Correlation and Path Coefficient Studies in Ajwain for Yield and Yield Attributing Traits

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Abstract

Twenty five genotypes of ajwain were evaluated for correlation and path analysis studies in randomized block design with three replications. Seed yield per plant was associated positively and significantly with days to first flowering, days to 50 % flowering, days to maturity, plant height at maturity, number of primary branches per plant, number of umbels per plant and test weight. The perusal of path coefficient analysis shown days to first flowering (4.207) had highest direct effect on seed yield per plant followed by diameter of main umbel (3.324), test weight (2.152), number of seeds per umbel (1.736), plant height at maturity (1.236), number of umbellate per umbel (0.967) and days to maturity (0.747). Therefore, in ajwain breeding programme greater emphasis should be given on these characters while selection.

Keywords

Correlation, Ajwain, Genetic Correlation Coefficient, Path analysis

Introduction

Ajwain (Trachyspermum ammi L. Sprague; 2n=18), belongs to the family Apiaceae, a highly valued medicinally important seed spices. It is native of Egypt and is cultivated in Iraq, Iran, Afghanistan and India. It is also known as Bishop’s weed and Carum in English and cultivated mainly for its seed, herb and volatile oil. It has medicinal value specially for curing indigestion, stomach pain and elements concerning digestive system. It is also used in cholera, diarrhea, gastric and urinary trouble. Seed contains volatile oil (2-4 %) that is yellow brownish in colour used in many ayurvedic medicines and industries. In India, it is grown in Gujarat, Rajasthan, Madhya Pradesh, Bihar, Punjab, Tamil Nadu, West Bengal, Andhra Pradesh and Uttar Pradesh. In India, 19000 mℓ of Ajwain was produced from 27000 ha area with the productivity of 703.70 kg/ha (Anonymous
In Maharashtra, its cultivation is mostly confined to vidharbha region. The production of ajwain in vidviarbha region is about 1208.9 mt in the area of 907 ha giving productivity of 1.33 mt/ha (Joint Director of Agriculture, Amravati and Nagpur, Department of Agriculture, Maharashtra, 2016). Ajwain’s flowers are protandrous in nature and cross pollination occurs through insects (Malhotra and Vijay, 2004).

Materials and Methods

The experimental material comprises of twenty five genotypes of ajwain, out of which 22 germplasm line viz., IC-255982, IC-570334, IC-334479, IC-394916, IC-570286, IC-348021, IC-572861, IC-544645, IC-571652, IC-255983, IC-430895, IC-571675, IC-334410, IC-570331, IC-530565, IC-339813, IC-571642, IC-339846, IC-530562, IC-430882, IC-530563, IC-02 were collected from NBPGR, New Delhi and 3 checks namely, AA-19-01, AA-2 and AA-93 were collected from NRCSS, Tabji, Ajmer, Rajasthan. The experiment was conducted in Randomized Block Design at Chilli and Vegetable Research Unit, Dr. PDKV, Akola (Maharashtra) during Rabi season 2017-2018. Each genotype was sown in three replication with plot size 3 x 1.8 m² and spacing 60 x 60 cm. The observation were recorded on five randomly selected plants of each genotype in each replication for thirteen characters viz., Plant height at maturity, Number of primary branches per plant, length of first internode, number of umbels per plant, number of umbellate per umbel, number of seeds per umbel, number of seeds per umbellate, diameter of main umbel, seed yield per plant and test weight. However, days to first flowering, days to 50 % flowering and days to maturity were recorded on plot basis.

Analysis of variance was done as per the methodology suggested by Panse & Sukhatme (1988). The genotypic and phenotypic correlation coefficients were calculated as per method suggested by Johnson et al., 1955. Path analysis based on genotypic correlation was performed according to Dewey and Lu (1959).

Results and Discussion

Analysis of variance (Table 1.) revealed significant differences among the genotypes for all the traits studied indicating presence of variability in the material.

The characters days to first flowering, days to 50 % flowering, days to maturity, plant height at maturity, plant height at maturity, number of primary branches per plant, number of umbels per plant and test weight were found in positive association with seed yield per plant and also in positive association among themselves. This resembles to the finding of Sharma et al., (2015) and Shivaprasad et al., (2017). Thus indicating the scope for the direct selection for further improvement.

Partitioning of correlation coefficient into direct and indirect effect provide information about the nature and magnitude of effects of other characters on seed yield. The result of present investigation on path coefficient analysis as presented in Table 3 revealed that days to first flowering (4.207) had highest direct effect on seed yield per plant followed by diameter of main umbel (3.324), test weight (2.152), number of seeds per umbel (1.736), plant height at maturity (1.236), number of umbellate per umbel (0.967) and days to maturity (0.747).

Plant height at maturity had positive and indirect effect on seed yield via days to first flowering (1.269), days to maturity (0.471) and test weight (0.335).
Table 1: Analysis of variance for the thirteen characters in ajwain

| Source               | Df | Mean sum of square for various characters |
|----------------------|----|------------------------------------------|
|                      |    | Days to first flowering                   |
|                      |    | Days to 50% flowering                     |
|                      |    | Days to maturity                          |
|                      |    | Plant height at maturity (cm)              |
|                      |    | Number of primary branches per plant      |
|                      |    | Length of first internode (cm)             |
|                      |    | Number of umbels per plant                |
| Replication          | 2  | 20.333                                   |
|                      |    | 75.293                                   |
|                      |    | 16.333                                   |
|                      |    | 10.816                                   |
|                      |    | 2.189                                    |
|                      |    | 0.017                                    |
|                      |    | 60.829                                   |
| Genotypes            | 24 | 640.858**                                |
|                      |    | 387.972**                                |
|                      |    | 145.142**                                |
|                      |    | 474.568**                                |
|                      |    | 8.148**                                  |
|                      |    | 1.556**                                  |
|                      |    | 2192.828**                               |
| Error                | 48 | 7.403                                    |
|                      |    | 39.682                                   |
|                      |    | 83.889                                   |
|                      |    | 30.495                                   |
|                      |    | 0.672                                    |
|                      |    | 0.040                                    |
|                      |    | 39.855                                   |

| Source               | df | Mean sum of square for various characters |
|----------------------|----|------------------------------------------|
|                      |    | Number of umbellate per umbel            |
|                      |    | Number of seeds per umbel                |
|                      |    | Number of seeds per umbellate            |
|                      |    | Diameter of main umbel (cm)              |
|                      |    | Test weight (g)                          |
|                      |    | Seed yield per plant (g)                 |
| Replication          | 2  | 0.218                                    |
|                      |    | 46.844                                   |
|                      |    | 2.360                                    |
|                      |    | 0.004                                    |
|                      |    | 0.006                                    |
|                      |    | 0.184                                    |
| Genotypes            | 24 | 11.307**                                 |
|                      |    | 33944.74**                               |
|                      |    | 139.527**                                |
|                      |    | 0.613**                                  |
|                      |    | 0.233**                                  |
|                      |    | 16.058**                                 |
| Error                | 48 | 1.105                                    |
|                      |    | 903.011                                  |
|                      |    | 6.923                                    |
|                      |    | 0.162                                    |
|                      |    | 0.004                                    |
|                      |    | 0.299                                    |

Significant at 5% level - *
Significant at 1% level - **
Table 2. Genetic correlation coefficient among the thirteen characters in ajwain

| Characters   | DF       | D50%F     | DM   | PH       | NPB    | LI    | NU    | NUT   | NSU   | NSUT   | DMU   | TW   | SYPP   |
|--------------|----------|-----------|------|----------|--------|-------|-------|-------|-------|--------|-------|------|--------|
| DF           | 1.000    | 0.931**   | 0.992** | 0.105   | 0.726** | -0.788** | -0.116 | -0.694** | -0.555** | -0.760** | -0.574** | 0.452** | 0.228* |
| D50%F        | 1.000    | 0.921**   | 0.190 | 0.969**  | -0.894** | 0.024 | -0.743** | -0.468** | -0.782** | -0.580** | 0.603** | 0.403** |
| DM           | 1.000    | 0.631**   | 0.976** | 0.987** | 0.447** | -0.651** | -0.446** | -0.908** | -0.816** | 0.232*   | 0.424** |
| PH           | 1.000    | 0.412**   | -0.093 | 0.568** | 0.005 | 0.027 | -0.038 | -0.426** | 0.156 | 0.300** |
| NPB          | 1.000    | -0.764**  | 0.358** | -0.567** | -0.268* | -0.725** | -0.522** | 0.640** | 0.525** |
| LI           | 1.000    | -0.075 | 0.628** | 0.464** | 0.800** | 0.683** | -0.489** | -0.295** |
| NU           | 1.000    | 0.091   | 0.382** | -0.097 | -0.169 | 0.142 | 0.334** |
| NUT          | 1.000    | 0.565**  | 0.779** | 0.404** | -0.508** | -0.060 |
| NSU          | 1.000    | 0.526**  | 0.262* | -0.196 | 0.090 |
| NSUT         | 1.000    | 0.669**  | -0.564** | -0.138 |
| DMU          | 1.000    | -0.384** | 0.061 |
| TW           | 1.000    | 0.537** |
| SYPP         | 1.000    |

DF: Days to first flowering  
D50%F: Days to 50% flowering  
DM: Days to maturity  
PH: Plant height at maturity  
NPB: Number of primary branches per plant  
LI: Length of first internode  
NU: Number of umbels per plant  
NUT: Number of umbellate per umbel  
NSU: Number of seeds per umbel  
NSUT: Number of seeds per umbellate  
DMU: Diameter of main umbel  
TW: Test weight  
SYPP: Seed yield per plant
Table 3 Direct (diagonal) and Indirect effect of different traits contributing to yield in ajwain

|        | DF    | D50% F | DM    | PH    | NPB   | LI    | NU    | NUT   | NSU   | NSUT  | DMU   | TW    | Correlation with SYPP |
|--------|-------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----------------------|
| DF     | 4.207 | -0.787 | 0.847 | 0.373 | -3.197| 0.564 | -0.001| -0.631| -1.021| 1.351 | -2.363| 0.896 | 0.228**               |
| D50% F | 4.182 | -0.792 | 0.687 | 0.235 | -3.716| 0.582 | -0.002| -0.719| -0.812| 1.386 | -1.928| 1.298 | 0.403**               |
| DM     | 4.773 | -0.729 | 0.747 | 0.780 | -3.745| 0.643 | -0.036| -0.630| -0.774| 1.609 | -2.712| 0.500 | 0.424**               |
| PH     | 1.269 | -0.151 | 0.471 | 1.236 | -1.581| 0.061 | -0.045| 0.005 | 0.047 | 0.068 | -1.414| 0.335 | 0.300**               |
| NPB    | 3.506 | -0.767 | 0.729 | 0.509 | -3.836| 0.497 | -0.028| -0.549| -0.465| 1.286 | -1.735| 1.377 | 0.525**               |
| LI     | -3.646| 0.708  | -0.737| -0.115| 2.929 | -0.651| 0.006 | 0.607 | 0.806 | -1.419| 2.269 | -1.052| -0.295**              |
| NU     | 0.055 | -0.019 | 0.334 | 0.702 | -1.374| 0.049 | -0.079| 0.088 | 0.663 | 0.171 | -0.562| 0.307 | 0.334**               |
| NUT    | -2.745| 0.589  | -0.486| 0.006 | 2.176 | -0.409| -0.007| 0.967 | 0.981 | -1.380| 1.342 | -1.093| -0.060NS              |
| NSU    | -2.475| 0.370  | -0.333| 0.034 | 1.027 | -0.302| -0.030| 0.547 | 1.736 | -0.932| 0.869 | -0.422| 0.090NS               |
| NSUT   | -3.206| 0.620  | -0.678| -0.047| 2.782 | -0.521| 0.008 | 0.753 | 0.913 | -1.773| 2.223 | -1.213| -0.138NS              |
| DMU    | -2.991| 0.459  | -0.609| -0.526| 2.002 | -0.444| 0.013 | 0.391 | 0.454 | -1.186| 3.324 | -0.826| 0.061NS               |
| TW     | 1.751 | -0.478 | 0.173 | 0.192 | -2.453| 0.318 | -0.011| -0.491| -0.340| 0.999 | -1.276| 2.152 | 0.537**               |

Residual effect (R) = -0.22361
Also the character test weight showed high positive and indirect effect on seed yield via days to first flowering (1.751), number of seeds per umbellate (0.999) and length of internode (0.318), plant height at maturity (0.192) and days to maturity (0.173). This resembles to the finding of Ghanshyam et al., (2014) and Shivaprasada et al., (2015). Thus the present investigation revealed the importance of plant height at maturity and test weight character on the basis of correlation and path analysis for yield improvement in ajwain.

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