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Per se performance of anthurium (*Anthurium andraeanum* Linden Ex André) cultivars for yield and quality under Shevaroys condtion eastern ghat

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ABSTRACT : A study was conducted to evaluate the twenty nine anthurium cultivars at Horticultural Research Station, Tamil Nadu Agricultural University, Yercaud between June 2008 and 2010 for quantitative and qualitative characters. Significant differences were observed for all the characters. In respect to the plant height cultivar Ria Bamboo Red recorded the highest plant height (73.90 cm) and Flamingo Blush Pink produced the maximum number of leaves per plant (11) and cv. Gino Orange (3.50) recorded minimum number of leaves per plant .Cultivars Lima White (4.21 no.) and Peach (3.60 no.) recorded maximum number of suckers. Linda De mole had the maximum plant spread (73.20 cm) and minimum was recorded in cv. Red KLP (32 cm). The highest leaf length was produced in Liver Red (40.84 cm) and maximum breadth (21.60 cm). In respect, to stalk length cultivar Hawaiin Red recorded the highest stalk length (64.90 cm) and Merignue Red (30.40 cm) recorded the lowest stalk length. Temptation recorded the highest spathe length (18.10 cm),spathe width (15.00 cm), spadix length of (11.5 cm) and the highest numbers of spikes per plant (9 no.). Honduras (24 d) recorded maximum vase life in water and vase life of flower on plant (23.68 d). In correlation and path co-efficients the characters *viz*., plant height, plant spread, leaf length, leaf breadth, stalk length, spathe length, spathe width, spadix length emerged out as important component. It could be concluded from the present investigation that out of twenty nine cultivars evaluated the Temptation, Honduras, Peach Ria Bamboo Red and Verdun Red were found to be the best cultivars with superior in qualities for cut flower production under Shevaroy condition of eastern ghat.

KEY WORDS : Anthurium, Cultivars, Correlation , Path co-efficient

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Anthurium (*Anthurium andraeanum* Linden Ex André) is a slow-growing perennial that requires shady, humid conditions as found in tropical forests and it includes more than 100 genera and about 1500 species. Anthurium assumes significant position on account of its beauty. It is grown for its showy cut flowers and attractive foliage. Anthurium ranks ninth in the global flower trade and commands a respectable price both for its cut flower and whole plant. In India, the anthurium cut flower industry is still in its infancy. These are very popular with flower arrangers because of the bold effect and long lasting qualities of flowers when cut. The long shelf-life of anthurium symbolizes a long, healthy life. The major countries importing anthurium are USA, Germany and Japan. In India, a few growers in Kerala, Tamil Nadu, Karnataka, Maharashtra and West Bengal have started growing anthurium on a large scale. Cultivation of anthurium both in homesteads and commercially is fast catching up. Moreover, it requires less labour. Even though anthurium is grown in Shevaroys condition; there is no scientific information on the use of high yielding varieties, standardization of suitable variety for quality, yield and vase life. Hence, identification of suitable varieties for yield, quality, vase life under this agroclimatic condition is beneficial to the anthurium growers to obtain high yield of good quality flowers. Keeping this in view, 29 cultivars were collected and evaluated to identify suitable anthurium cultivars for eastern ghat.

RESEARCH METHODS

The present investigation was carried out at Horticultural Research Station, Tamil Nadu Agricultural University, Yercaud between June 2008-09 and 2010. The experimental site is geographically situated between 11^0 04" to 11^0 05" North latitude and 78^0 05" to 78^0 23" East longitude and at an altitude of 1500 m above mean sea level. The average maximum and minimum temperature is 31.0^0C and 12.4^0C. The soil of the experimental plot was laterite in texture with 0.5 to 1.5 m depth. The experiment was laid out in a Randomized Block Design with three replications. Anthurium cultivars *viz.*, Verdun Red, Sweet Heart, Ria Bamboo Red, Gino Orange, Sweet Hearted Pink, Meringue Red, Bon Fire Orange, B -13, Red Dragon, Passion, Sunset Orange, Linda De' mole, Flamingo Blush Pink, Candy Queen, Tropical, Honduras ,Red KLP, Tropical Red, Temptation, Miniature Pink, Sunshine Orange, Meringue, Peach, Liver Red, Hawaiian Red, Lima White, Lambada, Margreta and Lucia were used under study. Uniform sized seedling were planted during May 2008; five plants from each cultivar in each replication were used as tester for plant height (cm), number of leaves, number of suckers, plant spread(cm), leaf length (cm), leaf breadth (cm), stalk length, spathe length (cm), spathe width (cm), spadix length, number of spikes/plant/ year, vase life on plant (d) and vase life in water days (d). The genotypic and phenotypic correlation co-efficients were calculated by the formulae suggested by Panse and Sukhatme (1967) . Parameters of variability were calculated as per the formula given by Burton and De Vane (1953). Heritability, genetic advance and expected genetic gain were calculated by the formula suggested by Johnson *et al. (*1955). The mean and standard errors were worked out as per standard methods and co-efficients of variations were computed

RESEARCH FINDINGS AND DISCUSSION

Investigations were conducted to study the performance of 29 anthurium (*A. andraeanum*) cultivars for their vegetative characters (Table 1). All the cultivars statistically differed significantly with respect to the plant height cultivar Ria Bamboo Red recorded the highest plant height (73.90 cm) followed by Tropical Red (71.50 cm), Peach (67.90 cm) and Honduras (64.10 cm). While the least plant height was noticed in Margreta (33.70 cm) and Mearague Red (45.40 cm). Cultivars Flamingo Blush Pink produced the maximum number of leaves per plant (11) and Sweet Hearted Pink (7.50) which was significantly superior to other cultivars. The minimum number of leaves per plant (3.50) was recorded in cv. Gino Orange. Variations in leaf production could be expected among the cultivars as the attribute to a genetic character. Even the environmental factors *i.e*. temperature, relative humidity and light intensity also determines the production of leaves. These results are in conformity with the reports of Femina *et al.* (2006) and Srinivasa and Reddy, (2005). Cultivars Lima White (4.21 no.) and Peach (3.60 no.) recorded maximum number of suckers which was superior over other cultivars, while cv Verdun Red and Linda De mole recorded minimum number of suckers per plant (2.00 no.). Production of suckers is highly cultivar dependent. Being genetically controlled factor, the suckers' production varied among the cultivars. These results are in line with that of Jawaharlal *et al*. (2001) in anthurium.

Plant spread was influenced by Linda De mole had the maximum plant spread (73.20 cm) and minimum was recorded in variety Red KLP (32.0 cm). Different varieties showed significant influence on leaf length and leaf diameter. The highest leaf length was produced in Liver Red (40.84 cm) compared to Lambada (16.41 cm) which recorded the lowest leaf length throughout the experimental period. Liver Red had the maximum breadth (21.60 cm) and minimum was recorded in Verdun Red (7.5 cm). The difference in leaf breadth is a varietals trait as it is governed by the genetic makeup and also due to ideal environmental conditions. These results are in accordance with Nirmala (1996) and Henny (1999).

Present study showed that floral characters differed significantly and it is presented in Table 2. Cultivar Hawaiin Red recorded the highest stalk length (64.90 cm) followed by Ria Bamboo Red (64.20 cm) and Bon Fire Orange (59.40 cm). The lowest stalk length was recorded in the Mearague Red (30.40 cm) which was inferior to other cultivars. Similar results were recorded by Srinivasa (2006) and Femina *et al.* (2006). Among the different cultivars studied cv. Temptation recorded the highest spathe length (18.10 cm) followed by Peach (16.50 cm) and Ria Bamboo Red (14.70 cm).The lowest spathe length was recorded in Mearague Red (7.50 cm) and Sunset Orange (8.20 cm). Similar results were recorded by Shriram *et al.* (2008). The spathe width was the highest in Temptation (15.00 cm) and Meringue (13.90 cm), while the cv. Mearague Red had the least spathe width of 6.30 cm. Spadix length was varied from 5.67 cm to 11.55 cm .In the present study cv. Temptation recorded the highest spadix length of 11.5 cm followed by Sweet Heart (9.93 cm) and the least spadix length was recorded by Mearague Red (5.67 cm).The number of spikes per plant is differed from each variety. It is observed that maximum numbers of spikes per plant were recorded in Temptation (9.00) and which was found to be at par and the lowest was recorded in cv. Lambada (6.00), Margreta (6.00) and Lucia (6.00). The number of spikes per plant is genetically controlled factor. Similar results were noticed in respect to flower production by Rajeevan *et al*. (2007) and Shiva and Nair (2008).

Vase life of flowers was significantly differing among different varieties. Data showed that maximum vase life in water was observed in Honduras (24 d) followed by Temptation (23 d), Peach (22 d), Verdun Red (22 d) and Ria

Bamboo Red (22 d). Minimum vase life in water was noticed in cv. Lambada (14 d). The Highest vase life of flower on plant was recorded in Honduras (23.68 d), followed by Temptation (21.91 d) and Ria Bamboo Red (21.00 d). Vase life of flower is seems to be an inherent capacity of the cultivar. These results are in line with that of Agasimani *et al.* (2011) and Shriram *et al.* (2008).

The genetic parameters for quantitative characters of anthurium are present in Table 3. In the present study, plant spread showed that the high heritability along with genetic advance of mean. This was followed by stalk length, length of leaves and spathe width. The characters like plant spread, stalk length, length of leaves and spathe width exhibited high heritability along with genetic advance which indicated that there was additive gene action in expression of these traits and thereby further improvement could be brought by selection. A similar trend was also observed by Shiva and Nair Sujatha (2008) in anthurium.

In the present study, genotypic and phenotypic correlation co-efficients and path-co-efficient analysis were carried out in anthurium cultivars for 13 quantitative characters (Table 4). The estimate of genotypic correlation co-efficient was higher than the corresponding phenotypic correlation co-efficient. In genotypic correlation studies between number of spikes per plant was found to be positively and significantly correlated with plant height (0.563), plant spread (0.265), leaf length (0.296), leaf breadth (0.289), stalk length (0.583), spathe length (0.514), spathe width (0.361) and spadix length (0.464). This is in consonance with results of Shiva and Nair (2008). While

Table 1 Performance of anthurium cultivars under Shevaroy conditions - growth attributes (Pooled Mean 2008,2009 &2010)

Sr. No.	Genotypes	Plant height (cm)	Number of leaves	Number of suckers	Plant spread	Leaf length	Leaf diameter
1.	Verdun Red	48.4	4.00	2.00	67.25	17.73	7.50
2.	Sweet Heart	62.90	5.00	3.00	42.50	16.72	8.50
3.	Ria Bamboo Red	73.90	5.00	2.10	40.50	37.49	16.20
4.	Gino Orange	52.10	3.50	1.00	33.00	30.91	13.00
5.	Sweet Hearted Pink	45.50	7.50	3.00	37.00	24.32	10.50
6.	Mearague Red	45.40	7.00	2.00	24.00	35.47	18.30
7.	Bon Fire Orange	59.50	5.00	3.10	32.50	19.76	8.50
8.	B -13	48.80	6.00	3.00	38.00	22.29	10.00
9.	Red Dragon	47.70	5.27	2.27	33.50	18.85	10.30
10.	Passion	51.63	5.43	2.69	32.50	21.16	11.43
11.	Sunset Orange	54.20	6.40	3.00	19.00	34.45	14.00
12.	Linda De' mole	53.90	6.00	2.00	73.20	36.89	18.50
13.	Flamingo Blush Pink	49.80	11.00	2.50	33.10	28.37	16.00
14.	Candy Queen	57.40	6.00	3.00	52.00	25.33	13.00
15.	Tropical	59.20	4.50	3.50	44.50	27.36	15.00
16.	Honduras	64.10	4.50	3.00	36.00	31.41	18.00
17.	Red KLP	62.20	5.00	2.70	32.00	34.45	16.00
18.	Tropical Red	71.50	4.50	1.90	26.00	32.43	18.00
19.	Temptation	58.20	8.00	3.00	53.75	30.91	17.50
20.	Miniature Pink	52.50	5.50	2.80	33.00	20.27	9.50
21.	Sunshine Orange	61.60	5.00	3.12	37.00	34.45	15.00
22.	Meringue	53.70	4.00	3.53	43.00	28.37	14.00
23.	Peach	67.90	6.50	3.60	62.15	23.31	15.50
24.	Liver Red	58.70	5.50	3.00	65.95	40.84	21.60
25.	Hawaiin Red	57.80	6.00	3.10	35.50	29.39	18.00
26.	Lima White	46.00	5.50	4.21	38.00	24.93	11.90
27.	Lambada	54.30	4.00	3.00	33.80	16.41	9.50
28.	Margreta	33.70	6.00	3.30	43.00	21.89	14.00
29.	Lucia	45.50	5.50	3.10	42.50	22.70	12.00
	Mean	55.11	5.63	2.81	40.84	27.20	13.84
	C.D. (P=0.05)	1.06	0.34	0.20	0.72	1.23	0.28
	S.E.+	2.12	0.68	0.40	1.45	2.45	0.56

Table 2 : Performance of anthurium cultivars under Shevaroy conditions- floral characters (Pooled Mean 2008, 2009 and 2010)

Sr. No.	Genotypes	Stalk length (cm)	Spathe length (cm)	Spathe width (cm)	Spadix length (cm)	No. of spikes per plant	Vase life in water days	Vase life on plant
1.	Verdun Red	57.60	12.40	9.10	8.71	8.00	22.00	20.96
2.	Sweet Heart	57.90	14.60	12.00	9.93	8.00	20.00	20.22
3.	Ria Bamboo Red	64.20	14.70	12.80	9.63	8.00	22.00	21.00
4.	Gino Orange	31.30	10.50	8.90	5.78	8.00	21.00	20.42
5.	Sweet Hearted Pink	39.30	11.40	9.60	8.41	7.00	18.00	19.06
6.	Mearague Red	30.40	7.50	6.30	5.67	7.00	19.00	20.83
7.	Bon Fire Orange	59.40	10.10	9.00	7.29	7.00	20.00	19.07
8.	B -13	47.40	8.30	8.20	5.58	7.00	18.00	18.79
9.	Red Dragon	38.60	13.10	9.70	9.12	8.00	20.00	20.91
10.	Passion	39.67	10.03	8.10	7.35	8.00	21.33	19.76
11.	Sunset Orange	47.60	8.20	9.00	8.00	8.00	21.00	19.41
12.	Linda De' mole	56.00	12.30	8.40	9.53	8.00	20.00	18.03
13.	Flamingo Blush Pink	53.20	12.30	9.00	8.11	7.00	17.00	17.52
14.	Candy Queen	47.70	14.20	10.20	7.50	8.00	20.00	20.03
15.	Tropical	56.70	11.80	10.80	8.31	8.00	21.00	20.86
16.	Honduras	49.30	13.50	11.60	7.80	8.00	24.00	23.68
17.	Red KLP	44.90	9.90	7.40	7.20	7.00	19.00	18.83
18.	Tropical Red	61.60	13.50	12.00	9.73	8.00	20.00	19.81
19.	Temptation	59.80	18.10	15.00	11.55	9.00	23.00	21.91
20.	Miniature Pink	49.90	9.90	11.10	6.59	8.00	17.00	17.83
21.	Sunshine Orange	56.90	11.40	9.60	6.79	8.00	20.00	20.22
22.	Meringue	46.00	13.90	13.00	7.60	7.00	20.00	18.88
23.	Peach	46.60	16.50	12.90	9.63	8.00	22.00	20.89
24.	Liver Red	42.60	14.00	9.40	9.63	8.00	19.00	19.58
25.	Hawaiin Red	64.90	12.70	10.00	9.32	8.00	20.00	19.73
26.	Lima White	41.30	11.20	9.20	8.62	7.00	17.00	16.61
27.	Lambada	33.70	11.10	11.00	6.99	6.00	14.00	14.44
28.	Margreta	42.80	11.80	9.70	8.82	6.00	17.00	17.75
29.	Lucia	24.10	9.90	8.40	6.28	6.00	17.00	17.49
	Mean	47.98	12.03	10.05	8.12	7.55	19.63	19.47
	C.D. (P=0.05)	0.83	0.45	0.55	0.41	0.44	0.34	0.67
	S.E.±	1.66	0.91	1.10	0.82	0.88	0.68	1.34

Table 3 : Analysis of genetic parameters for quantitative parameters of anthurium cultivars (Pooled Mean 2008, 2009 and 2010)

Sr. No.	Characters	GCV	PCV	ECV	HERT	GA(%) of mean
1.	Plant height (cm)	15.70	15.88	2.35	97.80	31.98
2.	Number of leaves	25.76	26.79	7.36	92.46	51.03
3.	Number of suckers	22.23	23.84	8.60	8697.00	42.71
4.	Plant spread	31.81	31.88	2.17	99.54	65.37
5.	Leaf length	25.06	25.66	5.52	95.38	50.41
6.	Leaf diameter	26.42	26.54	2.48	99.13	54.19
7.	Stalk length (cm)	22.10	22.20	2.11	99.09	45.33
8.	Spathe length (cm)	19.95	20.47	4.60	94.95	40.04
9.	Spathe width (cm)	18.65	19.82	6.72	88.51	36.14
10.	Spadix length (cm)	17.63	18.68	6.17	89.08	34.28
11.	No of spikes per plant	8.83	11.36	7.15	60.37	14.13
12.	Vase life in water days	10.82	11.02	2.12	96.31	21.87
13.	Vase life on plant	9.98	10.83	4.20	0.85	18.96

the characters *viz.*, number of leaves (-0.107) and number of suckers (-0.38) showed negative correlation with number of spikes per plant. Path co-efficient analysis revealed that number of leaves (0.047), leaf diameter (0.800), stalk length (0.459), spathe length (0.962) and vase life in water (3.381) were found to have positive effect with the yield (Table 5).

Table 4 : Genotypic and Phenotypic correlation for yield contributing parameters of anthurium (Pooled Mean 2008, 2009 and 2010)

Characters		Plant height	Number of leaves	Number of suckers	Plant spread	Leaf length	Leaf diameter	Stalk length	Spathe length	Spathe width	Spadix length	Vase life in water (Days)	Vase life on plant	No. of spikes per plant
Plant height	G	1	-0.256	-0.096	0.055	0.357	0.339	0.579	0.485	0.524	0.346	0.452	0.406	0.563
	P	1	-0.209	-0.038	0.062	0.374	0.347	0.583	0.466	0.518	0.345	0.459	0.412	0.514
Number of leaves	G		1	0.073	-0.027	0.109	0.239	0.045	0.066	-0.112	0.171	-0.085	-0.011	-0.107
	P		1	0.158	-0.009	0.156	0.25	0.067	0.085	-0.022	0.224	-0.032	0.089	0.087
Number of suckers	G			1	0.07	-0.281	-0.107	0.017	0.132	0.214	0.105	-0.253	-0.185	-0.380
	P			1	0.086	-0.184	-0.069	0.049	0.135	0.281	0.167	-0.174	-0.039	-0.063
Plant spread	G				1	0.041	0.158	0.195	0.559	0.218	0.467	0.003	-0.102	0.265
	P				1	0.052	0.161	0.199	0.552	0.226	0.459	0.016	-0.069	0.246
Leaf length	G					1	0.87	0.161	0.062	-0.077	0.117	0.48	0.439	0.296
	P					1	0.864	0.176	0.067	-0.019	0.153	0.494	0.464	0.348
Leaf diameter	G						1	0.17	0.293	0.095	0.32	0.449	0.467	0.289
	P						1	0.176	0.282	0.106	0.313	0.45	0.453	0.272
Stalk length	G							1	0.453	0.458	0.567	0.262	0.187	0.583
	P							1	0.446	0.455	0.555	0.272	0.204	0.509
Spathe length	G								1	0.822	0.801	0.305	0.286	0.514
	P								1	0.812	0.8	0.32	0.312	0.452
Spathe width	G									1	0.593	0.193	0.21	0.361
	P									1	0.634	0.242	0.31	0.458
Spadix length	G										1	0.249	0.162	0.464
	P										1	0.289	0.258	0.510
Vase life in water	G											1	0.965	0.711
days	P											1	0.947	0.659
Vase life on plant	G												1	0.579
	P												1	0.652
No of spikes per	G													1
plant	P													1

Table 5 : Path co-efficient analysis for Anthurium

Characters	Plant height	Number of leaves	Number of suckers	Plant spread	Leaf length	Leaf diameter	Stalk length	Spathe length	Spathe width	Spadix length	Vase life in water days	Vase life on plant	No. of spikes per plant
Plant height	-0.133	-0.012	0.020	-0.019	-0.284	0.271	0.266	0.466	-0.082	-0.270	0.528	-0.188	-0.133
Number of leaves	0.034	0.047	-0.015	0.009	-0.086	0.190	0.020	0.063	0.017	-0.133	-0.286	0.031	0.047
Number of suckers	0.012	0.003	-0.214	-0.024	0.223	-0.085	0.008	0.126	-0.033	-0.081	-0.856	0.540	-0.214
Plant spread	-0.007	-0.001	-0.015	-0.343	-0.032	0.126	0.089	0.537	-0.034	-0.364	0.010	0.299	-0.343
Leaf length	-0.047	0.005	0.060	-0.014	-0.796	0.695	0.074	0.059	0.012	-0.091	0.624	-0.286	-0.796
Leaf diameter	-0.045	0.011	0.023	-0.054	-0.692	0.800	0.078	0.282	-0.015	-0.250	0.517	-0.366	0.800
Stalk length	-0.077	0.002	-0.003	-0.066	-0.128	0.135	0.459	0.436	-0.071	-0.442	0.886	-0.546	0.459
Spathe length	-0.064	0.003	-0.028	-0.192	-0.049	0.234	0.208	0.962	-0.129	-0.626	0.032	-0.837	0.962
Spathe width	-0.070	-0.005	-0.045	-0.074	0.0614	0.076	0.210	0.791	-0.157	-0.463	0.653	-0.615	-0.157
Spadix length	-0.046	0.008	-0.022	-0.160	-0.093	0.256	0.260	0.771	-0.093	-0.781	0.840	-0.475	-0.781
Vase life in water days	-0.060	-0.004	0.054	-0.001	-0.382	0.359	0.120	0.293	-0.030	-0.194	3.381	-0.825	0.381
Vase life on plant	-0.054	-0.001	0.039	0.035	-0.349	0.373	0.085	0.275	-0.033	-0.127	3.263	-0.928	-0.928

The direct effect was the highest (0.962) for spathe length followed by leaf diameter (0.800) and stalk lenght (0.459). Plant spread had the highest indirect effect on number of flowers per plant per year (0.089) through stalk length. Considering correlation and path co-efficients of the characters *viz*., plant height, plant spread, leaf length, leaf breadth, stalk length, spathe length, spathe width and spadix length emerged out as an important component for yield. This is in conformity with reports of Asish (2004), Renu (2000) and Mayadevi (2001). It could be concluded from the present investigation that out of twenty nine cultivars evaluated the cultivar Temptation, Honduras, Peach, Ria Bamboo Red and Verdun Red were found to be the best cultivars with superior in quality and quantity for cut flower production under Shevaroy condition of eastern ghat.

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