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Characterization of Mungbean (*Vigna radiata* (L.) Wilczek) Genotypes through Chemical Tests and Seed Quality Parameters

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Abstract

An experiment was carried out at the Seed Testing Laboratory, Department of Seed Science and Technology, Junagadh Agricultural University, Junagadh, to characterize fifty mungbean genotypes based on seed quality parameters and chemical tests. Based on the seed coloration with phenol test genotypes were grouped into no change (18 genotypes), light brown (28 genotypes) and brown (4 genotypes). Based on the peroxidase test, genotypes were grouped into three categories viz., light brown (8 genotypes), brown (3 genotypes) and dark brown (39 genotypes) types. All 50 genotypes expressed reddish brown colour in potassium hydroxide test (KOH). On the basis of NaOH test genotypes were grouped into brown (10 genotypes) and orange (26 genotypes) and straw (14 genotypes). Based on seed quality parameters, significantly highest seed germination percentage was observed in GJM 1104 (99.00 %) and the lowest was observed in GJM 1822 (86.00 %). Seedling length ranged from 8.90 cm (GJM 1714) to 15.29 cm (GJM 1010) with a mean of 13.02 cm. Seedling vigour index I ranged from 836.96 (GJM 1714) to 1505.35 (GJM 1010). All the genotypes evaluated were vigorous with a mean of 1232.07. Seedling vigour index II ranged from 12.76 (GJM 1714) to 27.13 (GJM 1020) with a mean of 17.30.

Key words *: Mungbean, characterization, quality parameters, chemical tests.*

Introduction

The mungbean (*Vigna radiata* L.) is a member of the legume family (Fabaceae) with the chromosome number 2n=22. The mungbean is cultivated for its edible seeds and sprouts across Asia. It contains about 55% - 65% carbohydrate and are rich in protein, fat, vitamins and minerals. It is composed of about 20% - 25% protein, among which globulin (60%) and albumin (25%) are the primary storage proteins. The crop is also grown for hay, green manure and as cover crop (1). Besides being rich source of proteins and amino acids, they maintain soil fertility through the process of nitrogen fixation in symbiotic association with Rhizobium bacteria present in their nodules. Thus, they play a vital role as nitrogen fixing manufactories, which help in sustain productivity of soil.

It is one of the important pulse crop cultivated in India ranking third having about 70% of the world area and 45% of production. In India, pulses are grown in nearly 28.34 million hectare area with production status of nearly 23.15 million tonnes at an average productivity level of 817 kg/ha. Mungbean is grown in about 5.13 million hectares with the total production of 3.09 million tonnes with a productivity of 601 kg/ha and contributing 10 % to the total pulse production. Mungbean is mostly grown in the state of Rajasthan (30.81%), Maharashtra (19.51%), Karnataka (15.35%), Andhra Pradesh (12.79%), Orissa (7.41%), Tamil Nadu (4.97%), and Uttar Pradesh (2.09%). In Gujarat during 2020-21, mungbean is cultivated in an area of 154.69 lakh ha with the production of 110.14 lakh tonnes and productivity of 712 kg/ha (2, 3).

Laboratory procedures furnish several additional characteristics useful for genotype identification. In chemical tests, the chemical agents react with the seed and help in genotype identification. Some of the sensitive analytical techniques employed in the laboratory are phenol test, peroxidase test, potassium hydroxide (KOH) bleach test and sodium hydroxide (NaOH) test. The chemical tests reveal differences of colour among the seed. Study of phenotypic character along with chemical tests has additional benefits for producing more authentic result (4). Seed quality parameters study includes the study of germination percentage, seedling length and seedling vigour index I & II. These helps to know how rapidly seed germination occurs, strength of seed to germinate in adverse condition and yield of crop.

Materials and Methods

The experiment was conducted in the Seed Testing Laboratory of the Department of Seed Science and Technology, Junagadh Agricultural University, Junagadh during onwards sumer 2022 to characterize the 50 genotypes of mungbean (*Vigna radiata* (L.) Wilczek) *viz.,* GJM 1001, GJM 1002, GJM 1003, GJM 1004, GJM 1005, GJM 1006, GJM1007, GJM 1008, GJM 1009, GJM 1010,

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Table-1 : Identification and grouping of mungbean genotypes based on phenol test and peroxidase test.

Sr. No.	Genotypes	Phenol test	Peroxidase test	Sr. No.	Genotypes	Phenol test	Peroxidase test
1.	GJM 1001	No Change	Dark Brown	26.	GJM 1110	No Change	Dark Brown
2.	GJM 1002	No Change	Dark Brown	27.	GJM 1111	Light Brown	Dark Brown
3.	GJM 1003	No Change	Dark Brown	28.	GJM 1112	Light Brown	Dark Brown
4.	GJM 1004	Light Brown	Dark Brown	29.	GJM 1113	Light Brown	Dark Brown
5.	GJM 1005	Light Brown	Dark Brown	30.	GJM 1116	Brown	Brown
6.	GJM 1006	No Change	Dark Brown	31.	GJM 1117	No Change	Dark Brown
7.	GJM 1007	Light Brown	Dark Brown	32.	GJM 1118	Light Brown	Dark Brown
8.	GJM 1008	No Change	Dark Brown	33.	GJM 1102	Light Brown	Brown
9.	GJM 1009	No Change	Light Brown	34.	GJM 1103	Brown	Dark Brown
10.	GJM 1010	Light Brown	Dark Brown	35.	GJM 1703	Light Brown	Dark Brown
11.	GJM 1011	Light Brown	Light Brown	36.	GJM 1710	Light Brown	Dark Brown
12.	GJM 1012	No Change	Dark Brown	37.	GJM 1714	Light Brown	Light Brown
13.	GJM 1016	Light Brown	Dark Brown	38.	GJM 1810	Brown	Dark Brown
14.	GJM 1017	Light Brown	Light Brown	39.	GJM 1812	No Change	Dark Brown
15.	GJM 1020	No Change	Dark Brown	40.	GJM 1813	No Change	Brown
16.	GJM 1021	No Change	Light Brown	41.	GJM 1806	Light Brown	Dark Brown
17.	GJM 1022	Brown	Dark Brown	42.	GJM 1809	No Change	Dark Brown
18.	GJM 1024	Light Brown	Dark Brown	43.	GJM 1822	Light Brown	Dark Brown
19.	GJM 1025	Light Brown	Dark Brown	44.	GJM 1823	Light Brown	Dark Brown
20.	GJM 1026	Light Brown	Dark Brown	45.	GJM 1825	No Change	Dark Brown
21.	GJM 1027	Light Brown	Light Brown	46.	GJM 1826	Light Brown	Dark Brown
22.	GJM 1028	No Change	Dark Brown	47.	GJM 1832	Light Brown	Dark Brown
23.	GJM 1104	Light Brown	Light Brown	48.	GJM 1834	Light Brown	Dark Brown
24.	GJM 1105	Light Brown	Dark Brown	49.	GM 4	No Change	Dark Brown
25.	GJM 1108	Light Brown	Dark Brown	50.	K 851	No Change	Light Brown

Table-2 : Identification and grouping of mungbean genotypes based on KOH test and NaOH test.

Sr. No.	Genotypes	KOH test	NaOH test	Sr. No.	Genotypes	KOH test	NaOH test
1.	GJM 1001	Reddish Brown	Straw	26.	GJM 1110	Reddish Brown	Straw
2.	GJM 1002	Reddish Brown	Brown	27.	GJM 1111	Reddish Brown	Orange
3.	GJM 1003	Reddish Brown	Straw	28.	GJM 1112	Reddish Brown	Orange
4.	GJM 1004	Reddish Brown	Brown	29.	GJM 1113	Reddish Brown	Brown
5.	GJM 1005	Reddish Brown	Orange	30.	GJM 1116	Reddish Brown	Orange
6.	GJM 1006	Reddish Brown	Straw	31.	GJM 1117	Reddish Brown	Straw
7.	GJM 1007	Reddish Brown	Orange	32.	GJM 1118	Reddish Brown	Orange
8.	GJM 1008	Reddish Brown	Orange	33.	GJM 1102	Reddish Brown	Orange
9.	GJM 1009	Reddish Brown	Orange	34.	GJM 1103	Reddish Brown	Orange
10.	GJM 1010	Reddish Brown	Orange	35.	GJM 1703	Reddish Brown	Straw
11.	GJM 1011	Reddish Brown	Orange	36.	GJM 1710	Reddish Brown	Orange
12.	GJM 1012	Reddish Brown	Orange	37.	GJM 1714	Reddish Brown	Brown
13.	GJM 1016	Reddish Brown	Orange	38.	GJM 1810	Reddish Brown	Straw
14.	GJM 1017	Reddish Brown	Brown	39.	GJM 1812	Reddish Brown	Orange
15.	GJM 1020	Reddish Brown	Orange	40.	GJM 1813	Reddish Brown	Straw
16.	GJM 1021	Reddish Brown	Straw	41.	GJM 1806	Reddish Brown	Straw
17.	GJM 1022	Reddish Brown	Brown	42.	GJM 1809	Reddish Brown	Orange
18.	GJM 1024	Reddish Brown	Orange	43.	GJM 1822	Reddish Brown	Brown
19.	GJM 1025	Reddish Brown	Orange	44.	GJM 1823	Reddish Brown	Brown
20.	GJM 1026	Reddish Brown	Brown	45.	GJM 1825	Reddish Brown	Orange
21.	GJM 1027	Reddish Brown	Orange	46.	GJM 1826	Reddish Brown	Orange
22.	GJM 1028	Reddish Brown	Orange	47.	GJM 1832	Reddish Brown	Straw
23.	GJM 1104	Reddish Brown	Orange	48.	GJM 1834	Reddish Brown	Brown
24.	GJM 1105	Reddish Brown	Orange	49.	GM 4	Reddish Brown	Straw
25.	GJM 1108	Reddish Brown	Straw	50.	K 851	Reddish Brown	Straw

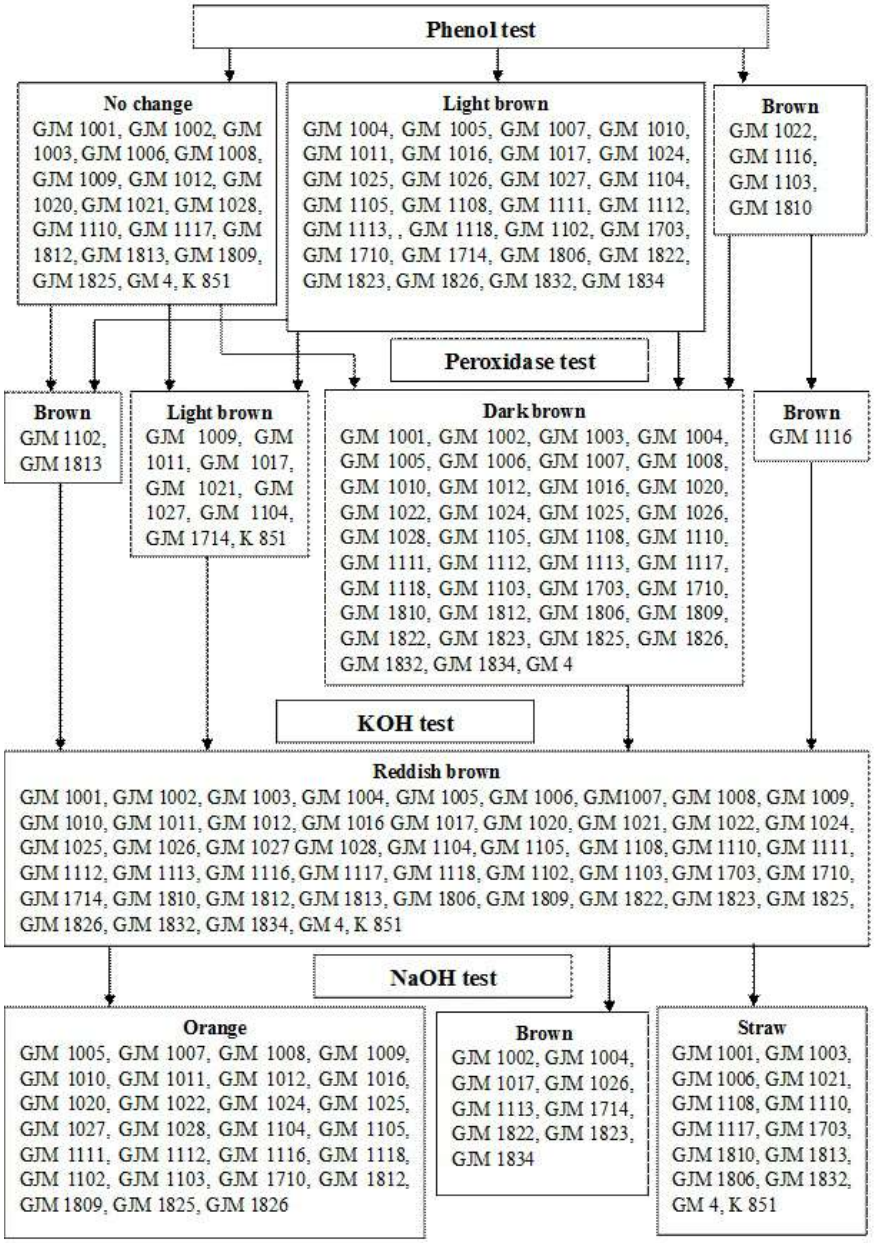

Figure-1 : Mungbean genotypes identification keys on the basis of chemical tests.

GJM 1011, GJM 1012, GJM 1016, GJM 1017, GJM 1020, GJM 1021, GJM 1022, GJM 1024, GJM 1025, GJM 1026, GJM 1027 GJM 1028, GJM 1104, GJM 1105, GJM 1108, GJM 1110, GJM 1111, GJM 1112, GJM 1113, GJM 1116, GJM 1117, GJM 1118, GJM 1102, GJM 1103, GJM 1703, GJM 1710, GJM 1714, GJM 1810, GJM 1812, GJM 1813, GJM 1806, GJM 1809, GJM 1822, GJM 1823, GJM 1825, GJM 1826, GJM 1832, GJM 1834, GM 4 and K 851, based on chemical tests and seed quality parameters. The experiment was conducted as per Completely Block Design with four repetitions. The data obtained from laboratory experiment conducted in CRD were analyzed as per standard method suggested by (5).

Results and Discussion

The seeds were subjected to phenol test, peroxidase test, potassium hydroxide (KOH) and sodium hydroxide (NaOH) tests for differentiating the genotypes (Table-1 and 2). Based on the seed coloration with phenol test genotypes were grouped into no change (18 genotypes), light brown (28 genotypes) and brown (4 genotypes). Based on the peroxidase test, genotypes were grouped into three categories *viz.,* light brown (8 genotypes), brown (3 genotypes) and dark brown (39 genotypes) types. The potassium hydroxide test didn't show any variation in mungbean genotypes. All 50 genotypes expressed

Table-3 : Identification and grouping of mungbean genotypes based on seed germination (%) and seedling length (cm).

Sr. No.	Genotypes	Seed germination (%)	Seedling length (cm)	Seedling vigour index (length) I	Seedling vigour index (Mass) II
1.	GJM 1001	92.50	12.88	1191.16	15.33
2.	GJM 1002	96.50	13.26	1279.72	17.86
3.	GJM 1003	95.00	13.10	1245.18	14.75
4.	GJM 1004	94.50	13.77	1301.35	16.10
5.	GJM 1005	88.50	12.72	1125.81	14.58
6.	GJM 1006	96.50	12.55	1211.71	16.18
7.	GJM 1007	91.50	13.07	1195.91	15.75
8.	GJM 1008	91.00	13.14	1195.31	15.44
9.	GJM 1009	94.00	14.34	1348.06	16.43
10.	GJM 1010	98.50	15.29	1505.35	21.17
11.	GJM 1011	87.50	12.47	1091.29	13.85
12.	GJM 1012	96.50	12.28	1186.47	18.77
13.	GJM 1016	98.50	12.91	1270.69	18.86
14.	GJM 1017	92.50	14.07	1301.64	14.82
15.	GJM 1020	97.50	14.35	1398.88	27.13
16.	GJM 1021	89.50	14.07	1259.51	19.42
17.	GJM 1022	97.50	13.97	1361.86	19.5
18.	GJM 1024	94.50	14.04	1327.86	18.26
19.	GJM 1025	97.50	13.30	1297.14	18.45
20.	GJM 1026	90.50	15.13	1367.93	19.63
21.	GJM 1027	98.50	13.72	1352.27	16.77
22.	GJM 1028	96.50	12.12	1169.90	16.82
23.	GJM 1104	99.00	14.34	1419.81	17.93
24.	GJM 1105	95.50	12.77	1219.35	15.42
25.	GJM 1108	91.50	13.83	1264.71	15.59
26.	GJM 1110	94.50	12.87	1215.64	14.86
27.	GJM 1111	98.00	14.32	1403.92	21.29
28.	GJM 1112	95.00	13.62	1292.95	16.54
29.	GJM 1113	98.00	14.73	1443.10	19.87
30.	GJM 1116	96.50	14.94	1442.09	18.65
31.	GJM 1117	93.00	11.10	1033.44	15.67
32.	GJM 1118	96.50	12.12	1169.00	16.23
33.	GJM 1102	93.00	11.41	1061.60	15.32
34.	GJM 1103	96.00	11.29	1083.45	15.09
35.	GJM 1703	96.00	12.72	1221.71	16.93
36.	GJM 1710	92.50	12.74	1178.57	14.49
37.	GJM 1714	94.00	8.90	836.96	12.76
38.	GJM 1810	96.50	10.77	1039.02	19.33
39.	GJM 1812	94.00	12.92	1214.77	21.87
40.	GJM 1813	97.50	12.14	1183.85	18.45
41.	GJM 1806	90.50	12.77	1156.10	18.70
42.	GJM 1809	95.00	13.38	1271.41	17.70
43.	GJM 1822	86.00	10.78	926.21	19.54
44.	GJM 1823	94.00	10.93	1027.28	16.22
45.	GJM 1825	97.50	12.76	1244.00	14.75
46.	GJM 1826	93.50	12.91	1206.21	16.49
47.	GJM 1832	95.50	12.07	1152.38	16.62
48.	GJM 1834	90.00	13.72	1235.15	18.94
49.	GM 4	96.50	13.88	1339.11	19.04
50.	K 851	96.50	13.85	1336.53	14.77
	Mean	94.55	13.02	1232.07	17.30
	S. Em ±	0.81	0.41	40.44	0.63
	C.D. at 5%	2.26	1.14	113.01	1.77

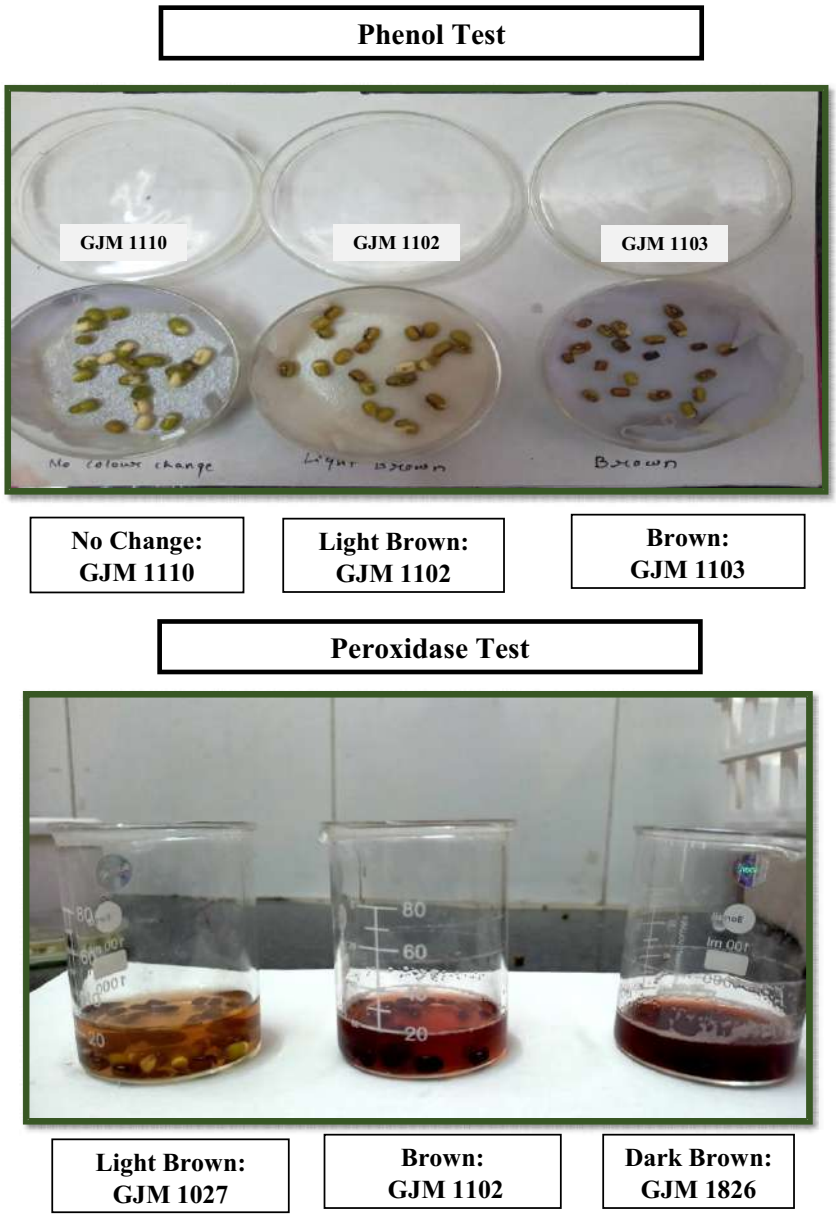

Figure-2 : Phenol test and peroxidase test of mungbean genotypes.

reddish brown color in potassium hydroxide test (KOH). On the basis of NaOH test genotypes were grouped into brown (10 genotypes) and orange (26 genotypes) and straw (14 genotypes).

On the basis of various chemical tests, genotypes identification keys were prepared (Figure-1). The genotypes GJM 1003, GJM 1007, GJM 1010, GJM 1016, GJM 1024, GJM 1025, GJM 1105, GJM 1111, GJM 1112, GJM 1118, GJM 1102, GJM 1710 and GJM 1726 were having light brown color in phenol test, dark brown color in peroxidase test, reddish brown in KOH test and orange in NaOH test. Genotypes GJM 1004, GJM 1026, GJM 1113, GJM 1822, GJM 1823 and GJM 1834 differed from above genotypes in respect to brown color in NaOH test, while the genotypes GJM 1703, GJM 1806 and GJM 1832 were differed from above genotypes with respect to straw color in NaOH test.

The genotype GM 4 was having no color in phenol test, dark brown color in peroxidase test, reddish brown color in KOH test and straw color in NaOH test. While, the genotype K 851 varied from the above genotypes with respect to light brown color in peroxidase test.

The genotypes GJM 1022 and GJM 1103 were having brown in phenol test, dark brown in peroxidase test, reddish brown in KOH test and orange in NaOH test, while the genotype GJM 1116 differed from above genotypes with respect to brown color in peroxidase test and genotype GJM 1810 straw color in NaOH test.

The genotypes GJM 1009, GJM 1111 and GJM

Reddish Brown: All genotypes

NaOH Test

Brown: GJM 1002 | **Orange: GJM 1809** | **Straw: GJM 1108**

Figure-3 : KOH test and NaOH test of mungbean genotypes.

1027 were having light brown color in phenol test, light brown color in peroxidase test, reddish brown in KOH test and orange in NaOH test, while the genotype GJM 1009 varied from the above genotypes with respect to no change in color in phenol test.

The genotypes GJM 1004, GJM 1026, GJM 1822, GJM 1823 and GJM 1834 were having light brown in phenol test, light brown in peroxidase test, reddish brown in KOH test and brown in NaOH test. While, the genotypes GJM 1017, GJM 1113 and GJM 1714 were differed from above genotypes with respect to light brown color in peroxidase test.

The genotypes GJM 1001, GJM 1003, GJM 1006, GJM 1110 and GJM 1117 were having no change in color in phenol test, dark brown color in peroxidase test, reddish brown in KOH test and straw color in NaOH test, while the genotypes GJM 1806, GJM 1832 and GJM 1703 were varied from the above genotypes with respect to light brown color in phenol test. Similar classification on the basis on phenol test, peroxidase test, KOH test and NaOH test is reported by (6, 7) in wheat; (8) in urdbean; (9, 10, 11) in chickpea.

Based on seed quality parameters, mungbean genotypes were categorized into different groups

Figure-4 : Seed germination and seedling length of mungbean genotypes.

(Table-3). Significantly highest seed germination percentage was observed in GJM 1104 (99.00 %) and the lowest was observed in GJM 1822 (86.00 %). Seedling length varied significantly among the fifty genotypes and the seedling length ranged from 8.90 cm (GJM 1714) to 15.29 cm (GJM 1010) with a mean of 13.02 cm. Seedling vigour index I varied significantly among the fifty genotypes and seedling vigour index I ranged from 836.96 (GJM 1714) to 1505.35 (GJM 1010). All the genotypes evaluated were vigorous with a mean of 1232.07. Seedling vigour index II varied significantly among the fifty genotypes and the seedling vigour index II ranged from 12.76 (GJM 1714) to 27.13 (GJM 1020) with a mean of 17.30. Similar findings and grouping of genotypes based on seed quality parameters was made by (1) in groundnut; (4) in French bean and (9) in urdbean.

Conclusions

From the above results, it can be concluded that based on chemical tests, the genotype GJM 1116 was distinct with brown color in phenol test, brown colour in peroxidase test and orange in NaOH test.

Assessment of genetic purity is an important criterion in seed production programme. Therefore, simple and reliable techniques need to be developed for

genetic purity assessment and genotype characterization. The study suggested that chemical tests and seed quality parameters, were found to be useful in broad classification of mungbean genotypes.

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