Genetic Variability studiesin*Oncidium* Orchids

Abstract

An investigation was carried out with eighteen *Oncidium* orchid genotypes for the assessment of genetic variability and heritability in 2023.In this investigation,variation due to genotypes for all the traits under study was found significant indicating high amount of variability among different genotypes for different traits providing ample scope for selection and further evaluation as well as improvement in the shelf life and other traits. Number of base leaves per plant, length of inflorescence(cm), petal length (cm), petal width (cm), and lip length (cm) had high heritability estimates along with high genetic advance expressed as per cent of mean which implied that these traits are controlled by genes which are additive in nature. Simple selection for such characters would be rewarding. In addition, vase life of flowers (days) had moderate heritability estimates along with moderate genetic advance expressed as per cent of mean, it may require a sustained effort and might be enhanced by complementary strategies such as environmental management and advanced breeding techniques.GCV(%) was found high in petal width which is close to PCV (%) indicating that variability of the trait is largely due to genetic factors with minimal environmental influence. High heritability (>60%) combined with high genetic advance (>20%) was exhibited by majority of the characters under study indicating additive gene action for these characters and it provides a scope for further improvement of these traits in advance generations.

Keywords: *Oncidium*, GCV, improvement, hybridisation, shelf-life and variability

Introduction

Oncidium orchids, commonly known as the "Dancing Lady" orchid, is a beloved and iconic species among orchid enthusiasts. With over 300 species and countless hybrids, *Oncidium* orchids are known for their delicate, exotic flowers with unique shapes and markings, vibrant colours, including yellow, pink, red, and white long-lasting blooms that can last several months. They bears fragrant flowers in some specieswith scents ranging from sweet to chocolate-like compact growth habit, making them perfect for small spaces, pseudobulbs, which store water and nutrients, allowing the plant to survive during dry periods, relatively easy care, with moderate watering and bright indirect light requirements. *Oncidium* orchids are native to the tropical regions of Central and South America, where they grow on trees and rocks. They have adapted to thrive in a variety of environments, from high-altitude cloud forests to lowland rainforests.

"*Oncidium*has been favoured as a collection of ornamental plants, and the most important is used as filler or filler flower arrangement. The most famous type of *Oncidium* as cut flowers are *Oncidium* Golden Shower, *Oncidium*Goldiana, *Oncidium* Sweet Sugar, and *Oncidium* Gower Ramsey" (Wang *et al*., 2016)."Usually, *Oncidium*orchids flower twice per year from March to May and from September to November. Cool nights are not required for

Oncidium to produce flowers.Orchids are now dominating the cut flower and potted plant commerce due to its longlasting charm, high productivity, seasonal blooming, convenient packing and transportation"(De *et al*., 2014). "When the genetic variability is high the chances for the selection of better genotypes are greater and the estimates of genetic parameters like genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) gives an account of the extent of variability present in the plant population" (George *et al*., 2020). Moreover, genetic parameters like heritability and genetic advance helps plant breeder in selecting elite genotypes from the heterogeneous populations. There is a wide range of variation for most of the traits studied, these genotypes can be utilised further for the production of novel hybrids.

"Understanding the variability within *Oncidium* orchids is critical for effective conservation and breeding efforts. Variability may be expressed phenotypically in terms of floral morphology, leaf structure or growth habit as well as genotypically, which could contribute to adaptability under different environmental stresses. Success of genetic improvement of any cropdepends upon the extent of available variabilityand its subsequent skillful management towardsselection of desirable type" (Moniruzzaman*et al*., 2012).In this study, genetic variability within a collection of *Oncidium*plants was investigated using various statistical assessments.

Materials and Methods

In present research programme, eighteen different*Oncidium* and equitant *Oncidium* orchid genotypes with good qualities and popularity in the market were evaluated for various vegetative and floraltraits. The study was conducted at nethouse underDepartment of Genetics and Plant Breeding, College of Agriculture, Vellayani, Kerala Agricultural University during 2023. The design was Completely Randamised design (CRD) with 3 replications. Various statistical analysis *viz*.,genetic variability, heritability and genetic advance studies were conducted.The important traits measured during this analysis were number of base leaves per plant, length of inflorescence(cm), petal length (cm), petal width (cm), lip length (cm), lip width (cm) and longevity of flowers (days). 'R studio', TNAUSTAT and KAU Grapes software were used for the analysis.

Results and discussion

Genetic variability refers to the diversity in gene frequencies within and between populations of organisms.The variability within the genus is exhibited in a variety of phenotypic traits, especially floral characteristics such as size, colour and shape, which are key to their evolutionary success in attracting pollinators. In this investigation,variation due to genotypes for all the traits under study was found significant indicating high amount of variability among different genotypes for different traits providing ample scope for selection and further evaluation as well as improvement in the vase life and other traits (Table 1). De *et al.* (2016) found significant variation in vegetative parameters such as plant size, pseudobulb length, number of cataphylls/pseudobulb and leaf length. Out of eight *Oncidium* hybrids, plants without pseudobulb were found in Popki Red, Jairak Rainbow Pink Spot and Jairak Rainbow Orange Spot(De *et al.*, 2016).

Even though the heritability values indicate effectiveness of selection based on thephenotypic performance, it does not necessarilymean a high genetic advance for a particularcharacter. Heritability along with estimates ofexpected genetic advance should be consideredwhile making selection. In crop improvementonly the genetic component of variation isimportant, as only this can guide the breeders(Moniruzzaman*et al*., 2012).

A wide range of values were observed for the characters under study for genetic advance. According to Robinson *et al*. (1949) characters with values greater than 20% were considered to have high genetic advance. The analysis of variance revealed that significant difference exists among the parental genotypes with respect to the majority of biometric characters studied. Heritability per cent was categorized as high (greater than 60%), moderate (30-60%) and low (below 30%) (Allard,1960). Majority of the characters exhibited high genetic advance. Number of base leaves per plant (71.5 %, 31.69 %), length of inflorescence(63.2 %, 25.81 %), petal length (68.8 %, 28.65 %), petal width (97.2 %, 62.69 %), and lip length (89.8 %, 30.23 %) had high heritability estimates along with high genetic advance expressed as per cent of mean respectively which implied that these traits are controlled by genes which are additive in nature. Simple selection for such characters would be rewarding. In addition, longevity of flowers (53%, 14.45 %) had moderate heritability estimates along with moderate genetic advance expressed as per cent of mean respectively which implied that while genetic improvement through selection is possible, it may require a sustained effort and might be enhanced by complementary strategies such as environmental management and advanced breeding techniques.

Table 1. Components of variance for some vegetative and floral traits

Traits	**G.V**	**P.V**	**E.V**	**C.V(%)**	**PCV (%)**	**GCV (%)**	**Herita bility**	**G.A(%)**
Number of base leaves/plant	0.628	0.878	0.250	11.480	21.509	18.190	71.5	31.687
Length of inflorescence	44.648	70.658	26.010	12.032	19.831	15.764	63.2	25.814
Petal length	0.198	0.288	0.090	11.297	20.221	16.770	68.8	28.652
Petal width	0.068	0.070	0.002	5.282	31.323	30.875	97.2	62.691
Lip length	0.282	0.314	0.032	5.214	16.340	15.486	89.8	30.234
Lip width	0.115	0.340	0.225	15.064	18.517	10.769	33.8	12.902
Longevity of flowers	1.128	2.128	1.000	9.073	13.234	9.634	53.0	14.449

GV-Genotypic variance, PV-Phenotypic variance, EV- Environmental Variance, CV-Coefficient of variation, PCV-Phenotypic Coefficient of Variance, GA- Genetic Advance

GCV(%) was found high in petal width (30.875 %) which is close to PCV (31.323 %) indicating that variability of the trait is largely due to genetic factors with minimal environmental influence. GCV(%) was found moderate in the characters *viz*., number of base leaves per plant (18.190 %), length of inflorescence (15.764 %), petal length (16.770 %), lip

length (15.486 %) and lip width (10.769 %). This indicates moderate genetic variability suggesting potential for genetic improvement through selection.

A wide range of values were observed for the characters under study for genetic advance. According to Robinson *et al*. (1949) characters with values greater than 20% were considered to have high genetic advance. Majority of the characters exhibited high genetic advance (Thomas and Lekha, 2017). High heritability (>60%) combined with high genetic advance (>20%) was exhibited by majority of the characters studied such as flower longevity on the plant and vase life in *Phalaenopsis* by George *et al*. (2020). Moderate heritability with high genetic advance was observed for plant height, leaf area, length of flower and width of flower.

Conclusion

The genetic variability within *Oncidium* orchids is anessentialdata for breeders aiming to develop new hybrids with improved traits such as flower colour, size, shape, and resistance to biotic and abiotic stresses. Breeding programmes often focus on selecting individuals with desirable traits from genetically diverse populations. By crossing genetically distinct individuals, breeders can increase the chances of obtaining offsprings with novel combinations of traits.

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