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Comparative efficacy and phytotoxicity evaluation of biopesticides, insecticides and *Neem* formulation against leaf folder (Cnaphlocrocis medinalis guenee) on paddy

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ABSTRACT

Effort were taken to compare the efficacy and phytotoxicity of bioagent *B.bassiana Neem* formulation and insecticide. Out of six treatment Monocrotophos 36 per cent SL @ 625 ml/ha and *Beauveria bassiana* 1.15 per cent WP ($1x10^8$ cfu/g min.) treatments @ 3000 and 2500 g/ha were effective to reducing leaf folder larval population on paddy crop and to increase the grain yield. All the treatments were non-phytotoxic to paddy crop and non-toxic to natural enemies in both the year. *Beauveria bassiana* 1.15 per cent WP applied @ 2500 g/ha dose was optimum to control leaf folder and to increase the yield. Based on the results of bioefficacy and grain yield, use of *Beauveria bassiana* 1.15 per cent WP @ 2500 g/ha is suggested for the effective management of leaf folder larvae on paddy crop.

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INTRODUCTION

Paddy (*Oryza sativa* L.) is an important cereal and source of calories for more than one third of the world population. Therefore, the major challenge in the year to come is to increase the productivity of paddy from the present level of 2.07 t/ha to more than 3t/ha. To achieve this goal the losses due to abiotic and biotic stresses have to be tackled (Prasad *et al*., 2007). In biotic stresses the leaf folder (Cnaphlocrosis medinalis guenee) is one of destructive insect pest causing hues loss of paddy crop. The paddy leaf folder has been controlled by various chemical pesticides. The problems of chemicals pesticides resistance as well as the consumer health and environmental hazards associated with pesticide residues in plant materials, have focused attention on alternative methods. *B. bassiana* invades insects by penetrating the cuticle and the fungus rapidly multiplied throughout the body, causes by tissue destruction and occasionally, by toxin produced by the fungus. It produces toxin like beauvericin, beauverolides Bassinolide is arolides pigments like tenellin and bassianin and oxalic acid (Roberts, 1981). The study was taken with an objective

to determine the comparative efficacy and phytotoxicity evaluation of biopesticides, insecticides and *Neem* formulation against leaf folder (Cnaphlocrocis medinalis guenee) on paddy crop.

MATERIAL AND METHODS

Experiment was conducted at K.V.K. instructional farm Sehore (M.P.) during *Kharif* season 2013 and 2014 in Randomized Block Design replicated four times. The cv. PUSA1121 was transplanted in Ist season 11.08.2013 and IInd season 21.07.2014. in field. Each plot measured 20 m^2 with spacing 15x60 cm. The application of treatments started on appearance of symptoms of pest damage in the experimental crops with six treatment including control *viz*., *Beauveria bassiana* 1.15 per cent WP @ 2000, *B. bassiana* 1.15 per cent WP @ 2500, *B. bassiana* 1.15 per cent WP @ 3000 g/ ha; *Neem* oil based EC containing Azadirachtin 0.03 per cent @ 2000 ml/ha, monocrotophos 36 per cent SL @ 625 ml/ha and control were used. All treatments were sprayed on paddy crop using spray volume @ 500 lit/ha by knapsack sprayer fitted with hollow cone nozzle twice at an interval of 15 days.

Treatments details :

T_1- *Beauveria bassiana* (1x10^8 cfu/g min)1.15 per cent WP @ 2000 g/ha,

T_2- *B. bassiana* (1x10^8 cfu/g min)1.15 per cent WP @ 2500 g/ha and

T_3- *B. bassiana* (1x10^8 cfu/g min)1.15 per cent WP @ 3000 g/ha;

T_4- *Neem* oil based EC containing Azadirachtin 0.03 per cent @ 2000 ml/ha ,

T_5- Monocrotophos 36 per cent SL @ 625 ml/ha and T_6- control untreated water.

Effect of *B. bassiana* and others against leaf folder on paddy :

Pre-treatment observations on number of leaf folder larvae were recorded one day before first spray on randomly selected 10 hills per plot. The folded leaves were carefully opened to observe the presence of larvae. Post-treatment observations were recorded after 7 and 14 days of each spray on randomly selected 10 hills per plot. Based on the data per cent reduction in larval population over control was calculated. The dead larvae were collected from the plots to confirm the insect mortality due to *Beauveria bassiana*. The collected larvae were kept in clean Petri dishes and observed for 7 days minimum. The plot wise yield was recorded at harvest.

Phytotoxicity evaluation of *Beauveria bassiana* 1.15 per cent WP on paddy crop during :

To observe phytotoxicity to paddy crop due to the application of *Beauveria bassiana* 1.15 per cent WP a higher dose 5000 g/ha was also used. Observations were recorded visually for the phytotoxicity parameters *viz*., leaf injury on tips/ surface, wilting, vein clearing, necrosis, epinasty and hyponasty after 1, 3, 7, 10 and 14 days of each application of treatments.

Effect of *Beauveria bassiana* 1.15 per cent WP on natural enemies in paddy crop :

To record the effect of *Beauveria bassiana* 1.15 per cent WP on the natural enemies, observations were made for the natural enemies prevailing in the crop ecosystem. The population count of spiders and mirid bug was recorded on randomly selected 10 hills per plot before first application and 7 and 14 days after each application of treatments.

RESULTS AND DISCUSSION

Effect of *B. bassiana* and others against leaf folder on paddy :

The population of leaf folder larvae recorded during two seasons has been presented in Table 1. Pre- spray population showed that the pest was uniformly established in all the experimental plots and the difference was non-significant. The larval population significantly declined in various treatments as compared to control at each observation time period. Monocrotophos 36 per cent SL a chemical insecticide showed better efficacy than *Beauveria bassiana* 1.15 per cent WP and *Neem* oil based EC containing Azadirachtin 0.03 per cent. However, *Beauveria bassiana* 1.15 per cent WP @ 2500 and 3000 g/ha was superior to *Neem* oil based EC containing Azadirachtin 0.03 per cent @ 2000 ml/ha. *Beauveria bassiana* 1.15 per cent WP @ 3000 g/ha was statistically equally effective to its lower dose @ 2500 g/ha.

The per cent reduction in larval population over control was also calculated out and presented in Table 2. The results revealed that all the treatments effectively

Table 1: Evaluation of *Beauveria bassiana* 1.15 per cent WP against leaf folder on paddy during 2013 and 2014

Sr. No.	Treatments	Dose formulation/ha	Leaf folder larval population/10 hills year 2013					Leaf folder larval population/10 hills year 2014				
			Pre - spray	After first spray		After second spray		Pre - spray	After first spray		After second spray	
				7 days	14 days	7 days	14 days		7 days	14 days	7 days	14 days
1.	*Beauveria bassiana* 1.15% WP	2000 g	26.25 (5.12)	21.50 (4.64)	13.00 (3.61)	11.75 (3.43)	10.00 (3.16)	41.75 (6.46)	32.25 (5.68)	25.50 (5.05)	19.50 (4.42)	16.75 (4.09)
2.	*B. bassiana* 1.15% WP	2500 g	24.75 (4.97)	15.00 (3.87)	8.50 (2.92)	7.25 (2.69)	5.25 (2.29)	38.25 (6.18)	23.50 (4.85)	16.25 (4.03)	11.75 (3.43)	8.75 (2.96)
3.	*B. bassiana* 1.15% WP	3000 g	20.00 (4.47)	14.25 (3.77)	9.25 (3.04)	6.75 (2.60)	5.50 (2.35)	40.50 (6.36)	21.75 (4.66)	14.50 (3.81)	12.50 (3.54)	8.00 (2.83)
4.	*Neem* oil based EC containing Azadirachtin 0.03%	2000 ml	23.50 (4.85)	17.00 (4.12)	11.25 (3.35)	10.00 (3.16)	8.75 (2.96)	37.25 (6.10)	27.00 (5.20)	21.75 (4.66)	17.25 (4.15)	13.25 (3.64)
5.	Monocrotophos 36% SL	625 ml	25.50 (5.05)	5.25 (2.29)	3.75 (1.94)	2.50 (1.58)	1.25 (1.12)	35.50 (5.96)	9.75 (3.12)	6.25 (2.50)	4.75 (2.18)	2.50 (1.58)
6.	Control	–	22.75 (4.77)	28.00 (5.29)	26.75 (5.17)	30.25 (5.50)	25.50 (5.05)	42.25 (6.50)	51.50 (7.18)	56.50 (7.52)	49.75 (7.05)	38.25 (6.18)
	S.E. ±		(0.27)	(0.18)	(0.12)	(0.14)	(0.17)	(0.32)	(0.16)	(0.17)	(0.11)	(0.14)
	C.D. (P=0.05)		(NS)	(0.56)	(0.37)	(0.44)	(0.52)	(NS)	(0.48)	(0.51)	(0.34)	(0.43)

NS = Non- significant Figures in parentheses are square root transformed values

Table 2 : Per cent reduction in leaf folder larvae over control in paddy during 2013 and 2014

Sr. No.	Treatments	Dose formulation/ha	Per cent reduction in leaf folder larvae over control-2013					Per cent reduction in leaf folder larvae over control-2014				
			After first spray		After second spray		Mean	After first spray		After second spray		Mean
			7 days	14 days	7 days	14 days			14 days	7 days	14 days	
1.	*Beauveria bassiana* 1.15% WP	2000 g	23.21 (28.79)	51.40 (45.80)	61.16 (51.45)	60.78 (51.23)	49.14 (44.51)	52.32 (46.33)	54.87 (47.79)	60.80 (51.24)	56.21 (48.57)	52.32 (46.33)
2.	*Beauveria bassiana* 1.15% WP	2500 g	46.43 (42.95)	68.22 (55.69)	76.03 (60.69)	79.41 (63.02)	67.52 (55.26)	69.78 (56.65)	71.24 (57.57)	76.38 (60.92)	77.12 (61.42)	69.78 (56.65)
3.	*Beauveria bassiana* 1.15% WP	3000 g	49.11 (44.49)	65.42 (53.99)	77.69 (61.82)	78.43 (62.33)	67.66 (55.34)	71.52 (57.75)	74.34 (59.57)	74.87 (59.91)	79.08 (62.78)	71.52 (57.75)
4.	*Neem* oil based EC containing Azadirachtin 0.03%	2000 ml	39.29 (38.82)	57.94 (49.57)	66.94 (54.90)	65.69 (54.15)	57.47 (49.30)	59.94 (50.73)	61.50 (51.65)	65.33 (53.93)	65.36 (53.95)	59.94 (50.73)
5.	Monocrotophos 36% SL	625 ml	81.25 (64.36)	85.98 (68.02)	91.74 (73.31)	95.10 (77.24)	88.52 (70.19)	88.48 (70.16)	88.94 (70.58)	90.45 (72.00)	93.46 (75.18)	88.48 (70.16)
6.	Control	–	-	-	-	-	-	-	-	-	-	-
	S.E. ±		(0.57)	(0.47)	(0.42)	(0.36)	(0.28)	(0.47)	(0.71).	(0.41	(0.54)	(0.47)
	C.D. (P=0.05)		(1.76)	(1.46)	(1.27)	(1.09)	(0.84)	(1.42)	(2.13)	(1.22)	(1.63)	(1.42)

Figures in parentheses are angular transformed values

Table 3 : Effect of *Beauveria bassiana* 1.15 per cent WP on paddy yield

Sr. No.	Treatments	Dose formulation/ha	Yield (q/ha)	
			During 2013	During 2014
1.	*Beauveria bassiana* 1.15% WP	2000 g	61.46 (7.84)	56.19 (7.50)
2.	*Beauveria bassiana* 1.15% WP	2500 g	71.37 (8.45)	67.35 (8.21)
3.	*Beauveria bassiana* 1.15% WP	3000 g	72.94 (8.54)	68.63 (8.28)
4.	*Neem* oil based EC containing Azadirachtin 0.03%	2000 ml	66.57 (8.16)	61.72 (7.86)
5.	Monocrotophos 36% SL	625 ml	75.48 (8.69)	70.18 (8.38)
6.	Control	–	47.73 (6.91)	48.43 (6.96)
	S.E. ±		(0.12)	(0.10)
	C.D. (P=0.05)		(0.36)	(0.31)

Figures in parentheses are square root transformed values

Table 4: Phytotoxicity evaluation of *Beauveria bassiana* 1.15 per cent WP on paddy crop during 2013 and 2014

Sr. No.	Treatments	Dose formulation/ ha	Leaf injury on tips/ surface*	Phytotoxicity parameters observed (Mean observations recorded after 1, 3, 7, 10 and 14 days of each spray)									
				2013					2014				
				Wilting	Vein clearing	Necrosis	Epinasty	Hyponasty	Wilting	Vein clearing	Necrosis	Epinasty	Hyponasty
1.	*Beauveria bassiana* 1.15% WP	2000 g	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
2.	*B. bassiana* 1.15% WP	2500 g	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
3.	*B. bassiana* 1.15% WP	3000 g	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
4.	*Neem* oil based EC containing Azadirachtin 0.03%	2000 ml	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
5.	Monocrotophos 36% SL	625 ml	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
6.	Control	–	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
7.	*Beauveria bassiana* 1.15% WP	5000 g	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

* Scale 1-10% = 1, 11-20% = 2, 21-30% =3, 31-40% = 4, 41-50% = 5, 51-60% = 6, 61-70% = 7, 71-80% = 8, 81-90% = 9, 91-100% = 10

Table 5 : Effect of *Beauveria bassiana* 1.15 per cent WP on natural enemies in paddy crop during 2013

Sr. No.	Treatments	Dose Formulation/ha	Mean population of natural enemies/ 10 hills										Mean population of natural enemies/ 10 hills									
			Spiders						Mirid bug				Spiders					Mirid bug				
			Pre spray	7 DAFS	Pre spray	7 DAFS	14 DAFS	7 DASS	14 DASS	Pre spray	7 DAFS	14 DAFS	Pre spray	7 DAFS	Pre spray	7 DAFS	14 DAFS	Pre spray	7 DAFS	Pre spray	7 DAFS	14 DAFS
1.	*Beauveria bassiana* 1.15% WP	2000 g	6.75	5.50	4.75	3.25	2.75	3.00	2.50	2.50	3.00	1.75	4.50	3.25	2.50	2.25	2.25	4.50	3.75	2.00	1.25	0.75
2.	*Beauveria bassiana* 1.15% WP	2500 g	5.75	5.25	4.50	2.75	2.50	4.25	3.00	2.25	2.50	2.25	4.25	3.25	2.25	2.00	1.50	3.75	3.25	1.50.	0.50	0.00
3.	*Beauveria bassiana* 1.15% WP	3000 g	7.25	5.25	4.00	2.25	2.75	3.50	3.00	2.00	2.25	1.75	3.75	3.00	2.00	2.00	1.75	4.25	3.25	1.75	0.00	0.00
4.	*Neem* oil based EC containing Azadirachtin 0.03%	2000 ml	6.25	6.00	4.75	3.25	2.50	4.50	3.50	2.50	1.50	2.00	4.00	3.75	2.25	2.25	2.00	3.50	2.75	1.25	1.00	0.75
5.	Monocrotophos 36% SL	625 ml	8.00	3.00	2.75	1.75	0.75	3.75	2.00	1.25	2.00	1.00	3.75	2.25	1.50	0.75	1.25	3.25	1.50	1.00	0.00	0.00
6.	Control	–	6.25	6.75	7.50	6.25	5.75	4.25	4.75	3.25	4.50	4.00	4.25	4.75	5.00	4.25	4.75	3.75	4.25	3.25	2.50	2.25
	S.E. ±		0.56	0.54	0.24	0.32	0.48	0.52	0.48	0.46	0.28	0.23	0.52	0.48	0.24	0.53	0.21	047	0.46	0.49	0.22	0.21
	C.D. (P=0.05)		NS	NS	0.73	0.96	NS	NS	NS	NS	0.83	0.69	NS	NS	0.73	NS	0.63	NS	NS	NS	0.66	0.64

DAFS – Days after first spray DASS – Days after second spray NS – Non significant

controlled the pest population, where *Beauveria bassiana* 1.15 per cent WP @ 3000 and 2500 g/ha was more effective than its lower dose @ 2000 g/ha. *Neem* oil based EC containing Azadirachtin 0.03 per cent @ 2000 ml/ha was also better than *Beauveria bassiana* 1.15 per cent WP @ 2000 g/ha. The paddy grain yield for two seasons has been presented in Table 3. Fairly high yield was recorded in the treatment of Monocrotophos 36 per cent SL @ 625 ml/ha followed by *Beauveria bassiana* 1.15 per cent WP @ 3000 and 2500 g/ha. There was no significant difference in the yield when *Beauveria bassiana* 1.15 per cent WP applied @ 3000 g/ha and 2500 g/ha, hence, 2500 g/ha dose of the product is optimum to control the leaf folder in paddy crop. The whitish mycelium growth of fungus, *Beauveria bassiana* on dead larvae collected from *Beauveria bassiana* 1.15 per cent WP treated plots confirmed the mortality due to the application of *Beauveria bassiana* 1.15 per cent WP.

Phytotoxicity evaluation of *Beauveria bassiana* 1.15 per cent WP on paddy crop during :

The observations recorded visually for the phytotoxicity symptoms after 1, 3, 7, 10 and 14 days after each spray have been presented in Table 4. The data showed that there was no phytotoxicty to paddy crop when *Beauveria bassiana* 1.15 per cent WP applied upto a level of 5000 g/ha. Hence, *Beauveria bassiana* 1.15 per cent WP formulation was non phytotoxic to paddy crop.

Effect of *Beauveria bassiana* 1.15 per cent WP on natural enemies in paddy crop :

The natural enemies population prevailing in the crop ecosystem recorded before first spray and after 7 and 14 days of each spray during both the seasons have been presented in Table 5. Pre - spray population of spiders and mirid bugs observed was more or less uniform in various treatment plots and the difference was non-significant. After application of treatments population of predators declined to some extent but monocrotophos showed greater adverse effect. The differences in population was non-significant at most of the occasions. A decline in predator's population in treated plots may be attributed to the fact that reduction in pest population forced predators to move out to search food. Chandel *et al.* (2006) NPV with plant extracts observed that admixed caused 58.0 per cent mortality of *Helcoverpa armigera.* Rajak and Singh (2002) found *Neem* powder @20kg/ha to be effective against *A. foveicollis* infesting muskmelon. Purwar and Sachan (2005) 75 per cent mortality of two insects however, *B.bassiana* was found to be more potent than *M. anisopliae*. Butani *et al.* (2009) also reported that *B. bassiana* was highly pathogenic to coriander aphid, when used in an integrated manner.

REFERENCES

Butani, P.G., Kapadia, M.N.,Virani, V.R. and Jethwa, D.M. (2009). Integrated management of *Hyadophis corianderin* coriander. *Ann. Pl. Proec. Sci.*,**17**:481-482.

Chandel, S.F., Singh, P.K. and Ahmad, R. (2006). Efficacy of NPV in association with botanical for control of *Helicoverpa armigera* infecting chick pea. *Ann. Pl. Protec. Sci*.,**15**:480-481.

Prasad, S.S., Gupta, P.K. and Kanaujia, B.L. (2007). Simulation study on yield loss due to *Scirpophaga incertulas* on semi deep water rice. *Ann. Pl. Protec. Sci*.,**15** : 491-492.

Purwar, J.P. and Sachan, G.C. (2005). Biotoxicity of *Beauveria bassiana* and *Metarhizoum anasopliae* against Spodoptera and Spilanctia oblique.*Ann. Pl. Proc. Sci*., **13** : 360-364.

Rajak, D.C. and Singh, H.M. (2002). Coparative efficacy of pesticide against red pumpkin beetle *Aulacophora foveicallis* on muskmelon. *Ann. Pl. Protec. Sci.,* **10** :147-148.

Roberts, D.W.(1981). Toxins of entomopathogenic fungi In: *Microbial control of pest and plant disease 1970- 1980* (Ed.) Roberts, D.W. Academic Press London, New York ,Toronto Sydney, San Francisco, pp. 441-464