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Assessment of Genetic and Correlation Studies in Single Types of Tuberose (*Polianthes tuberosa)*

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ABSTRACT: *Ten genotypes of tuberose single type were evaluated for fourteen different parameters to ascertain the genetic variability and association among the characters during the year 2011-13 at Tamil Nadu Agricultural University, Coimbatore. The phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the fourteen characters studied. The higher PCV and GCV estimates were found for flowering duration followed by weight of florets per spike. High heritability coupled with high genetic advance was observed for flowering duration, weight of florets per spike, number of florets per spike and rachis length. The correlation studies revealed that plant height exhibited positive correlation with spike length, rachis length, number of spikes/m^2, weight of florets per spike, yield of florets per plot and number of leaves per plant. There exists a positive relationship of number of leaves per plant with length of the floret, yield of florets per plot, weight of florets per spike, flowering duration, number of spikes per m^2, spike length and rachis length. Spike length exhibited positive and significant association with rachis length, number of spikes per m^2, weight of florets per spike and yield of florets per plot.*

Keywords: *Correlation, Genetic advance, Heritability, Tuberose.*

INTRODUCTION

The cut flowers like rose, carnation, gladiolus, tuberose, chrysanthemum, etc., are commonly and frequently demanded in both the local as well as international market. Among them, tuberose (*Polianthes tuberosa)* is one of the most important flowers used for both cut and loose flower purpose. It is an ornamental bulbous plant, native of Mexico and belongs to family *Amaryllidaceae*. 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 ; Benschop, 1993) and are in great demand for making floral arrangement and bouquets in major cities of India. A huge quantum of variability exists in this crop with respect to growth habit, flowering behavior etc. Inspite of such variability, very few are having desirable characters in terms of yield and quality. Considering the fact, there is a need for selection as well as conservation of good germplasm. The study of interrelationship of various characters in the form of correlation is an important aspect in crop breeding. Knowledge of correlation studies helps the plant breeder to ascertain the real components of yield and provide an effective basis of selection. The characters contributing significantly to desirable traits can be significantly identified and can be used as alternate selection criteria in crop improvement programme. Very little work on this aspect has been reported in single types tuberose, hence the present study was undertaken to find out the association among important quantitative characters in single genotypes of tuberose.

MATERIALS AND METHODS

The present study 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 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

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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 of about 25 grams were planted with a spacing of 45 x 30 m which accommodating 7 plants per m^2. Uniform cultural practices were followed throughout the experimentation. The data were recorded on five plants from each genotype in each replication for 14 characters *viz*., days taken for sprouting (days), bulb weight (g), plant height (cm), number of leaves per plant, 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, concrete recovery, yield of florets/plot (4*1m). Data were analysed and presented in tabular form. Data were put to statistical analysis as per Panse and Sukhatme (1967). Genetic parameters like genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were estimated according to Burton and Vane (1953) and heritability as suggested by Weber and Moorthy (1952). Correlation analysis was carried out as per the formulae suggested by Fisher (1954). The significance of phenotypic and genotypic correlation coefficients was tested against 'r' value given in Fisher and Yate's table (1963) at (n-2) degrees of freedom.

RESULTS AND DISCUSSION

The phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) (Table 1) was the highest for flowering duration followed by weight of florets per spike, suggesting that these characters are under genetic control. Hence, these characters can be relied upon selection for further improvement. The phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the characters under study, indicating the role of environment in expression of genotype. Similar results were also reported by Mishra *et al*., (1987) in dahlia and Sheela *et al*., (2005) in *heliconia*. Minimum values of phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) were recorded for characters like number of leaves per plant and days to spike emergence. This type of findings indicated that very minimum variation existed among the genotypes with respect to these characters.

High heritability coupled with high genetic advance was observed for flowering duration, weight of florets per spike, number of florets per spike, rachis length and concrete recovery (Table 1). This indicates the lesser influence of environment in expression of these characters and prevalence of additive gene action in their inheritance hence, suitable for selection. High heritability with moderate genetic advance was recorded for yield of florets/ plot (4* 1 m), spike length, plant height and number of spikes/m^2 suggesting the presence of both additive and non-additive gene actions, and simple selection offers best possibility of improvement of this trait. The estimate of heritability was high with low genetic advance as percentage of mean for bulb weight, days to sprouting, number of bulbils per clump and weight of bulbils per clump which indicated that high heritability were due to non-additive gene effects and influence of environment. Hence, there is a limited scope for selection. Sheikh and John (2005) reported similar results in Iris.

Table 1
Estimates of variability and genetic parameters for flower yield and its components

S.l. No.	*Characters*	*GCV*	*PCV*	*Heritability (%)*	*GA (%) of mean*
1	Days taken for sprouting of bulb	9.08	9.74	88.83	17.43
2	Bulb weight	11.41	11.91	91.88	22.54
3	Plant height	17.16	17.50	96.24	34.69
4	Number of leaves per plant	4.34	5.50	62.16	17.05
5	Days to spike emergence	5.60	6.60	71.99	19.78
6	Flowering duration	35.62	35.79	99.07	73.04
7	Spike length	21.64	21.91	97.58	44.04
8	Rachis length	26.64	26.85	98.47	54.46
9	Number of florets/ spike	31.80	32.01	98.72	65.08
10	Length of the floret	1.45	3.11	78.23	15.39
11	Weight of florets per spike	32.27	32.43	99.02	66.15
12	Number of spikes/m^2	16.34	16.68	95.00	32.96
13	Concrete recovery	20.34	20.76	96.94	52.96
14	Yield of florets/ plot (4* 1 m)	21.71	21.96	98.00	44.22

The genotypic and phenotypic correlation coefficients were computed in all possible combinations for fourteen characters and are presented in Tables 2 and 3. Correlation coefficient analysis measures the mutual relationship between various plant characters and determines the component characters on which selection is based for genetic improvement for a particular character (Robinson *et al*., 1949). A positive correlation between desirable characters is favorable to the plant breeder because it helps in simultaneous improvement of both the characters. In the present study, genotypic correlation coefficients were found to be higher than phenotypic correlation coefficients for most of the

Table 2
Phenotypic correlation coefficient among different characters in tuberose (single)

S.No.	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*
1.	1.000	-0.226	-0.197	-0.646	0.559	-0.283	-0.182	-0.027	0.108	-0.043	-0.638	-0.294	-0.653	-0.549
2.		1.000	0.660	0.376	-0.472	-0.387	0.620	0.451	-0.270	0.213	0.528	0.645	0.631	0.306
3.			1.000	0.271	-0.527	-0.137	0.996	0.595	-0.128	0.048	0.402	0.457	0.445	0.337
4.				1.000	-0.169	0.345	0.229	0.149	-0.189	0.705	0.571	0.326	0.321	0.577
5.					1.000	-0.211	-0.511	-0.407	0.068	0.375	-0.685	-0.650	-0.648	-0.719
6.						1.000	-0.125	0.050	0.175	0.232	0.430	0.298	0.293	0.602
7.							1.000	0.565	-0.131	0.016	0.373	0.435	0.421	0.297
8.								1.000	0.097	0.010	0.440	0.385	0.376	0.424
9.									1.000	0.161	0.256	0.100	0.174	0.176
10.										1.000	0.306	0.236	0.227	0.225
11.											1.000	0.856	0.882	0.846
12.												1.000	0.754	0.722
13.													1.000	0.737
14.														1.000

1. Days taken for sprouting of bulb
2. Bulb weight at planting
3. Plant height
4. No. of leaves per plant
5. Days to spike emergence
6. Flowering duration
7. Spike length
8. Rachis length
9. Number of florets/spike
10. Length of the floret
11. Weight of florets per spike
12. Number of spikes/m^2
13. Concrete recovery
14. Yield of florets/plot (4* 1 m)

Table 3
Genotypic correlation coefficient among different characters in tuberose (single)

S. No.	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*
1.	1.000	-0.368	-0.292	-1.180	0.465	-0.341	-0.258	-0.076	0.075	-1.014	-0.725	-0.401	-0.653	-0.287
2.		1.000	0.644	0.267	-0.764	-0.433	0.608	0.438	-0.315	-0.224	0.525	0.626	0.624	0.682
3.			1.000	0.197	-0.755	-0.159	0.997	0.587	-0.152	-0.359	0.393	0.435	0.426	0.978
4.				1.000	-0.738	0.368	0.173	0.097	-0.324	0.072	0.652	0.263	0.258	0.173
5.					1.000	-0.307	-0.707	-0.558	0.014	-0.526	-0.871	-0.910	-0.904	-0.737
6.						1.000	-0.141	0.039	0.167	0.282	0.424	0.287	0.242	-0.141
7.							1.000	0.558	-0.150	-0.332	0.364	0.418	0.403	0.423
8.								1.000	0.086	-0.263	0.434	0.371	0.367	0.474
9.									1.000	0.094	0.248	0.080	0.074	0.178
10.										1.000	0.430	0.032	0.028	0.138
11.											1.000	0.859	0.845	0.864
12.												1.000	0.714	0.752
13.													1.000	0.876
14.														1.000

1. Days taken for sprouting of bulb
2. Bulb weight at planting
3. Plant height
4. No. of leaves per plant
5. Days to spike emergence
6. Flowering duration
7. Spike length
8. Rachis length
9. Number of florets/ spike
10. Length of the floret
11. Weight of florets per spike
12. Number of spikes/m^2
13. Concrete recovery
14. Yield of florets/ plot (4* 1 m)

characters, indicating a strong inherent association between various characters and were masked by environmental component with regard to phenotypic expression. Similar results were obtained by Singh (2009) in antirrhinum and Pratap *et al.,* (1999) in marigold. The study showed a highly significant and positive correlation between days taken for sprouting of bulb and days taken for spike emergence, number of florets per spike at both genotypic and phenotypic levels. But it had a highly significant and negative association with bulb weight (g), plant height (cm), number of leaves per plant, flowering duration, spike length (cm), rachis length (cm), length of the floret, weight of the florets/spike, number of spikes/m^2, yield of florets/ plot.

Bulb weight exhibited a positive and significant association with plant height, number of spikes/m^2, concrete recovery, spike length, weight of floret per

spike, rachis length, number of leaves per plant and yield of florets/plot in both phenotypic and genotypic levels. But this character had negative correlation with days to spike emergence, flowering duration and number of florets/spike. In both genotypic and phenotypic levels, there exists a positive relationship of plant height with spike length, rachis length, number of spikes/m^2, concrete recovery, weight of florets per spike, yield of florets per plot and number of leaves per plant. But it had negative association with days to spike emergence, flowering duration, and number of florets/spike. Gowda (1989), Prabhat Kumar *et al.*, (2011) also reported significant and positive association of plant height with spike length in gladiolus. There exists a positive and highly significant relationship of number of leaves per plant with length of the floret, yield of florets per plot, weight of florets per spike, flowering duration, number of spikes per m^2, concrete recovery, spike length and rachis length. But it showed negative and significant relationship with days to spike emergence and number of florets per spike. Similar findings were also reported by Nair and Shiva (2003) in gerbera and Prabhat Kumar *et al*., (2011) in gladiolus.

Days to spike emergence showed positive and highly significant association with number of florets per spike at both phenotypic and genotypic levels. Its association with flowering duration, spike length, rachis length, weight of florets per spike, number of spikes per m^2, concrete recovery and yield of florets per plot was found to be negative. Positive and significant association was observed for duration of flowering with yield of florets per plot, weight of florets per spike, number of spikes per m^2, concrete recovery, length of the floret, number of florets/spike and rachis length. But it showed negative but significant association with spike length. This is in line with the findings of Rakesh Kumar and Santosh Kumar (2010) in snapdragon. Spike length exhibited positive and significant association with rachis length, number of spikes per m^2, concrete recovery, weight of florets per spike and yield of florets per plot. However, its association with number of florets/spike was negative at both phenotypic and genotypic levels. This is in consonance with the findings of Rakesh Kumar and Santosh Kumar (2010) in snapdragon. There exists a positive and highly significant relationship of rachis length with weight of florets per spike, yield of florets per plot, number of spikes per m^2, concrete recovery and number of florets per spike. Similar findings were also reported by Rakesh Kumar and Santosh Kumar (2010) in snapdragon. Positive and significant association was observed for number of florets/spike with weight of florets per spike, yield of florets per plot, length of the floret, concrete recovery and number of spikes/m^2. These results are in conformity with the findings of Prabhat Kumar *et al*., (2011) in gladiolus. Length of the floret exhibited positive and significant association with weight of florets per spike, number of spikes/m^2, concrete recovery and yield of florets/plot at both genotypic and phenotypic levels. In genotypic and phenotypic levels, weight of florets per spike exhibited positive relationship with number of spikes/m^2 and concrete recovery. Positive and significant association was also observed for yield of florets/plot with concrete recovery at both levels.

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