Plant Archives Vol. 25, No. 1, 2025 pp. 2282-2286 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org

DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2025.v25.no.1.330

CORRELATION COEFFICIENT AND PATH ANALYSIS STUDIES IN NATIVE COLLECTIONS OF KASHMIRI PRAN (*ALLIUM* X *CORNUTUM* CLEM. EX VIS)

Suraya Ahsan[1], Gazala Nazir[1]*, Ajaz Ahmad Lone[2], Saima Tabasum[1], Nageena Nazir[1], Irshad Ahmad[3], Khursheed Hussain[1], Ummyiah H. Masoodi[1] and Syed Berjes[1]

[1]Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Sciences and Technology, Shalimar, Srinagar, Kashmir - 190 025, India.

[2]Department of Genetics and Plant Breeding, Dryland Agriculture Research Station, Rangreth - 191 132, India.

[3]Sher-e-Kashmir University of Agricultural Sciences and Technology, Faculty of Agriculture, Wadura - 193 201, India.

*Corresponding author E-mail : gazalanazir6@gmail.com

(Date of Receiving- 14-01-2025; Date of Acceptance-16-04-2025)

ABSTRACT

The present study was conducted at the Urban Techonological Park Habbak, Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Science and Technology of Kashmir during *Rabi* 2023-2024 in which thirty genotypes of Kashmiri Pran (*Allium* x *cornutum* Clem. ex Vis) were evaluated to estimate the genetic diversity, heritability, genetic advance, correlation coefficients and genetic variability for eighteen characters. Local pran widely grown at SKUAST-K Shalimar was taken as check. The experiment was laid in a Randomised Block Design with three replications and observations were recorded on various traits viz; plant height (cm), leaf length, (cm) ,leaf number per plant , bulb length (cm) , bulb diameter (cm), bulb length to diameter ratio, No of bulbs per plant, days to harvest, average bulb weight (g), yield per plant(g)**,** bulb yield(q per ha), antioxidant activity(%DPPH inhibit), vitamin C(mg/100g), phenols(mg/100g), total soluble solids(°Brix), dry matter(%), pyruvic acid(mg/100g) and total sugars(%). In the present study, genotypic and phenotypic correlation coefficients were analyzed for eighteen quantitative and qualitative traits. Overall, genotypic correlation values were slightly higher than phenotypic correlations, suggesting minimal environmental influence and confirming the inherent association among various traits. Correlation coefficients revealed that yield/plant showed significant positive correlation with plant height, bulb length, bulb diameter, No of bulbs per plant and average bulb weight. Overall, the study highlights that trait such as plant height, bulb length, bulb diameter, and the number of bulbs per plant are strong indicators of bulb yield. Additionally, the positive correlations between yield and quality traits like antioxidant activity, Vitamin-C, and pyruvic acid suggest that improving these parameters can enhance both productivity and nutritional value. However, negative correlations between yield and certain traits (such as phenols and TSS) highlight potential trade-offs that need to be considered in breeding programs.

Key words : *Allium* x *cornutum* Clem. ex Vis, Correlation coefficient, Genetic variability, Antioxidants.

Introduction

Pran (*Allium* x *cornutum* Clem.ex Vis) is a rare triploid allium species with a chromosome number of $2n = 3x = 24$. In India it grows only in Kashmir and in Kishtwar district of Jammu. Some countries other than India where this unique allium is cultivated include Tibet, Croatia, Central and West Europe, Canada and Antilles. (Jones *et al.*, 2004). Pran has a rhizome which is condensed i.e discoid shape, bulb is solitary to clustered, ovate to pear shaped tunic texture. Apex of leaf blade is acuminate, cross section is terete (circular). Pran is a triploid, viviparous onion with a slender stature and pinkish-flushed flowers. While *Allium cepa* is confirmed as the source of two chromosome sets, the origin of the third remains debated, though *Allium fistulosum* has been ruled out (Singh, 1967; Rabinowtich, 2022). Jones and Mann classified onions into Common and Aggregatum types, with Aggregatum including *Allium proliferum*, which further divides into *Allium viviparium* and Common onion (*Allium cepa*). Their hybridization resulted in Pran (*Allium* × *cornutum* Clem. ex Vis). Initially identified as *Allium cepa* L. var. *viviparum*, it was later reassigned as *Allium* × *cornutum* to distinguish it from *Allium* × *proliferum*, a different viviparous onion. Originally described by Visiani, this hybrid was found in Dubrovnik's rocky terrains (Klaas and Friesen, 2002).

One notable species, Pran, is distinguished by its unique flavor and is widely used as a condiment in soups, meat dishes and salads. It holds a special place in Kashmiri cuisine, where the renowned "Wazwan" is considered incomplete without it. Pran is also a key ingredient in traditional chili cakes, locally called "Wari." Due to its exceptional qualities, Pran is extensively cultivated in northern China. Rich in essential nutrients and characterized by a strong pungent aroma and taste, it is a staple in local diets, particularly when consumed with beef and mutton, as it helps neutralize the strong odors. Boiled Pran is also believed to treat colds, dysentery and other ailments, making it a year-round essential for local communities (Jabeen *et al*., 2012).

Materials and Methods

The present investigation was conducted at the Urban Techonological Park Habbak, Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Science and Technology of Kashmir during *Rabi* 2023-2024 in which thirty genotypes of Kashmiri Pran (*Allium* x *cornutum* Clem. ex Vis) were evaluated to estimate genetic variability, correlation and path analysis. Observations were recorded from five randomly selected competitive plants per genotype, assessing both quantitative and qualitative parameters following standard procedures. The primary objectives were to evaluate genetic variability, correlation, and path coefficient analysis between yield and its contributing traits to identify high-performing genotypes in Pran. Correlation coefficients were computed for all possible character combinations at genotypic, phenotypic and environmental levels. Mean plant values were used to estimate genotypic correlation coefficients based on the method proposed by Johnson *et al*. (1955), while path coefficient analysis was conducted following the approach of Dewey and Lu (1959) to determine the relationship between yield and its attributes.

Results and Discussion

Correlation coefficient analysis

In the present study, genotypic and phenotypic correlation coefficients were analyzed for eighteen quantitative and qualitative traits. Overall, genotypic correlation values were slightly higher than phenotypic correlations, suggesting minimal environmental influence and confirming the inherent association among various traits. Bulb yield per hectare exhibited a positive and significant correlation with plant height (0.654), bulb length (0.469), bulb diameter (0.531), number of bulbs per plant (0.745) and average bulb weight (0.358). Among the quality parameters, yield demonstrated a positive and significant correlation with antioxidant activity (0.482), Vitamin C (0.629), dry matter content (0.363) and pyruvic acid (0.647). However, a negative and significant correlation was observed only with phenols (0.264). The genotypic correlation was generally higher than the phenotypic correlation for most traits, indicating a strong inherent association between various characteristics (Table 1). Yield per plant recorded is highly significant and positive correlation with no of bulbs per plant. Yield per plant (0.744), antioxidant activity (0.391), Vitamin C content (0.454), dry matter content (0.450), and pyruvic acid (0.423) showed a positive and significant correlation with the number of bulbs per plant. However, a negative and significant correlation was observed with average bulb weight (-0.384) and a positive correlation with total sugars (0.298) These findings corroborate the earlier findings of Hosamani *et al*. (2010), Dhotre *et al*. (2010), Awale *et al*. (2011).

The correlation analysis revealed several significant relationships between yield and various morphological and quality parameters, providing insights into key factors influencing bulb yield. Bulb yield per hectare exhibited a strong positive correlation with plant height, bulb length, bulb diameter, the number of bulbs per plant, and average bulb weight. Among quality parameters, yield showed a positive correlation with antioxidant activity, Vitamin -C, dry matter content, and pyruvic acid, indicating that these traits may be potential selection criteria for improving bulb yield. However, a negative correlation with phenols suggests that higher phenolic content might be associated with reduced yield. Singh *et al*. (2013) and Santra *et al*. (2017). Plant height showed a strong correlation with bulb length, bulb diameter, the number of bulbs per plant, and quality traits such as antioxidant activity, Vitamin-C, and pyruvic acid. However, its negative correlation with total soluble solids (TSS) suggests a trade-off between plant vigor and sugar accumulation. Similarly, leaf length was positively correlated with leaf number per plant and bulb-related traits, indicating its potential role in plant productivity. Bulb diameter had a positive correlation with average bulb weight and total sugars but exhibited a negative correlation with the bulb length-to-diameter ratio,

Table 1 : Correlation Matrix (Above diagonal Genotypic and below diagonal Phenotypic).

Parameters	Yield/ha	Plant height	Leaf length	Leaf no /plant	Bulb length	Bulb diameter	Bulb leaf dia ratio	No of bulbs /plant	Days to harvest	Avg bulb weight	Yield per plant	Antioxi-dants	Vit-C	Phenols	TSS	Dry matter	Pyruvic acid	Total sugars
Yield / ha	1.000	0.654**	0.088	0.055	0.469**	0.531**	0.063	0.745**	-0.024	0.358*	1.000**	0.482**	0.629**	-0.264*	-0.173	0.381**	0.647**	0.007
Plant height	0.642**	1.000	0.034	-0.222*	0.690**	0.282**	0.140	0.396**	0.025	0.375**	0.654**	0.672**	0.388**	-0.203	-0.412**	0.246*	0.607**	0.013
Leaflength	0.109	0.123	1.000	0.725**	0.118	0.278**	0.168	0.249*	-0.102	-0.080	0.087	0.219*	-0.046	0.136	-0.021	-0.360**	-0.105	-0.163
Leaf no / plant	0.065	-0.198	0.668**	1.000	-0.181	-0.065	0.263*	0.435**	-0.031	-0.375**	0.054	-0.107	-0.025	0.116	0.047	-0.213*	-0.159	-0.379**
Bulb length	0.449**	0.679**	0.181	-0.157	1.000	0.389**	0.169	0.149	-0.164	0.522**	0.469**	0.347**	0.370**	0.119	-0.402**	-0.020	0.564**	0.014
Bulb diameter	0.501**	0.281**	0.283**	-0.048	0.375**	1.000	-0.540**	-0.301**	0.028	0.676**	0.101**	0.163	0.129	0.029	-0.114	-0.426**	0.204	0.236*
Bulb leaf dia ratio	0.060	0.142	0.177	0.267*	0.169	-0.488**	1.000	0.558**	-0.208*	-0.627**	0.063	0.172	0.003	0.209*	-0.147	0.445**	0.021	-0.456**
No of bulbs/plant	0.741**	0.398**	0.261*	0.442**	0.153	-0.273**	0.552**	1.000	-0.046	-0.384**	0.744**	0.391**	0.454**	-0.039	-0.076	0.450**	0.423**	-0.298**
Days to harvest	-0.021	-0.024	-0.102	-0.035	-0.154	0.028	-0.205*	-0.041	1.000	0.057	-0.024	0.293**	-0.311**	-0.161	0.025	-0.175	0.064	0.154
Avg bulb weight	0.235*	0.353**	-0.078	-0.376**	0.491**	0.633**	-0.642**	-0.400**	0.051	1.000	0.358*	0.069	0.102	-0.247*	-0.135	-0.267*	0.242*	0.315**
Yield / plant	1.000**	0.642**	0.108	0.064	0.449**	0.101	0.060	0.741**	-0.022	0.235*	1.000	0.481**	0.629**	-0.265*	-0.173	0.382**	0.647**	0.007
Antioxidants	0.459**	0.691**	0.313**	-0.082	0.344**	0.175	0.167	0.403**	0.298	0.007	0.459**	1.000	0.703**	-0.320**	-0.225*	0.225*	0.663**	0.391**
Vit-C	0.449**	0.396**	0.394**	0.055	0.361**	0.173	0.068	0.352**	0.311	0.075	0.449**	0.680**	1.000	-0.179	-0.401**	-0.146	0.569**	0.447**
Phenols	-0.253*	-0.175	0.171	000000.123	0.135	0.040	0.215*	-0.027	-0.15	-0.246*	-0.254*	-0.297**	-0.020	1.000	-0.120	-0.329**	-0.005	-0.343**
TSS	-0.165	-0.357**	0.103	0.069	-0.346**	-0.078	-0.131	-0.056	-0.024	-0.148	-0.165	-0.199	-0.017	-0.088	1.000	0.041	-0.446**	0.136
Dry matter	0.363**	0.274**	-0.147	-0.174	0.016	-0.357**	0.435**	0.451**	-0.171	-0.289**	0.364**	0.239*	0.193	-0.279**	0.102	1.000	0.107	-0.202
Pyruvic acid	0.450**	0.506**	0.298**	-0.035	0.464**	0.207	0.056	0.329**	0.061	0.129	0.450**	0.564**	0.816**	0.075	-0.113	0.264*	1.000	0.111
Total sugars	0.002	0.054	0.028	-0.320**	0.056	0.232*	-0.403**	-0.256*	0.157	0.269*	0.002	0.394**	0.531**	-0.280**	0.189	-0.108	0.276**	1.000

** = Significant at 1 % and * = Significant at 5 % level of significance.

Table 2 : Estimate of direct (diagonal) and indirect effects (off diagonal) at genotypic level.

Prameters	Plant height	Leaf length	Leaf no /plant	Bulb length	Bulb diameter	Bulb leaf dia ratio	No of bulbs per plant	Days to harvest	Avg bulb weight	Correlation with yield
Plant height	-0.012	0.003	0.052	0.121	-0.031	-0.055	0.445	-0.001	0.132	0.654**
Leaf length	-0.001	0.079	-0.171	0.021	-0.030	-0.065	0.279	0.004	-0.028	0.087
Leaf no /plant	0.003	0.057	-0.236	-0.032	0.007	-0.103	0.489	0.001	-0.132	0.054
Bulb length	-0.009	0.009	0.043	0.176	0.042	0.066	0.168	0.007	0.183	0.469**
Bulb diameter	-0.003	0.022	0.011	0.068	0.109	0.211	-0.338	-0.001	0.237	0.101**
Bulb leaf dia ratio	-0.002	0.013	-0.062	0.030	0.059	-0.390	0.627	0.009	-0.220	0.063
No of bulbs/ plant	-0.005	0.020	-0.103	0.026	0.033	-0.217	1.124	0.002	-0.135	0.744**
Days to harvest	-0.001	-0.008	0.006	-0.029	-0.003	0.081	-0.051	-0.041	0.020	-0.025
Average bulb weight	-0.005	-0.006	0.088	0.092	0.073	0.245	0.431	-0.002	0.351	0.358**

Residual effect: 0.00319

the number of bulbs per plant, and dry matter content. These correlations indicate that selecting for larger bulb diameter may lead to fewer, but heavier and sweeter bulbs. However, this could come at the cost of reduced dry matter content and a shift in bulb shape .Quality traits also showed significant interrelationships. Antioxidant activity was positively correlated with Vitamin-C, dry matter content, pyruvic acid, and total sugars, but negatively correlated with TSS and phenols. Similarly, phenols were positively correlated with dry matter content and total sugars at the genotypic level but showed negative correlations at the phenotypic level.

Path coefficient analysis

The provided path coefficient table (Table 2) examines the relationships between various plant traits and their correlation with bulb yield. Understanding these relationships is crucial for identifying key factors that influence yield, aiding in the selection of desirable traits for cultivation and breeding programs (Dhotre *et al*., 2010; Lakshmi *et al*., 2015; Nikhil *et al*., 2016; Solanki, 2015; Singh *et al*., 2013).

The analysis reveals that plant height has a strong positive correlation with yield (0.654), indicating its significance in enhancing bulb production. However, its direct impact is minimal (-0.012), suggesting that its effect on yield is largely mediated through other parameters such as the number of bulbs per plant and average bulb weight. Leaf length exhibits a weak correlation with yield (0.087), implying a limited direct influence. Nevertheless, it may contribute indirectly through traits like bulb length and diameter. Similarly, the number of leaves per plant shows a very low correlation with yield (0.054), suggesting a negligible role. Its weak direct effect (-0.236) could indicate a slight negative influence, potentially offset by indirect effects. Bulb length has a moderate positive correlation with yield (0.469), highlighting its importance. It exerts a direct positive effect (0.176), suggesting its direct contribution to yield improvement. Conversely, bulb diameter shows a weaker correlation (0.101), but its direct effect (0.109) is notable. Indirect contributions through bulb weight and the number of bulbs per plant further enhance its role in yield determination. The bulb length-to-diameter ratio has a low correlation with yield (0.063), indicating a limited impact. Its weak direct effect (-0.390) suggests that other traits, such as bulb weight and bulb diameter, play more significant roles in determining yield. The number of bulbs per plant demonstrates the highest positive correlation with yield (0.744), making it a key determinant. Its direct effect is highly significant (1.124), emphasizing its crucial role in increasing yield. Days to

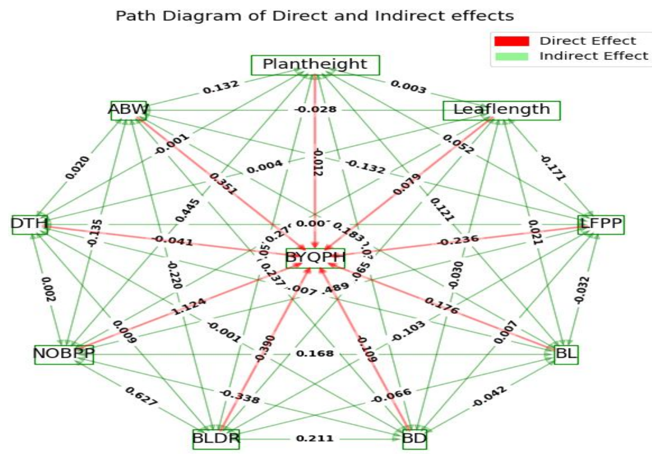

Fig. 1 : Path diagram of direct and indirect effects.

harvest shows a slight negative correlation with yield (-0.025), indicating that delayed harvesting may marginally reduce yield. Both its direct and indirect effects are minimal, signifying limited overall influence. Average bulb weight has a moderate positive correlation with yield (0.358), highlighting its role in yield determination. Its direct effect (0.351) underscores the importance of bulb size in improving yield. Overall, the most strongly correlated traits with yield are the number of bulbs per plant (0.744) and plant height (0.654), making them primary targets for selection in breeding programs. Additionally, bulb length (0.469) and average bulb weight (0.358) also contribute significantly to yield, primarily through their direct effects (Kalloo *et al.*, 1982 and Abayneh, 2001).

Conclusion

The present study on Kashmiri Pran (*Allium x cornutum* Clem. ex Vis) revealed significant genetic variability and trait associations that can aid in breeding programs aimed at enhancing yield and quality traits. The correlation and path analysis highlighted that yield per plant exhibited strong positive associations with plant height, bulb length, bulb diameter, and the number of bulbs per plant, indicating their significance in selection criteria. Moreover, quality traits such as antioxidant activity, Vitamin C and pyruvic acid also correlated positively with yield, suggesting that nutritional attributes can be improved alongside productivity. However, negative correlations between yield and certain traits like phenols and TSS indicate potential trade-offs, which should be carefully considered in breeding strategies. The findings underscore the importance of selecting genotypes with desirable yield and quality attributes while balancing potential compromises in biochemical traits. Future research should focus on molecular and genomic approaches to further refine selection methods and improve the breeding efficiency of this unique Allium species.

References

Abayneh, M. (2001). Variability and association among bulb yield, quality and related traits in onion (*Allium cepa*. L). *M. Sc. Thesis* submitted to College of Agriculture, Alemaya University.

Awale, D., Alamerew S. and Tabor G. (2011). Genetic variability and association of bulb yield and related traits in shallot (*Allium cepa* var. *aggregatum* Don.) in Ethiopia. *Int. J. Agricult. Res.*, **6(7)**, 517-536.

Dewey, D.R. and Lu K.M. (1959). A correlation and path coefficient analysis of crested wheat grass seed production. *Agron. J.,* **51**, 515-518.

Dhotre, M., Alloli T.B., Athani S.I. and Halemani (2010). Genetic variability, character association and path analysis studies in kharif onion (*Allium cepa* var. *cepa* L.). *The Asian J. Horticult.,* **5(1)**, 143–146.

Hosamani, R.M., Patil B.C. and Ajjappalavara P.S. (2010). Genetic variability and character association studies in onion (*Allium cepa* L.). *Karnataka J. Agricult. Sci.*, **23(2)**, 302-305.

Jabeen, N., Afroza B., Khan S.H. and Makhdoomi M.I. (2012). Kashmiri Chilli- A Gold Mine. *Indian J. Arecanut, Spices and Medicinal Plants*, **14(2)**, 33-36.

Johnson, H.W., Robinson H.F. and Comstock R.E. (1955). Estimates of genetic and environmental variability in soybean. *Agron. J.,* **47**, 314-318.

Jones, M.G., Hughes J., Tregova A., Milne J, Tomsett A.B. and Collin H.A. (2004). Biosynthesis of the flavour precursors of onion and garlic. *J. Exp. Bot.,* **55(404)**, 1903–1918.

Kalloo, J.C., Pandey S.C., Lal S. and Pandita M.L. (1982). Correlation and path analysis studies in onion. *Haryana J. Horticult. Sci.,* **11**, 97.

Klass, M. and Freisen N. (2002). Molecular markers in *Allium*. In: Rabinowitch, H.D. and Currah L. (eds) *Allium Crop Science*: *Recent Advances*. *CAB International*. 159-185.

Lakshmi, R.R. (2015). Studies on Genetic variability, correleation and path analysis of yield and yield components inn onion. *J. Horticult. Sci.*, **10(2)**, 237-241.

Nikhil, B.S.K., Jadhav A.S. and Kumar S. (2016). Studies on correlation and path analysis in *rabi* onion (*Allium cepa* L.). *Ecol., Environ. Conser.*, **22(1)**, 435–438.

Robinowitch, H.D. and Brewester J.L. (2022). *Onion and Allied crops*. **3** (15-18).

Santra, P., Manna D., Sarkar H.K. and Maity T.K. (2017). Genetic variability, heritability and genetic advance in *kharif* onion (*Allium cepa* L.). *J. Crop Weed*, **13(1)**, 103-106.

Singh, F., Ved Brat S. and Khoshoo T.N. (1967). Natural triploidy in viviparous onions. *Cytologia*, **32**, 403–407.

Singh, S., Ahmed N., Lal S., Amin A., Amin M., Ganie S. and Jan N. (2013). Character association and path analysis in garlic (*Allium sativum* L.) for yield and its attributes. *SAARC J. Agricult.*, **11(1)**, 45–52.

Solanki, P. (2015). Studies on genetic analysis and character association in different genotypes of onion *(Allium cepa* L.). *M. Sc. Thesis*, Department of Horticulture. Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh.