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Studies of genetic parameters for yield and its associated traits in tuberose

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Abstract
Ten varieties & genotypes have been collected from different sources and evaluated at Instructional farm, Dept. of Floriculture & Landscape Architecture, College of Horticulture, Junagadh Agricultural University, Junagadh during the year 2020-21 to assess the genotypic and phenotypic variability in tuberose. The present study revealed that, among the characters studied, the highest phenotypic range (1.16-2.80) was recorded for number of spikes per plant with coefficient of range 41.41% followed by plant height at 150 DAP (31.66-61.40), number of shoots per plant (3.03-5.66) and weight of bulblets per plant (30.00-56.00) with 34.28%; 31.95%;30.26%; and 30.23% coefficient of range respectively. The number of spikes per plant, the height of the plant at 120 DAP, spike weight, plant height at 150 DAP, and the weight of bulblets per plant all showed high genotypic and phenotypic coefficients of variation, indicating broad variety for these features. For spike weight, number of bulbs per plant, plant height at 150 DAP, and number of spikes per plant, high estimates of broad-sense heritability and genetic progress as a percentage of the mean were found.

Keywords: GCV, heritability, PCV, range, and tuberose

Introduction
Tuberose is half hardy, bulbous perennial with fibrous root. The leaves are fleshy long, narrow, linear, grass like light green foliage, and arise in rosette at the base. The flowers are funnel shaped waxy white, single or double and borne in spike. The flowering spike emerges from centre of cluster of leaves. Flowers are used for making artistic garlands, floral ornaments, bouquets and button holes, etc. Tuberose is not like other flowers that is just meant for decoration but also used for several purposes and in different forms. The spikes are generally lasts for 7-12 days in vase depending upon the room temperature. Individual florets are used for making veni, garland, button-holes or crowns; the last named ornament is used during marriage or other religious ceremonies such as Annaprasanna in Bengal. Certain genetical indices, such as phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability estimates (h2), and genetic advance (GA), would be used to evaluate genetic variability. PCV and GCV represent the relative degree of genetic variability for distinct traits in a genotype population. Heritability expresses the proportion of variation that is heritable. However, heritability estimates combined with genetic gain are more beneficial in identifying the best person in a group.

Materials and Methods
The current study, named "Studies of Genetic Parameters for Yield and Its Associated Traits in Tuberose," was conducted at the Junagadh Agricultural University's Instructional Farm, Department of Floriculture & Landscape Architecture, College of Horticulture, during the years 2020-21. Junagadh lies in Gujarat's South Saurashtra Agro-climatic Region. Geographically, this location is located at 21.50 N latitude and 70.50 E longitude, at an elevation of 60 meters above mean sea level, and 80 kilometers from the Arabian Sea Coast on the western side at the foothill of Mount Girnar.
The data obtained from the various individuals involved in the study were analyzed statistically to ensure a proper interpretation. We used the conventional method of analysis of variance suitable for the Randomized Block Design, as outlined by Panse and Sukhatme in 1985. To determine treatment differences, we conducted an "F" test at a significance level of five percent based on the null hypothesis. In each instance, we computed the appropriate standard errors (S.Em.±) and determined the Critical Difference (C.D.) at a five percent probability level. In cases where the treatment effects were deemed significant through the F-

test, we also calculated the percentage of the coefficient of variation (C.V. %) for all the scenarios.

The data collected for various characteristics underwent an analysis of variance. We estimated different variance components, such as phenotypic, genotypic, and environmental variances, and computed various genetic variability parameters using standard statistical techniques.

Results & Discussion

Phenotypic range

The present study revealed that, among the characters studied, the highest phenotypic range (1.16-2.80) was recorded for number of spikes per plant with coefficient of range 41.41% followed by plant height at 150 DAP (31.66-61.40), number of shoots per plant (3.03-5.66) and weight of bulblets per plant (30.00-56.00) with 34.28%, 31.95%, 30.26% and 30.23% coefficient of range. There was narrow range of variation (below 10%) for spike length (73.90-82.96 cm) with 5.77% range of variation. All other remaining characters exhibited medium range of variation (10-29%).

Genotypic coefficient of variation

Among all the characters studied, the highest GCV was recorded for number of spikes per plant (24.45%) followed by plant height at 150 DAP (22.81%); spike weight (22.27%); plant height at 120 DAP (20.89%); weight of bulblets per plant (20.11%). Whereas, the lowest GCV was observed for leaf area (6.66%); days to spike emergence (7.28%); number of bulblets per plant (5.71%); spike length (6.12%); and rachis length (2.42%). Remaining characters showed medium values of genotypic coefficient of variation during both years.

Phenotypic coefficient of variation

The highest PCV was recorded for number of spikes per plant (28.89%) followed by plant height at 120 DAP (21.15%); spike weight (22.29%); plant height at 150 DAP (23.02%); weight of bulblets per plant (20.63%). Whereas, the lowest PCV was observed for leaf area (7.43%); days to spike emergence (7.92%); number of bulblets per plant (6.83%); spike length (6.67%); and rachis length (6.99%). The rest of the characters showed medium values of phenotypic coefficient of variation.

Heritability estimates

The estimates of broad sense heritability in per cent are revealed that the highest heritability estimate was recorded for number of spikes per plant (99.82%) followed by spike weight (96.97%); number of bulbs per plant (99.39%); days to sprouting of bulbs (78.79%); number of leaves per plant at 120 DAP (91.34%); first floret opening (70.52%); days to 50% flowering (89.13%); spike length (84.27%); floret diameter (81.39%); number of bulblets per plant (69.99%); weight of bulbs per plant (63.81%); and weight of bulblets per plant (95.08%). Whereas, number of shoots per plant (21.19%); rachis length (12.05%); and florets per spike (11.10%) showed low heritability.

Genetic advance

Genetic advance at five per cent selection intensity was estimated for different characters during both the years. The highest genetic advance was observed for spike weight (45.69) followed by days to 50% flowering (28.98) and it is medium for weight of bulblets per plant (17.47) and days to spike emergence (14.67), it is medium for spike length (16.70 cm) and number of bulblets per plant (15.34). All remaining characters showed low genetic advance.

Genetic advance expressed as per cent of mean

Expected genetic advance as per cent of mean was found highest for number of spikes per plant (57.71%) followed by days to sprouting of bulbs (49.01%); spike weight (45.83%); number of leaves per plant at 120 DAP (42.08%); first floret opening (39.77%); days to 50% flowering (22.04%); spike length (21.58%); floret diameter (28.80%); number of bulbs per plant (35.09%); number of bulblets per plant (21.85%); weight of bulbs per plant (27.00%); and weight of bulblets per plant (40.40%). The lowest estimate of 1.73% and 9.85% genetic advance (%) observed in rachis length and number of bulblets per plant. The rest of the characters showed medium level of genetic advance expressed as per cent of mean (10-20%).

Table 1: Range, mean, coefficient of variation, phenotypic and genotypic coefficient of variation, heritability, genetic advance and genetic advance expressed as per cent of mean for various characters in tuberose for the years 2020-21

Characters	Range	Coefficient of variance (%)	Mean	GCV (%)	PCV (%)	Heritability in broad sense (%)	Genetic advance	Genetic Advance as (%) of mean
Days to sprouting of bulbs (days)	12.00-18.33	20.87	14.86	10.87	12.25	78.79	7.28	49.01
Plant height at 90 DAP (cm)	28.06-40.13	17.70	31.60	11.50	11.96	55.00	2.26	12.79
Plant height at 120 DAP (cm)	29.33-52.86	28.62	35.38	20.89	21.15	57.00	4.42	12.52
Plant height at 150 DAP (cm)	31.66-61.40	31.95	40.55	22.81	23.02	59.00	6.71	16.56
Number of leaves per plant at 90 DAP	25.33-38.33	20.42	30.80	11.30	11.83	55.00	3.76	12.24
Number of leaves per plant at 120 DAP	25.50-38.50	20.31	31.90	11.21	11.73	91.34	13.42	42.08
Number of leaves per plant at 150 DAP	27.33-39.66	18.40	32.20	11.23	11.83	44.00	5.79	18.00
Number of shoots per plant	3.03-5.66	30.26	4.26	14.53	17.22	21.19	0.64	15.25
Leaf area (cm^2)	38.00-48.66	12.30	44.01	6.66	7.43	54.84	5.42	12.32
Days to spike emergence (days)	94.66-117.66	10.83	106.23	7.28	7.92	64.00	14.67	13.81
Spike emergence to first floret opening (days)	10.11-15.66	21.53	12.81	11.43	13.61	70.52	5.09	39.77
Days to 50% flowering (days)	107.33-145.00	14.92	131.53	10.30	10.91	89.13	28.98	22.04
Number of spikes per plant	1.16-2.80	41.41	1.80	24.45	28.89	99.82	1.03	57.71
Spike length (cm)	73.90-82.96	5.77	77.42	6.12	6.67	84.27	16.70	21.58
Spike weight (g)	88.00-140	22.80	99.71	22.17	22.29	96.97	45.69	45.83
Rachis length (cm)	33.00-41.33	11.20	37.31	2.42	6.99	12.05	0.64	1.73
Number of florets per spike	22.00-31.66	18.00	25.90	12.83	13.19	11.10	4.07	15.73

Floret diameter (cm)	2.40-4.23	27.60	2.91	15.49	17.17	81.39	0.83	28.80
Vase life (days)	11.66-18.00	21.37	14.49	11.33	15.07	56.54	2.54	17.55
Number of bulbs per plant	3.91-6.11	21.95	4.62	17.08	17.13	99.39	1.62	35.09
Number of bulblets per plant	60.50-75.03	10.72	70.23	5.71	6.83	69.99	15.34	21.85
Weight of bulbs per plant (g)	6.33-9.66	20.82	8.08	10.33	12.94	80.09	2.18	27.00
Weight of bulblets per plant (g)	30.00-56.00	30.23	43.26	20.11	20.63	95.08	17.47	40.40

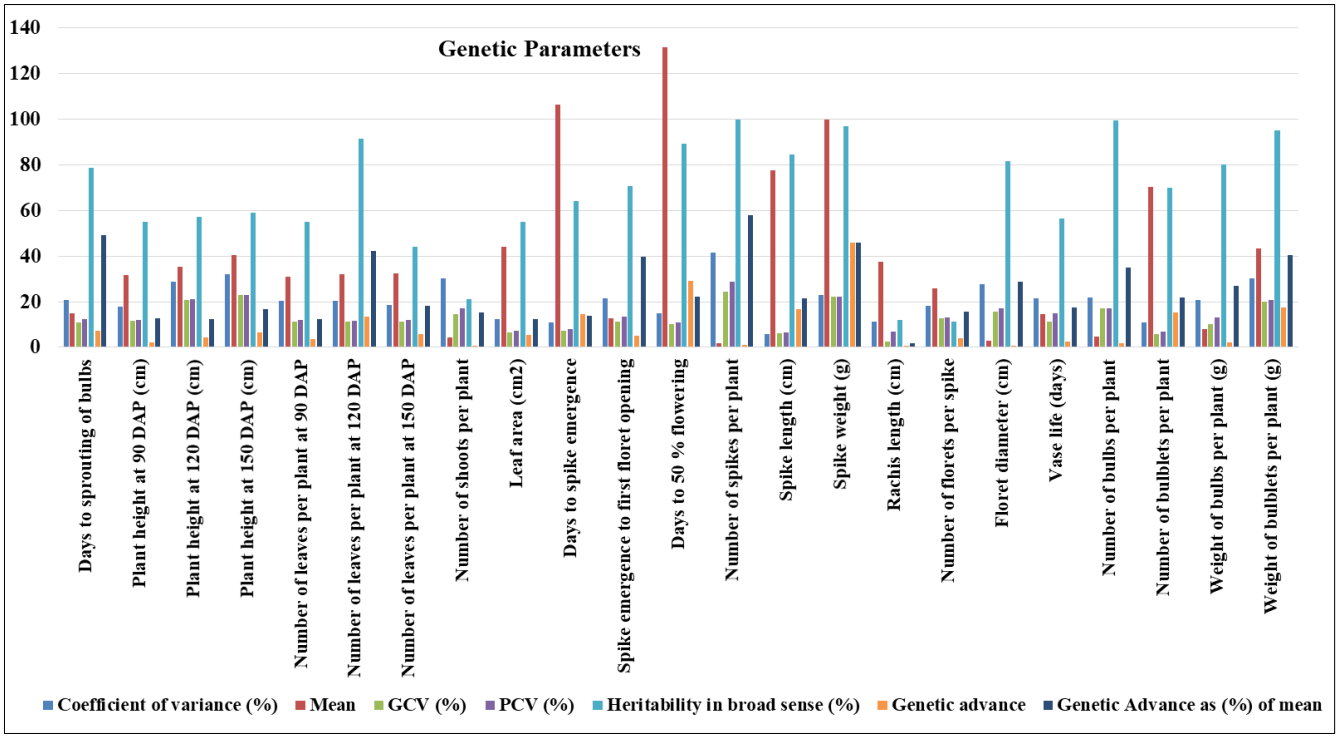

Fig 1: Range, mean, coefficient of variation, phenotypic and genotypic coefficient of variation, heritability, genetic advance and genetic advance expressed as per cent of mean for various characters in tuberose for the years 2020-21

Conclusion

The findings from our study indicate that tuberose varieties can be effectively classified based on their physical characteristics. These traits can serve as valuable descriptors for identifying and preserving tuberose varieties. Additionally, the diverse genotypes we identified with unique features can be used as potential parents in breeding programs to develop superior tuberose varieties. Based on our observations of growth, flowering, and yield parameters, we recommend Prajwal and Shringar for single-cut spike type tuberose and BRH-24 and Suvasini for double-type tuberose in terms of bulb yield, particularly in the Saurashtra region of Gujarat.

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