International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(4): 1100-1103

Received: 26-05-2019
Accepted: 30-06-2019

Sumedha J Shejulpatil
Student, Department of Agriculture Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Krishi Nagar, Akola, Maharashtra, India

MN Kakad
Student, Department of Agriculture Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Krishi Nagar, Akola, Maharashtra, India

GK Lande
Assistant Professor, Department of Agriculture, Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Krishi Nagar Akola, Maharashtra, India

Correspondence
Sumedha J Shejulpatil
Student, Department of Agriculture Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Krishi Nagar Akola, Maharashtra, India

Effect of insecticides against whitefly on brinjal under field condition

Sumedha J Shejulpatil, MN Kakad and GK Lande

Abstract
The present investigation entitled "Effect of insecticides against whitefly on brinjal under field condition" was carried out at the experimental farm of Department of Agricultural Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.) during the kharif season of 2014-2015 with a view to evaluate the management of whiteflies on brinjal using biopesticides and new generation insecticides. The treatments Azadirachtin 10000 ppm @ 2 ml/L + Thiamethoxam 25 WG @ 0.2 g/L followed by Azadirachtin 10000 ppm @ 2 ml/L + Imidacloprid 17.8 SL @ 0.12 ml/L, Thiamethoxam 25 WG @ 0.4 g/L, Imidacloprid 17.8 SL @ 0.25ml/L, Triazophos 40 EC @ 2ml/L, Azadirachtin 10000 ppm @ 2 ml/L + Triazophos 40 EC @ 1ml/L, Azadirachtin 10000 ppm @ 2 ml/L + Fenpropathrin 30 EC @ 0.75 ml/L and Fenpropathrin 30 EC @ 1.5 ml/L were found significantly effective in recording lower population of mites/leaf on brinjal.

Keywords: Thiamethoxam, biopesticides, whiteflies, brinjal

Introduction
The brinjal (*Solanum melongena* L.) fruit is a rich source of iron, phosphorous, calcium and vitamins like A, B and C. Normally, its fruit is consumed as vegetable, however, it is also used in the manufacturing of pickles and other by products (Singh *et al*., 1963) [17]. Brinjal is cultivated round the year due to the availability of water, therefore, it is very susceptible to be damaged by many pests including insects throughout its growth period (Regupathy, *et al*., 1997) [16]. Among the major insect pests infesting brinjal are shoot and fruit borer (*Leucinodes orbonalis*), whitefly (*Bemesia tabaci*), leafhopper (*Amrasca biguttula biguttula*), aphid (*Aphis gossypii*), thrips (*Thrips tabaci*) and non-insect pest i.e., red spider mite, (*Tetranychus macfurlanei*) (Dutta *et al*., 2017) [1]. Sucking pests of brinjal cause significant losses to crop directly by sucking the cell sap using their piercing and sucking mouth parts and indirectly by transmitting viral diseases or developing sooty mould on their honey dews (Srinivasan, 2007) [20]. Some sucking pests are cosmopolitan, polyphagous and widely distributed in tropical, subtropical and temperate regions and are also serving as vectors for a number of viral diseases in diversified plant species (Satar *et al.*, 1999) [17]. As a result of pest attack, considerable damage has been recorded to the yield and quality of the brinjal crop on regular basis (Karim *et al*., 2001 and Yarahmadi *et al*., 2011) [5, 23].
The most destructive pest infesting these crops is whitefly (Ghosal and Chatterjee, 2012) [2]. Whitefly (*Bemisia tabaci*) is one of the major sucking (Fig. 1) insect pest for many crops especially brinjal (Norhelina *et al*., 2013) [11]. Both nymphs and adults feed on the leaves surface and suck the phloem sap from sieve tubes. They produce honey dew that reduces the capacity of photosynthetic on the foliage (Rahim Khan *et al*., 2011) [15]. They also act as a vector for a few plant pathogens such as Gemini and Clostero viruses that causes damage to the crop direct or indirect (Mohd Rasdi *et al*., 2009) [9]. Damaged caused by whitefly contributes to yield losses of brinjal about 70% to 92 (Omprakash and Raju, 2014) [14].
However, careless and indiscriminate use of these chemicals leads to a number of problems like contamination of food, soil, ground water, lakes, rivers, oceans, and air with toxic residues which carry side effects on non-target insects and other organisms. Moreover, injudicious use of pesticides may also develop resistance among pests against these pesticides and thus, pest resurgence occurs frequently in recent years (Miller, 2004) [8]. In addition, many non-lethal and lethal accidents occur among human beings due to mishandling of highly toxic synthetic products. Because of these hazards of the pesticides, there is a growing awareness among the people, not only in developed but in developing countries for the safe use of synthetic

pesticides (Uversky, 2002) [14]. Biopesticides or biological pesticides based on plants or pathogenic microorganisms and specific to the target pest, offer an ecologically sound and effective solution to pest problems (Gupta, 2010) [3]. Moreover, use of these pesticides is safe to the humans and their environment (Kalra and Khanuja, 2007) [4]. Accordingly, the use of bio and botanical pesticides offer potential benefits to agriculture and public health programmes are considerable (Thakore, 2006) [21]. Therefore, here we focused on use of potential botanical insecticides with chemical insecticides to manage the pest populations on brinjal crop.

Materials and Methods

The experiment was laid out in randomized block design (RBD) with twelve treatments (Table 1) replicated thrice on the field of Department of Entomology Dr. PDKV, Akola during *kharif* 2014-15. The healthy seedling of variety Aruna of about 30 days old having uniform size were used for transplanting on the hills marked at 60 x 60 cm spacing and each gross plot size was 4.2 m × 3 m. The spraying was done during morning hours with the help of knapsack sprayer. Total five sprays were undertaken during crop growth period. The plots were sprayed as per treatment schedule. Pretreatment observations were recorded 24 hours before first spray and post treatment observations were recorded at 3, 7 and 14 days after each treatment spray on randomly selected five plants as number of whiteflies/leaf from each net plot and from three leaves (top, middle and bottom) on randomly selected plants.

Table 1: Treatment details

S. No.	Treatments	Formulation	Concentration (%)	Doses (g or ml / L)
T 1	Azadirachtin	10000 ppm	10000 ppm (1% w/w)	2 ml
T 2	*Verticillium lecanii*	1.15% WP	1 x 10^8 cfu/g	4 g
T 3	Imidacloprid	17.8 SL	0.0045	0.25 ml
T 4	Thiamethoxam	25 WG	0.01	0.4 g
T 5	Triazophos	40 EC	0.08	2 ml
T 6	Fenpropathrin	30 EC	0.045	1.5 ml
T 7	Azadirachtin + *Verticillium lecanii*	10000 ppm + 1.15% WP	10000 ppm + 1 x 10^8 cfu/g	2 ml + 2 g
T 8	Azadirachtin + Imidacloprid	10000 ppm + 17.8 SL	10000 ppm + 0.0023	2 ml + 0.12 ml
T 9	Azadirachtin + Thiamethoxam	10000 ppm + 25 WG	10000 ppm + 0.005	2 ml + 0.2 g
T 10	Azadirachtin + Triazophos	10000 ppm + 40 EC	10000 ppm + 0.04	2 ml + 1 ml
T 11	Azadirachtin + Fenpropathrin	10000 ppm + 30 EC	10000 ppm + 0.023	2 ml + 0.75 ml
T 12	Untreated control		-	-

Results

The cumulative effect of 5 sprays of various treatments presented here which shows the population of whiteflies/leaf of brinjal.

At 3 Days after Treatment

The data on whitefly population after five sprays was averaged and presented in Table 2. The cumulative average population of whiteflies/leaf in all treated plots were significantly lower (3.20 to 5.49) than the untreated control plot (11.04). The lowest population (3.20) was recorded due to treatment (T9) Azadirachtin 10000 ppm @ 2 ml/L + Thiamethoxam 25 WG @ 0.2 g/L and it was statistically at par with treatments (T8) Azadirachtin 10000 ppm @ 2 ml/L + Imidacloprid 17.8 SL @ 0.12 ml/L (3.59 whiteflies/leaf), (T4) Thiamethoxam 25 WG @ 0.4 g/L (3.74 whiteflies/leaf), (T3) Imidacloprid 17.8 SL @ 0.25 ml/L (3.91 whiteflies/leaf), (T10) Azadirachtin 10000 ppm @ 2 ml/L + Triazophos 40 EC @ 1 ml/L (4.09 whiteflies/leaf) and (T11) Azadirachtin 10000 ppm @ 2 ml/L + Fenpropathrin 30 EC @ 0.75 ml/L (4.27 whiteflies/leaf).

Fig 1: Showing infestation of whiteflies on brinjal leaves

The next effective treatment was (T5) Triazophos 40 EC @ 2 ml/L (4.55 whiteflies/leaf) at par with (T6) Fenpropathrin 30 EC @ 1.5 ml/L (4.78 whiteflies/leaf), (T7) Azadirachtin 10000 ppm @ 2 ml/L + *Verticillium lecanii* 1 x 10^8 cfu/g @ 2 g/L (4.97 whiteflies/leaf), (T1) Azadirachtin 10000 ppm @ 2 ml/L (5.15 whiteflies/leaf) and (T2) *Verticillium lecanii* 1 x 10^8 cfu/g @ 4 g/L (5.49 whiteflies/leaf) whereas highest population of whiteflies recorded in (T12) untreated control (11.04 whiteflies/leaf).

At 7 Days after treatment

The cumulative average population of whiteflies/leaf in all treated plots were significantly lower (4.39 to 7.02) than the untreated control plot (12.74). The treatment (T9) Azadirachtin 10000 ppm @ 2 ml/L + Thiamethoxam 25 WG @ 0.2 g/L recorded least number of (4.39 whiteflies/leaf) and it was statistically at par with treatments (T8) Azadirachtin 10000 ppm @ 2 ml/L + Imidacloprid 17.8 SL @ 0.12 ml/L (4.74 whiteflies/leaf), (T4) Thiamethoxam 25 WG @ 0.4 g/L (4.91 whiteflies/leaf), (T3) Imidacloprid 17.8 SL @ 0.25 ml/L (5.15

Table 2: Cumulative Effect of various treatments against whitefly population on Brinjal crop after five spray

Tr. No.	Treatment details	Formulation	Conc. (%), ml/L g/L	Number of Whitefly / leaf		
				3 DAT*	7 DAT*	14 DAT*
T1	Azadirachtin	10000 ppm	2ml/L	5.15 (2.26)	6.56 (2.57)	7.51 (2.73)
T2	*Verticillium lecanii*	1.15% WP	4g/L	5.49 (2.34)	7.02 (2.65)	7.89 (2.78)
T3	Imidacloprid	17.8 SL	0.0045	3.91 (1.97)	5.15 (2.27)	6.34 (2.52)
T4	Thiamethoxam	25 WG	0.01	3.74 (1.92)	4.91 (2.22)	6.14 (2.48)
T5	Triazophos	40 EC	0.08	4.55 (2.13)	5.81 (2.41)	6.68 (2.58)
T6	Fenpropathrin	30 EC	0.045	4.78 (2.18)	6.04 (2.46)	6.72 (2.59)
T7	Azadirachtin + *Verticillium lecanii*	10000 ppm + 1.15% WP	2ml/L + 2g/L	4.97 (2.22)	6.43 (2.52)	6.79 (2.60)
T8	Azadirachtin + Imidacloprid	10000 ppm + 17.8 SL	2ml/L + 0.0023	3.59 (1.89)	4.74 (2.17)	5.95 (2.44)
T9	Azadirachtin + Thiamethoxam	10000 ppm + 25 WG	2ml/L + 0.005	3.20 (1.79)	4.39 (2.09)	5.65 (2.36)
T10	Azadirachtin + Triazophos	10000 ppm + 40 EC	2ml/L + 0.04	4.09 (2.02)	5.49 (2.34)	6.48 (2.54)
T11	Azadirachtin + Fenpropathrin	10000 ppm + 30 EC	2ml/L + 0.023	4.27 (2.07)	5.66 (2.37)	6.54(2.56)
T12	Untreated control		-	11.04 (3.32)	12.74 (3.56)	13.52 (3.67)
	F test			Sig.	Sig.	Sig
	SE (M) ±			0.10	0.11	0.13
	CD at 5 %			0.31	0.33	0.39

* Figures in parenthesis are square root transformations.

DAT – Days after treatment

whiteflies/leaf), (T10) Azadirachtin 10000 ppm @ 2 ml/L + Triazophos 40 EC @ 1 ml/L (5.49 whiteflies/leaf), (T11) Azadirachtin 10000 ppm @ 2 ml/L + Fenpropathrin 30 EC @ 0.75 ml/L (5.66 whiteflies/leaf) and (T5) Triazophos 40 EC @ 2 ml/L (5.81 whiteflies/leaf).

The next effective treatment was (T6) Fenpropathrin 30 EC @ 1.5 ml/L (6.04 whiteflies/leaf) followed by treatments (T7) Azadirachtin 10000 ppm @ 2 ml/L + *Verticillium lecanii* 1 x 10^8 cfu/g @ 2 g/L (6.43 whiteflies/leaf), (T1) Azadirachtin 10000 ppm @ 2 ml/L (6.65 whiteflies/leaf) and (T2) *Verticillium lecanii* 1 x 10^8 cfu/g @ 4 g/L (7.02 whiteflies/leaf) and these are at par with each other whereas highest population of whiteflies recorded in (T12) untreated control (12.74 whiteflies/leaf).

At 14 days after treatment

The data at 14 DAT (Fig. 2) of cumulative average population of whiteflies revealed that population of whiteflies/leaf in all treated plots were significantly lower (5.65 to 7.89) than the untreated control plot (13.52). The lowest population of whiteflies/leaf recorded due to treatment (T9) Azadirachtin 10000 ppm @ 2 ml/L + Thiamethoxam 25 WG @ 0.2 g/L (5.65 whiteflies/leaf) and it was statistically at par with treatments (T8) Azadirachtin 10000 ppm @ 2 ml/L + Imidacloprid 17.8 SL @ 0.12 ml/L (5.95 whiteflies/leaf), (T4) Thiamethoxam 25 WG @ 0.4 g/L (6.14 whiteflies/leaf), (T3) Imidacloprid 17.8 SL @ 0.25 ml/L (6.34 whiteflies/leaf), (T10) Azadirachtin 10000 ppm @ 2 ml/L + Triazophos 40 EC @ 1 ml/L (6.48 whiteflies/leaf), (T11) Azadirachtin 10000 ppm @ 2 ml/L + Fenpropathrin 30 EC @ 0.75 ml/L (6.54 whiteflies/leaf), (T5) Triazophos 40 EC @ 2 ml/L (6.68 whiteflies/leaf), (T6) Fenpropathrin 30 EC @ 1.5 ml/L (6.72 whiteflies/leaf), (T7) Azadirachtin 10000 ppm @ 2 ml/L + *Verticillium lecanii* 1 x 10^8 cfu/g @ 2 g/L (6.79 whiteflies/leaf), (T1) Azadirachtin 10000 ppm @ 2 ml/L (7.51 whiteflies/leaf) except treatment (T2) *Verticillium lecanii* 1 x 10^8 cfu/g @ 4 g/L (7.89 whiteflies/leaf). Maximum average population of whiteflies/leaf recorded in (T12) untreated control (8.74).

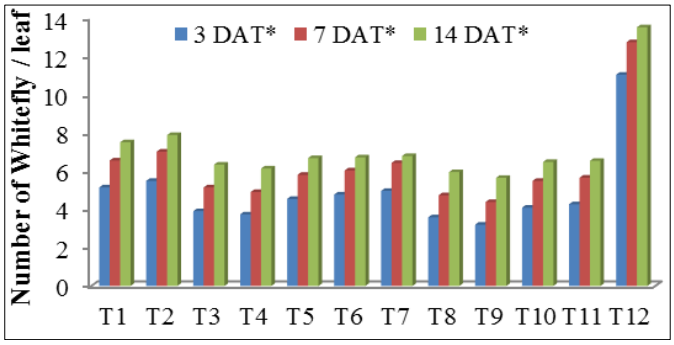

Fig 2: Cumulative Effect of various treatments against whitefly population on brinjal crop after five spray.

Discussion

These results are in confirmation with the findings of the authors *viz*., Naik *et al*.,(2009) [10] who also reported that thiamethoxam @ 0.005% showed higher efficacy against leafhoppers and also reported that combination effect of thiamethoxam @ 0.0025%+ azadirachtin @ 0.15% give better control of whiteflies. As regards the efficacy of Azadirachtin 10000 ppm @ 2 ml/L + Thiamethoxam 25 WG @ 0.2 g/L, Azadirachtin 10000 ppm @ 2 ml/L + Imidacloprid 17.8 SL @ 0.12 ml/L and Azadirachtin 10000 ppm @ 2 ml/L + Triazophos 40 EC @ 1 ml/L present finding are in confirmation with Omprakash and Raju, (2013)[12] who reported Azadirachtin 1500ppm + Thiomethoxam 25 WG (53.14%), Azadirachtin 1500ppm + Imidacloprid 17.8 % SL (51.33%), Azadirachtin 1500ppm + triazophos 40 EC (50.33%) showed moderate efficacy against whiteflies. Similarly Sharma and Lal, (2002) [18] reported efficacy of thiamethoxam @ 25 g a.i./ha against whiteflies of brinjal was superior over synthetic pyrethroid i.e deltamethrin, profenophos. Also Mhaske and Mote, (2005) [7] reported efficacy of Imidacloprid 18 and 22.5 g per ha and thiamethoxam 25 and 50 g per ha were effective against whiteflies of brinjal. Regarding the efficacy of Triazophos the above results are in close confirmation with Prasad kumar, (2010) [14] who reported that Triazophos @1250 ml/ha was found more effective against whiteflies.

Conclusion

The above findings showed that the combination treatment Azadirachtin 10000 ppm @ 2 ml/L + Thiamethoxam 25 WG @ 0.2 g/L was significantly superior over untreated control but at par with Azadirachtin 10000 ppm @ 2 ml/L + Imidacloprid 17.8 SL @ 0.12 ml/L, (T4) Thiamethoxam 25 WG @ 0.4 g/L, Imidacloprid 17.8 SL @ 0.25ml/L, Triazophos 40 EC @ 2ml/L, Azadirachtin 10000 ppm @ 2 ml/L + Triazophos 40 EC @ 1 ml/L and Azadirachtin 10000 ppm @ 2 ml/L + Fenpropathrin 30 EC @ 0.75 ml/L. More or less similar trend was found on 7 DAT and 14 DAT.

References

1. Dutta NK, Alam SN, Mahmudunnabi M, Amin MR, Kwon YJ. Effect of insecticides on population reduction of sucking insects and lady bird beetle in eggplant field. Bangladesh Journal of Agricultural Research. 2017; 42(1):35-42.
2. Ghosal, A. & Chatterjee ML. Bioefficacy of imidacloprid 17.8 SL against whitefly, Bemisia tabaci (Gennadius) in brinjal. The Journal of Plant Protection Sciences. 2012; 5(1), 37-41.
3. Gupta S and Dikshit AK. Biopesticides: an ecofriendly approach for pest control. Journal of Biopesticides. 2010; 3(1):186-188.
4. Kalra A and Khanuja SPS. Research and Development priorities for biopesticide and biofertilizer products for sustainable agriculture in India. Business Potential for Agricultural Biotechnology. Teng PS (Ed.), Asian Productivity Organisation. 2007; 96-102.
5. Karim KNS, Das BC, Khalequzzaman M. Population dynamics of *Aphis gossypii* Glover (Homoptera: Aphididae) at Rajshahi, Bangladesh Journal of Biological Sciences. 2001; 1:492-495.
6. Khan RM, Ghani AA, Khan RM, Ghaffar A and Tamkeen A. Host plant selection and oviposition behavior of whitefly, *Bemisia tabaci* (Gennadius) in a mono and simulated Polyculture crop habitat. African Journal of Biotecnology. 2011; 10(8):1467-1472.
7. Mhaske BM, Mote UN. Studies on evaluation of new insecticides against brinjal pest complex. Journal of Maharashtra Agricultural Universities. 2005; 30:303-306.
8. Miller GT. Sustaining the Earth, 6th edition. Thompson Learning, Inc. Pacific Grove, California, 2004.
9. Mohd Rasdi Z, Fauziah I, Fairuz K, Mohd Saiful MS, Md Jamaludin B. Population ecology of whitefly, Bemisia tabaci, (Homoptera: Aleyrodidae) in Brinjal. Journal of Agricultural Science, 2009, 1(1).
10. Naik VCB, Rao PA, Krishnayya PV, Chalam MSV. Seasonal incidence and management of *Bemisia tabaci* Gennadius and *Amrasca biguttula biguttula* Ishida of brinjal. Annals of Plant Protection Sciences. 2009; 17(1):9-13
11. Norhelina L, Sajap AS, Mansour SA and Idris AB. Infectivity of five *Metarhizium anisopliae* (Deuteromycota: Hyphomycetales) strains on whitefly, *Bemisia tabaci* (Homoptera: Aleyrodidae) infesting brinjal, *Solanum melongena* (Solanacea). Academic Journal of Entomology. 2013; 6(3):127-132.
12. Omprakash S, Raju SVS. Bioefficacy of some insecticides against *Bemisia tabaci* (Genn.) on brinjal. Indian Journal of Entomology. 2013; 75(4):310-314
13. Omprakash S and Raju SVS. A brief Review on abundance and management of major insect pests of brinjal (*Solanum melongena* L.). International Journal of Applied Biology and Pharmaceutical Technology, 2014, 5(1).
14. Prasad Kumar. Efficacy of triazophos 40EC against pest complex of brinjal Pest Management in Horticulture Ecosystem. 2010; 16(1):87-89.
15. Rahim Khan M, Abdul Ghani A, Rafique Khan M, Ghaffar A Tamkeen A. Host plant selection and oviposition behavior of whitefly, *Bemisia tabaci* (Gennadius) in a mono and simulated Polyculture crop habitat. African Journal of Biotecnology. 2011; 10(8):1467-1472.
16. Regupathy A, Palanisamy S, Chandramohan N, Gunathilagaraj K. A guide on crop pests. Sooriya Desk Top Publishers, Coimbatore, 1997, 264.
17. Satar S, Kersting U, Uygun, N. Development and fecundity of Aphis gossypii Glover (Homoptera: Aphididae) on three Malvaceae hosts. Turkish Journal of Agriculture and Forestry. 1999; 23(6):637-644.
18. Sharma D, Lal OP. Bioefficacy of thimethoxam in camprison to recommended insecticides against leafhopper and white fily of brinjal. (*Solanum melongena* L.) Journal of Entomological Research. 2002; 16(3):257-262.
19. Singh S, Krishnakumar S, Katyal SL. Fruit culture in India. Indian Council of Agricultural Research, New Delhi, 1963, 412.
20. Srinivasan R. Insect and mite pests on eggplant: a field guide for identification and management. AVRDC-The World Vegetable Center, Shanhua, Taiwan. 2009, 10-13.
21. Thakore Y. The biopesticide market for global agricultural use. Industrial Biotechnoogy. 2006; 2:194-208.
22. Uversky VN, Li J, Bower K, Fink AL. Synergestic effects of pesticides and metals on the fibrillation of αsynuclein: implications for Parkinson's disease. Neurotoxicology. 2002; 23:527-536.
23. Yarahmadi F, Rajabpur A, Shabazi A. Investigations on toxic effects of some insecticides on population of Aphis gossypii Glover and its parasitoids Hibiscusrosa chinensis in Ahwaz's groon landscape. Proceedings of the 1st Congress of Modern Agricultural Sciences and Technology, Zanjan, Iran, 2011.