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Integration of chemical botanical and microbial insecticides for control of thrips, *Scirtothrips dorsalis* Hood infesting chilli

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ABSTRACT

A field experiment was conducted during winter season of 2004-05 and 2005-06 to evaluate the effectiveness of different conventional & eco-friendly insecticide (synthetic and biological origin) against thrips (*Scirtothrips dorsalis* Hood) infesting chilli (*Capsicum frutescens)*. The effectiveness of four insecticides acetamiprid 0.004% (Dhanpreet – 20% SP), thiamethoxam 0.005% (Avant-25% WG), neem pesticide 0.4% (ultineem 1% W/W) and *Bacillus thuringiensis*, subsp. kurstaki (BT) at gL^{-1} was evaluated in the field of Coastal Saline Zone of West Bengal against thrips. It is evident from the result of present investigation that acetamiprid and thiamithoxam were most effective to minimize the thrips population 93.3% and 89.93% respectively. Neem pesticide (54.2%) and microbial pesticide BT (43.43%) were found moderately effective. However, two sprays of acetamiprid and thiamethoxam followed by two sprays of neem pesticide and BT proved to be effective for management of thrips and it gave highest marketable yield, higher cost benefit ratio and percent reduction in thrips' population.

Introduction

Chilli (*Capsicum frutescens* L.) is one of the versatile spice and vegetable crops grown in West Bengal. It is used as vegetable, spice, condiment, sauce, pickles and medicine. Among the various factors responsible for low yield of chilli, the insect pests are of prime importance, which significantly affect the production that varied from 60.5 to 74.3 percent. Chilli crop is infested with thrips starting from seedling stage in nursery to harvesting of crop in field. The major symptom associated with chilli thrips is upward curling of leaves with wrinkles.

The present agricultural scenario in India indicates that it is very difficult to manage insect pests without use of chemical pesticides. However, we can atleast minimize the use of chemical pesticides by replacing them botanical and microbial pesticides for producing healthy and good quality crop. Keeping in these view, studies were carried out to evaluate the newer insecticides like acetamiprid, thiamethoxam and their combination with botanical and microbial pesticides for the management of thrips infesting chilli.

Material and Methods

The field trials were conducted at Regional Research Station of Bidhan Chandra Krishi Viswavidyalaya, Kakdwip during winter season of 2004-05 and 2005-06. The experiment was laid out in a Randomized Block Design (RBD) with 10 treatments and three replication including untreated check or control. Thirty-day-old seedlings of chilli variety 'Beledanga' were transplanted in each treatment with plot size 2.5×1.8 m with 50×50 cm spacing. Four consecutive sprays were done at fifteen days interval, starting from one month after transplanting, to minimize the protection cost, residual effect on consumer, development of resistance in insect and environmental hazards.

Observations on the target pest population were reckoned one day before spraying, and after three and ten days of spray. During observation such five plants were selected randomly from each plot and three leaves (top, middle and bottom) from each plant were selected. The average percent reduction of pest population after 15 days of all four sprays was worked out using the Henderson and Tilton[1] formula described as under:

Percent reduction = $100\ (1 - Ta \times Cb / Tb \times Ca)$

Where, Ta = number of insects in treated plot after insecticide application.

Tb = number of insects in treated plot before insecticide application.

Ca = number of insects in untreated check after insecticide application.

Cb = number of insects in untreated check before insecticide application.

The percent reductions were transformed to angular values from which analysis of variance was calculated for determining critical difference (CD) at 5 percent level of significance.

The green chilli yield and number of chilli per plant was recorded treatment wise at each picking and two years data were pooled and subjected to statistical analysis. These data were also used to work out the economics of different insecticidal treatment by taking into consideration application cost (labour charges and cost of insecticides) and the market price of marketable additional green chilli obtained in different treatments.

Results and Discussion

It is evident from Table 1 that acetamiprid and thiamethoxam and those followed by neem pesticide and BT were most effective against thrips as there was a higher percent reduction in the population of thrips (78.9 to 93.3%). Neem pesticide (ultineem) and Bt and there combination were moderately effective against thrips (43.4 to 51.4%). In control plot thrips population were increased 45.96% on third day and 62.5% on tenth day. After final observation the mean of four sprayings were recorded. The population reduction was recorded with acetamiprid ranked first followed by the thiamethoxam. All the chemicals significantly reduced thrips population over control. Different type of sucking pests such as thrips, jassids, white flies and aphids are highly susceptible to this group of chloronicotinyl insecticide. Vastrad[5] reported that thiamethoxam is very effective against aphids, white fly and green bug. Jayewar *et al.*[2] conducted an experiment to record the bio-efficacy of acetamipride against sucking pests of chilli.

Other chemicals such as neem pesticides followed by microbial pesticides (Bt) were highly effective against the thrips whereas plant product alternative with microbial pesticides were safer[4].

The highest yield of green chilli fruit (40.5 $q.ha^{-1}$), higher cost benefit ratio of 1 : 16.97 alongwith highest reduction of thrips was recorded with acetamiprid followed by thiamethoxam (33.1 $q.ha^{-1}$) (Table 2). It was comparable to that of accetamiprid and thiamethoxam followed either by neem pesticide or microbial pesticide.

The descending order of effectiveness of various treatment in managing chilli thrips in present studies was four sprays of accetamiprid > four sprays of thiamethoxam > two sprays of acetameprid + two sprays of neem pesticide > two sprays of thiamethoxam + two sprays of neem pesticide > two sprays of acetamiprid + two sprays of Bt > two sprays of thiamethoxam + two sprays of Bt > four pesticide of neem pesticide > two sprays of neem + two sprays of Bt > four sprays of Bt.

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Table 1

Effect of different insecticidal (synthetic & biological origin) spray schedules on their formation of thrips, *S. dorsalis* on chilli and on its yield

Treatments	Dose	Av. No. of thrips before spraying	% reduction/increase (+) of thrips /leaf after spray at various interval		Pooled mean % of reduction/increase (+)	% reduction over control	No. of fruits per plant	Yield (q/ha)
			3 days	10 days				
T_1= Acetamipride	0.004%	6.05	98.3 *(82.5)	88.3 (69.99)	93.3 (74.99)	95.72	62.0	40.5
T_2= Thiamethoxam	0.005%	5.45	93.4 (75.11)	86.5 (68.44)	89.93 (71.49)	93.49	50.16	33.16
T_3= Neem	0.4%	5.56	61.86 (51.86)	46.6 (43.05)	54.2 (47.4)	70.29	35.18	23.08
T_4= B.T.	1gL^{-1}	5.66	49.26 (44.57)	37.6 (37.82)	43.43 (41.22)	63.31	31.6	22.08
T_5= Acetamipride + neem	0.004%+ 0.4%	5.00 (70.99)	89.4 (66.11)	83.6 (69.23)	87.43	91.84	47.5	30.16
T_6= Acetamipride + BT	0.004% + 1gL^{-1}	5.85 (67.78)	85.7 (64.01)	80.8 (65.82)	83.23	89.13	43.0	26.66
T_7= Thiamethoxam + neem	0.005% + 0.4%	5.00 (71.28)	89.7 (64.23)	81.1 (67.53)	85.4	90.54	47.06	27.33
T_8= Thiamethoxam + B.T.	0.005%+ 1gL^{-1}	6.04 (64.3)	81.2 (61.07)	76.6 (62.67)	78.93	86.34	41.5	25.66
T_9= Neem + BT	0.4%+ 1gL^{-1}	5.38 (46.41)	52.46 (45.17)	50.3 (45.8)	51.4	60.47	36.7	22.75
T_{10}= Control		6.08 (0.00)	+ 45.96 (0.00)	+ 62.5 (0.00)	+ 54.23		20.16	17.5
S. Em		NS	3.23	1.77	1.42		6.77	4.89
CD at 5%			9.6	5.25	4.22		20.11	14.53

*Figures in parenthesis are angular transformed values NS – Not significant.

**Pooled data of 2004-05 and 2005-06

Table 2
Economics for management of thrips infesting chilli

Treatments	No. of spray	Total insecticide required	Total cost of insecticide Rs./ha	Labour charges Rs./ha	Total cost of plant Protection Rs./ha	Yield (Kg.ha^{-1})	Net gain over control (Kg.ha^{-1})	Value of additional produce	Net Profit Rs./ha	Cost benefit ratio
T_1 = Acetamipride	4	0.4kg	1300	1260	2560	4050	2300	46000	43440	1 : 16.97
T_2 = Thiamethoxam	4	0.4 kg	2000	1260	3260	3316	1566	31320	28060	1 : 8.61
T_3 = Neem	4	4L	1520	1260	2780	2308	558	11160	8380	1 : 3.01
T_4 = B.T.	4	2 kg	2000	1260	3260	2208	458	9160	5900	1 : 1.81
T_5 = Acetamipride + neem	2 + 2	0.2 kg + 2L	1410	1260	2670	3016	1266	25320	22650	1 : 8.48
T_6 = Acetamipride + BT	2 +2	0.2 kg + 1 kg	1650	1260	2910	2666	916	18320	15410	1 : 5.30
T_7 = Thiamethoxam + neem	2 + 2	0.2 kg + 2 L	1760	1260	3020	2733	983	19660	16640	1 : 5.51
T_8 = Thiamethoxam + B.T.	2 + 2	0.2 kg + 1 kg	2000	1260	3260	2566	816	16320	13060	1 : 4.01
T_9 = Neem + BT	2+ 2	2L + 1 kg	1760	1260	3020	2275	525	10500	7480	1 : 2.48
T_{10} = Control						1750				

500 litre spray solution required for spray of one ha.
Labour charges Rs. 70/- per day × 3 labour per ha Rs. 210/- per spray of one ha.
Price of green chilli Rs. 20/- per kg.