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# Cultivating Resilience: Unveiling Key Traits for Preharvest Sprouting Tolerance in *Vigna radiata* (L.) Wilczek

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**ABSTRACT: *Vigna radiata* is a crucial pulse growing most of the parts of the globe. Imbibition is a first and key physiological process mainly depends on the permeability of seed coat. Looser seed coat invites the imbibition process quickly rather than harder seed coat. Based on this the present experiment was conducted to study the evaluation of mungbean genotypes for morpho - physiological traits imparting tolerance for preharvest sprouting. The experiment was laid out in Randomized block design, with sixteen genotypes *i.e.*, AKM-8802, PKV-GREEN GOLD, PKV-AKM-4, BM-2002-1, BM-2003-2, KOPERGAON, AKM-9907, AKM-09-2, AKM-10-16, AKM-10-21, AKM-0603, AKM-10-05, AKM-10-13, AKM-10-24, AKM-8803 and AKM-9801with three replications. The result revealed that high hard seed percentage, lower germination in pod and seed, less seed and pod moisture percentage observed in AKM-9801, AKM-9907, BM-2002-1 and AKM-10-05, genotypes. This study delves into the strategies and key traits that confer preharvest sprouting tolerance in *Vigna radiata.***

**Keywords:** Mungbean, Seed coat, Preharvest sprouting, Germination and Seed Moisture percentage.

## INTRODUCTION

As global challenges like climate change and food security loom large, the need for resilient crop varieties has never been more pressing. The mung bean, with its unique nutritional profile, is positioned to play a pivotal role in meeting the world's growing food demands. Cultivating resilience in Vigna radiata not only safeguards agricultural livelihoods but also contributes to a sustainable and food-secure future. The Mungbean, *Vigna radiata* (L.) Wilczek has been grown in India since ancient times. Mungbeans are commonly referred as 'nutritional powerhouses' (Annon., 2012). In India it is widely grown in Madhya Pradesh, Maharashtra, Uttar Pradesh, Punjab, Andhra Pradesh, Karnataka and Tamil Nadu (Murugapriya *et al.*, 2011). Pre-harvest sprouting is one of the major problems and causes huge yield losses due to untimely terminal rains in mungbean. Sometimes, losses due to preharvest sprouting could as high as 60-70 % (Cheralu *et al.*, 1999). Pre-harvest sprouting tolerant mutant was identified to overcome this problem (Reddy *et al.*, 2010). Many times, rain at maturity cause preharvest sprouting in pod itself and observe great losses. Therefore, it is essential to identify the genotypes tolerant to preharvest sprouting by studying the different morpho- physiological traits.

## MATERIALS AND METHODS

The present investigation entitled “Evaluation of mungbean genotypes for morpho -physiological traits imparting tolerance for pre-harvest sprouting” was conducted on the experimental field of Department of Agricultural Botany, Dr. PDKV, Akola during kharif 2012. The rainfall (mm), mean maximum and minimum temperature (0c) and humidity in percentage per day during the period of the present investigation *Kharif* 2012 are given from Meteorological Observatory Department of Agronomy Dr. PDKV., Akola. Total 602.1 mm rainfall was received from 1st June to 30 Sept. 2012. Experiment was laid out in the design Randomized Block Design (RBD) with sixteen genotypes AKM-8802, PKV-GREEN GOLD, PKV-AKM-4, BM-2002-1, BM-2003-2, KOPERGAON, AKM-9907, AKM-09-2, AKM-10-16, AKM-10-21, AKM-0603, AKM-10-05, AKM-10-13, AKM-10-24, AKM-8803 and AKM-9801 along with three replications. Observations were recorded on Hard seed percentage, Germination in pod and seed, Seed and Pod moisture percentage indicated as below

$$\text{Hard seed (\%)} = \frac{\text{Hard seeds}}{\text{Total seed put for germination}} \times 100$$

$$\text{Seed germination in pods (\%)} = \frac{\text{Number of seeds germinated in pods}}{\text{Total number of seeds in pods}} \times 100$$

$$\text{Seed Germination (\%)} = \frac{\text{Number of germinated seeds}}{\text{Total number of seeds used in germination}} \times 100$$

$$\text{Moisture content in pod (\%)} = \frac{\text{Initial wt.of pods} - \text{oven dry wt.of pods}}{\text{Oven dry wt.of pod}} \times 100$$

$$\text{Moisture content of seed (\%)} = \frac{\text{Initial wt.of seed} - \text{oven dry wt.of seed}}{\text{Oven dry wt.of seed}} \times 100$$

The analysis of variance was performed to get the significance of differences between the genotypes for above characters as per the methodology suggested by Panse and Sukhatme (1954).

## RESULTSANDDISCUSSION

### Hard seed percentage

The percentage of hard seeds varied significantly among all genotypes. Genotype AKM-9801 exhibited the highest percentage of hard seeds (61.33%), followed by AKM-9907 (59.67%), BM-2002-1 (53.33%), and AKM-10-05 (45.67%), which were significantly higher than the mean value of 22.17%. Conversely, the genotype BM-2003-2 had the lowest percentage of hard seeds (0.67%), which was a significant deviation from the mean value. Detailed data are provided in Table 1. An increase in the percentage of hard seeds during germination is closely associated with pre-harvest sprouting in mungbean. This phenomenon may be attributed to reduced water uptake during imbibition. Similar findings were reported by Lwan (1987); Fraczek *et al.* (2005) and an anonymous source in 2011.

**Table 1: Hard seed (%), Moisture content of pod and Moisture content of seed of mungbean genotypes after harvest.**

| Sr. No. | Genotypes | Hard seed (%) | Moisture content of pod (%) | Moisture content of seed (%) |
|---|---|---|---|---|
| 1. | AKM-8802 | 1.67 | 18.2 | 15.1 |
| 2. | PKV-GREEN GOLD | 7.67 | 17 | 14.6 |
| 3. | PKV-AKM-4 | 34.33 | 16.3 | 13.5 |
| 4. | BM-2002-1 | 53.33 | 15.7 | 13.1 |
| 5. | BM-2003-2 | 0.67 | 19 | 15.2 |
| 6. | KOPERGAON | 2.67 | 18.1 | 14.7 |
| 7. | AKM-9907 | 59.67 | 15.3 | 13.97 |
| 8. | AKM-09-2 | 14.33 | 17 | 13.9 |
| 9. | AKM-10-16 | 15.67 | 17 | 13.7 |
| 10. | AKM-10-21 | 22.33 | 16.5 | 15 |
| 11. | AKM-0603 | 4 | 18 | 13.3 |
| 12. | AKM-10-05 | 45.67 | 16.1 | 14.2 |
| 13. | AKM-10-13 | 11 | 17.4 | 14.8 |
| 14. | AKM-10-24 | 6.67 | 18 | 14.8 |
| 15. | AKM-8803 | 13.67 | 17.1 | 14.3 |
| 16. | AKM-9801 | 61.33 | 15.2 | 12.4 |
| | ‘F ‘ Test | S | S | S |
| | SE(m)± | 1.77 | 0.73 | 0.57 |
| | CD at 5% | 5.11 | 2.1 | 1.65 |

**Seed germination in pod.** The seed germination in pod was statistically significant in all the genotypes.

"At the 48-hour mark, genotype AKM-0603 exhibited the highest pod germination rate at 49.47%, followed closely by AKM-8802 at 47.72%. These rates were significantly higher than the overall mean of 33.61%. In contrast, the lowest germination rates were observed in genotype AKM-10-05 at 12.54%, and BM-2002-1 at 12.75%.

By the 72-hour point, genotype BM-2003-2 had the highest pod germination rate at 78.84%, closely followed by Kopergaon at 77.03%. Both of these rates significantly exceeded the general mean of 62.46%. Conversely, the lowest germination rates were recorded in genotypes AKM-9801 at 34.32% and AKM-9907 at 42.06%.

At the 96-hour mark, AKM-8802 had the highest pod germination rate at 91.08%, with BM-2003-2 following closely at 89.27%. Again, these rates were significantly higher than the general mean of 74.89%. In contrast, significantly lower pod germination was observed in genotype AKM-10-05 at 49.66%.

Reaching the 120-hour point, genotype BM-2003-2 demonstrated the highest pod germination rate at 98.08%, followed by AKM-8802 at 96.27%. These rates were significantly higher than the general mean of

81.70%. Conversely, AKM-9907 exhibited the lowest pod germination rate at 58.56%. The range of pod germination rates at this stage varied from 12.54% to 58.56%.

The genotypes with lower pod germination rates, falling within this range, are indicative of greater tolerance to pre-harvest sprouting. Similar results have been previously documented by Anupama *et al.* (2012) and an anonymous source in 2011 in the context of mungbean research.

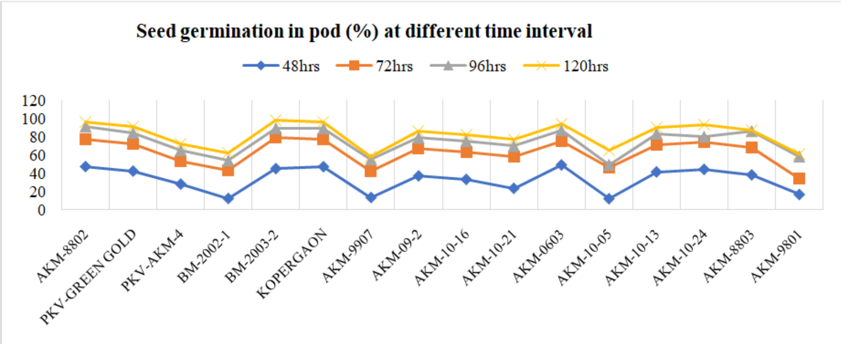


**Fig. 1.**

**Seed germination.** The seed germination percentages varied significantly among all the genotypes. After 24 hours, the genotype AKM-8802 exhibited the highest seed germination rate at 71.02%, followed closely by BM-2003-2. These rates were significantly higher than the overall mean of 52.22%. Conversely, the genotypes AKM-9907 and AKM-19801 recorded the lowest seed germination percentages at 16.68% and 19.35%, respectively.

At the 36-hour mark, BM-2003-2 demonstrated the highest seed germination at 92.1%, with AKM-8802 closely behind at 90.41%. These rates were again significantly higher than the general mean of 71.93%. On the other hand, AKM-9907 and AKM-9801 had the lowest seed germination percentages at 36.33% and 38.45%, respectively.

By the 48-hour point, BM-2003-2 maintained its lead with the highest seed germination of 99.15%, followed by AKM-8802 at 98.45%. Once more, these rates significantly exceeded the general mean of 78.36%. Meanwhile, AKM-9907 and AKM-9801 recorded the lowest seed germination percentages at 42.33% and 44.96%, respectively.

In summary, seed germination ranged from 16.68% in AKM-9907 to 71.02% in AKM-8802 at 24 hours, from 36.33% (AKM-9907) to 90.41% (AKM-8802) at 36 hours, and from 42.33% (AKM-9907) to 98.45% (BM-2003-2) at 48 hours. These findings align with similar results reported in Anonymous (2011); Durga and Kumar (1997).

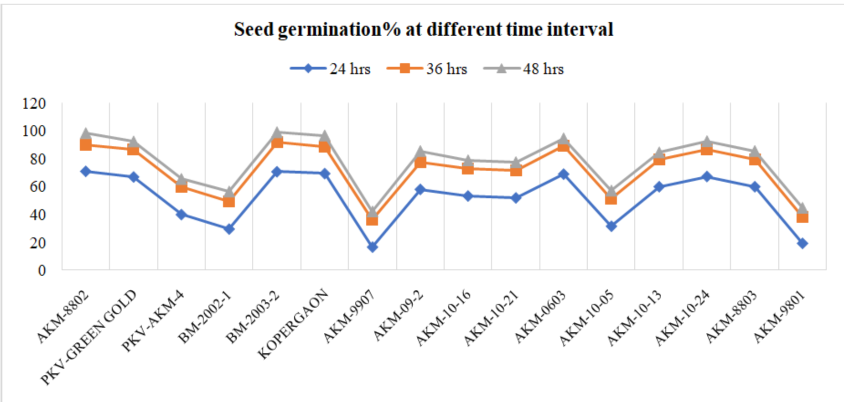


**Fig. 2.**

**Moisture content of pod:** Moisture content of pod was differed significantly in all genotypes. The genotype BM-2003-2 (19%) recorded highest moisture content of pod followed by AKM-8802 (18.20%). Lowest moisture content of pod was recorded in genotype AKM-9801 (15.20%), followed by AKM-9907(15.30%). Due to lower moisture content of pods in these genotypes less germination % in pods were noticed. These findings align with similar results reported in Yaklich and Cregan (1987).

**Moisture Content of Seed:** Moisture content of Seed was differed statistically significant in all genotype. The genotype BM-2003-2 (15.20%) recorded highest moisture content of seed followed by AKM-8802 (15.10%). Significant lowest moisture content of seed recorded in genotype AKM-9801 (12.40%), followed by BM-2002-1 (13.10%). The lower moisture content in seed reflected into lower seed germination % in seed in these genotypes, showed tolerance to preharvest sprouting. Similar findings were reported by Yaklich and Cregan (1987).

## CONCLUSIONS

The genotypes AKM-9801 (61.33%), AKM-9907 (59.67%), and BM-2002-1 (53.33%) exhibited a higher percentage of hard seeds, while lower seed germination within the pod was observed in genotypes AKM-9907 (58.56%) and AKM-9801 (61.30%). Additionally, these two genotypes, AKM-9907 (42.33%) and AKM-9801 (44.96%), displayed lower overall seed germination percentages. Furthermore, genotype AKM-9801 (12.40%) and BM-2002-1 (13.10%) demonstrated reduced moisture content in their seeds.

Based on the combination of high hard seed percentages, pod pubescence, lower germination rates within the pod and for individual seeds, as well as reduced seed and pod moisture percentages, it can be concluded that the genotypes AKM-9801, AKM-9907, BM-2002-1, and AKM-10-05 exhibit greater tolerance to preharvest sprouting.

## FUTURE SCOPE

The identification of mungbean genotypes that are more tolerant to pre-harvest sprouting represents a significant step in improving mungbean crops. The future scope includes using these genotypes for breeding programs, enhancing food security and advancing scientific knowledge in the field of agriculture.

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**Conflict of Interest.** None.

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