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# New High Yielding Mung Bean Variety Phule Chetak for Maharashtra

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## ABSTRACT

**Background:** Mung bean is one of the important pulse crop requiring low inputs. The productivity of *kharif* mung bean is very low. The present improved varieties have lower yield potential and disease susceptibility. There is a need to develop high yielding varieties combined with early to mid synchronous maturity, better quality and resistance/tolerance to major pests and diseases.

**Methods:** The green gram *var.* Phule Chetak was developed by pedigree selection method from a cross between SML-668 X Naval at Oilseeds Research Station, MPKV, Jalgaon. It was tested over several locations and environments for its stability performance.

**Result:** The results indicated a significant improvement in yield level under field conditions. The new variety Phule Chetak reported an average yield of 1003 kg/ha which is 26.96%, 36.46%, 29.42%, 21.72%, 17.58% and 13.21 per cent higher than the check varieties Vaibhav, BPMR-145, AKM-8802, BM-2002-1, BM-2003-2 and Utkarsha respectively. It is bold seeded having early maturity, moderately resistant to major diseases like powdery mildew, mungbean yellow mosaic virus under field conditions. Considering its consistent performance, the mung bean genotype PM-707-5 has been released for cultivation in the *kharif* season for Maharashtra under the name of Phule Chetak in Joint Agresco during 29-30 October, 2020 held at Dr PDKV, Akola.

**Key words:** Mung bean, Multilocation trials, Phule chetak, Yield.

## INTRODUCTION

Mung bean (*Vigna radiata* L.) is an important pulse crop in India cultivated over a wide range of agro-climatic zones of the country. It belongs to the family *Leguminoceae* (Fabaceae) and has originated from India and Central Asia. This crop is grown in all the seasons, however maximum area is under *kharif* cultivation where intercropping with sorghum, pearl millet, maize, cotton, castor, pigeon pea *etc.* is very popular (Anonymous, 2020). Due to its short duration, it has proved to be an ideal crop for catch cropping, intercropping and relay cropping. Mung bean is an excellent source of high quality protein. It is consumed in different ways as *dal, halwa* which is very nutritious. Sprouted whole mung bean is used in South India for preparing curry or savory dish. The seeds are boiled whole or after splitting and eaten as *dal* or ground to prepare *balls, bari, pakori* and *papad etc.* It is also recommended as a medicinal diet in cases of flatulence and to the sick. Ascorbic acid (Vitamin C) is synthesized in sprouted seeds of mung bean. The amount of riboflavin and thiamine also increases during seed sprouting. As it is a leguminous crop it has the capacity to fix atmospheric nitrogen through symbiotic nitrogen fixation. It is also used as a green manure crop. It also provides an excellent green fodder to the animals.

In India, many factors are responsible for improper growth and low yields of green gram. Out of that use of old varieties, imbalanced application of fertilizers and inadequate planting distance are some of the major factors, which adversely affect the growth of green gram (Patil *et al.*, 1985). Inclusion of only quality seed of improved varieties in its cultivation leads to increase of 15-20% seed yield. Availability of quality seed of improved variety at a reasonable price to the door of potential growers is still a big challenge. Because apart from the genetic constitution, a number of physiological, biochemical and lack of required packages of practices during the critical stages of crop growth have found to be some of the yield barriers of mung bean (Ahlawat and Rana, 2002). Timely sowing at the proper spacing along with application of recommended doses of fertilizer, microbial inoculants and boron foliar spray have been found to ameliorate such bottlenecks to a considerable extent in pulses (Vakeswaran *et al.*, 2016).

In India the major mung bean growing states are Maharashtra, Andhra Pradesh, Rajasthan, Orissa and Bihar. In Maharashtra it is the second important *kharif* pulse crop grown after pigeon pea. Mung bean is cultivated on an area of 3.95 lakh hectares producing 1.44 lakh tones with an average productivity of 365 kg per hectare in Maharashtra (Anonymous, 2021). However the present yield potential of improved varieties is not enough to attract the farmers, which is further aggravated by disease susceptibility. Therefore, there is a need to develop high yielding variety combined

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with early to mid late synchronous maturity, better quality and resistance/tolerance to major pests and diseases.

With this object in view, hybridization programme was undertaken at the Oilseeds Research Station, Jalgaon under Mahatma Phule Krishi Vidyapeeth, Rahuri. A cross between diverse parents viz., SML-668 and Naval resulted in isolation of promising culture Phule M-707-5. The culture Phule M-707-5 was entered in the mung bean Regional varietal trial during 2010 and State Multilocation varietal trial during 2011 to 2019.

## MATERIALS AND METHODS

The green gram promising *var.* Phule Chetak (PM-707-5) was developed by pedigree selection method from a cross between SML-668 X Naval at Oilseeds Research Station, Mahatma Phule Krishi Vidyapeeth, Jalgaon. This selected genotype has been screened for higher yield with pest and disease resistance in $F_1$ to $F_5$ generations. The genotype was studied for its yield and ancillary characteristics in station trials, multi-location as well as AICRP trials during 2012 to 2019 in *kharif* seasons (Table 1). It was tested for several locations and environments for its stability performance. The variety was evaluated in a randomized block design with 3 replications in university/state trials and in AICRP trials with checks. The variety Phule Chetak and existing released varieties were evaluated for their yield performance under field conditions. At maturity the yield and yield attributing characteristics were recorded. The statistical analysis was carried out according to Panse and Sukhatme (1985). The candidate variety was evaluated for its reaction to major diseases under endemic conditions during 2017 to 2019 *kharif* seasons.

### Crop management

Right after sowing, the experimental plots were taken care regularly at every growth stage interval until pods matured. Weeding was done manually. Plant protection measures were applied as and when required. The various morphological observations were recorded at proper stage till harvest.

## RESULTS AND DISCUSSION

The evaluation of Phule Chetak (PM-707-5) was done in *kharif* season through station and multi-location trials for eight years during 2012 to 2019 in 40 trials and performance of the genotype Phule Chetak was recorded on various traits. It was revealed that seed yield was 986 kg /ha in *kharif* which is 27.55, 34.15, 27.23, 19.66, 15.59 and 11.29 per cent higher than the check varieties *viz.* Vaibhav, BPMR-145, AKM-8802, BM-2002-1, BM-2003-2 and Utkarsha respectively (Table 1).

The genotype Phule Chetak (PM-707-5) was tested in co-ordinated trials under AICRP project in *kharif* for one year. Performance of Phule Chetak (PM-707-5) in these trials was also superior over the corresponding checks.

Taking into account best performance of Phule Chetak (PM-707-5) in *kharif* multilocation trials as well as co-ordinated trials, it was released for Maharashtra state for cultivation for farmers in *kharif* season.

### Performance of phule chetak (PM-707-5) in station trials

Phule Chetak (PM-707-5) was tested in station trials for three years at Oilseeds Research Station, MPKV, Jalgaon during *kharif* 2012-13 to 2014-15 (Anonymous, 2015). Phule Chetak recorded 776 kg/ha seed yield when compared with check

**Table 1:** Summary of yield performance of phule chetak (PM-707-5) in station, multilocation and IVT trials over checks (*Kharif* 2012-2019).

| Trial | Year | No. of Trials | PM-707-5 | Vaibhav | BPMR-145 | AKM-8802 | BM-2002-1 | BM-2003-2 | Utkarsha |
|---|---|---|---|---|---|---|---|---|---|
| SSYET | 2012 | 1 | 1275 | 969 | - | - | - | - | - |
| LSYET* | 2013 | 1 | 290 | 287 | | | | | |
| RVT | 2014 | 2 | 527 | 360 | - | - | - | - | - |
| Pooled weighted mean of station trials (03) | | 04 | 776 | 563 | - | - | - | - | - |
| Per cent increase over | | | - | 37.83 | | | | | |
| SMVT | 2015 | 5 | 966 | 651 | 526 | 576 | 622 | 666 | - |
| | 2016 | 7 | 1076 | 826 | 857 | 825 | 908 | 932 | 975 |
| | 2017 | 8 | 914 | 756 | 734 | 801 | 869 | 895 | 859 |
| | 2018 | 9 | 958 | 759 | 701 | 738 | 834 | 831 | 738 |
| | 2019 | 8 | 1100 | 913 | 797 | 871 | 822 | 883 | 1000 |
| Pooled weighted mean of multilocation trials (37) | | 37 | 1003 (37)<br>1008 (32) | 790 | 735 | 775 | 824 | 853 | 886 (32) |
| Per cent increase over | | | | 26.95 | 36.45 | 29.38 | 21.63 | 17.55 | 13.86 |
| Overall pooled weighted mean of station and SMVT trials (40) | | 40 | 986 | 773 | 735 | 775 | 824 | 853 | 886 |
| Per cent increase over | | | - | 27.55 | 34.15 | 27.23 | 19.66 | 15.59 | 11.29 |
| IVT | 2018 | 24 | 885 | - | - | 717 | - | - | - |
| Per cent increase over | | | - | - | - | 23.43 | | | |

Note: *Data of station trial (Jalgaon 2013) was excluded while calculating Weighted pooled mean due to low yield level below state average.

variety Vaibhav (563 kg/ha), which was 37.83 per cent higher over check (Table 1).

**Performance of Phule Chetak (PM-707-5) in multi-location trials**

The multilocation trials were conducted at 37 locations during *kharif* 2015-16 to 2019-20. On the basis of mean performance for five years Phule Chetak (PM-707-5) gave 1003 kg/ha seed yield as against check varieties *viz*., Vaibhav (790 kg/ha), BPMR-145 (735 kg/ha), AKM-8802 (775 kg/ha), BM-2002-1 (824 kg/ha), BM-2003-2 (853 kg/ha) and Utkarsha (886 kg /ha) with a percentage increase of 26.95, 36.45, 29.38, 21.63, 17.55 and 13.86 per cent respectively (Table 1).

**Performance of Phule Chetak (PM-707-5) in AICRP trials**

The genotype Phule Chetak (PM-707-5) was tested in AICRP IVT (2018-19) all over India. The overall mean performance for one year in 24 trials showed that Phule Chetak (PM-707-5) recorded 885 kg/ha grain yield which was 23.43 per cent increase over the check variety AKM-8802 (717 kg/ha) (Table 1) (Anonymous, 2019).

**Overall performance of Phule Chetak (PM-707-5) in station and multilocation trials**

The genotype Phule Chetak (PM-707-5) was tested in total 40 trials comprising of 3 station trials and 37 multilocation trials in *kharif* season during 2012-13 to 2019-20. The overall mean performance for eight years in 40 trials reported that Phule Chetak (PM-707-5) recorded higher grain yield of 986 kg/ha as against check varieties *viz*., Vaibhav (773 kg/ha), BPMR-145 (735 kg /ha), AKM-8802 (775 kg/ha), BM-2002-1 (824 kg/ha), BM-2003-2 (853 kg/ha) and Utkarsha (886 kg /ha) with percentage increase of 27.55, 34.15, 27.23, 19.66, 15.59 and 11.29 per cent respectively (Table 1).

**Performance of Phule Chetak (PM-707-5) in agronomic trial**

The genotype Phule Chetak (PM-707-5) was tested for Agronomic performance at Oilseeds Research Station, MPKV, Jalgaon during 2019-20 under rainfed condition (Table 2) (Anonymous, 2020).

**Effect of variety**

The results revealed that the variety PM-707-5 recorded significantly higher number of pods per plant (21.28), number of grains per pod (13.90), test weight (4.83 g), grain weight per plant (4.72 g), grain yield (942 kgha$^{-1}$) and haulm yield (2172 kgha$^{-1}$) over the check variety Vaibhav (18.80, 12.52, 3.86 g, 3.92 g, 787 kgha$^{-1}$ and 2002 kgha$^{-1}$, respectively). The same variety PM-707-5 also recorded the maximum net returns Rs. 38095 ha$^{-1}$ and a B:C ratio of 2.19. However, both the varieties did not show any significant effect on growth parameters like plant stand, plant height, plant spread and number of branches.

**Effect of spacing**

The growth attributes like initial and final plant stand (328, 312), plant height (88 cm) and number of branches (4.30)

**Table 2:** Crop production technology: Agronomy trial conducted at Jalgaon during *kharif* 2019. Effect of variety, spacing and fertilizer dose on seed yield, GMR, NMR and B:C ratio in Mungbean.

| Treatment | Initial plant stand | Final plant stand | Plant height (cm) | Plant spread (cm) | No. of branches/ plant | No. of pods/ plant | No. of grains/ pod | 100 grain weight | Grain weight/ plant | Grain yield (kg/ha) | Haulm yield (kg/ha) | Gross monetary returns (Rs/ha) | Net monetary returns (Rs/ha) | B: C Ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variety (V)** | | | | | | | | | | | | | | |
| PM-707-5 ($V_1$) | 273 | 258 | 85.25 | 11.50 | 4.43 | 21.28 | 13.90 | 4.83 | 4.72 | 942 | 2157 | 70011 | 38095 | 2.19 |
| Vaibhav ($V_2$) | 272 | 255 | 83.00 | 11.48 | 4.10 | 18.80 | 12.52 | 3.86 | 3.92 | 787 | 2002 | 58884 | 26969 | 1.85 |
| SEm± | 1.03 | 1.10 | 0.89 | 0.15 | 0.12 | 0.32 | 0.16 | 0.08 | 0.09 | 20.97 | 35.19 | 1434 | 1434 | 0.04 |
| CD at 5% | NS | NS | NS | NS | NS | 0.97 | 0.50 | 0.25 | 0.28 | 63.62 | 106.75 | 4351 | 4351 | 0.14 |
| **Spacing (S)** | | | | | | | | | | | | | | |
| 30 X 10 cm ($S_1$) | 328 | 312 | 88.42 | 11.37 | 4.30 | 20.50 | 13.03 | 4.26 | 4.30 | 889 | 2118 | 66268 | 34518 | 2.09 |
| 45 X 10 cm ($S_2$) | 218 | 202 | 79.83 | 11.62 | 4.23 | 19.58 | 13.38 | 4.44 | 4.33 | 839 | 2041 | 62627 | 30546 | 1.95 |
| SEm± | 1.03 | 1.10 | 0.89 | 0.15 | 0.12 | 0.32 | 0.16 | 0.08 | 0.09 | 20.97 | 35.19 | 1434 | 1434 | 0.04 |
| CD at 5% | 3.14 | 3.35 | 2.70 | 0.45 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| **Fertilizer dose (F)** | | | | | | | | | | | | | | |
| 100% RDF ($F_1$) | 272 | 256 | 83.42 | 11.27 | 4.20 | 19.85 | 13.00 | 4.26 | 4.27 | 855 | 2049 | 63724 | 32028 | 2.01 |
| 125% RDF ($F_2$) | 273 | 258 | 84.83 | 11.72 | 4.33 | 20.23 | 13.42 | 4.44 | 4.36 | 874 | 2110 | 65171 | 33036 | 2.03 |
| SEm± | 1.03 | 1.10 | 0.89 | 0.15 | 0.12 | 0.32 | 0.16 | 0.08 | 0.09 | 20.97 | 35.19 | 1434 | 1434 | 0.04 |
| CD at 5% | NS | NS | 1.70 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| Interaction | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

were recorded significantly higher under normal spacing 30 × 10 cm over broader spacing of 45 × 10 cm (218, 202, 80 cm, 4.23, respectively). But the plant spread at broader spacing (11.62 cm) recorded significantly higher than normal spacing (11.37 cm). However, all the yield attributes and economics shown non significant effect at varying levels of spacing.

**Effect of fertilizer dose**

Application of fertilizer doses (100% RDF and 125% RDF) to the green gram did not produce any significant effect on growth and yield attributes except at 125% of RDF recorded significantly higher plant height (85 cm) over 100% RDF (83 cm).

**Reaction to major diseases**

The candidate variety was tested at various locations under AICRP *viz.,* Raipur, Badnapur, Vamban, Akola, Berhampur, Dholi, Pantnagar, Lam, Sagar and SK Nagar against major diseases of mung bean. In 0-5 scale, the powdery mildew disease score in the variety Phule Chetak (PM-707-5) ranged from 1 to 2 as compared to check varieties 1 to 4. In 0-9 scale, the cercospora leaf spot disease score in this variety was in the range from 2 to 9 as compared to checks 3 to 9 and for mung bean yellow mosaic virus disease it ranged 1 to 3 as against 1 to 3 in checks. Also the stem rot disease percentage was ranged from 1.67 to 9.23% as compared to check varieties. Considering the overall performance, Phule Chetak (PM-707-5) has high level of resistance to powdery mildew, Cercospora Leaf Spot and mung bean yellow mosaic virus (Table 3a and 3b).

**Ancillary characters of phule chetak (PM-707-5)**

The ancillary data is reported in Table 4. The candidate variety Phule Chetak requires on an average 39.2 days for 50% flowering and 69.2 days for maturity. The no. of pods per plant (24.60) is less than Vaibhav, BPMR-145, BM-2003-2, AKM-8802 and Utkarsha, The mean plant height (56.84 cm) is less than Vaibhav, BM-2002-1, BPMR-145, BM-2003-2 and AKM-8802. The no. of branches per plant (3.68) is higher than all check varieties except Utkarsha. The no. of seeds per pod (13.20) is better than check varieties AKM-8802 and Utkarsha. The 100 seed weight (4.77) is maximum amongst all varieties including checks.

**Table 3a:** Screening of PM-707-5 genotype against major diseases of mungbean at various locations under AICRP (*Kharif* 2018).

| Diseases | Locations | PM-707-5 | BM-4 | AKM-8802 | Kopergaon |
|---|---|---|---|---|---|
| Powdery mildew (0-5 scale) | Raipur | 1.0 | 3.0 | 3.0 | 3.0 |
| | Badnapur | 2.0 | 1.0 | 1.0 | 1.0 |
| | Vamban | 1.0 | 3.0 | 0.0 | 1.0 |
| | Akola | 2.0 | 4.0 | 4.0 | 3.0 |
| | Reaction | R | R | R | R |
| Cercospora leaf spot (0-9 scale) | Berhampur | 4.0 | 5.0 | 6.0 | 7.0 |
| | Dholi | 2.0 | 3.0 | 3.0 | 3.0 |
| | Pantnagar | 4.0 | 9.0 | 6.0 | 5.0 |
| | Lam | 9.0 | 9.0 | 9.0 | 9.0 |
| | Reaction | R | R | R | R |
| Mungbean yellow mosaic virus | Raipur | 1.0 | 1.0 | 1.0 | 1.0 |
| (MYMV) (0-9 scale) | Berhampur | 1.0 | 1.0 | 1.0 | 1.0 |
| | Sagar | 2.0 | 3.0 | 3.0 | 3.0 |
| | SK Nagar | 1.0 | 3.0 | 2.0 | 1.0 |
| | Badnapur | 3.0 | 2.0 | 2.0 | 3.0 |
| | Reaction | MR | MR | MR | MR |

Source: Annual Report on MULLaRP- ICAR- IIPR Kanpur 2018-19.

**Table 3b:** Reaction of PM-707-5 to major diseases recorded at Jalgaon under field conditions (*Kharif* 2017-19).

| Diseases | Year | PM-707-5 | Vaibhav | BPMR-145 | Kopergaon |
|---|---|---|---|---|---|
| Powdery mildew (0-5 scale) | 2017 | 23.31 (MR) | 17.75 (MR) | 21.54 (MR) | 60.40 (S) |
| | 2018 | 8.50 (R) | 19.50 (MR) | 7.70 (R) | 69.50 (HS) |
| | 2019 | 9.12 (R) | 13.52 (MR) | 12.76 (MR) | 70.0 (HS) |
| Mean | | 13.64 (MR) | 16.91 (MR) | 13.98 (MR) | 66.63 (HS) |
| Reaction | | (MR) | (MR) | (MR) | (HS) |
| *Cercospora* leaf spot (0-5 scale) | 2017 | 19.97 (MR) | 62.51 (S) | 25.64 (M.S) | 65.00 (S) |
| | 2018 | 12.50 (MR) | 28.00 (MR) | 15.50 (MR) | 78.00 (HS) |
| | 2019 | 17.08 (MR) | 12.69 (MR) | 20.46 (MR) | 77.00 (HS) |
| Mean | | 16.51 (MR) | 34.40 (MS) | 20.53 (MR) | 73.33 (HS) |
| Reaction | | (MR) | (MS) | (MR) | (HS) |

**Table 4:** Ancillary observations of phule chetak (PM-707-5) in comparison with checks.

| Year | PM-707-5 | Vaibhav | BM-2002-1 | BPMR-145 | BM-2003-2 | AKM-8802 | Utkarsha |
|---|---|---|---|---|---|---|---|
| Days to 50% flowering | 39.2 | 41.0 | 40.0 | 40.4 | 39.2 | 38.8 | 39.0 |
| Days to maturity | 69.2 | 68.8 | 69.6 | 68.0 | 68.4 | 68.0 | 68.75 |
| Plant height (cm) | 56.84 | 57.30 | 68.24 | 61.26 | 59.64 | 57.26 | 44.10 |
| No. of branches/plant | 3.68 | 3.50 | 3.54 | 3.44 | 3.56 | 3.56 | 3.75 |
| No. of pods/plant | 24.60 | 27.42 | 22.92 | 25.62 | 28.00 | 28.02 | 24.87 |
| 100 seed weight (g) | 4.77 | 3.61 | 4.58 | 4.65 | 4.61 | 4.11 | 4.22 |
| No. of seeds/pod | 13.20 | 13.66 | 14.20 | 13.70 | 13.58 | 13.08 | 11.36 |

Note: Figures in brackets indicate number of observations.

**Table 5:** Quality parameters of mungbean genotypes grown at oilseeds Research Station, MPKV, Jalgaon.

| Genotype | Milling quality | | | | Cooking period (Min.) |
|---|---|---|---|---|---|
| | Clean dal (%) | Broken dal (%) | Churi + Gota (%) | Husk + whole seeds | |
| Phule Chetak (PM-707-5) | 76.4 | 3.0 | 4.1 | 16.5 | 08 |
| Vaibhav (C) | 74.9 | 2.6 | 3.8 | 18.7 | 10 |
| BM-2003-2 (C) | 76.8 | 3.1 | 5.8 | 14.3 | 09 |
| AKM-8802 (C) | 75.7 | 2.6 | 5.3 | 16.4 | 12 |
| Utkarsha (C) | 76.2 | 3.6 | 4.2 | 16.1 | 11 |

**Table 6:** Nutritional quality of mungbean genotype phule chetak (PM-707-5).

| Genotype | Nitrogen % | Dry seed protein % | Germinated seed protein % | Methionine % |
|---|---|---|---|---|
| Phule chetak (PM-707-5) | 4.10 | 25.60 | 21.88 | 0.58 |
| Vaibhav (C) | 4.21 | 26.31 | 20.85 | 0.43 |
| BM-2003-2 (C) | 4.04 | 25.22 | 21.47 | 0.52 |
| AKM-8802 (C) | 3.78 | 23.62 | 20.56 | 0.46 |
| Utkarsha (C) | 4.02 | 25.14 | 20.89 | 0.55 |

- Total protein content was estimated by Micro Kjeldhal method.
- Methionine content was estimated by Spectrophotometric analysis done by Lowery method.

### Quality parameters

The genotype Phule Chetak (PM-707-5) was tested for different quality parameters *viz*; clean dal, broken dal, churi, gota, husk, cooking period. Overall this genotype contains 76.4 per cent clean dal, 3% broken dal having 4.1 per cent churi + gota and 16.5 husk + whole seeds. It is superior in cooking period (08 min) required than the check varieties (Table 5).

The genotype Phule Chetak (PM-707-5) was also tested for different nutritional quality parameters. This genotype contains 4.10 per cent nitrogen, 25.60% dry seed protein and 21.88 per cent germinated seed protein. It is superior in methionine (0.58%) content as compared to the check varieties (Table 6).

## CONCLUSION

The new variety Phule Chetak developed at Oilseeds Research Station, MPKV, Jalgaon reported an average yield of 1003 kg/ha which is 26.96%, 36.46%, 29.42%, 21.72%, 17.58% and 13.21 per cent higher than the check varieties Vaibhav, BPMR-145, AKM-8802, BM-2002-1, BM-2003-2 and Utkarsha respectively. The leaves are dark green, stem is green coloured with pubescence. It is bold seeded having early maturity, moderately resistant to major diseases like powdery mildew, mungbean yellow mosaic virus under field conditions. Considering consistent performance, the mung bean genotype PM-707-5 has been released for cultivation in the *kharif* season for Maharashtra under the name of Phule Chetak by Varietal Release Committee in Joint Agresco during 29-30 October, 2020 held at Dr PDKV, Akola and State Seed Sub Committee meeting held by video conference on 2nd September, 2021 (Anonymous, 2021).

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