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Studies on Component Characters Association with Flower Yield of Dahlia (*Dahlia variabilis* L.) Genotypes

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Thirty five genotypes of dahlia (*Dahlia variabilis* L.) were studied for fifteen different growth, flowering, quality and yield traits for the association of different characters with flower yield per plant (g). The results indicated a significant and desirable correlation between flower yield per plant with the characters like number of secondary branches per plant, number of leaves, leaf area, duration of the crop, flower diameter, number of petals per flower, stalk length, individual flower weight, number of flowers per plant, number of tubers per plant at genotypic and phenotypic level respectively.. This provides a knowledge regarding association of various characters among themselves and to estimate the inherent association between genes.

Keywords: Genotypes; correlation.

1. INTRODUCTION

Dahlia (*Dahlia variabilis* L.) is a bushy, tuberous, herbaceous perennial and dicot plant native to Mexico and belongs to family Asteraceae (Compositae). Other flowers from this family are sunflower, daisy, chrysanthemum, marigold, *phlox* and zinnia. There are 85 species in the

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dahlia genus, with hybrids commonly grown as garden plants. It is valued for gorgeous attractive spectacular flowers with multitude of colours, variation in sizes ranging from miniature to giant. Dahlia has great diversity, resulted from it is being octoploid (2n=8x=64) that have eight sets of homologous chromosomes, whereas most plants have only two sets of chromosome [1].

Knowledge regarding association of various characters among themselves and economic characters is necessary for making indirect selection for improvement. The expression of a character in a plant is the consequence of a chain of inter-relationships between characters either directly or through other events. Character association on correlation is a measure of the degree of association between two characters. Correlation studies helps to know the association prevailing between highly heritable characters with most economic characters and gives better understandings on the contribution of each trait in building up of the genetic makeup of the crop. The phenotypic correlations indicate the extent of observed relationship because it includes both heritable and non heritable association. Genotypic correlations provide an estimate of inherent association between genes controlling any two characters. Hence, it is of greater significance and could be effectively utilized in formulating an effective selection scheme [2].

2. MATERIALS AND METHODS

The experiment was conducted to study the correlation of the different morphological characters influencing the flower yield in different genotypes of dahlia (*Dahlia variabilis* L.) genotypes. The experimental material comprised of thirty five genotypes such as HUBD-1 (Horticulture University of Bagalkot Dahlia) to HUBD-35. The genotypes were planted according to randomized block design with two replications at in the Department of Floriculture and Landscape Architecture, College of Horticulture, Sirsi, University of Horticultural Sciences, Bagalkot, Karnataka, India. The plants were planted at a spacing of 60 cm X 45 cm and all the recommended package of practices was followed to raise the good crop. The characters *viz,* plant height (cm), number of secondary branches, number of leaves, leaf area (cm^2), number of days taken to first flowering, duration of flowering (days), duration of the crop (days), flower diameter (cm), number of petals per flower, shelf life (days), stalk length (cm), individual flower weight (g), number of flowers per plant, individual tuber weight (g) and number of tubers per plant. The vegetative parameters like plant height, number of secondary branches, number of leaves and leaf area were taken taken at 120 days after transplanting. Mean values were subjected to analysis of variance, the correlation coefficients among all possible character combinations at phenotypic and genotypic level were estimated employing formula given by Al-Jibourie et al. [3].

3. RESULTS AND DISCUSSION

The correlation studies were carried out to know the nature of relationship existing between growth, flower, yield and quality contributing characters at both genotypic and phenotypic levels. The results obtained are given in the Table 1 and Table 2 respectively. In the present investigation genotypic correlation is more than the phenotypic correlation indicating the presence of inherent association between various characters. Among fifteen characters studied the characters *viz*., plant height (0.746 and 0.695), number of secondary branches per plant (0.560 and 0.545), number of leaves (0.758 and 0.715), leaf area (0.642 and 0.591), duration of the crop (0.690 and 0.532), flower diameter (0.320 and 0.322), number of petals per flower (0.384 and 0.373), stalk length (0.433 and 0.401), individual flower weight (0.464 and 0.479) number of flowers per plant (0.812 and 0.804), number of tubers per plant (0.4127 and 0.3939) showed significant positive correlation. While, number of days taken to first flowering (-0.645, and -0.533) showed significant negative correlation. However non significant negative correlation was recorded in tuber weight (-0.1101, -0.1238) at genotypic and phenotypic level respectively.

Plant height showed significant positive association with number of secondary of branches (0.643 and 0.606), number of leaves (0.738 and 0.678), duration of the crop (0.797 and 0.585), flower diameter (0.258 and 0.244), stalk length (0.406 and 0.357), number of flowers per plant (0.687 and 0.648) and number of tubers per plant (0.294 and 0.263) at genotypic and phenotypic level respectively. While, leaf area (0.691) at phenotypic level only. Whereas, non significant positive correlation for duration of flowering (0.041 and 0.048), number of petals per flower (0.23 and 0.21), individual flower weight (0.206 and 0.196), shelf life (0.075 and 0.041), individual tuber weight (0.133 and 0.196). However, it exhibited significant negative

correlation for the days taken to first flowering (-0.577 and -0.439) at genotypic and phenotypic level respectively. This suggests that, simultaneous selection for these characters would be effective in improving total flower yield per plant. The selection of taller plant results in wider canopy and more leaves increases photosynthetic area in turn leads to higher yield. Similar results were reported by Raghupathi et al. [4] in dahlia and in chrysanthemum by Prakash et al. [5].

Number of secondary branches showed significant positive association with number of leaves (0.745 and 0.704), leaf area (0.661 and 609), duration of the crop (0.841 and 0.595), number of flowers per plant (0.587 and 0.572) and number of tubers per plant (0.391 and 0.369). While, non significant positive association was found with flower diameter (0.187 and 0.167), stalk length (0.01 and 0.006), individual flower weight (0.025 and 0.036) and tuber weight (0.229 and 0.208). However, it showed significant negative correlation with days taken to first flowering (-0.672 and -0.552) also registered non significant negative association with duration of flowering (-0.001 and -0.026), shelf life (-0.109 and -0.106) at both genotypic and phenotypic level respectively. Because, dahlia flowers borne on current season growth, so more number of branches results in higher flower yield. This trend was confirmed by the results of Basavaraj [6] and Choudhary [7] in dahlia while, in chrysanthemum recorded by Telem et al. [8].

Number of leaves showed significant positive association with leaf area (0.769 and 0.740), duration of the crop (0.832 and 0.683), number of flowers per plant (0.768 and 0.745), number of tubers per plant (0.466 and 0.440) while, it showed non significant positive correlation with flower diameter (0.102 and 0.085), number of petals per flower (0.06 and 0.049), shelf life (0.139 and 0.139), stalk length (0.196 and 0.196), individual flower weight (0.069 and 0.048) and tuber weight (0.012 and 0.012) at both genotypic and phenotypic level Whereas, non significant negative correlation was noticed in duration of flowering (-0.015) at genotypic level and days taken to first flowering (-0.649) at phenotypic level. Because leaves help to provide food for plants, which in turn helps in increase the yield of flowers. These results were confirmed by the results of Vikas et al. [9] in dahlia and in China aster by Harishkumar et al. [10]. Leaf area showed significant positive association with duration of the crop (0.754 and 0.554), number of flowers per plant (0.640 and 0.608), number of tubers per plant (0.316 and 0.291) while, it showed non significant positive correlation with duration of flowering (0.055 and 0.065), flower diameter (0.141 and 0.125), number of petals per flower (0.179 and 0.141), shelf life (0.19 and 0.188) and individual flower weight (0.13 and 0.106). However significant negative correlation was registered for days taken to first flowering (-0.556 and -0.423) whereas, non significant negative correlation with stalk length (-0.013 and -0.012) and individual tuber weight (-0.035 and -0.016) at genotypic and phenotypic level respectively. These findings were confirmed by Patel et al. [11] in marigold and Tirakannanavar et al. [12] in China aster.

Number of days taken to first flowering showed significant positive association with duration of the crop (0.567) at phenotypic level. Significant negative association with number of flowers per plant (-0.647, -0.552) and number of tubers per plant (-0.374, -0.267) at genotypic and phenotypic level respectively, while duration of the crop (-0.672), flower diameter (-0.001) shelf life (-0.093), stalk length (-0.15) and flower weight (-0.06) at genotypic level, also found non-significant negative correlation for duration of flowering (-0.116,), flower diameter (-0.019), number of petals per flower (-0.158), shelf life (-0.103), stalk length (-0.123) and flower weight (-0.079). It had non significant positive correlation with tuber weight (0.014) and duration of flowering (0.087) at phenotypic level. Duration of flowering had significant positive correlation with flower diameter (0.417 and 0.264), flower weight (0.467 and 0.336) and non significant positive correlation with shelf life (0.213 and 0.133), individual tuber weight (0.145 and 0.057) while, non significant negative correlation for duration of the crop (-0.158 and -0.043), number of petals per flower (-0.005 and -0.044), stalk length (-0.066 and -0.036), number of flowers per plant (-0.222 and -0.168) and number of tubers per plant (-0.091 and -0.046) at both genotypic and phenotypic level respectively. This similar trend was noticed in dahlia by Basavaraj [6] and Vikas et al. [9]. Duration of crop had significant positive correlation with number of flowers per plant (0.699 and 0.547), number of tubers per plant (0.478 and 0.318) at genotypic and phenotypic level respectively, individual tuber weight (0.241) at phenotypic level. While, non significant positive correlation with flower diameter (0.211 and 0.167), number of flowers per plant (0.061 and 0.078), stalk length (0.103 and 0.116), flower weight (0.058 and 0.037) at genotypic and

Table 1. Genotypic correlation among different characters on flower yield per plant

Character	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	**1**	0.643**	0.738**	0.691**	-0.577**	0.041	0.797**	0.258*	0.23	0.075	0.406**	0.206	0.687**	0.133	0.294*
2		**1**	0.745**	0.661**	-0.672**	-0.001	0.841**	0.187	-0.006	-0.109	0.01	0.025	0.587**	0.229	0.391**
3			**1**	0.769**	-0.758**	-0.015	0.832**	0.102	0.06	0.139	0.196	0.069	0.768**	0.012	0.466**
4				**1**	-0.556**	0.055	0.754**	0.141	0.179	0.19	-0.013	0.13	0.640**	-0.035	0.316**
5					**1**	-0.116	-0.672**	-0.019	-0.158	-0.103	-0.123	-0.079	-0.647**	0.014	-0.374**
6						**1**	-0.158	0.417**	-0.005	0.213	-0.066	0.467**	-0.222	0.145	-0.091
7							**1**	0.211	0.061	-0.12	0.103	0.058	0.699**	0.226	0.478**
8								**1**	0.234	-0.368**	0.350**	0.767**	-0.168	0.359**	-0.055
9									**1**	0.511**	0.227	0.407**	0.232	0.048	0.033
10										**1**	0.035	0.029	0.369**	-0.451**	0.034
11											**1**	0.470**	0.134	0.095	-0.014
12												**1**	-0.121	0.129	-0.044
13													**1**	-0.193	0.490**
14														**1**	-1141
15															**1**

*Flower yield per plant 0.746**, 0.560**, 0.758**, 0.642**, -0.645**, 0.049, 0.690**, 0.320**, 0.384**, 0.276*, 0.433**, 0.464**, 0.812**, -0.1101, 0.4127. * & ** indicates significant @ 5 % and 1 % level respectively. 1. Plant height, 2. Number of secondary branches, 3. Number of leaves, 4.Leaf area, 5. Number of days taken to first flowering, 6. Duration of flowering, 7. Duration of the crop, 8. Flower diameter, 9. Number of petals per flower, 10. Shelf life, 11. Stalk length, 12. Flower weight, 13. Number of flowers per plant, 14.Tuber weight, 15.Number of tubers per plant*

Table 2. Phenotypic correlation among different characters on flower yield per plant

Character	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	**1**	0.606**	0.678**	0.639**	-0.439**	0.048	0.585**	0.244*	0.21	0.041	0.357**	0.196	0.648**	0.081	0.263*
2		**1**	0.704**	0.609**	-0.552**	-0.026	0.595**	0.167	0.008	-0.106	0.006	0.036	0.572**	0.208	0.369**
3			**1**	0.740**	-0.649**	0.007	0.683**	0.085	0.049	0.139	0.196	0.048	0.745**	0.012	0.440**
4				**1**	-0.423**	0.065	0.554**	0.125	0.141	0.188	-0.012	0.106	0.608**	-0.016	0.291*
5					**1**	0.087	-0.567**	-0.001	-0.142	-0.093	-0.15	-0.06	-0.552**	-0.033	-0.267*
6						**1**	-0.043	0.264*	-0.044	0.133	-0.036	0.336**	-0.168	0.057	-0.046
7							**1**	0.167	0.078	-0.078	0.116	0.037	0.547**	0.241*	0.318**
8								**1**	0.215	-0.332**	0.310**	0.752**	-0.16	0.322**	-0.052
9									**1**	0.460**	0.217	0.402**	0.215	0.059	0.032
10										**1**	0.033	0.039	0.347**	-0.354**	0.005
11											**1**	0.431**	0.127	0.071	-0.016
12												**1**	-0.115	0.11	-0.049
13													**1**	-0.098	0.457**
14														**1**	0.377**
15															**1**

*Flower yield per plant 0.695**, 0.545**, 0.715**, 0.591**,-0.533**,0.029, 0.532**,0.322**,0.373**,0.266,0.401**,0.479**,0.804**,-0.1238, 0.3939. * & ** indicates significant @ 5 % and 1 % level respectively. 1. plant height, 2. Number of secondary branches, 3. Number of leaves, 4. Leaf area, 5. Number of days taken to first flowering, 6. Duration of flowering, 7. Duration of the crop, 8. Flower diameter, 9. Number of petals per flower, 10. Shelf life, 11. Stalk length, 12. Flower weight, 13. Number of flowers per plant, 14. Tuber weight, 15. Number of tubers per plant*

phenotypic level respectively and individual tuber weight (0.226) at genotypic level. Whereas, non significant negative correlation for shelf life (-0.12), stalk length (-0.078) at phenotypic level. More the duration of the crop, more flowers for longer period. Similar results were inlined with the result of Sirohi and Behera [13] in chrysanthemum.

Flower diameter showed significant positive correlation with stalk length (0.350 and 0.310), individual flower weight (0.767 and 0.752) and individual tuber weight (0.359 and 0.322) while, non significant positive association with number of petals per flower (0.234 and 0.215) whereas, non significant negative association for number of tubers per plant (-0.055 and -0.052) at genotypic and phenotypic level respectively. Whereas it was having significant negative correlation number of flowers per plant (-0.16) and shelf life (-0.368) at phenotypic level. Number of petals per flower showed significant positive correlation with shelf life (0.511 and 0.460) and individual flower weight (0.407 and 0.402) whereas, non significant positive association with stalk length (0.227 and 0.217), number of flowers per plant (0.232 and 0.215), individual tuber weight (0.048 and 0.059) and number of tubers per plant (0.033 and 0.032) at genotypic and phenotypic level respectively. Shelf life of flower showed significant positive correlation with number of flowers per plant (0.369 and 0.347) and significant negative correlation with individual tuber weight (-0.451 and -0.354) while, non significant positive association with stalk length (0.035 and 0.033), flower weight (0.029 and 0.039) and number of tubers per plant (0.034 and 0.005) at phenotypic and genotypic level respectively. Stalk length showed significant positive association with flower weight (0.470 and 0.431) and significant negative correlation with number of tubers per plant (-0.014 and -0.016) whereas, non significant positive correlation with number of flowers per plant (0.134 and 0.127) and individual tuber weight (0.095 and 0.071) at phenotypic and genotypic level respectively. This kind of result was seen in dahlia by Beura [14], Basavaraj [6] and Feng et al. [15].

Flower weight was showed non significant positive correlation with tuber weight (0.129 and 0.11) and non significant negative association with number of flowers per plant (-0.121 and -0.115) and number of tubers per plant (-0.044 and -0.049) at both phenotypic and genotypic level respectively. Number of flowers per plant had significant positive correlation with number of tubers per plant (0.490 and 0.457) whereas tuber weight (-0.193 and -0.098) showed non significant negative correlation at genotypic and phenotypic level respectively. Tuber weight recorded non significant negative correlation with number of tubers (-0.1141) at genotypic level significant positive correlation with number of tubers (0.337) at phenotypic level. While more the flower weight lesser the number of flowers per plant. Similar findings were reported by Singh and Mishra [16] in dahlia whereas, Bhanupratap [17] in marigold and Hebbal et al. [18] in chrysanthemum.

4. CONCLUSION

In the present study, flower yield per plant showed significant positive correlation with plant height, number of secondary branches per plant, number of leaves, leaf area, duration of the crop, flower diameter, number of petals per flower, stalk length, individual flower weight, number of flowers per plant, number of tubers per plant. While, number of days taken to first flowering showed significant negative correlation. However, non significant negative correlation was recorded in tuber weight at genotypic and phenotypic level respectively. Hence, selection for the traits that are positively associated would be effective for flower yield improvement in dahlia.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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