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Efficacy of insecticides against sucking insect pests infesting tomato (*Solanum lycopersicum* L.) under protected cultivation

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Abstract
The experiment on management of sucking insect pests i.e., whitefly and mealybugs infesting tomato (*Solanum lycopersicum* L.) under protected cultivation was conducted to evaluate the efficacy of various insecticides with the treatments as acephate 75 SP, acetamiprid 20 SP, diafenthiuron 30 WP, 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, 2018. Among the different treatments, acetamiprid 20 SP was proved highly effective as it recorded the maximum population reduction with 65.66%, 67.20% and 58.32% in whitefly and mealybug population respectively, while neem oil @ 1% proved to be least effective against whitefly and mealybug among all the treatments applied.

Keywords: Whitefly, mealybugs, acetamiprid and sucking insect pests

Introduction
Tomato is most popular vegetable crop and extensively grown all over the world. India contributes 6% of tomato production and ranks fifth in world, whereas tomato is the third highest producing crop having 8.5% share of total vegetable production [11]. The main principle of protected cultivation is to create a favourable and congenial environment to recognize its maximum potential even in adverse or harsh climatic conditions. The necessity of protected cultivation since last 10 years has highly increased. This increment is due to advantages such as reduced weed pressure, higher crop yields, moisture maintenance, reduction of certain insect pests, and more effective use of soil nutrients [10]. Tomato is extensively grown under greenhouse and covers more than 50% of total greenhouse area [8]. All over the world, tomatoes are grown under open and protected conditions, on 4.7 mha with a total production of 165 million tons approximately in 2014 [1].

Tomatoes are hosts for different sucking insects, either in open or cover area for their shelter, food and reproduction sites for insects. It cause unthrifty growth or death of the tomato plant and damage to fruit in the form of tissue destruction, scarring and aberrations in shape or color and fruit can be contaminated by whole insects, insect excreta, and insect parts. Sucking pests puncture the fruits through their stylet and introduce secondary infections which destroy the quality of fruit or act as vector of many viruses and mycoplasmas that cause growth disorders or death of the plant [2]. Thrips, whitefly, aphids, gall midge, mites and nematodes are observed on vegetable crops under protected cultivation. Whitefly and aphids are the most serious pests, which have been reported to cause about 45% and 34% yield loss in tomato, respectively [4]. Among all the sucking pests attacking tomato whitefly and mealybugs were dominant during my experiment. Insecticide application is one of the management options that help in reducing yield losses caused by sucking insects. For formulating effective management strategies of insect pests efficacy of insecticides needs to be studied and this experiment was conducted.

Materials and Methods
The experiment on efficacy of various insecticides as acephate 75 SP, acetamiprid 20 SP, diafenthiuron 30 WP, spiromesifen 22.9 SC, *Beauveria bassiana* and neem oil (1%) against sucking insect pests of tomato under protected cultivation was carried out in a completely randomized design (CRD) with three replications in plot size 7.0x1.0 m^2 with row to row and

plant to plant spacing of 50x45 cm^2. The seedlings of tomato variety "Dev" were transplanted during first week of July, 2018. The observations of pests were recorded during morning hours between 7 AM to 9 AM, when the insect activity was low.

The population of whitefly was recorded from five leaves, two from the middle, two from the lower and one from the upper position of five randomly selected and tagged plants from each plot. The population of mealybug was recorded by counting the number of nymphs and adults from stem, twigs, petioles from five randomly selected plants of each plot. The population data thus recorded were converted to per cent reduction in population using the method utilized by [5] as under:

$$\text{Population reduction (\%)} = 100\left[1 - \frac{Ta \times Cb}{Tb \times Ca}\right]$$

Where,

T_a = Number of pest after treatment in treated plot.

T_b = Number of pest before treatment in treated plot.

C_a = Number of pest in untreated check after treatment.

C_b = Number of pest in untreated check before treatment.

The analyzed reduction percentage data were transformed in to arc sine values and then subjected to analysis of variance, through which efficacy of various treatments were evaluated.

Results and Discussion

Whitefly

The insecticidal treatments were evaluated and data recorded were based on mean population per cent reduction of whitefly population at 1, 3, 5 and 7 days after first as well as second spray presented in table (1). In all the plots, the pre-treatment population of whitefly showed uniform distribution and varied from 29.33 to 39.35 average no. of whitefly per 5 plants. It was recorded that all the treatments applied were significantly superior over the control.

Data estimates after the application of first spray proposed that acetaprimid 20 SP was highly effective against whiteflies causing 66.35, 66.65, 65.16 and 63.85 mean per cent population reduction respectively after 1, 3, 5 and 7 days. Neem oil (1%) was found to be least effective with 55.76, 53.40, 52.28 mean per cent reduction in the whiteflies respectively after 3 days, 5 days, 7 days of treatment. Correspondingly, the maximum mean per cent reduction in whiteflies 64.66%, 63.83, 63.03 and 61.43 population after 1,3,5 and 7 days of second spray was observed from acetamiprid 20 SP; while, *Beauveria bassiana* @ 0.4% proved to be the least effective with 50.10 mean per cent reduction in the population of whiteflies. After three, five and seven days, the least mean per cent reduction as 51.90, 51.79 and 50.40 was observed from neem oil @1%. [7] conducted an experiment to estimate the efficacy of bio-pesticides and insecticides against the whitefly infesting tomatoes under polyhouse [9]. Conducted an experiment during *kharif* 2011 at Bikaner, Rajasthan to check the bio-efficacy of botanicals and insecticides against sucking complex of chilli. Pesticides tested were acetamiprid 20 SP, imidacloprid 17.8 SL, thiamethoxam 25 WG, thiocloprid 21.7 SC, dimethoate 30 EC, ethion 50 EC, azadirachtin 0.03 EC, NSKE and neem oil. Acetamiprid 0.005% caused highest per cent reduction in whitefly. [6] also computed the efficacy of different insecticides treatments against whitefly, *Bemisia tabaci* infesting tomato. [3] also evaluated the efficacy of spiromesifen 22.9 SC, acephate 75 SP, diafenthiuron 30 WP, Acetamiprid 20 SP, Beauv*eria bassiana* and neem oil (1%) and proposed that acetamiprid 20 SP found most effective against whitefly as recorded 62.79 per cent population reduction, among all the treatments.

Mealybug

The data recorded were based on mean population per cent reduction of mealybug population at 1, 3, 5 and 7 days after first as well as second spray presented in table (2). In all the plots, the pre-treatment population of mealybug showed uniform distribution and varied from 29.33 to 39.35 average no. of whitefly per 5 plants. It was recorded that all the treatments applied were significantly superior over the control.

Data estimates after the application of first spray proposed that acetaprimid 20 SP was highly effective against mealybug causing 60.87, 64.59, 66.37 and 67.20 mean per cent population reduction respectively after 1, 3, 5 and 7 day. *Beauveria bassiana* @ 0.4% was found least effective against mealybugs with 47.77, 51.37, 54.17, 54.54 mean per cent reduction after 1, 3, 5 and 7 day. Correspondingly, the maximum mean per cent reduction in mealybug as 58.64, 60.41, 60.85 and 60.95 population after 1, 3, 5 and 7 days of second spray was observed from acetamiprid 20 SP while neem oil @ 1% was least effective with 39.83, 41.48, 43.61 and 46.59 mean per cent reduction population of mealybugs. [12] evaluated the effectiveness of microbials, botanicals and conventional insecticide against mealy bugs infesting tomato. The treatment with NSKE 5 per cent noted lowest incidence of mealybug on 3 and 7 DAS, followed by other neem based material.

Conclusion

The efficacy of seven different insecticides were computed against the whiteflies and mealybug infesting tomato under polyhouse condition. The treatments were computed based on number of whiteflies and mealybug present on the leaves after 1, 3, 5 and 7 days after the first as well as second spray application. Data estimates after the application of first spray proposed that acetaprimid 20 SP was highly effective against whiteflies and mealybug causing 66.35 and 60.87 mean per cent population reduction respectively after 1 day; 66.65 and 64.59 mean per cent population reduction respectively after 3 days; 65.16 and 66.37 mean per cent population reduction after 5 days; 63.85 and 67.20 mean per cent reduction after 7 days. *Beauveria bassiana* @ 0.4% was found least effective against mealybugs with 47.77 mean per cent reduction after 1 day; 51.37 mean per cent reduction after 3 days; 54.54 mean per cent reduction after 7 days. Neem oil (1%) was found to be least effective with 55.76, 53.40, 52.28 mean per cent reduction in the whiteflies respectively after 3 days, 5 days, 7 days of treatment.

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Table 1: Efficacy of different insecticides on whitefly population in tomato under protected cultivation, 2018

S. No	Treatments	Per cent population reduction									
		1st Spraying					2nd Spraying				
		PTP/5 plants	1DAS	3DAS	5DAS	7DAS	PTP/5 plants	1 DAS	3DAS	5DAS	7DAS
1.	Spiromesifen (22.9 SC) @ 0.10%	35.02 (5.87)	59.27^{c} (73.90	58.35^{c} (72.47)	56.89^{cd} (70.15)	56.87^{b} (70.11)	31.66 (5.66)	56.78^{b} (71.58)	57.06^{b} (70.44)	56.25^{b} (69.14)	55.84^{b} (68.47)
2.	Acetamiprid (20 SP) @ 0.02%	34.67 (5.93)	66.35^{a} (83.91)	66.65^{a} (84.29)	65.16^{a} (82.39)	63.85^{a} (80.57)	44.66 (6.70)	64.66^{a} (81.68)	63.83^{a} (80.54)	63.03^{a} (79.52)	61.43^{a} (77.13)
3.	Neem oil @ 1.00%	34.33 (5.90)	56.82^{d} (71.77)	55.76^{d} (68.34)	53.40^{d} (65.20)	52.28^{c} (65.92)	45.02 (6.71)	50.36^{c} (62.71)	51.90^{c} (62.60)	51.79^{c} (61.75)	50.40^{c} (59.37)
4.	*Beauveria bassiana* @ 0.40%	34.67 (5.91)	56.51^{d} (69.71)	56.06^{d} (70.28)	53.44^{d} (68.30)	52.42^{c} (66.90)	43.01 (6.55)	50.10^{c} (58.92)	52.30^{c} (60.22)	52.53^{c} (59.59)	51.45^{c} (55.13)
5.	Diafenthiuron (30 WP) @ 0.04%	37.67 (6.15)	59.38^{c} (74.06)	58.60^{c} (72.87)	57.14^{c} (71.66)	57.26^{b} (70.75)	43.02 (6.57)	55.57^{b} (68.03)	55.25^{bc} (67.25)	54.96^{bc} (67.04)	54.86^{b} (65.54)
6.	Acephate (75 SP) @ 0.20%	39.35 (6.38)	62.08^{b} (78.08)	61.73^{b} (77.57)	60.87^{b} (76.56)	60.44^{ab} (75.66)	43.66 (6.64)	62.47^{a} (78.63)	62.17^{a} (77.29)	61.90^{a} (70.35)	60.54^{a} (75.81)
7.	Control	29.33 (5.45)	-	-	-	-	43.33 (6.61)	-	-	-	-
	SEm	0.37	0.83	0.91	1.21	1.50	0.39	1.67	1.48	1.19	1.21
	C.D. at 5%	1.13	2.42	2.51	3.68	4.55	1.18	5.07	4.43	3.56	3.38

Figures in parenthesis of PTP are $\sqrt{x+0.5}$ transformed values

Figures in parenthesis of spraying are percent retransformed value

PTP: Pre treatment population numbers per 5 plants, 1-day before treatments; CD: Critical differences; S.Em: Standard error of mean; Numbers followed by the same alphabets in each column are not significantly different at 5%. DAS- Days after spray

Table 2: Efficacy of different pesticides on mealybug population in tomato under protected cultivation, 2018.

S. No.	Treatments	Per cent population reduction									
		1st Spraying					2nd Spraying				
		PTP/5 plants	1DAS	3DAS	5DAS	7DAS	PTP/5 plants	1 DAS	3DAS	5DAS	7DAS
1.	Spiromesifen (22.9 SC) @ 0.10%	33.31 (5.77)	51.77^{c} (61.71)	55.91^{c} (68.58)	58.46^{b} (72.63)	59.45^{b} (74.16)	28.11 (5.19)	46.88^{b} (53.28)	48.27^{b} (55.69)	50.06^{b} (57.06)	49.96^{b} (57.66)
2.	Acetamiprid (20 SP) @ 0.02%	38.30 (6.19)	60.87^{a} (76.30)	64.59^{a} (81.59)	66.37^{a} (83.94)	67.20^{a} (84.99)	39.01 (6.27)	58.64^{a} (72.91)	60.41^{a} (75.62)	60.85^{a} (76.27)	60.95^{a} (76.31)
3.	Neem oil @ 1.00%	40.01 (6.15)	48.07^{d} (58.48)	51.45^{d} (65.08)	54.19^{c} (68.98)	54.63^{c} (70.55)	34.67 (5.61)	39.83^{c} (41.03)	41.48^{c} (43.87)	43.61^{c} (47.58)	46.59^{c} (52.77)
4.	*Beauveria bassiana* @ 0.40%	57.01 (7.58)	47.77^{d} (56.57)	51.37^{d} (67.69)	54.17^{c} (70.55)	54.54^{c} (71.97)	46.33 (6.82)	41.15^{c} (43.30)	42.08^{c} (46.66)	44.29^{c} (50.51)	46.76^{c} (54.11)
5.	Diafenthiuron (30 WP) @ 0.04%	55.00 (7.49)	50.42^{cd} (59.40)	55.45^{c} (67.84)	58.18^{bc} (72.21)	60.05^{b} (75.08)	23.00 (4.83)	47.41^{b} (54.20)	50.66^{b} (59.81)	51.80^{b} (61.92)	51.53^{b} (61.30)
6.	Acephate (75 SP) @ 0.20%	51.02 (7.15)	55.60^{b} (68.08)	59.94^{b} (74.91)	61.55^{b} (77.30)	62.76^{ab} (79.06)	48.53 (6.97)	55.09^{a} (67.25)	56.23^{a} (69.10)	57.25^{a} (70.73)	57.83^{a} (70.84)
7.	Control	52.11 (7.26)	-	-	-	-	65.67 (8.13)	-	-	-	-
	SEm	1.12	1.29	1.33	1.42	1.48	1.19	1.21	1.76	1.86	1.51
	C.D. at 5%	3.36	3.68	3.99	4.26	4.54	3.57	3.63	5.28	5.38	4.67

Figures in parenthesis of PTP are $\sqrt{x+0.5}$ transformed values

Figures in parenthesis of spraying are percent retransformed value

PTP: Pre treatment population numbers per 5 plants, 1-day before treatments; CD: Critical differences; S.Em: Standard error of mean; Numbers followed by the same alphabets in each column are not significantly different at 5%. DAS- Days after spray

References

1. Anonymous. IBM SPSS Software. Available at: http://www.ibm.com/ analytics/us/en/ technology/spss/; accessed 14 July 2016.
2. Arno J, Sorribas R, Parat M, Matas M, Pozo C, Rodriguez D *et al*. *Tuta absoluta*, a new pest in IPM tomatoes in the northeast of Spain. IOBC Bulletin. 2009; 49:203-208.
3. Banshiwal R, Dangi NL, Mahla MK, Kumar K. Bioefficacy of various insecticides against pests of cucumber (*Cucumis sativus* L.) under protected cultivation. Journal of Pharacognosy and Phytochemistry. 2018; 7(6):389-392.
4. Cruz YP, Bernado EN. The biology and feeding of the melon aphid, *Aphis gossypii* Glover (Aphididae: Homoptera) on four host plants. Phillipine Entomologist. 1971; 2(2):156-166.
5. Hinderson CF, Tilton EW. Tests with acaricides against the brown wheat mite. Journal of Economic Entomology. 1955; 48:157-161.
6. Jha SK, Kumar M. Relative efficiency of different insecticides against whitefly, *Bemisia tabaci* on tomato under field condition. Journal of Applied Entomology. 2017; 5(5):728-732.
7. Kashyap L, Sharma D, 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.

8. Kaur S, Kaur S, Srinivasan R, Cheema DS, Lal T, Ghai TR *et al*. Monitoring of Major Pests on Cucumber, Sweet Pepper And Tomato Under Net-House Conditions In Punjab, India. Pest Management in Horticultural Ecosystems. 2010; 16:148-155.
9. Kumar YA, Sanp RK, Acharya VS. Bioefficacy of newer insecticide and botanicals against sucking insect pests of chilli. International Journal of Agriculture Sciences. 2017; 9(24):4288-4291.
10. Negi V, Maikhuri LS, Rawat LS, Parshwan D. Protected cultivation as an option of livelihood in mountain region of central Himalaya, India. International Journal of Sustainable Development & World Ecology. 2013; 20(5):416-425.
11. Singh B. Protected cultivation of vegetable crops. Kalyani Publ., New Delhi, India, 2015, 168.
12. Suradkar A, Ukey SP. Evaluation of certain botanicals, microbials: An conventional insecticide against mealybug infesting tomato. International Journal of Current Microbiology and Applies Sciences. 2014; 3(7):385-389.