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# Survey and management of web blight disease of mung bean

**Rashmi Rawate, Ashulata Kaushal, GK Awadhiya and Dev Prakash Patel**

**Abstract**
Random survey was conducted during the *kharif* season at 2020-21 to study the incidence of web blight in mung bean growing areas of Chhattisgarh *i.e.* Raipur, Balod, Kanker, Narayanpur and Rajnandgaon. Disease incidence ranged from 15.5% to 78.85%. The maximum incidence of web blight disease was recorded in Raipur District *i.e.*78.85%, while minimum incidence was recorded in Narayanpur District *i.e.*15.5%. Evaluate six different fungicides *in vitro* against the pathogen. Complete inhibition of the pathogen was recorded in Mancozeb and Hexaconazole at 100 ppm. At 500ppm, 1000ppm and 1500ppm all fungicides showed complete inhibition of the pathogen. In field condition Azoxystrobin recorded highly effective fungicide for disease reduction where disease severity was recorded 21.43% with 68.20% disease reduction over control. 52 germplasms were evaluated against web blight under field conditions during the year 2020-21. None of the genotype was found free and highly resistant. However, Barkha found resistant reaction against the disease. Five entries *i.e.* IPM 2-14-9, LGG 450, ML 818, PM 4, PM 6 found moderately resistant, five entries found moderately susceptible, 18 entries were found susceptible while 23 entries found highly susceptible.

**Keywords:** Web blight, mung bean, *Rhizoctonia solani*, survey, management, screening

## Introduction
Mung bean (*Vigna radiate* (L.) Wilczek) is a short season legume crop and belongs to the family Leguminaceae. It is herbaceous, annual, self-pollinated crop and generally grown as a rainy season crop, however it has been cultivated during all the three crop seasons, as *kharif*, *Rabi*, and summer crop in various regions of the country, taken as a sole or intercrop for grain or for green manure (after picking of pods). Mung bean contains about 25% of protein. In India total area under mung bean is 47.55 lakh ha with an annual production of 24.55 lakh tonnes with 516 kg/ha productivity (Anonymous, 2019) [2]. In Chhattisgarh total area, production and productivity of mung bean is 0.176 lakh ha, 0.063 lakh tonnes and 361.7 kg/ha respectively (Anonymous, 2019) [3].

Even with the best efforts, mung bean production and productivity has been lowered down due to various biotic and abiotic stresses. Among the major biotic stresses diseases are the major potential threats which adversely affect the productivity of mung bean. Several fungal, viral and bacterial diseases such as web blight, anthracnose, cercospora leaf spot, *Macrophomina* blight, powdery mildew, bacterial leaf blight, yellow mosaic, leaf crinkle, Halo blight are known to occur in mung bean crop.

Web blight is one of the major constraint in the production of pulses in warm humid tropic zones of the world. The causal organism of web blight of mung bean is known to be *Rhizoctonia solani* Kuhn (Teleomorph:- *Thanatephorus cucumeris*). In 1924, *Rhizoctonia* blight was reported for the first time in the mung bean from Philippines (Nacien, 1924) [15]. In India web blight disease on mung bean was reported from Kanpur, Uttar Pradesh (Dwivedi and Saksena 1974) [9]. This disease has also been reported from Punjab, Assam, Madhya Pradesh, Bihar, Haryana, Rajasthan, Jammu & Kashmir and Himanchal Pradesh. The pathogen causes huge losses in yield of mung bean in India. It was observed to reduce 33 to 40% grain yield (Singh *et al*., 2013) [21].

At the seedling stage: on the collar region irregular, reddish brown lesion appeared, lesion enlarged at a time and ultimately death of the seedlings was observed. On leaves: after two months of the sowing small, irregular water-soaked spot appeared on the surface of leaves. At high humidity the spots enlarged which were surrounded by water-soaked areas. On other parts: the lesion covered maximum portion of the plants *i.e.* leaves, stems, petioles and pods. Within few days of symptoms appearance whole plants seen blighted.

At leaves white mycelial growth of the fungus was also seen. At later stage of infection white sclerotia development also seen on the surface of leaves which within 2-3 days of their development turned into chest nut brown in colour. Infected pods and seeds inside the pods were shriveled.

## Material and Methods

### Koch's postulates study

Irregular, water soaked, blighted symptoms was seen on leaves of mung bean plants at research farm, College of Agriculture (IGKV), Raipur (C.G.), which covered maximum parts of the plant. Disease symptom was collected and isolated in the lab. Koch's postulate study was done to confirmation of the associated pathogen with the host. It was isolated from the infected leaves and pure culture was prepared. After 4-5 days of inoculation using mycelial disk of the pure culture of suspected pathogen (Kumar *et al.*, 2013) [12]. The host plant was able to produced similar symptoms (*i.e.* irregular, water soaked, brown spots which later enlarge to cover large area of leaves) as was seen in the field. The pathogen was re-isolated in the lab. And found to be morphological and cultural similarities in the compound microscope and culture media respectively.

### Survey

The disease survey was conducted during the *kharif* season at 2020-21, for the incidence study of web blight in mung bean growing 5 districts (*i.e.* Raipur, Balod, Kanker, Narayanpur and Rajnandgaon) of Chhattisgarh. During the survey, web blight infected mung bean plants were observed at vegetative and harvesting stages. The incidence of disease was recorded by random throwing of the quadrate (1m²) in farmer's fields. The number of healthy and diseased (web blight infected) plants were counted in quadrate and percent disease incidence was calculated by using the following formula,

$$\text{Percent disease incidence} = \frac{\text{Number of plants infected by web blight}}{\text{Total number of plant population}} \times 100$$

### Evaluation of different fungicide against pathogen *in vitro*

Six fungicides i.e. Azoxystrobin 23% SC, Thiophanate methyl 70% WP, Tebuconazole 25% EC, Hexaconazole 5% SC, Mancozeb 75% WP, Fluopyrum 17.7% + Tebuconazole 17.7% SC were evaluated at different concentrations (500, 1000 and 1500 ppm) to check the growth of *R. solani* on Potato dextrose agar (PDA) medium through poisoned food technique (Nane and Thapliyal, 1982) [18]. The colony diameter of the fungal pathogen on medium was recorded and percent inhibition in each treatment was calculated by using following formula (Vincent, 1947) [24].

$$PI = \frac{C - T}{C} \times 100$$

Where,
PI = Percent inhibition.
C = Growth in control.
T = Growth in treatment.

### Evaluation of different fungicide against pathogen *in vivo*

The field experiments were carried out at the Instructional and Research farm IGKV, Raipur during 2021-22. BM-4 variety of mung bean was sown. Standard agronomic practices were followed to raise the crop. The experiment was laid in randomized block design (RBD) with three replications in plot size 2×1.5 m². Fungicides, Azoxystrobin 23% SC @, Thiophanate methyl 70% WP @, Tebuconazole 25% EC @, Hexaconazole 5%SC @, Mancozeb 75%WP @, Fluopyrum + Tebuconazole @ including untreated plot (control) for each replication. These fungicides as well as one bio-agent (*Trichoderma* spp.) were applied as two foliar sprays from the initiation of the disease and were repeated at 15 days interval after first spray. The disease severity was recorded ten days after second spray.

The disease severity *i.e.* percentage foliage infected by web blight was recorded on randomly selected 5 plants/plot using 1-9 rating scale given by Stone house, 1994 was recorded.

To calculate percent disease index as per the formula given below:-

$$PDI = \frac{\text{Sum of all ratings of diseased plants}}{\text{Total number of observations} \times \text{highest rating}} \times 100$$

### Screening

A total of fifty-two genotypes in two replications of mung bean were sown during *Kharif* 2020-21. All the recommended agronomic practices were followed except and fungicidal spray, in order to encourage the natural infection. Symptomatic observations of disease severity on the plants were recorded at 15 days interval, starting with first appearance of symptoms till the maturity of crop using 1-9 rating scale given by Stone house, 1994.

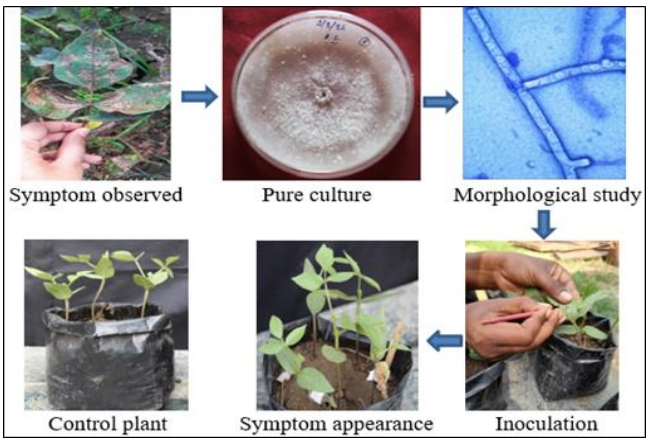
Disease rating scale for *Rhizoctonia* blight (Stone house, 1994)

| S. No. | Scale | Description | Reaction |
|---|---|---|---|
| 1. | 1-2 | No lesion on leaves | Highly resistant |
| 2. | 3-4 | 1-25% area covered by lesion | Moderately resistant |
| 3. | 5-6 | 25.1-50% area covered by lesion, pods also affected | Moderately resistant |
| 4. | 7-8 | 50.1-75% area covered by lesions, pods also affected. | Susceptible |
| 5. | 9 | 75.1-100% area covered by lesions, pods and stem also highly affected. | Highly Susceptible |

## Results

### Koch's postulates study

Koch's postulates study was done by using mycelial disc. Divya *et al.*, (2018) [8] tested pathogenicity of *R. solani* on healthy leaves of mung bean, groundnut, soybean, rice and maize by using mycelial disc. Baraka *et al.*, (1998) [5] tested pathogenicity of *R. solani*, by soil infestation method on faba bean.




Koch's postulates study of the suspected pathogen causing web blight disease on mung bean

**Survey**

Disease incidence at the time of survey ranged from 15.5% to 78.85%. In vegetative stage maximum disease incidence of web blight was recorded in Dumali (Block-Kanker) *i.e.*33.3%, while minimum incidence was recorded in Borpal (Block-Narayanpur) *i.e.* 15.5%. At flowering stage the disease incidence was 35.55% in Khallari (Block-Dondi). In pod filling stage maximum disease incidence was recorded in Malkunwar (Block-Dondi) *i.e.* 64.4% while minimum incidence was recorded in Adejhar (Block-Dondi) *i.e.* 53.33%. At Maturity stage, the maximum incidence of web blight was observed at Raipur (Block-Dharsiwa) *i.e.*78.85%, during this stage minimum incidence was recorded in Bhendra Navagaon (Block-Rajnandgaon) *i.e.*31.11%. Maximum disease severity was recorded in between pod filling to maturity stage. Higher disease incidence might be the higher relative humidity, moderate temperature condition and use of susceptible mung bean cultivars.

Many workers found that disease caused by *Rhizoctonia solani* are more severe at higher relative humidity conditions and moderate temperature (Yadav, 2012; Yaduman *et al.*, 2017) [25, 27]. Recorded 34.67% incidence with 55.26% yield loss by root rot of fenugreek caused by *Rhizoctonia solani* in Chhattisgarh (Singh and Rao, 2015) [28].

Survey for web blight disease of mung bean in different mung bean growing area of Chhattisgarh during 2020-21

| S. No. | District | Block | Village/location | GPS location | | Crop area (acre) | Variety | Probable date of sowing | Crop stage during survey | Disease incidence (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Longi. (°N) | Latit. (°E) | | | | | |
| 1. | Raipur | Dharsiwa | IGKV research field | 81.7853 | 21.1893 | 1.00 | HUM-16 | 1st week of July | Maturity | 78.85 |
| 2. | Balod | Doundi | Adejhar | 81.1703 | 20.3055 | 1.00 | Mung-39 | Last week of July | Pod filling stage | 53.33 |
| | | | Malkunwar | 81.1345 | 20.6978 | 0.75 | Shikha | Last week of July | Pod filling stage | 64.4 |
| | | | Khallari | 81.1166 | 20.6685 | 0.50 | Local | Last week of August | Flowering stage | 35.55 |
| Mean | | | | | | | | | | 51.09 |
| 3. | Rajnandgaon | Dongargarh | Musra | 80.8603 | 21.1654 | 5.00 | Local | 1st week of July | Maturity | 76.6 |
| | | Rajnandgaon | Bhendra navagaon | 81.1401 | 21.2893 | 2.00 | Pairy mung | Last week of July | Maturity | 31.11 |
| | | | Gopalpur | 81.1246 | 21.3002 | 0.47 | Local | Last week of July | Maturity | 74.2 |
| Mean | | | | | | | | | | 60.63 |
| 4 | Kanker | Kanker | Aturgaon | 81.4931 | 20.2730 | 0.50 | Local | Last week of July | Maturity | 62.22 |
| | | | Dumali | 81.4960 | 20.2726 | 0.60 | Local | Last week of August | Vegetative | 33.3 |
| Mean | | | | | | | | | | 47.76 |
| 5. | Narayanpur | Narayanpur | Borpal | 81.2929 | 19.7568 | 0.70 | Local | Last week of August | Vegetative | 15.5 |
| | | | Edka | 81.1154 | 20.2886 | 1.00 | Local | Last week of August | Vegetative | 22.2 |
| | | | Sitapal | 81.3242 | 19.7123 | 0.50 | Local | Last week of August | Vegetative | 17.7 |
| Mean | | | | | | | | | | 18.46 |

Raipur


Rajnandgaon


Balod

Kanker


Narayanpur

Incidence of web blight disease of mung bean in different mung bean growing areas of Chhattisgarh

**Evaluation of different fungicides against pathogen**

Six fungicides *i.e.* Azoxystrobin 23% SC, Thiophanate methyl 70%WP, Tebuconazole 25% EC, Hexaconazole 5% SC, Mancozeb 75% WP, Fluopyrum 17.7% + Tebuconazole 17.7% SC were evaluated at different concentrations (500,1000 and 1500 ppm) against *R. solani*.

At 100 ppm complete inhibition of the pathogen was recorded in Mancozeb and Hexaconazole and in other fungicides least mycelial growths were recorded. At 500ppm, 1000ppm and 1500ppm all fungicides showed complete inhibition of the pathogen.

Srinivas *et al*. (2014) [22] evaluated 14 fungicides against *R. solani* and recorded 100% inhibition in Mancozeb, Thiophenate methyl, Metalaxyl and Tricyclazole Carbendaizm + Mancozeb at 0.1% concentration. Kumar *et al.* (2019) [10] recorded 100% inhibition of the pathogen *R. solani* in mancozeb 75% WP, propiconazole, carbendazim 50% WP, thiophanate methyl and carboxin at 100ppm. Madhavi *et al.* (2021) [13] reported Propiconazole, tebuconazole, trifloxystrobin + tebuconazole, azoxystrobin, carbendazim more effective at 100ppm.

Evaluation of different fungicides against *R. solani*

| S. No. | Fungicide | Radial growth on different concentration | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 100 ppm | | 500 ppm | | 1000 ppm | | 1500 ppm | |
| | | Radial growth | Inhibition (%) | Radial growth | Inhibition (%) | Radial growth | Inhibition (%) | Radial growth | Inhibition (%) |
| 1. | Azoxystrobin | 17.67 | 81.10 | 0 | 100 | 0 | 100 | 0 | 100 |
| 2. | Thiophanate methyl | 22.67 | 74.88 | 0 | 100 | 0 | 100 | 0 | 100 |
| 3. | Tebuconazole | 14.67 | 83.77 | 0 | 100 | 0 | 100 | 0 | 100 |
| 4. | Fluopyrum+Tebuconazole | 12 | 86.65 | 0 | 100 | 0 | 100 | 0 | 100 |
| 5. | Mancozeb | 0 | 100 | 0 | 100 | 0 | 100 | 0 | 100 |
| 6. | Hexaconazole | 0 | 100 | 0 | 100 | 0 | 100 | 0 | 100 |
| 7. | Control | 90 | - | 90 | - | 90 | - | 90 | - |
| C.D. (P=0.05) | | 2.50 | | | | | | | |
| SE(m)± | | 0.82 | | | | | | | |

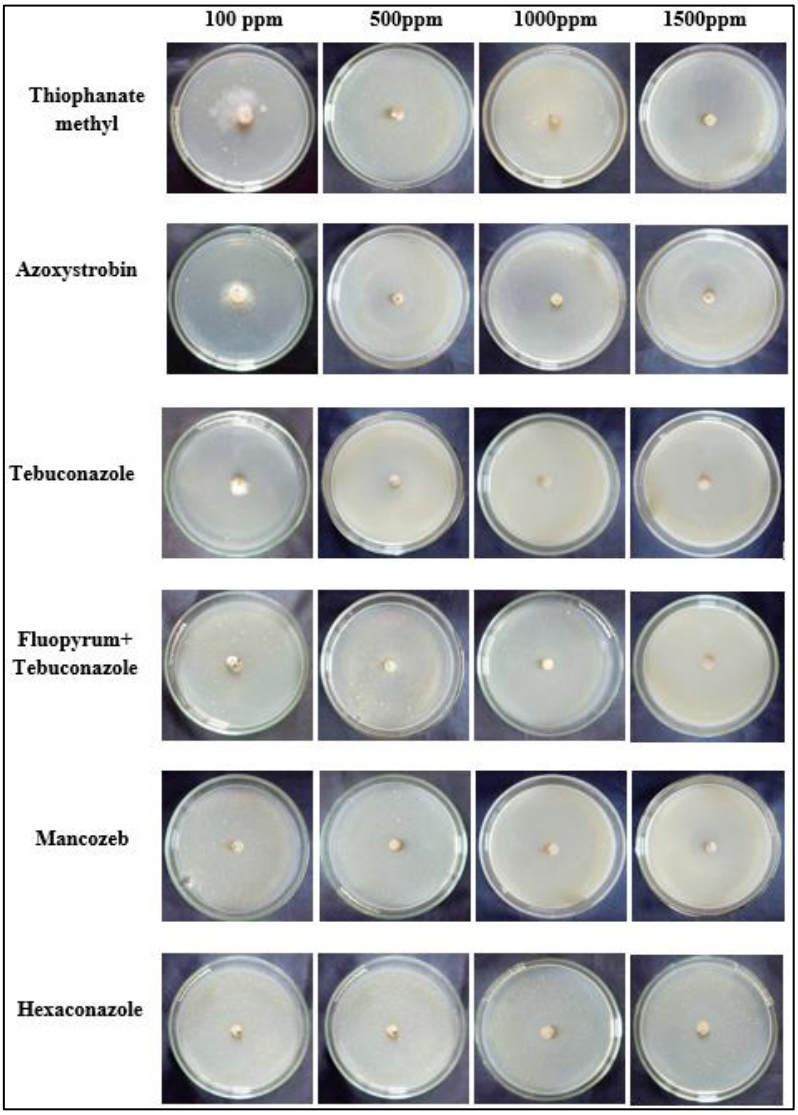
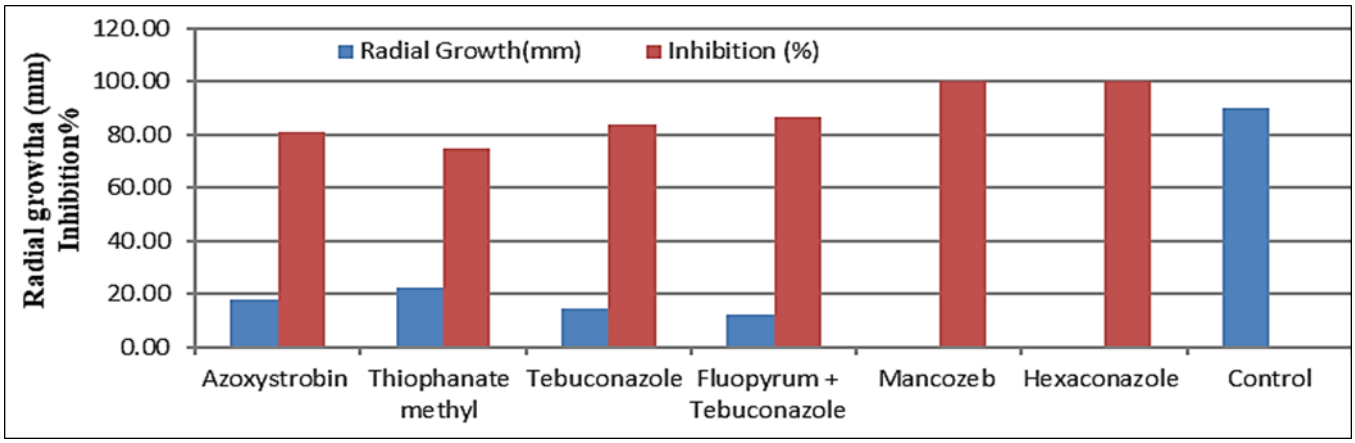
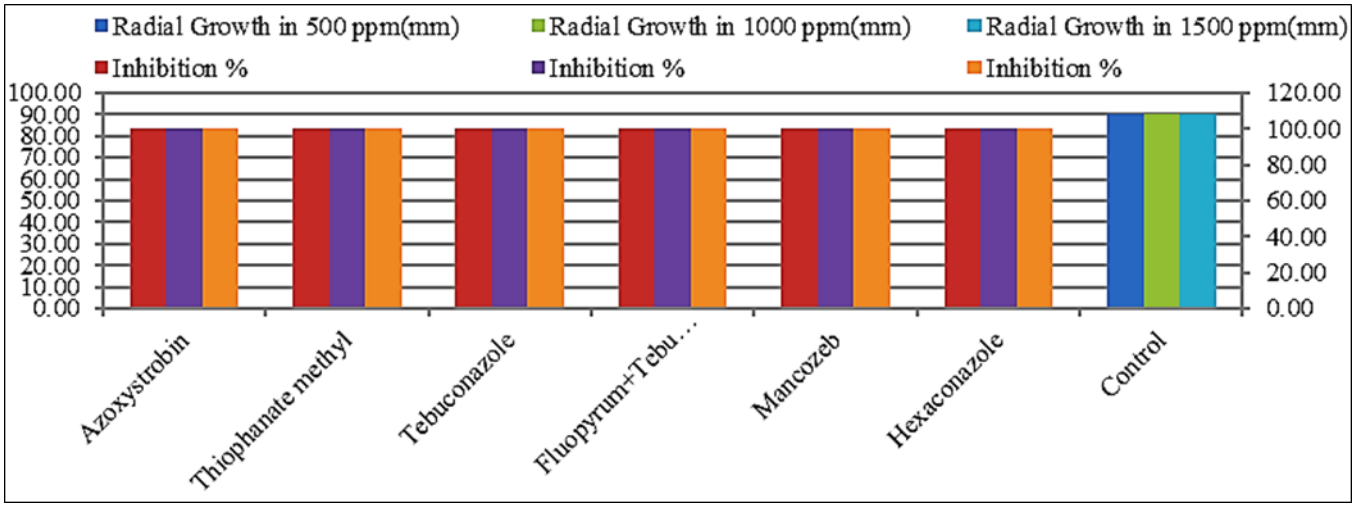



**Plate 1:** Evaluation of different fungicides against *R. solani*




Evaluation of different fungicides against *Rhizoctonia solani* under *in vitro* at 100ppm




Evaluation of different fungicides against *Rhizoctonia solani* under *in vitro* condition at 500, 1000 and 1500 ppm

**Evaluation of different fungicides against pathogen *in vivo***

Six fungicides *i.e.* Azoxystrobin 23% SC, Tebuconazole 25% EC, Hexaconazole 5%SC, Mancozeb 75%WP, Fluopyrum 17.7% +Tebuconazole 17.7% SC including untreated plot (control) and bio-agent *Trichoderma* spp. were evaluated *in vivo* against the disease. Among different treatments T1 showed minimum disease severity *i.e.* 21.43% with 68.20% disease reduction over control followed by T2 has 24.25% disease severity with 63.72% disease reduction over control. T4 has 28.89% disease severity with 57.13% disease reduction over control which was statically at par with T3 has 31.11% with 53.84% disease reduction over control, while T5 recorded minimum disease severity *i.e.* 47.40% with 29.67% disease reduction over control. 67.06% disease severity was recorded in control.

(Naik *et al.*, 2017; Prasad *et al.*, 2020) [16, 19] reported Hexaconazole as effective fungicide against sheath blight caused by *R. solani*. Mahantesh *et al.* (2018) [14] reported Azoxystrobin 23% SC as most effective fungicide for the management of sheath blight disease.

Evaluation of different fungicides against *Rhizoctonia solani* in field condition

| S. No. | Fungicides | Dose per litre of water (ml.) | Percent disease severity | Percent disease reduction over control |
|---|---|---|---|---|
| 1. | T1 Azoxystrobin | 1 | 21.43 | 68.20 |
| 2. | T2 Hexaconazole | 1.33 | 24.45 | 63.72 |
| 3. | T3 Tebuconazole | 1 | 31.11 | 53.84 |
| 4. | T4 Fluopyrum+ Tebuconazole | 1 | 28.89 | 57.13 |
| 5. | T5 *Trichoderma* spp. | 10 | 47.40 | 29.67 |
| 6. | T6 Control | | 67.06 | - |
| C.D. (P=0.05) | | | 8.72 | |
| SE(m)± | | | 2.73 | |

Field view

T1 Azoxystrobin 23% SC

T2 Hexaconazole 5% SC

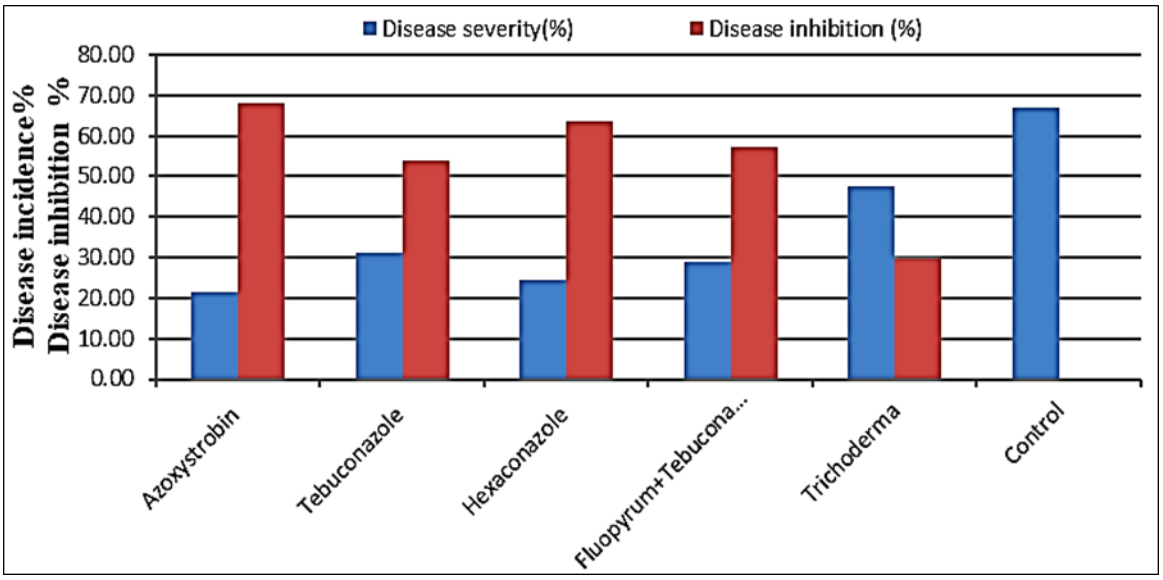
T3 Tebuconazole 25% EC

T4 Fluopyrum17.7% + Tebuconazole 17.7% SC

T5 *Trichoderma*

T6 Control

**Evaluation of different fungicides against *Rhizoctonia solani* in field condition.**




Evaluation of different fungicides against web blight disease caused by *Rhizoctonia solani* in field condition

**To screen different mung bean entries against web blight disease under natural field conditions**

52 entries were evaluated against web blight under field conditions. None of the genotype was found free and highly resistant. However, Barkha found resistant reaction against the disease. Five entries *i.e.* IPM 2-14-9, LGG 450, ML 818, PM 4, PM 6 found moderately resistant, five entries found moderately susceptible *i.e.* IPM 1604-1, LGG 460, MH 1703, OBGG 109, VBN-4. 18 entries *i.e.* BCM 18-2, COGG 16-10, DGGV-91, IIPM 20-1, IIPM 20-2, IPM 2-14, IPM 604-1-2, KM 2419, LGG 600, MH 2-15, PM 1603, PM 1609, Pusa 2071, RMG 1139, RVSM 18-1, MGG 453,MI 750-1, PKV AKM 4 were found susceptible while 23 entries found highly susceptible *i.e.* BCM 18-1, IGM 06-18-3, IPM 2-3, IPM 312-394-1, Kopergaon, MH 1468, MH 1772, ML 2459, ML 2482, MLS, OBGG 104, Pusa 0672, Pusa 0871, Pusa 1371, Pusa 2072, Pusa BM-5, Pusa BM-6, SKNM 1705, SML 1839,SML 2015, VGG 15-013, VGG 17-049, MI 181-1.

Bal *et al.* (2019) [4] reported none of the genotype of mung bean was free, highly resistant and resistant while six genotypes showed moderately resistant reaction (*i.e.* ML 818, LGG 607, LGG 460, Pant M 4, Pant M 6, Pusa 1772) against the web blight disease. Neelam *et al.* (2014) [17] reported 14 genotypes of urd bean were found moderately resistant reaction against the disease web blight.

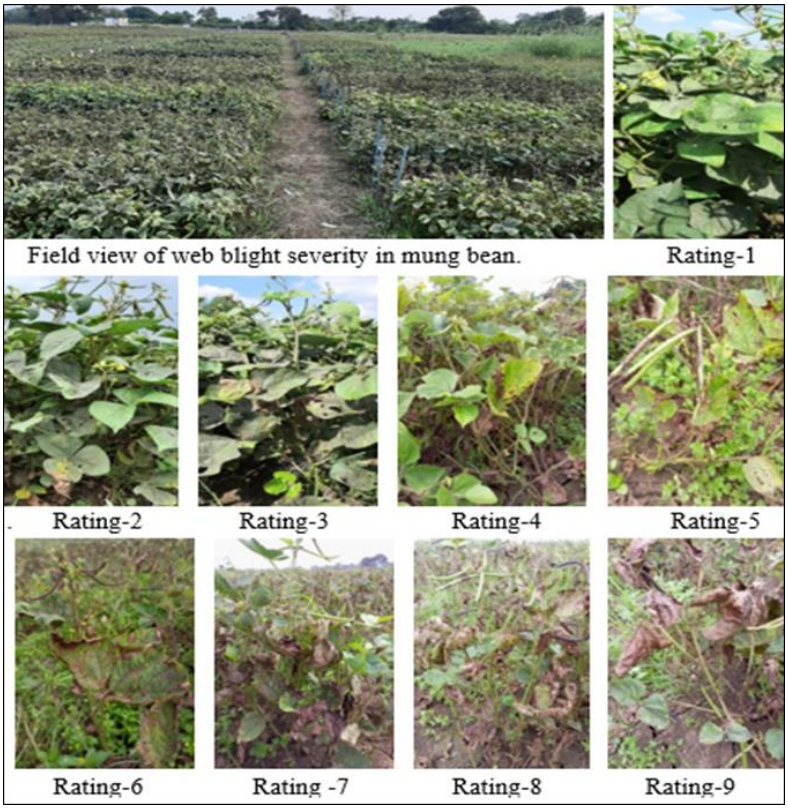
Evaluation of different mung bean entries against web blight under field conditions at IGKV, Raipur

| S. No. | Entries | Percent disease index | Reaction |
|---|---|---|---|
| 1. | BCM 18-1 | 53.82 | HS |
| 2. | BCM 18-2 | 28.62 | S |
| 3. | COGG 16-10 | 49.79 | S |
| 4. | DGGV 91 | 25.29 | S |
| 5. | IGM 06-18-3 | 67.75 | HS |
| 6. | IPM 1604-1 | 17.3 | MS |
| 7. | IIPM 20-1 | 28.3 | S |
| 8. | IIPM 20-2 | 43.86 | S |
| 9. | IPM 2-14 | 46.6 | S |
| 10. | IPM 2-14-9 | 11.07 | MR |
| 11. | IPM 2-3 | 51.64 | HS |
| 12. | IPM 312-394-1 | 70.26 | HS |
| 13. | IPM 604-1-2 | 32.74 | S |
| 14. | KM 2419 | 39.95 | S |
| 15. | Kopergaon | 74.44 | HS |
| 16. | LGG 450 | 13.3 | MR |
| 17. | LGG 460 | 18.57 | MS |
| 18. | LGG 600 | 28.3 | S |
| 19. | MH 1468 | 80.5 | HS |
| 20. | MH 1703 | 15.1 | MS |
| 21. | MH 1772 | 55.5 | HS |
| 22. | MH 2-15 | 23.6 | S |
| 23. | ML 2459 | 68.59 | HS |
| 24. | ML 2482 | 62.72 | HS |
| 25. | ML 818 | 11.5 | MR |
| 26. | MLS | 72.17 | HS |
| 27. | OBGG 104 | 73.2 | HS |
| 28. | OBGG 109 | 18.27 | MS |

| | | | |
|---|---|---|---|
| 29. | PM 1603 | 42.72 | S |
| 30. | PM 1609 | 30.2 | S |
| 31. | PM 4 | 12.2 | MR |
| 32. | PM 6 | 11.95 | MR |
| 33. | Pusa 0672 | 53.3 | HS |
| 34. | Pusa 0871 | 68.85 | HS |
| 35. | Pusa 1371 | 55.5 | HS |
| 36. | Pusa 2071 | 34.15 | S |
| 37. | Pusa 2072 | 66.65 | HS |
| 38. | Pusa BM -5 | 70.47 | HS |
| 39. | Pusa BM -6 | 53.25 | HS |
| 40. | RMG 1139 | 22.72 | S |
| 41. | RVSM 18-1 | 48.27 | S |
| 42. | SKNM 1705 | 50.85 | HS |
| 43. | SML 1839 | 62.72 | HS |
| 44. | SML 2015 | 71.62 | HS |
| 45. | VBN-4 | 16.6 | MS |
| 46. | VGG 15-013 | 74.95 | HS |
| 47. | VGG 17-049 | 61.5 | HS |
| 48. | MGG 453 | 23.85 | S |
| 49. | MI 181-1 | 87.72 | HS |
| 50. | MI 750-1 | 45.5 | S |
| 51. | PKV AKM-4 | 48.25 | S |
| 52. | Barkha | 8.93 | R |

Disease reaction of different mung bean germplasm against web blight pathogen *Rhizoctonia solani*

| Disease Rating Scale | Disease reaction | Entries | Total |
|---|---|---|---|
| 1. | Free | - | 0 |
| 2. | Highly resistant | - | 0 |
| 3. | Resistant | Barkha | 1 |
| 4. | Moderately resistant | IPM 2-14-9, LGG 450, ML 818, PM 4, PM 6 | 5 |
| 5. | Moderately susceptible | IPM 1604-1, LGG 460, MH 1703, OBGG 109, VBN-4 | 5 |
| 6-7. | Susceptible | BCM 18-2, COGG 16-10, DGGV-91, IIPM 20-1, IIPM 20-2, IPM 2-14, IPM 604-1-2, KM 2419, LGG 600, MH 2-15, PM 1603, PM 1609, Pusa 2071, RMG 1139, RVSM 18-1, MGG 453, MI 750-1, PKV AKM 4 | 18 |
| 8-9. | Highly susceptible | BCM 18-1, IGM 06-18-3, IPM 2-3, IPM 312-394-1, Kopergaon, MH 1468, MH 1772, ML 2459, ML 2482, MLS, OBGG 104, Pusa 0672, Pusa 0871, Pusa 1371, Pusa 2072, Pusa BM-5, Pusa BM-6, SKNM 1705, SML 18390, SML 2015, VGG 15-013, VGG 17-049, MI 181-1 | 23 |




Screening of different mung bean entries against web blight disease under natural field conditions

## Conclusion

At vegetative stage web blight disease spread rapidly due to high humidity and maximum damage of plant was seen in podding to maturity stage. *Rhizoctonia solani* has wide host range which belong to different families, in pulses mung bean, urd bean, cow pea, red gram, Bengal gram, French bean and faba bean were also infected by the pathogen *Rhizoctonia solani.* More fungicides may be tested against the pathogen *Rhizoctonia solani*. There was some genotypes showed resistant reaction against the disease, many other genotypes may be evaluate against the disease web blight.

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