

Correlation and Path Co-Efficient Analysis in F₂ Segregating Population of “AAC-1×Arka Poornima” Cross in China aster (*Callistephus chinensis* [L.] Nees.)

Harishkumar K.^{1*}, Mukund Shiragur², Balaji S. Kulkarni³, B. C. Patil⁴ and Sandhyarani Nishani⁵

^{1,2,3,4}Department of Floriculture and Landscape Architecture

⁵Department of Biotechnology and Crop Improvement

Kittur Rani Channamma College of Horticulture, Arabhavi, Karnataka, India

*Corresponding Author E-mail: harishhassan92@gmail.com

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ABSTRACT

The correlation and path coefficient analysis were worked out for F₂ segregating population of AAC-1×Arka Poornima in China aster for 19 and 9 characters, respectively. The correlation study revealed that number of branches, number of leaves per plant, leaf area, plant spread in (North-South and East-West), number of flowers per plant, individual flower weight (g), weight of 10 flowers (g), flower diameter (cm), ray florets length (cm) and disc diameter (cm) were found to positively correlated with flower yield. Path analysis revealed that number of flowers per plant, individual flower weight (g) and flower diameter (cm) had maximum positive direct effect on yield of flowers. Hence, these traits deserve greater weightage than other traits while formulating selection in F₂ segregating population of AAC-1×Arka Poornima in China aster.

Key words: China aster, Correlation and Path co-efficient

INTRODUCTION

China aster (*Callistephus chinensis* [L.] Nees.) is a semi hardy annual and commercial flower crop belonging to the family Asteraceae. The present day China aster had been developed from single wild species. According to Emsweller *et al.*⁴ the original plant had single flower with two to four rows of blue, violet or white ray florets. The first change in the flower type had been the prolongation or development of central florets and the production of quilled flowers. China aster is a self pollinated crop, but the natural crossing is approximately 10 per cent as reported by Fleming⁵ and Strube¹⁶ described floral biology

of China aster. Development of high yielding varieties with better quality blooms has been main objective of most of the breeding programmes. Heritability of yield and flower quality are complex characters and known to be collectively influenced by various polygenically inherited traits which are highly vulnerable to environmental effects. Hence, for an effective and efficient selection of genotypes in China aster for yield and quality parameters, the knowledge of direction and magnitude of association between yield, quality and its components and within components themselves become necessary.

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The path coefficient analysis method splits the correlation coefficients into direct and indirect effects which help in assessing the relative influence of each important character on the ultimate yield and flower quality. With this background information, a study on correlation and path coefficient analysis was undertaken for F₂ segregating population 'AAC-1×Arka Poornima' in China aster.

MATERIAL AND METHODS

The study was undertaken during the year 2015-2016 at Department of Floriculture and Landscape Architecture, Kittur Rani Channamma College of Horticulture, Arabhavi. The F₂ population of cross AAC-1 × Arka Poornima is selected based on the superior yield and yield contributing characters. The parent AAC-1 is pure line maintained at the department with yield of 50 flowers per plant, flower diameter of 6cm and pink color flowers and Arka Poornima with flower yield per plant of 25 flowers, flower diameter of 5cm and white color flowers. The crop was raised during 2015. 45days old seedling were transplanted to main field with spacing of 30×30cm. observation were recorded in 250 plant population on single plant basis for plant height (cm), number of branches, number of leaves per plant, flower stalk length (cm), flower diameter (cm), ray florets length (cm), disc diameter (cm), days taken for flower bud initiation (days), duration of flowering (days), number of flowers per plant, individual flower weight (g) and flower yield (g/plant). A total of 250 plants reading were recorded on different quantitative and qualitative traits. The observed data were subjected to statistical analysis. The estimates of correlation coefficient were done by the method suggested by Al-jibouri *et al.*¹. The path coefficient analysis was carried out by using the technique outlined by Dewey and Lu³ for flower yield and its components keeping flower yield as resultant variable and its component as causal variables.

RESULTS AND DISCUSSION

Correlation measures the degree of association between the characters. The information on correlation between the important economic

traits are of considerable usefull in the selection programme, because correlation ensures simultaneous improvement in one or two or more variables and negative correlation bring out the need to obtained a compromise between the desirable traits. Correlation between the characters may be due to either pleiotrophy or genetic linkage. It is possible to break the association due to genetic linkage through genetic manipulations, while the association due to pleiotrophy is not easy. Knowledge of association of various characters among themselves and also with economic characters provides necessary information on indirect selection for improvement of economic characters. The relationship could be obtained from simple correlation coefficients, which will aid in determining the direction and number of characters to be considered in improving economic characters.

High correlation between two characters indicates that selection for the improvement of one character leads to the simultaneous improvement in the other characters, depending upon the magnitude of association between them and selection for a character independent when weak correlation exists between them and selection for a character may not affect the other.

The phenotypic correlation coefficients between different characters in Chain aster are presented in Table 1.

The flower yield per plant recorded significant and positive correlation with other traits. High and significant correlation was observed for number of flowers per plant (0.713) followed by individual flower weight (0.636), weight of ten flowers (0.620), flower diameter (0.284), number of leaves per plant (0.253), ray florets length (0.197), leaf area (0.172), number of branches (0.162), plant spread in north-south (0.159), plant spread in east-west (0.129) and disc diameter (0.127).

Plant height exhibited positive and significant correlation with plant spread in north-south (0.327) and plant spread in east-west (0.237). Similar results were reported by Mukesh *et al.*¹¹ in chrysanthemum and Shivakumar *et al.*¹⁵ in marigold. Number of branches showed positive and highly

significant correlation with number of leaves (0.257), leaf area (0.278), plant spread in north-south (0.229), plant spread in east-west (0.249), number of flowers per plant (0.272) and flower yield per plant (0.162). This trend was confirmed by Tarannum and Hemlanaik¹⁷ in carnation. Negative and significant correlation with flower stalk length (-0.164) it is confirmed by Mathew *et al.*¹⁰ had in marigold. Number of leaves per plant had positive and significant correlation with leaf area (0.711), plant spread in north-south (0.147), plant spread in east-west (0.145), days taken for first flowering (0.155), number of flowers per plant (0.288), ray floret length (0.127) and flower yield per plant (0.253). Similar results were reported by Magar *et al.*⁸ in gerbera and Vikas *et al.*¹⁹ in dahlia. Leaf area showed positive and significant correlation with plant spread east-west (0.130), days taken for first flowering (0.144), number of flowers per plant (0.256) and flower yield per plant (0.172) as reported by Magar *et al.*⁸ in gerbera and Vikas *et al.*¹⁹ in dahlia. Stem girth showed negative and significant correlation with disc diameter (-0.146). Plant spread in North-South had positive and significant correlation with Plant spread in East-West (0.625), number of flowers per plant (0.210), flowers diameter (0.161), disc diameter (0.144) and flower yield per plant

(0.159). Plant spread in East-West had positive and significant correlation with flowers diameter (0.253), disc diameter (0.128) and flower yield per plant (0.129). Similar results were found by Mahesh *et al.*⁹ and Shivakumar *et al.*¹⁵ in marigold. Plant spread in North-South had negative significant correlation with days taken for first flower (-0.136), days taken for fifty per cent flowering (-0.146) and days taken for flower bud initiation (-0.156). Similar results were found by Anil *et al.*² in balsam.

Days taken for flowers bud initiation had positive and highly significant correlation with days taken for first flowering (0.959), days taken for fifty per cent flowering (0.871) and duration of flowering (0.253) results are in confirmation with Shivakumar *et al.*¹⁵ in marigold and it had negative and significant correlation with ray floret length (-0.135). Days taken for first flowering had positive and highly significant correlation with days taken for fifty per cent flowering (0.900) and duration of flowering (0.338). Similar results were found by Negi *et al.*¹² in China aster. Days taken for fifty per cent flowering had positive and highly significant correlation with duration of flowering (0.538). These results are in confirmation with Shivakumar *et al.*¹⁵ in marigold.

Table 1: Estimates of phenotypic correlation coefficients for F₂ population of a cross “AAC-1 × Arka Poornima” in China aster

| | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. | 16. | 17. | 18. | 19. |
|----|-------|--------|---------|---------|--------|---------|---------|---------|---------|---------|---------|---------|--------|---------|----------|---------|---------|---------|---------|
| 1 | 1.000 | -0.084 | -0.017 | 0.011 | -0.037 | 0.327** | 0.237** | 0.030 | 0.043 | 0.076 | 0.051 | -0.026 | 0.098 | 0.111 | 0.052 | 0.058 | 0.069 | 0.109 | 0.043 |
| 2 | | 1.000 | 0.257** | 0.278** | 0.055 | 0.229** | 0.249** | 0.006 | 0.046 | 0.029 | 0.075 | 0.272** | -0.064 | -0.055 | -0.164** | 0.073 | 0.040 | -0.038 | 0.162* |
| 3 | | | 1.000 | 0.711** | -0.061 | 0.147 | 0.145* | 0.088 | 0.155* | 0.109 | 0.045 | 0.288** | 0.067 | 0.051 | 0.114 | 0.092 | 0.127 | 0.020 | 0.253** |
| 4 | | | | 1.000 | -0.023 | 0.120 | 0.130* | 0.100 | 0.144* | 0.089 | -0.042 | 0.256** | -0.023 | -0.030 | 0.015 | -0.005 | -0.011 | -0.058 | 0.172** |
| 5 | | | | | 1.000 | 0.012 | 0.068 | 0.076 | 0.046 | 0.031 | 0.032 | 0.006 | -0.074 | -0.075 | 0.072 | 0.009 | 0.024 | -0.146* | -0.025 |
| 6 | | | | | | 1.000 | 0.625** | -0.156* | -0.136* | -0.146* | -0.019 | 0.210** | 0.035 | 0.027 | 0.077 | 0.161* | 0.084 | 0.144* | 0.159* |
| 7 | | | | | | | 1.000 | -0.031 | -0.021 | -0.070 | -0.047 | 0.115 | 0.094 | 0.082 | -0.003 | 0.253** | 0.095 | 0.128* | 0.129* |
| 8 | | | | | | | | 1.000 | 0.959** | 0.871** | 0.253** | -0.019 | 0.024 | 0.001 | 0.012 | -0.111 | -0.135* | -0.089 | -0.020 |
| 9 | | | | | | | | | 1.000 | 0.900** | 0.338** | 0.017 | 0.072 | 0.026 | 0.007 | -0.074 | -0.105 | -0.078 | 0.036 |
| 10 | | | | | | | | | | 1.000 | 0.538** | 0.023 | 0.049 | 0.007 | -0.007 | -0.087 | -0.094 | -0.103 | 0.021 |
| 11 | | | | | | | | | | | 1.000 | -0.003 | 0.084 | 0.052 | 0.030 | -0.011 | -0.060 | 0.017 | 0.019 |
| 12 | | | | | | | | | | | | 1.000 | -0.002 | -0.055 | 0.004 | 0.026 | -0.025 | 0.017 | 0.713** |
| 13 | | | | | | | | | | | | | 1.000 | 0.939** | 0.099 | 0.372** | 0.322** | 0.188** | 0.636** |
| 14 | | | | | | | | | | | | | | 1.000 | 0.079 | 0.364** | 0.319** | 0.160* | 0.620** |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.002 | -0.079 | -0.023 | 0.068 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.702** | 0.540** | 0.284** |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.278** | 0.197** |
| 18 | | | | | | | | | | | | | | | | | | 1.000 | 0.127* |
| 19 | | | | | | | | | | | | | | | | | | | 1.000 |

* Significant at P = 0.05 **Significant at P = 0.01

| | | | |
|---------------------------------|---|----------------------------------|-----------------------------|
| 1. Plant height (cm) | 6. Plant spread (cm) in [North – South] | 11. Duration of flowering | 16. Flower diameter (cm) |
| 2. Number of branches | 7. Plant spread (cm) in [East- West] | 12. Number of flowers per plant | 17. Ray florets length (cm) |
| 3. Number of leaves per plant | 8. Days taken for flower bud initiation | 13. Individual flower weight (g) | 18. Disc diameter (cm) |
| 4. Leaf area (cm ²) | 9. Days taken for first flowering | 14. Weight of 10 flowers (g) | 19. Flower yield (g/plant) |
| 5. Stem girth (cm) | 10. Days taken for 50% flowering | 15. Flower stalk length (cm) | |

Number of flower had shown positive and highly significant correlation with flower yield per plant (0.713) as reported by Kuruppaiah *et al.*⁷ in marigold. Individual flowers weight had shown positive and highly significant correlation with weight of ten flowers (0.939), flowers diameter (0.372), ray floret length (0.322), disc diameter (0.188) and flower yield per plant (0.636), these results are confirming with results of Mahesh *et al.*¹¹ in carnation. Weight of ten flowers had positive and significant correlation with flower diameter (0.364), ray floret length (0.319), disc diameter (0.160) and flower yield per plant (0.620). Flowers diameter showed positive and highly significant correlation with ray floret length (0.702), disc diameter (0.540) and flower yield (0.284). Similar results were obtained by Patil and Rane¹³ in China aster. Ray floret length showed positive and significant correlation with disc diameter (0.278) and flower yield per plant (0.197). Disc diameter showed positive and significant correlation with flower yield per plant (0.127).

Correlation studies in F₂ generation of the cross “AAC-1×Arka Poornima” for yield revealed high significant positive correlation with number of flower per plant, individual flower weight, weight of ten flowers, flower diameter, ray floret length, disk diameter,

number of branches per plant and number of leaf per plant, suggesting the possibility of simultaneous selection for these traits for improving yield.

Assessment of direct and indirect effects of characters on flower yield through path analysis indicated maximum positive direct effect of number of flowers per plant (0.7142) and individual flower weight (0.6263) on flower yield per plant (Table-2). The finding of Usha *et al.*¹⁸ and Karuppaiah and Kumar⁶ in marigold are in agreement with the above results. Plant height (0.0109), number of branches (0.0128) and number of leaves (0.0055) exhibited low positive direct effect. Number of branches (0.0128) showed low positive direct effect and positive indirect effect *via.*, number of flower per plant (0.1944) and flower diameter (0.0026) resulting a high positive significant correlation with flower yield per plant (0.1616), it is in conformity with earlier report of Mahesh *et al.*¹¹ in marigold. On the other hand number of leaves (0.0055) had low positive direct effect and positive indirect effect *via.*, number of flower per plant (0.2060) and individual flower weight (0.0422) resulted in high positive significant correlation with flower yield per plant (0.2530).

Table 2: Estimates of direct and indirect effects of characters on flower yield per plant in F₂ population of a cross “AAC-1 × Arka Poornima” in China aster

| | Plant height (cm) | Number of branches | Number of leaves | Plant spread in north-south (cm) | Plant spread in east-west (cm) | Days taken for first bud initiation | Number of flowers per plant | Individual flower weight (g) | Flower diameter (cm) | Correlation (r) with flower yield per plant |
|-------------------------------------|-------------------|--------------------|------------------|----------------------------------|--------------------------------|-------------------------------------|-----------------------------|------------------------------|----------------------|---|
| Plant height (cm) | 0.0109 | -0.0011 | -0.0001 | -0.0062 | -0.0038 | -0.0007 | -0.0188 | 0.0612 | 0.0021 | 0.0435 |
| Number of branches | -0.0009 | 0.0128 | 0.0014 | -0.0043 | -0.0040 | -0.0001 | 0.1944 | -0.0402 | 0.0026 | 0.1616* |
| Number of leaves | -0.0002 | 0.0033 | 0.0055 | -0.0028 | -0.0023 | -0.0020 | 0.2060 | 0.0422 | 0.0033 | 0.2530** |
| Plant spread in north-south (cm) | 0.0036 | 0.0029 | 0.0008 | -0.0190 | -0.0099 | 0.0035 | 0.1499 | 0.0220 | 0.0057 | 0.1595* |
| Plant spread in east-west (cm) | 0.0026 | 0.0032 | 0.0008 | -0.0119 | -0.0159 | 0.0007 | 0.0822 | 0.0586 | 0.0089 | 0.1292* |
| Days taken for first bud initiation | 0.0003 | 0.0001 | 0.0005 | 0.0029 | 0.0005 | -0.0225 | -0.0133 | 0.0152 | -0.0039 | -0.0202 |
| Number of flowers per plant | -0.0003 | 0.0035 | 0.0016 | -0.0040 | -0.0018 | 0.0004 | 0.7142 | -0.0014 | 0.0009 | 0.7130** |
| Individual flower weight (g) | 0.0011 | -0.0008 | 0.0004 | -0.0007 | -0.0015 | -0.0005 | -0.0016 | 0.6263 | 0.0131 | 0.6357** |
| Flower diameter (cm) | 0.0006 | 0.0009 | 0.0005 | -0.0031 | -0.0040 | 0.0025 | 0.0185 | 0.2327 | 0.0353 | 0.2839** |

Residual effect = 0.289

Plant spread in north-south (-0.0190) and east-west (-0.0159) had low negative direct effect and positive indirect effect *via.*, number of flower per plant (0.1499 in N/S and 0.0822 in E/W) and individual flower weight (0.0220 in N/S and 0.0586 in E/W) resulted in high positive significant correlation with flower yield per plant (0.1595 in N/S and 0.1292 in E/W) Rachappa¹⁴ also observed the negative direct effect. Flower diameter (0.0353) had low positive direct effect and positive indirect effect *via.*, number of flower per plant (0.0185) and individual flower weight (0.2327) resulted in high positive significant correlation with flower yield per plant (0.2839). The estimate of residual factor (0.289) attained in phenotypic analysis was low, which indicated that the characters chosen contributed for higher variability towards yield.

Path analysis for flower yield per plant revealed that the number of flowers per plant and individual flower weight have high direct effect indicating the possibility of increasing flower yield by selecting these characters directly.

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