International Journal of Agriculture Sciences
ISSN: 0975-3710&E-ISSN: 0975-9107, Volume 9, Issue 24, 2017, pp.-4288-4291.
Available online at http://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Research Article

BIO-EFFICACY OF NEWER INSECTICIDE AND BOTANICALS AGAINST SUCKING INSECT- PESTS OF CHILLI

YADAV AMIT KUMAR[1*], SANP R. K.[2] AND ACHARYA V.S.[2]

[1]Division of Entomology, Rajasthan Agricultural Research Institute, Jaipur, Rajasthan 302018 India
[2]Department of Entomology, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan 334006 India
*Corresponding Author: Email-amitvidrohi002@gmail.com

Received: October 21, 2016; Revised: April 29, 2017; Accepted: April 30, 2017; Published: May 24, 2017

Abstract- Field experiment was conducted during *kharif* 2011 at Instructional farm, College of Agriculture, Swami Keshwan and Rajasthan Agricultural University, Bikaner, Rajasthan to evaluate the bio-efficacy of insecticides and botanicals against sucking pests of chilli. Nine pesticides tested against sucking insect-pests of chilli *viz*., Imidacloprid 17.8 SL, Thiocloprid 21.7 SC , Thiamethoxam 25 WG, Acetamiprid 20 SP, Ethion 50 EC, Dimethoate 30 EC, Azadirachtin 0.03 EC, NSKE and neem oil. Among these pesticides acetamiprid 0.005% caused maximum per cent reduction in thrips and whitefly population of the both sprays. While, in case of jassid imidacloprid 17.8 SL was registered with maximum per cent reduction in the both sprays.

Keywords- Bio-efficacy, Insecticides, Botanicals, Imidacloprid, Acetamiprid

Citation: Yadav Amit Kumar, et al., (2017) Bio-Efficacy of Newer Insecticide and Botanicals against Sucking Insect- Pests of Chilli. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 9, Issue 24, pp.-4288-4291.

Introduction

Chilli (*Capsicum annuum* L.) is the most extensively cultivated spices as well as vegetable crop of the world. It is believed that the chilli plant was introduced in India about the middle of 17th century by the portages. There are two main species of chilli *viz., Capsicum annum* L. and *Capsicum frutescence* of which Indian chilli, *C. annum* is an important vegetable crop due to its adaptability to varied climatic conditions. The medicinal value of chilli has been much realized, because of its vitamin 'C' and capsaicin contents. [1] India accounts for about 40 per cent of total chilli hetaerae (Red ripped as well as green fruit) of the world. The area of chilli was about 6.27 lakh ha with a production of about 25.84 lakh tones of green tender fruits leading to a national productivity of 4120 Kg ha^{-1} [2] Andhra Pradesh, Maharashtra, Karnataka, Orissa, Rajasthan, West Bengal, Tamil Nadu and Gujarat are major chilli growing states forming more than 70 per cent acreage of India. In Rajasthan It occupies about 25.85 thousand ha area with an annual production of 19.97 thousand tonnes and average productivity of 1318 kg/ha^{-1} [3]. The crop is also grown in of Jodhpur, Udaipur, Swaimadhopur, Ajmer, Bhilwara, Jaipur, Kota, Sikar, Alwar, Bharatpur, Chittorgarh and Bikaner. Many factors are responsible for low productivity and production with time but the magnitude of insect pest have been reported to damage the chilli crop from sowing to maturity is most important. About 51 insect and 2 mites species, belonging to 27 families and 9 orders were found infesting chilli [4]. Among these, thrips, *Scirtothrips dorsalis* Hood, whitefly, *Bemisiatabaci* Genn. aphid, *Aphis gossypii* Glover, jassid, *Amrasca biguttula biguttula* and mite, *Polyphagotarsonemus latus* Banks are major sucking pests contributing 60 to 75 per cent yield loss in green chilli [5] These sucking pests causes serious damage to chilli crop by direct feeding and transmit deadly chilli leaf curl disease as vector of pathogen. Hitherto, the control of these sucking pests was mainly achieved through the use of insecticide but excessive and indiscriminate use of insecticide has created many pests problems like development of resistance to most of available insecticides, a insecticide induced resurgence and disruption of population of predator and parasitoids. This situation warrants search for more effective alternate strategy to manage these pests and overcome the crises.

Material and Methods

The present investigation was conducted at Instructional farm, College of Agriculture, Bikaner during summer 2010. Seeds of chilli variety RCH-1 were sown in the well prepared nursery beds. One month old healthy seedlings were taken and transplanted in well prepared experimental plots at row to row spacing of 60 cm and plant to plant spacing of 45 cm. The experiment to evaluate the bioefficacy of nine pesticides was laid out in a randomized block design with four replications.

Treatment Details

Details of insecticides / botanicals used.

NSKE- Neem Seed Kernel Extract

S.No.	Name of Insecticides / botanicals Used	Trade name	Formulation	Conc. (%)/ dose
1.	Imidacloprid	Confidor	17.8 SL	0.005
2.	Thiocloprid	Alanto	21.7SC	0.005
3.	Thiamethoxam	Actara	25 WG	0.005
4.	Acetamiprid	Pride	20SP	0.005
5.	Ethion	Fosmite	50EC	0.03
6.	Dimethoate	Rogor	30EC	0.03
7.	Azadirachtin	Nimbecidine	0.03EC	0.5
8.	NSKE	Local Preparation	-	5.00
9.	Neem oil	Neem oil	-	0.5
10.	Control	-	-	-

Observations

The observation for the population of sucking insect- pests were recorded 24 hours before the spray and at 1, 3, 7 and 15 day after each spray on five plants selected randomly in each plot.

Statistical analysis

Efficacy of different treatments against the sucking insect–pests were analyzed by analysis of variance. The mean reduction in population of sucking pests were corrected by the correction factor for determination of per cent reduction using formula giving by [6] referring it to be modification of [7].

$$\text{Per cent reduction in population} = 100 \times \left[1 - \frac{T_a \times C_b}{T_b \times C_a}\right]$$

Where,

T_a = Number of insects in different treatments after spray

T_b = Number of insects in different treatments before spray

C_a = Number of insects in the untreated check after spray

C_b = Number of insects in the untreated check before spray

The mean reduction (%) were transformed into arc sine values and subjected to analysis of variance.

Result and Discussion

Thrips

The reduction in thrips population as a result of first and second application of insecticides and botanicals during *summer*, 2010 has been cleared in the results [Table-1] After one day of first application of insecticides and botanicals the reduction in thrips population ranged from 12.89 to 62.67 and 26.44 to 62.71 per cent in different treatments in first and second application, respectively. All the treatments were found significantly superior over untreated control. The minimum reduction was recorded in the azadirachtin, NSKE and neem oil treated plots which were found at par to each other, whereas, the maximum reduction was recorded in the plots treated with acetamiprid followed by imidacloprid, thiamethoxam and thiocloprid however, these treatments formed a non significant group. Studies conducted by [8] revealed that acetamiprid proved significantly superior in reducing the incidence of sucking pests in chilli support the present findings. The other treatments resulted in the middle order in exhibiting the thrips reduction. The decreasing trend of effectively of the tested treatments was found to be in the order of acetamiprid, Imidacloprid, thiamethoxam, thiocloprid, dimethoate, ethion, azadirachtin neem oil and NSKE.

Table-1 *Bio-efficacy of different insecticides / botanicals against thrips on chilli during summer, 2010 (First & Second spray)*

Treatments	Conc. (%)	Mean per cent reduction in thrips population							
		First Spray				Second spray			
		1 day after	3 days after	7 days after	15 days after	1 day after	3 days after	7 days after	15 days after
Imidacloprid 17.8 SL	0.005	60.17	70.30	59.57	40.57	59.87	69.82	58.34	40.26
		(50.87)*	(56.98)	(50.51)	(39.57)	(50.70)	(56.68)	(49.80)	(39.38)
Thiocloprid 21.7 SC	0.005	58.08	66.22	56.16	37.43	57.22	66.30	54.92	37.05
		(49.65)	(54.47)	(48.54)	(37.72)	(49.15)	(54.51)	(47.82)	(37.49)
Thiamethoxam 25 WG	0.005	59.00	67.20	57.23	38.50	58.91	67.23	56.94	39.13
		(50.18)	(55.06)	(49.16)	(38.35)	(50.13)	(55.08)	(48.99)	(38.72)
Acetamiprid 20 SP	0.005	62.67	72.46	62.25	43.32	62.71	71.69	60.24	42.63
		(52.34)	(58.35)	(52.09)	(41.16)	(52.36)	(57.85)	(50.91)	(40.76)
Ethion 50 EC	0.03	22.40	52.21	33.20	27.89	24.85	52.59	34.48	27.99
		(28.25)	(46.26)	(35.19)	(31.88)	(29.90)	(46.48)	(35.96)	(31.94)
Dimethoate 30 EC	0.03	26.51	56.34	36.53	30.43	27.33	56.51	37.59	30.21
		(30.99)	(48.64)	(37.19)	(33.48)	(31.52)	(48.74)	(37.82)	(33.34)
Azadirachtin 0.03 EC	0.5	15.77	31.33	26.23	21.57	18.07	33.51	27.69	21.45
		(23.40)	(34.04)	(30.81)	(27.67)	(25.16)	(35.37)	(31.75)	(27.59)
NSKE	5.00	12.89	25.51	21.85	16.28	15.33	28.34	23.38	16.90
		(21.04)	(30.34)	(27.87)	(23.80)	(23.05)	(32.16)	(28.92)	(24.28)
Neem oil	0.5	14.60	28.95	24.26	18.60	16.77	30.27	25.09	18.86
		(22.46)	(32.55)	(29.51)	(25.55)	(24.18)	(33.38)	(30.06)	(25.74)
Control	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S.Em±		0.93	1.35	1.24	1.31	1.41	1.17	1.05	1.15
CD (5%)		2.80	4.05	3.71	3.93	4.24	3.52	3.14	3.46

***Figures in parenthesis are angular transformed values**

After three days of first application, the maximum reduction was recorded in plots treated with acetamiprid (72.46%) which was found significantly superior over rest of the treatments. [9] found that acetamiprid was found good in reducing thrips on chilli which was in conformity with the present findings. The minimum reduction in thrips population was recorded in plots treated with azadirachtin, neem oil and NSKE, however, these treatments were found at par to each other. The present results are in agreement to that of [10]. Who reported that the neem based insecticides were found inferior to the chemical check. The other treatments of dimethoate and ethion in the middle order. The decreasing pattern of the efficacy was found to be in order of: acetamiprid, imidacloprid, thiamethoxam, thiocloprid, dimethoate, ethion, azadirachtin, neem oil and NSKE.

After seven days of application of 1st spray, acetamiprid, imidacloprid, thiamethoxam and thiocloprid recorded highest reduction in thrips population and these treatments were statistically at par to each other. The lowest reduction in thrips was shown by the treatments of NSKE, neem oil and azadirachtin, these were statistically at par to each other. These results are in close agreement to these of [11,12] who reported that imidacloprid and acetamiprid were found most effective against thrips. Rest of the treatments were found in the middle order with respect to reduction in thrips population. The decreasing order of thrips reduction was observed in the treatments acetamiprid, imidacloprid, thiamethoxam, thiocloprid, dimethoate, ethion, azadirachtin, neem oil and NSKE.

After 15th days of first spray, the maximum reduction in thrips population was recorded in plots treated with acetamiprid followed by imidacloprid, thiamethoxam and thiocloprid which were found statistically at par to each other. The study conducted [13,14] revealed that imidacloprid and thiamethoxam were found most effective against thrips support the present finding. The minimum per cent thrips reduction was recorded in NSKE, neem oil and azadirachtin treated plots which were found to be at par to each other. The descending order of efficacy was found acetamiprid imidacloprid, thiamethoxam, Thiocloprid, dimethoate, ethion, azadirachtin, neem oil and NSKE.

Whiteflies

The reduction in whitefly population as a result of first and second application of insecticides and botanicals during *summer* 2010 has been cleared from the results [Table-2] after one day of treatmentAll the treatments were found significant superior over untreated control. The minimum reduction was recorded in the azadirachtin, neem oil and NSKE treated plots which were found at par to each other, where as the maximum reduction was recorded in the plots treated with acetamiprid, followed by thiocloprid, imidacloprid and thiamethoxam however, these treatments formed a non-significant group.

After three days of application, the maximum reduction was recorded in treated plots with acetamiprid followed by thiocloprid, imidacloprid and thiamethoxam.

These treatments were found significantly superior to the rest of treatments and these results are in conformity to that of [15] who reported imidacloprid and acetamiprid were most effective against whitefly. The minimum whitefly population was recorded in plot treated with NSKE. The other treatments of dimethoate and ethion stood in the middle order of efficacy. The descending pattern of efficacy was found in order of acetamiprid, thiocloprid, Imidacloprid, thiamethoxam, dimethoate, Ethion, azadirachtin neem oil and NSKE.

Table-2 *Bio-efficacy of different insecticides/ botanicals against whitefly on chilli during summer, 2010 (First & Second spray)*

Treatments	Conc. (%)	Mean per cent reduction in whitefly population							
		First Spray				Second spray			
		1 day after	3 days after	7 days after	15 days after	1 day after	3 days after	7 days after	15 days after
Imidacloprid 17.8 SL	0.005	43.48	65.22	46.71	32.73	43.17	67.18	49.29	29.26
		(41.26)	(53.87)	(43.11)	(34.89)	(41.07)	(55.05)	(44.59)	(32.74)
Thiocloprid 21.7 SC	0.005	44.92	67.96	48.36	34.33	45.01	68.10	51.30	30.91
		(42.09)	(55.53)	(44.05)	(35.87)	(42.14)	(55.61)	(45.75)	(33.78)
Thiamethoxam 25 WG	0.005	42.00	63.85	45.99	31.94	41.41	63.85	46.52	28.75
		(40.40)	(53.08)	(42.70)	(34.40)	(40.05)	(53.04)	(43.00)	(32.43)
Acetamiprid 20 SP	0.005	47.80	68.84	50.74	34.59	47.59	70.74	53.49	32.40
		(43.74)	(56.12)	(45.42)	(36.01)	(43.62)	(57.25)	(47.00)	(34.69)
Ethion 50 EC	0.03	34.38	44.87	35.22	22.58	32.40	46.75	36.98	21.56
		(35.90)	(44.70)	(36.40)	(28.37)	(34.70)	(43.14)	(37.45)	(27.67)
Dimethoate 30 EC	0.03	35.15	49.50	37.25	24.28	33.79	50.69	39.24	22.49
		(36.36)	(44.71)	(37.61)	(29.52)	(35.54)	(45.40)	(38.79)	(28.31)
Azadirachtin 0.03 EC	0.5	27.89	34.27	26.15	15.96	25.13	27.05	21.93	13.66
		(31.88)	(35.83)	(30.76)	(23.55)	(30.09)	(42.02)	(27.92)	(21.69)
NSKE	5.00	23.64	28.06	19.65	11.52	19.80	21.69	16.98	10.64
		(29.09)	(31.99)	(26.32)	(19.84)	(26.42)	(27.76)	(24.34)	(19.03)
Neem oil	0.5	25.13	30.16	21.42	12.43	22.18	25.85	19.45	12.44
		(30.09)	(33.31)	(27.57)	(20.64)	(28.10)	(30.56)	(26.17)	(20.65)
Control	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S.Em±		1.16	1.44	1.64	1.27	1.33	1.41	1.43	1.37
CD (5%)		3.49	4.31	4.92	3.80	4.01	4.23	4.28	4.10

***Figures in parenthesis are angular transformed values**

After seven days of application the treatment of acetamiprid, thiocloprid, imidacloprid, thiamethoxam resulted highest reduction in whitefly population. These treatments were found statistically superior to other treatments but at par to each other. The lowest reduction in whitefly was recorded in the treatments of azadirachtin, neem oil and NSKE. Earlier [16] also reported that imidacloprid was most effective against sucking pests of chilli while neem pesticide, nimbecidine was found moderately effective partially support the present findings. The descending order of whitefly reduction was observed in the treatments of acetamiprid, thiocloprid, imidacloprid, thiamethoxam, dimethoate, ethion, azadirachtin, neem oil and NSKE.

After 15th days of first spray the maximum reduction in whitefly population was recorded in plots treated with acetamiprid thiocloprid, imidacloprid and thiamethoxam which were found statically at par to each other. These results are in agreement with that of [13] who reported that higher dose of imidacloprid and thiamethoxam were found most effective against whitefly. The minimum reduction was found in the treatment of NSKE followed by neem oil and azadirachtin however all these treatments were at par to each other.

Jassids

The reduction in jassid population as a result of first and second application of insecticides and botanicals during *summer* 2010 has been cleared in the results [Table-3]. The minimum reduction in jassid population was an evident in NSKE, neem oil and azadirachtin and these treatments exhibited a non-significant difference between each other whereas, significantly inferior to other treatments were as, the maximum reduction was recorded in the plots treated with imidacloprid, thiamethoxam, thiocloprid, acetamiprid, dimethoate, ethion, azadirachtin, neem oil and NSKE.

Table-3 *Bio-efficacy of different insecticides/ botanicals against jassid on chilli during summer, 2010 (First & Second spray)*

Treatments	Conc. (%)	Mean per cent reduction in jassid population							
		First Spray				Second spray			
		1 day after	3 days after	7 days after	15 days after	1 day after	3 days after	7 days after	15 days after
Imidacloprid 17.8 SL	0.005	58.44	74.12	65.33	30.85	56.08	73.15	64.36	29.54
		(49.86)*	(59.42)	(53.93)	(33.74)	(48.49)	(58.79)	(53.34)	(32.92)
Thiocloprid 21.7 SC	0.005	54.98	71.10	61.18	25.66	53.41	70.36	59.44	26.00
		(47.86)	(57.48)	(51.46)	(30.43)	(46.96)	(57.01)	(50.44)	(30.65)
Thiamethoxam 25 WG	0.005	56.23	73.25	62.14	28.60	55.45	72.07	61.68	27.02
		(48.58)	(58.86)	(52.03)	(32.33)	(48.13)	(58.09)	(51.75)	(31.32)
Acetamiprid 20 SP	0.005	53.44	68.78	60.27	25.34	52.52	68.94	58.07	24.27
		(46.97)	(56.03)	(50.93)	(30.22)	(46.44)	(56.13)	(49.64)	(29.51)
Ethion 50 EC	0.03	44.55	59.88	51.32	17.57	44.32	58.94	46.65	16.26
		(41.87)	(50.70)	(45.76)	(24.78)	(41.74)	(50.15)	(43.08)	(23.78)
Dimethoate 30 EC	0.03	46.34	61.95	53.62	19.05	46.86	62.79	51.08	18.16
		(42.90)	(51.92)	(47.08)	(25.88)	(43.20)	(52.41)	(45.62)	(25.22)
Azadirachtin 0.03 EC	0.5	30.96	36.73	26.87	12.55	28.17	32.86	26.29	11.78
		(33.81)	(37.30)	(31.22)	(20.75)	(32.06)	(34.98)	(30.85)	(20.08)
NSKE	5.00	26.31	30.42	22.32	8.42	24.48	28.08	21.67	8.01
		(30.86)	(33.47)	(28.19)	(16.86)	(29.65)	(32.00)	(27.74)	(16.45)
Neem oil	0.5	27.85	31.62	23.45	10.15	26.25	29.97	22.79	9.85
		(31.85)	(34.22)	(28.96)	(18.58)	(30.82)	(33.19)	(28.51)	(18.29)
Control	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S.Em±		1.18	1.28	1.09	1.32	0.83	1.02	1.30	1.23
CD (5%)		3.55	3.83	3.27	3.96	2.48	3.05	3.90	3.67

***Figures in parenthesis are angular transformed values**

After three days of first application, the maximum reduction was recorded in treated plots with imidacloprid, followed by thiamethoxam, thiocloprid and acetamiprid, however, these treatments formed a non significant group and significantly superior over rest of the treatments. [12] also reported that imidacloprid and acetamiprid were found most effective in the management of jassid support the present findings. The minimum jassid population was recorded in plots treatment with azadirachtin followed by neem oil and NSKE. These treatments were at par to each other. The decreasing pattern of the efficacy was found to be in order of imidacloprid, thiamethoxam, thiocloprid, acetamiprid, dimethoate, ethion, azadirachtin, neem oil and NSKE.

After seven days of application, the treatments, of imidacloprid, thiamethoxam, thiocloprid, acetamiprid given the highest reduction in jassid population. All these treatments were statically at par to each other and superior to rest of the treatments. The lowest reduction in jassid was revealed by the treatments of azadirachtin, neem oil and NSKE. Likewise, the study conducted by [11] also incedance reported that imidacloprid was most effective against jassid while [13] reported that imidacloprid, thiamethoxam and azadirachtin were found most effective against Jassid support the present findings. The decreasing order of jassid reduction was observed in the treatments of imidacloprid thiamethoxam, thiocloprid, acetamiprid, dimethoate, ethion, azadirachtin, neem oil and NSKE.

After 15th days of first spray the maximum reduction in jassid population was recorded in plots treated with imidacloprid, thiamethoxam, thiocloprid, acetamiprid. These treatments were significantly superior to rest of the treatments and comparable to each other. The data indicated that the treatments of dimethoate and ethion formed the second group causing reduction in population of jassid on chilli.

Conclusion

The experiment on bio-efficacy of different insecticides /botanicals revealed that all the treatments proved significantly superior over control among the tested insecticides/botanicals acetamiprid, imidacloprid, thiamethoxam and thiocloprid, were found highly effective in reducing the thrips, whitefly and jassid population and also resulted in higher yield.

Acknowledgement

Authors highly thankful to Head, Department of Entomology, College of Agriculture, SKRAU Bikaner, Rajasthan 334006 India for providing necessary facilities during this research

Author Contributions: All author equally contributed

Abbreviations: ha^{-1} – Hectare, kg/ha^{-1} -Kilogram per Hectare, cm- Centimetre

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Conflict of Interest: None declared

References

[1] Sayed S. and Bagavandoss M.(1980) *South Indian Hort.,* 28(1), 31
[2] Anonymous (2004) *Area and Proudction Directorate of Horticulture, Gujarat state, Gandhinagar.*
[3] Anonymous (2009) *Rajasthan Agricultural Statistics at a glance* 2008-09. P.87.
[4] Reddy D.N.R. and Puttaswamy (1983) *Maysore J. Agric Sci.,* 17(3),122-125.
[5] Patel V.N. and Gupta H.C.L. (1998) *Estimation of losses and management of thrips infesting chillies in National Seminar on "Entomology in 21st Century" Biodiversity, Sustainability, Environmental Safety and Human Healthpp 99. to Rajasthan Agriculture University, Udaipur.*
[6] Henderson C.F. and Tiltion E.W. (1995) *Journal of Economic Entomology*, 48, 157-161.
[7] Abbott W.S. (1925) *J. Econ. Ento.,* 18, 265-267.
[8] Dharne P.K. and kabre G.B. (2009) *Karnataka J. Agric. Sci.,* 22(3-SPL.Issue), 585-587.
[9] Nandihalli B.S. (2009) *Karnataka Journal of Agricultural Sciences.,* 22(3), 591-593.
[10] Chandrasekaran M. and Veeravel R. (1998) *Madras Agricultural J.,* 85, 2, 120-122.
[11] Ameta O.P. and Sharma K.C. (2005) *Insect Environment*, 11, 9-13.
[12] Gosalwad S.S., Kwathekar B.R., Wadherkar D.W., Asewar B.V. and Dhutraj D.N. (2008) *J. Maharashtra agric. Univ.,* 33(3), 343-346.
[13] Mhaske B. M. and Mote U. N. (2005) *Journal of Maharashtra Agricultural University*, 30, 303-306.
[14] Patel B.H., Koshiya D.K., Korat D.M. and Vaishnav P.R. (2009) *Karnataka J. Agric Sci.,* 22(2), 327-330.
[15] Misra H.P. (2005) *Orissa Journal of Horticulture.,* 33, 76-78.
[16] Jain K.L. and Ameta O.P. (2006) *Pestology,* 30.