International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(5): 2813-2816

Received: 09-07-2018
Accepted: 10-08-2018

AJ Mokal
Department of Agril. Entomology, College of Agriculture, Dapoli Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. Dist. Ratnagiri, Maharashtra, India

BD Shinde
Department of Agril. Entomology, College of Agriculture, Dapoli Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. Dist. Ratnagiri, Maharashtra, India

KV Naik
Department of Agril. Entomology, College of Agriculture, Dapoli Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. Dist. Ratnagiri, Maharashtra, India

GM Golvankar
Department of Agril. Entomology, College of Agriculture, Dapoli Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. Dist. Ratnagiri

AL Narangalkar
Department of Agril. Entomology, College of Agriculture, Dapoli Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. Dist. Ratnagiri, Maharashtra, India

Correspondence
BD Shinde
Department of Agril. Entomology, College of Agriculture, Dapoli Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. Dist. Ratnagiri, Maharashtra, India

Chemical management of whiteflies infesting chilli

AJ Mokal, BD Shinde, KV Naik, GM Golvankar and AL Narangalkar

Abstract
The field trail was carried out to chemical management of whiteflies infesting chilli during *rabi* season of 2016-17 at Central Experimental Station, Wakawali, Dist- Ratnagiri. During this experiment total seven insecticides tested *viz*., acetamiprid 20 SP @ 0.004, dimethoate 30 EC @ 0.6, emamectin benzoate 5 SG @ 0.002, imidacloprid 17.8 SL @ 0.004, lambda cyhalothrin 5 EC @ 0.018, spinosad 45 SC @ 0.014 and thiamethoxam 25 WG @ 0.01 percent, respectively. The results regarding overall mean of three sprays against whiteflies revealed that the mean whitefly population was reduced in treatment acetamiprid 20 SP @ 0.004 percent (0.11) and at par with thiamethoxam 25 WG @ 0.01 percent (0.17) whereas Spinosad 45 SC @ 0.014 percent recorded (0.36).

Keywords: Chemical management, whiteflies, chilli, insecticides.

Introduction
Chilli cultivation is mostly concentrated in the southern states *viz.*, Andhra Pradesh, Karnataka and Tamil Nadu occupying nearly 75 percent of the total area under chilli in India. In Chhattisgarh, it is cultivated about 3.96 thousand hectares with annual production of 2.74 lac metric tonnes in all parts during rainy, spring and summer season (Anon., 2015) [2].
Besides several factors responsible for low productivity and quality deterioration of chilli the damage caused by insect pests is the most important. Over 35 species of insect and mite are reported as pests of pepper which includes thrips, aphids, whiteflies, fruit borers, cutworms, plant bug, mites and other minor pests (Sorensen, 2005) [6]. Unlike many of the field problems, insect pest problems are peculiar to poly house/green house/shade net cultivation. Thrips *S. dorsalis*, mite *P. latus*, aphid *Myzus persicae* (Sulz.), whitefly *Bemisia tabaci* (Gennadius), leaf miner *Liriomyza trifolii* (Burgess), gall midge *Asphondylia capsici* Barens and nematodes *Meloidogyne incognita* Chitwood are serious problems on capsicum under protected condition (Kaur *et al*., 2010) [4].
During the last two decades insecticidal control of chilli pests in general and especially in irrigated crop characterised by high pesticides usage, has posed problems of residues in the fruits (Joia *et al*., 2001) [3].
The several insecticides are being used to manage chilli whiteflies but because of development of many fold resistance to existing insecticides, it has become difficult to manage the pests effectively. Considering the seriousness of *Bemisia tabici* infesting chilli in the *Konkan* region, some new molecules need to be evaluated against this pest so that these pesticides can be incorporated in the spray schedule for management of *Bemisia tabici* infesting chilli.

Materials and methods
A field experiment was conducted during *rabi* season of 2016-17 to study chemical management of whiteflies infesting chilli (cv. Konkan kirti). The details of experiment are given in below

Cultural operations
The land was prepared as per the requirements of cucumber crop and cleared by removing the residues of the previous crop. The experiment was laid out in Randomized Block Design (RBD). The recommended dose of fertilizers for cucumber is 100:50:50 N:P:K kg ha^{-1}. Nitrogen @ 100 kg ha^{-1} was applied in three splits doses *viz*., first dose of 50 percent N at the time of transplanting, second dose of 50 percent N during flowering and fruiting stage.

Phosphorus was applied @ 50 kg ha^{-1} and potassium was applied @ 50 kg ha^{-1}, these fertilizers were applied in a single dose at the time of transplanting.

The experimental area was sown with good seed of chilli (cv. Konkan kirti) in each plot. The transplanting of seedlings was done forty days after sowing. The other agronomic operations *viz.*, intercultural operations and weeding were done as per recommendation.

Details of the field experiment

1	**Location**	**:**	**Central Experimental Station, Wakawali, Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli, Dist- Ratnagiri**
2	Variety	:	Konkan kirti
3	Spacing	:	60 cm × 60 cm
4	Total plot size	:	190.08 m^2
5	Size of treatment plot	:	6.6 m × 1.2 m
6	Date of transplanting	:	26th December, 2016
7	Method of planting	:	On raised bed
8	Design	:	Randomized Block Design (RBD)
9	Number of treatment	:	Eight
10	Number of replication	:	Three
Treatment Details:			
No.	**Insecticides**		**Concentration (%)**
T_1	Acetamiprid 20 SP		0.004
T_2	Dimethoate 30 EC		0.6
T_3	Emamectin benzoate 5 SG		0.002
T_4	Imidacloprid 17.8 SL		0.004
T_5	Lambda cyhalothrin 5 EC		0.018
T_6	Emamectin benzoate 5 SG		0.002
T_7	Thiamethoxam 25 WG		0.01
T_8	Untreated Control		-

Spraying

The quantity of spray suspension required for each treatment was calibrated by spraying water over three plots in the experiment prior to the application of insecticide. Spray suspension of desired strength of each insecticide was prepared against whitefly in the field.

The insecticides were sprayed thrice. First spray of each insecticide was applied when incidence was noticed, while remaining two sprays were given at an interval of 15 days with manually operated knapsack sprayer. The observations were recorded in each treatment on randomly selected five plants.

Method of recording observations

Observations on the number of whiteflies were recorded on five randomly selected plants per plot. Numbers of whitefly were recorded from three leaves top, middle and bottom of the plant. The populations of aphids before spraying as precount and on third, seventh, tenth and fourteenth days after each spray were recorded in the early morning hours. The data thus obtained were converted into square root transformation and then statistically analysed.

Results and Discussion

Efficacy of insecticides against whitefly (*B. tabaci*) infesting chilli

1. Efficacy of some insecticides against whitefly (*B tabaci*) infesting chilli recorded at different intervals after first spray

The data pertaining to the efficacy of different insecticides against whitefly infesting chilli at 3, 7, 10 and 14 days after spray are represented in Table 1.

The data on mean population of whitefly per three leaves per plant prior to insecticide application ranges from 0.23 to 0.33. There is no significant difference among the different treatments since uniform distribution of whitefly population in different treatments.

The observations recorded at third day after spraying of insecticide ranges from 0.00 to 0.49. The treatment acetamiprid 20 SP @ 0.004 percent (0.00) were at par with treatments spinosad 45 SC @ 0.014 percent (0.02) and thiamethoxam 25 WG @ 0.01 percent (0.04). The remaining treatments were in descending order of effectiveness lambda cyhalothrin 5 EC @ 0.018 percent, emamectin benzoate 5 SG @ 0.002 percent, dimethoate 30 EC @ 0.6 percent and imidacloprid 17.8 SL @ 0.004 percent recorded 0.12, 0.17, 0.20 and 0.25 mean whitefly population, respectively. The maximum (0.49) pest population was found in untreated control.

At the seventh day after first spray the no pest population recorded in the treatment acetamiprid 20 SP @ 0.004 percent and treatment thiamethoxam 25 WG @ 0.01 percent. The next best treatment spinosad 45 SC @ 0.014 percent (0.08) which was at par with the treatments emamectin benzoate 5 SG @ 0.002 percent (0.11), lambda cyhalothrin 5 EC @ 0.018 percent (0.11), dimethoate 30 EC @ 0.6 percent (0.21) and imidacloprid 17.8 SL @ 0.004 percent (0.23) while maximum (0.95) whitefly population was noticed in untreated control.

The observations recorded at 10th day after first spray revealed that the whitefly population in the treatment acetamiprid 20 SP @ 0.004 percent (0.16) and treatment thiamethoxam 25 WG @ 0.01 percent (0.33) was at with each other. The remaining treatments *viz*., spinosad 45 SC @ 0.014 percent (0.52), emamectin benzoate 5 SG @ 0.002 percent (0.72), lambda cyhalothrin 5 EC @ 0.018 percent (0.81), dimethoate 30 EC @ 0.6 percent (1.00) and imidacloprid 17.8 SL @ 0.004 percent (1.12) both at par with each other. The maximum (1.40) whitefly population was recorded in untreated plot.

At 14th day of observation, the minimum pest population was recorded in spinosad 45 SC @ 0.014 percent (0.52) which

was at par with treatments acetamiprid 20 SP @ 0.004 percent (0.54) and thiamethoxam 25 WG @ 0.01 percent (0.61). The remaining treatments were emamectin benzoate 5 SG @ 0.002 percent, dimethoate 30 EC @ 0.6 percent, lambda cyhalothrin 5 EC @ 0.018 percent and imidacloprid 17.8 SL @ 0.004 percent recorded thrips population 1.13, 1.17, 1.23 and 1.84, respectively. The maximum population (2.11) was found in untreated plot.

2. Efficacy of some insecticides against whitefly (*B. tabaci*) recorded at different intervals after second spray

The results on effect of second spray are presented in Table 1. The observations recorded at third day after second spray indicated that the treatment acetamiprid 20 SP @ 0.004 percent (0.10) and thiamethoxam 25 WG @ 0.01 percent (0.22) was at with each other. The treatments *viz*., spinosad 45 SC @ 0.014 percent (0.48) was at par with emamectin benzoate 5 SG @ 0.002 percent (0.75). The rest of the treatments were lambda cyhalothrin 5 EC @ 0.018 percent (0.99), dimethoate 30 EC @ 0.6 percent (1.13) and imidacloprid 17.8 SL @ 0.004 percent (1.43) while maximum (2.68) mean whitefly population per three leaves per plant was noticed in untreated control.

At 7th day after second spray, no whitefly population was recorded in the treatment acetamiprid 20 SP @ 0.004 percent (0.00) and was at par with the treatment thiamethoxam 25 WG @ 0.01 percent (0.03). The treatments spinosad 45 SC @ 0.014 percent (0.33) was at par with emamectin benzoate 5 SG @ 0.002 percent (0.36). The rest of the treatments were lambda cyhalothrin 5EC @ 0.018 percent (0.63), dimethoate 30 EC @ 0.6 percent (1.19) and imidacloprid 17.8 SL @ 0.004 percent (1.21). The maximum (2.52) whitefly population was observed in untreated control.

The observations recorded at 10th day after second spray revealed that no whitefly population was recorded in the treatment thiamethoxam 25 WG @ 0.01 percent followed by acetamiprid 20 SP @ 0.004 percent recorded (0.02) and was at par with each other. The remaining treatments were spinosad 45 SC @ 0.014 percent (0.52), emamectin benzoate 5 SG @ 0.002 percent (0.91), lambda cyhalothrin 5EC @ 0.018 percent (0.98), dimethoate 30 EC @ 0.6 percent (1.14) and imidacloprid 17.8 SL @ 0.004 percent (1.20). The maximum whitefly population (3.28) recorded in untreated control.

At 14th day of observation, the minimum (0.39) whitefly population was recorded in acetamiprid 20 SP @ 0.004 percent which was significantly superior over rest of the treatments. The remaining treatment *viz*., thiamethoxam 25 WG @ 0.01 percent (0.63) and spinosad 45 SC @ 0.014 percent (1.09), emamectin benzoate 5 SG @ 0.002 percent (1.47), lambda cyhalothrin 5 EC @ 0.018 percent (1.63), dimethoate 30 EC @ 0.6 percent (1.98) and imidacloprid 17.8 SL @ 0.004 percent (2.03). The maximum population observed 3.50 in untreated control.

3. Efficacy of some insecticides against whitefly (*B. tabaci*) infesting chilli recorded at different intervals after third spray

The results on effect of third spray are presented in Table 1. After 3 days of third spray, the treatment acetamiprid 20 SP @ 0.004% recorded (0.02) mean population per three leaves per plant followed by thiamethoxam 25 WG @ 0.01 percent (0.03) and was at par with each other. The whitefly population in rest of the treatments were spinosad 45 SC @ 0.014 percent (0.48), emamectin benzoate 5 SG @ 0.002 percent (0.91), dimethoate 30 EC @ 0.6 percent (1.25), lambda cyhalothrin 5EC @ 0.018 percent (1.31) and imidacloprid 17.8 SL @ 0.004 percent (2.01). The highest whitefly population was noticed in untreated control (3.32).

The data at 7th day of third spray indicated that recorded no pest population was observed in treatments *viz*., acetamiprid 20 SP @ 0.004% and thiamethoxam 25 WG @ 0.01 percent. The whitefly population in remaining treatments were spinosad 45 SC @ 0.014 percent (0.14), emamectin benzoate 5 SG @ 0.002 percent (0.57), lambda cyhalothrin 5EC @ 0.018 percent (0.96), imidacloprid 17.8 SL @ 0.004 percent (1.24) and dimethoate 30 EC @ 0.6 percent (1.31). The maximum (3.47) population was recorded in untreated control.

The observations recorded at 10th day after third spray revealed that no whitefly population in acetamiprid 20 SP @ 0.004% and was at par with thiamethoxam 25 WG @ 0.01 percent (0.08) and spinosad 45 SC @ 0.014 percent (0.10). The whitefly population in remaining treatments were emamectin benzoate 5 SG @ 0.002 percent (0.65), lambda cyhalothrin 5EC @ 0.018 percent (0.85), imidacloprid 17.8 SL @ 0.004 percent (1.16) and dimethoate 30 EC @ 0.6 percent (1.18). Untreated plot recorded highest (3.26) mean whitefly population per three leaves per plant.

At 14th day of observation, revealed that no whitefly population was recorded in acetamiprid 20 SP @ 0.004% and was at par with spinosad 45 SC @ 0.014 percent (0.02) and thiamethoxam 25 WG @ 0.01 percent (0.07). The treatments *viz*., emamectin benzoate 5 SG @ 0.002 percent (0.77) was at par with lambda cyhalothrin 5EC @ 0.018 percent (0.85). The remaining treatments imidacloprid 17.8 SL @ 0.004 percent (1.25) and dimethoate 30 EC @ 0.6 percent (1.29) was at par with each other while untreated control recorded maximum pest population (3.35).

4. Overall mean of different insecticides against whitefly (*B. tabaci*) infesting chilli

The data pertaining to the overall efficacy of different insecticides against whitefly infesting chilli are presented in Table 1.

The results regarding overall mean of all sprays revealed that acetamiprid 20 SP @ 0.004 percent (0.11) was at par with thiamethoxam 25 WG @ 0.01 percent (0.17). The remaining treatments *viz*., spinosad 45 SC @ 0.014 percent recorded (0.36), emamectin benzoate 5 SG @ 0.002 percent (0.71), lambda cyhalothrin 5EC @ 0.018 percent (0.87), dimethoate 30 EC @ 0.6 percent (1.01) and imidacloprid 17.8 SL @ 0.004 percent (1.25). All the above treatments were found to be superior over untreated control which recorded highest pest population (2.53).

The present findings strongly confirm with results of Ali *et al*. (2005) [1]. They evaluated the efficacy of IGR, neonicotinoid and other insecticides against the cotton whitefly. The insecticides were used against the whitefly *i.e*., acetamiprid, diafenthiuron, imidacloprid and buprofezin was effective against the whitefly during the year 2003 and 2004.

Similarly, Khaire (2017) [5] reported that the treatment acetamiprid 20 SP @ 0.004 percent recorded minimum of 1.38 mean whiteflies/3 leaves/plant which was at par with treatments spinosad 45 SC @ 0.016 percent (1.39), emamectin benzoate 5 SG @ 0.0016 percent (1.46) and diafenthiuron 50 WP @ 0.06 percent (1.53).

Table 1: Efficacy of different insecticides against whitefly (*B. tabaci*) infesting chilli

Treatment	Pre count	Mean population of whitefly per 3 leaves per plant												Overall mean
		I st spray				II nd spray				III rd spray				
		3 DAS	7 DAS	10 DAS	14 DAS	3 DAS	7 DAS	10 DAS	14 DAS	3 DAS	7 DAS	10 DAS	14 DAS	
T_1	0.33 (1.15)*	0.00 (1.00)	0.00 (1.00)	0.16 (1.08)	0.54 (1.24)	0.10 (1.05)	0.00 (1.00)	0.02 (1.01)	0.39 (1.18)	0.02 (1.01)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.11 (1.05)
T_2	0.30 (1.13)	0.20 (1.09)	0.21 (1.10)	1.00 (1.42)	1.17 (1.47)	1.13 (1.46)	1.19 (1.48)	1.14 (1.46)	1.98 (1.73)	1.25 (1.50)	1.31 (1.52)	1.18 (1.48)	1.29 (1.51)	1.01 (1.42)
T_3	0.23 (1.10)	0.17 (1.08)	0.11 (1.05)	0.72 (1.31)	1.13 (1.46)	0.75 (1.32)	0.36 (1.17)	0.91 (1.38)	1.47 (1.57)	0.91 (1.38)	0.57 (1.25)	0.65 (1.28)	0.77 (1.33)	0.71 (1.31)
T_4	0.23 (1.10)	0.25 (1.12)	0.23 (1.11)	1.12 (1.45)	1.84 (1.68)	1.43 (1.56)	1.21 (1.49)	1.20 (1.48)	2.03 (1.74)	2.01 (1.74)	1.24 (1.50)	1.16 (1.47)	1.25 (1.50)	1.25 (1.50)
T_5	0.25 (1.12)	0.12 (1.06)	0.11 (1.05)	0.81 (1.35)	1.23 (1.49)	0.99 (1.41)	0.63 (1.28)	0.98 (1.41)	1.63 (1.62)	1.31 (1.52)	0.96 (1.40)	0.85 (1.36)	0.85 (1.36)	0.87 (1.37)
T_6	0.27 (1.12)	0.02 (1.01)	0.08 (1.04)	0.52 (1.23)	0.52 (1.23)	0.48 (1.22)	0.33 (1.15)	0.52 (1.23)	1.09 (1.45)	0.48 (1.22)	0.14 (1.07)	0.10 (1.05)	0.02 (1.01)	0.36 (1.17)
T_7	0.27 (1.12)	0.04 (1.02)	0.00 (1.00)	0.33 (1.15)	0.61 (1.27)	0.22 (1.10)	0.03 (1.02)	0.00 (1.00)	0.63 (1.27)	0.03 (1.02)	0.00 (1.00)	0.08 (1.04)	0.07 (1.04)	0.17 (1.08)
T_8	0.33 (1.15)	0.49 (1.22)	0.95 (1.39)	1.40 (1.55)	2.11 (1.76)	2.68 (1.92)	2.52 (1.88)	3.28 (2.07)	3.50 (2.12)	3.32 (2.08)	3.47 (2.11)	3.26 (2.06)	3.35 (2.08)	2.53 (1.88)
SE (m±)	0.08	0.02	0.03	0.02	0.04	0.03	0.03	0.04	0.02	0.03	0.05	0.02	0.02	0.03
CD at 0.05%	NS	0.05	0.08	0.07	0.12	0.10	0.10	0.11	0.06	0.08	0.14	0.07	0.06	0.09

*Figures in parenthesis are $\sqrt{X+1}$ values (DAS- Days after Spraying)

Conclusion

From the present study, it can be concluded that the chemical management of whitefly infesting chilli and there results on overall mean of all sprays revealed that acetamiprid 20 SP @ 0.004 percent (0.11) was at par with thiamethoxam 25 WG @ 0.01 percent (0.17). The remaining treatments *viz*., spinosad 45 SC @ 0.014 percent recorded (0.36), emamectin benzoate 5 SG @ 0.002 percent (0.71), lambda cyhalothrin 5EC @ 0.018 percent (0.87), dimethoate 30 EC @ 0.6 percent (1.01) and imidacloprid 17.8 SL @ 0.004 percent (1.25). All the above treatments were found to be superior over untreated control which recorded highest pest population (2.53).

References

1. Ali Rehman R, Tatla YH, Ali Z. Evaluation of different insecticides for the control of whitefly on cotton crop in Karor district layyah. Pak. Entomol. 2005; 27:1.
2. Anonymous. Report of Agriculture Department, Chhattisgarh Government. Krishi Darshika, Directorate of Extension Service, IGKV, Raipur (C.G.), 2015, 7.
3. Joia BS, Jaswinder Kaur, Udean AS. Persistence of ethion residues on/in chilli. Paper presented in the National Symposium on Integrated Pest Management (IPM) in horticultural crops, Bangalore, 2001.
4. Kaur S, Dhaliwal MS, Cheema DS, Sharma A. Screening of chilli germplasm for resistance against chilli thrips and yellow mite. J. Res. Punjab Agric. Univ. 2010; 47(3-4):143-144.
5. Khaire AC. Seasonal incidence, screening and management of pest infesting chilli. Ph. D. thesis submitted to Department of Agril. Entomology, College of Agriculture, Dapoli, Dr. B. S. K. K. V., Dapoli, 2017, 1-2.
6. Sorensen KA. Vegetable insect pest management. www.ces.ncsu.edu/depts./ent/notes/vegetables/veg37.htm l1-11k