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CHARACTER ASSOCIATION AND PATH ANALYSIS FOR SEED VIGOR TRAITS IN SESAME (*Sesamum indicum* L.)

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KEYWORDS

Sesame

Genotype, Correlation

Path analysis

ABSTRACT

The present investigation was conducted using 24 genotypes of sesame for correlation and path analysis among seven seed quality characters which revealed that standard germination showed a significant and positive correlation with shoot length, root length, seedling length, seed vigor index-I and seed vigor index-II, which indicated that by increasing these attributes, standard germination will be increased, thus these parameters are suggestive of good plant stand and ultimately seed yield. Path coefficient analysis suggested that seed vigor index-I, shoot length and seedling length are major components of standard germination which could increase the seed yield.

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1 Introduction

Crop yields and quality would be greatly affected without a steady supply of high-quality seed (Douglas, 2019). Seed is a basic input in agriculture and quality seed plays an important role in the sustainable agronomic and horticultural crops production (Shubha et al., 2017). Seed quality describes the potential performance of a seed lot. Trueness to variety is depended on the various important aspects of seed quality among these some common are, the presence of inert matter, other crops seeds, noxious weed seed, freedom from disease and insect infestations (Bishaw et al., 2007). High-quality seed lots should meet minimum standards for each of these characteristics. Achieving and maintaining high seed quality is the prerequisite for any seed certification programs (Gebeyehu et al., 2019). Germination potential and vigor are at their highest potential when the seed reaches physiological maturity. Due to high seed moisture, most crops are not ready to be harvested at that time (Rao et al., 2017). Seed vigor is the potential of seeds for rapid and uniform emergence and development of normal seedlings under various environmental conditions (Marcos Filho, 2015). Although vigor testing is not required for labeling of seed, many seed producers use vigor tests as a quality control to ensure that the seed produced is of high quality. Seed vigor is influenced by many factors, such as maturity level at harvest, age of the seed, mechanical injuries, disease infection, storage environment and genetic constitutions of the seeds (Khare & Bhale, 2016). Correlation coefficient analysis is very important in plant breeding experiment because it computes the degree of genetic and non-genetic association between two or more traits and to help in concurrent selection when more than one trait is desired (Laidig et al., 2017). Although, correlation coefficient analysis among the different traits does not considers the cause and effect relationships between dependent and independent characters. Path analysis provides a measure of relative significance of each independent variable to prediction of changes in the dependent one. A path coefficient is a standardized partial regression coefficient which measures the direct effect of one trait upon other and allows the partition of correlation coefficient into direct and indirect effects (Yakubu, 2010; Mecha et al., 2017). Path coefficients show direct influence of independent variable upon dependent variable (Jiang et al., 2017). In plant breeding programme, path coefficient analysis has been used by geneticist and crop breeders to aid in identifying traits that are useful as selection criteria to improve seed germination and seed vigor traits (Sunday et al., 2007; Rahman et al., 2012). Therefore, the present study was planned to study the association between different seed quality traits which influences the seed vigor and germination per cent.

2 Materials and methods

The experimental material comprised of 24 diverse genotypes of sesame procured from Oilseeds Section, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar. Seed quality parameters *viz.,* standard germination (%), shoot length (cm), root length (cm), seedling length (cm), seedling dry weight (mg), seed vigor index-I & seed vigor index-II were estimated and recorded in the seed quality testing laboratory of the Department of Seed Science and Technology from the harvested seeds of selected plants. For the estimation of standard germination (%), 3 replications with 100 seeds per replication for each genotype were placed on sufficiently moistened rolled germination papers in petri dishes (top of the paper method of standard germination testing) at 25°C temperature with 90-95% relative humidity in the seed germinator. Final count for germination was recorded on 6th day (as per International Seed Testing Association, 2009). At the time of final seedling evaluation, seeds were classified as normal seedling, abnormal seedling, fresh un-germinated seeds and dead seed. Normal seedlings including fresh un-germinated seeds were expressed as per cent germination. Shoot length (cm) and root length (cm) were estimated using 30 seedlings selected randomly from the normal seedlings in each replication for all genotypes at the time of final count of standard germination and average shoot and root length for each genotype were measured. Seedling length (cm) was calculated using the same seedlings which used for calculating shoot and root lengths for all the genotypes and average seedling length was measured as Seedling length = Root length + Shoot length**.** Seedling dry weight (mg) was measured using the same 30 normal seedlings that were taken for measuring the root and shoot length and these seedlings were kept further in hot air oven at 80°C for 24 hours and average dry weight per seedling was recorded in milligram. From the observations of standard germination test, the seed vigor index-I and seed vigor index-II were calculated according to the method suggested by Abdul-Baki & Anderson (1973) using the following formulae *viz.*, Seed vigor index-I = Standard Germination (%) X Seedling length (cm) and Seed vigor index-II = Standard Germination (%) X Seedling dry weight (mg). The correlation coefficients among all possible character combinations at phenotypic 'r (p)' and genotypic 'r (g)' level were estimated by employing the formulae given by Al- Jibouri et al. (1958). The path coefficient analysis was performed as per the formula given by Wright (1921) and adopted by Dewey & Lu (1959).

3 Results and Discussion

Genotypic correlation coefficients have higher magnitude than their corresponding phenotypic correlation coefficients, which revealing a good amount of strong inherent association between different attributes. Similar findings were also reported by Garg et al. (2017) in green gram. Standard germination (%) showed significantly positive correlation at both genotypic and phenotypic level with shoot length (cm), root length (cm), seedling length (cm), seed vigor index-I and seed vigor index-II. These parameters were indicative of good plant stand in the field and ultimately seed

Table 1 Phenotypic (above diagonal) and genotypic (below diagonal) correlation coefficients among seed quality traits in sesame

Seed quality traits	SL	RL	SdL	SdW	VG 1	VG 2	SG
SL	1.000	0.347**	0.667**	0.324**	0.614**	0.413**	0.306**
RL	0.815**	1.000	0.930**	0.387**	0.848**	0.524**	0.427**
SdL	0.891**	0.989**	1.000	0.434**	0.913**	0.578**	0.459**
SdW	0.171	0.603**	0.515**	1.000	0.371**	0.844**	0.157
VG 1	0.924**	0.928**	0.960**	0.527**	1.000	0.703**	0.775**
VG 2	0.596**	0.751**	0.739**	0.861**	0.835**	1.000	0.659**
SG	0.807**	0.663**	0.724**	0.462**	0.891**	0.849**	1.000

* Significant at P = 0.05 Level; ** Significant at P = 0.01 Level

Table 2 Path coefficient analysis for seed quality traits in sesame for standard germination

Seed Quality traits	SL	RL	SdL	SdW	VG 1	VG 2
Shoot length (cm)	**0.872**	-0.710	-0.777	-0.149	-0.805	-0.519
Root length (cm)	-1.306	**-1.602**	-1.584	-0.966	-1.486	-1.203
Seedling length (cm)	0.236	0.262	**0.265**	0.137	0.255	0.196
Seedling dry weight (mg)	-0.010	-0.034	-0.029	**-0.057**	-0.030	-0.049
Seedling vigour index I	1.103	2.857	2.957	1.623	**3.080**	2.572
Seedling vigour index II	-0.088	-0.111	-0.109	-0.127	-0.124	**-0.148**
Genotypic correlation with SG	0.807**	0.663**	0.724**	0.462**	0.891**	0.849**

Residual effect = -0.01721; * Significant at P = 0.05 Level ** Significant at P = 0.01 Level; **SG** = Standard germination (%), **SL** = Shoot length (cm), **RL** = Root length (cm), **SdL** = Seedling length (cm), **SdW** = Seedling dry weight (mg), **VG 1** = Seed vigor index-I, **VG 2** = Seed vigor index-II

yield. Similar results for one or more characters were reported by Singh et al. (2000) in wheat, Garg et al. (2017) in mungbean, Yadav et al. (2011) in barley and Jan & Kashyap (2019) in rice. Both the seed vigor index-I and seed vigor index-II showed significantly positive correction at both genotypic and phenotypic level with shoot length (cm), root length (cm), seedling length (cm), seedling dry weight (mg) and standard germination (%), and also showed significantly positive correlation with each other at both genotypic and phenotypic level (Table 1). Similar results for one or more of these characters were also reported in barley (Yadav et al., 2011). Usually, traits that exerted positive direct effect as well as significantly positive correlation coefficient with standard germination (%) and seed vigor indices were known to affect seed vigor and germination in the favourable direction and need much consideration during the process of selection. The highest positive direct effect on standard germination (%) was exerted by seed vigor index-I (3.080) followed by shoot length (0.872). The positive direct effect on standard germination (%) was also exhibited by seedling length (0.265) while the characters *viz.,* root length (cm), seed vigor index-II and seedling dry weight (mg) had negative direct effect on standard germination (%) with the values of -1.602, -0.148 and -0.057, respectively (Table 2). The residual effect (-0.01721) indicate that the component characters under study were responsible for about 98% of variability in standard germination.

Conclusion

So far from the combined results of correlation coefficient and path coefficient analysis, it may be concluded that seed vigor index-I, shoot length and seedling length are major components of standard germination which can be taken into consideration to improve plant population through increasing germination per cent, ultimately resulting in higher seed yield.

Conflict Of Interest

Authors would hereby like to declare that there is no conflict of interests that could possibly arise.

References

Abdul-Baki AA, Anderson JD (1973) Vigor determination in soybean seed by multiple criteria 1. Crop Science 13: 630-633.

Al-Jibouri HA, Miller PA, Robinson HF (1958) Genetic and environmental variances and co-variances in an upland cotton cross of interspecific origin. Agronomy Journal 50: 633-636.

Bishaw Z, Niane AA, Gan Y (2007) Quality seed production. In: Springer, Dordrecht, Lentil, Pp. 349-383.

Dewey DI, Lu KH (1959) A correlation and path-coefficient analysis of components of crested wheatgrass seed production. Agronomy Journal 51: 515-518.

Douglas JE (2019) Successful seed programs: A planning and management guide. CRC Press.

Garg GK, Verma PK, Kesh H, Kumar A (2017) Genetic variability, character association and genetic divergence for seed quality traits in mungbean [*Vigna radiata* (L.) Wilczek]. Indian Journal of Agriculture Research 51: 521-528.

Gebeyehu S, Kangile J, Mwakatobe E (2019) Assessment of seed quality along the rice seed value chain in Tanzania. Development in Practice 29: 854-866.

ISTA (2009) International rules for seed testing. Seed Science and Technology 27: 1-334.

Jan N, Kashyap SC (2019) Correlation and path analysis in rice (*Oryza sativa* L.) for seed and seed vigor traits. Journal of Pharmacognosy & Phytochemistry 8: 222-226.

Jiang S, Zhou F, Yang Q, Yang L (2017) Correlation and path coefficient analyses of the morphological characteristics and body weight of *Penaeus monodon* (Crustacea, Decapoda, Penaeidae). Insights in Aquaculture and Biotechnology 1: 2.

Khare D, Bhale MS (2016) Seed technology. Scientific Publishers, Jodhpur, India.

Laidig F, Piepho HP, Rentel D, Drobek T, Meyer U (2017) Breeding progress, genotypic and environmental variation and correlation of quality traits in malting barley in German official variety trials between 1983 and 2015. Theoretical and Applied Genetics **130**: 2411-2429.

Marcos Filho J (2015) Seed vigor testing: an overview of the past, present and future perspective. Scientia Agricola 72: 363-374.

Mecha B, Alamerew S, Assefa A, Assefa E, Dutamo D (2017) Correlation and path coefficient studies of yield and yield associated traits in bread wheat (*Triticum aestivum* L.) genotypes. Advances in Plants & Agriculture Research 6: 00226.

Rahman MM, Syed MA, Adil M, Ahmad H, Rashid MM (2012) Genetic variability, correlation and path coefficient analysis of some physiological traits of transplanted Aman rice (*Oryza sativa* L.). Middle East Journal of Scientific Research 11: 563-566.

Rao NK, Dulloo ME and Engels JM (2017) A review of factors that influence the production of quality seed for long-term conservation in genebanks. Genetic Resources and Crop Evolution 64: 1061-1074.

Shubha K, Mukherjee A, Kumari M, Tiwari K, Meena VS (2017) Bio-stimulants: an approach towards the sustainable vegetable production. In: agriculturally important microbes for sustainable agriculture, Springer, Singapore, Pp. 259-277.

Singh AK, Prakash V, Sastry EVD (2000) Effect of salinity stress on seed germination and seeding growth of wheat. Agricultural Science Digest 20: 96-98.

Sunday OF, Ayodele AM, Babatunde KO and Oluwole AM (2007) Genotypic and phenotypic variability for seed vigour traits and seed yield in West African rice (*Oryza sativa* L.) genotypes. Journal of American Science 3: 34-41.

Wright S (1921) Correlation and causation. Journal of Agricultural Research 20: 557-585.

Yadav INDAL, Soni SK, Jain R, Vimal SC, Yadav VK (2011) Character Association and Path Analysis of Vigor Index with some Important Seed Vigor Contributing Traits in Barley (*H. vulgare* L.). Environment and Ecology 29: 1866-1870.

Yakubu A (2010) Path coefficient and path Analysis of body weight and biometric traits of Yankasa lambs. Slovak Journal of Animal Science 43: 17-25.