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Study of Morphological Breeding Traits in Mungbean [*Vigna radiata* (L.) Wilczek] Genotypes as per DUS Guidelines

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ABSTRACT: An experiment was conducted to study 14 mungbean genotypes for 19 morphological traits as per DUS guidelines at Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) India, during Kharif 2020 as well as in summer 2021. All the genotypes were grown in randomized block design in a replication of three in the seasons mentioned above. Morphological traits were recorded as per crop DUS guideline approved by PPV & FR, New Delhi. Maximum morphological variability was recorded in leaf vein colour, colour of petal, leaf colour, leaflet lobe, pod colour, pod curvature, seed lusture and anthocyanin colouration. The distribution frequency of the traits like seed size (7.69%) followed by colour of pre-mature pods (7.14%), leaf vein colour (7.14%) and anthocyanin colouration (7.14%) was very low. Genotype SL 668 was reported as diverse mungbean variety dominated with green with pigmented suture in pre mature pod colour and also dominated with large seed size. The trait anthocyanin colouration was absent in variety Shikha (IPM 410-03) while in TJM 3, leaf vein colour was green. These identified diverse morphological breeding traits is present in very few of the genotypes included in this investigation. The identified diverse breeding traits may be employed in hybridization programme in developing diverse morphology based genotype/varieties so, that the genotypes with unique morphological identity will easily be identified in between the group of varieties. Maintenance of the varietal purity has been one of the major challenges in the research area and it is very important to check whether the genotypes or treatments or population under study are satisfying the requirements of morphological characterization protocols which includes distinctness, uniformity and stability. These unique identities will be helpful as an important morphological trait to distinguish one variety from the other in seed production programme. By the diverse identity of the varieties, genetic purity maintenance will be very easy and may stay in seed production chain for a very long time.

Keywords: Greengram, Morphological characterization, variability, Distinctness, Uniformity and Stability (DUS), breeding traits.

INTRODUCTION

Greengram [*Vigna radiata* (L.) Wilczek] being a self-pollinated, short duration leguminous crop that comes under family Fabaceae, subgenus *Ceratotropis* and genus *Vigna* with 2n=22 number of chromosomes. Its genome size is 579 Mb/1C (Sabatina *et al.,* 2021).This crop is of Indian origin and has two wild species and only one cultivated species. It is well suited to dry areas, mainly under irrigated conditions. This crop gives good response when subjected to numerous cropping systems contributing in protein an important element of human diet. During 2019-20, the total coverage under mungbean has been about 40.20 million ha with the production of 1.42 million tons (Anonymous, 2019-20). The protein available in this crop is palatable, simple to cook and absent in flatulence factors contrary to other legumes. Mungbean seeds contain protein (22.88to 24.65%), carbohydrate (62.6%), crude fibre (4.30 to 4.80%) and lipid (1.53 to 2.63%). Apart from this, this particular crop adds a good range of micronutrients to the Indian vegan diet (Ramakrishnan *et al.,* 2013). Like other pulses, the protein of greengram has abundant lysine, which is an essential amino acid that is absent in cereals (Saleem *et al.,* 1998).

PPV & FRA, 2001 was enacted by the India Government to ensure the protection of plant varieties which provides legal protection to the newly developed varieties, breeder's, researcher's, and farmer's right to bring motivation in the developmental growth of seed industry and provide the new varieties with economic importance which are used for breeding programme. PPV & FRA implements DUS testing that was initiated in 2007 with twelve crops. The criteria of novelty, distinctiveness, uniformity and stability is essential for the registration of new variety. A DUS test is generally taken up for two successive planting seasons either in

field or glasshouse condition. Evaluation period primarily comprises characterization of various morphological traits of the concerned crop on the basis of the internationally agreed protocols (Rashtriyakrishi, 2015).

Morphological characterization is considered as an important phenomenon for classification, visual identification and differentiation of the germplasm. Characterization is considerably beneficial to plant breeder in utilizing these germplasm in area of research programmes. Morphological markers are simple, inexpensive rapid to score and are highly heritable traits which are employed for the study of morphological characterization (Kumawat *et al.,* 2020), Germplasm characterization aids in grouping specific traits to obtain idea about traits that distinguish one genotype from the other (Lee *et al*., 2004). Piyada *et al*., (2010) also emphasized on morphological characterization to check the variability and differentiate the crop germplasm. Some of the agro-morphological traits may be used as morphological breeding traits in crop improvement programme. These diverse traits will be utilized in mungbean breeding programme for improving the seed physical quality. It also helps in assessment of genetic variability and diversity present in available mungbean germplasm. (Singh *et al*., 2014).

MATERIALS AND METHODS

The experimental material comprised 14 diverse lines of mungbean received from the project entitled "Field Evaluation of Trombay Mutant Selections and Research Activities in Agriculture" and also from the pulse improvement programme, Department of Plant Breeding and Genetics, College of Agriculture, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh, India. The experiment was conducted in a randomized block design with three replications during Kharif 2020 and summer 2021. All the lines were planted in four rows in four meter length adopting 30 cm row to row distance and 10 cm plant to plant distance respectively. The observations were recorded at specific stages of crop growth period as per DUS descriptor. The anthocyanin pigmentation was noted at cotyledonary stage. Time of flowering was observed when 50 percent plants were with at least one open flower. Plant growth habit, plant habit, stem colour, stem pubescence, leaflet lobes (terminal), leaf colour, leaf vein colour and flower colour of petal (standard) were observed at 50 percent flowering stage. The colour of pre mature pod, pod pubescence was observed at the stage of fully developed green pods. The characters pod colour and curvature of mature pod was observed at the stage of maturity. The characters like seed colour, seed lusture, and seed shape and seed size were observed at matured seed stage.

RESULTS AND DISCUSSIONS

Hypocotyl: Anthocyanin Colouration. This trait was observed at cotyledonary stage. Out of 14 parents, 13 showed anthocyanin colouration and only one was without pigmentation (Table 1). The intensity of cotyledon colour is affected with both storage condition and time. So this trait can be utilized only for varietal protection before entering into active seed multiplication chain.

Plant Characters. The characters like growth habit and plant habit were observed at days to 50 percent flowering. Among 14 genotypes, six were grouped into spreading and eight into semi-erect type of plant growth habit. Further two of the genotypes Pusa Vishal and PDM 139 showed determinate plant habit where rests were indeterminate in nature (Table 1). This result was supported by Jain *et al.,* (2002); Singh *et al.,* (2014); Kaur *et al.,* (2017) in mungbean.

Stem Characters. 6 genotypes showed green stem colour and eight genotypes showed green with purple splashes type of stem colour revealing variation in the lines. All the genotypes showed pubescence (Table 1) indicating similarity in all of the genotypes for this trait (Jain *et al.,* 2002); (Katiyar *et al.,* 2008); (Singh *et al.,* 2014); (Kaur *et al.,* 2017) in mungbean.

Leaf Characters. All these characters showed variability in the studied genotypes and these were classified into different categories (Table 1). 9 genotypes showed the presence of leaflet lobes and the remaining 5 were deprived of leaflet lobes. Leaf shape was deltoid in TMB37 and Shikha and ovate in 12 genotypes. 4 genotypes had dark green leaf color while 10 had green leaf colour. Leaf vein colour was greenish purple in six genotypes, purple in seven genotypes and green in one genotype i.e. TJM3 (Kaur *et al.,* 2017 in mungbean); Chakrabarthy and Agarwal (1989) in blackgram.

Flower Characters. Flower colour is an authentic morphological marker for differentiating the green gram genotypes. 9 genotypes showed yellow flower colour and 5 genotypes showed light yellow colour. Out of 14 parents, 4 were early, whereas rests of the 10 parents were medium in their flowering duration while late duration was not noted in any of the parents (Table 1).

Flowering time ranged from 32 days (TJM136) to 45 days (PDM11). The short duration genotypes have the ability to mitigate the unfavorable effects of terminal heat stress and unpredictable rains at harvesting time. Similar findings and groupings of genotypes based on flower morphological characters were made by Jain *et al.,* (2002); Singh *et al.,* (2014); Kaur *et al.,* (2017) in mungbean.

Pod Characters. Greengram pod characteristics are highly useful in the identification of genotypes. These are important yield attributing traits and affect the yielding ability of plants. Considerable variation was observed in characters mentioned above and were classified into different group. All these characters showed variation and were categorized into distinct groups except for the traits pod pubescence and colour of pre-mature pod.

Table 1: Morphological characterization of 14 mungbean genotypes.

Characters	Stage of Observation	Genotypes													
		TJM196	TJM136	TJM3	TMB37	Ganga8	LGG460	HUM 1	SL668	Pusa Vishal	PDM11	PDM139	Shikha	Kanika	Virat
Hypocotyl: Anthocyanin colouration	Cotyledons unfolded	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Absent	Present	Present
Flowering time	50% plants with at least one open flower	Medium	Early	Medium	Medium	Medium	Medium	Medium	Early	Early	Medium	Early	Medium	Medium	Medium
Plant: Growth habit	50% flowering	Spreading	Semi-erect	Spreading	Semi-erect	Semi-erect	Semi-erect	Spreading	Spreading	Spreading	Semi-erect	Semi-erect	Semi-erect	Semi-erect	Spreading
Plant: Habit	50% flowering	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Determinate	Indeterminate	Determinate	Indeterminate	Indeterminate	Indeterminate
Stem: color	50% flowering	Green	Green with purple splashes	Green	Green	Green with purple splashes	Green with purple splashes	Green with purple splashes	Green with purple splashes	Green with purple splashes	Green	Green	Green	Green with purple splashes	Green with purple splashes
Stem: Pubescence	50% flowering	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present
Leaflet lobes (terminal)	50% flowering	Present	Present	Absent	Present	Present	Present	Absent	Absent	Absent	Absent	Present	Present	Present	Present
Leaf: Shape (terminal)	50% flowering	Ovate	Ovate	Ovate	Deltoid	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate	Deltoid	Ovate	Ovate
Leaf: Color	50% flowering	Green	Dark green	Dark green	Dark green	Green	Green	Green	Dark green	Green	Green	Green	Green	Green	Green
Leaf: Vein color	50% flowering	Greenish purple	Purple	Green	Greenish purple	Purple	Purple	Purple	Greenish purple	Greenish purple	Greenish purple	Purple	Greenish purple	Purple	Purple
Flower: Petal Color (Standard)	50% flowering	Yellow	Yellow	Light Yellow	Light yellow	Yellow	Yellow	Light yellow	Light yellow	Yellow	Yellow	Light yellow	Yellow	Yellow	Yellow
Pod: Pubescence	Fully developed green pods	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present
Pod: Pre mature pod color	Fully developed green pods	Green	Green	Green	Green	Green	Green	Green	Green with pigmented suture	Green	Green	Green	Green	Green	Green
Pod: Color	Harvest maturity	Brown	Black	Brown	Black	Brown	Brown	Brown	Black	Brown	Black	Black	Brown	Brown	Brown
Curvature: Mature pod	Harvest maturity	Straight	Curved	Curved	Curved	Straight	Straight	Straight	Curved	Curved	Straight	Straight	Curved	Straight	Curved
Seed: color	Mature seeds	Mottled	Mottled	Mottled	Green	Mottled	Mottled	Green	Mottled	Mottled	Mottled	Mottled	Mottled	Mottled	Mottled
Seed: Shape	Mature seeds	Oval	Oval	Drum shaped	Oval	Oval	Oval	Drum shaped	Drum shaped	Drum shaped	Drum shaped	Oval	Oval	Oval	Oval
Seed: Lusture	Mature seeds	Dull	Dull	Dull	Shiny	Shiny	Dull	Shiny	Dull	Dull	Dull	Dull	Shiny	Dull	Dull
Seed: Size	Mature seeds	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Large	Medium	Medium	Medium	Medium	Medium	Medium

The trait, colour of pre-mature pod was green in 13 genotypes and green with pigmented suture reported in only one genotype (SL668). Pod pubescence was present in all the genotypes indicating these traits are of abundant in the studied material and may not use for identification of lines in the present material. Pod colour is quiet useful morphological marker and may be used in quality seed production programmes at maturity stage to monitor the mixture of other varieties. 9 genotypes showed brown pod colour and five genotypes showed black pod colour.

Curvature of mature pod was straight in 7 genotypes and curved in rest of seven genotypes. Thus, these pod characteristics can be exploited for identification and characterization but are found to be variable due to more number of genes and environmental influence on the expression. Sunil *et al.,* (2014) observed straight pods without curvature in their study and this morphology may be helpful to identify the impurities during quality seed production programme. Based in pod morphological characters, similar observations were made by Singh *et al.,* (2014) and Kaur *et al.,* (2017) in mungbean and Gnyandev *et al.,* (2009); Bayahi and Rezguy (2015) in chickpea.

Seed characters. The price of premium genotypes of greengram or consumer acceptance of a variety is decided by the seed characteristics like colour, lusture, shape and size (Pratap *et al.,* 2013). Seed morphological characters like colour, lusture, shape and size were observed at mature seed stage of plant in the present experiment (Table 1).

All these characters were assigned into distinct groups. Seed colour was mottled in twelve genotypes, green in 2 genotypes (TMB37 and HUM1) respectively. Seed lusture was shiny in 4 and dull in 10 genotypes. Seed shape was oval in 9 genotypes and drum shaped in 5 genotypes. Except SL668 which fell under the large seed category, all the genotypes has seeds of medium size (Table 1). (Venkateswarlu *et al.,* 2001) and (Khajudparn and Tantasawat 2011) also discussed the usefulness of seed characters in the characterization of lines in greengram.

Table 2: Frequency distribution of morphological traits of fourteen mungbean genotypes.

Characters	Classes	Number of entry	Percentage of entry (%)
Hypocotyl: Anthocyanin Colouration	Present	13	92.85
	Absent	1	7.14
Time of flowering	Early (<40 days)	4	28.57
	Medium (40-50 days)	10	71.42
	Late (More the 50 days)	00	00
Plant: Growth habit	Erect	00	00
	Semi-erect	8	57.14
	Spreading	6	42.85
Plant: Habit	Determinate	2	14.28
	Indeterminate	12	85.71
Stem: Colour	Green	6	42.85
	Green with purple splashes	8	57.14
	Purple	00	00
Stem: Pubescence	Absent	00	00
	Present	14	100
Leaflet: Lobes (terminal)	Absent	5	35.71
	Present	9	64.28
Leaf: Shape	Deltoid	2	14.28
	Ovate	12	85.71
	Lanceolate	00	00
	Cuneate	00	00
Leaf: Colour	Green	10	71.42
	Dark green	4	28.57
Leaf: Vein colour	Green	1	7.14
	Greenish purple	6	42.85
	Purple	7	50
Flower: Colour of Petal	Yellow	9	64.28
	Light yellow	5	35.71
Pod: Colour of pre mature pod	Green	13	92.85
	Green with pigmented suture	1	7.14
Pod: Pubescence	Absent	00	00
	Present	14	100
Pod: Colour	Brown	9	64.28
	Black	5	35.71
Pod: Curvature of mature pod	Straight	7	50
	Curved	7	50
Seed: Colour	Yellow	00	00
	Green	2	14.28
	Mottled	12	85.71
	Black	00	00
Seed: Lusture	Shiny	4	28.57
	Dull	10	71.42
Seed: Shape	Oval	9	64.28
	Drum shaped	5	35.71
Seed: Size	Small (<3g)	00	00
	Medium (3-5g)	13	92.85
	Large (> 5g)	1	7.69

Deltoid

Ovate

Curved and Straight Pod

Presence and absence of anthocyanin coloration

Light yellow petal

In the present investigation, anthocyanin colouration, plant habit, stem pubescence, pre mature pod colour and leaflet lobes were same in all the lines and were not useful for discrimination but rest of the traits had lots of variability which can be exploited for the elite lines identification and utilization as reported by (Patel *et al.*, 2019) and facilitate the easy registration with these distich characters present in the genotypes with PPV&FRA.

CONCLUSION

The study highlighted the importance of introducing new material in the breeding programmes to broaden the genetic base of the crop. Thus, characterization of elite improved lines holds an important significance in the identification of lines and their registration with PPV&FRA and maintenance of line having the information of genetic base. Lines found with unique traits and present only in few of the genotypes will be of great importance for the development of morphologically diverse breeding populations. These lines with unique morphological identity will be considered as a varietal marker in the seed production chain to maintain the genetic purity of the variety. These traits may also be useful when varieties may mix and purelines can easily beisolated very easily by normal selection method.

REFERENCES

Anonymous (2019-20). 1th Advance Estimates, Agriculture Statistics Division, Directorate of Economics and Statistics, New Delhi.

Bayahi, K. and Rezgui, S. (2015). Agro-morphological characterization and genetic study of new improved lines and cultivars of chickpea (*Cicer arietinum* L.). *J. Plant Breed. Genet.*, *3*(3): 59-65.

Chakrabarthy, S. K. and Agarwal, R. L. (1989). Identification of black gram varieties I: Utilization of seed characteristics. *Seed Res.*, *17*(1): 23-28.

Gnyandev, B. (2009). Seed technological studies in chickpea varieties (*Cicer arietinum* L.). Ph. D. Thesis (Unpublished) Submitted to University of Agricultural Sciences, Dharwad, Karnataka (India).

Jain, S. K., Khare, D., Bhale, M. S. and Raut, N. D. (2002). Characterization of mungbean varieties for verification of genetic purity. *Seed Tech News*, *32*(1): 200-201.

Jyoti, B., Usha. and Singh, P. (2015). Role of DUS testing in registration of plant varieties under PPV & FR Act, 2001. *Rashtriya Krishi*, *10*(2): 5-6.

Jyoti, B., Usha, and Singh, P. (2015). Role of DUS testing in registration of plant varieties under PPV & FR Act, 2001. *Rashtriya Krishi*, *10*(2): 5-6.

Katiyar, P. K., Dixit G. P., and Singh B. B. (2008). Morphological characterization of green gram (*Vigna radiata*) varieties and their application for distinctness, uniformity and stability testing. *Indian J. Agri. Sci.*, *78*(5), 439-444.

Kaur, R., Toor, A. K., Geeta, B. and Bains, T. S. (2017). Characterization of mungbean (*Vigna radiata* L. Wilczek) varieties using morphological and molecular descriptors. *Int. J. Curr. Microbiol. App. Sci*, *6*(6): 1609-1618.

Khajudparn, P. and Tantasawat, P. (2011). Relationships and variability of agronomic and physiological characters in mungbean. *African J. Biotechnol*, *10*: 9992-10000.

Kumawat, S., Babbar, A., Solanki, R.S., Biswal, M. and Banjarey P. (2020). Morphological Characterization of Elite Kabuli Chickpea Lines. *Int. J. Curr. Microbial. App. Sci.*, *9*(09): 121-1250.

Lee, Y. S., Lee, J. Y., Kim, D. K., Yoon, C. Y., Bak, G. C., ParkI, J., Bang, G. P., Moon, J. K.,Oh, Y. J. and KminK, S. (2004). A new high-yielding mungbean cultivar, "Samgang" with lobed leaflet. *Korean J. Breed. Sci*, *36*: 183-184.

Patel, J. D., Patel, J. B. and Chetariya, C. P. (2019). Characterization of mungbean (*Vigna radiata* (L.) Wilczek) genotypes based on plant morphology. *Indian J. Pure and App. Biosci., 7*(5): 433-443.

Piyada, T., Juthamas,T., Thongchai, P., Thanawit, T., Chutamas, P., Worapa, S. and Thitiporn, M. (2010). Variety identification and genetic relationships of mungbean and blackgram in Thailand based on morphological characters and ISSR analysis. *African J. Biotechnol, 9*: 4452-4464.

Protection of Plant Varieties and Farmers' Rights Authority (PPV & FRA), 2007.

Ramakrishnan, M. N., Yang, R.Y., Warwick, J .E., Dil Thavarajah, D., Pushparajah, T. and Keatinge, J. D.H. (2013). Biofortification of mungbean (*Vigna radiata*) as a whole food to enhance human health. *J. Sci. Food Agric, 93*: 1805-1813.

Saleem, B. F., Ilyas, S., Qureshi, A. and Malik, I. A. (1998). Studies on chemical analysis of mungbean [*Vigna radiata* (L.) Wilczek.). *Pak. J. Bio. Sc., 1*(2): 120-123.

Sheena Sabatina, A., M. Lal Ahamed, J. V. Ramana. and Harisatyanarayana, N. (2021). DUS Characterization of Elite Improved Lines of Greengram [*Vigna radiata* (L.) Wilczek]. *Int. J. Curr. Microbiol. App. Sci, 10*(01): 3380-3391.

Singh, C. M., Mishra, S. B., Pandey, A. and Arya, M. (2014). Morphological characterization and discriminant function analysis in mungbean [*Vigna radiata* (L.) Wilczek] germplasm. *Electronic Journal of Plant Breeding, 5*(1): 87-96.

Sunil, N., Rao, S.P., Natarajan, S., Reddy, J., Chakrabarthy, S. K., Ashok, J. and Bhist, I. S. (2014). Diversity in the landraces of greengram (*Vigna radiata* (L) R. Wilczek) collected from Tribal communities of Peninsular India. *Photon, 114*: 392-400.

Venkateshwarlu, O. (2001). Correlation and path analysis in greengram. *Legume Res., 24*: 115-117.

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