Management of Mungbean Yellow Mosaic Virus (MYMV) disease using chemical insecticides and bio-pesticides

Abstract

Field trial was conducted during 2018-19 and 2019-20 crop seasons to evaluate the efficacy of insecticides and bio-pesticides for the management of Mungbean Yellow Mosaic Virus (MYMV) disease naturally spread by vector whitefly (*Bemisia tabaci*). The mean of two-year data showed~~,~~ lowest disease incidence and least number of whiteflies ~~were recorded~~ in Imidacloprid (17.8% SL) treated plots. Fifteen days after 1st spray and 2nd spray of the Imidacloprid (17.8% SL), recorded 17.09% & 18.15% disease incidence, respectively, and also reported least number of whiteflies being 3.10 five days after 1st spray and 3.32 five days after 2nd spray which consequently resulted in higher yield (9.10 q/ha). In bio-pesticides, *Beauveria bassiana* @0.5% and Neem Oil @ 3ml/lit, were found to be moderately effective in managing the disease incidence and the population of whiteflies, 22.82 and 25.11 per cent disease incidence recorded at 15 days after first spray and 25.32 and 26.73 per cent at 15 days after second spray.

Keywords: Imidacloprid,*Beauveria bassiana*,Bio-pesticide, Neem andMungbean

Comment [D1]: Rephrase it. Effect of treatments on disease incidence and whitefly population need to be stated *vis a vis* control or check.

Introduction

Mungbean or green gram (*Vigna radiata* L.) is important pulse crop in India. It is cultivated in tropical and sub-tropical regions of the world. In India it is cultivated throughout the year in an area 4.07 mha and its production is 1.90 mt [9]. The highest acreage under the crop and its production are in the States of Rajasthan, MP, Maharashtra followed by Bihar. The major constraints in the production of mungbean ~~is~~ are biotic factors like diseases caused by f~~F~~ungi~~us~~, bacteria and viruses. Among which ~~virus is causing extensive losses.~~ Mungbean yellow mosaic virus (MYMV) is the major restraint in the production of the crop. The disease is spread in nature through the whitefly vector, *Bemisia tabaci* in a persistent (circulative) manner, and by inoculation with sap [2]. Nymphs of *Bemisia tabaci* acquires the virus from diseased leaves. Higher incidences occur in regions where the temperature ranges between 31 to 35°C with a relative humidity of around 70 percent [12].These conditions favour disease development and multiplication of the whitefly vector, *Bemisia tabaci*[2,7,8].in the present work, in order to restrict the natural spread of MYMV disease through the whitefly vector newer insecticides and biopesticides were evaluated under prevailing agro-climatic conditions of Jharkhand state.

Comment [D2]: Provide latest data available

Comment [D3]: constraint

Comment [D4]: This is needs unequivocal evidence that the disease spreads by sap inoculation

Comment [D5]: How was the identity of the virus as MYMV ascertained? Mungbean yellow mosaic India virus (MYMIV) is also known to cause yellow mosaic disease in mungbean. Therefore claiming the cause of the disease as MYMV or MYMIV needs clarification.

Material and Method

Field trials were laid out during *Kharif*, 2018-19 and 2019-20 crop seasons in Randomized Block Design with nine chemical insecticides and bio-pesticides as treatments replicated three times. The variants were sown in plots of 3×1.5 m^2 with spacing of 30×10cm^2. For seed priming treatment seeds were pre-soaked in the Pesticide/Bio-agent/Chemical before sowing. The treatments were as follows:1.Dupont Tm Rekord TM(Acetamiprid) @ 1.5 ml/lit, 2. A-One (Imidacloprid) @ 0.25 ml/lit, 3. Rogor Plus (Dimethoate) @ 1.5 ml/l, 4. Success (Spinosad) @ 0.25%, 5. Maxtara (Thiomethoxam) @ 0.5g/lit, 6. Daman *(Beauveria bassiana)* @ 0.5 %, 7. Vertifire-L *(Verticillium lecani)* @ 0.25ml/l, 8. Neem Baan (Neem Oil) @ 3ml/lit, 9. Control.

Comment [D6]: Variants?

Comment [D7]: Indicate the duration for which seeds were soaked in each chemical/bioagent formulation?

Spraying of insecticides was undertaken at intervals of 25 and 40 days after sowing. The per cent yellow mosaic virus disease incidence was recorded by counting the number of plants infected with the disease at 15 Days after 1st spray subsequently 15 Days after 2nd spray and the total number of plants in the plot and converted to per cent incidence. The samples were taken to the laboratory and using stereo zoom microscope the live population of nymphs were counted. Data on whitefly population was recorded before and after spraying & taken at 20 DAS, 30 DAS followed by 45 DAS, further disease incidence was recorded at 15 days after 1st spray and 15 days after 2nd spray. The data thus obtained was subjected to ANOVA after using proper transformations.

Comment [D8]: Why was disease incidence not recorded before spray?

$$\text{Percent disease incidence} = \frac{\text{Number of infected plants in a row}}{\text{Total number of plants in a row}} \text{x } 100$$

Result and discussion:

Effect of chemical and bio-pesticide on incidence of MYMV and grain yield of *V. radiata* during, 2018-19 and 2019-20

Results obtained have been presented in Tables 1 and 2, and also depicted in Figs 1 and 2. During *Kharif*, 2018-19,two sprays of A-One (Imidacloprid 17.8% SL) on 25 and 40 days after sowing (DAS) was recorded highly efficacious and best for the management of the disease. Foliar spray application of A-One (Imidaclorprid) 17.8 SL @ 0.5/lit (T_2) on 25 DAS and 40 DAS recorded higher grain yield (9.04q/ha), lowest disease incidence of MYMV (18.70%) and highest disease reduction over control (61.41%). This treatment was followed by Success (Spinosad)2.5%SC@0.5ml/lit (T_4) which recorded disease incidence of MYMV of 20.88%, disease reduction over control of 56.91%; and grain yield of 8.37q/ha, table 1, fig. 1. During *Kharif*, 2019-20, foliar sprays of A-One (Imidaclorprid)17.8 SL @ 0.5/lit (T_2) on 25 DAS and 40 DAS recorded notable higher grain yield (9.16q/ha) with the lowest disease incidence of MYMV (17.60%) and highest disease reduction over control (62.10%). This is followed by Success(Spinosad)2.5%SC@0.5ml/lit (T_4) disease incidence of MYMV (19.48%), disease reduction over control (58.06%) and grain yield (8.80q/ha). Mean of two-year data showed lowest disease incidence and least number of whiteflies was recorded in A-One (Imidacloprid) treated plots. Fifteen days after 1st spray and 2nd spray recorded 17.09% &18.15% disease incidence respectively, and also reported least number of whiteflies being

Comment [D9]: state only per cent reduction

3.10 five days after 1st spray and 3.32 five days after 2nd spray which consequently resulted in higher yield (9.10 q/ha), table 2, fig. 2. Effectiveness of A-One (Imidacloprid 17.8 % SL) for the management of whitefly and MYMV disease, as it is having nicotinic acetylcholine receptor agonists. Similar results have been reported by other workers under different agro-climatic situations (Hossain et al. [5]; Akram & Naimuddin [1]; Jayappa et al. [3]; Islam et al. [6]; Reang et al. [10]).

During*Kharif* 2018-19, in bio-pesticides Vertifire-L1% WP @ 1.5 g/lit (T_7) sprayed plot disease incidence of MYMV of 26.41%, disease reduction over control (45.50%) and grain yield (6.15/ha) followed by Daman 2 % WP@ 1.5g/lit(T_6) sprayed plot disease incidence of MYMV of 27.60%, disease reduction over control of 43.04% and grain yield of 6.03q/ha, table 1, fig. 1. During*Kharif* 2019-20, Vertifire-*L* 1% WP @ 1.5 g/lit (T_7) sprayed plot disease incidence of MYMV of 23.82%, disease reduction over control of 48.71% and grain yield of 7.46q/ha followed by Daman 2 % WP@ 1.5g/lit(T_6) sprayed plot disease incidence of MYMV (25.94%), disease reduction over control (44.15%) and grain yield (6.72q/ha). Two sprays of Daman *(Beauveria bassiana)* and Neem Baan (Neem Oil) were found to be moderately effective in managing the disease and whiteflies population recording, 22.82 and 25.11 per cent incidence at 15 days after first spray and 25.32 and 26.73 per cent at 15 days after second spray. Whitefly counts of 4.19 and 6.13 per plant at 5 days after first spray and 4.32 and 6.41 whiteflies per plant at 5 days after second spray,table 2, fig. 2.Efficacies of bio-pesticides in the management of whitefly –borne MYMV, it acts as insect antifeeding and affect fecundity of insects, the azadirachtin-based product canalso act as an insect growth regulator by blocking the synthesisand release of moulting hormones leading to incomplete moulting of immature insects. Similar results have also been reported by El Shafie [4], Sharma et al. [11], Sujatha & Bharpoda [13], Reang et al. [10]reported that among the five plant origin products with different doses tested as spray application, Neem Baan (Neem Oil) @ 0.2% showed lowest incidence (10.49%) and severity (9.58%).

Conclusion

Comprehenshive analysis of two year's data showed that combination of seed priming/ treatment with A-One (Imidacloprid) 17.8 SL @ 3ml/kg and two foliar sprays of A-One (Imidacloprid) 17.8 SL @ 0.5/lit (T_1) sprayed on 25 DAS and 40 DAS recorded lowest disease incidence of MYMV 15.37% and 17.90%, respectively.Two sprays of Daman *(Beauveria bassiana)* (2% WP@ 1.5 g/L)and *Azadirachtin* oil (0.2%) were efficacious in the management of whitefly vector population build-up.

Table-1:Population of whitefly, *B.tabaci* in Chemicals and bio-pesticides on management of transmitted MYMV in *V. radiata* during 2018-19 & 2019- 20

	Treatment	No. of Vector(DAS)								
		20			30			45		
		2018-19	2019-20	Mean	2018-19	2019-20	Mean	2018-19	2019-20	Mean
1	Dupont Tm Rekord TM @0.5g/lit	21.69 (4.71)	20.20 (4.54)	20.94	4.15 (2.15)	3.73 (2.06)	3.94	4.57 (2.25)	4.17 (2.14)	4.37
2	A-One @0.5ml/lit	18.46 (4.35)	17.80 (4.27)	18.13	3.27 (1.94)	2.93 (1.85)	3.10	3.55 (2.01)	3.10 (1.89)	3.32
3	Rogor Plus @1.5ml/lit	20.99 (4.63)	19.10 (4.40)	20.04	3.88 (2.09)	3.54 (2.01)	3.71	4.11 (2.15)	4.04 (2.13)	4.07
4	Success @0.5 ml/lit	19.21 (4.43)	18.51 (4.36)	18.86	3.31 (1.95)	3.18 (1.91)	3.24	3.75 (2.06)	3.35 (1.96)	3.55
5	Maxtara @ 0.5g/lit	22.44 (4.77)	22.78 (4.81)	22.61	4.97 (2.32)	4.31 (2.19)	4.64	5.27 (2.40)	4.67 (2.27)	4.97
6	*Daman* @ 1.5g/lit	23.15 (4.86)	23.81 (4.93)	23.48	4.33 (2.19)	4.06 (2.13)	4.19	4.53 (2.24)	4.11 (2.15)	4.32
7	*Vertifire-L* @ 1.5 g/lit	25.59 (5.09)	24.59 (5.00)	25.09	6.77 (2.69)	6.09 (2.57)	6.43	6.99 (2.73)	6.59 (2.66)	6.79
8	Neem Baan @ 0.2%	24.77 (5.02)	23.77 (4.92)	24.27	6.31 (2.61)	5.95 (2.54)	6.13	6.81 (2.70)	6.01 (2.55)	6.41
9	Control	27.77 (5.30)	28.10 (5.35)	27.93	7.38 (2.80)	7.76 (2.87)	7.57	7.32 (2.78)	7.89 (2.90)	7.60
	SEm±	0.21	0.20	0.205	0.12	0.08	0.1	0.10	0.09	0.09
	CD 5%	0.64	0.61	0.62	0.35	3.73	2.04	0.31	0.28	0.29
	CV %	7.65	7.39	7.52	8.74	2.93	5.83	7.47	7.13	7.3

**The Trade and Chemical Names of Chemicals are used in the Trial is Dupont ^{Tm} Rekord TM(Acetamiprid 20% SP),Maxtara (Thamethoxam 25% WG),A-One (Imidaclorpid 17.8% SL), Rogor Plus(Dimethoate 30 % EC),Success(spinosad 2.5 % SC), Daman(Beauveria bassiana 2 % WP, CFUI 2X10^{8}), Vertifire-L (Verticillium lecani 1% WP, CFUI 1X10^{8}), Neem Baan (Azadiractin 0.15%W/W 1500 ppm).*

Comment [D10]: Why has the whitefly population reduced in control?

Table-2: Effect of Chemicals and bio-pesticides on management of whitefly, *B. tabaci* transmitted MYMV in *V. radiata* during, 2018-19 & 2019- 20

Treatments (Brand names of Pesticides)		15 Days after 1st Spray			15 Days after 2nd Spray			% Reduction over control			Yield (q/ha)		
		2018-19	2019-20	Mean	2018-19	2019-20	Mean	2018-19	2019-20	Mean	2018-19	2019-20	Mean
1	Dupont Tm Rekord TM	23.06 (28.61)	22.04 (27.88)	22.55	24.76 (29.75)	23.21 (28.68)	23.98	48.90	50.03	49.46	7.35	7.62	7.48
2	A-One)	17.55 (24.65)	16.63 (24.05)	17.09	18.70 (25.53)	17.60 (24.76)	18.15	61.41	62.10	61.75	9.04	9.16	9.10
3	Rogor Plus	20.75 (27.03)	19.09 (25.86)	19.92	21.51 (27.48)	20.92 (27.21)	21.21	55.61	54.96	55.28	8.13	8.54	8.33
4	Success	19.75 (26.26)	18.90 (25.70)	19.32	20.88 (27.15)	19.48 (26.15)	20.18	56.91	58.06	57.48	8.37	8.80	8.58
5	Maxtara	22.33 (28.15)	21.01 (27.70)	21.67	25.58 (30.36)	22.59 (28.33)	24.08	47.21	51.36	49.28	7.04	7.92	7.48
6	*Daman*	24.24 (29.49)	21.41 (27.17)	22.82	26.41 (30.91)	23.82 (29.21)	25.11	45.50	48.71	47.10	6.15	7.46	6.80
7	*Vertifire-L*	28.75 (32.42)	25.78 (30.45)	27.26	28.87 (32.46)	26.25 (30.70)	27.56	40.42	43.48	41.95	4.51	5.44	4.97
8	Neem Baan	25.87 (30.48)	24.36 (29.56)	25.11	27.60 (31.65)	25.94 (30.59)	26.77	43.04	44.15	43.59	6.03	6.72	6.37
9	Control	47.88 (43.78)	47.11 (43.34)	47.49	48.46 (44.11)	46.45 (42.96)	47.45	-	-		3.49	4.23	3.86
	SEm±	1.69	1.86	1.77	1.65	1.47	1.56				0.51	0.52	0.51
	CD 5%	5.06	5.56	5.31	4.95	4.41	4.68				1.54	1.56	1.55
	CV %	9.71	11.07	10.39	9.21	8.54	8.87				6.03	6.08	6.05

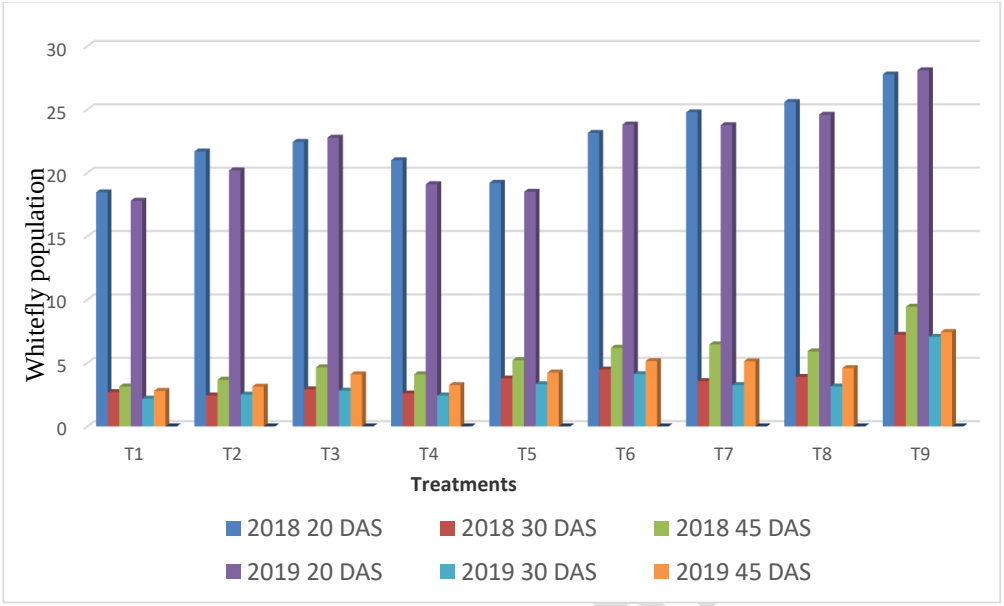

Fig. 1: Population of whitefly, *B. tabaci* in Chemicals and bio-pesticides on managementof transmitted MYMV in *V. radiata*during 2018-19 & 2019- 20

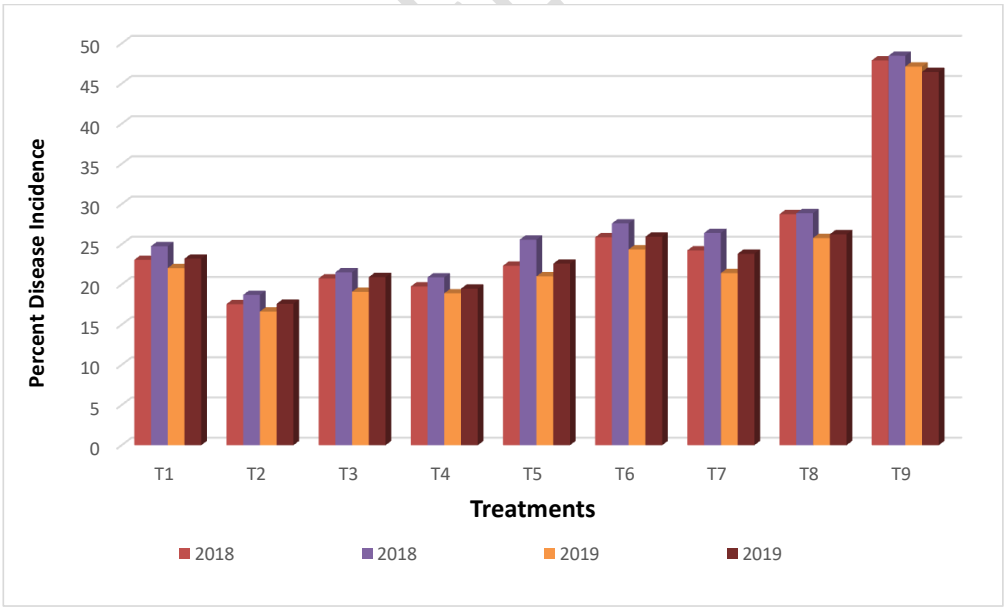

Fig. 2: Effect of Chemicals and bio-pesticides on management of whitefly, *B. tabaci* transmitted MYMV in *V. radiata* during 2018-19 & 2019- 20

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