IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 8, Issue 3 Ver. I (Mar. 2015), PP 07-10
www.iosrjournals.org

Extent of genetic variation in Anthurium (*Anthurium andreanum* linden ex Andre) cultivars for growth, flowers and physiological characters under soil-less culture

Priyasree Sarma Tamuli[1*], Madhumita Choudhury Talukdar[2], Pranab Talukdar[3]
[1,2,](Department of Horticulture, Assam Agricultural University, Jorhat-785013, Assam, India)
[3](Department of Plant Breeding and Genetics, Assam Agricultural University, Jorhat-785013, Assam, India)

Abstract: *An experiment was conducted during 2011-2013 at the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat (Assam), India, to determine the genetic variability, heritability and genetic advance as percent of grand mean with respect to various growth, flower and physiological characters in twelve Anthurium (Anthurium andreanum linden ex andre) cultivars. Significant variation was recorded for the various characters studied. Phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the characters indicating the influence of environment. High heritability coupled with high genetic advance had been exhibited by leaf area, number of suckers, plant height, plant spread, increase in spathe size at third (3rd) day after harvest, water uptake at third (3rd) day after harvest and at senescence, fresh weight of the cut flower at senescence, total chlorophyll and anthocyanin content in spathe and its ratio provide greater scope for further improvement of these traits in advance generations. High heritability with low genetic advance was exhibited by spadix diameter, flower stalk girth and spadix to spathe angle.*

Keywords: *Genetic variation, Soil-less culture.*

I. Introduction

Anthurium belongs to the family Araceae, are tropical plants of great beauty which are grown either for the showy cut flowers or for their unusually attractive foliage. They are commonly known as painter's palette and are very popular cut flower because of its bold effect, bright colour and long lasting quality of flowers. The flower consists of a colourful modified leaf called the 'spathe' and hundreds of small spirally arranged bisexual flowers on a pencil like structure called the 'spadix', arising from the base of the spathe commonly known as 'candle'. Due to the increasing demand for cut flowers in the world market, large numbers of novel anthurium cultivars are continually being imported from the Netherlands and Hawaii for commercial cultivation. In order to further boost up commercial production of anthurium in North East India, particularly in Assam there is need to identify suitable varieties of anthurium. In addition there is also scope to develop novel varieties to meet the increasing demand at national and international market. Hence it is important to derive information on the extent of genetic variation and other genetic parameters like heritability and genetic advance for growth, flower and physiological traits in the available cultivars under the soil-less culture condition so as to formulate effective breeding programme to develop novel attractive anthurium cultivars suitable for commercial soil-less cultivation.

II. Materials And Methods

The experiment was conducted in the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat (Assam), India, during 2011-12 and 2012-13 under shade-net house in soil-less culture. The experiment was laid out in Randomized Block Design (RBD) with twelve Anthurium (Anthurium andreanum linden ex andre) cultivars replicated thrice. The cultivars were: Tropical, Fire, Calorie, Acropolis, Moments, Agnihotri, Cherry Red, Evita Red, Daniel, Evita Pink, Magic Pink and Sweet Heart. The size of the shade-net house was 13.5 m x 4m (54m^2) with a bed size 12 m x 1.2m (2 beds per house). The shade-net house was constructed with angle iron rod as supports and the top portion and the side walls were covered with single layer of 75% shade-net. The tissue culture plantlets of anthurium were grown in 30 cm raised bed framed with cemented brick wall which hold the growing media. The beds were constructed by giving a gentle slope of 7.6 cm (3 inch). In between two beds 80 cm gap was given. At bottom black polythene is placed to prevent the contact of root system of plant with soil. The beds were filled up with 10.2 cm (4 inch) layers of brick pieces at the bottom, followed by 7.6 cm (3 inch) layer of charcoal on its top followed by 5.1 (2.1 inch) layer of coco husk (3 cm x 3 cm pieces). A spacing of 30 cm in between rows and 30cm in between plants were maintained. For planting of each plant a small pit was prepared and filled up with coco peat and sand in 3:1 ratio. Nutrients were supplied to the plants following the recommended dose of fertilizer. Important cultural practices were

carried out from time to time. All observations were recorded from five sampled plants of each shade-net house and the mean data of the 2011-12 and 2012-13 year were subjected to pooled analyses over years. The mean value for each character in each replication was subjected to analyses of variance (Table 1, Table 2 and Table 3). Parameters of variability and heritability were calculated as per the formula given by Burton and De Vane (1953) [1] and expected genetic advance was calculated by the formula suggested by Johnson, Robinson and Comstock (1955) [2]. The mean and standard errors were worked out as per standard methods and co-efficient of variations were computed.

III. Result And Discussion

A better comparison of the range of genetic variation can be made from the estimates of genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV). In the present investigation, the estimates of PCV were higher than the GCV for all the characters (Table 4, Table 5 and Table 6). Results showed that for all the growth, flower and physiological characters, the estimates of PCV's were found to be higher and close to the estimates of GCV's except for interval of flowering. This has been reflected in the lower estimates of environmental coefficients of variation's (ECV) which indicated that there was low influence of environment on all the characters except for interval of flowering. So the results revealed that the variation was not only due to genotypes but was also due to the influence of environment in the phenotypic expression of genotypes for interval of flowering. GCV helps in the measurement of range of genetic diversity in a character and provides means to compare the genetic variability in quantitative characters. However, it is not possible to understand the value of the heritable variation with the help of GCV alone. Burton (1953) [1] had suggested that GCV together with heritability (h^2) estimates would give the best picture of the amount of advance to be impacted by selection. The heritability expresses the proportion of the total variance that is attributed to be average effect of genes and that is what determines the degree of resemblance between parents and offsprings. It is useful in selection of elite genotypes from diverse genetic population. In the present study, phenotypic and genotypic coefficients of variation were found to be higher for leaf area, number of suckers, plant height, plant spread, increase in spathe length on 6th day after harvest, increase in spathe breadth on 6th day after harvest, increase in spathe breadth on 3rd day after harvest, increase in spathe length on 3rd day after harvest, water uptake at senescence, fresh weight of the cut flower at senescence, water uptake at 3rd day after harvest, fresh weight of the cut flower at harvest, spadix length, days from unfurl to full bloom of spathe, days from emergence to unfurl of spathe, spadix diameter, spadix to spathe angle, flower stalk girth, vase life, total chlorophyll content of spathe, total anthocyanin content of spathe and chlorophyll to anthocyanin ratio in spathe indicating high variation in these characters predicting greater scope for improvement and indicating the reliability of selection based on the phenotypic performance (Table 4,Table 5 and Table 6). The high estimates of heritability were also observed for these characters. High heritability estimates are helpful in selecting superior genotypes on the basis of phenotypic performance of quantitative characters. Johnson et al. (1955) [2] reported that heritability along with genetic gain is more useful than the heritability alone. Heritability and genetic advance (GA) are important selection parameters. Heritability estimates with genetic advance are normally more helpful in predicting the gain under selection than heritability estimates alone. High heritability with high genetic advance signifies that the character is governed by additive gene action and for that simple phenotypic selection is advocated. In the present study, high heritability coupled with high genetic advance was observed in the characters viz. leaf area, number of suckers, plant height, plant spread, increase in spathe length at 6th day after harvest, increase in spathe breadth at 6th day after harvest, increase in spathe breadth at 3rd day after harvest, increase in spathe length at 3rd day after harvest, water uptake at senescence, fresh weight of the cut flower at senescence, water uptake at 3rd day after harvest, total chlorophyll content of spathe, total anthocyanin content of spathe and chlorophyll to anthocyanin ratio in spathe (Table 4,Table 5 and Table 6) which indicated that apparently these characters are governed by additive gene effect. Thus their genetic improvement could be accomplished through phenotypic selection without progeny testing. Similar findings were reported by Patnaik and Mohanty (2002) [3] in marigold and Palai et al. (2003) [4] in rose. However it is not necessary that a character showing a high heritability would also exhibit high genetic advance. In the present study high heritability accompanied with low genetic advance for the characters viz., fresh weight of the cut flower at harvest, spadix length, days taken from unfurl to full bloom, days taken from emergence to unfurl, spadix diameter, spadix to spathe angle, flower stalk girth and vase life (Table 5) are indicative of non-additive gene action and for these selection with adequate progeny testing can be practiced (Panse, 1957) [5].

Hence there are tremendous scope in exploiting these characters through the development of hybrids. Based on these information effective selection criteria could be formulated following hybridization between genetically distinct parental cultivars.

IV. Tables

Table 1. Pooled Analyses Of Variance (Mean Sum Of Squares) For Growth Characters

Source	d.f.	Plant height	Number of leaves	Leaf length	Leaf breadth	Leaf area	Plant spread	Number of suckers
Replication (within environment)	4	128.428*	0.02514^{NS}	1.685*	0.204*	12460.777^{NS}	1.023^{NS}	0.005972^{NS}
Environment (Year)	1	127.789*	0.222*	58.934*	12.070*	2651.443^{NS}	0.02569^{NS}	0.006806^{NS}
Cultivar (C)	11	685.965*	3.993*	121.504*	62.942*	4029677*	401.497*	1.384*
(YxC)	11	8.831^{NS}	1.259*	19.195*	9.004*	199237.8*	1.992*	0.09741*
Pooled Error	44	9.181	0.03696	0.391	0.079	5503.746	0.873	0.01128

* Significant at 5% probability level, NS : Non-significant

Table 2. Pooled Analyses Of Variance (Mean Sum Of Squares) For Flower Characters

Source	d.f.	Spathe length	Spathe breadth	Spadix length	Spadix diameter	Flower stalk length	Stalk girth	Spadix to spathe angle
Replication (within environment)	4	0.0470*	0.008649^{NS}	0.02743*	0.00002078^{NS}	0.05016^{NS}	0.00000461^{NS}	1.702^{NS}
Environment (Year)	1	602.16*	281.280*	0.02880^{NS}	0.002850*	1858.569*	0.0034*	12.334*
Cultivar (C)	11	53.957*	47.890*	19.798*	0.140*	307.943*	0.041*	795.247*
(YxC)	11	16.295*	7.372*	0.004873^{NS}	0.0001051*	67.825*	0.00022*	0.328^{NS}
Pooled Error	44	0.00773	0.009955	0.009822	0.00002410	0.05077	0.0000077	0.995

Table 2. Contd./-

Source	d.f.	Number of flowers	Days taken from emergence of bud to unfurl of spathe	Days taken from unfurl to full bloom of spathe	Duration of flowering/ Self life	Interval of flowering	Fresh weight of cut flower at harvest	Fresh weight of cut flower at senescence
Replication (within environment)	4	0.01772^{NS}	0.026^{NS}	0.0144^{NS}	0.02939^{NS}	108.765^{NS}	0.08097*	0.264*
Environment (Year)	1	30.890*	8.681*	0.320*	7.207*	25132.820*	2.067*	1.901*
Cultivar (C)	11	12.634*	183.154*	98.29*	32.205*	11788.325*	28.871*	15.932*
(YxC)	11	1.406*	4.491*	2.915*	4.476*	9564.331*	0.03086*	0.02973*
Pooled Error	44	0.02007	0.029	0.032	0.02193	134.683	0.01158	0.01460

Table 2. Contd./-

Source	d.f.	Vase life of flowers	Increase in spathe length on 3rd day after harvest	Increase in spathe breadth on 3rd day after harvest	Increase in spathe length on 6th day after harvest	Increase in spathe breadth on 6th day after harvest	Water uptake at 3rd day after harvest	Water uptake at senescence
Replication (within environment)	4	0.112*	0.00003887^{NS}	0.00004306^{NS}	0.00003611^{NS}	0.00006389^{NS}	0.0133^{NS}	0.167^{NS}
Environment (Year)	1	28.113*	0.0003556*	0.0002722*	0.002568*	0.0008681*	1.191*	10.125*
Cultivar (C)	11	78.518*	0.06147*	0.05400*	0.06893*	0.02520*	6.807*	91.852*
(YxC)	11	6.602*	0.0001525*	0.00006313*	0.0002135*	0.0001014*	0.057^{NS}	0.186*
Pooled Error	44	0.03654	0.00004798	0.00003093	0.00003005	0.00003662	0.0073	0.197

* Significant at 5% probability level NS : Non-significant

Table 3. Pooled Analyses Of Variance (Mean Sum Of Squares) For Physiological Characters

Source	d.f.	Membrane stability index of flowers	Total chlorophyll content in spathe	Total anthocyanin content in spathe	Total chlorophyll to anthocyanin ratio in spathe
Replication(within environment)	4	0.0004536^{NS}	0.0000019^{NS}	0.000118^{NS}	0.000000065^{NS}
Environment (Year)	1	1.396*	0.000011*	0.000793*	0.000000211*
Cultivar (C)	11	49.729*	0.05201*	83.692*	0.000361*
(YxC)	11	8.844*	0.000000797^{NS}	0.0005835*	0.000000056^{NS}
Pooled Error	44	0.00123	0.000000875	0.000164	0.000000035

* Significant at 5% probability level NS : Non-significant

Table 4. Components Of Variance And Genetic Parameters For Different Growth Characters Pooled Over Environments

Character	Components of variance (%)			Heritability (h^2) (%)	Expected genetic advance as % of mean
	PCV	GCV	ECV		
Plant height	1.85	1.84	0.56	98.71	3.77
Number of leaves	1.51	1.25	0.36	68.47	2.13
Leaf length	1.30	1.19	0.18	84.20	2.26
Leaf breadth	1.68	1.55	0.15	85.69	2.96
Leaf area	4.19	4.09	0.38	95.06	8.21
Plant spread	1.73	1.73	0.20	99.50	3.54
Number of suckers	3.02	2.90	0.67	92.96	5.78

Table 5) Components Of Variance And Genetic Parameters For Different Flower Characters Pooled Over Environments

Character	Components of variance (%)			Heritability (h^2) (%)	Expected genetic advance as % of mean
	PCV	GCV	ECV		
Spathe length	1.84	1.54	0.05	69.80	2.65
Spathe breadth	2.23	2.05	0.08	84.61	3.89
Spadix length	2.06	2.06	0.11	99.98	4.24
Spadix diameter	1.45	1.45	0.05	99.92	2.99
Flower stalk length	1.63	1.44	0.05	77.97	2.63
Flower stalk girth	1.43	1.42	0.05	99.46	2.93
Spadix to spathe angle	1.43	1.43	0.12	99.95	2.94
Number of flowers per plant	2.43	2.29	0.24	88.87	4.45
Days taken from emergence of bud to unfurl of spathe	1.89	1.87	0.06	97.55	3.81
Days taken from unfurl to full bloom of spathe	1.94	1.91	0.09	97.03	3.87
Duration of flowering/Self life	0.39	0.36	0.02	86.10	0.69
Interval of flowering	4.31	1.87	1.13	18.87	1.68
Fresh weight of the cut flower at harvest	2.14	2.14	0.10	99.89	4.40
Vase life	1.37	1.31	0.07	91.59	2.59
Fresh weight of the cut flower at senescence	3.56	3.56	0.26	99.81	7.33
Increase in spathe length at 3rd day of harvest	4.39	4.38	0.30	99.75	9.02
Increase in spathe breadth at 3rd day of harvest	5.31	5.31	0.31	99.88	10.93
Increase in spathe length at 6th day of harvest	7.57	7.56	0.39	99.69	15.56
Increase in spathe breadth at 6th day of harvest	5.50	5.49	0.51	99.60	11.28
Water uptake at 3rd day after harvest	3.19	3.17	0.26	99.16	6.51
Water uptake at senescence	3.57	3.57	0.41	99.80	7.34

Table 6) Components Of Variance And Genetic Parameters For Different Physiological Characters Pooled Over Environments

Character	Components of variance (%)			Heritability (h^2) (%)	Expected genetic advance as % of mean
	PCV	GCV	ECV		
Membrane stability index of flowers	0.30	0.27	0.01	82.86	0.51
Total chlorophyll content in spathe	6.40	6.39	0.06	99.998	13.17
Total anthocyanin content in spathe	4.76	4.75	0.02	99.99	9.79
Total chlorophyll to anthocyanin ratio	3.75	3.74	0.09	99.98	7.71

Acknowledgements

The author is thankful to the Head, Department of Horticulture, Assam Agricultural University, Jorhat-13, Assam , India for providing necessary facilities.

References

[1]. G.W. Burton, and E.H. De Vane, Estimating heritability in tall fescue (Festuca arundinacea) from replicated clonal material, Agronomy Journal, 45**,** (1953), 478-485.

[2]. H.W. Johnson, H.F. Robinson, and R.E. Comstock, Estimates of genetic and environmental variability in soybean, Agronomy Journal, 47, (1955), 314-318.

[3]. N. Patnaik, and C.R. Mohanty, Genetic variability, heritability and genetic advance in African marigold (Tagetes erecta L.), Orissa Journal of Horticulture, 30(2), (2002), 90-94.

[4]. S.K. Palai, M. Mishra, S. Bhuyan, and H.N. Mishra, Genetic variability in hybrid tea roses, Journal of Ornamental Horticulture, 6(1), (2003), 29-33.

[5]. V.G. Panse, Genetics of quantitative characters in relation to plant breeding, Indian Journal of Genetics and Plant Breeding, 17, (1957), 318-328.