Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2020; 8(1): 1222-1225

Received: 06-11-2019
Accepted: 10-12-2019

Praveen Kumar
Department of Entomology, CCS Haryana Agricultural University, Hisar, Haryana, India

SP Yadav
Department of Entomology, CCS Haryana Agricultural University, Hisar, Haryana, India

Sunita Yadav
Department of Entomology, CCS Haryana Agricultural University, Hisar, Haryana, India

Puneet
Department of Entomology, CCS Haryana Agricultural University, Hisar, Haryana, India

Corresponding Author:
Sunita Yadav
Department of Entomology, CCS Haryana Agricultural University, Hisar, Haryana, India

Efficacy of different chemical and botanical insecticides against cotton leafhopper, *Amrasca biguttula biguttula* (Ishida)

Praveen Kumar, SP Yadav, Sunita Yadav and Puneet

Abstract
Bio-efficacy of six insecticides (Imidacloprid 17.8 SL @ 40ml/acre, Thiamethoxam 25 WG @ 40 g/acre, Nimbecidine 1500 ppm @ 1.00 l/acre, Nimbecidine 300 ppm @ 1.00 l/acre, Neem oil 5% and NSKE 5%) was evaluated against untreated control. Thiamethoxam 25 WG @ 40g/acre exhibited maximum reduction in cotton leafhopper population followed by imidacloprid 17.8 SL @ 40ml/acre. NSKE 5% reduced minimum population. The maximum net profit (Rs. 10442 per ha) was recorded in thiamethoxam 25 WG treatment followed by imidacloprid 17.8 SL (Rs. 9210 per ha). The highest incremental cost benefit ratio (ICBC) was also obtained in the thiamethoxam (12.00) treatment followed by imidacloprid (8.00).

Keywords: Efficacy, botanical, leafhopper, imidacloprid, thiamethoxam, ICBC

Introduction
Cotton (*Gossypium* spp.) is a major commercial crop commonly designated as "King of Fibres" and globally grown for its lint and seed. India is the only country where all four cultivated species (*G. hirsutum, G. barbadense, G. arboreum* and *G. herbaceum*) of cotton are grown on commercial scale. In India, cotton is cultivated in an area of 12.65 m ha with a production of 37.39 million bales (170 kg/bale) of seed cotton during 2015-16 and in Haryana, total area under cotton is 6.39 lakh ha and production is 22.00 lakh bales of 170 kg with productivity of 665 kg per ha (Anonymous, 2015) [1].

There are a number of causes responsible for low yield of cotton but losses caused by insect-pests are of prime importance. In India, 162 species of insect-pests have been recorded to cause damage to the cotton crop. (Dhaliwal *et al.*, 2008) [2]. After introduction of *Bt* cotton, sucking pests like leafhopper (*Amrasca biguttula biguttula*), aphid (*Aphis gossypii*), thrips (*Thrips tabaci*) and whiteflies (*Bemisia tabaci*) etc. are responsible for the major threat and destruction of cotton crop (Gahukar, 1997) [8]. Sap feeders have been reported to cause loss in the yield to extent of 8.45q/ha in *hirsutum* cotton (Radhika *et al.*, 2006) [4]. In case of leafhopper, both nymph as well as adult suck the cell sap from under surface of the leaf causing crinkling, specking and distortion of the leaves. Generally, the leaves are curled downwards with reddening along the sides. Yield losses due to this pest have been reported to be in the tune of 18 to 24 per cent (Bhat *et al*., 1986; Dhawan *et al.*, 1988; Javed *et al*., 1992; Grover and Pental, 2003) [5, 6, 7, 8].

For management of cotton leafhopper, farmers use insecticides indiscriminately which directly increase their cost of cultivation, insect resistant to insecticides, environmental pollution, pesticide hazards etc. Owing to the over-reliance on conventional chemicals and undesirable effects caused by them, the recent advancements in pesticide industries are targeted for development of insecticides which are relatively safer to natural enemies and exhibit less persistence in the environment. Use of botanical insecticides (NSKE, nimbecidine and neem oil) can be an effective solution. Insecticides of plant origin are comparatively safer for non-target organisms including natural enemies as well as human beings. Secondly, repeated use of insecticides has resulted in problems such as pest resurgence and secondary pest outbreaks, simultaneously giving rise to the emergence of insect strains (biotype) that are highly tolerant or resistant. These newer insecticide molecules such as neonicotinoids are advantageous in pest management strategies as they are economical, non-hazardous and are required in very less quantity, hence creating minimum or negligible disturbances to the agro ecosystem.

Thus, to study the efficacy of different neonicotinoids and botanicals against leafhopper, this experiment was conducted. Keeping the above facts in view, the present investigation was undertaken to study the efficacy of different chemical and botanical insecticides against cotton leafhopper.

Materials and Methods

Bio-efficacy of various insecticides against cotton leafhopper was evaluated in the field on transgenic cotton hybrid, RCH 650 BGII during 2015-16 at Regional Research Station of Chaudhary Charan Singh Haryana Agricultural University at Samargopalpur, Rohtak (Haryana).

Experimental layout: The experiment was carried out in three replications and each replication comprised of plots of size 4 x 3 m^2 in Randomized Block Design (RBD).

Treatments: The experiment consisted of seven treatments including control *viz.* T_1: Imidacloprid 17.8 SL @ 40ml/acre; T_2: Thiamethoxam 25 WG @ 40 g/acre; T_3: Nimbecidine 1500 ppm @ 1.00 l/acre; T_4: Nimbecidine 300 ppm @ 1.00 l/acre; T_5: Neem oil 5%; T_6: NSKE 5% and T_7: Control. Spray was started at economic threshold (ET) *i.e.* 2 nymphs per leaf. Knapsack sprayer was used for application of insecticide at their respective doses.

Observations recorded*:* Leafhopper population recorded on three leaves (upper, middle and lower canopy) from five randomly selected plants per plot one day before spray and 1, 3, 7 and 10 days after spray.

Statistical analysis: The data recorded during the experiment was subjected to statistical analysis by proper methods using online statistical package OPSTAT developed by Sheoran *et al.*1998 [9].

Results and Discussion

The data presented in Table 1 indicates that before spray the mean number of nymphs/leaf per plant varied from 2.06 to 2.69 nymphs/ leaf and the difference in the nymphal population among different treatments was non-significant. Data on mean reduction of leafhopper after spray are presented in Table1. After one day of spray, it is evident that all the insecticidal treatments were significantly effective in suppressing the population of leafhopper as compared to control. Among the different insecticides, Thiamethoxam 25WG @ 40g/acre was found most effective in suppressing the nymphal population (0.31 nymphs/leaf) followed by imidacloprid 17.8 SL @ 40ml/acre (0.35 nymphs/leaf). Nimbecidine 300 ppm @ 1 l/acre was also found most effective among neem products and suppress population up to 0.88 nymphs per leaf. Neem oil 5%, nimbecidine 1500 ppm @ 1 l/acre and NSKE 5% reduced the population up to 0.91, 1.04 and 1.13 nymphs per leaf, respectively. They showed moderate efficacy as compared to control (3.13 nymphs per leaf).

The perusal of data revealed that three days after spraying, all the insecticidal treatments exhibited significantly higher mean reduction of leafhopper population over control. The treatment of thiamethoxam 25WG@ 40g/acre (0.18 nymphs per leaf) maintained its superiority by recording the maximum population reduction followed by imidacloprid 17.8 SL @ 40ml/acre (0.22 nymphs per leaf). In botanicals, Neem oil 5% was found most effective and suppressed nymphal population up to 0.73 nymphs per leaf. Reduction of population by nimbecidine 300 ppm @ 1 l/acre was up to 0.84 nymphs per leaf. Nimbecidine 1500 ppm @ 1 l/acre and NSKE 5% reduced nymphal population up to 0.93 and 1.10 nymphs per leaf, respectively.

The data presented in Table 1 revealed that on seventh days after spraying the treatment of thiamethoxam 25WG @ 40g/acre recorded the significantly higher mean reduction of leafhopper population (0.24 nymphs per leaf) followed by imidacloprid 17.8 SL @ 40ml/acre (0.37 nymphs per leaf). Neem oil 5% reduced population up to 0.86 nymphs per leaf. Nymphal population was 0.91 nymphs per leaf in treatment with nimbecidine 300 ppm @ 1 l/acre. Nimbecidine1500 ppm @ 1 l/acre and NSKE 5% decreased population up to 1.06 and 1.15 nymphs per leaf.

Ten days after spraying, thiamethoxam 25WG @ 40g/acre exhibited maximum population reduction i.e. 0.37 nymphs per leaf (85.54%) followed by imidacloprid 17.8 SL @ 40ml/acre i.e. 0.67 nymphs per leaf (74.38%). Neem oil 5% suppressed population up to 0.90 nymphs per leaf and suppression of nymphal population by nimbecidine 300 ppm @ 1 l/acre was 0.95 nymphs per leaf while by nimbecidine 1500 ppm @ 1 l/acre was 1.11 nymphs per leaf. NSKE 5% reduced minimum population up to 1.18 nymphs per leaf (51.24%).

The maximum net profit (Rs 10442 per ha) was recorded in thiamethoxam 25 WG treatment followed by imidacloprid 17.8 SL (Rs 9210 per ha) as shown in Table 2. The highest incremental cost benefit ratio (ICBC) was also obtained in the thiamethoxam (12.00) treatment followed by imidacloprid (8.00).

On the basis of evaluation of bio-efficacy of various insecticides and botanicals against *A. biguttula biguttula*, it was found that thiamethoxam 25 WG @ 40g/acre was most effective treatment in reducing the nymphal population after 1, 3, 7 and 10 days of spray followed by imidacloprid 17.8 SL @ 40ml/acre. The present study was in agreement with Abbas *et al.* (2012) [10] who found thiamethoxam @ 40g/acre more effective as compared to imidacloprid after seven days of spray. Karar *et al.* (2013) [11] and Patel and Patel (2014) [12] also found that thiamethoxam @ 40 g/acre was more effective than imidacloprid @ 40 ml/acre after seven and ten days of spray. Naggar and Zidan (2013) [13] concluded that imidacloprid reduced 70 per cent leafhopper population whereas thiamethoxam reduced 60 per cent nymphal population of leafhopper. Mandal *et al.* (2013) [14] found mean reduction of leafhopper was 73% by thiamethoxam.

Similarly, among botanical insecticides, neem oil 5% reduced maximum population of leafhopper followed by nimbecidine 300 ppm. NSKE 5% was least effective in controlling leafhopper population. Boda and Ilyas (2017) [15] concluded that thiamethoxam 25 WG @ 250 g/ha was more effective than NSKE 5% @ 2500ml/ha against cotton leafhopper in *Bt* cotton. Study of Jat and Jeyakumar (2006) [16] were in accordance with present study, that showed neem oil 3% was more effective than NSKE 5%. Kalyan *et al.* (2017) [17] evaluated that NSKE 5% reduced the population of cotton leafhopper up to 46.86 per cent. Whereas, Vonodhini and Malaikozhundan (2011) [18] found that NSKE reduced more leafhopper population as compared to neem oil. Dhiloo *et al.* (2016) [19] concluded that 59% reduction in leafhopper population by neem oil.

Conclusion

Studies on evaluation of insecticides and botanicals against *A.*

biguttula biguttula indicated that thiamethoxam 25 WG @ 40g/acre exhibited maximum population reduction followed by imidacloprid 17.8 SL @ 40ml/acre. After ten days of spray, thiamethoxam 25WG, imidacloprid 17.8 SL, neem oil 5%, nimbecidine 300 ppm, nimbecidine 1500 ppm and NSKE @ 5% reduced population up to 0.35, 0.67, 0.90, 0.95, 1.11 and 1.18 nymphs per leaf, respectively.

Economic analysis of insecticides and botanicals showed that thiamethoxam 25 WG @100g/ha yielded maximum production of 20.34 q/ha followed by imidacloprid 17.8 SL @100ml/acre *i.e.* 20.12 q/ha. The highest of ICBC ratio (12.00) was obtained from treatment T_2: Thiamethoxam 25 WG followed by T_1: Imidacloprid 17.8 SL (8.00), T_3: Nimbecidine 300 ppm (4.00), T_4: Nimbecidine 1500 ppm (1.19), T_5: Neem oil 5% (1.05).

Table 1: Efficacy of various treatments against *A. biguttula biguttula* on RCH 650 BGII during the year 2015-16 at RRS, Rohtak

S. No.	Treatments	Mean number of nymphs/leaf					%Nymphs reduction over control	Nymphs reduction BS and 10DAS%
		Pre- treatment	1DAS	3DAS	7DAS	10DAS		
T_1	Imidacloprid 17.8 SL @ 40ml/acre	2.46	0.35(1.16)	0.22(1.10)	0.37(1.72)	0.67(1.27)	74.38	74.80
T_2	Thiamethoxam 25 WG @ 40g/acre	2.38	0.31(1.14)	0.18(1.08)	0.24(1.11)	0.35(1.16)	85.54	85.29
T_3	Nimbecidine 1500 ppm @ 1 l/acre	2.62	1.04(1.43)	0.93(1.39)	1.06(1.44)	1.11(1.45)	54.13	57.63
T_4	Nimbecidine 300 ppm @ 1 l/acre	2.06	0.88(1.37)	0.84(1.35)	0.91(1.38)	0.95(1.40)	60.74	53.88
T_5	Neem oil 5%	2.69	0.91(1.38)	0.73(1.31)	0.86(1.36)	0.90(1.38)	62.81	66.54
T_6	NSKE 5%	2.49	1.13(1.45)	1.10(1.44)	1.15(1.47)	1.18(1.48)	51.24	52.61
T_7	Control	2.69	3.13 (2.03)	3.11(0.22)	2.66(1.92)	2.42(1.85)		
	SE(m)		0.06	0.04	0.05	0.04		
	CD at 5%		0.19	0.12	0.14	0.11		

Table 2: Economic analysis of different treatments against *A. biguttula biguttula* on RCH 650 BGII during 2015-16, at Rohtak

Treatments	Yield q/ha	Gross income (Rs/ha)	Net gain (Rs /ha)	Total cost/treatment (Rs /ha)	Net profit over control (Rs /ha)	ICBC ratio
T_1	20.12	87516	19150	1150	9201	8.00
T_2	20.34	88462	20391	870	10442	12.00
T_3	18.40	80120	11502	1306	1553	1.19
T_4	18.94	82442	14145	1050	4196	4.00
T_5	19.32	84076	13209	3100	3260	1.05
T_6	17.84	77712	9541	950	-408	-
T_7	17.76	77368	9949			

References

1. Anonymous. AICRP on Cotton Annual Report (2014-15) ICAR- All India Coordinated Research Project on Cotton. 2015, Coimbatore – 641 003, Tamil Nadu.
2. Dhaliwal GS, Singh R, Chillar BS. In Essentials of Agricultural Entomology. Kalyani Publishers, Ludhiana, 2008, 451.
3. Gahukar RT. Production and utilization of potential biological control agents- Cotton insect pest in India. Pestology. 1997; 21(8):28-48.
4. Radhika P, Sudhakar K, Reddy BS, Mohiddin SB. Field evaluation of cotton genotype against *Amrasca biguttula bigutulla*. Journal of Cotton Research and Development. 2006; 20(1):134-134.
5. Bhat MG, Joshi AB, Singh M. Relative loss of seed cotton yield by jassid and bollworm in some cotton genotypes (*Gossypium hirsutum* L.). Indian Journal of Entomology. 1986; 46:169-173.
6. Dhawan AK, Sidhu AS, Simwat GS. Assessment of avoidable losses in cotton (*Gossypium hirsutum* and *G. arboreum*) due to sucking pests and bollworms. Indian Journal of Agricultural Research. 1988; 58(4):290-292.
7. Javed H, Khan MR, Ahmad M. Role of physico-chemical factors imparting resistance in cotton against some insect pests. Pakistan Entomologist. 1992; 14:53-55.
8. Grover A, Pental D. Breeding objectives and requirements for producing transgenics for major field crops of India. Current Science. 2003; 84(3):310-320.
9. Sheoran OP, Tonk DS, Kaushik LS, Hasija RC, Pannu RS. Statistical Software Package for Agricultural Research Workers. In Recent Advances in information theory, Statistics & Computer Applications (Eds.) DS Hooda and RC Hasija, Department of Mathematics Statistics, CCS HAU, Hisar, 1998, 139-143.
10. Abbas Q, Arif MJ, Gogi MD, Abbas SK, Karar H. Performance of imidacloprid, thiomethoxam, acetamaprid and a biocontrol Agent (*Chrysoperla carnea*) against whitefly, jassid and thrips on different cotton cultivars. World Journal of Zoology. 2012; **7**(2):141-146.
11. Karar H, Babar TK, Shahazad MF, Saleem M, Ali A, Akram M. Performance of novel Vs Traditional insecticides for the control of *Amrasca biguttula biggutula* (Homoptera, Cicadellidae) on cotton. Pakistan Journal of Agricultural Sciences. 2013; 50(2):223-228.
12. Patel Y, Patel P. Study on Efficacy and Economics of Some Modern Insecticides against Jassid *Amrasca biguttula biguttula* Ishida in Cotton. Trends in Biosciences. 2014; 7(10):889-892.
13. Naggar JB, Zidan NH. Field evaluation of imidacloprid and thiamethoxam against sucking insects and their side effects on soil fauna. Journal of Plant Protection Research. 2013; 53(4):375-386.
14. Mandal D, Bhowmik P, Chatterjee ML. Effect of newer insecticides against whitefly, *Bemisia tabaci* (Gennadius) and Jassid, *Amrasca biguttula biguttula* on Cotton.

Pesticide Research Journal. 2013; 25(2):117-122.
15. Boda V, Ilyas M. Population dynamics of sucking pests of *Bt* cotton and their correlation with Abiotic factors. Bulletin of Environment, Pharmacology and Life Sciences. 2017; 1(6):167-171.
16. Jat MC, Jeyakumar P. Bio-efficacy of botanicals and bio-Agents on sucking pests of cotton. Annals of Plant Protection Sciences. 2006; 14(1):8-10.
17. Kalyan RK, Saini DP, Meena BM, Pareek A, Naruka P, Verma S *et al*. Evaluation of new molecules against jassid and whiteflies of *Bt* cotton. Journal of Entomology and Zoology Studies. 2017; 5(3):236-240.
18. Vinodhini J, Malaikozhundan B. Efficacy of neem And Pungam based botanical pesticides on sucking pests of cotton. Indian Journal of Agricultural Research. 2011; 45(4):341-345.
19. Dhiloo KH, Rizwan S, Ursani TJ, Sidhoo MN. Efficacy of different neem oil concentrations against jassid on eggplant under field conditions. European Academic Research. 2016; 3(2):12170-12179.