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# Character association and path coefficient analysis in roselle (*Hibiscus sabdariffa* L.)

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**Abstract**
Correlation and path coefficient analysis were studied in a set of 52 diverse genotypes of roselle (*Hibiscus sabdariffa*) during *kharif*, 2018 at ARS Amadalavalasa for eleven important traits. Fibre yield per plant was found to be significantly and positively correlated for all the characters plant height, base diameter, mid diameter, petiole length, number of nodes per plant, green fresh weight per plant, dry stick weight per plant and fibre wood ratio; whereas days to 50% flowering showed significant negative association both at phenotypic and genotypic levels. All these yield component characters also exhibited strong positive correlation among themselves. Partitioning of correlation coefficients of various yield components upon fibre yield into direct and indirect contributions revealed that dry stick weight per plant has maximum direct effect upon fibre yield per plant followed by fibre wood ratio. Therefore, these characters may serve as potent characters for selection in crop improvement programmes for high fibre yield in roselle.

**Keywords:** Correlation, path coefficient analysis, roselle

## Introduction
Roselle (*Hibiscus sabdariffa*) is an annual or biennial plant belonging to the large family Malvaceae and it is cultivated in Tropical and Sub Tropical regions for bast fibre, paper pulp or edible calyces, leaves and seed (Osman *et al*., 2011) [6]. Roselle fibre blended with jute is used in the manufacture of jute goods *viz*., cordage, sacking, hessian, canvas, rough sacks, ropes , twines etc.; the stalks were used in making paper pulp, structural boards as a blend for wood pulp and thatching huts (Juhi Agarwal and Ela Dedhia, 2014) [4].
Yield is a complex character and polygenic nature of inheritance. This requires a deeper insight into the nature of variability present in the germplasm and knowing about the association of yield with its component characters before launching of any breeding program. The extent of association between yield and its attributes can be known through correlation studies. The information on direct and indirect effects contributed by each character on yield can be obtained through path coefficient analysis. Hence, an attempt has been made to study the correlation and path coefficient analysis by utilizing 52 genotypes of roselle.

## Materials and Methods
Fifty two genotypes of roselle were supplied from All India Network Project on Jute and Allied Fibres, ICAR-CRIJAF, Barrackpore, Kolkata. The experiment was conducted at Agricultural Research Station, Amadalavalasa, Srikakulam district, Andhra Pradesh during *kharif* 2018 in randomized block design with 3 replications. Each genotype was sown in a single row per replication with a row length of 4.5 m. The crop was harvested at 50% flowering stage and fibre was extracted by the standard process of retting. Data of the characters viz., days to 50% flowering, plant height (cm), base diameter (mm), mid diameter (mm), petiole length (cm), number of nodes per plant, internode length (cm), green fresh weight per plant (g), dry stick weight per plant (g), fibre wood ratio and fibre yield per plant (g) were recorded. Mean data was subjected to correlation coefficient analysis as suggested by Johnson *et al*., (1955) and path coefficient analysis as suggested by Wright (1921) and elaborated by Dewey and Lu (1959) [2].

## Results and discussions

Analysis of variance revealed significant differences among the genotypes for all the eleven characters studied. All the traits showed the higher magnitude of genotypic correlation than phenotypic correlation indicating that there was strong inherent association between characters which was truly reflected in phenotypic expression.

The character fibre yield per plant showed significant positive association with plant height, base diameter, mid diameter, petiole length, number of nodes, green fresh weight per plant, dry stick weight per plant and fibre wood ratio (Table 1). The results are in agreement with Satyanarayana *et al*., (2017) [9], Aruna *et al*., (1989) [1], Pullibai *et al*., (2005) [7]. Plant height, base diameter, mid diameter and petiole length showed significant positive association with most of the other yield components except days to 50% flowering; whereas, nodes per plant has significant negative association with days to 50% flowering along with internode length. Similarly, green fresh weight per plant and dry stick weight per plant also had significant negative association with days to 50% flowering. Fibre wood ratio showed significant negative association with days to 50% flowering along with dry stick weight, as the increase in dry stick weight reduces the percent fibre yield.

Yield being a complex and quantitatively inherited character with low heritability for which direct selection is not effective. Path analysis measures both direct and indirect effects of the characters that influence on yield. Out of eleven fibre yield components dry stick weight per plant (0.891, 1.021) and fibre wood ratio (0.723, 0.653) had maximum direct effect in positive direction (Table 2 and 3). The direct effect of remaining characters was low. The results are in agreement with Satyanarayana *et al*., (2015) [10] and Kameswara Rao (2002) [5], Rani *et al*., (2006) [8]. High positive correlation coefficients of most of the yield contributing characters (both phenotypic and genotypic) towards fibre yield was mainly due to the indirect effects of dry stick weight which indicates the importance of the character dry stick weight. The character dry stick weight in turn has shown positive correlation with plant height, base diameter, mid diameter, petiole length, number of nodes per plant and green fresh weight.

The residual effect permits precise explanation about pattern of interaction of other possible components of yield. However, the residual effect (0.242, 0.209) was low indicating that characters other than studied have very little effect on fibre yield.

Based on this study, the characters plant height, base diameter, mid diameter, green fresh weight and dry stick weight were very much important for the crop improvement of roselle and selections made with all these desirable characters will be useful for developing high fibre yielding varieties of roselle.

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**Table 1:** Phenotypic (above diagonal) and genotypic (below diagonal) correlation of 11 characters in 52 roselle (*Hibiscus sabdariffa* L.) genotypes

| S. No. | Character | DF | PH | BD | MD | PL | NODES | IL | GFW | DSW | FWR | FYP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | DF | 1.000 | -0.340* | -0.232 | -0.252 | 0.008 | -0.316* | 0.043 | -0.173 | -0.178 | -0.042 | -0.235 |
| 2 | PH | -0.961** | 1.000 | 0.560** | 0.678** | 0.216 | 0.578** | 0.270 | 0.435** | 0.487** | 0.014 | 0.529** |
| 3 | BD | -0.613** | 0.855** | 1.000 | 0.785** | 0.330* | 0.532** | -0.075 | 0.665** | 0.685** | -0.054 | 0.673** |
| 4 | MD | -0.667** | 0.921** | 0.861** | 1.000 | 0.371** | 0.564** | 0.042 | 0.611** | 0.641** | 0.009 | 0.666** |
| 5 | PL | -0.637** | 0.320* | 0.544** | 0.541** | 1.000 | 0.188 | 0.056 | 0.351* | 0.277* | 0.001 | 0.348* |
| 6 | NODES | -0.931** | 0.796** | 0.823** | 0.757** | 0.226 | 1.000 | -0.103 | 0.480** | 0.416** | 0.053 | 0.508** |
| 7 | IL | -0.096 | 0.370** | -0.167 | 0.052 | 0.149 | -0.301* | 1.000 | -0.065 | 0.051 | 0.040 | 0.083 |
| 8 | GFW | -0.735** | 0.506** | 0.867** | 0.728** | 0.704** | 0.642** | -0.172 | 1.000 | 0.768** | -0.162 | 0.669** |
| 9 | DSW | -0.596** | 0.692** | 0.814** | 0.768** | 0.632** | 0.567** | 0.051 | 0.821** | 1.000 | -0.425** | 0.668** |
| 10 | FWR | 0.034 | -0.087 | 0.062 | 0.138 | -0.103 | 0.218 | 0.090 | -0.127 | -0.321* | 1.000 | 0.346* |
| 11 | DFY | -0.580** | 0.755** | 0.847** | 0.841** | 0.513** | 0.712** | 0.129 | 0.727** | 0.786** | 0.335* | 1.000 |

**DF**-Days to 50 per cent flowering ; **PH**-Plant height ; **BD**-Base diameter ; **MD**-Mid diameter ; **PL**-Petiole length ; **IL**-Internode length;
**GFW**-Green fresh weight per plant; **DSW**- Dry stick weight per plant; **FWR**- Fibre wood ratio; **FYP**-Fibre yield per plant; **DFY**-Dry fibre yield per plant.
*significance at 5% level (0.273)
**significance at 1% level (0.354)

**Table 2:** Phenotypic path coefficient analysis in 52 genotypes of roselle (*Hibiscus sabdaiffa* L.)

| S. No. | Characters | DF | PH | BD | MD | PL | NODES | IL | GFW | DSW | FWR | FYP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | DF | -0.018 | -0.005 | -0.011 | 0.012 | 0.001 | -0.017 | 0.000 | -0.006 | -0.158 | -0.031 | -0.235 |
| 2 | PH | 0.006 | 0.015 | 0.028 | -0.033 | 0.016 | 0.032 | 0.004 | 0.017 | 0.434 | 0.010 | 0.529** |
| 3 | BD | 0.004 | 0.008 | 0.049 | -0.038 | 0.025 | 0.029 | -0.001 | 0.024 | 0.610 | -0.039 | 0.673** |
| 4 | MD | 0.004 | 0.010 | 0.039 | -0.048 | 0.028 | 0.031 | 0.006 | 0.022 | 0.568 | 0.006 | 0.665** |
| 5 | PL | -0.001 | 0.003 | 0.012 | -0.018 | 0.074 | 0.010 | 0.008 | 0.012 | 0.246 | 0.003 | 0.348* |
| 6 | NODES | 0.006 | 0.008 | 0.028 | -0.027 | 0.014 | 0.055 | -0.001 | 0.017 | 0.370 | 0.038 | 0.508** |
| 7 | IL | -0.008 | 0.010 | -0.003 | -0.029 | 0.008 | -0.005 | 0.020 | -0.002 | 0.055 | 0.035 | 0.083 |
| 8 | GFW | 0.016 | 0.008 | 0.009 | -0.029 | 0.028 | 0.026 | -0.009 | 0.048 | 0.688 | -0.117 | 0.669** |
| 9 | DSW | 0.003 | 0.005 | 0.034 | -0.031 | 0.021 | 0.023 | 0.007 | 0.024 | 0.891** | -0.309 | 0.668** |
| 10 | FWR | 0.005 | 0.002 | -0.002 | -0.004 | 0.000 | 0.002 | 0.004 | -0.005 | -0.378 | 0.723** | 0.346* |

**DF**-Days to 50 per cent flowering ; **PH**-Plant height ; **BD**-Base diameter ; **MD**-Mid diameter ; **PL**-Petiole length ; **IL**-Internode length;
**GFW**-Green fresh weight per plant; **DSW**- Dry stick weight per plant; **FWR**- Fibre wood ratio;

FYP-Fibre yield per plant (Bold and diagonal values indicate direct effects)
*Significant at 5% level. (0.273) Residual effects: 0.242
**Significant at 1% level. (0.354)

**Table 3:** Genotypic path coefficient analysis in 52 genotypes of roselle (*Hibiscus sabdaiffa* L.)

| S.No. | Characters | DF | PH | BD | MD | PL | NODES | IL | GFW | DSW | FWR | FYP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | DF | 0.023 | 0.007 | 0.056 | -0.009 | 0.065 | -0.051 | -0.005 | -0.079 | -0.608 | 0.021 | -0.580** |
| 2 | PH | -0.022 | -0.008 | -0.079 | 0.013 | -0.032 | 0.043 | 0.022 | 0.054 | 0.707 | 0.056 | 0.755** |
| 3 | BD | -0.014 | -0.006 | -0.092 | 0.014 | -0.055 | 0.045 | -0.009 | 0.093 | 0.831 | 0.040 | 0.847** |
| 4 | MD | -0.015 | -0.007 | -0.093 | 0.014 | -0.055 | 0.041 | 0.002 | 0.078 | 0.785 | 0.090 | 0.841** |
| 5 | PL | -0.014 | -0.002 | -0.050 | 0.007 | -0.202 | 0.012 | 0.008 | 0.076 | 0.645 | -0.067 | 0.513** |
| 6 | NODES | -0.021 | -0.006 | -0.076 | 0.011 | -0.023 | 0.055 | -0.017 | 0.069 | 0.578 | 0.142 | 0.712** |
| 7 | IL | -0.002 | -0.002 | 0.015 | 0.001 | -0.015 | -0.016 | 0.057 | -0.018 | 0.052 | 0.058 | 0.129 |
| 8 | GFW | -0.017 | -0.004 | -0.080 | 0.010 | -0.072 | 0.035 | -0.009 | 0.107 | 0.838 | -0.082 | 0.727** |
| 9 | DSW | -0.013 | -0.005 | -0.075 | 0.011 | -0.064 | 0.031 | 0.002 | 0.088 | 1.021 | -0.209 | 0.786** |
| 10 | FWR | 0.001 | -0.001 | -0.005 | 0.002 | 0.010 | 0.012 | 0.005 | -0.013 | -0.328 | 0.653 | 0.335* |

DF-Days to 50 per cent flowering ; PH-Plant height ; BD-Base diameter ; MD-Mid diameter ; PL-Petiole length ; IL-Internode length;
GFW-Green fresh weight per plant; DSW- Dry stick weight per plant; FWR- Fibre wood ratio;
FYP-Fibre yield per plant (Bold and diagonal values indicate direct effects)
*Significant at 5% level. (0.273)
Residual effects : 0.209
**Significant at 1% level. (0.354)

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