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**Research Article**

# Character association and path analysis in coriander (*Coriandrum sativum* L.) genotypes

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**Abstract**
An investigation was carried out in ZAHRS, Babbur farm, Hiriyur during 2016- 2017 *rabi* season for evaluation of Coriander (*Coriandrum sativum* L.) genotypes for growth, yield and quality under central dry zone of Karnataka. The experiment was laid out in the Randomized Complete Block Design with 20 genotypes and were replicated thrice. The study revealed that plant height, number of primary branches per plant, plant spread and test weight of seed showed significantly positive association with seed yield per plant. Path analysis revealed that, number of primary branches per plant had highest direct positive effect on seed yield followed by plant height at harvest. Therefore, greater emphasis should be given on these characters while selecting for higher seed yield and related traits.

**Keywords**
Coriander, Correlation Coefficient, Path analysis and Yield.

## Introduction

Coriander (*Coriandrum sativum* L.) is an important seed spice which belongs to family Apiaceae (Umbelliferae) and possess chromosome number 2n=22 with cross-pollination as mode of reproduction. Western Europe and Asia are considered to be the centre of origin of this crop Gal *et al*.(2010). It is also one of the most important spice crop grown in India and throughout the world. In India it is mainly grown in Rajasthan, Gujarath, Madhya Pradesh, Andhra Pradesh and Tamil Nadu. In India, coriander is grown with an area of 662.50 thousand hectare with the production of 609.40 thousand MT and productivity is 1.08 MT per hectare (Anon, 2017).

In Karnataka, coriander is mainly grown under *rainfed* conditions both in *kharif* and *rabi* season in an area of 4.50 thousand hectares with a production of 1.90 MT (Anon, 2017). Yield is a complex trait and direct selection for this trait based on heritability estimates alone will not be rewarding. Seed yield is dependent on various other component traits like plant height, number of branches, seed weight *etc*. Knowledge on the relationship between these traits helps in achieving improved yield (Thakur and Saini, 1995). Knowledge regarding association and path coefficient analysis between yield and its components traits are important in determining the component characters that could be used as selection parameters for effective improvement of the crop.

## Material and Methods

The present investigation was carried out at Zonal Agricultural and Horticultural Research station (ZAHRS), Babbur farm, HiriyurTaluk, Chitradurga (Distt.) which comesunder the central dry zone of Karnataka. The experimental material comprised of twenty diverse genotypes namely, Rcr-475, RCr-480, RCr-728, RCr-446, RCr-20, RCr-41, RCr-435, RCr-436, RCr-684, GCr-1, GCr-2, ACr-1, Co-1, Co-2, Co-3, Co-4, DCC-1, DCC-2, DCC-3 and DCC-4. These genotypes are collected from SKNA-Sri Karana Narendra Agriculture, Jobner, Rajasthan, HRES- Horticultural Research and Extension Station, Devihosur, TNAU- Tamil Nadu Agriculture University, Coimbatore, GAU- Gujarat Agriculture University, Gujarat, NRCSS- National Research Centre on Seed Spices, Ajmer, Rajasthan. The experiment was laid out in the Randomized Complete Block Design with three replications. The seeds of twenty genotypes were sown on 3rd Nov 2016 at ZAHRS, Babbur farm, Hiriyur during *rabi* season with a spacing of 30 x 22.5 cm between row to row and plant to plant spacing were maintained. All the agronomic package of practices was adapted to grow a healthy crop. In each replication five plants

randomly selected were marked for observation. Observations were recorded for 17 characters viz., plant height (cm), number of primary branches per plant, number of secondary branches per plant, plant spread ($cm^2$), days to first flowering, days to 50 percent flowering, days to harvesting, number of umbels per plant, number of umbellets per umbel, number of seeds per umbel, days taken to maturity, dry matter production (g), seed yield per plant (g), seed yield per hectare (q), harvest index (%), test weight (g) and essential oil content (%).The analysis of variance for testing the variation among treatments was carried out as per the method suggested by Panse and Sukhatme (1957). The phenotypic correlation coefficients were calculated as per methods given by Fisher and Yates (1963). Path analysis based on phenotypic correlations was performed according to Dewey & Lu (1959).

**Results and Discussion**

Analysis of variance revealed significant differences among genotypes for all traits studied indicating presence of significant variability in the materials.

Yield of a crop is the result of interaction of a number of inter-related characters. Therefore, selection should be based on these component characters after assessing their correlation with seed yield per plot. Character association reveals the mutual relationship between two characters, and it is an important parameter for taking a decision regarding the nature of selection to be followed for improvement in the crop under study. The phenotypic correlation among the yield and yield components in coriander are presented in (Table 1). Significant correlation among characters suggested that there is much scope for direct and indirect selection for further improvement. In the present investigation, seed yield per plant was positively significantly correlated with number of primary branches (0.35), plant spread (0.27), number of umbels per plant (0.26), test weight (0.24) and plant height (0.23) at phenotypic level. Therefore, these characters should be considered while making selection for seed yield improvement in coriander. These results are in conformity with those of Beena *et al*.(2013) in coriander.

Number of primary branches showed a highly significant positive association with secondary branches per plant, days to first flowering, days to 50 per cent flowering, seeds per umbellet, days taken for maturity. Similar results were reported by Singh *et al*.(2006) and Ali *et al*.(1993) in coriander. Plant spread recorded a significant positive association with umbels per plant, seed yield per hectare and essential oil content. It indicates that, improvement in plant spread may possibly improve number of umbels per plant and seed yield and as a result plant spread may also contribute towards yield improvement in coriander. Similar results were reported by Giridhar and Sarada (2005) in coriander.

Number of umbels per plant showed a highly significant positive association with number of seeds per umbellet, seed yield per plot, seed yield per hectare and test weight. Number of umbels increases the seed yield in coriander so relationship between those is important for increasing the seed yield. Similar results are reported by Shridhar *et al*.(1990) and Singh *et al*.(2006) in coriander. Test weight showed significant positive association with harvest index. Similar results were reported by Singh *et al*.(2008) and Singh *et al*.(2005) in coriander.

Correlation coefficient analysis just facilitates us to know the nature and degree of relationship among characters. Still, direct contribution of every component towards yield and their indirect contributions through other components are unknown. In this context, the path analysis facilitates in partitioning the correlation coefficients into direct and indirect effects of the component characters on yield which would be very useful for accurate selection. If the correlation between yield and any of its component traits is due to the direct effect, it reveals a true relation between them and selection for that character will be effective in order to improve yield. But if the correlation is mainly due to indirect effect of another component character, the breeder has to select the latter character through which the indirect effect is used. The trait number of primary branches per plant (0.662) had a highest direct positive effect on seed yield per plant followed by plant height at harvest (0.618), number of umbels per plant (0.286), plant spread (0.274). This indicated that seed yield could be improved by making selection on the basis of these characters. These findings are in agreement with that of Singh *et al*.(2008)for number of primary branches, Singh *et al*.(2006) for plant height and number of umbels per plant, Vedamuthu and Rajan (1990), Shridhar *et al*.(1990), Singh *et al*.(2006) for plant spread in coriander.Path coefficient analysis indicated utility of the character like number of primary branches on seed yield per plant which showed highest positive direct effects on this trait.

The high (0.88) residual effect was indicating low contribution of independent characters toward the dependent character i.e. seed yield per plant.

Among the traits, primary branches and plant height had highest direct positive effect on seed yield followed by umbels per plant. These results are in line with the findings of Singh *et al.*(2005). This indicates that if other characters are kept constant, an increase in number of primary branches per plant and plant height attachment will increase the seed yield significantly. But the traits like days taken for 1st flowering, secondary branches, 50 per cent flowering umbellate per umbel had direct negative effect on fruit yield. Among these traits, days taken for 1st flowering had highest negative effect on fruit yield. This result has reduces vegetative growth which leads to reduce no of branches per plant ultimately lowers the seed yield per plant.

This study of correlation and path coefficient analysis revealed the importance of plant height, primary branches, plant spread and umbels per plant for increasing seed yield per hectare. So, these above mentioned traits should be considered as selection indices for further crop improvement.

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**Table 1. Estimates of phenotypic correlation coefficients for yield and yield attributing traits in coriander genotypes**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | **1.000** | 0.590** | 0.139 | 0.142 | 0.935** | 0.281* | 0.175 | 0.196 | 0.341** | 0.316* | 0.392* | 0.396** | -0.237 | 0.069 | -0.080 | 0.053 | **0.237*** |
| **2** | | **1.000** | 0.504** | 0.243 | 0.620** | 0.460** | 0.138 | 0.236 | 0.295* | 0.384** | 0.392** | 0.543** | -0.228 | 0.110 | -0.097 | 0.061 | **0.359**** |
| **3** | | | **1.000** | 0.302* | 0.177 | 0.504** | -0.120 | 0.005 | -0.164 | 0.109 | 0.073 | 0.247 | -0.193 | -0.054 | 0.006 | 0.376** | **0.224** |
| **4** | | | | **1.000** | 0.159 | 0.557** | 0.060 | 0.191 | -0.052 | 0.152 | 0.288* | 0.238 | -0.252 | 0.029 | 0.243 | 0.298* | **0.279*** |
| **5** | | | | | **1.000** | 0.192 | 0.234 | 0.087 | 0.384** | 0.284* | 0.441** | 0.457** | -0.271* | 0.055 | -0.077 | -0.033 | **0.170** |
| **6** | | | | | | **1.000** | -0.264 | 0.214 | 0.026 | 0.206 | 0.123 | 0.188 | -0.150 | 0.011 | 0.159 | 0.260* | **0.224** |
| **7** | | | | | | | **1.000** | 0.205 | 0.243 | 0.077 | 0.541** | 0.330** | 0.083 | 0.449** | 0.0195 | -0.014 | **0.269*** |
| **8** | | | | | | | | **1.000** | 0.287* | 0.219 | 0.259* | 0.056 | 0.197 | 0.082 | -0.119 | 0.002 | **0.118** |
| **9** | | | | | | | | | **1.000** | 0.040 | 0.130 | 0.140 | 0.094 | 0.066 | 0.019 | -0.437** | **0.073** |
| **10** | | | | | | | | | | **1.000** | 0.377** | 0.197 | 0.014 | 0.096 | 0.037 | -0.077 | **0.047** |
| **11** | | | | | | | | | | | **1.000** | 0.664** | -0.128 | 0.410** | 0.285* | 0.080 | **0.180** |
| **12** | | | | | | | | | | | | **1.000** | 0.916 | 0.331** | 0.353** | 0.130 | **0.178** |
| **13** | | | | | | | | | | | | | **1.000** | 0.105 | 0.376** | -0.155 | **0.116** |
| **14** | | | | | | | | | | | | | | **1.000** | 0.265* | 0.018 | **0.244*** |
| **15** | | | | | | | | | | | | | | | **1.000** | 0.090 | **0.043** |
| **16** | | | | | | | | | | | | | | | | **1.000** | **0.140** |
| | | | | | | | | | | | | | | | | | **1.000** |

**Critical r value 1%= 0.301 5%=0.231 *&** indicates significant @ 5% and 1% level respectively rP – Phenotypic correlation with seed yield per plant**

1. Plant height (cm)
2. Number of primary branches
3. Number of secondary branches
4. Plant spread ($cm^2$)
5. Days to first flowering
6. Days to 50% flowering
7. Number of umbels per plant
8. Number of umbellet per umbel
9. Number of seed per umbellet
10. Days taken for maturity
11. Seed yield per plot (g)
12. Seed yield per (ha)
13. Dry matter production ($qha^{-1}$)
14. Dry weight of thousand seed
15. Harvest index (%)
16. Essential oil content (%)
17. Seed yield per plant (g)

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**Table 2. Estimates of direct (diagonal) and indirect effects (of diagonal) of growth, yield and quality on seed yield at phenotypic level in coriander genotypes**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | rP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | **0.618** | 0.364 | 0.086 | 0.087 | 0.578 | 0.173 | 0.108 | 0.121 | 0.211 | 0.195 | 0.242 | 0.244 | -0.146 | 0.043 | -0.049 | -0.033 | **0.237*** |
| **2** | 0.391 | **0.662** | 0.334 | 0.161 | 0.411 | 0.304 | 0.091 | 0.156 | 0.196 | 0.254 | 0.259 | 0.359 | -0.151 | 0.073 | -0.064 | 0.040 | **0.359**** |
| **3** | -0.028 | -0.103 | **-0.205** | -0.062 | -0.036 | -0.103 | 0.024 | -0.001 | 0.033 | -0.022 | -0.015 | -0.050 | 0.039 | 0.011 | -0.001 | -0.077 | **0.224** |
| **4** | 0.039 | 0.066 | 0.083 | **0.274** | 0.043 | 0.153 | 0.016 | 0.052 | -0.014 | 0.042 | 0.079 | 0.065 | -0.069 | 0.008 | 0.066 | 0.082 | **0.279*** |
| **5** | -0.624 | -0.414 | -0.118 | -0.106 | **-0.667** | -0.128 | -0.156 | -0.058 | -0.256 | -0.189 | -0.294 | -0.305 | 0.181 | -0.037 | 0.051 | 0.022 | **0.170** |
| **6** | -0.007 | -0.011 | -0.012 | -0.013 | -0.004 | **-0.024** | 0.006 | -0.005 | -0.000 | -0.005 | -0.003 | -0.004 | 0.003 | -0.000 | -0.003 | -0.006 | **0.217** |
| **7** | 0.050 | 0.039 | -0.034 | 0.017 | 0.067 | -0.075 | **0.286** | 0.058 | 0.069 | 0.022 | 0.155 | 0.094 | 0.024 | 0.128 | 0.005 | -0.004 | **0.269*** |
| **8** | -0.026 | -0.032 | -0.000 | -0.026 | -0.012 | -0.029 | -0.028 | **-0.137** | -0.039 | -0.030 | -0.035 | -0.007 | -0.027 | -0.011 | 0.016 | -0.000 | **0.118** |
| **9** | -0.013 | -0.011 | 0.006 | 0.002 | -0.015 | -0.011 | -0.009 | -0.011 | **-0.039** | -0.001 | -0.005 | -0.005 | -0.003 | -0.002 | -0.000 | 0.017 | **0.073** |
| **10** | -0.046 | -0.056 | -0.016 | -0.022 | -0.041 | -0.030 | -0.013 | -0.032 | -0.006 | **-0.146** | -0.055 | -0.028 | -0.002 | -0.014 | -0.005 | 0.011 | **0.047** |
| **11** | 0.039 | -0.039 | -0.007 | -0.028 | 0.044 | -0.012 | 0.054 | -0.025 | -0.013 | -0.037 | **0.098** | 0.066 | -0.012 | -0.041 | -0.028 | -0.008 | **0.180** |
| **12** | 0.080 | 0.110 | -0.050 | -0.048 | 0.093 | -0.038 | 0.067 | -0.011 | -0.028 | -0.040 | -0.135 | **0.203** | -0.018 | 0.067 | -0.071 | -0.026 | **0.178** |
| **13** | -0.011 | -0.011 | -0.009 | -0.012 | -0.013 | -0.007 | 0.004 | 0.009 | 0.004 | 0.000 | 0.006 | 0.004 | **0.048** | 0.005 | 0.018 | -0.007 | **0.116** |
| **14** | 0.009 | 0.014 | -0.007 | 0.003 | 0.007 | 0.001 | 0.058 | 0.010 | 0.008 | 0.012 | 0.053 | 0.042 | 0.013 | **0.129** | 0.034 | 0.002 | **0.244*** |
| **15** | -0.005 | -0.006 | 0.000 | 0.015 | -0.005 | -0.010 | 0.001 | -0.007 | 0.001 | 0.002 | 0.018 | 0.023 | 0.024 | 0.017 | **0.065** | 0.005 | **0.043** |
| **16** | -0.006 | 0.007 | 0.045 | 0.036 | -0.004 | -0.031 | -0.001 | 0.000 | -0.053 | -0.009 | 0.009 | 0.015 | -0.018 | 0.002 | 0.011 | **0.121** | **0.140** |
| **Partial $R^2$** | **0.134** | **0.238** | **-0.019** | **0.076** | **-0.114** | **-0.005** | **0.077** | **-0.016** | **-0.002** | **-0.007** | **0.018** | **0.036** | **0.005** | **0.031** | **0.002** | **0.017** | |

**Residual effect-0.8040**

1. Plant height (cm)
2. Number of primary branches
3. Number of secondary branches
4. Plant spread ($cm^2$)
5. Days to first flowering
6.Days to 50% flowering
7.Number of umbels per plant
8.Number of umbellet per umbel
9.Number of seed per umbellet
10.Days taken for maturity
11.Seed yield per plot (g)
12. Seed yield per (ha)
13.Dry matter production ($qha^{-1}$)
14. Dry weight of thousand seed
15.Harvest index (%)
16. Essential oil content (%)
17.Seed yield per plant (g)

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**Fig.1. General view of the experimental plot**

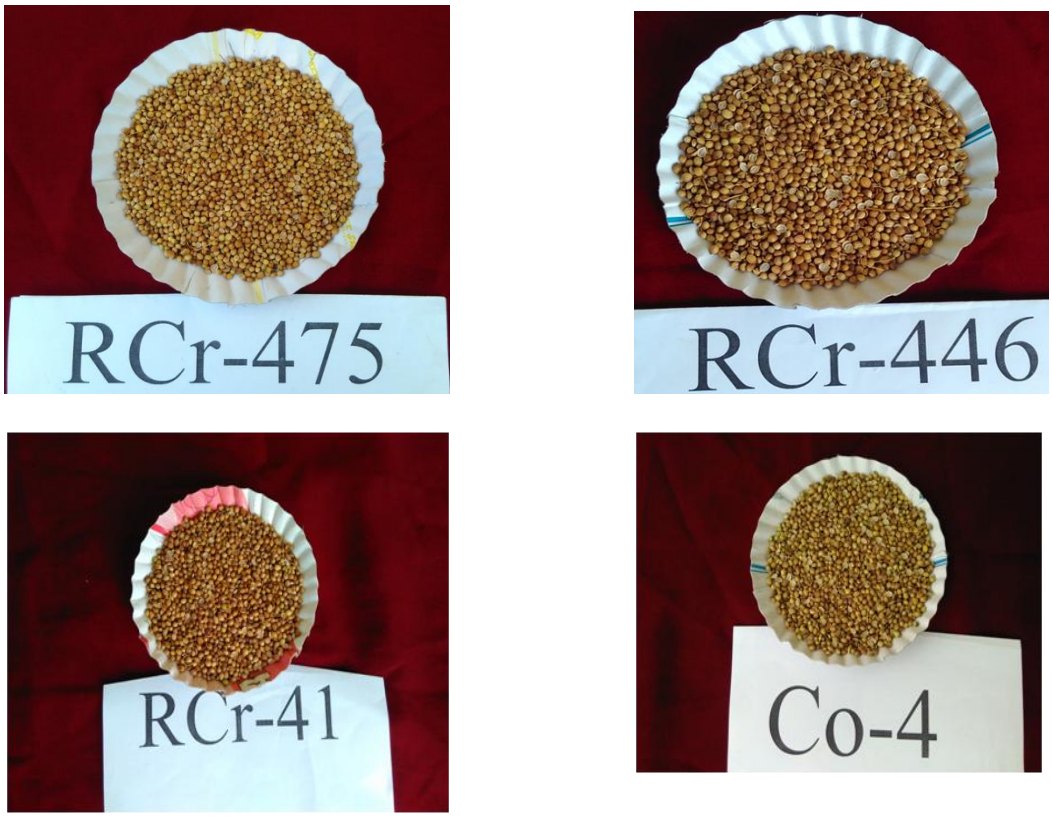


**Fig.2. Best performing coriander genotypes**