25	5.86	11.13	3.50	4.41
Arka Kanaka	66.67	5.82	14.32	3.37	4.19
Arka Shreeya	71.83	5.43	11.43	3.30	4.00
Arka Shrvya	62.67	7.01	16.05	3.10	4.22
Local-1	68.67	6.23	13.49	2.51	3.51
Local-2	70.17	5.44	11.13	2.77	3.59
Local-3	73.58	5.17	9.47	2.62	3.63
SE(m) ±	1.39	0.14	0.24	0.02	0.025

Table 3: Performance of different crossandra genotype on yield characters

Genotypes	No. of flowers per spike	No. of flowers per picking	Wt. of flowers per picking (g)	Wt. of 100 flowers (g)	Yield per plant (g)
ArkaAmbara	18.78	38.01	3.08	8.10	25.33
Arka Kanaka	17.67	46.27	4.08	8.76	29.67
ArkaShreeya	19.00	35.56	3.31	9.30	17.33
ArkaShrvya	34.67	192.33	12.62	6.57	86.33
Local-1	27.67	36.15	1.74	4.80	13.00
Local-2	21.33	45.45	2.09	4.60	16.00
Local-3	15.33	30.86	1.31	4.23	5.00
SE(m) ±	1.51	4.10	0.34	0.24	3.75
C.D. at 5%	4.70	12.78	1.06	0.76	11.70

Table 4: Performance of different crossandra genotype for qualitative characters

Genotypes	Flower colour	
	Fl. Colour	Fl. Code
Arka Ambara	Mars Orange	o13/1
Arka Kanaka	Nasturtium Orange	610/1
Arka Shreeya	Jasper Red	o18/1
Arka Shrvya	Burnt Orange	o14
Local-1	Rhodonite Red	oo22/1
Local-2	Naturtium orange	610/2
Local-3	Mars Orange	o13/3
SE(m) ±		
C.D. at 5%		

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