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Genetic variability analysis for selection of high yielding and superior *Anthuriumandreanum* Linden hybrids

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Abstract
Anthuriumandreanum Linden, is one of the most commercially cultivated anthurium species belonging to the family Araceae. They are widely accepted as ornamental for their showy and colorful spadix. Fifteen *Anthuriumandreanum* Linden hybrids maintained at the Department of Plant Breeding and Genetics, College of Agriculture, Vellayani were utilized for the study. The hybrids were evaluated for commercially important characters and the genetic parameters contributing to these characters were analyzed. Phenotypic Coefficient of Variation (PCV), Genotypic Coefficient of Variation (GCV), heritability and genetic advance of seventeen characters were studied to identify the yield contributing characters and their gene action. PCV was found higher in magnitude than GCV for all the observed characters. The highest GCV and PCV were observed for the character number of suckers per plant. The characters such as internode length and duration of male and female phases were found to be influenced by environmental factors as they indicate high PCV and low GCV. High heritability coupled with high genetic advance was observed in almost all characters except internode length, days from emergence to maturity of leaves, number of suckers per plant, days from emergence to maturity of inflorescence and duration of female and male phases. These traits are controlled byadditive gene action and are less influenced by the environment. Thus, these characters can be used for reliable phenotypic selection of high yielding and superior anthurium hybrids.

Keywords: Anthurium, PCV, GCV, Heritability, Genetic Advance, Environmental effects

Introduction
Anthuriums are commercially accepted as ornamental for their showy and colorful spadix and are widely used both as cut flowers and potted garden plants. Anturiuums belong to family Araceae and is a semi terrestrial and perennial epiphytic plant (Singh, 1987) [10]. Anthurium is commonly called 'painter's palette' and it consists of a modified leaf known as spathe along with a candle-like spadix. The two anthurium species namely *Anthuriumandreanum* Linden and *Anthuriumscherzerianum* have vibrant inflorescences and attractive foliage.

The growing floriculture and tourism industries have high demand for cut flowers and that create a greater demand for anthurium flowers in the domestic as well as international markets. Thus anthurium cultivation and commercial production proves to be a remunerative agri-business sector. However the major constraints for anthurium growers are unavailability of quality planting material and market availability. In this regard high yielding and commercially superior varieties are to be developed and they must be made available to farmers in reasonable price all-round the year.

In every variety release programme variability analysis is the key to selection of parent genotypes that are to be used in the hybridization programme. Since anthurium has very high genetic potential due to its heterozygous nature, there is much scope in hybridization programmes by harnessing its variability, incorporated with effective selection and multiplication. In the light of above facts the current study is aimed at analysis of genetic variability parameters of 15 different *Anthuriumandreanum* Linden hybrids for the selection of high yielding and superior anthurium hybrids.

Materials and Methods
The current study was conducted at the Department of Plant Breeding and Genetics, College of Agriculture, Vellayani during 2017-18. Fifteen *Anthuriumandreanum* Linden hybrids were utilized for the study. The experimental plants were maintained in pots under greenhouse condition with 70% shade. The list of hybrids used in the study are included in Table: 1. The experimental design was Completely Randomized Design with five replications. Analysis was done for the selection of superior hybrids with respect to both vegetative as well as floral

characters.

Genetic variability analysis was conducted based on 17 characters namely, plant height (cm), leaf area (cm^2), internode length (cm), days from emergence to maturity of leaves, number of leaves per plant per year, number of suckers per plant, days from emergence to maturity of inflorescence, spathe size, spadix length (cm), number of flowers per spadix, life of spadix (days), days to initiation of female phase, duration of female phase, duration of interphase, duration of male phase, inclination of candle with spathe and number of flowers per year.

Genotypic and phenotypic coefficients of variation, heritability and genetic advance expressed as percentage of mean were estimated using the formula proposed by Singh and Chowdhury (1977) [11].

Table 1: List of *Anthuriumandreanum* Linden hybrids used in the study.

Sl. No	Genotypes (Female Parent X Male Parent)
1	Liver Red X Dragons Tongue (LR X DT)
2	Honeymoon Red X Merin Red (HR X MR)
3	Lady Jane X Orange Glory (LJ X OG)
4	Orange Glory X Nitta Orange (OG X NO)
5	Honeymoon Red X Kalympong Red (HR X KR)
6	Honduras Red X Kalympong Red (HoR X KR)
7	Honeymoon Red X Lady Jane (HR X LJ)
8	Honeymoon Red X Dragons Tongue (HR X DT)
9	Pompon Red X Honeymoon Red (PR X HR)
10	Honeymoon Red X Pink (HR X P)
11	Pink X Liver Red (P X LR)
12	Ceylon Red X Kalympong Red (CR X KR)
13	Honeymoon Red X Liver Red (HR X LR)
14	Pompon Red X Dragon's Tongue (PR X DT)
15	White X Lady Jane (W X LJ)

Result and discussion

In the variability analysis of 15 different *Anthuriumandreanum* Linden hybrids, phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability and genetic advance of seventeen characters were studied to identify the yield attributing characters and to analyze the type of gene action. In general phenotypic coefficient of variation (PCV) was found higher in magnitude than genotypic coefficient of variation (GCV) for all the observed characters, indicating the effect of environment on phenotypic expression of traits. The genetic parameters of vegetative and floral characters, such as PCV, GCV, heritability and genetic advance expressed as percentage mean are presented in Table 2 and 3.

Genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) are categorized based on the scale given by Sivasubramanian and Menon (1973) [12]. The highest genotypic coefficient of variation (117.222 per cent) and phenotypic coefficient of variation (191.843 per cent) were found for the character number of suckers per plant. This was in accordance with reports by Pravin (2004) [5] and Reshma (2016) [8]. High GCV was noticed in the characters like number of leaves per plant per year (59.247 per cent) followed by spathe size (47.683 per cent), leaf area (37.668 per cent), number of flowers per spadix (33.136 per cent), number of flowers per year (31.589 per cent), inclination of candle with spathe (28.45 per cent), spadix length (24.401 per cent), days to initiation of female phase (24.155 per cent) and duration of interphase (23.437 per cent). High GCV values indicate that there is better scope of improvement of these character by direct selection. According to Burton (1952) [2], GCV along with estimate of heritability can give a better picture of heritable variation rather than GCV alone. Characters such as plant height (16.504 per cent), internode length (15.426 per cent), duration of female phase (15.116 per cent), life of spadix (12.535 per cent), duration of male phase (11.878 per cent) and days from emergence to maturity of leaves (11.649 per cent) showed moderate GCV while days from emergence to maturity of inflorescence (9.074 per cent) had low GCV. Similar results were reported by Premna (2003) [6] and Sheena (2015) [9].

Phenotypic coefficient of variation (PCV) ranged from 13.256 per cent for days from emergence to maturity of inflorescence to 191.843 per cent for number of suckers per plant. The maximum PCV was expressed by the character number of suckers per plant (191.843 per cent), followed by number of leaves per plant per year (67.907 per cent), spathe size (51.846per cent), number of flowers per year (40.374 per cent), leaf area (39.988 per cent), number of flowers per spadix (33.880 per cent), duration of interphase (33.144 per cent),inclination of candle with spathe (28.45 per cent), days to initiation of female phase (29.927 per cent), spadix length (28.080 per cent), internodal length (25.420 per cent) and duration of female phase (21.050 per cent). Most of the characters showed GCV values close to their corresponding PCV values indicating relatively less influence of environmental components on these characters. Similar results have also been given by Pravin (2004) [5] and Sheena (2015) [9].

Influence of environmental factors was evident in traits like internode length and duration of female phase as they indicate high PCV and moderate GCV. This gives an indication to theplant breeders for paying proper attention while exercising selection for these characters.

The basis of phenotypic selection of a character is determined by the heritability of that character. Higher the heritability higher will be the chance for effective phenotypic selection. Estimation of heritability was done by formula suggested by Allard (1960) [1] and categorization of heritability was done based on the scale proposed by Johnson *et al*., (1955) [3] where heritability less than 30 percent is considered to be low, 30 to 60 per cent means medium heritability and more than 60 per cent represents high heritability. In the present investigation on anthurium hybrids, high heritability was noticed in characters such as number of flowers per spadix (95.656 per cent), inclination of candle with the spathe (90.369 per cent), leaf area (88.732 per cent), spathe size (84.586 per cent), number of leaves per plant per year (76.121 per cent), spadix length (75.513 per cent), life of spadix (72.503 per cent), plant height (71.118 per cent), days to initiation of female phase (68.538 per cent) and number of flowers per year (61.216 per cent), spadix length (75.41 per cent), days from emergence to maturity of inflorescence (64.91 per cent) and days to initiation of female phase (62.2 per cent). These results are in line with the findings of Pravin (2004) [5] and Madhukumar (2010) [4]. The characters, days from emergence to maturity of leaves (52.957 per cent), duration of female phase (51.564 per cent), duration of interphase (50 per cent), days from emergence to maturity of inflorescence (46.863 per cent), duration of male phase (40.47 per cent), number of suckers per plant (37.336 per cent) and internode length 36.825 showed only moderate heritability.

Genetic advance expressed as percentage of mean is the measure of improvement in mean genotypic values of plants

over parental population. According to Johnson *et al*., (1955) [3], if genetic advance is more than 20 per cent, then the character has high genetic advance and if it is between 10 to 20 per cent, it means moderate genetic advance and less than 10 percent indicates low genetic advance. In the present experiment high genetic advance was noticed in traits such as number of suckers per plant (147.551 per cent), number of leaves per plant per year (106.404 per cent), spathe size (90.341 per cent), leaf area (73.094 per cent), number of flowers per spadix (66.761 per cent), inclination of candle with the spathe (55.713 per cent), number of flowers per year (50.914 per cent), spadix length (43.681 per cent), days to initiation of female phase (41.194 per cent), plant height (28.672 per cent), duration of female phase (22.360 per cent) and life of spadix (21.987 per cent). Similar results were reported by Premna (2003) [6] and Reshma (2016) [8].

Table 2: Genetic parameters of vegetative traits in 15 *Anthuriumandreanum* Linden hybrids.

Sl. No.	Character	GCV	PCV	Heritability (%)	Genetic Advance (% of Mean)
1	Plant Height (cm)	16.504	19.571	71.118	28.672
2	Leaf Area (cm^2)	37.668	39.988	88.732	73.094
3	Internode Length (cm)	15.426	25.42	36.825	19.284
4	Days from emergence to maturity of leaves	11.649	16.008	52.957	17.463
5	Number of leaves per plant per year	59.247	67.907	76.121	106.484
6	Number of Suckers per plant	117.222	191.843	37.336	147.551

Table 3: Genetic parameters of floral traits in 15 *Anthuriumandreanum* Linden hybrids.

Sl. No.	Character	GCV	PCV	Heritability (%)	Genetic Advance (% of Mean)
1	Days from emergence to maturity of inflorescence	9.074	13.256	46.863	12.797
2	Spathe Size	47.683	51.846	84.586	90.341
3	Spadix Length (cm)	24.401	28.08	75.513	43.681
4	Number of Flowers per Spadix	33.136	33.88	95.656	66.761
5	Life of Spadix (Days)	12.535	14.721	72.503	21.987
6	Days to initiation of female phase	24.155	29.176	68.538	41.194
7	Duration of female phase	15.116	21.05	51.564	22.36
8	Duration of interphase	23.437	33.144	50	34.139
9	Duration of male phase	11.878	18.671	40.47	15.566
10	Inclination of Candle with Spathe	28.45	29.927	90.369	55.713
11	Number of flowers per year	31.589	40.374	61.216	50.914

High heritability coupled with high genetic advance was observed in almost all characters except internode length, days from emergence to maturity of leaves, number of suckers per plant, days to emergence to maturity of inflorescence and duration of female and male phase. Such traits are controlled by additive gene action and are less influenced by the environment. Thus, these characters can be exploited for the genetic improvement of the quantitative traits in *Anthuriumandreanum* Linden hybrids.

The results of the present study reveal that desirable improvement in flower yield in *Anthuriumandreanum* Linden hybridscan easily be achieved on implementation of effective selection scheme for the characters such as plant height, leaf area, number of leaves per plant, spathe size, spadix length, number of flowers per spadix, life of spadix, days to initiation of female phase, inclination of candle with spathe and number of flowers per year.

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