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Phytotoxic effect and efficacy of chemical insecticides used for management of mulberry thrips on natural enemy (Coccinellid) population

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Abstract

In the present investigation, attempt was made to find out phytotoxic effect and impact on natural enemies using chemical insecticides for the management of mulberry thrips, *Pseudodendrothrips mori*. Data was recorded on phytotoxicity on mulberry and safety to natural enemies. Among the insecticides, fipronil 5 SC @ 2 ml/l, Imidacloprid 17.8 SC @ 0.3 ml/l and Dimethoate 30 EC @ 2 ml/l were found non phytotoxic to mulberry and safer to natural enemies of thrips. On contrary Acetamiprid 20 SP @ 0.2g/l and acephate 75 SP @ 1g/l exhibited phytotoxicity and impact on natural enemies.

Keywords: Phytotoxicity, natural enemies, mulberry thrips

Introduction

Sericulture is an agro based industry and an integral part of rural economy in India. The production of good quality leaves in required quantity is influenced by pests, diseases, weeds and others (Govindaiah *et al.* 2005) [2]. Earlier good number of methods were adopted for the management of mulberry thrips like cultural, physical, rising of pest resistant/tolerant variety, biological and chemical methods (Reddy and Narayanaswamy 1999) [6] and through IPM approach (Singh and Sarathchandra 2011) [9]. As traditional methods of pest management were tedious and time consuming and it is the need of hour to use chemical insecticide for the better management of mulberry thrips with production good quality and quantity of mulberry leaves and also without effecting natural enemies of thrips

Materials and Methods

The investigation on “Management of mulberry thrips through chemical insecticides and their impact on silkworm rearing performance” was conducted during 2020-21, at the Department of Sericulture, University of Agricultural Sciences, GKVK, Bengaluru. The experimental site is located in the Eastern Dry Zone (zone-5) of Karnataka at 12°58' N latitude and 77°35' E longitude and at an altitude of 930 m above mean sea level.

Table 1: Experiment details

Crop	Mulberry
Variety	Victory-1(V1)
spacing	(90+150) *60 cm (paired row)
No. of treatments	7
No. of replications	3
Season	Summer 2021
Crop period	February-April 2021
Design	RCBD
Gross plot size	200.7m ²
Net plot size	116.4m ²

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Table 2: Treatment details

Treatment No.	Treatment	Dosage
T ₁	Acephate 75 SP	1.00 g / l
T ₂	Acetamiprid 20 SP	0.20 g / l
T ₃	Dimethoate 30 EC	2.00 ml / l
T ₄	Fipronil 5 SC	2.00 ml / l
T ₅	Imidacloprid 17.8 SC	0.30 ml / l
T ₆	Dichlorvos 76 EC (std check)	2.63 ml / l
T ₇	Control (water spray)	-

Observations recorded

Phytotoxicity on the treated plants

Phytotoxicity symptoms like leaf injury on tips or surface, wilting of the plants, vein clearing or discolouration on the leaves, epinasty, hyponasty and necrosis were taken into consideration and observations were made on these symptoms on 7th and 15th day after the second spray of insecticides. These symptoms were recorded based on the standard scoring method with 0-10 scale (Number of leaves showing phytotoxic symptoms per plant were taken into consideration) (Table 3).

Table 3: Standard scoring table of phytotoxicity

Scale	Percentage of phytotoxicity symptoms
0	None
1	0-10
2	11-20
3	21-30
4	31-40
5	41-50
6	51-60
7	61-70
8	71-80
9	81-90
10	91-100

Safety to natural enemies

The most predominantly found natural enemy of mulberry thrips found in the mulberry ecosystem is coccinellid beetle whose population was recorded pre and post application of chemicals, in order to understand the impact of spraying insecticides on their population. Pre-treatment count was recorded prior to spraying and post treatment count were recorded on 7th and 15th day after the spraying of insecticides. Coccinellid population was counted with the help of magnifying hand lens on fifteen plants in each treatment.

Results and Discussion

Table 4: Phytotoxic effect of chemical insecticides on mulberry (V-1) under field condition

Treatments		Phytotoxicity (Scoring method)			
		Necrosis		Epinasty	
		7 DAS	15 DAS	7 DAS	15 DAS
T ₁	Acephate 75 SP	0.67	1.33	0.33	0.67
T ₂	Acetamiprid 20 SP	1.33	2.67	0.67	1.00
T ₃	Dimethoate 30 EC	0.00	0.00	0.00	0.00
T ₄	Fipronil 5 SC	0.33	0.67	0.00	0.00
T ₅	Imidacloprid 17.8 SC	0.00	0.00	0.00	0.00
T ₆	Dichlorvos 76 EC	0.00	0.00	0.00	0.00
T ₇	Control (Water spray)	0.00	0.00	0.00	0.00
F- test		*	*	NS	*
S. Em. ±		0.230	0.212	0.171	0.126
CD @ 5%		0.709	0.653	0.526	0.388

*Significant at 5%, DAS- Days after spraying. Scoring: 0= none, 1=0-10%, 2= 11-20%; 3=21-30%; 4=31-40%; 5=41-50%; 6=51-60%; 7= 61-70%; 8= 71-80%; 9= 81-90%; 10=91-100%

Effect of chemical insecticides on natural enemy (coccinellid) population

The coccinellid count per plant taken before spraying of chemical insecticides showed non -significant difference among different treatments and it ranged from 3 - 4.33 / plant.

On 7 DAS of chemical insecticides, the control (Water spray) recorded highest coccinellid population of 4 per plant and the lowest coccinellid population was observed in T₂ (acetamiprid 20 SP @ 0.2 g / l) (0.33 coccinellid / plant). Among the insecticides treated on mulberry, T₆ (dichlorvos 76 EC @ 2.63 ml / l) recorded highest coccinellid population (3.33 / plant) followed by T₄ (fipronil 5 SC @ 2 ml / l) (2.67 / plant), T₁ (acephate 75 SP @ 1 g / l) (2.33 / plant), T₅ (imidacloprid 17.8 SC @ 0.3 ml / l) (2.33 / plant) and T₃ (dimethoate 30 EC @ 2 ml / l) showed the coccinellid population of 2 per plant (Table 5).

After 15 DAS control (Water spray) recorded highest coccinellid population of 5 per plant and 0 per plant was the least coccinellid population count recorded from the treatment T₂ (acetamiprid 20 SP @ 0.2 g / l), followed by T₅ (imidacloprid 17.8 SC @ 0.3 ml / l) (3 / plant), T₆ (dichlorvos 76 EC @ 2.63 ml / l) (3 / plant) and T₄ (Fipronil 5 SC @ 2 ml / l) (3 / plant). T₃ (dimethoate 30 EC @ 2 ml / l) showed the population of 2.67 per plant followed by T₁ (Acephate 75 SP @ 1 g / l) (2 / plant). Among the treatments T₂ (Acetamiprid 20 SP @ 0.2 g / l) showed lowest coccinellid population i.e., 0.33 and 0.00 per plant both in 7 and 15 DAS respectively. In the control (water spray) the coccinellid population was found to be the highest in both 7th (4 / plant) and 15th (5 / plant) day after spraying (Table 5).

Similarly, Mukhopadhyay and Santha Kumar (2010) ^[4] reported that mortality of natural enemies of thrips of mulberry ecosystem was least in dichlorvos. Roychoudhury and Mishra (2015) ^[7] reported that spraying of dichlorvos 76 EC is most preferred due to the fact that it is harmless to the natural enemies. Sakthivel *et al.* (2011) ^[8] compared efficacy of water jetting and chemical measures against major sucking pests of mulberry and their safety to natural enemies. Result indicated that water jetting in mulberry garden showed slight or no deleterious effect on predatory coccinellids. Whereas, there was drastic reduction in their population with chemical control measures. In contrary, Ghosh *et al.* (2014) ^[1] reported that dinotefuran at 15, 20, 25 and 30 g a.i., per ha, along with imidacloprid at 25 g a.i., per ha, acephate at 400 g a.i., per ha against brown plant hopper of rice suggested that, dinotefuran 25 g a.i., per ha molecule was also found to be very safe to natural enemies.

Mulberry leaf yield per plant (kg) and kg / ha/ crop after spraying insecticides

Selected insecticides were studied for their efficacy against mulberry thrips in the current study. As thrips feed primarily on mulberry leaves, any reduction in pest population as a consequence of insecticide spraying could contribute for increase in mulberry leaf yield. Hence, the mulberry leaf yield (V-1 variety) was estimated in all the insecticide treated blocks at 45 days after pruning.

Mulberry leaf yield was recorded initially per plant and leaf yield recorded on 45th day after pruning showed highest in the treatment T₆ (dichlorvos 76 EC @ 2.63 ml / l) (0.37 kg / plant) followed by T₃ (dimethoate 30 EC @ 2 ml / l) (0.35 kg / plant), T₅ (imidacloprid 17.8 SC @ 0.3 ml / l) (0.34 kg / plant), T₄ (fipronil 5 SC @ 2 ml / l) (0.33 kg / plant) and acephate 75 SP @ 1 g / l recorded the leaf yield of 0.30 kg per plant. The least leaf yield per plant was recorded in acetamiprid 20 SP @ 0.2 g /

l (0.29 kg / plant).

Table 5: Efficacy of chemical insecticides on natural enemy (Coccinellid) population

Treatments		Coccinellid population (No./plant)		
		Count before spray	7DAS	15DAS
T ₁	Acephate 75 SP	4.00	2.33	2.00
T ₂	Acetamiprid 20 SP	3.00	0.33	0.00
T ₃	Dimethoate 30 EC	3.33	2.00	2.67
T ₄	Fipronil 5 SC	4.00	2.67	3.00
T ₅	Imidacloprid 17.8 SC	3.33	2.33	3.00
T ₆	Dichlorvos 76 EC	4.33	3.33	3.00
T ₇	Control (Water spray)	3.67	4.00	5.00
F- test		NS	*	*
S. Em. ±		0.766	0.595	0.690
CD @ 5%		2.361	1.835	2.126

Significant at 5%, DAS- Days after spraying

Further the mulberry leaf yield was calculated per hectare per crop and was found that the highest leaf yield per hectare per crop was recorded in T₆ (Dichlorvos 76 EC @ 2.63 ml / l) (5069.12 kg / ha / crop) followed by T₃ (Dimethoate 30 EC @ 2 ml / l) (4851.54 kg / ha / crop), T₅ (Imidacloprid 17.8 SC @ 0.3 ml / l) (4758.95 kg / ha / crop), T₄ (Fipronil 5 SC @ 2 ml / l) (4587.67 kg / ha / crop) and acephate 75 SP @ 1 g / l recorded the leaf yield of 4175.66 kg per hectare per crop. The least leaf yield was recorded in the treatment T₂ (Acetamiprid 20 SP @ 0.2 g / l) (3971.97 kg / ha / crop). The control (Water spray) also recorded lowest yield of 0.31 kg / plant and 4245.10 kg / ha / crop along with insecticide, acetamiprid 20 SP @ 0.2 g / l. When no spray was given in control, the thrips population increased over a period of time. Due to severe infestation of thrips mulberry leaf yield in control was observed to be lowest.

Spraying of dichlorvos 76 EC @ 2.63 ml / l was effective in controlling thrips population resulting in maximum yield in this treatment and did not show any phytotoxic symptoms. Therefore, there was no wastage of leaves due to phytotoxic symptoms viz., epinasty, hyponasty, necrosis etc. in this treatment (Table 4).

Though, acephate and acetamiprid were effective against thrips, they exhibited phytotoxic effect on mulberry plants. Severe phytotoxic symptoms viz., epinasty, hyponasty and necrosis on leaves were noticed after spraying of this insecticide molecule. The phytotoxic symptoms were more conspicuous and prominent at 15 DAS coinciding with the mulberry leaf harvest. Leaves with these phytotoxic symptoms were poor in quality and hence deemed unfit for consumption by silkworm. Owing to these reasons, the mulberry leaf yield was lowest in the blocks sprayed with acetamiprid 20 SP @ 0.2 g / l.

Similar to the current findings, reduction in yield due to thrips infestation has been reported from other studies on mulberry. In contrary Khaliq *et al.* (2014) [3] reported that the chemical treatments resulted in a higher yield compared to the untreated control. Poornima (2015) [5] reported that the mulberry yield was enhanced by spraying spinosad 45 SC @ 0.25 ml / l.

Conclusion

Among the insecticides assessed, fipronil 5 SC @ 2 ml / l was observed to be more effective in controlling thrips population, non-phytotoxic to mulberry though acephate and acetamiprid recorded higher reduction in population of thrips, mulberry leaves exhibited phytotoxic symptoms as well as reduced population of natural enemy (coccinellid).

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