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Correlation and Path Coefficient Analysis in Tuberose Cultivars Single

D. Priyanka Gandhi[1], T. Usha Bharathi

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ABSTRACT

A study was carried out to determine the association between different quantitative characters of eighteen genotypes of tuberose cultivars single. The highest positive and significant association was recorded for spike yield with plant height (0.33), rachis length (0.30), number of florets per spike (0.34), weight of single floret (0.63), matured bud weight (0.66), duration of flowering (0.52). The results of path coefficient analysis indicated that the weight of the floret (1.48) had very high positive direct effect on spike yield per plant followed by length of the floret (0.84) number of florets per spike (0.45) and duration of flowering (0.41). Spike length (0.27) had moderate positive direct effect. Plant height (0.16) and number of leaves (0.17) showed low positive direct effect and rest of the characters had negligible positive direct effect on spike yield per plant. The results of the study indicates that the above mentioned characters can be used for the improvement of tuberose.

Key words: Correlation coefficient, Path analysis, Tuberose.

INTRODUCTION

Tuberose (*Polianthes tuberosa* L.) belongs to the family Asparagaceae is a bulbous fragrant ornamental plant, native to Mexico (Trueblood, 1973). Tuberose occupies a prime position in Indian floriculture industry. The major consumption of tuberose flowers is in the form of loose flowers and cut flowers. The tuberose flowers are valued much for their sweet and lingering pleasant fragrance. The highly fragrant single type tuberose cultivars contain 0.08 to 0.14% concrete which is used in high grade perfumes. It is commercially cultivated in India in an area of about 16.19 ('000 ha), with a loose flower production of 107.91 ('000 MT) and cut flower production of 89.29 (Lakh Nos.) of cut stems (Anon, 2016). Due to its increasing demand, farmers have begun growing tuberose and it has also gained considerable commercial importance and cultivated for its varied uses. Development of high yielding varieties is the need of the hour in tuberose. The characters contributing significantly to desirable traits can be identified and used as alternate selection criteria in crop improvement programme. The information on association of plant characters as determined by the correlation coefficient will be useful for selection. Study on correlation along with path coefficient analysis is essential to partition the correlation coefficient into direct and indirect effect of independent variables on dependent variable. The main aim of the breeder is to develop high yielding varieties and the knowledge on the degree of relationship between yield and its contributing characters is essential. Keeping the above in view, the present investigation was carried out with an objective to determine the traits having direct and indirect association with flower yield by means of association analysis and path coefficient analysis.

ICAR-Indian Institute of Horticultural Research, Hesaraghatta, Bengaluru-560 089, Karnataka, India.

Corresponding Author: D. Priyanka Gandhi, ICAR-Indian Institute of Horticultural Research, Hesaraghatta, Bengaluru-560 089, Karnataka, India. Email: priyanka.ruth28@gmail.com

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MATERIALS AND METHODS

The field experiment was conducted at the Division of Floriculture and Medicinal Crops, ICAR-Indian Institute of Horticultural Research (ICAR-IIHR), Bengaluru during the period 2016-2017. ICAR-IIHR is situated at an altitude of 930 meter above mean sea level and latitude 12° 58´ North latitude, 78° 45´ East longitude, respectively. The experiment was laid out in randomized block design with three replications. Eighteen single tuberose cultivars *viz*., Arka Shringar, Arka Prajwal, Arka Nirantara, Arka Sugandhi, IIHR-6, IIHR-11, IIHR-12, IIHR-9, IIHR-10, Calcutta Single, Hyderabad Single, Mexican Single, Variegated, GK-T-C4, Phule Rajani, Bidhan Rajani-1, Bidhan Rajani-2 and Bidhan Rajani-3 were used as experimental material. Uniform size of bulbs (2.5 cm dia) were planted at a spacing of 30 x 30 cm and standard cultural practices were followed. The observations on quantitative parameters such as plant height, number of leaves per clump, days to spike appearance, spike length, rachis length, number of florets per spike, length of the floret, floret tube length, diameter of the floret, weight of single floret, matured bud weight, duration of flowering and number of spikes per clump were

recorded. The data recorded were subjected to statistical analysis. The estimates of correlation coefficient were carried out by using the technique outlined by Hayes *et al*. (1955) and Al-jibouri *et al*. (1958). The path coefficient analysis was done by the method suggested by Dewey and Lu (1959) for spike yield per clump and its components keeping spike yield as resultant variable and its component as causal variables.

RESULTS AND DISCUSSION

The simple correlation coefficients between yield and various yield components and inter-relationship among the traits were computed and they are presented in Table 1. Spike yield per plant showed positive and significant association with plant height (0.33), rachis length (0.30), number of florets per spike (0.34), weight of single floret (0.63), matured bud weight (0.66), duration of flowering (0.52) and high negative correlation with days to spike appearance (-0.84). Flower yield is a complex trait, the expression of which depends on the action and multiple interactions of various components. The associations of these characters with flower yield per plant are in desirable direction and selection of these traits may ultimately improve the yield. The results are in line with the findings of Kannan *et al.*(1998), Nagaraja and Gowda (2002), Ranchana *et al.* (2015), Gaidhani *et al.* (2016) in tuberose and Kameswari *et al*. (2015) in chrysanthemum.

Plant height showed positive and significant association with number of florets per spike (0.36), weight of single floret (0.47), matured bud weight (0.59). Kumar *et al.* (2011) reported significant and positive association of plant height with spike length in gladiolus and the results are in line with findings of Ranchana *et al.* (2015) in tuberose. Number of leaves per clump showed positive correlation with floret tube length (0.38). This is in consonance with the findings of Vetrivel (2010), Kumar *et al.* (2012) in gladiolus and Ranchana *et al.* (2015) in tuberose. Days to spike appearance showed significant negative correlation with number of florets per spike (-0.40), length of the floret (-0.35), weight of single floret (-0.50), matured bud weight (-0.56) and duration of flowering (-0.49). Similar findings were also reported by Vetrivel (2010), Kumar *et al.* (2011) in gladiolus and Ranchana *et al.* (2015) in tuberose.

Spike length has significant positive association with floret tube length (0.40) and weight of single floret (0.33). A significant positive association between spike length, plant height and number of florets was evidenced by Anuradha and Gowda, (2000) in gladiolus. Ranchana *et al.* (2015) also reported that the length of the floret and number of florets per spike had significant but negative correlation with spike length. Rachis length showed significant positive correlation with length of the floret (0.52), diameter of the floret (0.69), weight of single floret (0.81), matured bud weight (0.72) and duration of flowering (0.59). Findings derive support from the results of Kumar *et al.* (2012) in snapdragon and Ranchana *et al.* (2015) in tuberose.

Table 1: Simple correlation coefficient among various characters in the tuberose cultivars single.

Character	No. of leaves	Days to spike appearance	Spike length	Rachis length	No. of florets per spike	Length of the floret	Flower tube length	Diameter of the floret	Weight of single floret	Matured bud weight	Duration of flowering	Spike yield/ Number of spikes per clump
Plant height	0.11	-0.31	0.30	0.25	0.36*	0.11	0.11	0.27	0.47**	0.59**	0.19	0.33*
No. of leaves		-0.19	0.05	-0.28	-0.03	0.18	0.38*	-0.06	-0.06	-0.05	0.02	0.15
Days to spike appearance			0.04	-0.13	-0.40*	-0.35*	-0.14	-0.16	-0.50**	-0.56**	-0.49**	-0.84**
Spike length				0.27	-0.32	0.17	0.40*	0.11	0.33*	0.28	0.09	0.10
Rachis length					-0.07	0.52**	0.29	0.69**	0.81**	0.72**	0.59**	0.30
Number of florets per spike						-0.03	-0.06	0.16	0.20	0.28	-0.05	0.34*
Length of the floret							0.57**	0.79**	0.60**	0.59**	0.50**	0.32
Flower tube length								0.32	0.35*	0.31	0.31	0.07
Diameter of the floret									0.66**	0.64**	0.53**	0.24
Weight of single floret										0.97**	0.68**	0.63**
Matured bud weight											0.68**	0.66**
Duration of flowering												0.52**
Number of spikes per clump												1.00**

* Significant at 5 % level ** Significant at 1 % level.

Length of the floret showed positive correlation with flower tube length (0.57), diameter of the floret (0.79), weight of single floret (0.60), matured bud weight (0.59) and duration of flowering (0.50). This is in accordance with the findings of Ranchana *et al.* (2015) in tuberose. A significant and positive correlation between leaf area and floret length was noted in gladiolus by Zorana *et al.* (2011) and Aasia *et al.* (2016). Floret tube length had significant positive association with weight of single floret (0.35). Diameter of the floret showed positive correlation with weight of single floret (0.66), matured bud weight (0.64) and duration of flowering (0.53). Weight of single floret showed positive correlation with matured bud weight (0.97) and duration of flowering (0.68). Matured bud weight had significant positive association with duration of flowering (0.68). The results derive the support from the findings of Bharathi *et al.* (2014) in marigold.

Path coefficient analysis

The genotypic correlation co-efficient of single tuberose genotypes was apportioned into direct effects and indirect effects by path analysis and the results are presented in Table 2. The residual effect (0.342) indicated that most of the yield contributing characters was included in the study. The path coefficient analysis was studied for 13 characters which indicated that the weight of the floret (1.48) had very high positive direct effect on spike yield per plant followed by length of the floret (0.84) number of florets per spike (0.45) and duration of flowering (0.41) which had high positive direct effect, spike length (0.27) had moderate positive direct effect, plant height (0.16) and number of leaves (0.17) showed low positive direct effect and rest of the characters had negligible positive direct effect on spike yield per plant. Similar results were recorded by Kannan *et al.* (1998) in tuberose. Matured bud weight (-1.40) had very high negative direct effect on spike yield per plant followed by diameter of the floret (-0.78), flower tube length (-0.70), days to appearance (-0.36) which showed high negative direct effect on spike yield per plant. Similar such findings were reported by Kannan *et al.* (1998), Saravanakumar (2000) and Ranchana *et al.* (2015) in tuberose.

Plant height recorded very high positive indirect effect through weight of single floret (0.71) and low indirect through days to spike appearance (0.11), number of florets per spike (0.17) and length of the floret (0.10). Negligible influence was exhibited through number of leaves (0.02), spike length (0.08), rachis length (0.02) and duration of flowering (0.07) whereas other characters exerted negative indirect effect. Results are in consonance with the findings of Ranchana *et al.* (2015) in tuberose. Number of leaves evidenced low positive indirect effect on spike yield per plant through length of the floret (0.15) and negligible positive indirect effect through plant height (0.01), days to spike appearance (0.07), spike length (0.01), diameter of the floret (0.04), matured bud weight (0.07) and duration of flowering (0.00) whereas other characters showed negative effect. In contradiction to this Ranchana *et al.* (2015) recorded strong positive

Table 2: Direct and indirect effects of component characters on yield of tuberose cultivars single.

Character	Plant height	No. of leaves	Days to spike appearance	Spike length	Rachis length	No. of florets per spike	Length of the floret	Flower tube length	Diameter of the floret	Weight of single floret	Matured bud weight	Duration of flowering	Correlation factor with Number of spikes per clump
Plant height	0.16	0.02	0.11	0.08	0.02	0.17	0.10	-0.07	-0.21	0.71	-0.84	0.07	0.33*
No. of leaves	0.01	0.17	0.07	0.01	-0.02	-0.01	0.15	-0.28	0.04	-0.09	0.07	0.00	0.15
Days to spike appearance	-0.05	-0.03	-0.36	0.01	-0.01	-0.18	-0.30	0.11	0.12	-0.75	0.79	-0.20	-0.84**
Spike length	0.04	0.00	-0.01	0.27	0.02	-0.14	0.14	-0.29	-0.08	0.49	-0.39	0.03	0.10
Rachis length	0.04	-0.05	0.04	0.07	0.09	-0.03	0.47	-0.21	-0.57	1.24	-1.04	0.25	0.30
Number of florets per spike	0.06	-0.00	0.14	-0.08	-0.00	0.45	-0.02	0.04	-0.12	0.32	-0.42	-0.01	0.34*
Length of the floret	0.01	0.03	0.13	0.04	0.05	-0.01	0.84	-0.44	-0.62	0.88	-0.82	0.21	0.32
Flower tube length	0.01	0.07	0.05	0.11	0.02	-0.02	0.53	-0.70	-0.26	0.55	-0.45	0.14	0.07
Diameter of the floret	0.04	-0.01	0.05	0.02	0.06	0.07	0.67	-0.23	-0.78	0.98	-0.90	0.23	0.24
Weight of single floret	0.07	-0.01	0.18	0.09	0.07	0.10	0.50	-0.26	-0.51	1.48	-1.37	0.29	0.63**
Matured bud weight	0.09	-0.01	0.20	0.07	0.06	0.13	0.49	-0.22	-0.50	1.44	-1.40	0.29	0.66**
Duration of flowering	0.03	0.00	0.18	0.02	0.05	-0.01	0.44	-0.23	-0.43	1.06	-1.00	0.41	0.52**

Residual effect =0.342.

indirect effect through plant height, spike length and duration of flowering in tuberose.

Days to spike appearance recorded very high positive indirect effect through matured bud weight (0.79), low indirect effect through floret tube length (0.11) and diameter of the floret (0.12) and negligible positive effect through spike length (0.01) whereas other characters exerted negative indirect effect.

Spike length showed high positive indirect effect through weight of single floret (0.49), low positive indirect effect through length of the floret (0.14), negligible indirect effect through plant height (0.04), number of leaves (0.00), rachis length (0.02) and duration of flowering (0.03) whereas other characters exhibited negative indirect effect. Similar observations were recorded by Vetrivel (2010) in gladiolus and Ranchana *et al.* (2015) in tuberose. Rachis length recorded very high positive indirect effect through weight of single floret (1.24) and length of the floret (0.47) showed high positive indirect effect, moderate effect was shown by duration of flowering (0.25) and negligible positive indirect effect through plant height (0.04), days to spike appearance(0.04) and spike length (0.07) whereas other characters showed negative indirect effect. Similar observations were also recorded by Ranchana *et al.* (2015).

Number of florets per spike recorded high positive indirect effect for spike yield per plant through weight of single floret (0.32) and low negative effect through days to spike appearance (0.14). Negligible positive indirect effect through plant height (0.06) and flower tube length (0.04) whereas other characters showed negligible positive and negative indirect effect. Results of the present study derive support from the findings of Ranchana *et al.* (2015) in tuberose. Length of the floret recorded very high positive indirect effect through weight of single floret (0.88), moderate effect through duration of flowering (0.21), low positive indirect effect through days to spike appearance (0.13) and negligible positive effect through plant height (0.01), number of leaves (0.03), spike length (0.04) and rachis length (0.05) while other characters showed negative indirect effect. Results are in consonance with the findings of Ranchana *et al.* (2015) in tuberose.

Floret tube length floret recorded high positive indirect effect through weight of single floret (0.55), length of floret (0.53) and low positive effect through duration of flowering (0.14), spike length (0.11), negligible positive indirect effect through plant height (0.01), number of leaves per clump (0.07), days to spike appearance (0.05) and rachis length (0.02) whereas other characters showed negative indirect effect. Diameter of the floret recorded high positive indirect effect through weight of single floret (0.98), length of the floret (0.67), moderate effect through duration of flowering (0.23) and negligible positive effect through plant height (0.04), days to spike appearance (0.05), spike length (0.02), rachis length (0.06) and number of florets per spike (0.07) while other characters showed negative indirect effect.

Weight of single floret recorded high positive indirect effect through length of the floret (0.50), moderate positive effect through duration of flowering (0.29), low positive effect through days to spike appearance (0.18), number of florets per spike (0.10) and negligible positive effect through plant height (0.07), spike length (0.09) and rachis length (0.07) whereas other characters showed negative indirect effect. Matured bud weight recorded very high positive indirect effect through weight of the single floret (1.44), high positive indirect effect through length of the floret (0.49), moderate high positive indirect effect through days to spike appearance (0.20), duration of flowering (0.29) low positive indirect effect was shown by number of florets per spike (0.13) whereas other characters showed negative indirect effect. Duration of flowering recorded very high positive indirect effect through weight of single floret (1.06), high positive indirect effect was recorded by length of the floret (0.44), low positive indirect effect was exhibited by days to spike appearance (0.18) whereas other characters showed negative indirect effect. This is in consonance with the findings of Ranchana *et al.* (2015) and Saravanakumar (2000).

CONCLUSION

It is evident from the association analysis that the characters plant height, rachis length, number of florets per spike, weight of single floret, matured bud weight, duration of flowering need to be given importance for selection during breeding for flower yield in tuberose.It could be inferred from the results of path analysis of single genotypes that the characters *viz.* plant height, number of leaves, days to spike appearance, spike length, rachis length, number of florets per spike, length of the floret, flower tube length, diameter of the floret, weight of single floret, matured bud weight, duration of flowering are reliable indices for selection of genotypes for flower yield.

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