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Genetic Divergence Analysis in Single Types of Tuberose (*Polianthes tuberosa*)

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ABSTRACT: *Genetic divergence in the single type tuberose genotypes based on yield and component characters were estimated using D^2 statistic. Divergence analysis grouped the genotypes into four clusters respectively. Cluster II had highest mean values for plant height (45.69), number of leaves per plant (27.83), spike length (128.10), number of florets per spike (36.58), number of spikes per m^2 (1.82), floret length (6.62), weight of florets per spike (0.98) and yield of florets per plot (4 * 1 m) (36.18). Cluster III possessed the highest mean values for days to sprouting of bulb (16.25) and days to spike emergence (43.28). Cluster IV had the highest mean values for rachis length (22.36) and flowering duration (22.06). Yield of florets per plot (4 * 1 m) contributed maximum (36.25%) towards genetic divergence, followed by weight of florets per spike (28.84 %). Genotypes were much in use having the above mentioned characters in cluster II would offer a good scope for the improvement of this crop through hybridization and rational selection.*

Key words: *D^2 analysis, Divergence, Selection criteria, Tuberose*

INTRODUCTION

Tuberose (*Polianthes tuberosa)* is one of the most important cut flower. It is an ornamental bulbous plant, native of Mexico and belongs to the family Amaryllidaceae (Benschop, 1993). In India, it is an important commercially grown flower crop much adored for its colour, elegance and fragrance. It occupies a prime position because of its popularity as a cut flower, loose flower, as well as for its potential in perfume industry. Waxy white flowering spikes of single as well as double flower tuberose impregnate the atmosphere with their sweet fragrance and longer keeping quality of flower spikes (Sadhu and Bose, 1973) and are in great demand for making floral arrangement and bouquets in major cities of India. It is widely grown as specimen for exhibition and cut flower. In plant breeding, genetic diversity plays an important role because hybrids between genetically diverse parents manifest greater heterosis than those between closely related parents (Ramanujam *at al.*, 1974; Singh and Sharma, 1989 and Ivy *et al.*, 2007). The D^2 technique based on multivariate analysis developed by Mahalanobis (1936) is the most effective method for quantifying the degree of genetic diversity among genotypes, which helps in selecting the parents for hybridization and the magnitude of genetic diveristy among all the possible pairs of population at genotypic level before effecting actual crosses in modeling the genotypes in a desired genetic architecture has become possible. The scope for improvement in a crop is dependent on the gentic diversity present in available germplasm. Keeping this in view the genetic divergence study was undertaken in tuberose.

MATERIALS AND METHODS

The experiment was carried out at Botanical gardens, Tamil Nadu Agricultural University, Coimbatore during the year 2011-2013. It is situated at 11^0 02" N latitude, 76^0 57" E longitude and 426.76 m above mean sea level. Experimental material consists of ten single genotypes of tuberose *viz*., Calcutta Single, Hyderabad Single, Kahikuchi Single, Mexican Single, Navsari Local, Phule Rajani, Prajwal, Pune Single, Shringar and Variegated Single. The experiment was laid out in randomized block design (RBD) with three replications. The soil was brought to a fine tilth by giving four deep ploughings. Weeds, stubbles, roots etc., were removed. At the time of last ploughing, FYM was applied at the rate of 25 t ha^{-1}. After levelling, raised beds of 1.5 x 1.5 m were formed and the medium sized bulbs of 3.0 – 3.5 cm diameter weighing about 25 grams were planted at a spacing of 45 x 30 m which accommodates 7 plants per m^2. Uniform cultural practices were followed

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throughout the experimentation. Observations were recorded from 10 randomly selected plants in each genotype for days taken for sprouting (days), plant height (cm), number of leaves per clump, days to spike emergence, flowering duration, spike length (cm), rachis length (cm), number of florets/spike, length of the floret, weight of the florets/spike, number of spikes/m^2, yield of florets/plot (4 * 1 m). Genetic diversity was studied following Mahalanobis's (1936) generalized distance (D^2) extended by Rao (1952). Clustering of genotypes was done according to Tocher's method (Rao, 1952).

RESULTS AND DISCUSSION

The genotypes were significantly different from each other. D^2 values also varied to a large extent. The ten genotypes were grouped into 4 clusters or group constellations indicating wide genetic diversity in the present material (Table 1 and 2). Among the four clusters, cluster I was the largest consisting of four genotypes followed by cluster IV with 3 genotypes. Cluster II had two genotypes and cluster III had one genotype. In the present study, all clusters had genotypes from different geographical origin indicating factors other than geographical diversity might be responsible for such grouping. Moll *et al.*, 1962 regarded eco-geographical diversity as a reasonable index of genetic divergence. But eco-geographical diversity might be an inferential criterion which obviously could not always be used for the discrimination among the populations inhibiting the similar agroclimatic regions. Moreover, geographic distribution and genetic diversity as estimated by D^2 statistic need not be directly related (Murthy and Arunachalam, 1966).

Table 1
Composition of D^2 cluster and their geographical origin in tuberose (Single types)

Cluster	*Total number of types*	*Name of types*	*Origin*
I	4	Shringar	IIHR, Bangalore
		Calcutta Single	Calcutta
		Hyderabad Single	Hyderabad
		Kahikuchi Single	Assam
II	2	Phule Rajani	MPKV, Rahuri, Maharastra
		Prajwal	IIHR, Bangalore
III	1	Mexican Single	Mexico
IV	3	Pune Single	Pune
		Variegared Single	Local
		Navsari Local	Gujarat

Table 2
Intra and Inter cluster distance variation for different characters in tuberose (Single types)

Clusters	*I*	*II*	*III*	*IV*
I	10.71	17.17	1.85	34.28
II		0.000	24.90	38.24
III			0.000	22.36
IV				12.56

The intra and inter cluster distance indicates that the crossing of genotypes between these three clusters in single types with high genetic divergence might result in a high degree of heterosis (Moll *et al.*, 1962). A considerable divergence among Assam, Bangalore, Calcutta, Gujarat, Hyderabad, Maharastra and Pune types distributed into different clusters showed varying degree of inter cluster genetic divergence which might be desirable for heterosis breeding.

Cluster mean for twelve characters (Table 3) indicated that in Cluster II had the highest values for plant height (45.69), number of leaves per plant (27.83), spike length (128.10), number of florets per spike (36.58), number of spikes per m^2 (1.82), floret length (6.62), weight of florets per spike (0.98) and yield of florets per plot (4 * 1 m) (36.18) while it had the lowest mean values for days taken for sprouing of bulb (12.24) and days to spike emergence (3.19). Cluster III had the highest mean values for days to sprouing of bulb (16.25) and days to spike emergence (43.28). Cluster IV had the highest mean values for rachis length (22.36) and flowering duration (22.06). While cluster

Table 3
Cluster means for different characters in tuberose (Single types)

Clusters	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12
I	14.76	**30.62**	**19.00**	**20.97**	**16.06**	124.46	18.76	**29.00**	**4.06**	0.91	1.53	35.78
II	**12.24**	**45.69**	**27.83**	30.19	18.76	**128.10**	20.13	**36.58**	**6.62**	**0.98**	**1.82**	**36.18**
III	**16.25**	37.64	24.53	**43.28**	20.98	123.45	**15.46**	32.23	4.07	**0.72**	**1.08**	**21.63**
IV	13.25	42.57	21.19	34.85	**22.06**	**92.53**	**22.36**	31.00	5.53	0.85	1.62	24.89

X1. Days taken for sprouting of bulb
X2. Plant height
X3. No. of leaves per plant
X4. Days to spike emergence
X5. Flowering duration
X6. Spike length
X7. Rachis length
X8. Number of florets/ spike
X9. Length of the floret
X10. Weight of florets per spike
X11. Number of spikes/m^2
X12. Yield of florets/ plot (4 * 1 m)

I had the lowest values for plant height (30.62), number of leaves per plant (19.00), number of florets per spike (29.00), flowering duration (16.06), spike length (24.46) and floret length (4.06). Similarly cluster III had the lowest mean values for rachis length (15.46), weight of florets per spike (0.72) and yield of florets per plot (4 * 1 m) (21.63).

In single types yield of florets per plot (4 * 1 m) contributed maximum (36.25%) towards genetic divergence followed by weight of florets per spike (28.84%), whereas the contribution by plant height (2.38%), number of leaves per plant (0.26%), spike length (8.20%), rachis length (0.26%), number of florets per spike (0.53%), days to spike emergence (0.26%), flowering duration (0.79%), number of spikes per m2 (1.85%), floret length (10.58%) was less towards divergence (Fig. 1). There was no genetic diversity towards days taken for sprouting of bulb. This is in consonanace with the findings of Vairavan *et al.* (1973). Further, yield of flowers per plot showed high heritability. Based on the mean performance and genetic divergence the genotype Prajwal (Single) have been identified for commercial cultivation.

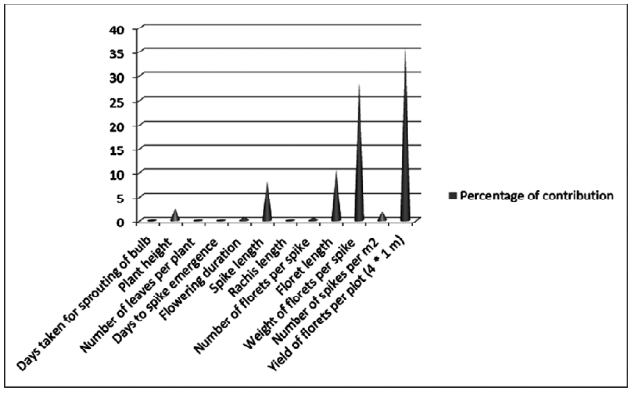

Figure 1: Contribution of each character to divergence in tuberose (Single types)

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