Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(6): 389-392
Received: 13-09-2018
Accepted: 15-10-2018

Richa Banshiwal
Department of Entomology, Maharana Pratap University of Agriculture and Technology, Udaipur (MPUAT), Udaipur, Rajasthan, India

NL Dangi
Department of Entomology, Maharana Pratap University of Agriculture and Technology, Udaipur (MPUAT), Udaipur, Rajasthan, India

MK Mahla
Department of Entomology, Maharana Pratap University of Agriculture and Technology, Udaipur (MPUAT), Udaipur, Rajasthan, India

Kuldeep Kumar
Department of Entomology, Maharana Pratap University of Agriculture and Technology, Udaipur (MPUAT), Udaipur, Rajasthan, India

Correspondence
Richa Banshiwal
Department of Entomology, Maharana Pratap University of Agriculture and Technology, Udaipur (MPUAT), Udaipur, Rajasthan, India

Bio-efficacy of various insecticides against insect pests of cucumber (*Cucumis sativus* L.) under protected cultivation

Richa Banshiwal, NL Dangi, MK Mahla and Kuldeep Kumar

Abstract
An experiment was conducted in polyhouse to evaluate insecticide for controlling leaf miner, whitefly and thrips infesting cucumber crop with the treatments i.e., difenthiuron 30 WP, acephate 75 SP, Acetamiprid 20 SP, spiromesifen 22.9 SC, *Beauveria bassiana* and neem oil (1%) including untreated control at High-tech Unit of Department of horticulture, Rajasthan College of Agriculture, MPUAT, Udaipur during *kharif* season, 2017, subsequently. All among the treatments, acetamiprid 20 SP found most effective against whitefly as recorded 62.79 per cent population reduction. While in case of leaf miner maximum reduction of maggot population was observed in difenthiuron 30 WP was 73.52% and in thrips highest population reduction observed in the treatment acetamiprid 20 SP recorded 55.74 per cent reductions in polyhouse cucumber crop.

Keywords: Whitefly, leaf miner, thrips, cucumber, acetamiprid, difenthiuron and sucking pests

Introduction
Cucumber (*Cucumis sativus* L. Cucurbitaceae) is a popular and widely grown vegetables all over the country, is reported to have originated in India. It is one of the quickest maturing vine vegetable crops and is the second most widely cultivated cucurbit after watermelon. Cucumber is grown in an area of 74, 000 hectares with the production of 1142, 000 metric tons (Anon., 2017) [1]. Nutritively 100 g of edible portion of cucumber contains 96.3 g moisture, 2.5 g carbohydrates, 0.4 g protein, 0.1 g fat, 0.3 g minerals, 10 mg calcium, 0.4 g fiber and traces of vitamin C and iron. The protected vegetable cultivation technology can be utilized for year round production of high value quality vegetable crops, with high yield. Increasing photosynthetic efficiency and reduction in transpiratory loss are added advantages of protected cultivation Protected cultivation of crops provides protection from adverse environmental conditions (Sood *et al*., 2015) [12] In India, about twenty insect and mite species have been recorded to be associated with the crops under protected cultivation (Sood *et al*., 2006) [11]. Thrips, whitefly, leaf miner, aphids, gall midge, mites and nematodes are serious problems on vegetable crops under protected cultivation. Among all the sucking pests attacking cucumber whitefly, leaf miner and thrips are dominant pests. Insecticide application is one of the management options that can substantially reduce yield losses caused by sucking insects. Bio-efficacy of pesticides needs to be studied for formulating effective and economical management strategies of insect pests. Therefore, the present investigation was conducted to evaluate the bio-efficacy of certain insecticides against sucking insect pests infesting cucumber.

Materials and Method
The experiment on the bio-efficacy of difenthiuron 30 WP, acephate 75 SP, Acetamiprid 20 SP, spiromesifen 22.9 SC, *Beauveria bassiana* and neem oil (1%) against whitefly, leaf miner and thrips was conducted in Complete Randomized Design with three replications at High-tech Unit of Department of horticulture, Rajasthan College of Agriculture, MPUAT, Udaipur during *kharif* season, 2017. Three weeks old seedlings of cucumber variety (Terminator) at 2-3 true leaf stage were transplanted on 20th June 2017 according to the treatment combinations. Sowing was done in plots each measuring 4 X 1 m^2 at row to row and plant to plant spacing of 40 X 30 cm^2. There were seven treatments replicated three times. Each treatment was applied two times initiating first spray as soon as a pest's infestation starts and subsequent second spray was given at 20 days interval. The population of whiteflies and thrips on cucumber was recorded by counting the number of nymphs and adults on five randomly selected plants from each plot that were maintained without plant protection measures. The observations for

sucking pests were recorded during morning hours between 6:30 AM to 8:30 AM. The population of whitefly was recorded from five leaves, two from the middle, two from the lower and one from the upper position from five randomly selected plants. The population of thrips was counted on white piece of paper by finger tapping method from other five randomly selected plant with the help of 10× hand lens. Leaf miner damage was estimated by counting the numbers with maggots within leaves, and expressed as maggot percent mortality per plant. The observations of whitefly, thrips and leaf miner recorded before spraying as pre-treatment population and at 3,7 and 10 days after spray.

The percent corrected mortality of the pests was calculated from the formula given by Henderson and Tilton (1955):

$$\text{Percent corrected mortality} = 100\left[1 - \frac{T_a \times C_b}{T_b \times C_a}\right]$$

T_a = Number of insects after treatment
T_b= Number of insects before treatment
C_a= Number of insects in control after treatment
C_b= Number of insects in control before treatment

Result and discussion

Whitefly

The data recorded on mean reduction in the population of whitefly at 3, 7 and 10 days after first and second sprays have been presented in Table 1 and 2. The population of whitefly recorded before spray showed non-significant difference among different treatments indicated that its population was uniformly distributed in all the experimental plots in both the seasons. The data reveals that all the treatments were found significantly superior to untreated control. Among all the insecticidal treatments acetamiprid 20 SP was significantly superior and showed highest reduction per cent in whitefly population as 78.55, 72.13, 66.23 and 75.88, 67.28, 62.79 followed by acephate 75 SP 74.80, 70.27, 65.08 and 70.69, 64.52, 61.53 3, 7 and 10 days after first and second spray during *Kharif* 2017, respectively and both were statistically at par with each other. The least effective treatment was neem oil @ 1 percent with 52.01, 48.08, 52.00 and 46.59, 44.30, 48.07 per cent population reduction and it was at par with *Beauveria bassiana* 54.61, 51.16, 54.53 and 51.81, 46.21, 51.05 at 3, 7 and 10 DAS after first and second spray, respectively. Spiromesifen 22.9 SC were moderately effective and recorded 67.84, 62.31, 62.73 and 64.85, 58.59, 57.39 per cent reduction followed by difenthiuron 30 WP with 65.76, 60.08, 62.73 and 60.06, 55.9, 54.41 per cent reduction in whitefly population, at 3,7 and 10 days after first and second spray, respectively. The results are similar to those of Kontsedalov *et al*. (2008) [6] who showed that adult *B. tabaci* mortality rate after spiromesifen treatment (5mg L−1) was 40%. While Kashyap et al. (2016) [5] conducted a study to investigate the efficacy of insecticides and bio-pesticides against the greenhouse whitefly on tomatoes grown in polyhouses and found that abamectin resulted in the highest mean percent reduction in immatures of *T. vaporariorum*, followed by acetamiprid and buprofezin, Spiromesifen and bifenthrin resulted in moderate levels of efficacy, followed by azadirachtin and mineral oil. Mayoral *et al.* (2006) [8] also observed that all *B. bassiana* treatments, irrespective of the dose (doses tested: 125, 250, and 300 ml/hl), significantly reduced the whitefly infestation on protected tomato compared to the untreated control.

Leaf miner

The data recorded on mean reduction in the maggot population of leaf miner at 3, 7 and 10 days after first and second sprays have been presented in Table 3 and 4. The data reveals that all the treatments were found significantly superior to untreated control. The highest mean reduction in the maggot population of leaf miner was recorded in case of two spray of difenthiuron 30 WP which resulted 50.94, 65.82, 71.18 and 54.57, 70.81, 73.52 per cent reduction at 3, 7, 10 days after first and second spray during *Kharif* 2017, respectively. Spray of acephate 75 SP was at par with above treatment which recorded 47.14, 64.09, 66.55 and 51.54, 67.40, 70.75 per cent reduction in mean population of leaf miner at 3, 7 and 10 days after first and second spray during *Kharif* 2017, respectively. Acetamiprid 20 SP was moderately effective with 46, 62.57, 64.89 and 48.95, 66.80, 68.14 per cent reduction followed by spiromesifen 22.9 SC which resulted 42.25, 60.48, 64.89 and 45.58, 63.99, 65.76 per cent reduction at 3,7 and 10 days after first and second spray. While neem oil (1%) were less effective as by indicative significantly lower reduction of maggot population being 41.06, 55.62, 56.75 and 42.27, 58.44, 60.61 per cent, respectively followed by *Beauveria bassiana* with 42.23, 57.04, 59.15 and 43.24, 60.07, 63.17 per cent reduction in maggot population at 3, 7 and 10 days after first and second spray during *Kharif* 2017, respectively. The results are similar to those of Mondol (2016) [9] who evaluated the efficacy of insecticides in monitoring the damage caused by *Liriomyza brassicae* on the pea crop and found that imidachloprid (0.01%) followed by, acephate (0.15%) gave lower percent larval population after spraying were found to be statistically at par with each other. Wankhede *et al.* (2007) [14] conducted an experiment to evaluate different insecticides against *L. trifolii* in tomato crop and result showed that Neem oil 1% gave the lowest (4.37%) leaf miner infestation at 14 days after second spray followed by 0.01% spinosad and 5% neem seed extract. Larew *et al.* (2014) [7] applied crude neem extract (0.4%) as a soil drench to chrysenthemum, which caused significant mortality of late instar maggots and pupae of *Liriomyza trifolii* (Burgess) in both research and commercial greenhouses.

Thrips

The data recorded on mean reduction in the population of thrips at 3, 7 and 10 days after first and second sprays have been presented in Table 5 and 6. The population of thrips recorded before spray showed non-significant difference among different treatments indicated that its population was uniformly distributed in all the experimental plots in both the seasons. The data reveals that all the treatments were found significantly superior to untreated control. Among all the insecticidal treatments acetamiprid 20 SP was significantly superior and showed highest reduction per cent in thrips population as 75.67, 70.08, 59.46 and 70.84, 67.58, 55.74 followed by acephate 75 SP 70.07, 65.43, 58.09 and 68.22, 63.51, 54.31 at 3, 7 and 10 days after first and second spray during *Kharif* 2017, respectively and both were statistically at par with each other. The least effective treatment was neem oil @ 1 percent with 54.07, 49.23, 46.35 and 51.71, 48.06, 45.85 per cent population reduction and it was at par with *Beauveria bassiana* 56.06, 51.69, 48.49 and 53.24, 50.41,48.51 at 3, 7 and 10 DAS after first and second spray, respectively. Difenthiuron 30 WP were moderately effective and recorded 68.63, 63.61, 55.93 and 65.73, 60.22, 53.25 per cent reduction followed by Spiromesifen 22.9 SC with 60.84, 58.41, 54.43 and 58.59, 55.70, 50.11 per cent reduction in thrips population, at 3,7 and 10 days after first and second spray, respectively. The present result are supported by the findings of Cloyd *et al.* (2000) [3] who reported that acephate @ 600 ppm was effective against western flower thrips (*Franklinilla occidentalis*) on gerbera. Bhatnagar *et al.* (2009) [2] reported that after 10 days of first spray, the least population of thrips was noticed in imidacloprid, followed by acetameprid, thiamethoxam and dimethoate. Among indigenous materials the least count was noticed in NSKE treatment. Venkatesh *et al.* (2003) [13] tested the efficacy of neem oil in comparison with insecticides over two consecutive seasons at Tamilnadu and the result revealed that neem oil and insecticides were significantly effective against both nymphs and adults of *Thrips tabaci*. Similarly, Pallai *et al.* (1988) [10] did experiments for the control of thrips with neem products and found that neem oil at 2% was as effective as phosphamidon and fenthion for controlling rice thrips.

Table 1: Bio-efficacy of insecticide against whitefly (First spray)

S. No.	Treatment (%)	Pre-treatment population	% Mean reduction of whitefly		
			3DAS	7DAS	10DAS
T1	Spiromesifen (0.1)	14.07	67.84^{b}	62.31^{b}	62.73^{b}
T2	Acetamiprid (0.02)	15.60	78.55^{c}	72.13^{c}	66.23^{b}
T3	Neem oil *(A. Indica)* (1)	16.20	52.01^{a}	48.08^{a}	52.00^{a}
T4	*Beauveria bassiana* (0.4)	15.87	54.61^{a}	51.16^{a}	54.53^{a}
T5	Difenthiuron (0.04)	15.07	65.76^{b}	60.08^{b}	59.80^{a}
T6	Acephate (0.2)	15.47	74.80^{c}	70.27^{c}	65.08^{b}
T7	Control	16.14			
	S.Em.±	0.671	1.574	1.928	3.357
	C.D. (5%)	N S	4.850	5.940	10.345

PTP: Pre-treatment population numbers per plant of whitefly 1-day before treatments;
NS: Non significant; CD: Critical differences; S.Em: Standard error of mean;
Numbers followed by the same letter in each column are not significantly different at 5%

Table 2: Bio-efficacy of insecticide against whitefly (Second spray)

S. No.	Treatment (%)	Pre-treatment population	% Mean reduction of whitefly		
			3DAS	7DAS	10DAS
T1	Spiromesifen (0.1)	14.07	64.85^{d}	58.59^{b}	57.39^{a}
T2	Acetamiprid (0.02)	10.87	75.88^{f}	67.28^{c}	62.79^{b}
T3	Neem oil (*A. indica)* (1)	15.40	46.59^{a}	44.30^{a}	48.07^{a}
T4	*Beauveria bassiana* (0.4)	14.87	51.81^{b}	46.21^{a}	51.05^{a}
T5	Difenthiuron (0.04)	13.67	60.06^{c}	55.91^{b}	54.41^{a}
T6	Acephate (0.2)	11.80	70.69^{e}	64.52^{b}	61.53^{b}
T7	Control	23.47			
	S. Em.±	2.518	1.120	1.537	3.330
	C.D. (5%)	N S	3.450	4.737	10.262

PTP: Pre-treatment population numbers per plant of whitefly 1-day before treatments;
NS: Non significant; CD: Critical differences; S.Em: Standard error of mean;
Numbers followed by the same letter in each column are not significantly different at 5%

Table 3: Bio-efficacy of insecticide against leaf miner (First spray)

S. No.	Treatment (%)	Pre-treatment population	% Mean reduction of leaf miner maggot		
			3DAS	7DAS	10DAS
T1	Spiromesifen (0.1)	3.50	42.45^{a}	60.48^{a}	62.6^{a}
T2	Acetamiprid (0.02)	3.60	46.00^{a}	62.57^{b}	64.89^{b}
T3	Neemoil *(A. Indica*)(1)	3.63	41.06^{a}	55.62^{a}	56.75^{a}
T4	*Beauveria bassiana* (0.4)	3.77	42.23^{a}	57.04^{a}	59.15^{a}
T5	Difenthiuron (0.04)	3.57	50.94^{b}	65.82^{b}	71.18^{b}
T6	Acephate (0.2)	3.77	47.14^{b}	64.09^{b}	66.55^{b}
T7	Control	3.60			
	S.Em.±	0.218	1.707	2.519	2.363
	C.D. (5%)	N S	5.179	7.641	7.168

PTP: Pre-treatment population numbers per six leaves of leaf-miner 1-day before treatments;
NS: Non significant; CD: Critical differences; S.Em: Standard error of mean;
Numbers followed by the same letter in each column are not significantly different at 5%

Table 4: Bio-efficacy of insecticide against leaf miner (Second spray)

S. No.	Treatment (%)	Pre-treatment population	% Mean reduction of leaf miner maggot		
			3DAS	7DAS	10DAS
T1	Spiromesifen (0.1)	2.60	45.58^{a}	63.99^{a}	65.76^{a}
T2	Acetamiprid (0.02)	2.90	48.95^{b}	66.80^{b}	68.14^{b}
T3	Neemoil (*A. indica)* (1)	2.80	42.27^{a}	58.44^{a}	60.61^{a}
T4	*Beauveria bassiana* (0.4)	2.50	43.24^{a}	60.07^{a}	63.17^{a}
T5	Difenthiuron (0.04)	2.43	54.57^{b}	70.81^{b}	73.52^{b}
T6	Acephate (0.2)	2.47	51.54^{b}	67.40^{b}	70.75^{b}
T7	Control	2.70			
	S. Em.±	0.161	2.078	2.607	2.336
	C.D. (5%)	N S	6.302	7.909	7.086

PTP: Pre-treatment population numbers per six leaves of leaf-miner 1-day before treatments;
NS: Non significant; CD: Critical differences; S.Em: Standard error of mean;
Numbers followed by the same letter in each column are not significantly different at 5%

Table 5: Bio-efficacy of insecticide against Thrips (First spray)

S. No.	Treatment (%)	Pre-treatment population	% Mean reduction of thrips		
			3DAS	7DAS	10DAS
T1	Spiromesifen (0.1)	22.27	60.84[b]	58.41[b]	54.53[a]
T2	Acetamiprid (0.02)	21.07	75.67[d]	70.08[d]	59.46[b]
T3	Neem oil (*A. Indica)* (1)	22.60	54.07[a]	49.23[a]	46.35[a]
T4	*Beauveria bassiana* (0.4)	22.47	56.06[a]	51.69[a]	48.49[a]
T5	Difenthiuron (0.04)	21.40	68.63[c]	63.61[c]	55.93[a]
T6	Acephate (0.2)	22.07	70.07[c]	65.43[c]	58.09[b]
T7	Control	22.70			
	S. Em.±	0.558	1.203	0.866	3.142
	C.D. (5%)	N S	3.706	2.668	9.681

PTP: Pre-treatment population numbers per plant of thrips 1-day before treatments;
NS: Non significant; CD: Critical differences; S.Em: Standard error of mean;
Numbers followed by the same letter in each column are not significantly different at 5%

Table 6: Bio-efficacy of insecticide against Thrips (Second spray)

S. No.	Treatment (%)	Pre-treatment population	% Mean reduction of thrips		
			3DAS	7DAS	10DAS
T1	Spiromesifen (0.1)	13.53	58.59[b]	55.70[b]	50.11[a]
T2	Acetamiprid (0.02)	12.33	70.84[c]	67.58[d]	55.74[b]
T3	Neem oil *(A. Indica)* (1)	13.33	51.71[a]	48.06[a]	45.85[a]
T4	*Beauveria bassiana* (0.4)	12.47	53.24[a]	50.41[a]	48.51[a]
T5	Difenthiuron (0.04)	12.53	65.73[c]	60.22[c]	53.25[b]
T6	Acephate (0.2)	13.20	68.22[c]	63.51[c]	54.91[b]
T7	Control	14.00			
	S.Em.±	0.423	1.989	1.121	2.357
	C.D. (5%)	N S	6.129	3.454	1.282

PTP: Pre-treatment population numbers per plant of Thrips 1-day before treatments;
NS: Non significant; CD: Critical differences; S. Em: Standard error of mean;
Numbers followed by the same letter in each column are not significantly different at 5%

References

1. Anonymous Indian Horticulture database, Gurgaon, 2017, 18.
2. Bhatnagar A. Efficacy and economics of insecticides and biopesticides against thrips on potato. Annals of Plant Protection Science. 2009; 17:501-503
3. Cloyd RA, Sadof CS. Effect of spinosad and acephate on western flower thrips inside and outside greenhouse. American Society for Horticulture Science. 2000; 10:359-362.
4. Henderson CF, Tilton EV. Test with acaricides against the brow wheat mite, Journal of Economic Entomology. 1955; 48:157-161.
5. Kashyap L, Sharma DC, Anil. Efficacy of Insecticides and Bio-pesticides for Control of Greenhouse Whitefly on Tomatoes in Greenhouses in India. Journal of Agriculture Urban Entomology. 2016; 32:40-49.
6. Kontsedalov S, Gottlieb Y, Ishaaya I, Nauen R, Horowitzc R, Ghanima M. Toxicity of spiromesifen to the developmental stages of *Bemisia tabaci* Biotype B. Pest management science. 2008; 8:1540-1549.
7. Larew HG, Knodel JJ, Webb RE, Warthen DJ. *Liriomyza trifolii* (Burgess) (Diptera; Agromyzidea) control on chrysenthemum by neem seed extract applied to soil. Journal of Economic Entomology. 2014; 78:80-84.
8. Mayoral F, Benuzzi M, Ladurner E. Efficacy of the *Beauveria bassiana* strain ATCC 74040 (Naturalis®) against whiteflies on protected crops. International Organization for Biological and Integrated Control of Noxious Animals and Plants/ West Palearctic Regional Section, Bulletin. 2006; 29:83-88.
9. Mondol D. Efficacy of Some Insecticides in the Management of *Liriomyza Brassicae* on Pisum Sativum. International Journal of Engineering Science and Computing. 2016; 6:1640-1642.
10. Pillai MAK, Ponnah S. Neem for control of rice thrips. International Rice Research Newsletter. 1988; 13:33-34.
11. Sood AK, Sood S, Mehta PK. Development of greenhouse whitefly, *Trialeurodes vaporariorum* on summer vegetable crops. Indian Journal of Entomology. 2006; 68:44-47.
12. Sood AK, Sood S, Singh V. Efficacy evaluation of spiromesifen against red spider mite, *Tetranychus urticae* Koch on parthenocarpic cucumber under protected environment. The Bioscan. 2015; 10:963-966.
13. Venkatesh D, David PM. Efficacy of fish oil rosin soap, neem oil and insecticides against onion thrips, *Thrips tabaci* Lindman. Madras Agriculture Journal. 2003; 90:562-564.
14. Wankhede SM, Deotale VY, Undirwade DB, Mane PN, Deotale RO, Kahare RN. Performance of some insecticides and Biopesticides against tomato leaf miner *Liriomyza trifolii* Burgess**.** Journal of Soils Crops. 2007; 17:136-138.