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CORRELATION AND PATH COEFFICIENT ANALYSIS FOR VARIOUS TRAITS IN BOTTLE GOURD (*LAGENARIA SICERARIA* MOLINA STANDL.) GENOTYPES

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ABSTRACT

The present study was conducted at the Department of Vegetable Science, College of Horticulture, Bagalkot, Karnataka, India during *Rabi 2024*. Thirty-five bottle gourd genotypes were evaluated in a randomized complete block design (RCBD) with two replications to study correlation and path analysis among various traits. The results indicated that fruit yield per plant was positively correlated with vine length, number of primary branches at harvest, node of first male flower appearance, average fruit weight, fruit length and number of fruits per vine. Notably, days to last fruit harvest and number of fruits per plant exhibited significant positive genotypic correlations with fruit yield per plant, suggesting that selection based on these traits would be effective. Path coefficient analysis demonstrated that average fruit weight had the highest direct positive effect on yield, followed by number of fruits per vine, fruit diameter, days to first female flower, node at first male flower, node at first female flower and number of primary branches.
***Keywords* :** Correlation, selection, path analysis, bottle gourd.

Introduction

Bottle gourd (*Lagenaria siceraria* (Molina) Standl.) (2n = 2x = 22), belonging to the Cucurbitaceae family, is one of the oldest cultivated vegetables, grown worldwide during the summer season. The genus name *Lagenaria* is derived from the Latin word *lagena*, meaning "bottle." In India, it is commonly referred to as Calabash, Doodhi, or Lauki (Deore *et al.*, 2009). Africa is regarded as its primary center of origin (Singh, 1990) and fossil records suggest its cultivation in India dates back to before 2000 B.C. As a monoecious and andromonoecious crop, bottle gourd exhibits a high level of cross-pollination (Swiander *et al.*, 1994), resulting in considerable variability in economically important traits such as fruit size, shape and color. Nutritionally, the fruit is rich in vitamins and minerals, containing 95.54% moisture, vitamin C (10.1 g), vitamin A (16 IU), thiamine (0.029 g), riboflavin (0.022 g), niacin (0.320 g), carbohydrates (3.39 g), fats (0.02 g) and potassium (150 mg) per 100 g of edible portion (USDA, 2018). It is a nutritious vegetable suitable for human consumption and can also serve as animal feed (Ogunbusola *et al.*, 2010). Due to its light and easily digestible nature, it is recommended for recovery from illness. Its high dietary fiber content helps prevent digestive issues such as constipation and is associated with a lower risk of coronary heart disease and diabetes (Hemeda *et al.*, 2008). Traditionally, bottle gourd juice has been used to alleviate acidity, indigestion and ulcers and it acts as an effective thirst quencher. Medicinally, it is believed to counteract certain poisons and scorpion stings, while offering cooling, purgative, analgesic and fever-reducing effects, making it beneficial for conditions like asthma and bronchial disorders. Additionally, it is a rich source of natural antioxidants (Deore *et al.*, 2009). From a genetic perspective, analyzing genotypic, phenotypic and environmental correlations among traits enables breeders to select optimal trait combinations, facilitating simultaneous improvement of multiple characteristics (Falconer, 1981). Moreover, path analysis, as outlined by Dewey and Lu (1959), helps in understanding cause-and-effect relationships by separating total correlations into direct and indirect effects, providing deeper insight into trait interactions.

Materials and Methods

The present study was conducted at the Department of Vegetable Science, College of Horticulture, Bagalkot, Karnataka, India during *Rabi 2024*. A total of thirty-five bottle gourd genotypes were evaluated for various yield and yield-contributing traits. The experiment was arranged as a single-factor trial in a randomized complete block design (RCBD) with two replications per accession. Plants of each genotype were transplanted randomly within each block, maintaining a spacing of 1 m between rows and 0.75 m between plants. Standard recommended agronomic practices were followed to ensure healthy crop growth. Observations were recorded for vine length, number of primary branches per plant at harvest, days to first male and female flower opening, days to 50 per cent flowering, node number of first male and female flower appearance, days to first fruit harvest, fruit length, fruit diameter, number of fruits per vine, average fruit weight, fruit yield per vine, Genotypic and phenotypic variances and covariances were used according to the formula proposed by Panse and Sukatme (1985) to calculate correlation coefficients among all trait combinations. Additionally, path coefficient analysis was performed following the methods described by Wright (1921) and Li (1956), using the formula given by Dewey and Lu (1959)

Results and Discussion

In this study, thirty-five bottle gourd genotypes were evaluated to assess correlation and path analysis among various yield and yield-contributing traits. Correlation analysis provides insights into the relationships between highly heritable and economically important traits, highlighting their contribution to the genetic architecture of the crop. Phenotypic correlations reflect the observed association between two traits, encompassing both genetic and environmental influences, while genotypic correlations estimate the inherent genetic relationship between traits and are therefore more reliable for selection. The results (Table 1) showed that genotypic correlation coefficients were generally higher than phenotypic ones, indicating minimal environmental influence and that the observed associations were largely genetic. Overall, the pattern of genotypic correlations was similar to that of phenotypic correlations. Both phenotypic and genotypic analyses revealed that fruit yield per plant was positively correlated with traits such as vine length, number of primary branches, node of first male flower, fruit length, fruit diameter, number of fruits per vine and average fruit weight, which agrees with findings by Singh *et al.* (2006), Kumar *et al.* (2007), Yadav *et al.* (2010), Deepthi *et al.* (2012), Muralidharan *et al.* (2013), Janaranjani and Kanthaswamy (2015) and Thakur *et al.* (2017).

Path coefficient analysis (Table 3) further dissected the direct and indirect effects of component traits on yield. The results indicated that average fruit weight, number of fruits per vine, fruit diameter, days to first female flower, node at first male flower, node at first female flower and number of primary branches had substantial direct positive effects on yield. Among these, average fruit weight, number of fruits per vine, fruit diameter, node at first male flower and number of primary branches also exhibited significant positive genotypic correlations with fruit yield, suggesting that selection for these traits would effectively improve yield in bottle gourd. In contrast, traits such as node number at first female flower, fruit length, vine length, days to first male flower, days to first fruit harvest and days to 50 per cent flowering showed negative direct effects, indicating their limited utility in selection programs. These findings are consistent with those reported by Umamaheswarappa *et al.* (2004), Singh *et al.* (2006), Kumar *et al.* (2007), Husna *et al.* (2011), Muralidharan *et al.* (2013), Janaranjani and Kanthaswamy (2015) and Thakur *et al.* (2017).

Table 1: Estimates of genotypic correlation coefficients among different characters in bottle gourd

Traits	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1.00	0.946**	-0.274*	-0.176*	-0.116	0.212*	-0.02	0.052	-0.038	-0.101	0.901**	-0.188*	0.375**
2		1.00	-0.356**	-0.239*	-0.148	0.226*	-0.041	0.082	0.054	-0.037	0.889**	-0.233*	0.326*
3			1.00	0.918**	0.398**	0.101	0.437**	0.175*	0.027	0.044	-0.22*	-0.363**	-0.48**
4				1.00	0.211*	0.179*	0.435**	0.168	0.047	0.086	-0.144	-0.243*	-0.313*
5					1.00	-0.146	0.203*	-0.174*	0.011	-0.036	0.016	-0.267*	-0.236*
6						1.00	0.552**	-0.1	0.031	-0.022	0.291*	0.05	0.264*
7							1.00	0.002	-0.052	-0.004	0.058	-0.153	-0.074
8								1.00	-0.06	-0.112	0.055	-0.222*	-0.23*

9									1.00	0.927**	0.05	0.217*	0.207*
10										1	-0.065	0.227*	0.158
11											1.00	-0.241*	0.398**
12												1.00	0.78**
13													1.00

* 5 % significant ** 1% significant

1) Vine length
2) Number of primary branches
3) Days to first male flower
4) Days to first female flower
5) Days 50 % flowering
6) Node at first male flower
7) Node at first female flower
8) Days to first fruit harvest
9) Fruit length (cm)
10) Fruit diameter (cm)
11) Number of fruits per vine
12) Average fruit weight (g)
13) Fruit yield per vine (kg)

Table 2: Estimates of phenotypic correlation coefficients among different characters in bottle gourd

Traits	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1	0.914**	-0.272*	-0.173*	-0.082	0.205*	-0.023	0.046	-0.039	-0.1	0.881**	-0.189*	0.354**
2		1	-0.35**	-0.236*	-0.101	0.225*	-0.044	0.084	0.053	-0.037	0.879**	-0.224*	0.323*
3			1	0.913**	0.288*	0.102	0.436**	0.166	0.028	0.045	-0.22*	-0.355**	-0.469**
4				1	0.166	0.177*	0.433**	0.167	0.045	0.084	-0.143	-0.237*	-0.305*
5					1	-0.099	0.145	-0.014	0.005	-0.034	0.015	-0.18*	-0.153
6						1	0.548**	-0.095	0.03	-0.022	0.29*	0.051	0.26*
7							1	-0.002	-0.052	-0.003	0.058	-0.149	-0.071
8								1	-0.059	-0.111	0.056	-0.21*	-0.213*
9									1	0.926**	0.05	0.214*	0.203*
10										1	-0.065	0.223*	0.154
11											1	-0.232*	0.398**
12												1	0.785**
12													1

* 5 % significant ** 1% significant

1) Vine length
2) Number of primary branches
3) Days to first male flower
4) Days to first female flower
5) Days 50 % flowering
6) Node at first male flower
7) Node at first female flower
8) Days to first fruit harvest
9) Fruit length (cm)
10) Fruit diameter (cm)
11) Number of fruits per vine
12) Average fruit weight (g)
13) Fruit yield per vine (kg)

Table 3: Path coefficient analysis among different characters in bottle gourd

Traits	1	2	3	4	5	6	7	8	9	10	11	12	rG
1	**-0.092**	0.006	0.016	-0.008	0.001	0.005	0.001	-0.003	0.004	-0.008	0.628	-0.172	0.375
2	-0.087	**0.006**	0.021	-0.012	0.001	0.005	-0.001	-0.005	-0.006	-0.003	0.62	-0.214	0.326
3	0.025	-0.002	**-0.059**	0.044	-0.002	0.002	0.006	-0.01	-0.003	0.003	-0.153	-0.332	-0.48
4	0.016	-0.001	-0.054	**0.048**	-0.001	0.004	0.006	-0.009	-0.005	0.006	-0.1	-0.223	-0.313
5	0.011	-0.001	-0.023	0.01	**-0.005**	-0.003	0.003	0.01	-0.001	-0.003	0.011	-0.244	-0.236
6	-0.02	0.001	-0.006	0.009	0.001	**0.021**	0.007	0.006	-0.003	-0.002	0.203	0.046	0.264
7	0.002	0.001	-0.026	0.021	-0.001	0.012	**0.013**	0.001	0.005	0.001	0.04	-0.14	-0.074
8	-0.005	0.001	-0.01	0.008	0.001	-0.002	0.001	**-0.055**	0.006	-0.008	0.039	-0.203	-0.23
9	0.004	0.001	-0.002	0.002	0.001	0.001	-0.001	0.003	**-0.104**	0.07	0.035	0.199	0.207
10	0.009	0.001	-0.003	0.004	0.001	0.001	0.001	0.006	-0.096	**0.075**	-0.045	0.208	0.158
11	-0.083	0.005	0.013	-0.007	0.001	0.006	0.001	-0.003	-0.005	-0.005	**0.697**	-0.221	0.398
12	0.017	-0.001	0.021	-0.012	0.001	0.001	-0.002	0.012	-0.023	0.017	-0.168	**0.916**	0.78

Residual effect square = 0.0018 Diagonal values indicate direct effect rG = Genotypic correlation coefficient of fruit yield per vine

1) Vine length
2) Number of primary branches
3) Days to first male flower
4) Days to first female flower
5) Days to 50 % flowering
7) Node at first female flower
8) Days to first fruit harvest
9) Fruit length (cm)
10) Fruit diameter (cm)
11) Number of fruits per vine
12) Average fruit weight (g)

Node at first male flower

Conclusion

Correlation studies indicated that characters *viz*., vine length, number of primary branches, node of first male flower, fruit length, fruit diameter, number of fruits per vine and average fruit weight should be considered for improving quantitative traits in bottle gourd. Path coefficient analysis further suggested that number of fruits per plant, average fruit weight, fruit diameter, days to first female flower, node at first male flower, node at first female flower and number of primary branches have the highest direct effects on fruit yield per plant and should be given due importance in selection for breeding of new cultivars.

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