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Research Article

EVALUATION OF BIOEFFICACY OF MET 52 EC (METARZHIZIUM ANISOPLIAE) AGAINST RICE BROWN PLANTHOPPER, NILAPARVATA LUGENS STAL

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ABSTRACT

Two season field trials were laid out to study the bioefficacy of Met 52 EC (*Metarzhizium anisopliae*) against brown planthopper in rice. Weekly and fortnight spraying of Met 52 EC@ 2000 ml ha^{-1}, 1000 ml ha^{-1},500 ml ha^{-1} were done along with standard check Imidacloprid 17.8 SL @100 ml ha^{-1}. The untreated check was sprayed with water alone. At 7DAT of weekly spraying, maximum population reduction of BPH over control was observed in Met 52 EC @ 2000 ml ha^{-1}(91 &98%).This was followed by Met 52 EC @ 1000 ml ha^{-1}(88 &94%) and Met 52 EC @ 500 ml ha^{-1}(84 &92%) and it was on par with standard check, Imidacloprid 17.8 SL @ 100 ml ha^{-1}(79 &97%) during *Kuruvai* and *Samba* 2014. At 7DAT of fortnightly spraying of Met 52EC, maximum population reduction of BPH over control was observed in Met 52 EC @ 2000 ml ha^{-1}(97 &93%).This was followed by Met 52 EC @ 1000 ml ha^{-1}(96 &90%) and Met 52 EC @ 500 ml ha^{-1}(94 &87%). It is on par with standard check, Imidacloprid 17.8 SL @ 100 ml ha^{-1}(97&96%). From this study, it is inferred that the Met 52EC (*Metarhizium anisopliae*) was effective against BPH without causing any phytotoxic symptom.

INTRODUCTION

Rice is the staple food of over half the world's population and is grown over about 145 million hectares. Classified primarily as a tropical and subtropical crop, it is cultivated as far north as 49° and as far south as 35°, and from sea level to altitude of 3000 metres. Rice is one of the main cereal crops of India and is grown in 40.2 million hectares with an annual production of 143.4 million tons. One of the main reasons for the low production of rice is the pest problems associated with the crop. Microbial control of insects is based on the rational use of pathogens to maintain environmentally balanced pest population levels, and *Metarhizium anisopliae* has been the most studied and most utilized fungal species for that purpose. The natural genetic variability of entomopathogenic fungi is considered one of the principal advantages of microbial insect control. The inter- and intraspecific variability and the genetic diversity and population structures of *Metarhizium* and other entomopathogenic fungi have been examined using ITS-RFLP, ISSR, and ISSP molecular markers (Jackson and Jaronski, 2009). The persistence of *M.anisopliae* in the soil and its possible effects on the structures of resident microbial communities must be considered when selecting isolates for biological insect control (Freed, 2010). Pathogenicity, entomopathogenic fungus *Metarhizium anisopliae* has been recorded for the first time on rice leaffolder, *Cnaphalocrocis medinalis* (Lepidoptera: Pyralidae). Effective control of leaffolder was recorded under field conditions after application of spore suspension of *Metarhizium anisopliae* in gelatin (1 %) at 1×10^8 spores/ml on the infested rice crop. Between 5 to 7 days after treatment, 60-70 per cent mortality was recorded (Padmaja and Kaur, 2014). In this paper, the efficacy of commercial formulation, Met 52EC against rice brown planhopper was studied.

MATERIALS AND METHODS

Two season field trials were conducted with ADT43 rice variety during *Kuruvai* 2014(June-Sept.) and CR1009 variety during *Samba* 2014 (Aug'14-Jan'15) at TRRI, Aduthurai, in a randomized block design with nine treatments, untreated check;Met52 EC (500ml ha^{-1}); Met52 EC (1000 ml ha^{-1}); Met 52EC (2000ml/ha); standard check-Imidacloprid 17.8SL (100ml ha^{-1}) at weekly application and Met 52EC (500ml ha^{-1}); Met 52EC (1000ml ha^{-1}); Met 52EC (2000ml ha^{-1}); standard check-Imidacloprid 17.8 SL (100ml ha^{-1}) at fortnightly application. The treatments were replicated thrice and pneumatic knapsack sprayer was used with spray fluid of 500 litres $ha^{-1.}$ Pre and post treatment counts of BPH were observed from 10 randomly selected plants per plot on 3, 5, 7 and 15 days after treatment spray and percent reduction of BPH over

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control was calculated. The percent reduction was subjected arcsine transformation and statistical analysis was carried out. Grain yield was recorded at crop harvest. Phytotoxic effect of Met 52 EC was also recorded.

RESULTS AND DISCUSSION

***Kuruvai* 2014**

The pre treatment population of BPH varied from 3.7 to 5.2 no/hill.

At 3DAT of weekly spraying, maximum population reduction of BPH over control was observed in Met 52 EC @ 2000 ml ha^{-1} (87%).This was followed by Met 52 EC @ 1000 ml ha^{-1} (83%) and Met 52 EC @ 500 ml /ha (80%). It is on par with standard check, Imidacloprid 17.8 SL @ 100 ml/ha (73%). At 5DAT, maximum population reduction of BPH over control was observed in Met 52 EC @ 2000 ml/ha (89%).This was followed by Met 52 EC @ 1000 ml/ha (86%) and Met 52 EC @ 500 ml /ha (82%).

Table 1 Evaluation of Bioefficacy of Met 52EC *(Metarhizium anisopliae)* against Brown PlantHopper in Rice- *Kuruvai* 2014

1st Spraying (no. hill^{-1})								
TREATMENT		Pretreatment Count	3DAT		5DAT		7DAT	
		No	No	P	No	P	No	P
T1-Met52 EC @500ml/ha –Weekly application		3.1	1.1	80 (63.43)	1.0	82 (64.89)	0.9	84 (66.42)
T2-Met52 EC @ 1000ml/ha- Weekly application		4.9	0.9	83 (65.84)	0.8	86 (68.02)	0.7	88 (69.73)
T3-Met52 EC @ 2000ml/ha- Weekly application		4.0	0.7	87 (68.86)	0.7	89 (70.63)	0.5	91 (72.54)
T4-Met52 EC @ 500ml/ha- Fortnightly application		5.2	1.3	76 (60.66)	1.3	77 (61.34)	1.3	77 (61.34)
T5-Met52 EC @1000ml/ha- Fortnightly application		4.2	1.4	75 (60)	1.2	79 (62.72)	1.1	81 (64.15)
T6-Met52 EC @ 2000ml/ha- Fortnightly application		4.3	1.2	78 (62.02)	1.1	81 (64.15)	1.0	83 (65.64)
T7-Standard check-Imidacloprid 17.8 SL- Weekly		4.7	1.5	73 (58.69)	1.4	75 (60)	1.2	79 (62.72)
T8-Standard check-Imidacloprid 17.8 SL- Fortnightly		4.2	1.4	75 (60)	1.2	79 (62.72)	1.4	76 (60.66)
T9-Untreated control		4.1	5.6		5.8		5.9	
	F Test	NS	**	**	**	**	**	**
	S.Ed	NS	0.22	12.50	0.34	4.12	0.50	3.62
Statistical Analysis	CD 5%	NS	0.48	26.51	0.73	8.73	1.05	7.67

No=Population number per hill; In parentheses the values arcsine square root of P; where P is reduction over control
DAT- Days After Treatment NS-Non-Significant * Significant**Highly Significant

Table 2 Evaluation of Bioefficacy of Met 52EC *(Metarhizium anisopliae)* against Brown PlantHopper in Rice- *Kuruvai* 2014

2nd Spraying (no. hill^{-1})									
Treatment		Pretreatment Count	3DAT		5DAT		7DAT		Yield t ha^{-}
		No	No	P	No	P	No	P	
T1-Met52 EC @500ml/ha –Weekly application		0.8	0.4	93 (74.65)	0.5	92 (73.52)	0.3	95 (77.07)	6.0
T2-Met52 EC @ 1000ml/ha- Weekly application		1.1	0.3	94 (75.82)	0.4	94 (75.82)	0.2	97 (80.02)	6.1
T3-Met52 EC @ 2000ml/ha- Weekly application		0.8	0.2	96 (78.46)	0.2	97 (80.02)	0.1	98 (81.86)	6.3
T4-Met52 EC @ 500ml/ha- Fortnightly application		0.8	0.5	91 (72.54)	0.6	91 (72.54)	0.2	97 (80.02)	6.3
T5-Met52 EC @1000ml/ha- Fortnightly application		0.9	0.7	88 (69.73)	0.5	92 (73.57)	0.3	95 (77.07)	6.1
T6-Met52 EC @ 2000ml/ha- Fortnightly application		1.2	0.8	86 (68.02)	0.4	94 (75.82)	0.2	97 (80.02)	6.2
T7-Standard check-Imidacloprid 17.8 SL- Weekly		0.9	0.6	89 (70.63)	0.5	92 (73.57)	0.3	95 (77.07)	5.5
T8-Standard check-Imidacloprid 17.8 SL- Fortnightly		1.0	0.5	91 (72.54)	0.3	95 (77.07)	0.2	97 (80.02)	5.8
T9-Untreated control		5.3	5.9		6.9		7.2		4.8
	F Test	**	**	**	**	**	**	**	NS
	S.Ed	0.18	0.16	2.12	0.20	1.78	0.14	0.93	0.71
Statistical Analysis	CD 5%	0.39	0.34	4.50	0.42	3.77	0.30	1.97	1.51
	CV(%)	15.25	17.99	3.22	14.04	2.62	17.40	1.33	9.64

No=Population number per hill; In parentheses the values arcsine square root of P; where P is reduction over control.
DAT- Days After Treatment NS-Non-Significant * Significant**Highly Significant

Table 3 Evaluation of Bioefficacy of Met 52EC*(Metarhizium anisopliae)* against Brown PlantHopper in Rice- *Samba* 2014

Treatment	Pretreatment Count	3DAT		5DAT		7DAT	
	1st Spraying (no. hill^{-1})						
	No	No	P	No	P	No	P
T1-Met52 EC @500ml/ha –Weekly application	2.5	1.6	67	1.3	75 (60)	1.0	82 (64.89)
T2-Met52 EC @ 1000ml/ha- Weekly application	3.3	1.2	75 (60)	1.1	78 (62.02)	0.8	86 (68.02)
T3-Met52 EC @ 2000ml/ha- Weekly application	3.5	0.9	81 (64.15)	0.8	84 (66.42)	0.6	89 (70.63)
T4-Met52 EC @ 500ml/ha- Fortnightly application	4.2	1.4	71 (58.69)	1.2	69	1.4	75 (60)
T5-Met52 EC @1000ml/ha- Fortnightly application	2.1	1.3	73 (58.69)	1.4	71 (58.69)	1.2	78 (62.02)
T6-Met52 EC @ 2000ml/ha- Fortnightly application	3.9	1.5	69	1.6	73 (58.69)	1.3	77 (61.34)
T7-Standard check-Imidacloprid 17.8 SL- Weekly	3.5	1.0	79 (62.72)	1.0	80 (63.43)	0.9	84 (66.42)
T8-Standard check-Imidacloprid 17.8 SL- Fortnightly	3.9	1.1	80 (63.43)	1.5	82 (64.89)	1.1	82 (64.89)
T1-Met52 EC @500ml/ha –Weekly application	4.5	4.8		5.2		5.7	
F Test	NS	**	**	**	**	**	**
Statistical Analysis S.Ed	NS	0.20	4.60	0.19	2.77	0.15	2.59
Statistical Analysis CD 5%	NS	0.43	9.76	0.395	5.88	0.31	5.50

In parentheses the values arcsine square root of P; where P is reduction over control.
DAT- Days AfterTreatmentNS-Non-Significant * Significant **Highly Significant

It is on par with standard check, Imidacloprid 17.8 SL @ 100 ml ha^{-1} (75%). At 7DAT, maximum population reduction of BPH over control was observed in Met 52 EC @ 2000 ml ha^{-1} (91%). This was followed by Met 52 EC @ 1000 ml ha^{-1} (88%) and Met 52 EC @ 500 ml ha^{-1} (84%). It is on par with standard check, Imidacloprid 17.8 SL @ 100 ml/ha (79%)(Table 1)

At 5DAT, maximum population reduction of BPH over control was observed in T6- Met 52 EC @ 2000 ml/ha (94%).This was followed by T5-Met 52 EC @ 1000 ml/ha (92%) and T4-Met 52 EC @ 500 ml /ha (90%). It is on par with T8-standard check, Imidacloprid 17.8 SL @ 100 ml/ha (97%).

Table 4 Evaluation of bioefficacy of Met 52 EC *(Metarhizium anisopliae)* against brown plant hopper in rice - *Samba*2014

Treatment	Pre treatment Count	3DAT		5DAT		7DAT		Yield t ha^{-1}
	2nd Spraying (no. hill^{-1})							
	No	No	P	No	P	No	P	
Met52 EC @ 500 ml ha^{-1}–Weekly application	0.9	0.8	88 (69.73)	0.7	90 (71.56)	0.6	92 (73.57)	8.3
Met52 EC @ 1000 ml ha^{-1}- Weekly application	0.7	0.6	91 (72.54)	0.5	93 (74.65)	0.4	94 (75.82)	8.6
Met52 EC @ 2000 ml ha^{-1}- Weekly application	0.5	0.4	94 (75.82)	0.3	96 (78.46)	0.1	98 (81.86)	9.6
Met52 EC @ 500 ml ha^{-1}- Fortnightly application	1.2	1.1	83 (65.84)	1.0	86 (68.02)	0.9	87 (68.86)	8.1
Met52 EC @1000 ml ha^{-1}- Fortnightly application	1.1	0.9	86 (68.02)	0.8	88 (69.73)	0.7	90 (71.56)	8.5
Met52 EC @ 2000 ml ha^{-1}- Fortnightly application	1.0	0.5	91 (72.54)	0.6	93 (74.65)	0.5	93 (74.65)	9.3
Standard check-Imidacloprid 17.8 SL - Weekly application	0.8	0.7	89 (70.63)	0.9	87 (68.86)	0.2	97 (80.02)	9.1
Standard check-Imidacloprid 17.8 SL - Fortnightly application	1.3	1.0	85	0.4	94 (75.82)	0.5	96 (78.46)	9.0
Untreated control	6.3	6.5		7.0		7.2		7.3
F Test	**	**	**	**	**	**	**	NS
Statistical Analysis S.Ed	0.18	1.05	1.81	0.16	2.22	0.09	1.41	NS
Statistical Analysis CD 5%	0.38	2.23	3.83	0.35	4.7	0.2	2.99	NS

In parentheses the values arcsine square root of P; where P is reduction over control DAT- Days After Treatment

At 3DAT of fortnightly spraying, maximum population reduction of BPH over control was observed in T6- Met 52 EC @ 2000 ml/ha (91%).This was followed by T5-Met 52 EC @ 1000 ml/ha (88%) and T4-Met 52 EC @ 500 ml /ha (86%). It is on par with T8-standard check, Imidacloprid 17.8 SL @ 100 ml/ha (91%).

At 7DAT, maximum population reduction of BPH over control was observed in T6- Met 52 EC @ 2000 ml/ha (97%). This was followed by T5-Met 52 EC @ 1000 ml/ha (96%) and T4-Met 52 EC @ 500 ml /ha (94%). It is on par with T8-standard check, Imidacloprid 17.8 SL @ 100 ml/ha (97%). The same trend was observed at second spraying (Table 2).

Table 5 Phytotoxic effect of Met 52 EC *(Metarhizium anisopliae)* on rice crop– *Kuruvai&Samba* 2014

Treatment	Symptoms	Post treatment observation			
		3DAT	5DAT	7DAT	15DAT
Met52 EC @500 ml ha^{-1}	Leaf injury	0	0	0	0
	Wilting	0	0	0	0
	Vein clearing	0	0	0	0
	Necrosis	0	0	0	0
	Epinasty	0	0	0	0
	Hyponasty	0	0	0	0
Met52 EC @ 2000 ml ha^{-1}	Leaf injury	0	0	0	0
	Wilting	0	0	0	0
	Vein clearing	0	0	0	0
	Necrosis	0	0	0	0
	Epinasty	0	0	0	0
	Hyponasty	0	0	0	0
Untreated control	Leaf injury	0	0	0	0
	Wilting	0	0	0	0
	Vein clearing	0	0	0	0
	Necrosis	0	0	0	0
	Epinasty	0	0	0	0
	Hyponasty	0	0	0	0

DAT- Days After Treatment

***Samba* 2014**

The pre treatment population of BPH varied from 3.7 to 5.2 no. hill^{-1}. In weekly spraying, at 3DAT, maximum population reduction of BPH over control was observed in Met 52 EC @ 2000 ml ha^{-1}(94%). This was followed by Met 52 EC @ 1000 ml ha^{-1}(91%) and Met 52 EC @ 500 ml ha^{-1}(88%). It is on par with standard check, Imidacloprid 17.8 SL @ 100 ml ha^{-1}(89%). At 5DAT, maximum population reduction of BPH over control was observed in Met 52 EC @ 2000 ml ha^{-1}(96%).This was followed by Met 52 EC @ 1000 ml ha^{-1}(93%) and Met 52 EC @ 500 ml ha^{-1}(90%). It is on par with standard check, Imidacloprid 17.8 SL @ 100 ml ha^{-1}(87%).At 7DAT, maximum population reduction of BPH over control was observed in Met 52 EC @ 2000 ml ha^{-1}(98%).This was followed by Met 52 EC @ 1000 ml ha^{-1}(94%) and Met 52 EC @ 500 ml ha^{-1}(92%).

It was on par with standard check, Imidacloprid 17.8 SL @ 100 ml ha^{-1}(97%) during *samba* 2014 (Table 3).

At fortnightly interval spraying, maximum population reduction of BPH over control was observed in Met 52 EC @ 2000 ml ha^{-1}(91%) at 3DAT. This was followed by Met 52 EC @ 1000 ml ha^{-1}(86%) and Met 52 EC @ 500 ml ha^{-1}(83%). It is on par with standard check, Imidacloprid 17.8 SL @ 100 ml ha^{-1}(85%). At5DAT, maximum population reduction of BPH over control was observed in Met 52 EC @ 2000 ml ha^{-1}(96%).This was followed by Met 52 EC @ 1000 ml ha^{-1}(93%) and Met 52 EC @ 500 ml ha^{-1}(90%). It is on par with standard check, Imidacloprid 17.8 SL @ 100 ml ha^{-1}(94%). At 7DAT, maximum population reduction of BPH over control was observed in Met 52 EC @ 2000 ml ha^{-1}(93%).This was followed by Met 52 EC @ 1000 ml ha^{-1}(90%) and Met 52 EC @ 500 ml ha^{-1}(87%). It is on par with standard check, Imidacloprid 17.8 SL @ 100 ml ha^{-1}(96%) during *samba*2014 (Table 4).

Influence of Met52 EC on grain yield of rice

***Kuruvai* 2014**

Highest yield was recorded at weekly spraying of Met 52EC@ 2000 mlha^{-1}(6.3t ha^{-1}) followed by Met 52 EC@1000mlha^{-1}(6.1t ha^{-1}), Met 52EC@500mlha^{-1}(6.0 t ha^{-1}) and the standard chemicalImidacloprid 17.8 SL @ 100 mlha^{-1} recorded (5.5 t ha^{-1}). Fortnightly spraying of Met 52EC@ 2000mlha^{-1}yield recorded (6.2t ha^{-1}), followed by Met 52EC@ 1000mlha^{-1}(6.0t ha^{-1}), Met 52 EC @ 500mlha^{-1}(5.3t ha^{-1}) and the standard chemical Imidacloprid 17.8 SL @ 100mlha^{-1}yield recorded (5.8t ha^{-1}) whereas the untreated control recorded yield of 4.8t ha^{-1} (Table 2).

***Samba* 2014**

Higher grain yield was recorded at weekly spraying of Met 52 EC@ 2000 ml ha^{-1}(9.6t ha^{-1}) followed by Met 52 EC @ 1000ml ha^{-1}(8.6t ha^{-1}), Met 52 EC@500ml ha^{-1}(8.3t ha^{-1}) and the standard check Imidacloprid 17.8 SL @ 100 ml ha^{-1} (9.1t ha^{-1}). Fortnightly spraying of Met 52 EC@ 2000ml ha^{-1}recordedyield (9.3t ha^{-1}), followed by Met 52 EC@ 1000ml ha^{-1}(8.5t ha^{-1}), Met 52 EC 500ml ha^{-1}(8.1t ha^{-1}) and the standard check, Imidacloprid 17.8 SL @ 100ml ha^{-1} (9.0t/ha) as against 7.3 t ha^{-1} in untreated control (Table 4). There were no phytotoxic symptoms observed by spraying of Met 52 EC on rice crop (Table 5).

CONCLUSION

Foliar spray of Met 52 EC @ 2000ml ha^{-1}was very effective against BPH followed by 1000 and 500ml ha^{-1}and it was in accordance with findings of Venkat Reddy *et al*, (2013). Maximum population reduction over control was observed in 2000ml ha^{-1}. Compared to other treatment, Met 52EC @ 2000ml ha^{-1}was recommended and given subsequent increase in the grain yield and it did not cause any phototoxic symptoms on rice crop.

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