RESEARCH ARTICLE

COMPARATIVE BIO-EFFICACY OF BIO-INSECTICIDE, *METARHIZIUM ANISOPLIAE* (METCHNIKOFF) SOROKIN AGAINST CHILLI THRIPS, (*SCIRTOTHRIPS DORSALIS* HOOD).

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Abstract: The field investigation was carried out during Kharif season of 2014-15 in the research farm of College of Agriculture, Indore (M.P.) in randomized block design with eight treatments and three replications with plant spacing of 45x60 cm on Pusa Jwala variety of chilli against thrips. Six repeated application of Metarrhizium annisoplae in the name of Met 52 with different doses at 10 days interval were made and it was also alternated with thiacloprid and different doses of fipronil 5 S C The treatments were named as T_{1-} Untreated control, T_{2-} Fipronil 5 SC @ 1000 ml/ha and alternated with Thiacloprid 21.7 SC @ 300 ml/ha, T_{3-} Met52@ 250ml/ha foliar spray, T_{4-} Met52@ 500ml/ha foliar spray T_{5-} Met52@ 1000ml/ha foliar spray, T_{6-} Met52@250ml/ha foliar spray alternated with Fipronil 5 SC @ 850 ml/ha, T_{7-} Met52@ 500ml/ha foliar spray alternated with Fipronil 5 SC @ 900 ml/ha and T_{8-} Met52@ 1000ml/ha foliar spray alternated with Fipronil 5 SC @ 950 ml/ha The population of thrips was counted at ten days interval on five tagged plants from each plot and five leaves from each plant with the help of 10X magnifying lens. Overall population reduction was calculated based on pre treatment observation and last observation of final spray. The overall highest population reduction was also calculated in T5 (99.63%), and followed with T4 (99.27%). T3 (98.65%), T8 (97.36%), T7 (96.45%), T6 (95.13%) and T2 (85.52%). The highest dried chilli yield with highest cost benefit ratio was noted in T5 (2256kg/ha. and 2.34) and differed significantly with all the treatments.

Keywords: Alternation, Bio-insecticide efficacy, Chilli, insecticides, Metarrhizium *annisoplae, Scirtothrips dorsalis*

INTRODUCTION

The main constraints for low productivity of inferior fruit quality in chilli are due to ravages caused by insect pest irrespective of seasons and geographic locations. The leaf curl symptoms of chilli are caused by thrips (*Scirtothrips dorsalis* Hood) and mites (*Polyphagotarsonemus latus* Bank) beside virus attack (Naitam *et. al*. 1990). The symptoms produced by mites, thrips and virus are in general similar but, they distinctly differ from each other under critical observation (Karmakar, 1995).

Thrips, *Scirtothrips dorsalis* Hood (Thripidae: Thysanoptera) is considered as the most serious and important pest (Krishna Kumar *et al.*, 1996). The yield losses 60.5 to 74.3 per cent of green chilli due to thrips were estimated by Patel and Gupta (1998) at Udaipur (Rajasthan). Patel and Gupta (1992) also reported that thrips *S. dorsalis* was responsible for causing leaf curling in chilli. The infested leaves curled upward (adaxially) presenting a boat shaped appearance. Similarly Reddy and Puttaswamy, 1983 also reported that in infested field of chilli the affected leaves and fruits are deformed, twisted, brittle and crumpled.

Presently the management of chilli thrips is becoming serious menace after many sprays of chemical insecticides. Increased number of sprays also increased the cost of cultivation making cultivation of chilli highly risky. Additionally pesticidal sprays became a threat to chilli ecosystem causing problems of resistance, resurgence of pests, pesticides residue and menace to natural enemy fauna (David, 1986). Recently emphasis has been given on bio control management system but application of bio control agents did not show significant effect against the pest. Viewing the above situations the experiment was planned to test the *Metarrhizium annisoplae* in alternation with other effective insecticides against chilli thrips.

MATERIALS AND METHODS

The experiment was conducted in *Kharif* season of 2014-15 in the research farm of College of Agriculture, Indore (M.P.) in randomized block design with eight treatments and three replications with plant spacing of 45x60 cm on Pusa Jwala variety of chilli, transplanted on 17th July, 2014 with net plot size of 3.15 m. X 3 m. The treatments were applied as T_{1-} Untreated control, T_{2-} Fipronil 5 SC @ 1000 ml/ha and alternated with Thiacloprid 21.7 SC @ 300 ml/ha.(3+3 applications), T_{3-} Met52@ 250ml/ha foliar spray x 6 applications, T_{4-} Met52@ 500ml/ha foliar spray x 6 applications, T_{5-} Met52@ 1000ml/ha foliar spray x 6 applications, T_{6-} Met52@250ml/ha foliar spray alternated with Fipronil 5 SC @ 850 ml/ha (3+3 applications), T_{7-} Met52@ 500ml/ha foliar spray alternated with Fipronil 5 SC @ 900 ml/ha (3+3 applications) and

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T_{8}- Met52@ 1000ml/ha foliar spray alternated with Fipronil 5 SC @ 950 ml/ha (3+3 applications). Six foliar applications were made at 10 days interval with knapsack sprayer fitted with a duromist nozzle with 500 liter water per hectare. All the agronomical practices were applied as per the recommendations. The population of thrips was counted before and after ten days interval on five tagged plants from each plot and five leaves from each plant i.e. two leaves from top, two from middle and one from lower portion of the plant with the help of 10X magnifying lens. After last observation, overall population reduction was calculated based on pre treatment observation. The dried fruit yield (Kg/ha) was recorded and cost benefit ratio was worked out.

RESULTS AND DISCUSSION

Thrips population

From overall findings, it was revealed that all the treatments (table1) differed significantly with untreated check. After first spray T5- Met52 (*Metarhizium anisopliae*) @ 1000ml/ha foliar spray alternated with fipronil 5 SC @ 950 ml/ha. reduced maximum thrips population (2.20/leaf) and differed non significantly with all the treatments except T2- fipronil 5 SC @ 1000 ml/ha alternated with thiacloprid 21.7 SC @ 300 ml/ha (3.20/leaf), The trend of effectiveness was recorded as T4- Met52@500 ml/ha alternated with fipronil 5 SC @ 900 ml/ha (2.30) and T3- Met52@500 ml/ha alternated with fipronil 5 SC @ 850 ml/ha (2.30) > T7- Met52@ 500 ml/ha (2.60) > T8- Met52@ 1000 ml/ha (2.66) > T6- Met52@ 250 ml/ha (2.70) > T2- (3.20). After second, third and fourth sprays the least population was noted in T5 and found at par with T4 and T3. After fifth spray the least population was observed in T5 (0.05) and found at par with T4 (0.09), T3 (0.13) and T8 (0.22). After sixth and last spray again except T2, all the treatments showed no significant difference but least thrips population was noted in T5 (0.02) followed by T4 (0.04). T3 (0.07), T8 (0.17), T7 (0.22) and T6 (0.29). The overall highest population reduction (table 2) was also calculated in T5 (99.63%) followed by T4 (99.27%). T3 (98.65%), T8 (97.36%), T7 (96.45%), T6 (95.13%) and T2 (85.52%). Finally the highest dose of Met52@ 1000ml/ ha alternated with highest dose of fipronil 5 SC @ 950 ml/ha proved highly effective in reducing the thrips population. The efficacy of fipronil was exhibited by Reddy *et al.,* (2007) reported that fipronil 5% SC @ 2ml and 0.01%, was the best treatment against chilli thrips in reducing the population. Similar findings were also reported by Mahalingappa *et al*., (2008). Reddy and Sreehari (2009) noticed that fipronil 80 WG @ 50 g.*a.i*./ha and lower dose @ 40 g.*a.i*./ha found effective to reduce thrips population. Ghosh *et al.* (2009) also recorded the lowest population of chilli thrips (*Scirtothrips dorsalis* Hood) with the application of. fipronil @ 100 g.*a.i../*ha. Nayak *et al.,* (2014) reported that fipronil found to be effective insecticide in minimizing the incidence of chilli thrips. These researchers exhibited the highest efficacy of fipronil with different doses and supported the present study. The effectiveness of *Metarhizium anisopliae* was reported by Ansari *et al*., (2007) and found more effective than chemical insecticides in killing pupae of the western flower thrips. Further, Arthurs *et al*., (2013) found in laboratory assays that four applications of *M. brunneum* F52 against chilli thrips, *Scirtothrips dorsalis* Hood, reduced thrips populations over 10 weeks. Visalakshy *et al*., (2012) suggested that entomopathogens including *M. ansiopliae* can substitute chemical pesticides in the management of *Thrips tabaci* in onion. Similarly Thungrabeab *et al.,* (2006) showed that mortalities of onion thrips *Thrips tabaci* . caused by *Metarhizium spp*. ranged from 23.5% to 97.3%. Karkar *et al., (*2014) also reported the efficacy of *M. anisopliae* and *L. lecanii* applied at 40 g/10 litres of water against sucking pests of brinjal. These findings exhibited that *Metarhizium anisopliae*is was effective in reducing the thrips and other sucking insect population which is in support of present investigation.

Yield and economics

The present study revealed (table 1) that highest dried chilli yield with highest cost benefit ratio was noted in T5 (2256kg/ha. and 2.34) and differed significantly with all the treatments followed by T4 (2114kg/ha and 2.16), T8 (1905kg/ha and 1.93), T2 (1895kg/ha and 1.88), T7 (1784kg/ha and 1.79), T3 (1745 kg/ha and 1.69), and T6 (1589kg/ha and 1.54). The findings of Nayak *et al.,* (2014) are in the line of agreement as they reported that fipronil was effective insecticides in minimizing the incidence of thrips and maximizing the yield and net return in chilli production. The partial support to the present study was noticed by Pandey *et al.* (2013) as they reported that lowest mean thrips population and the highest marketable yield by applying fipronil @ 1.5 ml/lt. resulting in the highest cost benefit ratio (1:11.55) leading to an arbitration of spraying fipronil @ 1.5 ml/lt. at fifteen days interval in *Rabi* onion. Hosamani *et al*., (2012), recorded the effectiveness of fipronil 80 WG in onion with minimum thrips population at three and ten days after spray with the highest yield of 29.16 t/ha. As far as the response of *Metarhizium anisopliae* is concerned Arthurs *et al*.,(2013) reported that the proportion of marketable fruit was significantly increased due to application of *M. brunneum* F52, *B. bassiana* GHA, and 2% SuffOil-X treatments against chilli thrips, *Scirtothrips dorsalis*. Naik and Shekharappa (2009) observed that the yield of okra was significantly higher in oil based formulation of *M. anisopliae* (38.80 q/ha) and *V. lecanii* (38.50 q/ha) with monitory returns of Rs. 14720 and Rs. 14480/ha,

respectively followed by *B. bassiana*. These findings are in close association with the present investigation. Further, thiacloprid was also tested in the alternation with fipronil which exhibited the least effectiveness. This might be due to change in climatic conditions and resistance against insecticides and indiscriminate use of insecticides by growers.

Table 1. Relative efficacy of treatments against thrips

Treatments	Pre treatment Population	Thrips population 10 days after						Chilli yield (Kg/ha)	C: B Ratio
		1st spray	2nd spray	3rd spray	4th spray	5th spray	6th spray		
T1	5.48 (2.44)	5.80 (2.51)	5.91 (2.53)	5.95 (2.54)	6.07 (2.56)	6.18 (2.58)	6.31 (2.60)	1178	-
T2	4.49 (2.23)	3.20 (1.92)	2.00 (1.58)	1.50 (1.41)	1.10 (1.26)	0.80 (1.14)	0.65 (1.07)	1895	1:1.88
T3	5.22 (2.39)	2.30 (1.67)	1.10 (1.26)	0.53 (1.01)	0.27 (0.87)	0.13 (0.79)	0.07 (0.75)	1745	1:1.69
T4	5.53 (2.45	2.30 (1.67)	0.90 (1.18)	0.40 (0.95)	0.20 (0.83)	0.09 (0.76)	0.04 (0.73)	2114	1:2.16
T5	5.46 (2.44)	2.20 (1.64)	0.70 (1.09)	0.28 (0.88)	0.13 (0.79)	0.05 (0.74)	0.02 (0.72	2256	1:2.34
T6	5.96 (2.54)	2.70 (1.78)	1.90 (1.55)	0.90 (1.18)	0.70 (1.09)	0.35 (0.92)	0.29 (0.88)	1589	1:1.54
T7	6.21 (2.59)	2.60 (1.76)	1.80 (1.51)	0.77 (1.13)	0.59 (1.04)	0.27 (0.87)	0.22 (0.84)	1784	1:1.79
T8	6.45 (2.63)	2.66 (1.77)	1.80 (1.51)	0.75 (1.12)	0.55 (1.02)	0.22 (0.84)	0.17 (0.81)	1905	1:1:93
S Em±		0.09	0.06	0.06	0.06	0.04	0.05	29.494	
CD at 5 % (p=0.05)		0.26	0.20	0.18	0.18	0.12	0.16	89.47	
CV		8.24	7.34	7.88	8.72	6.24	8.86	8.477	

The values in parentheses are square root transformed values

Treatments detail

T1- Untreated control
T2- Fipronil 5 SC @ 1000 ml/ha alternated with thiacloprid 21.7 SC @ 300 ml/ha
T3- Met52@250 ml/ha alternated with fipronil 5 SC @ 850 ml/ha
T4- Met52@500 ml/ha alternated with fipronil 5 SC @ 900 ml/ha
T5- Met52@1000 ml/ha alternated with fipronil 5 SC @ 950 ml/ha
T6- Met52@ 250 ml/ha
T7- Met52@ 500 ml/ha
T8- Met52@ 1000 ml/ha

Table 2. Relative reduction of thrips population in different treatments after 10 days of sprays

Treatments	1st Spray	2nd spray	3rd spray	4th spray	5th spray	6th spray	Overall population reduction (%)
T1							
T2	71.26	37.50	25.00	26.66	27.27	18.75	85.52
T3	55.93	52.17	51.81	49.05	51.85	46.15	98.65
T4	58.40	60.86	55.55	50.00	55.00	55.55	99.27
T5	59.70	68.18	80.40	53.57	61.53	60.00	99.63
T6	54.69	16.29	52.63	22.22	50.00	17.14	95.13
T7	58.13	30.76	57.22	23.37	54.23	18.51	96.45
T8	58.75	32.33	58.33	26.66	60.00	22.72	97.36

Treatments detail

T1- Untreated control
T2- Fipronil 5 SC @ 1000 ml/ha alternated with thiacloprid 21.7 SC @ 300 ml/ha
T3- Met52@250 ml/ha alternated with fipronil 5 SC @ 850 ml/ha
T4- Met52@500 ml/ha alternated with fipronil 5 SC @ 900 ml/ha
T5- Met52@1000 ml/ha alternated with fipronil 5 SC @ 950 ml/ha
T6- Met52@ 250 ml/ha
T7- Met52@ 500 ml/ha
T8- Met52@ 1000 ml/ha

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