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Characterization of Mung bean (*Vigna radiata*) Genotypes Based on DUS Traits

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ABSTRACT

The mung bean (*Vigna radiata*) is an important pulse crop. Being a hardy crop mung bean can be grown under water scarcity conditions. In Kashmir crop mung bean is not commercially cultivated, however with the changing climate it can be used as a catch crop or emergency crop in case of crop failures. To develop new varieties of different crops DUS (Distinctness, Uniformity and Stability) characterization is an important tool to be followed. The plant morphological characters are polygenic in nature and are highly influenced by environment. Hence, there is immense need to use alternate descriptors which are rapid, accurate and less influenced by environment. The present study was investigated at Dry-Land Agriculture Research Station (DARS), Budgam, SKUAST-Kashmir in year-2022 to evaluate a set of 124 mung bean genotypes for DUS characterization. During the study 24 DUS (Distinctiveness, Uniformity and Stability) characters were recorded as per the guidelines prescribed by PPV and FRA, 2007. The results of the study concluded that a wide range of variability was observed in mung bean genotypes and hence can be used for further breeding programmes.

Key words : *Characterization, DUS, Mung bean, PPV and FRA, Variability*

Introduction

Mung bean (*Vigna radiata* L.) also known as green gram is an important pulse crop, providing plant protein for people throughout Asia (Tomooka *et al*., 2003). It belongs to family *Fabaceae* with chromosome number of 2n=2x=22. Mung bean is a traditional food in China and is widely grown as monoculture in dry and semi-dry regions, as well as being used as an intercrop across different regions of the country because of its drought tolerance and nitrogen-fixing soil fertilization (Zheng, 1995). The plant is used as green manure and cover crop. The hulls and straw are used as fodder. It is a good source of minerals, pro-vitamin A and vitamin B-complex. Mung (*Vigna radiata*) is an economically important short duration grain legume characterized by relatively more palatable, nutritive, cheap source of high quality and easily digestible protein, non-flatulent than other pulses and constitute an important source of cereal based diets in Asia (Kamleshwar *et al*., 2014). Identification of new genotypes requires proper, accepted, well defined norms and regulations. Several agencies and organizations are working at international and national levels for characterization of genotypes in order to develop environment and location specific varieties. DUS (Distinctness, Uniformity and Stability) characterization is an important tool to be followed to develop new varieties of plants. A variety is said to be new if it possess characters which are novel (not in public domain), distinct from other varieties, uniform in its characteristics and genetically stable. Use of morphological descriptors in sequential fashion is useful

and convenient to discriminate the different varieties (Joshi *et al*., 2011). The plant morphological characters are polygenic in nature and are highly influenced by environment. Hence, there is immense need to use alternate descriptors which are rapid, accurate and less influenced by environment.

Materials and Methods

The present study was under taken at Dry Land Agriculture Research Station, Budgam, SKUAST-Kashmir. A total of 124 mung bean (*Vigna radiata*) genotypes were used under the study. The material under study was characterized for DUS traits as per the DUS guidelines given by DUS Descriptor, PPV and FRA, New Delhi, 2007). Different traits were recorded at their recommended stages of observation. The various DUS characteristics in mung bean (*Vigna radiata*) are presented in Table 1.

Results

The various DUS characters were recorded at their recommended stages of observation as per the DUS descriptor given by PPV & FRA, 2007. For each characteristic is given a "class" and "code'. A "code" for each character is a number to represent a particular "class". According to the guidelines of DUS descriptor used in the present study, there are 24 characteristics for mung bean (*Vigna radiata*) to evaluate the germplasm for DUS characterization. The frequency for each code for a character under study was taken by counting the number of a particular code. After the frequency, the percentage of a particular code was recorded in each character as given in table-2. On the basis of frequency distribution the various characters were studied to characterize the germplasm under investigation in the present study. The data pertaining to various DUS characters discriminates the genotypes by providing a wide range of variability among them. However, some the characters were not having much of the variability to discriminate among the genotypes. For instance, the character "leaf shape (terminal)" was having high variability among the different genotypes as illustrated by the frequency and percentage distribution. For this particular character among the 124 genotypes of mung bean (*Vigna radiata*), 71.77% (89 genotypes) were having "ovate" shape of terminal leaves, 12.96% (16 genotypes) as "cuneate" shape, 8.87% (11 genotypes) as "lanceolate" and 6.4% (8 genotypes) were "deltoid" in shape. On the other hand the character *viz.* "anthocyanin coloration of hypocotyl" does not vary among the various mung beans (*Vigna radiata*) genotypes. For this character all the genotypes (100%) were having anthocyanin coloration in their hypocotyl. None of the genotype in the present study was absent for hypocotyl coloration. Among the all given DUS characteristics leaf and seed related traits *viz.* leaf colour, leaf petiole colour, leaf size, leaf shape, seed colour , seed lusture, seed shape, 100-seed weight showed the high variability for the present germplasm of mung bean (*Vigna radiata*) as illustrated by the frequency distribution table. The results obtained depict high variability in the studied mung bean (*Vigna radiata*) germplasm, hence, can be used for further breeding programs to develop new and improved varieties for the benefit of farmers.

Discussion

To safeguard both new and existing plant varieties, the criteria of Distinctness, Uniformity, and Stability (DUS) play a pivotal and indispensable role. DUS characterization entails the assessment of various agro-morphological and genetic traits to distinguish between different varieties or to establish the uniqueness of a newly introduced variety compared to those already in the public domain (Singh *et al*., 2006). In our study, we undertook the classification of 124 mung bean (*Vigna radiata*) genotypes using the DUS descriptor outlined by PPV and FRA in 2007. Our findings revealed that, for the majority of the examined characteristics, there existed a substantial and suitable level of variation among the different genotypes. These results align harmoniously with previous research conducted by Rohilla *et al*. (2022). Among the 124 mung bean (*Vigna radiata*) genotypes analyzed in our study, 91 exhibited a short plant height, while 33 were categorized as medium in terms of plant height, as indicated in the frequency distribution table. This distinction in plant height assumes particular significance, with taller genotypes being considered desirable for some applications, whereas shorter plant height is sought after in dwarf genotypes due to its association with lodging resistance. These results echo the findings of previous studies by Patel *et al*. (2019) in mung bean (*Vigna radiata*), where similar patterns were observed in plant height. Our study further distinguished mung bean (*Vigna radiata*) genotypes into

Table 1. Frequency distribution of mung bean (*Vigna radiata*) genotypes for various DUS characteristics

Characteristic	Class	Code	Frequency	Percentage (%)
Hypocotyl:Anthocyanin colouration	Absent	1	0	0
	Present	9	124	100
Time of flowering	Early	3	9	7.2
	Medium	5	115	92.8
	Late	7	0	0
Plant: Growth habit	Erect	3	0	0
	Semi-erect	5	100	81.7
	Spreading	7	24	19.3
Plant: Habit	Dterminate	1	84	67.7
	Indeterminate	3	40	32.3
Stem: Colour	Green	1	121	97.5
	Green with purple splashes	2	3	2.5
	Purple	3	0	0
Stem: Pubescence	Absent	1	0	0
	Present	9	124	100
Leaflet: Lobes (terminal)	Absent	1	9	7.2
	Present	9	115	92.8
Leaf: Shape (terminal)	Deltoid	1	3	2.5
	Ovate	2	121	97.5
	Lanceolate	3	0	0
	Cuneate	4	0	0
Leaf: Colour	Green	1	34	27.41
	Dark green	2	90	72.59
Leaf: Vein colour	Green	1	6	4.8
	Greenish purple	2	117	94.3
	Purple	3	1	0.9
Petiole: Colour	Green	1	1	0.9
	Green with purple splashes	2	115	92.8
	Purple	3	8	6.3
Leaf: Size	Small	3	34	27.41
	Medium	5	71	57.25
	Large	7	19	15.34
Flower: Colour of petal	Yellow	3	42	33.87
	Light yellow	5	82	66.13
Pod: Colour of premature pod	Green	1	7	5.64
	Green with pigmented suture	2	117	94.36
Pod: Pubescence	Absent	1	0	0
	Present	9	124	100
Pod: Position	Above canopy	3	79	63.7
	Intermediate	5	45	36.3
	Not visible	7	0	0
Plant: Height	Short	3	91	73.38
	Medium	5	33	26.62
	Long	7	0	0
Pod: Colour of premature pod	Brown	1	124	100
	Black	2	0	0
Pod: Curvature of mature pod	Straight	1	55	44.35
	Curved	3	69	55.65
Pod: Length	Short	3	67	54.03
	Medium	5	55	44.35
	Long	7	2	1.62
Seed: Colour	Yellow	1	0	0
	Green	2	122	98.38

Table 1. *Continued ...*

Characteristic	Class	Code	Frequency	Percentage (%)
	Mottled	3	1	0.81
	Black	4	1	0.81
Seed: Lusture	Shiny	1	62	50
	Dull	2	62	50
Seed: Shape	Oval	1	121	97.5
	Drum shaped	3	3	2.5
Seed: size (weight of 100 seeds)	Small	3	11	8.9
	Medium	5	102	82.2
	Large	7	11	8.9

semi-erect and spreading types. Out of the total 124 genotypes, 100 were characterized as semi-erect, while 24 displayed a spreading growth pattern, a classification consistent with observations made by Versha *et al*. (2022) in their investigations of five and twenty high-yielding genotypes of mung bean, respectively. For mung bean (*Vigna radiata*) genotypes, we categorized them into small, medium, and large seed groups based on their 100-seed weight. The majority of genotypes fell into the medium seed group, totaling 102, while 11 genotypes were classified in both the small and large seed categories, indicating the significance of seed characteristics. These findings are in line with similar observations made by Rahangdale *et al*. (2023).

Conclusion

DUS (Distinctness, Uniformity and Stability) characterization is an important tool to be followed to develop new varieties of plants. The various mung bean genotypes varied for maximum traits under study which can be further used in various breeding programmes to develop improved and new varieties**.**

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