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EVALUATION OF BIORATIONALS AGAINST THRIPS, *SCIRTOTHRIPS DORSALIS* (THRIPIDAE: THYSANOPTERA) INFESTING CAPSICUM

Sharanappa, C.H. Pramod Katti, Arunkumar, H. Sushila, N.B.K. Desai and Pampanna,Y.
Department of Agricultural Entomology, Main Agricultural Research Station, University of Agricultural Sciences, Raichur-584104, Karnataka, India

Abstract

The study was carried out at Main Agriculture Research Station, Raichur, during *Rabi* 2018. The precount population were recorded at one day before spraying, while the post treatment observations were recorded at 3, 5 and 7 days after each spraying. There are three sprays of different doses of *Beauveria bassiana* @ 400 g/acre, *Lecanicillium lecanii* @ 400 g/acre, *Metarhizium anisopliae* @ 400 g/acre, commercial neem based formulation 1500ppm @ 600 ml/acre, *Beeauveria. bassiana* @ 800 g/acre, *Lecanicillium lecanii* @ 800 g/acre and *Metarhizium anisopliae* @ 800 g/acre in capsicum at 20 days interval. The results revealed that the overall mean per cent reduction after the application of first, second and third spray was highest in commercial neem based formulation 1500 ppm @ 600 ml/acre (78.51 %) were found significantly superior than rest of the treatments. This was followed by *B. bassiana* @ 800 g/acre (68.68 %), *M. anisopliae* @ 800 g/acre (66.58 %), *L. lecanii* @ 800 g/acre (66.02 %), *M. anisopliae* @ 400 g/acre (61.10 %), *L. lecanii* @ 400 g/acre (59.12 %) and *B. bassiana* @ 400 g/acre (58.80 %) and these treatments were found significantly superior than control. The biorationals in the decreasing order of their efficacy were commercial neem based formulation 1500ppm @ 600 ml/acre > *B. bassiana* @ 800 g/acre > *M. anisopliae* @ 800 g/acre > *V. lecanii* @ 800 g/acre > *M. anisopliae* @ 400 g/acre > *V. lecanii* @ 400 g/acre > *B. bassiana* @ 400 g/acre.

Keywords: Capsicum thrips, biorationals, spray

Introduction

Capsicum is one of the most popular and highly remunerative vegetable crops grown throughout the world. India's contribution was estimated to be 130.71 thousand metric tonnes from an area of 9.91thousand hectares. Bell pepper has attained the status of a high value crop in India during recent years. The high market price it fetches is attributed to the heavy demand from the urban consumers and even a small blemish on the fruit will drastically reduce its market value. Under these circumstances the study of insect pests which reduce the fruit quality

In India, it is cultivated in an area of 45,850 ha with a production of 327,020 tons. Karnataka is the major capsicum cultivating state with an area of 4,130 ha and production of 81,670 tons followed by Himachal Pradesh and Madhya Pradesh (Anon., 2017).

Most of the bell peppers are harvested in about three months on an average and open pollinated varieties yields around 12-15 t/ha whereas, F_1 hybrids yields 20-25 t/ha (Reddy, 2015). Surveys conducted by AVRDC in Asia revealed that Chilli is known to be infested by several insect and non-insect pests of which the tarsonemid mite, *Polyphagotarsonemus latus* Banks (Acari: Tarsonemidae) and yellow thrips, *Scirtothrips dorsalis* Hood are the most destructive and are considered as major pests (Berke and Sheih, 2000). They have got some bio-ecological advantages than the other pests, due to having, very small size, high biotic potential, lack of effective natural enemies, capacity to adopt newer environment quickly and quick resistance development against toxicants (Venkatesalu *et al.,* 2009). They cause a havoc economic loss each year and have become a threat to the chilli growers (Sarkar *et al.,* 2008). Chilli thrips and mites affected leaves curl "upward" and "down ward" respectively, resulting in a typical damage known as "leaf curl syndrome". Economic yield loss may be 11-75% quantitatively and 60-80% qualitatively in the event of serious infestation (Ghosh *et al.,* 2009).

Pesticides, as a key component for the management of crop pests, a number of chemical insecticides are mostly sprayed on the vegetable crops. But continuous, injudicious and indiscriminate use of insecticides by farmers resulted in resistance development, resurgence of pests and destruction of natural enemies and pollution in environment. Most of the farmers are now experiencing that the recommended doses of largely used insecticides could not give the expected control of sucking pests. For overcoming these pest problems, farmers undertake 4-6 sprays of insecticides injudiciously against sucking pests, out of which 30 to 40% sprays compose of nicotinoid insecticides, followed by insecticides from organophosphates and synthetic pyrethroid groups.

In order to overcome the harmuful effect of pesticides and the highest cost involved in plant protection so keeping in this view, a study was undertaken to evaluate the efficacy of biorationals against thrips pest of capsicum.

Material and Methods

The experiment was conducted to evaluate the efficacy of biorationals against thrips nfesting capsicum at Agricultural Research Station, Raichur, under open condition during *Rabi* 2018. The experiment was laid out in a Randamized Block Design (RBD) with three replication having a plot size of 3 x 2.5m. Seedlings of capsicum F_1 hybrid Indra (30 days old) were procured from nursery and transplanted in the main field at spacing of 90 cm × 30 cm. All the management practices except the plant protection measures against capsicum pests were followed as per the recommended package of practices (Anon., 2013).

Different biorationals *viz*., *Beauveria bassiana* @ 400 g/acre, *Lecanicillium lecanii* @ 400 g/acre, *Metarhizium anisopliae* @ 400 g/acre, commercial neem based formulation 1500ppm @ 600 ml/acre, *Beeauveria. bassiana* @ 800 g/acre, *Lecanicillium lecanii* @ 800 g/acre and

Metarhizium anisopliae @ 800 g/acre was evaluated against capsicum thrips.

A measured quantity of biorational solution or powder was mixed with a little quantity of water and stirred well, after which the remaining quantity of water was added to obtain the required concentration of spray fluid. Sprayings were given by using a hand compression knapsack high volume sprayer during morning or evening hours. The plot in each treatment was sprayed with respective biorational ensuring uniform coverage of biorational.

The per cent reduction over untreated control was worked using modified Abbot's formula given below.

$$P = \frac{100 \times 1 - \left(T_a \times C_b\right)}{\left(T_b \times C_a\right)}$$

Where,

P = Per cent population reduction over control

T_a = Population n treatment after spray

C_a = Population n control after spray

T_b = Population n treatment before spray

C_b = Population n control before spray (Fleming and Ratnakaran, 1985)

Results and Discussion

First spray: Population of thrips one day before spray

3 DAS: At Three days after imposing the treatments, the least population was recorded in commercial neem based formulation 1500 ppm @ 600 ml/acre (1.93 thrips/3 leaves) which was significantly superior than rest of the treatments followed by *V. lecanii* @ 800 g/acre (3.00 thrips/3 leaves), *M. anisopliae* @ 400 g/acre (3.05 thrips/3 leaves), *M. anisopliae* @ 800 g/acre (3.07 thrips/3 leaves), *V. lecanii* @ 400 g/acre (3.07 thrips/3 leaves), *B. bassiana* @ 800 g/acre (3.20 thrips/3 leaves) and *B. bassiana* @ 400 g/acre (3.27 thrips/3 leaves) and these treatment were at par with each other but significantly superior than the control which has recorded highest thrips population (4.27 thrips/3 leaves) and formed the next best treatments. **5 DAS:** Five days after imposing the treatments, the lowest population was recorded in *B. bassiana* @ 800 g/acre (0.80 thrips/3 leaves) followed by commercial neem based formulation 1500 ppm @ 600 ml/acre (0.87 thrips/3 leaves), *V. lecanii* @ 800 g/acre (1.07 thrips/3 leaves), *M. anisopliae* @ 800 g/acre (1.13 thrips/3 leaves) and these treatments found to be significantly superior than rest of the treatments. **7 DAS:** Seven days after imposing the treatments, the lowest population was recorded in *M. anisopliae* @ 800 g/acre (0.27 thrips/3 leaves) followed by *B. bassiana* @ 800 g/acre (0.40 thrips/3 leaves), commercial neem based formulation 1500 ppm @ 600 ml/acre (0.40 thrips/3 leaves), *V. lecanii* @ 800 g/acre (0.47 thrips/3 leaves) and these treatments were found to be significantly superior than rest of the treatments.

Per cent reduction over control

The mean per cent reduction of thrips population after imposing the first spray was highest in commercial neem based formulation 1500ppm @ 600 ml/acre (77.12 %). This was followed by *B. bassiana* @ 800 g/acre (72.91 %), *V. lecanii* @ 800 g/acre (65.78 %), *M. anisopliae* @ 800 g/acre (62.45 %), *V. lecanii* @ 400 g/acre (61.88 %), *B. bassiana* @ 400 g/acre (61.33 %) and *M. anisopliae* @ 400 g/ha (53.11 %).

Second spray: Population of thrips one day before spray

3 DAS: At three days after imposing the treatments, the lowest population was recorded in commercial neem based formulation 1500 ppm @ 600 ml/acre (1.94 thrips/3 leaves), which was significantly superior than rest of the treatments followed by *M. anisopliae* @ 800 g/acre (3.12 thrips/3 leaves), *V. lecanii* @ 800 g/acre (3.16 thrips/3 leaves) and these treatments were at par with each other and significantly superior than rest of the treatments. **5 DAS:** At Five days after imposing the treatments, the lowest population was recorded in commercial neem based formulation 1500 ppm @ 600 ml/acre (0.82 thrips/3 leaves) followed by *M. anisopliae* @ 800 g/acre (1.02 thrips/3 leaves), *B. bassiana* @ 800 g/acre (1.14 thrips/3 leaves) and these treatments were significantly superior than rest of the treatments. **7 DAS:** Seven days after imposing the treatments, the lowest population was recorded in *B. bassiana* @ 800 g/acre (0.36 thrips/3 leaves) followed by *M. anisopliae* @ 800 g/acre (0.38 thrips/3 leaves) and these treatments found to be significantly superior than rest of the treatments.

Per cent reduction over control

The mean per cent reduction of thrips population after imposing the second spray was highest in commercial neem based formulation 1500 ppm @ 600 ml/acre (78.26 %). This was followed by *M. anisopliae* @ 800 g/acre (66.04 %), *V. lecanii* @ 800 g/acre (64.30 %), *B. bassiana* @ 800 g/acre (61.97 %), *M. anisopliae* @ 400 g/acre (60.10 %), *V. lecanii* @ 400 g/acre (51.00 %) and *B. bassiana* @ 400 g/acre (50.08 %).

Third spray: Population of thrips one day before spray

3 DAS: Three days after imposing the treatments, the lowest population was recorded in commercial neem based formulation 1500 ppm @ 600 ml/acre (1.82 thrips/3 leaves) which was significantly superior than rest of the treatments followed by *M. anisopliae* @ 800 g/acre (3.42 thrips/3 leaves), *B. bassiana* @ 800 g/acre (3.68 thrips/3 leaves), *V. lecanii* @ 800 g/acre (3.72 thrips/3 leaves), *V. lecanii* @ 400 g/acre (4.12 thrips/3 leaves), *B. bassiana* @ 400 g/acre (4.14 thrips/3 leaves) and these treatments were at par with each other. **5 DAS:** Five days after spraying of the biorationals, the lowest population was recorded in commercial neem based formulation 1500 ppm @ 600 ml/acre (0.72 thrips/3 leaves) which was significantly superior than rest of the treatments followed by *B. bassiana* @ 800 g/acre (1.18 thrips/3 leaves), *M. anisopliae* @ 800 g/acre (1.42 thrips/3 leaves), *M. anisopliae* @ 400 g/acre (1.84 thrips/3 leaves), *V. lecanii* @ 800 g/acre (1.92 thrips/3 leaves), and these treatment were at par with each other but significantly superior than the control which has recorded highest thrips population (7.48 thrips/3 leaves). **7 DAS:** At Seven days after imposing the treatments, the lowest population was recorded in *M. anisopliae* @ 800 g/acre (0.12 thrips/3 leaves) followed by *V. lecanii* @ 800 g/acre (0.22 thrips/3 leaves), *B. bassiana* @ 800 g/acre (0.26 thrips/3 leaves), commercial neem based formulation 1500 ppm @ 600 ml/acre (0.32 thrips/3 leaves), *M. anisopliae* @ 400 g/acre (0.48 thrips/3 leaves) and these treatments were significantly superior than rest of the treatments.

Per cent reduction over control

Overall mean per cent reduction

The overall mean per cent reduction after imposing first, second and third spray was highest in commercial neem based formulation 1500 ppm @ 600 ml/acre (78.51 %) followed by *B. bassiana* @ 800 g/acre (68.68 %), *M. anisopliae* @ 800 g/acre (66.58 %), *V. lecanii* @ 800 g/acre (66.02 %), *M. anisopliae* @ 400 g/acre (61.10 %), *V. lecanii* @ 400 g/acre (59.12 %), *B. bassiana* @ 400 g/acre (58.80 %). The biorationals in the decreasing order of their efficacy were commercial neem based formulation 1500ppm @ 600 ml/acre > *B. bassiana* @ 800 g/acre > *M. anisopliae* @ 800 g/acre > *V. lecanii* @ 800 g/acre > *M. anisopliae* @ 400 g/acre > *V. lecanii* @ 400 g/acre > *B. bassiana* @ 400 g/acre. These results are in confirmation with the findings of Chandrasekaran and Veeravel (1998) who recorded 53.00 per cent and 38.95 per cent reduction in *S. dorsalis* population by Achock (1% azardirachtin) and NSKE (5%) on *Capsicum annum* and chilli respectively. Halagatti (2006) reported NSKE @ 5% proved to be very effective against chilli thrips, *S. dorsalis* of rose under polyhouse conditions and among the botanicals evaluated against thrips NSKE 5% recorded the highest mortality of 82.6 per cent. Samota *et al* (2017) who reported NSKE 5% proved to be effective against chilli thrips than *B. bassiana* and *M. anisopliae.* Halagatti (2006) reported among different entomopathogenic fungi *V. lecanii* recorded the highest mortality of 82.5 and 80 per cent in pre-pupa and pupal stage at 60 DAT, followed by local strains of *B. bassiana*. Hadiya *et al*. (2016) who reported among different entomopathogenic fungi *B. bassiana* 0.4 per cent proved to be very effective against chilli thrips and recorded highest yield and highest net benefit ratio. Shanmugapriyan and Siby (2010) evaluated *M. anisopliae* 1% WP @ 3.75 g/l recorded 96.7 % mortality of tea thrips after 96 hours of treatments. Gouli *et al*. (2008) reported that formulations based on *B. bassiana* (Balsamo) Vuillemin, *M. anisopliae* (Metschnikoff) and *V. lecanii* (Zimmermann) have been reported to significantly reduce Western Flower Thrips populations in green house vegetable and floral crops. Thungrabeab *et al*. (2006) studied on onion thrips *Thrips tabaci* Lindeman (Thys., Thripidae) using different entomopathogenic fungi and showed that mortalities caused by *Metarhizium spp*. ranged from 23.5 % to 97.3 %. Ansari *et al*. (2007) found that *M. anisopliae* V 275 was more efficacious than chemical insecticides (imidacloprid, fipronil) in killing pupae of the western flower thrips. Karkar *et al*. (2014) noted the bio-efficacy of microbial insecticides against insect pests of brinjal and found that application of *M. anisopliae* and *L. lecanii* applied at 40 g/10 litres of water was effective against sucking pests.

Table 1: Evaluation of insecticides against capsicum thrips, *S. dorsalis* during *Rabi* 2018.

Sl. No.	Treatments	Dose (ml or g/acre)	No. of thrips/3 leaves											
			I spray				II spray				III spray			
			1 DBS	3 DAS	5 DAS	7 DAS	1 DBS	3 DAS	5 DAS	7 DAS	1 DBS	3 DBS	5 DBS	7 DBS
1	*Beauveria bassiana*	400	3.73 (2.06)	3.27 (1.94)b	1.23 (1.28)ab	0.73 (1.11)ab	4.56 (1.96)	4.24 (1.52)c	2.14 (1.17)ab	1.50 (1.35)c	4.66 (1.74)	4.14 (1.28)b	2.12 (1.28)b	1.40 (1.02)b
2	*Lecanicillium lecanii*	400	3.60 (2.02)	3.07 (1.89)b	1.20 (1.40)ab	0.80 (1.14)ab	4.43 (1.97)	4.02 (1.35)c	2.02 (1.02)ab	1.48 (1.22)c	4.23 (1.96)	4.12 (1.38)b	2.40 (1.22)b	1.28 (0.98)b
3	*Metarhizium anisopliae*	400	3.27 (1.94)	3.05 (1.90)b	1.23 (1.28)ab	0.80 (1.14)ab	5.16 (2.12)	4.22 (1.17)c	2.24 (1.22)c	0.58 (1.14)ab	4.92 (1.52)	4.24 (2.14)c	1.84 (1.33)b	0.48 (1.11)a
4	Commercial neem based formulation 1500ppm	600	3.87 (2.09)	1.93 (1.56)a	0.87 (1.28)a	0.40 (0.95)a	4.27 (2.01)	1.94 (1.11)a	0.82 (0.95)a	0.42 (0.98)ab	4.02 (1.91)	1.82 (1.02)a	0.72 (1.05)a	0.32 (1.08)a
5	*Beauveria bassiana*	800	3.47 (1.99)	3.20 (1.64)b	0.80 (1.39)a	0.40 (0.95)a	4.26 (2.06)	3.98 (1.17)c	1.14 (0.91)a	0.36 (1.05)a	4.02 (1.62)	3.68 (1.22)b	1.18 (1.11)b	0.26 (0.91)a
6	*Lecanicillium ecanii*	800	3.67 (2.04)	3.00 (1.87)b	1.07 (1.29)a	0.47 (0.98)a	4.42 (1.85)	3.16 (1.11)b	1.82 (1.08)b	0.42 (1.11)ab	4.12 (1.68)	3.72 (1.24)b	1.92 (0.98)b	0.22 (1.14)a
7	*Metarhizium anisopliae*	800	3.27 (1.94)	3.07 (1.89)b	1.13 (1.29)a	0.27 (0.88)a	4.53 (2.01)	3.12 (1.11)b	1.02 (1.05)a	0.38 (1.07)a	4.06 (1.25)	3.42 (1.96)b	1.42 (1.05)b	0.12 (1.08)a
8	Untreated control	--	3.60 (2.02)	4.27 (2.18)c	4.80 (1.73)c	5.00 (2.35)c	6.24 (2.64)	6.86 (2.86)d	7.42 (2.33)d	7.98 (2.82)d	4.74 (1.84)	6.76 (2.88)d	7.48 (2.35)c	8.24 (2.92)c
S.Em (±)		--	NS	**0.07**	**0.07**	**0.06**	NS	**0.13**	**0.10**	**0.10**	NS	**0.09**	**0.07**	**0.05**
CD @ 5 %		--		**0.23**	**0.21**	**0.19**		**0.41**	**0.30**	**0.30**		**0.28**	**0.21**	**0.14**

DBS – Day before spraying; DAS – Days after spraying, NS – Non significant, Figures in parentheses are square root transformed values

Table 2: Effect of different biorationals on Percent reduction of thrips, *S. dorsalis*

SI. No.	Treatments	Dose (ml or g/acre)	No. of thrips/3 leaves			
			I spray	II spray	III spray	Overall Mean per cent reduction
			Percent reduction over control	Percent reduction over control	Percent reduction over control	
1	*Beauveria bassiana*	400	61.33	50.08	63.87	58.80
2	*Lecanicillium lecanii*	400	61.88	51.00	64.47	59.12
3	*Metarhizium anisopliae*	400	53.11	60.10	70.09	61.10
4	Commercial neem based formulation 1500ppm	600	77.17	78.26	80.11	78.51
5	*Beauveria bassiana*	800	72.91	61.97	71.16	68.68
6	*Lecanicillium ecanii*	800	65.78	64.30	67.98	66.02
7	*Metarhizium anisopliae*	800	62.45	66.04	72.36	66.58
8	Untreated control	--	--	--	--	--

Conclusion

The study revealed that among different biorationals evaluated against thrips infesting capsicum showed that commercial neem based formulation of conc. 1500ppm was found to be most effective against thrips of capsicum followed by *B. bassiana* @800g/acre, *Metarhizium anisopliae* @ 800 g/acre and *V. leccanii* @ 800g/acre and also these biorationals recorded maximum percent reduction over control

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