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Correlation and Path-Coefficient Analysis in Chrysanthemum (*Chrysanthemum morifolium* Ramat.)

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ABSTRACT

A study was conducted to determine association between seventeen traits of twenty genotypes of chrysanthemum. The results revealed strong positive correlation of flower yield per plant with flower yield per plot, plant height at 60 days after transplanting and at full bloom, number of primary branches, plant spread (N-S and E-W direction), number of leaves per plant, stem girth and flowers yield per ha. The findings of path analysis revealed that flower yield per hectare, plant height at 60 days after transplanting, plant spread in E-W direction, stem girth, days to bud initiation, days to full bloom, fresh weight of flower and number of flowers per plant had positive direct effect on yield of flowers per plant. Hence, it is concluded from this study that flower yield can be increased by selecting these traits directly while formulating crop improvement program in chrysanthemum.

Keywords Chrysanthemum, Correlation, Path-coefficient analysis, Flowers yield.

INTRODUCTION

Chrysanthemum, which is second most important commercial flower next to rose, is an important member of Asteraceae family. Chrysanthemum is commonly used as cut and loose flowers for making bouquets, garlands and other flower arrangements, as bedding plant in garden landscape as well as most adored in the form of beautiful portable pot mums. With the time, it has gained popularity among the farmers and gardeners due to its easy cultivation and wide range of attractive colors, shape and size along with good keeping quality. There are many varieties in this crop with different flower colors, forms and shapes of flowers but still the main breeding objectives in chrysanthemum isto develop high yielding varieties. Flower yield is a most complex character and associated with different other components. Further, in chrysanthemum this becomes more complex due to availability of different groups and varieties in this crop. Therefore, for the improvement of this character, selection based on components of the

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yield will be more worthwhile. Correlation and path coefficient analysis are the important tools to know nature and magnitude of associations of characters and to measure their influence on each other. It is vital to give emphasis on yield contributing traits as well as to evaluate the degree of association of various characters in order to initiate effective selection programme. Keeping in view the above factsthis field investigation was carried out to determine the character association with loose flower yield utilizing the correlation and path analysis tools and to help breeders in improvement of chrysanthemum.

MATERIALS AND METHODS

The experiment was carried out during August 2020 to January 2021 at Floriculture field, College of Horticulture, SD Agricultural University, Jagudan, Dist Mehsana, Gujarat. The experiment was carried out under open field condition using Randomized Block Design with three replications. Transplanting of healthy and uniform rooted cuttings was done at 30cm x 30cm spacing on raised beds. The observations were recorded on five randomly selected plants for seventeen important characters viz., plant height at 60 days after transplanting and at full bloom (cm), number of primary branches, plant spread in North to South and East to West directions (cm), number of leaves per plant, stem girth (cm), days to bud initiation, days to 50% flowering, days to full bloom, flower diameter (cm), fresh weight of flower (g), number of flowers per plant, yield of flowers per plant (g), yield of flowers per plot (kg), yield of flowers per hectare (q) and shelf life (days). The estimates of correlation coefficients and path coefficients analysis were calculated as per the formula outlined by Panse and Sukhatme (1978) and Dewey and Lu (1959).

RESULTS AND DISCUSSION

The data pertaining to correlation matrix between flower yield per plant and different vegetative and flowering attributes in twenty genotypes of chrysanthemum are presented in Table 1. In the current studyflower yield per plant has been taken as dependent variable, whereas, remaining sixteentraits were taken as independent variables contributing towards flower yield per plant.

It is clear from the data that genotypic correlation coefficient was higher in magnitude than phenotypic correlation coefficient in majority of the characters which further indicates the high heritable nature of these traits. This further indicates the presence of strong inherent association between different characters but their phenotypic expression was impeded through the influence of environmental factors.

The genotypic correlation of flower yield per plant was found highly significant and has positive correlation with plant height at 60 days after transplanting, number of primary branches, plant spread in both direction (N-S and E-W), number of leaves per plant, stem girth, number of flowers per plant, yield of flowers per plot and yield of flowers per ha. Whereas, significant and positive relationship was observed for plant height at full bloom with flower yield per plant. The relationship of these characters with yield of flowers per plant is in advantageous trend and selection of these may ultimately improve the flower yield. Therefore, it is suggested to select genotypes performing well for flower yield contributing traits. These results are in line with the earlier reports of Kaur *et al.* (2018), Prakash *et al*. (2018) and Bindhushree *et al.* (2019) in chrysanthemum.

The genotypic association among days to bud initiation, days to 50 % flowering, flower diameter, fresh weight of flower and self-life were highly significant and has negative association with flower yield per plant. With the inclusion of more variables in association studies, the indirect correlation becomes more complex. Two characters may explain correlation just because they are correlated with the third one. In such circumstances, path coefficient analysis provides an effective means of finding out direct and indirect effects of association and permits a critical examination of particular forces acting to produce a given relationship and measure the relative importance of each factor. The matrix of direct and indirect effects is presented in the Table 2.

In path coefficient analysis at genotypic level, yield of flower per hectare has expressed highest positive direct effect on yield of flowers per plant followed by plant height at 60 days after transplanting, days to full bloom, fresh weight of flower, number

Table 1. Genotypic and phenotypic correlation coefficient of seventeen characters in chrysanthemum.

Characters		2	3	4	5	6	7	8	9
1	rg	0.658*	0.687**	0.673**	0.607**	0.609**	0.855**	-0.640**	-0.180
	rp	0.659**	0.532**	0.561**	0.471**	0.444**	0.530**	-0.475**	-0.131
2	rg		0.272*	0.475**	0.482**	0.239	0.019	-0.071	0.165
	rp		0.237	0.432**	0.427**	0.194	0.137	-0.044	0.129
3	rg			0.309*	0.428**	0.629**	1.114**	0.480**	-0.156
	rp			0.266*	0.332**	0.624**	0.492**	-0.471**	-0.144
4	rg				0.987**	0.202	0.467**	-0.521**	-0.405**
	rp				0.788**	0.156	0.351**	0.443**	-0.352**
5	rg					0.172	0.390**	-0.552**	-0.427**
	rp					0.115	0.331**	-0.415**	-0.322*
6	rg						0.854**	-0.347**	0.232
	rp						0.344**	-0.344**	0.215
7	rg							-0.910**	-0.448**
	rp							-0.376	-0.131
8	rg								0.676**
	rp								0.621**
9	rg								
	rp								
10	rg								
	rp								
11	rg								
	rp								
12	rg								
	rp								
13	rg								
	rp								
14	rg								
	rp								
15	rg								
	rp								
16	rg								
	rp								

Table 1. Continued.

Characters		10	11	12	13	14	15	16	17
1	rp	-0.268*	-0.017	-0.188	0.403**	0.695**	0.782**	0.121	0.728**
	rg	-0.187	0.018	-0.147	0.364**	0.570**	0.564**	0.123	0.559**
2	rp	0.037	0.555**	0.440**	-0.136	0.158	0.347**	0.445**	0.313*
	rg	0.028	0.476**	0.364**	-0.091	0.147	0.283	0.407**	0.255*
3	rp	-0.076	-0.319*	-0.469**	0.711**	0.759**	0.746**	-0.119	0.726**
	rg	-0.070	-0.304*	-0.440**	0.692**	0.702**	0.677**	-0.115	0.711**
4	rp	-0.386**	0.327*	0.112	0.173	0.518**	0.642**	0.400**	0.610**
	rg	-0.348**	0.268*	0.110	0.148	0.423**	0.500**	0.346**	0.514**
5	rp	-0.342**	0.479**	0.224	0.147	0.409**	0.641**	0.344**	0.643**
	rg	-0.277	0.347**	0.201	0.125	0.303	0.425**	0.282	0.507**
6	rp	0.190	-0.440**	-0.423**	0.540**	0.645**	0.611**	-0.060	0.587**
	rg	0.185	-0.411**	-0.397**	0.525**	0.592**	0.557**	-0.062	0.571**
7	rp	-0.382**	-0.410**	-0.890**	1.112**	1.299**	1.246**	-0.419**	1.011**
	rg	-0.113	-0.226	-0.335**	0.463**	0.478**	0.398**	-0.157	0.481**
8	rp	0.606**	0.006	0.265	-0.220	-0.397**	-0.490**	-0.160	-0.513**
	rg	0.585**	-0.004	0.243	-0.216	-0.373**	-0.463**	-0.159	-0.499**
9	rp	0.965**	-0.160	-0.119	0.069	-0.126	-0.279*	-0.240	-0.280*
	rg	0.921**	-0.118	-0.061	0.048	-0.111	-0.223	-0.228	-0.248
10	rp		-0.155	-0.176	0.127	-0.137	-0.264*	-0.261	-0.242
	rg		-0.14	-0.144	0.118	-0.124	-0.244	-0.246	-0.223

Table 1. Continued.

Characters		10	11	12	13	14	15	16	17
11	rp			0.827**	-0.655**	-0.482**	-0.183	0.573**	-0.125
	rg			0.761**	-0.604**	-0.426**	-0.131	0.537**	-0.094
12	rp				-0.717**	-0.576**	-0.301	0.500**	-0.243
	rg				-0.664**	-0.490**	-0.272	0.461**	-0.211
13	rp					0.863**	0.684**	-0.486**	0.650**
	rg					0.820**	0.618**	-0.462**	0.624**
14	rp						0.922**	-0.150	0.862**
	rg						0.878**	-0.136	0.800**
15	rp							0.130	1.014**
	rg							0.120	0.908**
16	rp								0.162
	rg								0.159

* Significant at p= 5% level and ** significant at p= 1% level.

1 Plant height 60 DAT (cm)
2 Plant height at full bloom (cm)
3 Number of primary branches
4 Plant spread (N-S) (cm)
5 Plant spread (E-W) (cm)
6 Number of leaves per plant
7 Stem girth (cm)
8 Days to bud initiation
9 Days to 50% flowering
10 Days to full bloom
11 Flower diameter (cm)
12 Fresh weight of flower (g)
13 Number of flowers per plant
14 Yield of flowers per plot (kg)
15 Yield of flowers per ha (q)
16 Shelf life (days)
17 Yield of flowers per plant (g)

of flowers per plant, shelf life, days to bud initiation and stem girth. This might be due to morphological as well as reproductive growth habit of genotypes leading to increased yield of flowers. These results are in line with the finding of Kameswari *et al.*(2015) and Beeralingappa *et al.*(2019) in chrysanthemum crop.

Among the negative direct effect, yield of flowers per plot showed highest negative direct effect on yield of flowers per plant followed by days to 50% flowering, plant height at full bloom, plant spread (N-S), flower diameter and number of leaves per plant. This could be due to the growth habit and regional adaptability of certain genotypes,resulting in more morphological growth than the reproductive growth leading to reduced yield of flowers. The results are similar with the finding of Kumar *et al.* (2012) and Misra *et al.* (2013) in chrysanthemum.

The path analysis revealed residual effect of -0.0876 suggesting that there were few more component traits other than those included in the present

Table 2. Genotypic path coefficient among yield and yield attributing characters in chrysanthemum.

Traits	PH (60)	PH (FB)	PB	PS (N-S)	PS(E-W)	NL	SG	BI	DF
PH (60)	**0.6874**	-0.2764	-0.1001	-0.0986	0.0173	-0.0626	0.0837	-0.1155	0.0815
PH(FB)	0.4526	**-0.4198**	-0.0397	-0.0695	0.0138	-0.0245	0.0019	-0.0128	-0.0748
PB	0.4722	-0.1144	**-0.1457**	-0.0452	0.0122	-0.0647	0.1092	-0.0867	0.0704
PS (N-S)	0.4629	-0.1992	-0.0449	**-0.1463**	0.0282	-0.0208	0.0458	-0.0941	0.1831
PS(E-W)	0.4174	-0.2025	-0.0623	-0.1445	**0.0286**	-0.0177	0.0382	-0.0996	0.1931
NL	0.4188	-0.1001	-0.0916	-0.0296	0.0049	**-0.1028**	0.0837	-0.0627	-0.1047
SG	0.5874	-0.0080	-0.1623	-0.0684	0.0111	-0.0878	**0.0980**	-0.1643	0.2025
BI	-0.4396	0.0297	0.0700	0.0763	-0.0158	0.0357	-0.0892	**0.1805**	-0.3056
DF	-0.1239	-0.0695	0.0227	0.0593	-0.0122	-0.0238	-0.0439	0.1221	**-0.4520**
DFB	-0.1840	-0.0156	0.0111	0.0565	-0.0098	-0.0195	-0.0374	0.1093	-0.4362
FD	-0.0114	-0.2331	0.0465	-0.0478	0.0137	0.0452	-0.0402	0.0011	0.0722
WF	-0.1290	-0.1847	0.0683	-0.0164	0.0064	0.0435	-0.0872	0.0478	0.0539
FPP	0.2768	0.0572	-0.1036	-0.0253	0.0042	-0.0556	0.1090	-0.0397	-0.0313
YPP	0.4774	-0.0661	-0.1106	-0.0758	0.0117	-0.0663	0.1273	-0.0716	0.0570
YPH	0.5374	-0.1457	-0.1086	-0.0940	0.0183	-0.0628	0.1221	-0.0885	0.1262
SL	0.0829	-0.1868	0.0173	-0.0585	0.0098	0.0062	-0.0410	-0.0289	0.1083

Table 2. Continued.

Traits	DFB	FD	WF	FPP	YPP	YPH	SL	Correlation with yield of flowers per plant
PH (60	-0.1615	0.0020	-0.0450	0.0738	-0.4870	1.1096	0.0187	0.728**
PH(FB	0.0224	-0.0687	0.1055	-0.0250	-0.1105	0.4927	0.0692	0.313*
PB	-0.0459	0.0395	-0.1124	0.1305	-0.5326	1.0583	-0.0184	0.726**
PS (N-S)	-0.2328	-0.0404	0.0268	0.0317	-0.3634	0.9115	0.0622	0.610**
PS (E-W)	-0.2061	-0.0592	0.0536	0.0269	-0.2867	0.9098	0.0536	0.643**
NL	0.1145	0.0544	-0.1014	0.0991	-0.4525	0.8668	-0.0093	0.587**
SG	-0.2304	0.0507	-0.2132	0.2039	-0.9112	1.7678	-0.0652	1.011**
BI	0.3653	-0.0008	0.0634	-0.0403	0.2782	-0.6956	-0.0248	-0.513**
DF	0.5823	0.0198	-0.0286	0.0127	0.0885	-0.3964	-0.0373	-0.280*
DFB	**0.6033**	0.0192	-0.0422	0.0233	0.0959	-0.3750	-0.0406	-0.242
FD	-0.0935	**-0.1236**	0.1983	-0.1200	0.3378	-0.2596	0.0892	-0.125
WF	-0.1061	-0.1023	**0.2396**	-0.1315	0.4042	-0.4276	0.0778	-0.243
FPP	0.0766	0.0809	-0.1718	**0.1834**	-0.6053	0.9704	-0.0756	0.650**
YPP	-0.0825	0.0596	-0.1381	0.1583	**-0.7012**	1.3080	-0.0244	0.863**
YPH	-0.1594	0.0226	-0.0722	0.1254	-0.6463	**1.4193**	0.0202	0.684**
SL	-0.1574	-0.0709	0.1198	-0.0891	0.1101	0.1844	**0.0187**	-0.486**

Significant at p= 5% level and** significant at p= 1% level. Residual effect= -0.0876.

1	PH (60)	Plant height 60 DAT (cm)	7	SG	Stem girth (cm)	13	FPP	Number of flowers per plant
2	PH(FB)	Plant height at full bloom (cm)	8	BI	Days to bud initiation	14	YPP	Yield of flowers per plot (kg)
3	PB	Number of primary branches	9	DF	Days to 50% flowering	15	YPH	Yield of flowers per ha (q)
4	PS(N-S)	Plant spread (N-S) (cm)	10	DFB	Days to full bloom	16	SL	Shelf life (days)
5	PS (EW)	Plant spread (E-W) (cm)	11	FD	Flower diameter (cm)	17	Yield of flowers per plant (g)	
6	NL	Number of leaves per plant	12	WF	Fresh weight of flower (g)			

investigation which had negligible influence on the flower yield per plant. Path analysis showed that yield of flowers per ha, plant height at 60 days after transplanting, plant spread in E-W direction, stem girth, days to bud initiation, days to full bloom, fresh weight of flower and number of flowers per plant at genotypic and phenotypic level expressed highest positive direct effect on yield of flowers per plant. Hence, selection of these characters will help to improve flower yield.

REFERENCES

Beeralingappa P, Kumar H, Hegde PP, Chandrashekhar SY (2019) Correlation and path coefficient analysis for yield contributing parameters in chrysanthemum (*Dendranthema gran diflora* Tzvelev). *Int J Curr Microbiol Appl Sci* 8(7): 2564-2574.

Bindhushree MP, Patil BC, Shiragur M, Patil SR, Bhat AM, Masuthi DA (2019) Correlation and path analysis in annual chrysanthemum (*Chrysanthemum coronarium* L.). *Int J Curr Microbiol Appl Sci* 8(9): 936-942.

Dewey DR, LuK N (1959) A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agron J* 51: 515-518.

Kameswari PL, Pratap M, Hameedunnisabegum, Anuradha G (2015) Studies on genetic variability and character association for yield and its attributes in chrysanthemum (*Dendranthema grandiflora* Tzvelev). *Agric Sci Dig* 35(1): 25-30.

Kaur M, Dahiya DS, Kumar S, Yadav G, Malik A (2018) Appraisal for flower yield and genetic correlation of chrysanthemum (*Chrysanthemum morifolium*) genotypes in semi-arid Haryana. *J Pharmacog Phytochem* 7(4): 1267-1272.

Kumar M, Kumar S, Singh MK, Malik Sand, Kumar A (2012) Studies on correlation and path analysis in chrysanthemum (*Dendranthema grandiflora* Tzvelev). *Int J Pl Res* 25(2): 62-65.

Misra S, Mandal T, Vanlalruati, Das SK (2013) Correlation and path coefficient analysis for yield contributing parameters in spray chrysanthemum. *J Hortic Lett* 3(1): 14-16.

Panse VG, Sukhatme PV (1978) Statistical methods for agricultural workers. 3rd edn. ICAR Publication, New Delhi.

Prakash A, Kumar M, Singh C, Kumar A, Badal DS, Singh S (2018) Correlation and path analysis studies in chrysanthemum (*Dendranthema grandiflora*Tzvelev). *J Pharmacog Phytochem* 7(2): 3890- 3893.