

## Viral Diseases in Mung Bean and their Integrated Management

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### ABSTRACT

Mung bean (*Vigna radiata* L., Leguminaceae,  $2n=22, 24$ ) is an important legume crop in India, which suffers from many fungal, bacterial and viral diseases. This document gives an idea of the occurrence of different viral diseases that caused significant losses in Mung bean crop in Uttar Pradesh, during Kharif season. Mung bean is prone to many diseases among which, viral diseases are annihilatory, causing sententious yield losses. The most common viral diseases are Mungbean Yellow Mosaic Disease, Leaf crinckle, Mungbean leaf curl disease and Mosaic Mottle Disease. Yellow mosaic disease mung bean is caused by Mungbean Yellow Mosaic Virus (MYMV), which is serious as far as rate of spread and yield loss is concerned. Leaf crinckle, caused by Urd bean leaf crinckle virus, is the second most important viral disease with an incidence of 5-28% whereas the incidence of MYMV is 4-40%. MYMV is characterised by Bright yellow mosaic or Golden yellow mosaic symptom. Mung bean leaf curl virus is a potential killer of the plants, which is transmitted by Thrips( *Frankliniella schultezia*) in a persistent manner. Mosaic mottle disease caused by Bean Common Mosaic Virus (BCMV) is transmitted by both sap and seed. Widespread infection of viral diseases in commercial crops and experimental stations is of great concern, especially when individual virus incidence is high and two or more virus are present. Incorporation of viral disease resistance in the present cultivars is the only practical way to control viral diseases.

**Key words:** Mung Bean (*Vigna radiata* L.), viral diseases, MYMV, ULCV, BCMV

### INTRODUCTION

The Mung Bean [*Vigna radiata* (L.) Wilczek, Syn., *Phaseolus aurius* Roxb., *Phaseolus radiatus* L.] belonging to family Leguminaceae, is one of the thirteen food legumes grown in India and third most important pulse crop in India with an area of approx. 3.43 Mha ( about 15% of the National pulse crop area ), production 1.71 Mtonnes of grain with productivity of 498 Kg/ha<sup>1</sup>. To meet global demand it is imperative to improve the

current average global productivity (400 Kg/ha) as well as to expand the crop to new regions.<sup>2</sup> Mungbean has many common names viz., Mung, Moong, Mungo, Greengram, Goldenbean. It is native to India-Burma region of South East Asia. In India, mung bean is extensively grown in Uttar Pradesh, Madhya Pradesh, Rajasthan, Maharashtra, Odisha, Karnataka, Andhra Pradesh, Gujarat, Bihar, Haryana and Delhi during kharif and Zaid seasons.

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Maharashtra ranks first in the area under cultivation of mungbean, followed by Rajasthan, Andhra Pradesh, Karnataka while in terms of productivity, Maharashtra is followed by Andhra Pradesh, Bihar and Tamil Nadu. Being a crop of tropical and sub-tropical region, Mung Bean is able to tolerate warm temperature as high as 40 degree celsius. It is considered as “ Poor men’s protien”<sup>3</sup>. Apart from 26% protein, it also contains 51% carbohydrate, 10% moisture, 4% minerals and 3% vitamins<sup>4</sup>.

Mungbean is grown principally for its high protein seeds that are used as human food, by cooking, fermenting, milling or sprouting, and are utilized in making soups, curries, bread, sweets, noodles, salads, Papad etc<sup>5</sup>.

The yield of mungbean is affected by several biotic and abiotic factors<sup>6</sup>. Among the biotic factors, Mungbean yellow mosaic virus (MYMV), Leaf crinkle virus (ULCV), Mungbean leaf curl virus (MLCV) and Mosaic mottle virus (BCMV) are of prime importance in reducing crop yield. The account of diseases and their management practices are mentioned below:

### 1. Mungbean Yellow Mosaic Virus Disease:

#### CLASSIFICATION

(Group(Gr)>Family(F)>Genus(G)>Species (S):

Group II

(ssDNA)>Geminiviridae>Begomovirus>

Mung bean yellow mosaic virus

#### IMPORTANCE AND LOSSES:

Yellow mosaic disease is the most serious limiting factor in mungbean cultivation. The occurrence of Mungbean yellow mosaic virus was first time reported from Delhi, India<sup>7</sup>. It is widely prevalent in Uttar Pradesh, Bihar, Chhattisgarh, Delhi, Punjab, Haryana, Himachal Pradesh, Rajasthan, Odisha, Tamil Nadu, Karnataka, Madhya Pradesh. Yield losses due to this disease vary from 5 to 100 percent depending upon disease severity, susceptibility of cultivars and population of whitefly<sup>8,9,10</sup>. The infection not only drastically reduces yield but also delayed in pod maturity<sup>11</sup> and reduced number of pod per

plant. In mungbean, Yellow mosaic disease incidence in farmers’ fields might be as high as 100 Per cent<sup>12</sup>.

**SYMPTOMS:** Initially small yellow patches or spots appear on green lamina of young leaves. Soon it develops into a bright yellow mosaic or golden yellow mosaic symptom. Yellow discoloration slowly increases and leaves turn completely yellow. Maturity is delayed in the diseased plants and flower and pod formation are severely reduced. Seeds that develop on severely infected plants are small and immature. The pods are small and distorted. Early infection causes death of the plant before seed set.

**TRANSMISSION:** Weed serves as reservoir of the virus, and are a source of primary inoculums. The virus starts spreading with the onset of the monsoon in India<sup>6</sup>. It is transmitted by whitefly, *Bemisia tabaci* and grafting under favourable conditions in a circulative, non-propagative manner and by grafting. It is not seed or soil borne or sap transmissible.

### 2. Leaf crinkle disease:

#### CLASSIFICATION (Gr>F>G>S):

Group II

(ssDNA)>Geminiviridae>Begomovirus>

*Urdbean crinkle leaf virus*

**IMPORTANCE AND LOSSES:** Urdbean leaf crinkle virus (ULCV) has been reported in natural infections of mungbean in India by Singh<sup>13</sup>. ULCV has the potential to cause heavy yield losses in mungbean. In early infected plants seed production may fail completely. The grain yield losses range from 2-95% in mungbean depending on plant age and symptom onset<sup>14</sup>. The virus also reduced yield components such as plant height, root length, nodulation, pods/plant, pod length, seeds/pod and weight of 100 seeds, but it increases the leaf area and dry weight of roots and shoots<sup>15</sup>.

**SYMPTOMS:** The initial symptoms appear on youngest leaves as chlorosis around some lateral veins and its branches near the margin. The leaves show curling of margin downwards. Some of the leaves show twisting. The veins show reddish brown discoloration

on the under surface which also extended to petioles. Plants showing symptoms within 5 weeks after sowing invariably remain stunted and majority of these die due to top necrosis within a week or two. Plants infected in late stages of growth do not show severe curling and twisting of the leaves but show conspicuous veinal chlorosis anywhere on the leaf lamina. Petioles as well as internodes are shortened. Infected plant gives a stunted and bushy appearance. Flowering is delayed, inflorescence, if formed, are malformed with small size flower buds and fail to open. Pollen fertility and pod formation is severely reduced on infected plants which decreases the drastically.

**TRANSMISSION:** The Urdbean Leaf Crinkle Virus is transmitted through sap, grafting, insect vectors and seeds. reported it has been seed transmitted to an extant of 15% in mungbean. Many workers have reported its transmission by various insects viz., Aphid, *Aphis craccivora* and *A. gossypii*<sup>17,18</sup>, beetle, *Henosepilachna dodecastigma*<sup>19</sup> and white fly, *Bemisia tabaci*<sup>20</sup>. The presence of weed hosts like *Aristolochia bracteata* and *Digera arvensis*. Kharif season crop is highly susceptible.

### 3. Mungbean Leaf Curl Disease:

#### CLASSIFICATION (Gr>F>G>S):

Group V (ss(-)RNA)> Tospoviridae> Orthotospovirus > *Mungbean leaf curl virus* (MLCV)

**IMPORTANCE AND LOSSES:** In India, the leaf curl disease of mungbean and urd bean was first time reported in 1968 from Pantnagar, Uttaranchal<sup>21</sup>. This disease has also been reported from Andhra Pradesh and Delhi. Among the viral diseases recorded on mungbean, leaf curl is a potential killer of the plants but very few information is available on this disease. Yield loss from leaf curl disease is goes on as high as 40 per cent<sup>22</sup>.

**SYMPTOMS:**<sup>23</sup> reported that infected mungbean leaves shows downward curling, venial necrosis, chlorotic area developed on leaf lamina and over all stunting of the plants and finally death of affected plants due to apical necrosis has been observed . Even late

infection reduced number of pods which either produced smaller or larger seeds or no seeds at all. The virus also produces characteristic ring spots on cowpea and necrotic lesion on Petunia<sup>22</sup>.

**TRANSMISSION:** The mungbean leaf curl virus is transmitted by Thrips (*Frankliniella schultzei*) in a persistent manner and by sap also. The virus is not transmitted by either seed or soil.

#### 4. Mosaic Mottle disease:

#### CLASSIFICATION (Gr>F>G>S):

Group II (ssRNA(+))>Potyviridae > Potyvirus > *Bean common mosaic virus* (BCMV)

**IMPORTANCE AND LOSSES:** In 1968, mosaic mottle disease of mungbean was first time reported by Kaiser<sup>24</sup>, from Iran and it is also quite common in India. This virus infects mungbean as well as urdbean and occurs in several South East Asian countries including Philippines and Thailand<sup>25</sup>.

**SYMPTOMS:** The disease first appears in the form of irregular light green patches alternating with normal green areas. The size of leaf gets reduced and the margins show upward rolling. Later on, these young leaves show puckering and blistering and the normal green areas are seen on both sides of the longer veins, and the leaves become rough and brittle. Affected plants are stunted and often display excessive branching<sup>26</sup>. In severe infection, complete inflorescence in changed into a leafy structure resulting in complete seed loss<sup>27</sup>.

**TRANSMISSION:** The virus is transmitted both by sap and seed. It is seed transmitted in mungbean to an extent of 8-32 per cent<sup>27,28</sup> also reported its transmission by aphids (*Aphis craccivora* and *A. gossypii*) in style-borne manner.

#### INTERGRATED MANAGEMENT:

1. To grow resistant varieties i.e., Pant Mung-3, Pant Mung-4, Pant Mung-5, PantMung-6, Pusa Vishal, Basanti, ML-267, ML-337, PDM-54, PDM 139, LGG-407, LGG-460, Narendra mung-5, HUM-1, TM-99-37, HUM-16, TARM-1, Pusa-95-31, Sweta and Samrat against *Mungbean yellow mosaic virus*, mosaic

- mottle disease against-T-2, Hyb-43, L-51-1 and L-293<sup>29,30</sup>, *Mungbean leaf curl virus* against SML 99, SML 100 resistant<sup>31</sup> and Pant Mung-3 moderately resistant<sup>32</sup>.
2. Manipulation in sowing dates, plant density.
  3. Intercropping with two rows of maize (60×30 cm) or Sorghum (45×15 cm) for every 15 rows of greengram inhibit the congenial atmosphere for vector and reduced the movement of vectors.
  4. To remove collateral weed hosts around the field and rogue out the diseased plants.
  5. Hot water seed treatment at 52 °C for 20-30 min reduced seed borne infection.
  6. Thiamethoxam as seed treatment (4g/ kg seed) providing production to healthy seedling from MYMV, and its subsequent sprays (0.02%)<sup>33</sup> or
  7. Seed treatment with Imidacloprid - 70WS @ 4g/kg seed and two subsequent spray at 21 and 35 days protect the crop up to the pod formation stage<sup>34,35</sup>.
  8. Application of nitrogen, phosphorus, potash, zinc, boron and naphthalene acetic acid (NAA) were effectively reducing ULCV infection<sup>35</sup>.
  9. Six foliar spray of the 10 per cent aqueous root extract of *Boerhaavia diffusa* and eight spray of leaf extract of *Clerodendrum aculeatum* were found most effective and suppress symptoms severity by 62 to 90 per cent under natural conditions<sup>36,37</sup>.
  10. Uses of neem and akk extract @2% reduced the severity of ULCV infection.<sup>38</sup>
  11. Neem seed Kernal extract at 5 per cent and neem oil at 2 per cent to be as effective as monocrotophos 0.05%<sup>22</sup>.
  12. Foliar spray of Thiomethaxam 0.02 per cent at 15 days after showing, decreased whitefly population and incidence of leaf crinkle<sup>39</sup>.

### CONCLUSION

Pulses play a significant role in Indian agriculture as providers of protein rich component in human diet. Mung bean is an important pulse crop having global economic

importance as a dietary ingredient of the stable food. It contains 55% carbohydrate, 26% protein, 10% moisture and 3% vitamins. It is also capable of fixing atmospheric nitrogen (222 kg/ha) through symbiotic relationship with *Rhizobium* in the root nodule of the crop. Some biotic stresses specifically pest and diseases are important constraints in realizing the full yield potential in mung bean production resulting in low yields. Because of the damaging impact of viral diseases on yield and seed quality of infected crop legumes. The extent of virus infection is a cause of great concern. The widespread infection of viral diseases in mungbean provides a measure of economic importance they have already attained. They provide an indication of potential threat for commercial crops in the future. The infected plots become source of infection in the vicinity of commercial plots both during growing season and through sowing of infected seed in subsequent years. The viruses which may infect mungbean are MYMV, ULCV, BCMV and leaf curl virus. Recently, due to the introduction of various resistant varieties in mung bean, the incidence of viral diseases has been found to be low. Control of viral diseases of legume crops rests with breeding new cultivars with virus resistance. The other approach is production of virus-free certified seed. Application of insecticides for vector control is feasible only in case of persistently transmitted viruses. Removal of weed hosts and cultural practices also limit virus spread.

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