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Screening of Mung Bean (*Vigna radiata*) Germplasm Against Precocious Germination Susptability

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ABSTRACT

An experiment was carried out during zaid 2014, 20 diverse genotypes of mungbean were evaluated for their pre harvest sprouting (PHS) tolerance and other important agronomic traits. The analysis of variance revealed significant differences among the genotypes for all the characters studied. Seed germination % in pods(SGP), which was used as a measure of PHS tolerance, ranged from 2.078 in Vigna radiate var: sublobata (wild progenitor of mungbean) to 99.9 in the cultivar PDM139 . The parameters direct and indirect effect revealed in the present studies and give an idea about different parameter like pods and seeds traits playing role against pre harvest sprouting in mung bean. The present investigation also provide information on the characters of some of the popular mung bean genotypes related to pre harvest sprouting tolerance.

Key word: *Mung bean, Pre harvest sprouting , Seed dormancy*

INTRODUCTION

Mungbean requires hot and dry climate. Cloudy weather, continuous and heavy rains adversely affect the flowering and podding in mungbean, causing low yields. Mungbean can be grown on well-drained loamy sand to sandy loam soils. The crop is sensitive to alkaline, saline or waterlogged soil. Being a short duration crop, mungbean is cultivated in all three seasons (kharif, rabi and zaid) in different parts of country as a pure crop as well as an associate crop in various cropping systems. Among the three seasons, kharif is most important and in this season pre-harvest sprouting is a big problem causing huge losses in production. Nearly 60-70% of yield losses have been reported in green gram and black gram due to pre-harvest sprouting [4]**.** The pre-harvest sprouting is sometimes referred to as weather damage. Weather damage is a general term used to describe a range of adverse physical and chemical changes that occur in seed following its exposure to rainfall and humidity. In view of the substantial losses caused by pre-harvest sprouting, it is imperative to develop pre-harvest sprouting tolerant varieties for yield improvement in mungbean.

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However, the information on pre-harvest sprouting is lacking because little work has been done on this aspect of the crop. Weather damaged seed is more prone to fungal infection, and to cracking during harvest and threasing[8].Pre-harvest sprouting is one of the most important factors for lower productivity in pulses particularly in mungbean. Warm humid conditions at maturity in tropical and temperate regions are conducive to pre harvest sprouting. Which results in rupture of seed coat which is the physical barrier that protect the seed from adverse environmental conditions and disease causing organism, lead to reduction in seed quality and quantity. Thus, the seed of mungbean becomes substantial genetic improvement has been made in developing disease resistance in these crop but not against abiotic factors causing pre-harvest sprouting. Pre harvest sprouting/ weather damage has been described as a range of adverse physical and chemical changes that occur in seed following its exposure to periods of rainfall or high humidity right when on mother plant before its harvest[1].In situ germination with the onset of rain before harvest is a common feature in cereals and legumes. Very often rains at the time of harvest not only delay the harvesting but also cause yield loss up to 70% or more and deterioration in quality due to use as seed[4,9] .The yield gap in many high yielding varieties of mung bean crop could be mainly due to lack of resistance to pre-harvest wetting and sprouting due to rains at physiological maturity or just before harvesting. Hence, prevention of pre harvest sprouting damage forms the most important challenge in mungbean since it has been identified as the crucial constraint for improving seed yield and quality seed.

MATERIAL AND METHODS

The experiment was conducted during Zaid 2014-15 at student instructional farm of N.D.U.A.T University of Agriculture and Technology, Kumarganj .The experimental materials for the study consisted of 20 mungbean genotypes comprising of released varieties, advance breeding lines of inter varietal and inter specific origin, local germplasm, collections, the wild progenitor of mung bean (Vigna radiate var: sublobata) and 4 check Pant mung2, Pant mung4, Pant mung 5 and Pant mung 6. The field experiment was laid out Factorial Randomized Block Design. Each genotype was planted in two rows of 4m with spacing 60×10cm. The laboratory evaluation was conducted in Completely Randomized Design (CRD) with 3 replications for each genotype. Observations on anthocyanin pigmentation in hypocotyls, growth habit and days to 50% were recorded on plot basis. The scores for anthocyanin pigmentation in hypocotyls, growth habit and pod pubescence were recorded as per the green gram DUS guidelines. Plant height, number of branches, number of clusters, number of pods/cluster, number of pods/plant and number of leaves were recorded on five randomly selected plants in each genotype. Observations on pod pubescence, pod length, pod diameter, pod wall thickness, water imbibitions by pods (%) and seed germination in pods (%) were recorded on three sets of 10 pods each of the five randomly selected plants. Seed length and seed diameter were recorded on 10 randomly selected seeds from the bulk seed of each genotype. 100 seed weight, seed density, water imbibitions by seeds (%) and seed germination (%) were recorded on three sets of 1000 seeds each from the bulk seed of each genotype. Pod wall thickness, seed length and seed diameter were recorded using a screw gauge. The observations on other pod and seed related parameters were recorded as describe by Singh *et al*[11] with minor modifications.

Statistical analysis:

RESULTS AND DISCUSSION

Analysis of variance showed significant differences among the genotypes for all the characters. The general statistical parameters for various characters are presented in Table 1.The mean seed germination % in pods (SGP), which was used as a measure of PHS tolerance, ranged from 2.09 in Vigna radiate var: sublobata (wild progenitor of mungbean) to 99.90 in the genotype PDM139 (Table 2). The low SGP in V. radiata var: sublobata may be attributed to presence of seed dormancy as evident from very low seed germination (5.6%). Among the cultivated types, the genotype Pusa Vishal (13.50%) exhibited lowest SGP followed by Kopergaon and Taram with SGP of 21.00% and 22.01%, respectively. These genotypes too exhibited lower SG which may be due to presence of higher amount of hard seeds. In the present investigation, association of various plant, pod and seed characters with pre harvest sprouting was determined by studying the correlation coefficient and direct/indirect effects of these characters on seed germination% in pods (SGP), which revealed the role of various characters against pre harvest sprouting tolerance. Highly significant and positive association with SGP was also exhibited by seed germination % (SG) Table 3. The correlation between water imbibition by seeds(WIS) and SGP, However ; was non significant. The rate of water absorption and amount absorbed directly determines the rate and percentage of germination of normal seed, some seeds that otherwise are normal, fail to imbibe water and do not germinate. This behaviour is known as hard seededness and results in non germination of seeds even through sufficient moisture is available to the seed for initiation of germination process. Minimum germination percentage resulting from presence of hard seeds, therefore, minimum the incidence of seed germination inside the pod and indirectly affected PHS resistance. The hard seededness of with PHS resistance has been reported earlier by Kueneman[7] in soyabean and by Imrie[5] in mung bean. Water imbibitions % by pod (WIP) showed highly significant and positive correlation with SGP. Higher amount of water absorbed by the pod makes sufficient moisture available for the seeds present inside to initiate process of germination. Similar role of pre harvest with rate of water imbibitions through pod wall has been reported by Satyanarayana[10] in mungbean. The correlation of pod wall thickness with SGP was non significant with SGP was non- significant. A negative role between PWT and SGP has, however; been reported by Tekrony *et al* [13] in soyabean and by William[15] in mungbean. However; pod wall thickness alone may not account for minimum imbibitions of water by pods. Higher wax content in pod wall of PHS tolerant genotypes might restrict water to come in contact with the seeds causing failure of seed germination and thereby making the genotypes PHS tolerant[14]. Pod length showed highly significant positive correlation with SGP, while non significant positive correlation was observed with WIP. The positive role of pod length with SGP may be explained by the fact that a longer pod o account of its larger surface area is likely absorb more water compared to the smaller pod, thereby causing higher percent of seed germination in the pod. No role was observed between hypocotyls pigmentation and SGP. The correlation of pod pubescence with SGP was also found non significant. Dougherty and Boerma[3] however have reported positive role between pod pubescence and pre harvest sprouting in soyabean . Growth habit showed non significant negative correlation with WIP and SGP. The correlation of SGP with remaining characters was non significant Path coefficient analysis showed that highest positive direct effect on SGP was exhibited by seed germination %. Direct positive effects on SGP was also exhibited by number of pods/cluster; plant height, pod length, number of leaves, water imbibitions % by seeds and water imbibitions % by pods Table 4. The characters, viz. pods/plant, growth habit and 1000 seed weight had negative direct effects on SGP. Growth habit exhibited positive indirect negative indirect effect on SGP through growth habit, whereas plant height exhibited positive indirect effect on SGP through growth habit. Negative indirect effects on SGP were reported by seed germination % (through pod pubescence) and total number of pods/plants. The indirect effect of seed germination and seed germination in pod through no of cluster/plant were reported positive. Pre harvest sprouting is a complicated problem and is control by many genes showing significant interaction with environment. For the development of PHS tolerant cultivar, availability of suitable donors is a prerequisite. In this study information provide about the performance of the some popular mung bean cultivars in the respect of pre harvest sprouting tolerance. The character revealed in the study gives a preliminary idea about various plant, pod and seed traits that play role against pre harvest sprouting in mung bean.

Table 1: General statistical parameters for various characters in 20 mungbean genotypes

Character	Mean	SEM	Range	CD	CV
Days to 50 % flowering	38.38	30.00-47.60	6.25	1.696	6.57
Plant height (cm)	58.71	36.29-84.49	6.29	2.611	10.44
No. of branches	4.10	2.35-9.25	5.01	0.145	0.53
No. of clusters	15.76	3.83-38.03	7.51	0.837	3.65
No. of pods/cluster	3.95	3.17-5.67	5.70	0.159	0.63
Total no. of pods/plant	44.14	18.09-88.35	7.28	2.556	10.64
No. of leaves	29.85	4.10-10.32	5.57	1.537	5.91
Pod length (cm)	7.59	2.00-6.01	4.04	0.299	1.12
Pod diameter (mm)	4.66	0.14-0.28	1.90	0.133	0.49
Pod wall thickness(mm)	0.20	0.14-0.28	1.90	0.003	0.01
Seed length (mm)	4.27	2.63-7.51	2.59	0.078	0.27
Seed length (mm)	3.29	1.73-4.02	2.49	0.058	0.21
Seed diameter (mm)	3.81	2.20-5.85	5.62	5.62	0.12
1000-seed weight (g)	1.36	1.12-1.72	4.74	4.74	0.04
Seed density (g/l)	54.91	31.02-88.87	9.44	9.44	2.99
WI % by pods	15.32	4.26-42.00	30.37	30.37	2.69
WI % by seeds	69.80	6.60-98.67	10.81	10.81	4.36
SG % (SG)	70.30	2.09-100.00	9.21	9.21	3.74

Table 2: Mean seed germination % in pods (SGP) and seed germination % (SG) of 20 mungbean

Genotypes	SGP	SG	Genotypes	SGP	SG
Pant mung 2-3	80.10	50.33	Pusa Vishal	13.50	29.36
NDM 5	98.10	90.67	PantMung2- 4	50.88	44.67
TARAM-18	22.10	22.67	PantMung 2	92.83	95.00
Copergaon	21.00	30.63	Taram	22.01	22.67
Pant mung 6-16	87.74	60.00	Swati	46.08	52.67
HUM16	53.62	92.67	Samrat	78.44	60.67
SML668	63.30	85.67	Ganga	65.68	19.33
Pusa Ratna	37.49	88.00	PDM139	76.25	90.67
Pusa Vishal	93.64	93.33	Sublobata	2.10	5.96
NDM-1	67.17	95.33	PM-3-22	75.28	62.50

Table: 3 Correlation coefficients of various characters with SGP and WIP

Characters	Water imbibition % by pods	(WIP) Seed germination %pods
Hypocotyl colour	0.17	0.15
Gowth habit	-0.17	-0.04
Pod pubescence	-0.10	-0.094
Plant height	-0.23*	0.10
No. of clusters/plant	-0.15	-0.04
Total no. of pods/plant	-0.15	-0.060
No. of leaves/plant	-0.21	0.07
Pod length	0.08	0.26**
Pod diameter	-0.08	0.29*
Pod wall thickness	-0.13	0.08
Seed length	0.14	0.16
Seed diameter	0.02	0.34**
100-seed weight	0.10	0.20*
Density of seeds	0.13	0.07
WI % by seeds	-0.02	0.15
Seed germination %	0.11	0.36**
Water imbibition % by pods	1.00	0.21

Table:4 Direct and Indirect effect of various characters on SGP

Characters	1	2	3	4	5	6	7	8	9	10	11	12
Growth habit	-0.30	-0.23	-0.08	-0.094	-0.13	-0.14	0.06	0.03	0.06	-0.08	0.01	0.05
Plant height	0.19	0.25	0.14	0.06	0.16	0.14	-0.02	-0.02	-0.03	0.06	-0.02	-0.04
Pod pubescence	-0.03	-0.03	-0.13	-0.02	-0.03	-0.02	0.07	0.03	0.02	-0.02	0.01	0.01
No. Of clusters/plant	0.08	0.08	0.04	0.26	0.10	0.07	-0.01	-0.04	-0.01	-0.04	0.02	-0.02
Total pod/plat	-0.14	-0.16	-0.08	-0.13	-0.32	-0.23	0.01	0.07	0.08	0.001	-0.01	0.049
No. of leaves	0.10	0.12	0.03	0.06	0.16	0.22	0.03	-0.05	-0.03	0.009	0.02	-0.04
Pod length	-0.04	-0.09	-0.01	-0.01	-0.01	-0.02	0.24	0.12	0.14	-0.03	0.001	0.019
Seed diameter	-0.04	0.02	0.01	0.08	-0.01	0.02	0.08	0.13	0.03	0.01	0.009	0.002
100 seed weight	0.04	0.03	0.04	0.01	0.05	0.03	-0.12	-0.11	-0.21	0.02	-0.02	-0.02
WI% by seeds	0.06	0.06	0.04	-0.03	-0.01	0.09	-0.03	0.01	-0.02	0.23	0.01	-0.03
Seed germination	-0.04	-0.08	-0.68	0.62	0.03	0.70	01	-0.025	0.103	0.005	0.76	0.08
WI% by pod	-0.034	-0.047	-0.021	-0.02	-0.03	-0.043	0.015	0.02	0.02	-0.003	0.023	0.20

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