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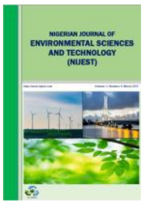

Effect of Environment on Morphometric Characteristics of Mung bean (*vigna radiata* (L.) Genotypes through Seed Digital Imaging Analysis

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ABSTRACT

Digital imaging is a fast and reliable method for cultivar identification and discrimination. Computer seed digital imaging was utilized in this study to evaluate the differences in seed metric traits in ten genotypes of mung bean as affected by the seed production environment. A hundred seeds in each of the mung bean genotypes were subjected to digital imaging analysis using the 'WinSEEDLE™' software to differentiate the seed metric characters. For every replication, a hundred seeds were placed on the lighting hood in such a way that the embryo axis of the seed faces the image analysis system and the longitudinal axis runs parallel to the surface of the scanner. Seeds were automatically analyzed by the scanner and the image of the seed was recorded by the 'WinSEEDLE™'. The procedure of hundred seeds placement on seed digital image was repeated three times for each genotype. The parameters observed were seed area, straight length, curve length, straight width, curve width, width length, and seed perimeter. Scan data collected from 'WinSEEDLE™' were subjected to analysis of variance and principal component analysis. The result revealed that the Mung bean genotypes evaluated were highly variable in all the seed metric traits evaluated. The study recommended that attention should be given to genotypes and seed production environments in the seed production of Mung bean. Genotypes Tvr-73, Tvr-27, Tvr-98, and Tvr-78 have been identified with consistent and high seed morphometric characteristic performance for most of the attributes examined, hence, can be important criteria in selecting superior seed physical traits and could be used as parental material, in the development of high seed yielding varieties

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Keywords: Genotypes, seed imaging, seed metric, seed quality, seed scanner, Mung bean

1.0. Introduction

Pulses are legume-dried seeds, such as lentils, peas, chickpeas, and beans. They are vital nutritional sources for billions of people around the world, although their functional attributes and benefits have not yet been fully explored (Singh, 2017). Mung bean (Vigna radiate), although still classified as an underutilized crop, is a legume cultivated throughout Asia for its edible seeds and sprouts (Asari et al., 2019). According to Schrinemachers, et al., (2019), and the International Mung bean improvement Network, (IMIN., 2022) the Current world production area of Mung bean is about 7.3 million ha with about global output of 5.3 million tons with India and Myanmar each supplying about 30% of this, china 16% and Indonesia 5%.six million hectares per year, out of which 90% from Asia, with an average yield of 400 kg·ha−1. Currently, the productivity of Mung bean is still very low, but the demand might increase in the future due to its high dietary quality (Ebert, 2014 Sehrawat et al., 2015).

Shi et al., (2016) reported that the crop provides significant amounts of protein, carbohydrates, and a range of micronutrients to human diets and also contains the essential amino acid lysine. In addition, the bean contains high levels of antioxidant activity, which scavenge free radicals in the body. Hilger, et al., (2015) reported that in recent years, the crop has been tremendously gaining attention as a short-season crop that can tolerate dryland conditions, fixes atmospheric nitrogen, and its ability to decrease soil nutrient depletion. It is a source of high-quality protein for human consumption and can serve as a multipurpose crop. Global demand for miscellaneous legumes has increased, including for Mung bean. At present, the global food supply is based on 30 crops, supplying 95% of our daily caloric intake, 60% of which is provided by just four crops, i.e. potatoes, wheat, maize, and rice (IMIN, 2022). Nonetheless, minor crops are still important at local, regional, and national levels. In most nations, especially in developing countries in Africa, these minor crops are staples, contributing to the food supply in certain periods and a nutritionally balanced diet as a whole.

In Nigeria, no known released varieties of this crop yet, while the few accessions of Mung bean available are kept in the gene banks of some scattered agricultural research Institutes in the country and cannot be accessed by potential farmers and seed companies. This shows the need for more research work on the selection and improvement of promising Mung bean genotypes with high-yielding potentials for sustainable cultivation and integration into the cropping system of Nigeria. The crop has several uses and can be cooked fresh, sundried, or made into flour. It can be made into soups, porridge, snacks, bread, noodles, and ice cream.

According to (Singh, 2017), the crop can be processed into popular starch noodles (vermicelli, bean thread noodles, and cellophane noodles) or soap. Singh, (2017) reported that the sprouted seeds called ("bean sprouts") in English can be relished raw or cooked throughout the world, even the immature pods and young leaves are of enormous importance as they can be eaten as a vegetable. Their usefulness in livestock cannot be over-emphasized as they are a source of livestock feeds and fodder which can be either hay, straw, or silage (Shi et al., 2016). Its by-products when processed can be made into Mung bean bran. In Nigeria, Mung bean is delicious and can be used as an alternative to most other beans in dishes like curries, salads, and soups. However, the crop can be environmentally influenced when planted on the field, some scientists like Adebisi (2004) in his work reported that the term environment is used to represent the conditions under which plants grow and includes locations, years, and management practices adopted among others. The occurrence of Genotype × Environment interaction has been a major problem in understanding the behaviour of genotypes across the environment. This has hampered the effectiveness of many selection procedures in the improvement of crop varieties.

Vasconcelos, (2018) and Medeiros et al., (2019) are of the opinion that Image analysis of seeds and seedlings can be used in agriculture to establish correlations of seed morphology to seedling performance, in other to express seed vigour with greater precision and less subjectivity. They further established that the results of seed Image analysis are non-destructive, quick, and reliable.

According to Medeiros et al., (2018) through image analysis, it is possible to obtain variables like length, area, circularity, width, perimeter, and colour of the seed coat, among others. These variables can be evaluated using software to characterize the physical aspects of the seeds. However, one of the major requirements in developing machine vision systems for analysing and sorting plant products (e.g., seeds, fruits, or vegetables) is the ability to analyse an image accurately and quickly. Various methods (e.g., use of a CCD camera, flatbed scanner, X-ray scanning, or NMR imaging) can be used to obtain seed images showing external or internal features of certain quality factors, such as size, shape, colours, and defects (Noronha et al., 2019).

Several, scientists have reported using seed imaging machines in analysing, adsorption, and studying the growth of crops in many ways. Rahman, (2016) uses image analyses to detect the colour, size, and shape characteristics of plant products. The capability to produce digital images suitable for further processing makes modern image acquisition techniques highly adaptable tools. Therefore, the use of the X-ray technique is a viable alternative for evaluating seed vigour (Rahman, 2016). Also, in modifications of embryo reserves (Nielsen, et al., 2017), the percentage of the space occupied by embryo reserves in the internal cavity (Noronha et al., 2019), and physical damage that directly reflects on seed germination and vigour (Abud et al., 2018; Medeiros et al., 2018). Thiago, et al., (2020) worked on the X-ray image analysis of the internal morphology of Vigna radiata seeds and was able to identify various damage types. Also, Haynna et al., (2022) use image analysis to identify seeds of greater physiological potential, through which more-vigorous batches of Mung bean seeds were selected.

In Nigeria, one of the main challenges of plant breeders/geneticists in selecting the best genotype in terms of high yield, drought, and disease tolerance have been the environmental influence and the complexity of genes associated with such traits. Therefore, effective selection methods are required to obtain a high selection gain (Resende, 2002), showing the importance of evaluating and assessing the suitability of available genotypes to an environment or across several environments. A cursory look at the literature showed that meager information was available on the effect of the environment on Mung bean especially using seed imaging analysis. This study, therefore, evaluated the effect of environment on morphometric differences in computer-determined seed physical (metric) characteristics in some Mung bean genotypes and the extent of associations among these traits.

2.0. Methodology

2.1 Sources of seeds

Seeds of 10 genotypes of Mung bean (TVr-9, TVr-27, TVr-33, TVr-45, TVr-61, TVr-64, TVr-70, TVr-73, TVr78, and TVr-98) were obtained from Institute of Agricultural Research and Training, located in Ibadan, Nigeria. The initial seed imaging analyses were conducted and recorded before multiplying the seeds in two different agroecological zones. Seeds harvested from Ile-Ife (Rainforest, agroecology 8°98'N, 3°94'E, at 280 m above sea level) and Kishi (Southern Guinea Savanna agroecology, 8°98'N, 3°94'E, at 380 m above sea level) Nigeria were used for the experiment.

2.2 Study area.

This experiment was conducted at the laboratory of the Department of Plant Breeding and Seed Technology, Federal University of Agriculture, Abeokuta, Nigeria in 2021.

An EPSON scanner was connected to a computer device to acquire an image. The Regent Instrument (Regent Instrument Inc, Canada) was used for the image analysis by running the custom-written software WinSEEDLE^{TM} (Pro Version). For every replication, a hundred seeds of Mung bean were placed on the lighting hood in such a way that the embryo axis of the seed faces the image analysis system and the longitudinal axis ran parallel to the surface of the scanner. Seeds were automatically analyzed by the scanner and the image of the Mung bean seed was recorded by the 'WinSEEDLE™'. The procedure of hundred seeds placement for each genotype was repeated three times in other to validate the results. The parameters that were recorded include the total projected area, the average projected area, projected area, straight length, curve length, straight width, curve width, volume circle, surface area circle, and projected perimeter.

2.3 Data analysis

The data collected were subjected to Statistical Analysis System (SAS™, 2017) procedures for Analysis of Variance (ANOVA) and principal component analysis. The treatment means were separated using Tukey's HSD test at a 5% level of probability. The following seed physical characteristics were determined using the seed image electronics scanner as adopted from Dell" Aquila (2004) in (Table 1).

Table 1. Image analysis parameters (adapted from De ll'Aquila, 2004a)

Parameter	Unit	Definition
Seed area	mm^2	The area of the polygon that defines the seed's outline
Seed perimeter	mm	The length of the outline of each seed
Seed length	mm	The diameter along the major axis of the seed
Seed width	mm	The diameter along the minor axis of the seed
Radicle length	mm	The distance between the point of the seed coat in which radicle protrusion occurs and the radicle tip

3.0. Results and Discussion

Table 2: Mean squares from analysis of variance for the effect of seed production environment on seed morphometric parameters of 10 Mung bean genotypes.

Source	Df	S. A	S. L	C. L	S. W	C. W	W. L	S. P
Rep.	2	5.75	3.00*	1.24	2.29**	1.91**	0.00	34.77*
Spp (E)	1	9.93	0.52	1.92	18.58**	20.38**	0.29**	19.78
GType (G)	9	139.66**	2.44**	2.41**	1.07**	0.97**	0.16**	41.87**
E X G	9	172.41**	3.29**	3.41**	0.83**	0.75**	0.00**	4.41
Error	238	36.40	0.98	0.71	0.34	0.28	0.05	11.68

***Significant at 1 % probability level *Significant at 5 % probability level according to Tukey test.*
SPE- Seed production environment

The mean square from the analysis of variance for the effect of seed production environment on seed morphometric parameters of 10 Mung bean genotypes is presented in (Table 2). The ANOVA result showed that the seed production environmental effect was highly significant ($p<0.01$) on straight width, curve width, and width length. However, the genotype effect was highly significant ($p<0.01$) on all the seed morphometric parameters examined (seed area, straight length, curve length, straight width, curve width, width length, and seed perimeter). The effect of the seed production environment and genotype interaction was highly significant ($p<0.01$) on seed area, straight length, curve length, straight width, curve width, and width length.

Table 3: Mean values of morphometric characters of 10 Mung bean genotypes before planting

GENOTYPE	S.A (mm^2)	S. L (mm)	C.L (mm)	S.W (mm)	C.W (mm)	W.L (mm)	S.P (mm)
TVr-9	22.49^{a}	6.27^{b}	5.96^{a}	4.86^{ab}	4.92^{a}	0.79^{a}	$16.03^{a\text{-}c}$
TVr-27	22.35^{a}	6.24^{b}	5.95^{a}	4.92^{ab}	4.91^{a}	0.81^{a}	18.72^{ab}
TVr-33	22.13^{a}	6.24^{b}	5.91^{a}	4.83^{ab}	4.88^{a}	0.80^{a}	19.00^{a}
TVr-45	22.51^{a}	6.37^{b}	6.02^{a}	4.93^{ab}	4.98^{a}	0.81^{a}	18.95^{a}
TVr-73	21.09^{a}	6.11^{b}	5.79^{a}	4.73^{ab}	4.76^{ab}	0.79^{a}	18.28^{a}
TVr-61	21.26^{a}	6.15^{b}	5.79^{a}	4.73^{ab}	4.78^{ab}	0.80^{a}	18.41^{ab}
TVr-64	17.09^{ab}	5.99^{b}	5.00^{ab}	4.51^{ab}	4.60^{ab}	0.77^{ab}	17.97^{ab}
TVr-70	16.85^{ab}	5.82^{b}	5.47^{ab}	4.41^{ab}	4.51^{ab}	0.76^{ab}	17.77^{ab}
TVr78	17.69^{ab}	5.80^{b}	5.46^{a}	4.43^{ab}	4.48^{ab}	0.79^{ab}	17.55^{ab}
TVr-98	24.41^{a}	7.58^{a}	6.20^{a}	5.23^{a}	5.16^{a}	0.81^{a}	21.16^{a}

Notes-Seed Area-S.A, Straight length-S.L, Curve length-CL, Straight width-SW, Curve width-CW, Width length-WL, Seed perimeter-SP, Means followed by the same alphabets along the columns within a character are not significantly different from one another at 5 % probability according to the Tukey test.

The mean values of morphometric characters of 10 Mung bean genotypes before planting are presented in table 3. The table showed that insignificant differences occurred among the Mung bean genotypes in seed area, seed length, curve length, weight length, and seed perimeter. TVr-98 recorded the highest seed area (24.41mm^2), although not significantly different from the lowest recorded in TVr-70 with (16.85). A similar, result was recorded in seed length and other parameters measured as all the values were not significantly different from one another, except seed perimeter which was recorded the highest in TVr-98 with (21.16mm) while the lowest was recorded in TVr-9 with (16.03mm).

Table 4: Mean performance of genotypes for seed morphometric characteristics in 10 Mung bean genotypes across southern guinea savanna seed production environment

GENOTYPE	S.A (mm^2)	S.L (mm)	C.L (mm)	S.W (mm)	C.W (mm)	W.L (mm)	S.P (mm)
TVr-9	18.92^{d}	5.73^{b}	6.15^{ab}	3.97^{c}	4.07^{a}	0.67^{ab}	19.12^{d}
TVr-27	24.36^{a}	6.73^{a}	7.28^{a}	3.82^{c}	3.86^{b}	0.64^{ab}	16.26^{f}
TVr-33	23.62^{a}	6.14^{a}	6.53^{ab}	4.87^{a}	4.93^{a}	0.74^{ab}	21.15^{c}
TVr-45	20.99^{c}	6.00^{a}	6.39^{ab}	4.11^{ab}	4.18^{a}	0.67^{ab}	18.63^{d}
TVr-73	23.23^{a}	6.17^{a}	6.49^{ab}	4.80^{a}	4.87^{a}	0.77^{ab}	18.32^{d}
TVr-61	16.49^{e}	5.33^{b}	$5.92^{b\text{-}h}$	3.34^{c}	3.45^{b}	0.65^{ab}	24.43^{bc}
TVr-64	22.45^{b}	6.36^{a}	7.04^{a}	3.61^{c}	3.72^{b}	0.64^{ab}	21.19^{c}
TVr-70	22.09^{b}	5.81^{b}	6.26^{ab}	4.52^{ab}	4.57^{a}	0.75^{ab}	26.86^{b}
TVr-78	19.09^{c}	5.45^{b}	5.24^{h}	4.24^{ab}	4.31^{a}	0.74^{ab}	33.29^{a}
TVr-98	22.95^{b}	6.12^{a}	6.44^{ab}	5.07^{a}	4.95^{a}	0.84^{a}	23.59^{bc}

Notes-Seed Area-S.A, Straight length-S.L, Curve length-CL, Straight width-SW, Curve width-CW, Width length-WL, Seed perimeter-SP, Means followed by the same alphabets along the columns within a character are not significantly different from one another at 5 % probability according to the Tukey test.

The mean performance of genotypes for seed morphometric characteristics in 10 Mung bean genotypes across the southern guinea savanna seed production environment is presented in Table 4. Significant differences occurred among the attributes evaluated. The highest seed area was recorded in TVr-27 with (24.36mm^2) while TVr-61 had the least value (16.49 mm$^{2)}$. A similar result was recorded in seed curve length with the highest recorded in TVr-27 (7.28mm) and the lowest in TVr-61 (5.33 mm) while seed straight length values were not significantly different from one another. For seed width, and curve width TVr-98 had the highest value of (5.07mm) and (4.95mm) respectively, while the least was recorded in TVr-61 with (3.34mm) and (3.45) mm respectively. The width length values were not significantly different from one another while TVr78 had the highest seed perimeter (33.29mm) while the lowest was recorded in TVr-27 with 16.26mm.

Table 5: Mean performance of genotypes for seed morphometric characteristics in 10 Mung bean genotypes across rainforest seed production environment

GENOTYPE	S.A(mm$^{2)}$	S. L(mm)	C.L(mm)	S.W(mm)	C.W (mm)	W.L (mm)	S.P (mm)
TVr-9	20.45^{ab}	5.64^{ab}	6.09^{a}	5.01^{a}	4.63^{ab}	0.76^{ab}	20.25^{d}
TVr-27	18.11^{c}	5.29^{ab}	5.39^{ab}	4.00^{ac}	4.14^{ab}	0.71^{ab}	15.36^{e}
TVr-33	19.40^{ab}	5.58^{ab}	6.08^{a}	4.27^{ab}	4.39^{ab}	0.75^{ab}	22.25^{c}
TVr-45	22.02^{ab}	5.63^{ab}	6.09^{a}	4.75^{ab}	4.81^{a}	0.78^{ab}	19.73^{de}
TVr-73	24.99^{a}	6.21^{a}	6.55^{a}	5.07^{a}	5.09^{a}	0.81^{a}	19.42^{de}
TVr-61	21.85^{ab}	5.94^{a}	6.42^{a}	4.57^{ab}	4.67^{ab}	0.77^{ab}	25.53^{bc}
TVr-64	20.39^{ab}	5.75^{a}	6.31^{a}	4.19^{ab}	4.39^{ab}	0.71^{ab}	22.09^{c}
TVr-70	21.46^{ab}	5.85^{a}	6.45^{a}	4.42^{ab}	4.61^{ab}	0.73^{ab}	27.96^{b}
TVr78	23.47^{a}	6.22^{a}	6.96^{a}	4.57^{ab}	4.80^{ab}	0.74^{ab}	34.19^{a}
TVr-98	20.48^{ab}	5.84^{a}	6.50^{a}	4.36^{ab}	4.61^{ab}	0.74^{ab}	24.69^{bc}

Notes-Seed Area-S.A, Straight length-S.L, Curve length-CL, Straight width-SW, Curve width-CW, Width length-WL, Seed perimeter-SP, Means followed by the same alphabets along the columns within a character are not significantly different from one another at 5 % probability according to Tukey test.

The mean performance of genotypes for seed morphometric characteristics in 10 Mung bean genotypes across rainforest seed production environments is presented in Table 5. Rainforest attributes recorded significant differences in seed area, seed width, curve width, and seed perimeter while seed length, curve length, and width length showed no significant differences among the attributes examined. TVr-73 had the highest seed area (24.99 mm^2) while the lowest was recorded in TVr-27 (18.11 mm^2). Similarly, TVr-9 had the highest value in seed width (5.01mm) while TVr-27 (4.00mm) had the lowest. Lastly, TVr78 had the highest seed perimeter (34.19mm) while TVr-27 (15.36mm) had the lowest value.

Table 6: Effect of seed production environments on seed morphometric attributes of Mung bean across genotype

Parameter	southern guinea savanna	Rainforest	S.E	Lsd (0.05)
Seed area(mm^2)	22.73	22.38	0.45	0.74
Seed straight length(mm)	6.09	6.02	0.07	0.12
Seed curve length(mm	6.56	6.41	0.06	0.09
Seed straight width(mm)	4.24	4.69	0.04	0.06
Seed curve width(mm)	4.29	4.69	0.04	0.06
Seed width length(mm)	0.72	0.77	0.1	0.17
Seed perimeter(mm)	19.33	19.77	0.25	0.41

The effect of seed production environments on seed morphometric characteristics of Mung bean across genotypes is presented in Table 6. The table revealed that seed straight width (4.69 mm), curve width (4.29 mm) and seed perimeter (19.33 mm) of seeds harvested at (rainforest) Ife environment was higher in values compared to values recorded in (southern guinea savanna) Kishi. Conversely, the seed curve length (6.56 mm) of seeds produced in Kishi was higher in values compared to that of the rainforest environment. Values of seed area, seed straight length, and seed width were statistically similar between the two environments. The result from the above showed that seed morphometric characteristics were variable among some genotypes implying that, it should be given due consideration in seed conditioning and improvement. The Mung bean seeds from the two ecological seed production environments showed total deviation from the initial morphometric attributes recorded before planting. The variability may be due to inherent genetic differences among genotypes, and seed production environment. A cursory look at the result of the seed morphometric analysis from this study reveals that the ,Mung bean genotypes were different from each other as there were significant differences among the parameters measured at a 5% probability level. These findings corroborate the work of Vasconcelos, (2018) in which he established that seed deviation is possible and can result in a relationship with the morphological and physiological characteristics. He further established that, through the use of seed image analysis, selection of seed batches allowed metabolic processes to increase the growth rate and greater uniformity during the germination process. Also, Abud *et al.*, (2018) used different techniques of image analysis on different species of varying sizes and morphological characteristics, such as radiographic images related to the internal morphology of *broccoli* seeds and the physiological quality of *Leucaena* seeds. Similarly, Medeiros *et al.,* (2020) classified soya bean seedlings by vigor through image analysis. From the result, it is clear that variation exists among the seeds of ten (10) Mung bean genotypes concerning some of the morphometric characters evaluated. Arapa and pardon.,(2014) established that the resultant environmental effect on different seed metric measurements has a significant effect on seed quantitative variables for determining the size and shape of seeds.

Table 7: Principal component based on correlation coefficient matrix for seed morphometric attributes across two seed production environments

Variable	PCI	PC2	PC3
Seed area	**0.65**	**0.56**	**0.50**
Seed straight length	**0.56**	**0.67**	0.15
Seed curve length	**0.51**	**0.79**	0.10
Seed straight width	**0.82**	**0.78**	0.16
Seed curve width	**0.83**	**0.45**	0.21
Seed width length	**0.69**	**-0.59**	0.10
Seed perimeter	0.12	**-0.31**	**0.84**
Eigen value	4.62	2.44	1.24
Proportion of variation%	41.90	22.16	11.57
Cumulative variation%	41.99	64.15	75.72

Bolded*- A value above 0.30 was considered with the major contribution*

In Table 7, the result of Principal component analysis (PCA) based on the correlation coefficient matrix for seed morphometric attributes across two seed production environments reveals that three of the component axes had Eigen values that are greater than 1.0 and accounted for 75.72% of the total variation. The relative discriminating power of the PCA as revealed by Eigen values were 4.62, 2.44, and 1.24 for PC1, PC2, and PC3, respectively. The arithmetic sign of the co-efficient is irrelevant since a common rule of thumb for determining the significance of a trait co-efficient is to treat a co-efficient greater than 0.03 as having enough effect to be considered important. PC1 accounted for 41.90% of the variation and was loaded with seed area, seed straight length, seed curve length, seed straight width, seed curve width, and seed width length with values 0.05, 0.56, 0.51, 0.82, 0.83, and 0.69, respectively while PC 2 was relatively loaded with seed area, seed straight length, seed curve length, seed straight width, seed curve width, seed width length and seed perimeter with values between 0.79 and 0.31. In PC3, only two characters (seed area (0.50) and seed perimeter (0.84) loaded the axis whereas every other seed shape parameter examined showed no significant contribution to the variation among the entries. These results suggest that these traits are the main seed metric variables to select, for effective discrimination among Mung bean seeds. This support earlier findings by Arapa and Padrón (2014) in quinoa (*Chenopodium quinoa Willd*.) seeds and Daniel *et al.*(2012) who reported that seed area, seed length, perimeter, and flatness index contributed largely to the variability in the first two principal component axes of tropical inbred maize genotypes. These traits with high contribution to the major variation could be included in the seed improvement program for improved seed quality in mung bean.

4.0 Conclusion

The genotypic performance of seed morphometric characteristics across seed production environments revealed that Tvr-73 and Tvr-27 had the highest seed area (24.99mm^2) and straight length (6.73mm), respectively, while Tvr-73 was outstanding in straight width and curve weight with 5.07mm and 5.09mm, respectively while Tvr-98 and Tvr-78 recorded outstanding performance in width length and seed perimeter. Genotypes Tvr-73, Tvr-27, Tvr-98, and Tvr-78 were identified with consistent and high seed morphometric characteristic performance for most of the attributes evaluated within and across the two seed production environments. These performances imply that it provides an opportunity for selecting Mung bean genotypes with superior seed physical traits. A similar observation was earlier reported by Kehinde *et al* (2017) on genetic diversity in some kenaf genotypes. The study has revealed that attention should be given to genotypes and seed production environments in the seed production of Mung bean. Genotypes Tvr-73, Tvr-27, Tvr-98, and Tvr-78 have been identified with consistent and high seed morphometric characteristic performance for most of the attributes examined. However, this study has further established the use of morphometric characteristics of seeds using seed imaging analysis, as tools that can provide a useful management strategy for increasing establishment count and selection of superior seed physical traits that could be used as parental material, in Mung bean, thereby leading to higher yield.

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