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Research Article

Management of chilli thrips *Scirtothrips dorsalis* (Hood) (Thysanoptera: Thripidae) in chilli crop

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Abstract

Evaluation of different management tactics against chilli thrips *Scirtothrips dorsalis* was carried at Agricultural Research Institute, Tarnab during 2016. Experiment was carried out in Randomized Complete Block Design (RCBD) with three replications. Six control measures i.e Solvigo 108SC, Confidor 200SC, *Chrysoperla carnea*, *Parthenium hysterophorus* 7%, Combination-1 (*P. hysterophorus* 7% extract + *C. carnea*) and Combinaion-2 (*P. hysterophorus* 7% extract + Pest Oil@500 ml ha^{-1}) including control were applied twice at 30 days interval. Results revealed that all the tested control measures were found to be superior than control however in both the spray application Solvigo was found to be the most effective in reducing nymphal and adult thrips infestation with (1.79, 2.83) nymphal and (0.49, 0.85) adult population, followed by Confidor after first and Second spray respectively. *C. carnea* alone did not give significant control of thrips as compared to the plot where *C. carnea* were applied in combination with botanicals. Highest yield was obtained from the plots treated with Solvigo while the lowest yield was recorded from Control (untreated plots). It was concluded that Solvigo and Confidor were found to be better in managing chilli thrips infestation and can be incorporated in IPM programs against chilli thrips.

Keywords: Chilli thrips; Synthetic insecticide; Thrips management

Introduction

Chilli is an important commodity in the current time with its diverse qualities of providing vitamins, boasting the immune system, lower cholesterol level and is also helpful in getting rid of parasites of gut **[1]**. Chilli crop is attacked by many insect pests causing considerable loss in yield. Among them chilli thrips, *Scirtothrips dorsalis* is one of the major pest of chilli crop causing more than 25% damages under higher density attack **[2]**. Chilli thrips attacks foliage, with both adults and larvae preferentially feeding on young leaves, buds, and fruits. Feeding causes distortion and discoloration, and severe infestations can lead to defoliation and stunted growth **[3]**. In a severe pest attack the appropriate control measure is the application of insecticides with multiple applications **[4]**. *C. carnea* is a predator of wide range of soft

bodied insect pest in Pakistan and belong to family Chrysopidae and order Neuroptera [5]. Larvae of *C. carnea* feed on thrips, jassids and whitefly and causes intermediate reduction in its population [6]. Chemical insecticide imidacloprid belong to neonicotinoid an insecticides class, effectively managed the chilli thrips population [7]. Apart from chemical control biocontrol agents such as minute pirate bugs, *Oriusspp* and the phytoseiid mites *Neoseiulus cucumeris* and *Amblyseius swirskii* and herbal extracts are also termed effective in controlling the pest population [8, 9]. Hence the present study is an attempt to develop an IPM strategy to manage chilli thrips infestation.

Materials and methods

To study the effect of different treatments against chillithrips was conducted at Agriculture Research Institute (ARI) Tarnab, Peshawar during 2016. The experiment was conducted in randomized complete block design with three replications. Nursery of China Shimla variety was collected from local market, the field was prepared for transplantation of chilli crop according to standard agronomic practices. Transplantation of nursery was done in 2nd week of March 2016 with total experimental area of 405m^2, divided into three blocks and each block was divided into seven plots. Size of each plot was 3×5 m^2 with buffer zone of 1 meter. Treatments included Solvigo 108SC (Abamectin 3.6% and Thiamethoxim 7.2%), Confidor 200SC (Imidacloprid), Herbal weed extract (*P. hysterophorus*) 7 %, Combination-1 [herbal extract (*P. hysterophorus*) 7 % + *C. carnea* (1000 eggs ha^{-1})], Combination-2 [herbal extract (*P.hysterophorus*) 7 % + Pest oil (500 ml ha^{-1})] and control. All the control measures were applied twice with 3 weeks interval. Data were recorded on number of (nymph and adult/plant) thrips on randomly selected 15 plants in each plot after 24, 48, 72 hours and one week interval. Mean data on thrips nymph and adults were then subjected to computer software Statistix Ver 8.1 for analysis. Formula used during the experiment;

$$\text{Avoidable losses (\%)} = \frac{A - B}{A} \times 100$$

A= Total Yield of a Treated Yield

B= Yield of control plot

Results and discussion

Effect of different control measures on nymphal population of thrips in chilli crop during 2016

Table 1 shows the effect of different treatments on nymphal population of chilli thrips recorded after (24, 48 and 72) hours and 1 week. In first spray application Solvigo was found to be the most effective insecticide with the least mean population of (1.79) thrips plant^{-1} followed by Confidor (1.94), Combination-1 (4.43), Combination-2 (4.48), *P. hysterophorous* (5.22) and *C. carnea* (8.10) thrips plant^{-1}. Similar trend has been observed during the second course of application of control measures in minimizing the pest population Solvigo (2.83) having the most impact followed by Confidor (3.17), Combination-1 (5.32), Combination-2 (6.56), *P. hysterophorous* (6.97) and *C. carnea* (9.18) thrips plant^{-1}. Our results showed that chemical application reduced the pest population significantly which results in a similar pattern with that of [10]. They applied different chemicals to apprehend the chillithrips attack in the field. Imidaclropid being the second most successful chemical as compare to the other insecticides to control the population of thrips. [11] used Confidor and different other chemicals and botanical extract in order to minimize the harmful effects of chilli thrips. Confidor being the third most effective chemical in managing the population of thrips while botanical extracts i.e. neem appeared to be an effective control measure in this experiment as compared to control.

Our study is also coherence with **[12]**, they applied chemical similar to Salvigo in chemical structure and method of application and found that management of chillithrips through chemicals is quite effective, and 90% control was achieved in comparison to the untreated plot. It was also noted that nymph population of thrips before 1st spray is quite low as compare to nymph population before 2nd spray because the population reaches its peak in April-May, **[13]** also recorded same pattern in population dynamics of thrips.

Effect of different control measures on adult population of thrips in chilli crop during 2016

Table 2 shows the effect of different treatments on adult population of chilli thrips noted after (24, 48 and 72) hours and 1 week. Solvigo was found to be the most effective insecticide with the least thrips infestation of (0.49) thrips plant^{-1} followed by Confidor (1.47), Combination-2 (4.10), Combination-1 (4.63), *P. hysterophorous* (4.72) and *C. carnea* (7.52) thrips plant^{-1}. Similar trend has been observed during the second course of application of control measures in minimizing the pest population Solvigo (0.85) having the most impact followed by confidor (1.94), Combination-2 (3.90), Combination-1 (4.61), *P. hysterophorous* (5.23) and *C. carnea* (7.87) thrips plant^{-1}. Our research study showed that *C. carnea* was less effective to control chilli thrips. This could be due to *C. carnea* is least acive at high temperatures, which results in the lower outcome of its abilities to enhance the integration measures to control chilli thrips. Our results were also supported by **[14]** as they reported that *C. carnea* is effective between 28-32^{o}C and with the rise in temperature had an adverse impact on the ability of *C. carnea* to predate. Our study also showed that *C. carnea* less much effective this is may be due to the reason that lower number of eggs (1000 eggs ha^{-1}) installed in the field couldn't provide significant control of the pest. **[15]** Conducted field experiment comprising of *C. carnea* (1500 eggs ha^{-1}) against thrips and reported that *C. carnea* proved to be effective in reducing pest population. **[16]** Also reported that with *C. carnea* is effective against thrips if used in a combination with other tactics could yield appreciating results. **[17]** Applied several plant extracts including *P. hysterophorous* against thrips and reported that it provided significant control of the pest. Pest oil applied during the experiment also performed well in combination with biopesticide and revealed that synergist can be helpful when used in combination. Similar observation were also made by **[18]** that plant extracts used in combination with pesticide can aid in reducing the population of various insects. Also population of adult is low as compare to nymph population of thrips because of the effective pesticide application, it is also recorded that nymph stage is more susceptible to pesticide application than adult stage even at the same dose. Our results can be compared with that of **[13]** who reported that treatment with pesticide can effectively reduce the population of thrips. **[19]** Also recorded that application of insecticide can readily reduce the population of thrips.

Table1. Effect of different control measures on nymphal population of thrips in chilli crop during 2016

Treatments	Nymph population plant^{-1}									
	1st spray application					2nd spray application				
	24hours	48hours	72hours	1 week	Means	24hours	48hours	72hours	1week	Mean
Solvigo	1.37	1.51	1.82	2.46	1.79 d	2.53	2.60	2.93	3.29	2.83 e
Confidor	1.49	1.62	2.06	2.58	1.94 d	2.69	2.73	3.13	4.13	3.17 de
C. carnea	7.71	8.02	7.60	9.06	8.10 b	8.00	8.53	8.16	12.02	9.18 b
P. hysterophorus	4.15	4.15	5.57	7.02	5.22 c	5.13	5.53	6.33	10.91	6.97 bc
Combination-1	4.04	4.04	3.37	6.26	4.43 c	5.08	5.30	5.60	10.26	6.56 c
Combination-2	4.18	4.18	4.22	5.35	4.48 c	5.09	5.26	5.53	5.40	5.32 cd
Control	14.84	15.13	15.62	17.26	15.71a	15.75	16.06	17.10	18.27	16.79 a
Means	5.40 b	5.52 b	5.75 b	7.14 a		6.32 b	6.57 b	6.97 b	9.18 a	
LSD (Treatments)	1.48					2.40				

Means with similar alphabets within rows and columns are non-significantly different at 0.05 level of probability

*Combination-1 [herbal extract (P. hysterophorus) 7 % + C. carnea (1000 eggs ha^{-1})]

*Combination-2 [herbal extract (P. hysterophorus) 7 % + Pest oil (500 ml ha^{-1})]

Table 2. Effect of different control measures on adult population of thrips in chilli crop during 2016

Treatments	Adult population plant^{-1}									
	1st spray application					2nd spray application				
	24hours	48hours	72hours	1week	Means	24hours	48hours	72hours	1week	Mean
Solvigo	0.15	0.24	0.42	1.15	0.49d	0.15	1.16	1.02	1.07	0.85 d
Confidor	0.26	1.31	2.30	2.01	1.47d	1.54	1.25	2.08	2.90	1.94 d
C. carnea	5.80	8.44	8.42	7.43	7.52b	5.96	8.26	7.82	9.44	7.87 b
P. hysterophorus	3.61	4.13	5.19	5.94	4.72c	3.74	5.24	5.24	6.69	5.23 c
Combination-1	3.11	5.51	5.36	4.54	4.63c	3.03	5.11	3.73	6.56	4.61 c
Combination-2	3.17	4.31	4.69	4.23	4.10c	3.00	4.69	3.78	4.13	3.90 c
Control	9.40	12.09	11.65	14.81	11.99a	10.56	12.00	11.33	12.95	11.71 a
Means	3.64b	5.14a	5.43a	5.73a		4.00 c	5.39 ab	5.00 bc	6.25 a	
LSD (Treatments)	1.56					1.47				

Means with similar alphabets within rows and columns are non-significantly different at 0.05 level of probability

*Combination-1 [herbal extract (*P. hysterophorus*) 7 % + *C. carnea* (1000 eggs ha^{-1})]

*Combination-2 [herbal extract (*P.hysterophorus*) 7 % + Pest oil (500 ml ha^{-1})]

Effect of different treatments application on yield and % avoidable losses

Table 3 revealed that application of different treatments had a prominent impact on population of thrips which resulted significant differences in yield. Highest yield was recorded from Solvigo (13244 kg ha^{-1}) followed by Confidor (11956 kg ha^{-1}), Combination-2 (10311 kg ha^{-1}), Combination-1 (9778 kg ha^{-1}), *C. carnea* (7667 kg ha^{-1}) *P. hysterophorous* (8667 kg ha^{-1}) and control (6689 kg ha^{-1}). In yield highest percent avoidable losses were recorded in plot treated with insecticides Solvigo (49.49%) and Confidor (44.05%) followed by combination-2 (35.12%), combination-1 (31.59%), *P. hysterophorous*(22.82%) while lowest percent avoidable loss was in *C. carnea*(12.75%) compared with control plot. Results showed that insecticide used during the course of experiment suppressed the pest population significantly and enhanced crop yield while plots aided with *C. carnea* being the least effective in increasing the yield. **[20]** Reported significant higher yield from plot which were treated with synthetic insecticide and herbal extracts. **[21]** Used herbal and insecticide in combination and also reported high yield in combination treatments. **[22]** Applied different herbal extracts and chemical insecticides on onion crop and reported maximum yield in plots where chemical insecticides and herbal extracts are applied.

Table 3. Effect of different treatments application on yield and avoidable losses

Treatments	Yield (Kg ha^{-1})	Avoidable loss (%)
Solvigo	13244 a	49.49
Confidor	11956 b	44.05
C. carnea	7667 e	12.75
P. hysterophorus	8667 d	22.82
Combination-1	9778 c	31.59
Combination-2	10311 c	35.12
Control	6689 f	
LSD(0.05)	0.58	

Means with similar alphabets within rows and columns are non-significantly different at 0.05 level of probability
*Combination-1 [herbal extract (*P. hysterophorus*) 7 % + *C. carnea* (1000 eggs ha^{-1})]
*Combination-2 [herbal extract (*P.hysterophorus*) 7 % + Pest oil (500 ml ha^{-1})]

Conclusion

It is concluded that all treatments showed tendency to reduce population of chilli thrips when compared with control. Maximum yield were observed in solvigo followed by confidor, while the least effective treatment was *P. hysterophorus*. Bio agent (*C. carnea*) also controls the population effectively but was less efficient than the insecticides. On the basis of present study it is recommended to apply Solvigo in combination with Confidor for effective control of chilli thrips.

Author's contributions

Conceived and designed the experiments: M Shah & M Yousuf, Performed the experiments: A Usman, Analyzed the data: J Iqbal & RA Shah, Wrote the paper: J Sarwar.

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