

MUNG BEAN (*Vigna radiata* L.) DISEASE MANAGEMENT IN THE NORTH CENTRAL PROVINCE

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ABSTRACT

Mung bean (*Vigna radiata* L.) is one of the important food legumes cultivated as a subsistence crop in Sri Lanka. This crop not only provides cheap source of protein for rural masses but also improves the soil fertility through nitrogen fixation. Statistics showed that the yield of the crop in farmer's field is very low and estimated as less than 1mt/ha. Disease is found to be one of the major constraints responsible for low productivity. Among the mung bean diseases Mung bean Yellow Mosaic virus (MYMV) is predominant during *yala* season, whilst *Cercospora* leaf spots and powdery mildew caused by *Erysiphe polygonii* are predominant during *maha* season. Therefore, study was undertaken to introduce low cost appropriate disease management techniques for minimising crop losses caused by diseases at Field Crops Research Development Institute, Mahailuppallama during *yala* 1985 and *maha* 1985/1986. Fifteen varieties were screened to identify resistant material to MYMV during *yala* 1985. Artificial defoliation studies, varieties with diverse resistant to foliar diseases and fungicides were tested during *maha* 1985/1986 to control foliar diseases. Mung bean varieties namely 76-187-M1-5-9A and S37 showed high tolerance to mildew. Seed treatment with thiram (Pomarsol forte) or foliar spraying with benomyl (Benlate) at 10 day interval after disease appearance significantly reduced the disease severity of *C. cruenta*. Artificial defoliation studies showed that the pod filling stage critically affected the crop yield. Therefore, defoliation due to foliar diseases should be controlled at this stage. MYMV tolerant varieties such as Harsha, TV-79-11 7704 and TV-79-6 can be recommended during *yala* and resistant varieties and fungicides are appropriate to control foliar diseases during *maha*.

KEY WORDS: Mung bean diseases, Varietal resistance, Fungicides, Defoliation

INTRODUCTION

Mung bean (*Vigna radiata* L.) ranks next to cowpea (*Vigna unguiculata* L.) with respect to production and consumption. Per capita consumption of mung bean is low at 1.02 kg / year due to importation of masoor dhal. Promotion of this food legume is important to save the foreign exchange incurred to importation of masoor dhal (Joseph, 1995).

Diseases mainly affect the crop yield and quality. Approximately 14% of the total cost of production goes for pest and disease control (Anon., 1998). Shivanathan (1980) indicated that the *Cercospora* leaf spot and powdery mildew are important during *maha* while Mung bean Yellow Mosaic Virus MYMV is a serious problem during *yala*. He also stated that the economic losses due to *Cercospora* leaf spot range from 20 to 50 percent in most years.

Therefore, aim of this study was to identify of disease resistant materials and effective fungicide formulations to control the diseases. The level of defoliation, which affects the crop yield was also assessed. Eco-friendly approaches to disease control are expected to be most suitable in the sustainable agricultural systems in the North Central Province.

MATERIALS AND METHODS

The experiment was conducted at Field Crops Research and Development Institute, Mahailuppallama during *yala* 1985 and *maha* 1985/1986. The plots were arranged in Randomised Complete Block Design (RCBD) with three replicates unless otherwise stated. The results were analyzed using SAS programme.

Screening mung bean varieties for yellow mosaic virus

Fifteen mung bean varieties were screened against MYMV during the *yala* 1985 season. Recommended cultivar MI 5 was used as a check. The plot size was 2.4 X 2.0 m². MYMV susceptible variety, H101 was established as the source of inoculum in the middle row of each plot at sowing of test plots at plant spacing 7.5X15 cm². *Phaseolous lathyroides*, a weed, which harbor MYMV was planted as spreader about two weeks before sowing. Disease incidence was recorded as percentage virus infected plants.

Screening mung bean varieties for *Cercospora* leaf spots reaction

Ten varieties were screened against *C.cruenta* and *C.canacense* during *maha* 1985/1986 under natural infection. Plot size used was 2.0 X 3.0 m² at plant spacing of 7.5 X 15 cm². Each plot was replicated thrice and arranged in RCBD design. Middle row of each plot and borders were established with susceptible variety TV-79-6.

Second leaf from the apical bud was excised from randomly selected six plants from each plot. Assessments were done in a laboratory using 1-5 scale as described in IITA rating system as described below. (Williams and Allen, 1977).

1. No spots,
2. Scattered pustules on less than 50% leaves/plants,
3. Moderate concentration of pustules on less than 50% leaves/plant,
4. Moderate concentration of pustules on less than 50% leaves/plant or high, concentration on more than 50% leaves/plant,
5. High concentrations of pustules on more than 50% leaves/plant, chlorosis an defoliation severe.

The disease severity assessments were taken, 45 days after planting. Disease severity (%) was computed from the following formula.

$$DS(\%) = \frac{(W \times N_s)}{T \times N_m} \times 100$$

Where,

DS	=	Disease severity
W	=	Number of wilted plants
N _s	=	Severity scale
T	=	Total number of observations
N _m	=	Maximum scale number (9).

Screening fungicides for *C.cruenta*

Fungicides used for foliar sprays to control *C.cruenta* were Propineb 70% (Antracol) 20g/10 l, Sulphur 80% 30g/10 l, Mancozeb 80% (Dithane M45) 30g/10 l, Benomyl (Benlate) 6.7g/10 l, Mancozeb 56% + Oxadixyl 10% (Sandofan M) 20g/10 l, copper 50% WP(Kocide)30g/10 l. Seed treatment was carried out with fungicides, Thiram 80% WP (Pomrasol forte) 2g/kg seed, Carboxin 37.5% + Thiram 37.5% (Vitavax-T) 2.5g/kg seed and Pencycuron 25% (Monoceren)3.0 g/kg. Foliar sprays were given in 10 day intervals. Water sprayed plots served as controls. Recommended variety MI-5 was used as control and spraying was commenced after natural infection in 10 day intervals. The plots were arranged with four replications in RCBD design. The plot size 3 X 2.4 m² and plant spacing of 7.5X15 cm² were used. Disease severity assessments and computation were carried out as described above.

Screening mung bean varieties for powdery mildew reaction

Twenty eight mung bean varieties were screened against powdery mildew during *maha* 1985/86 to identify resistant variety. Plot size of 2.4 X 2.0 m² and plant spacing of 7.5X15 cm² were used. 0-9 disease rating was used, where 0=No disease, 1=1-5% infection, 3=6-25%, 6=26-50%, 7=51-75% and 9=76-100%. Disease severity assessments and computation were carried out as described above.

Artificial defoliation

The defoliation treatments included cutting half of a trifoliate leaflet (mild), half of two trifoliate leaflets (medium) and two trifoliate leaflet (severe) of all leaves unfolded at 20, 32, 44, 52 and 61 Days after sowing. Continuous defoliation at three levels and undefoliated plants in a plots were served as controls. Recommended cultivar MI 5 was used with a plot size of 3 X 1.8 m² and 7.5 X 15 cm² plant spacing. The treatments were replicated four times.

RESULTS

Varietal screening experiments showed that Harsha, TV-79-11, 7704 and TV-79-6 are highly resistant to MYMV (table 1).

Table 1 Mung bean yellow mosaic virus incidence (%) in 15 mung bean varieties within a disease plot 45 days after sowing.

<i>Variety</i>	<i>Disease incidence(%)</i> *
H101	40.6(39.6) a
VC1973A	24.1(29.4) b
CES-IF-1	22.3(28.2) b
VC2774A	20.3(26.8) bc
CES-ID-21	18.1(25.2) bc
VC2764A	17.4(24.7) bc
TV-79-3	15.1(22.9) bcd
Type 77	22.5(14.7) bcd
IPBM-79-1329	9.5(17.9) bcde
7715	6.5(14.8) cde
IPBM-79-22-62	5.5(13.6) de
MI-5	4.6(12.4) de
TV-79-6	3.9(11.4) e
7704	3.5(10.8) e
TV-79-11	2.7(9.4) e
Harsha	1.7(7.5) e

* Each figure is the mean of three replications and figures in parentheses are arcsin transformed. Varieties followed the same letter do not differ significantly according to DMRT at P=0.05.

Varieties 7715, Type77 and TV-79-11 showed high resistance to *C.cruenta*, while MI5, CES-IF-1 and TV-79-6 possessed high susceptibility (table-2). However, all varieties showed non significant (p=0.05) low level disease severities to *C.canacense*.

Table 2. Reaction of ten mung bean varieties for *Cercospora cruenta* and *C.canacense* 45 days after sowing.

Variety	Disease severity (%) [*]	
	<i>C.cruenta</i> ¹	<i>C.canacense</i> ²
MI-5 (Check 2)	38.9(38.6) a	0.03 (0.73)a
CES-IF-1	38.6(38.4) a	1.21 (1.31)a
TV-79-6	36.6(37.2) a	0.64 (1.97)a
VC1973A	31.8(34.4) ab	2.12 (1.62)a
VC2764A	31.1(33.9) ab	2.06 (1.06)a
CES-ID-21	26.7(31.1) bc	1.81 (1.52)a
Harsha (Check 1)	24.4(29.6) bc	2.06 (1.60)a
TV-79-11	20.0(26.6) c	3.67 (2.04)a
Type 77	20.0(26.6) c	4.20 (2.17)a
7715	20.0(26.6) c	1.94)a

Each figure is the mean of three replications.

1. figures in parentheses are arcsin transformed
2. figures in parentheses are square root transformed Varieties followed the same letter in a column do not differ significantly according to DMRT at P=0.05.

The seed treatment with thiram (Pomarsol forte) significantly reduced the *C.cruenta* at 5% level. Benomyl is superior to other fungicides used for foliar application in 10 day interval (table 3).

Table 3. Efficacy of fungicides on *Cercospora* leaf spot in mung bean as foliar application and seed treatment.

Fungicide	Dosage	Disease severity (%)
<u>Foliar application</u>		
Propineb (Antracol) ¹	20 g / 10lit	45.1 (42.2) ² def
sulphur	30 g / 10 lit	57.7 (49.4) cde
mancozeb (Dithane-M-45)	30 g / 10 lit	52.9 (46.7) def
benomyl (Benlate)	6.7 g / 10 lit	30.1 (33.3) ef
mancozeb+oxadixyl (sandofan-M)	20 g / 10 lit	31.9 (34.4) def
copper (Kocide)	30 g / 10 lit	61.5 (51.7) bcd
<u>Seed treatment</u>		
thiram (Pmarsol forte)	200g / 100 kg	25.8 (30.5) f
carboxin + thiram (Vitavax-T)	250 g /100kg	95.5 (77.8) a
pencycuron (Monoceren)	300 g / 100kg	86.4 (68.3) ab
Control (Water)	-	81.3 (64.4) abc

Trade names of the fungicides are given in parantheses¹.

Each figure is the mean of four replications and figures in parentheses² are arcsin transformed. Varieties followed the same letter do not differ significantly according to DMRT at P=0.05.

Varieties 76-187-MI5-9A and S 37 showed high levels of resistance to Powdery mildew and varieties IPBM-79-13-45 and TV-79-11 are highly susceptible to the disease (table 4). Among the recommended varieties, MI-5 is more resistant than Harsha.

Table 4. Disease severities of mung bean varieties against powdery mildew.

<i>Variety</i>	<i>Disease severity (%)</i> *
IPBM 79-13-45	
TV-79-11	72.9(58.6) a
M 31-37	70.3(56.9) a
VC 1482 C	62.8(52.4) ab
IPBM 79-9-94	58.7(50.0) abc
IPBM 79-13-29	58.4(49.8) abc
Pagasa-3	55.5(48.2) abcd
T51X76-187 (26-1A)	51.6(45.9) abcde
TV-79-3	51.1(45.6) abcde
Kabuli mung	50.6(45.3) abcde
76-187 X MI5-9E-7	47.2(43.4) abcde
T51X76-187 (10-1B)	45.1(42.2) abcde
VC 2523 A	42.0(40.4) abcde
Harsha (Check 1)	39.5(38.9) abcde
VC 2750 A	33.5(35.4) abcde
T51X76-187 (38-3A)	33.4(35.3) abcde
6601	30.9(33.8) abcde
77-193XMI5-4A	29.5(32.9) abcde
VC 1000 C	28.0(31.9) abcde
Pagasa-1	25.4(30.3) bcde
H101XT51(64-K)	23.5(29.0) bcde
E 72	20.2(26.6) bcde
Pagasa-2	19.3(26.0) bcde
MI-5 (Check-2)	15.8(23.4) cde
IPBM 79-9-82	13.9(21.9) de
V 6017	13.5(21.6) de
S 37	13.4(21.5) de
76-187-MI5-9A	11.9(20.2) e
	11.2(19.5) e

*Each figure is the mean of three replications and figures in parentheses are arcsin transformed. Varieties followed the same letter do not differ significantly according to DMRT at P=0.05.

There is no significant difference among treatment in number of plants/100 seed weight and number of plants. (table 5). Although there is a significant reduction of yield at severe defoliation level in 20, 32, 44, 52 and 66 DAS when compared to the undefoliated control. In 44 DAS there is a significant reduction of yield at medium defoliation level.

Table 5. Yield parameters* of mung bean cv. MI-5 at different defoliation levels and stage of development.

<i>Level of defoliation</i>	<i>Number of pods/five plants</i>	<i>100 seed weight</i>	<i>Total yield/five plants (g)</i>
Continuos mild	79.5	6.8	47.4(43.5)
Continuos medium	74.0	6.8	34.0(35.7)
Continuous severe	67.0	6.3	29.2(32.7)
20 DAS mild	94.5	5.7	56.6(48.8)
20 DAS medium	79.0	6.7	44.4(41.8)
20 DAS severe	75.0	6.4	40.9(39.8)
32 DAS mild	96.5	7.2	47.6(43.6)
32 DAS medium	83.5	6.5	54.0(47.3)
32 DAS severe	58.7	6.9	28.6(32.4)
44 DAS mild	87.5	6.3	44.0(41.6)
44 DAS medium	71.5	7.1	36.2(36.9)
44 DAS severe	79.0	6.2	34.4(35.9)
52 DAS mild	89.7	6.4	56.2(48.6)
52 DAS medium	87.5	6.9	53.4(46.9)
52 DAS severe	62.2	6.8	29.1(32.7)
61 DAS mild	86.7	6.7	48.7(44.3)
61 DAS medium	66.7	6.4	35.4(36.5)
61 DAS severe	83.5	6.2	40.8(39.7)
Control	87.7	6.7	61.0(51.4)
LSD (p=0.05)	NS	NS	13.6
CV(%)	24.2	8.9	23.6

*Each figure is the mean of four replications and figures in parentheses are arcsin transformed.

DISCUSSION

The results showed that the Harsha variety is least susceptible to MYMV disease. Therefore, this variety could be recommended to cultivation during *yala* season when virus problem is predominant (Shivanathan, 1980; Kangatharalingam and Jayaratne, 1982).

It was found that the disease severity of *C. cruenta* was higher than that of *C. canacense*. Therefore, more attention should be focused to control *C. cruenta*. Varieties 7715 Type 77 and TV-79-11 are resistant to disease. Further, seed treatment with thiram reduced three fold the disease severity of

C. cruenta. Seed treatment is one of the economical methods to control diseases.

Powdery mildew is an important disease during *maha* where intermittent rain fall occurs. Of the recommended varieties MI-5 showed higher resistance to the disease than Harsha. Therefore, resistant varieties such as MI-5, S37 and 76-287-MI5-9A could be grown during *maha* season.

Artificial defoliation studies revealed that there is a significant ($p=0.05$) yield reduction at the medium defoliation level. This indicated that the pod filling stage (i.e. 44 DAS) is most critical for defoliation. Prior to this stage most of the assimilated products may be utilized for vegetative growth rather than for production of seeds. The results implied that the defoliation of mung bean should be checked at the pod filling stage. Thus, fungicidal protection should be done at early development stage of the crop.

Of the disease control measures, use of resistant varieties is the eco-friendly and low cost approach. However, in severe cases this should be augmented with fungicidal seed treatment or spraying and the plants should be protected at the early stages. Since the MYMV controlled by insecticide spraying is limited and expensive, use of resistant variety like Harsha is the only economically viable solution especially during *yala* season.

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