The Pharma Innovation Journal 2022; SP-11(5): 1224-1227

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(5): 1224-1227

www.thepharmajournal.com
Received: 05-02-2022
Accepted: 09-03-2022

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Evaluation of certain newer insecticides for the management of onion thrips *Thrips tabaci*

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Abstract
Field experiments were conducted in two locations to evaluate the efficacy of certain insecticides against Onion Thrips (*Thrips tabaci*). Imidacloprid, Fipronil, Spinosad, Chlorfenapyr, Profenofos, dimethoate (Standard Check) and untreated check were the seven treatments. Two rounds of treatment sprays were given at fortnight intervals and pre and post treatment counts were recorded on 3, 7 and 14 Days after treatment (DAT). Natural enemy (spider) population and yield data were also recorded. In the first experiment, Spinosad @ 1ml/lit recorded mean thrips population of 3.19/ plant followed by Imidacloprid @ 1 ml/ lit (4.97/ plant). The standard check recorded 9.67 thrips per plant and in untreated check the mean population was 31.33. In the second experiment also the same trend was observed. Spinosad @ 1ml/lit was the best treatment (2.56 thrips/ plant) followed by imidacloprid (3.31 thrips / plant). Both the treatments were on par. Highest population of 22.0 thrips / plant was recorded in untreated check. The impact of newer insecticides on spider population in field condition revealed that Spinosad and Imidacloprid treatments recorded higher spider population (7.17 and 6.50 in I experiment, 9.17 and 8.50 in II experiment). The lowest spider population was recorded in standard check dimethoate 2.0 ml/ lit. Highest yields (18.1 t/ha, 18.4 t/ ha) and higher benefit cost ratio (2.94, 2.98) were obtained in spinosed treatment and this was followed by imidacloprid@ 1 ml/ lit.

Keywords: Onion, thrips, *Thrips tabaci*, new insecticides, spinosad, imidacloprid, spiders

Introduction
Onion is valued as condiment due its flavour and is the most important vegetable grown in India. It is the second important vegetable crop next to tomato. Tamil Nadu ranks eighth in production. Production of onion is hampered by onion thrips, *Thrips tabaci*. To control onion thrips dimethoate 30 EC or methyl demeton 25 EC are normally recommended. Many new insecticides are being evaluated against onion thrips. Fipronil 5 SC @ 1.5 ml/ lit followed by imidacloprid 0.3 ml/ lit and Spinosad 1 ml/ lit were effective against onion thrips (Sujay Pandey *et al*., 2013) [8]. Naima Din *et al.* (2016) [6] reported that fipronil 80 WG 60 gm/ ac and chlorfenapyr 36 SC 100 ml/ac-controlled onion thrips population. The chemical imidacloprid 17.8 SL @ 1 ml/ lit was the best as reported by Das *et al*., (2017) [3] from Bihar. Muhammad Ashghan *et al.* (2018) [5] found that bifenthrin 10 EC reduced thrips population in onion. Ameer Uddin *et al*. (2019) [1] evaluated different insecticides against onion thrips and found that acetamiprid 125 g ai/ac was the best treatment followed by imidacloprid 80 ml/ac and profenofos 500 ml/ ac. Field experiments were conducted to evaluate efficacy of new insecticides against onion thrips and their impact on natural enemies in onion eco system.

Materials and Methods
Two field experiments were conducted to evaluate efficacy of new insecticides against onion thrips. The first experiment was conducted in a farmers holding at Periya Ilanthaikulam, Alanganallur Block, Madurai District during July-Sep 2021. There were seven treatments as in Table 1 and the treatments were replicated thrice. The experimental design was randomized block design and plot size was 4m X 5m. The spray fluids were prpared to the specified concentration (Table 1) and applied using high volume sprayer after adding Teepol (0.1%) as surfactant. The number of thrips and their natural enemies present on ten plant were counted before spray as well as three, seven and fourteen days after each treatment. Population of thrips (nymphs and adults) was expressed as number of thrips / plant. Population of predatory spiders was expressed as number of spiders per ten plants. Two rounds of treatment sprays were given. Yield data was recorded at the time of harvest and expressed as tons/ ha.

Benefit cost ratio was also worked out for all the treatments. The second field experiment was laid out at Arasakulam, Kariapatti Block, Virudhunagar District during January-March 2022. All the procedures followed in the first experiment were repeated in the second experiment. Two rounds of treatment sprays were given in the second experiment and data were collected and analysed using AGRES package.

Results

Data on the effect of new insecticides on onion thrips in field experiment I are presented in Table 1. From the table it was observed that mean thrips population ranged from 3.19 to 24.50. The lowest population was recorded in spinosad and the highest population was recorded in untreated check. Spinosad recorded 86.96 Percent reduction over control. The next best treatment was imidacloprid with a thrips population of 4.97 and 79.71 Percent reduction over control. Immediately after I spray Spinosad and imidacloprid registered lowest thrips population (3.0 and 4.67) and standard check dimethoate recorded 9.0 thrips. There was a gradual build up of population 14 Days after treatment. After the II spray also Spinosad and imidacloprid were effective (3.0 and 5.67)

Table 2 depicts the impact of new inseticides on spider population in onion eco system in field experiment I. The mean spider population ranged from 3.00 to 6.42. Untreated check recorded maximum population of 6.42 and the minimum population 3.0 was noticed in dimethoate treatment. Spinosad treatment had mean population of 4.97 and imidacloprid registered 4.42. There was a build-up of spider population in untreated check from 3.67 to 9.17 where as it was 3.67 to 7.17 in Spinosad on 14 days after II spray. Both the treatments were statistically on par. Imidacloprid was the next best treatment with 4.42 spiders on 14 days after II spray.

Data accrued on the influence of new insecticides on onion thripsin field experiment II are presented in Table 3. Mean thrips population ranged from 2.56 in Spinosad to 22.00 in untreated check. Next to Spinosad imidacloprid was the best treatment (3.31 thrips) and both the treatments were statistically on par. Chlorfenapyr recorded more thrips (7.92) than standard check dimethoate (7.25). Highest percent reduction over control was registered in spinosad (88.38) followed by imidacloprid (84.97). There was a reduction of thrips population on 3 days after I spray and there after gradual increase in population was observed. Spinosad treatment had 1.0 thrips on 3 DAT of I spray and 2.67 thrips on 3 DAT of II spray. On 14 DAT of II spray both Spinosad (3.67) and imidacloprid were statistically on par.

Impact of new insecticides on spiders in onion eco system is presented in Table 4. From the table it was observed that the spider population ranged from 5.00 in dimethoate treatment to 8.42 in untreated check. The second highest population of 6.97 spiders was recorded in Spinosad treatment followed by imidacloprid (6.19). The initial spider population ranged from 4.67 to 5.67. A reduction in population was observed on 3DAT of I spray in all the treatments except untreated check. A gradual build up was observed in untreated check plots.

Table 5 provides data on yield of onion and benefit cost ratio in both the field experiments on the effect of new insecticides against onion thrips. The highest yield of 18.1 t/ha was recorded in Spinosad treatment with B:C ratio of 2.94. Imidacloprid was the next best treatment (17.0 t/ ha, 2.56 B:C ratio) and both were statistically different from each other. Yield in dimethoate was 15.3 t/ ha and B:C ratio was 2.32. Lowest yield and B:C ratio were recorded in untreated check. The above trend was observed in field experiment II also where Spinosad followed by imidacloprid recorded highest yield (18.4 t/ha and 17.3 t/ha) and B:C ratio (2.98 and 2.62). Lowest yield (12.6 t/ ha) and B:C ratio(1.84) were recorded in untreated check.

Table 1: Influence of different newer insecticide molecules on onion thrips Field Experiment – I

Sl. No.	Treatments	Pre count	Mean thrips population (No./plant)							% Reduction over control
			I spray			II SPRAY			MEAN	
			3 DAT	7 DAT	14 DAT	3DAT	7 DAT	14 DAT		
1	Imidacloprid @ 1ml/l	15.33	4.67 (2.16)[b]	5.33 (2.31)[a]	7.67 (2.77)[b]	2.33 (1.53)[b]	4.17 (2.04)[b]	5.67 (2.38)[b]	4.97	79.71
2	Fipronil @ 1.5 ml/l	16.33	6.67 (2.58)[c]	10.00 (3.16)[b]	11.83 (3.44)[cd]	4.00 (2.00)[c]	5.50 (2.35)[c]	7.17 (2.68)[c]	7.53	69.27
3	Spinosad @ 1 ml/lit	14.67	3.00 (1.73)[a]	4.33 (2.08)[a]	5.00 (2.24)[a]	1.33 (1.15)[a]	2.50 (1.58)[a]	3.00 (1.73)[a]	3.19	86.96
4	Chlorfenapyr @ 1 ml/l	14.00	10.33 (3.21)[e]	13.50 (3.67)[c]	15.17 (3.89)[e]	7.83 (2.80)[d]	9.33 (3.05)[e]	11.33 (3.37)[e]	11.25	54.08
5	Profenophos @ 2ml/l	13.00	7.33 (2.71)[c]	9.83 (3.14)[b]	11.50 (3.39)[c]	4.67 (2.16)[c]	6.00 (2.45)[c]	7.33 (2.71)[c]	7.78	68.25
6	Dimethoate @ 2ml/l	13.67	9.00 (3.00)[d]	11.50 (3.39)[b]	13.50 (3.67)[de]	6.33 (2.52)[d]	7.83 (2.80)[d]	9.67 (3.11)[d]	9.64	60.66
7	Untreated Check	16.33	18.67 (4.32)[f]	21.00 (4.58)[d]	23.00 (4.80)[f]	24.33 (4.93)[e]	28.67 (4.93)[f]	31.33 (5.60)[f]	24.50	0.00
	CD (0.05)		0.19	0.26	0.25	0.30	0.24	0.19		
	CV		3.96	4.58	4.12	7.11	4.87	3.50		

Table 2: Impact of different newer insecticide molecules sprayed on onion to spider population - Field Experiment – I

Sl. No.	Treatments	Mean spider population (No./10plants)							
		Pre count	I Spray			II Spray			Mean
			3 DAT	7 DAT	14 DAT	3DAT	7 DAT	14 DAT	
1	Imidacloprid @ 1ml/l	3.67	2.67 (1.63)^{ab}	3.67 (1.91)^{bcd}	4.67 (2.16)^{bcd}	4.00 (2.00)^{bc}	5.00 (2.24)^{bc}	6.50 (2.55)^{bc}	4.42
2	Fipronil @ 1.5 ml/l	3.50	2.00 (1.41)^{a}	3.00 (1.73)^{ab}	4.00 (2.00)^{ab}	3.33 (1.83)^{ab}	4.33 (2.08)^{ab}	5.83 (2.42)^{ab}	3.75
s3	Spinosad @ 1 ml/lit	3.67	2.67 (1.63)^{ab}	4.33 (2.08)^{cd}	5.33 (2.31)^{cd}	4.67 (2.16)^{c}	5.67 (2.38)^{c}	7.17 (2.68)^{c}	4.97
4	Chlorfenapyr @ 1 ml/l	3.17	2.17 (1.47)^{a}	3.17 (1.78)^{abc}	4.17 (2.04)^{abc}	3.17 (1.78)^{ab}	4.17 (2.04)^{ab}	5.67 (2.38)^{ab}	3.75
5	Profenophos @ 2ml/l	3.33	2.33 (1.53)^{a}	3.33 (1.83)^{abc}	4.33 (2.08)^{abc}	3.67 (1.91)^{bc}	4.33 (2.08)^{ab}	6.17 (2.48)^{abc}	4.03
6	Dimethoate @ 2ml/l	2.67	1.67 (1.29)^{a}	2.33 (1.53)^{a}	3.33 (1.83)^{a}	2.33 (1.53)^{a}	3.33 (1.83)^{a}	5.00 (2.24)^{a}	3.00
7	Untreated Check	3.67	4.00 (2.00)^{b}	5.00 (2.24)^{d}	6.00 (2.45)^{d}	6.67 (2.58)^{d}	7.67 (2.77)^{d}	9.17 (3.03)^{d}	6.42
	CD (0.05)		0.4063	0.3377	0.2931	0.3365	0.2614	0.2524	
	CV		14.71	10.18	7.77	9.63	6.68	5.59	

Table 3: Influence of different newer insecticide molecules on onion thrips Field Experiment – II

Sl. No.	Treatments	Pre count	Mean thrips population (No./plant)							% Reduction over control
			I Spray			II Spray			Mean	
			3 DAT	7 DAT	14 DAT	3DAT	7 DAT	14 DAT		
1	Imidacloprid @ 1ml/l	7.67	2.67 (1.63)^{b}	3.83 (1.96)^{b}	4.00 (2.00)^{a}	2.00 (1.41)^{ab}	3.33 (1.83)^{b}	4.00 (2.00)^{a}	3.31	84.97
2	Fipronil @ 1.5 ml/l	7.50	3.33 (1.82)^{bc}	6.83 (2.61)^{c}	8.00 (2.83)^{b}	2.33 (1.53)^{bc}	5.67 (2.38)^{cd}	8.67 (2.94)^{c}	5.81	73.61
3	Spinosad @ 1 ml/lit	7.67	1.00 (1.00)^{a}	3.00 (1.73)^{a}	3.33 (1.83)^{a}	1.67 (1.29)^{a}	2.67 (1.63)^{a}	3.67 (1.91)^{a}	2.56	88.38
4	Chlorfenapyr @ 1 ml/l	7.17	6.67 (2.58)^{d}	8.00 (2.83)^{d}	9.67 (3.11)^{c}	5.67 (2.38)^{d}	7.17 (2.68)^{e}	10.33 (3.21)^{d}	7.92	64.02
5	Profenophos @ 2ml/l	7.33	4.00 (2.00)^{c}	6.83 (2.61)^{c}	8.33 (2.89)^{b}	3.00 (1.73)^{c}	5.00 (2.24)^{c}	7.67 (2.77)^{b}	5.81	73.61
6	Dimethoate @ 2ml/l	6.67	6.00 (2.45)^{d}	7.67 (2.77)^{cd}	8.67 (2.94)^{bc}	5.00 (2.24)^{d}	6.50 (2.55)^{de}	9.67 (3.11)^{cd}	7.25	67.05
7	Untreated Check	7.67	9.33 (3.05)^{e}	13.33 (3.65)^{e}	16.67 (4.08)^{d}	18.00 (4.24)^{e}	19.67 (4.43)^{f}	22.00 (4.69)^{e}	22.00	0.00
	CD (0.05)		0.2341	0.1640	0.1930	0.2303	0.1743	0.1668		
	CV		6.34	3.55	3.86	6.13	3.87	3.18		

Table 4: Impact of different newer insecticide molecules sprayed on onion to spider population - Field Experiment - II

Sl. No.	Treatments	Mean spider population (No./10plants)							
		Pre count	I Spray			II Spray			Mean
			3 DAT	7 DAT	14 DAT	3DAT	7 DAT	14 DAT	
1	Imidacloprid @ 1ml/l	5.67	4.00 (2.00)^{a}	5.33 (2.31)^{ab}	6.33 (2.52)^{ab}	6.00 (2.45)^{bc}	7.00 (2.65)^{bc}	8.50 (2.92)^{bc}	6.19
2	Fipronil @ 1.5 ml/l	5.50	4.00 (2.00)^{a}	5.00 (2.24)^{a}	6.00 (2.45)^{a}	5.33 (2.31)^{abc}	6.33 (2.52)^{ab}	7.83 (2.80)^{ab}	5.75
s3	Spinosad @ 1 ml/lit	5.67	4.67 (2.16)^{a}	6.33 (2.52)^{bc}	7.33 (2.71)^{bc}	6.67 (2.58)^{c}	7.67 (2.77)^{c}	9.17 (3.03)^{c}	6.97
4	Chlorfenapyr @ 1 ml/l	5.17	4.17 (2.04)^{a}	5.17 (2.27)^{ab}	6.17 (2.48)^{ab}	5.17 (2.27)^{ab}	6.17 (2.48)^{ab}	7.67 (2.77)^{ab}	5.75
5	Profenophos @ 2ml/l	5.33	4.33 (2.08)^{a}	5.33 (2.31)^{ab}	6.33 (2.52)^{ab}	5.67 (2.38)^{bc}	6.33 (2.52)^{ab}	8.17 (2.86)^{abc}	6.03
6	Dimethoate @ 2ml/l	4.67	3.67 (1.91)^{a}	4.33 (2.08)^{a}	5.33 (2.31)^{a}	4.33 (2.08)^{a}	5.33 (2.31)^{ab}	7.00 (2.65)^{a}	5.00
7	Untreated Check	5.67	6.00 (2.45)^{b}	7.00 (2.65)^{c}	8.00 (2.83)^{c}	8.67 (2.94)^{d}	9.67 (3.11)^{d}	11.17 (3.34)^{d}	8.42
	CD (0.05)		0.2785	0.2585	0.2528	0.2753	0.2231	0.2248	
	CV		7.49	6.21	5.59	6.37	4.78	4.35	

Table 5: Impact of different newer insecticide molecules sprayed on onion yield

Sl. No.	Treatments	Field Experiment I		Field Experiment II	
		Yield (t/ha)	C: B Ratio	Yield (t/ha)	C: B Ratio
1	Imidacloprid @ 1ml/l	17.0b	2.56	17.3b	2.62
2	Fipronil @ 1.5 ml/l	16.2bc	2.47	16.6bc	2.57
s3	Spinosad @ 1 ml/lit	18.1a	2.94	18.4a	2.98
4	Chlorfenapyr @ 1 ml/l	14.4d	2.24	14.7d	2.32
5	Profenophos @ 2ml/l	15.6c	2.39	16.0c	2.43
6	Dimethoate @ 2ml/l	15.3c	2.32	15.8c	2.36
7	Control	12.1e	1.8	12.6e	1.84
	CD (0.05)	0.897	-	0.953	-
	CV	3.24	-	3.37	-

Discussion

In both the field trials conducted to evaluate the effect of new insecticides against onion thrips. Spinosad @ 1ml/ lit recorded lowest number of thrips. This result is in confirmation with the findings of Kadam *et al*. (2019) [4] who reported the efficacy of Spinosad 45 SC @ 73 gai/ ha. Imidacloprid was the next best treatment against onion thrips in the present study. The chemical imidacloprid 17.8 SL @1 ml/ lit was the best as reported by Das *et al*. (2017) [3]. Imidacloprid as the second best chemical was reported by several authors (Sujay Pandey *et al*., 2013; Ameer Uddin *et al*., 2019) [8, 1]. In field experiments I and II, the mean spider population was higher in untreated check (6.42 and 8.42). This is in confirmation with the findings of Arfan *et al.* (2018) [2] who reported that arthropod diversity including spiders were more in red onion fields not treated with insecticides. Dimethoate recorded the lowest mean number of spiders (3.0 and 5.0). Toxicity of dimethoate to adults and their off spring of spider *Hylyphantes* was reported by Peng *et al*. (2010) [7]. Spinosad and imidacloprid were relatively safe to spiders. Highest yield and BC ratio were recorded in Spinosad treatment followed by imidacloprid.

Conclusion

The present study concluded that two rounds of sprays with Spinosad @ 1ml/lit at fortnightly interval effectively controlled onion thrips. Imidacloprid @ 1ml/lit was the next best treatment. Both the treatments were relatively safe to predatory spiders in the onion eco system. Highest Yield of onion bulbs and highest BC ratio were recorded in the above treatment.

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