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Short Communication

Evaluation of tuberose (*Polianthes tuberosa* L.) genotypes under coastal ecosystem of Tamil Nadu

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ABSTRACT

Genetic variability existing among genotypes is the prime and basic factor for the improvement of any character in a successful breeding programme of tuberose (*Polianthes tuberosa* L.). Though the attempts made so far to exploit the available variability have culminated in the release of a few improved region specific selections as varieties from different centers in India, still, varieties suited to coastal eco-system are yet to be identified. Hence, an experiment was laid out to study the performance of 21 genotypes of *Polianthes tuberosa* L. collected from varied geographical locations. The trial was conducted in the floriculture unit of the Department of Horticulture, Faculty of Agriculture, Annamalai University under randomized block design replicated thrice to assess the genetic variability for eleven economic characters. The results showed that the genotype PT-15 recorded relatively superior mean performance with respect to all characters. High PCV and GCV were observed for number of leaves per plant, plant height and rachis length. Low variability in terms of PCV and GCV was observed for length of the flower and time taken for flowering. High PCV and GCV values of more than 60 per cent was observed for bulb volume followed by yield of flowers per plant, rachis length and duration of flowering. The genotypes *viz.*, PT-15 (Kuzhumani, Thiruchirappalli District), PT-3 (Ravanthavadi, Dharmapuri District) and PT-10(Perumalpatti, Dindugul District) were identified as superior genotypes which are suitable for the coastal region based on *per se* values and can be utilized for future breeding programmes.

Key words: Tuberose -*Polianthes tuberosa*- PCV and GCV – Heritability

INTRODUCTION

Tuberose (*Polianthes tuberosa* L.) is an ornamental bulbous plant belongs to the family Amaryllidaceae. It is an important, popular flower crop being cultivated on a large scale for its scented flower in many parts of the world and in plains of India. Among the ornamental bulbous plants valued for their beauty and fragrance of the flowers, the tuberose occupies a very selective and special position. There are four tuberose cultivars popularly grown in India *viz.*, single, double, semi double and variegated. The cultivar single occupies the foremost position than the others because of great demand for its waxy white flowers of sweet lingering fragrance. In order to make its successful cultivation, the knowledge and performance of different germplasm is essential and the germplasm which perform better than others are only to be grown commercially in a particular location rather than to go for growing all the known germplasm so that maximum benefit can be derived out of total land area under the crop. It is also essential to develop varieties suited to specific climatic conditions and which can be further utilized for genetic improvement of tuberose. Genetic variability existing among genotypes is the prime and basic factor for the improvement of any character in a successful breeding programme.

Hence, there is a need for assessing the breeding material under consideration for the extent of genetic variability available with it for various characters that a plant breeder would like to improve upon. Further, it is known that often most of the characters are interrelated because of the integrated structure of the plant, due to which a change in one character influences the other. Therefore, direct selection based on a single character, may not be so effective and it is also necessary to study the

interrelationship among the characters for improvement through breeding. For a sound breeding programme, a thorough knowledge of the mean performance, magnitude of genetic variability, heritability and genetic advance is essential.

Attempts made so far to exploit the available variability have culminated in the release of a few improved region specific selections as varieties from different centers in India. Still, varieties suited to coastal eco-system are yet to be identified. Nevertheless, there still exists an ample scope to exploit the available variability to identify genotypes to suit coastal eco-system. This will also pave the way for future breeding programmes. Hence, an experiment was laid out to study the performance of 21 genotypes of *Polianthes tuberosa* L. collected from varied geographical locations and were raised to assess the genetic variability for eleven economic characters and the interrelationship existing among them.

With a view to identify superior genotypes, a field trial was carried out in the floriculture unit of the Department of Horticulture, Annamalai university with following 21 genotypes collected from diverse sources of tuberose. The genotypes are nomenclature as PT (*Polianthes tuberosa*) prefixed with collection number 1 to 21. The experiments were laid out under randomized block design with three replications.

Genotypes	Source of Collection
PT -1	Farmers field at Pachamalayankottai, Dindugul Dt.,
PT -2	Farmers field at Perungudi, Madurai Dt.,
PT -3	Farmers field at Ravanthavadi, Dharmapuri Dt.,
PT-4	Farmers field at Iyngunam, Thiruvannamalai Dt.,
PT-5	Farmers field at Thuraiyur, Thiruchirapalli Dt.,
PT -6	Farmers field at Sempatti, Dindugul Dt.,
PT -7	Farmers field at Nilakottai, Dindugul Dt.,
PT -8	Farmers field at Davasimalai, Dindugul Dt.,
PT -9	Farmers field at Pallapatti, Dindugul Dt.,
PT-10	Farmers field at Perumalpatti, Dindugul Dt.,
PT -11	Farmers field at Naduppatti, Dindugul Dt.,
PT -12	Farmers field at Kidathalaimedu, Nagappatinum Dt.,
PT -13	Farmers field at Nanjangud, Mysore Dt.,
PT -14	Farmers field at Belgaum, Karnataka.
PT -15	Farmers field at Kuzhumani, Thiruchirappalli Dt.,
PT -16	Farmers field at Viralipatti, Dindugul Dt.,
PT -17	Farmers field at Andapattu, Thiruvannamalai Dt.,
PT -18	Farmers field at Erumpoondi, Thiruvannamalai Dt.,
PT -19	Farmers field at Kodaginaikenpatti, Dindugul Dt.,
PT -20	Farmers field at Kattampundi, Thiruvannamalai Dt.,
PT -21	Farmers field at T. Narsipur, Mysore Dt.,

The following observations *viz.*, time taken for sprouting, plant height, number of leaves per plant, time taken for flowering, duration of flowering, spike length, rachis length, length of the flower, diameter of the flower, number of flowers per spike, yield of flowers per plant, number of bulblets per plant, weight of bulbs per plant, bulb diameter, bulb volume and vase life were recorded. The statistical analysis of data was done by adopting the standard statistical procedure given by Panse and Sukhatme (1978).

A critical assessment of genetic variability among the genotypes is a pre-requisite for initiating appropriate breeding procedures in crop improvement programme. It is also an effective tool in the hands of breeders to design the testing procedures more precisely for identifying superior genotypes. The analysis of variance (**Table 1)** revealed significant differences among all entries for almost all the traits. This justifies the present effort to isolate superior genotypes from the available germplasm. In the present study, the variation that existed among the 21 genotypes were estimated using co-efficient of variation. PT-15 recorded the highest mean value for number of flowers per spike (48.27), which exceeded the grand mean value of 35.50. This genotype was recognized for highest mean values for spike lenth (47.12cm), rachis length (31.70cm) and flower yield (55.58 g).The estimates of GCV would be more useful for the assessment of the heritable portion of variation (Allard, 1970). In the present study, the traits like number of leaves per plant (28.54 % & 28.49%), plant height (24.84 % & 24.81%, duration of flowering (22.11 &22.07%), spike length (20.39% & 20.38%) and time taken for sprouting (15.67% & 15.63%) recorded high values for PCV and GCV whereas, low PCV and GCV values were noted for time taken for flowering(7.41% & 7.37%) length of the flower (7.05% & 6.75%), and bulb volume (10.57% & 10.57%).

In tuberose, PCV and GCV were found to be high for 100 floret weight, rachis length, number of flower stalks per plant and weight of spike were reported by Gurav *et al.,* (2005). Similarly in gladiolus high PCV and GCV for number of cormels per plant and average weight of cormels per plant were reported by Desh raj and Misra, (1996). Comparison of GCV and PCV values for different traits indicated that the values of PCV were higher as compared to GCV for all characters which are suggestive that the apparent variation is not only due to genotype, but also due to the influence of environment. These results are in agreement with the results of Deepti Singh and Santosh Kumar (2008) in marigold.

Heritability is the ratio of genotypic variance to the phenotypic variance or total variance. It signifies the heritable portion of phenotypic variance which also serve as a reliable index of transmission of characters from parents to their off springs (Falconer, 1981).The genetic coefficient of variation alone may not offer full scope to access the relative amount of heritable variation present in the genotypes under study. Hence, a quantitative estimate of that portion of variability that is due to genetic effect is most important. This estimate is termed as heritability, which has a close bearing on its response to selection of genotypes, can be based on phenotypic performance. Thus heritability precisely provides information on the relative efficiency of selection and to determine the extent to which different characters will respond to selection procedure (**Table 2**).

In the present study, the highest heritability estimated in broad sense was observed for bulb volume (99.96%) followed by yield of flowers per plant (99.77%), duration of flowering (99.66%), number of leaves per plant (99.63%). The heritability for all other traits was in the range of 91 to 97%. These results go in line with the findings of Wricke *et al.,* (1982), Mahanta *et al.,* (1997) in gerbera. The results reported in gladiolus (Katwate *et al.,* 1998), African marigold (Singh *et al.,* 2000), Niharika Pattnaik and Mohan (2002), Bhanupratap *et al.,* (2003) and in Dahlia, Singh (2003), Srinivas and Narayana gowda (2003) also correlate the findings of the present study. Johnson *et al.,* (1955) were of the view that the heritability values along with estimates of genetic gain would be more useful and reliable than heritability value alone. Heritability would provide information only on the magnitude of inheritance of a quantitative character, while genetic advance will be helpful in formulating appropriate selection procedure.

Table 1. Mean performance of different genotypes for various characters of Tuberose

Genotypes	Time taken for sprouting (days)	Plant height (cm)	Number of leaves/ plant	Time taken for flowering (days)	Duration of flowering (days)	Spike length (cm)	Length of the flower (cm)	Number of flowers/ spike	Yield of flowers/ plant (gm)	Bulb volume (cc)	Vase life (days)
PT-1	10.05	45.85	40.65	79.95	9.40	25.05	5.01	33.06	36.40	17.00	15.42
PT-2	10.26	51.10	39.70	79.15	10.60	25.25	5.02	34.01	33.16	16.92	11.22
PT-3	9.50	75.85	55.65	68.95	16.39	39.95	5.77	43.19	46.84	20.07	17.77
PT-4	10.13	48.20	43.95	73.25	12.60	34.95	5.02	36.38	35.35	15.07	14.90
PT-5	10.05	43.25	35.25	80.20	13.07	36.01	5.01	29.34	36.01	15.97	13.46
PT-6	13.08	42.15	31.85	81.20	7.03	35.01	5.03	30.80	37.01	16.01	12.63
PT-7	12.06	39.35	40.75	86.95	13.45	34.20	5.06	30.65	35.65	15.11	11.85
PT-8	12.70	37.95	27.35	84.90	12.35	30.51	5.02	34.55	36.35	16.75	13.67
PT-9	12.66	39.15	33.20	74.85	9.65	35.45	5.01	34.90	35.74	17.55	12.92
PT-10	9.62	60.65	47.65	71.15	14.11	38.90	5.38	41.43	40.81	18.01	15.97
PT-11	13.08	56.15	29.95	75.75	12.65	28.15	5.00	40.06	37.27	15.76	12.62
PT-12	13.01	56.70	26.85	80.20	10.07	28.42	5.05	38.98	36.45	16.60	13.50
PT-13	10.27	55.10	18.80	77.20	11.65	27.55	5.00	37.05	37.49	17.01	14.67
PT-14	10.17	54.85	37.75	74.50	10.75	27.85	5.01	29.39	34.85	17.50	15.72
PT-15	7.07	89.25	61.45	66.05	17.27	41.72	6.24	48.27	55.58	23.05	18.29
PT-16	10.60	44.15	36.30	72.35	12.90	22.22	4.98	36.83	36.92	16.50	15.62
PT-17	10.18	46.15	37.95	73.65	12.06	27.65	4.96	32.91	38.52	17.77	12.63
PT-18	10.13	51.20	40.00	73.15	13.69	28.85	4.97	35.60	37.85	16.50	13.77
PT-19	10.11	55.55	42.55	75.95	10.98	24.05	5.02	34.31	40.17	17.01	12.62
PT-20	10.03	53.50	35.65	73.35	13.27	27.35	5.01	35.39	36.00	16.02	11.60
PT-21	14.45	34.10	16.15	88.20	6.30	17.95	4.40	28.54	32.07	15.00	11.02
Mean	0.91	51.43	7.11	76.70	11.91	30.33	5.09	35.50	37.93	17.01	13.90
SE.d	0.08	0.39	0.44	0.40	0.10	0.13	0.07	0.24	0.16	0.02	0.09
CD(*P=0.05*)	0.16	0.81	0.93	0.84	0.22	0.27	0.14	0.50	0.34	0.05	0.20

Table 2. Magnitude of variability and estimates of heritability, genetic advance and genetic advance as per cent of mean for various characters in Tuberose (*Polianthes tuberosa* L.)

S.No.	Characters	PV	PCV (%)	GV	GCV (%)	Heritability (BS) (%)	Genetic advance	Genetic advance as per cent of mean
1.	Time taken for sprouting	2.92	15.67	2.91	15.63	99.54	3.50	32.13
2.	Plant height	163.29	24.84	162.96	24.81	99.80	26.27	51.07
3.	Number of leaves/plant	112.26	28.54	111.84	28.49	99.63	21.74	58.59
4.	Time taken for flowering	32.37	7.41	32.03	7.37	98.93	11.59	15.11
5.	Duration of flowering	6.94	22.11	6.92	22.07	99.66	5.41	45.40
6.	Spike length	38.29	20.39	38.26	20.38	99.90	12.73	41.98
7.	Length of the flower	0.12	7.05	0.11	6.75	91.63	0.67	13.31
8.	Number of flowers/spike	24.16	13.84	24.04	13.80	99.49	10.07	28.37
9.	Yield of flowers/plant	25.26	13.25	25.20	13.23	99.77	10.32	27.23
10.	Bulb volume	3.23	10.57	3.23	10.57	99.96	3.70	21.76
11.	Vase life	4.08	14.54	4.06	14.51	99.49	4.14	29.81

In the present study the traits *viz.,* bulb volume, yield of flowers per plant, duration of flowering and number of leaves per plant recorded high heritability values combined with higher values of genetic advances as per cent of mean. High heritability combined with moderate values of genetic advance over the mean values were observed for time taken for flowering and length of the flower. This suggests substantial additive gene effect governing these characters and phenotypic selection will be useful in improving these traits. Bindiya *et al,* (2018) also observe that the in tuberose plant height exhibited positive correlation with number of spikes per plant, spike length and number of leaves. This results in accordance with the findings of Gurav *et al.* (2005) in tuberose, Syamal and Kumar (2002) in dahlia, Palai *et al.,* (2003) in hybrid tea rose and Srinivas and Narayana gowda (2003) in African marigold, Singh Kanwar and Saha (2006) in French marigold, Anil Singh and Nalini Singh (2007) in balsam, Kanwar and Bharadwaj (2009) in French marigold, Deepti Singh and Santosh Kumar (2008) and Nilima Gobade *et al*. (2017) in Marigold. As per the above investigation the genotypes suited for this location were identified as PT-15, PT-3 and PT-10 were found to be best.

From the various genetic parameters *viz.,* GCV, PCV, heritability and genetic advance studied in this experiment, seven characters *viz.*, bulb volume, yield of flowers per plant, duration of flowering and number of leaves per plant were identified for primary selection as they had high GCV, PCV, high heritability along with genetic advance. Considering these characters, the three genotypes PT-15, PT-3 and PT-10 which showed significantly superiority in mean performance were identified for further purification and multiplication for their commercial exploitation in coastal Tamil Nadu Condition.

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