Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2019; 7(2): 850-854

Received: 01-01-2019
Accepted: 04-02-2019

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

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

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

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

Effect of Azadirachtin with chemical insecticides and *Verticillium lecanii* against shoot infestation due to *Leucinodes orbonalis* (Guenee) of brinjal

Sumedha J Shejulpatil, MN Kakad and GK Lande

Abstract
The present investigation entitled "Effect of azadirachtin with chemical insecticides and *Verticillium lecanii* against shoot infestation due to *Leucinodes orbonalis* (Guenee) of brinjal" were 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 major pest of brinjal using botanicals, microbial, newer and conventional insecticides. The treatment Azadirachtin 10000 ppm @ 2 ml/L + Triazophos 40 EC @ 1 ml/L followed by Azadirachtin 10000 ppm @ 2 ml/L + Fenpropathrin 30 EC @ 0.75 ml/L, Triazophos 40 EC @ 2 ml/L, Fenpropathrin 30 EC @ 1.5 ml/L were found significantly effective in recording lower percentage of shoot damage due to shoot and fruit borer.

Keywords: Azadirachtin, *Leucinodes orbonalis*, *Verticillium lecanii*, brinjal

Introduction
Brinjal or eggplant (*Solanum melongena* L.) is also called by some as the 'King of Vegetables'. Brinjal can be grown throughout the year in different agro-climatic regions. It is a perennial but grown commercially as an annual crop. It is grown by a number of cultivars in India and fruit colour, size and shape depends on the consumer's preference. In India, it is one of the most common, principal and popular vegetable crop grown throughout the country except higher altitudes. It is often described as a poor man's vegetable because it is popular amongst small-scale farmers and low income consumers. It is used in ayurvedic medicine for curing diabetes and also as a good appetizer, good cardio tonic, laxative, mutant and reliever of inflammation.

It is the third most important vegetable crop grown throughout the year in all parts of India and contributes 17.8 per cent of the total production of vegetables in the country. The global area under brinjal cultivation has been estimated at 18, 75, 095 hectares with total production 4, 96, 67, 881 million tonnes with productivity of 26.5 tonnes ha^{-1} of brinjal fruit. In India, brinjal is cultivated in an area of 722 thousand ha with an annual production of 13444 thousand million tonnes with productivity of 18.6 tonnes ha^{-1} during 2012-13. The highest area of brinjal in India was in West Bengal with 161 thousand ha with production of 2,965.60 thousand million tonnes with productivity of 18.4 tonnes ha^{-1} (Anonymus, 2014) [2]. In India, productivity is more in Karnataka with 26.2 tonnes ha^{-1} with area and production of 16.10 thousand hectares and 421.40 thousand million tonnes, respectively. The major brinjal producing states are Orissa, Bihar, Karnataka, West Bengal, Andhra Pradesh, Maharashtra and Uttar Pradesh (Anonymus, 2014) [2].

Though brinjal is a summer crop, it is being grown throughout the year under irrigated condition. Hence, it is subjected to attack by number of insect Pests right from nursery stage to till harvesting (Regupathy *et al.*, 1997) [7]. *Leucinodes orbonalis* is considered as the main constraint as it damages the crop throughout the year. This pest is reported from all brinjal growing areas like Germany, Burma, USA, Srilanka and India of the world. It is known to damage shoot and fruit of brinjal in all its growth stages. It has been recorded that the yield loss due to this pest is to the extent of 70-92 per cent (Eswara Reddy and Srinivas, 2004) [4].

In early stage of the crop growth, *Leucinodes orbonalis* larva bores into the shoots resulting in drooping, withering and drying of the affected shoots. It is, thus, amply obvious that unless adequate, appropriate and effective measures are adopted to control these pest menace, brinjal

production will suffer a serious setback resulting into the considerable yield loss. Deadly poisonous chemicals are also sprayed on brinjal which is perishable commodity. Also everywhere there is a severe problem of timely availability of labour in rural area for the application of plant protection chemical to save the labour, time and economy on plant protection. Due to this reason, farmers have to face many problem for crop growth, nutritive quality and yield deterioration and also in proper management of insect pests. Hence in order to know the effect of Azadirachtin with chemical insecticides and entomopathogenic fungi to test their synergistic or antagonistic action against the pest and its effect on crop, the present investigation is undertaken.

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.

Table 1: Treatment details

Sr. 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		-	-

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. The plots were sprayed as per treatment schedule. The two rounds of insecticidal sprayings as per treatments were applied at fortnightly intervals. The observations on the shoot damage were recorded at 3, 7, 14 days after each application. At each observation, infested shoots per net plot were counted and percent of shoot infestation per plot was worked out.

Percent shoot infestation = (Number of infested shoot / Number of total shoots) x 100

Results

Effect of various treatments against per cent shoot infestation due to *Leucinodes orbonalis* on brinjal crop at first spray.

At 3 Days after first spray application

All the treatments were significantly superior over untreated control (Table 2). The minimum percentage of shoot damage due to *Leucinodes orbonalis* recorded in the treatment (T10) Azadirachtin 10000 ppm @ 2 ml/L + Triazophos 40 EC @ 1 ml/L (9.51%shoot damage/plot) and it was statistically at par with the treatments (T11) Azadirachtin 10000 ppm @ 2 ml/L + Fenpropathrin 30 EC @ 0.75 ml/L (9.79% shoot damage/plot), (T5) Triazophos 40 EC @ 2 ml/L (10.44% shoot damage/plot), (T6) Fenpropathrin 30 EC @ 1.5 ml/L (10.45% shoot damage/plot), (T8) Azadirachtin 10000 ppm @ 2 ml/L + Imidacloprid 17.8 SL @ 0.12 ml/L (10.79% shoot damage/plot), (T9) Azadirachtin 10000ppm@ 2ml/L+ Thiamethoxam 25 WG @ 0.2 g/L (11.35% shoot damage/plot), (T7) Azadirachtin 10000 ppm @ 2 ml/L + *Verticillium lecanii* 1 x 10^8 cfu/g @ 4 g/L (11.73% shoot damage/plot), (T1) Azadirachtin 10000 ppm @ 2 ml/L (11.97%shoot damage/plot), (T2) *Verticillium lecanii* 1 x 10^8 cfu/g @ 4 g/L (12.80% shoot damage/plot), (T3) Imidacloprid 17.8 SL @ 0.25 ml/L (12.93% shoot damage/plot) and (T4) Thiamethoxam 25 WG @ 0.4 g/L (13.57% shoot damage/plot). Maximum average percentage of shoot damage was recorded in (T12) untreated control (19.82% shoot damage/plot).

At 7 Days after first spray application

At seven days after treatment (Table 2, Figure 1), the minimum percentage of shoot damage due to *Leucinodes orbonalis* recorded in the treatment (T10) Azadirachtin 10000 ppm @ 2 ml/L + Triazophos 40 EC @ 1 ml/L (9.89% shoot damage/plot), (T11) Azadirachtin 10000 ppm @ 2 ml/L + Fenpropathrin 30 EC @ 0.75 ml/L (10.26% shoot damage/plot), (T5) Triazophos 40 EC @ 2 ml/L (11.39% shoot damage/plot), (T6) Fenpropathrin 30 EC @ 1.5 ml/L (11.56% shoot damage/plot), (T8) Azadirachtin 10000 ppm @ 2 ml/L + Imidacloprid 17.8 SL @ 0.12 ml/L (11.66% shoot damage/plot), (T9) Azadirachtin 10000 ppm @ 2 ml/L + Thiamethoxam 25 WG @ 0.2 g/L(11.82% shoot damage/plot), (T7) Azadirachtin 10000 ppm @ 2 ml/L + *Verticillium lecanii* 1 x 10^8 cfu/g @ 4 g/L (12.03% shoot damage/plot)**,** (T1) Azadirachtin 10000 ppm @ 2 ml/L (12.50% shoot damage/plot), (T2) *Verticillium lecanii* 1 x 10^8 cfu/g @ 4 g/L(12.93% shoot damage/plot), (T3) Imidacloprid 17.8 SL @ 0.25 ml/L (13.07% shoot damage/plot) and (T4) Thiamethoxam 25 WG @ 0.4 g/L (13.70% shoot damage/plot). Maximum average percentage of shoot damage was recorded in (T12) untreated control (20.75% shoot damage/plot).

At 14 Days after first spray application

The entire treated plots revealed significant differences over control at 14 DAT (Table 2). The lowest percent of *Leucinodes orbonalis* (10.83% shoot damage/plot) was observed in treatment (T10) Azadirachtin 10000 ppm @ 2 ml/L + Triazophos 40 EC @ 1 ml/L and was at par with rest of the treatments except treatment (T4) Thiomethoxam (25 WG) @0.4 g/L (14.10% shoot damage/plot). Maximum average percentage of shoot damage as recorded in (T12) untreated control (21.87% shoot damage/plot).

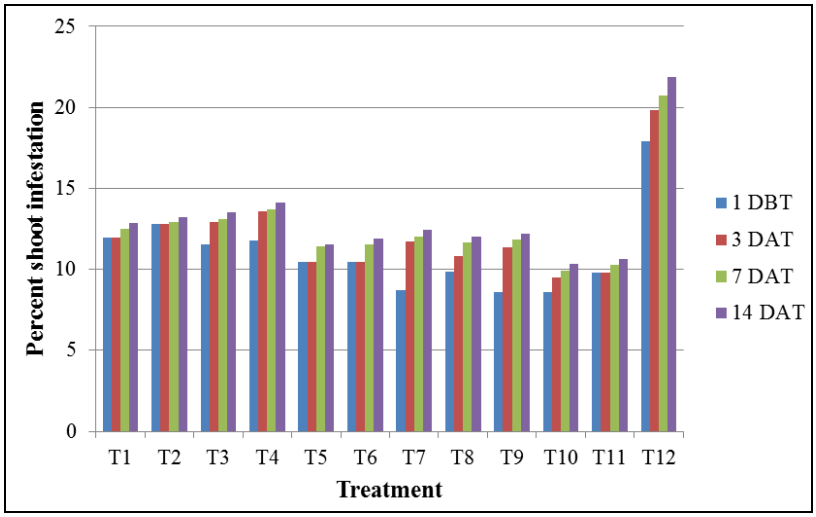

Fig 1: Percent shoot infestation due to *Leucinodes orbonalis* on brinjal crop at first spray.

Table 2: Effect of various treatments on percent shoot infestation on brinjal crop at first spray

Tr. No.	Treatment Details	Formulation	Conc. (%),/ml/L/g/L	percent shoot infestation			
				1 DBT*	3 DAT*	7 DAT*	14 DAT*
T1	Azadirachtin	10000 ppm	2 ml/L	11.97 (3.45)	11.97 (3.45)*	12.50 (3.53)	12.83 (3.58)
T2	*Verticillium lecanii*	1.15% WP	4 g/L	12.80 (3.57)	12.80 (3.57)	12.93 (3.59)	13.20 (3.63)
T3	Imidacloprid	17.8 SL	0.0045	11.52 (3.38)	12.93 (3.59)	13.07 (3.61)	13.53 (3.68)
T4	Thiamethoxam	25 WG	0.01	11.80 (3.44)	13.57 (3.67)	13.70 (3.69)	14.10 (3.74)
T5	Triazophos	40 EC	0.08	10.44 (3.18)	10.44 (3.18)	11.39 (3.36)	11.56 (3.39)
T6	Fenpropathrin	30 EC	0.045	10.45 (3.21)	10.45 (3.21)	11.56 (3.39)	11.87 (3.44)
T7	Azadirachtin + *Verticillium lecanii*	10000 ppm + 1.15% WP	2 ml/L + 2 g/L	8.73 (2.93)	11.73 (3.41)	12.03 (3.46)	12.43 (3.52)
T8	Azadirachtin + Imidacloprid	10000 ppm + 17.8 SL	2 ml/L + 0.0023	9.83 (3.08)	10.79 (3.26)	11.66 (3.40)	12.00 (3.45)
T9	Azadirachtin + Thiamethoxam	10000 ppm + 25 WG	2 ml/L + 0.005	8.56 (2.90)	11.35 (3.35)	11.82 (3.43)	12.22 (3.49)
T10	Azadirachtin + Triazophos	10000 ppm + 40 EC	2 ml/L + 0.04	8.56 (2.90)	9.51 (3.08)	9.89 (3.14)	10.36 (3.21)
T11	Azadirachtin + Fenpropathrin	10000 ppm + 30 EC	2 ml/L + 0.023	9.79 (3.12)	9.79 (3.12)	10.26 (3.20)	10.63 (3.25)
T12	Untreated control		-	17.92 (4.23)	19.82 (4.44)	20.75 (4.54)	21.87 (4.67)
	F test			N.S.	Sig.	Sig.	Sig.
	SE (M) ±			0.26	0.24	0.19	0.16
	CD at 5 %			0.77	0.71	0.57	0.48

* Figures in parenthesis are square root transformations. DBT – Days before treatment,
DAT – Days after treatment

Effect of various treatments against per cent shoot infestation due to *Leucinodes orbonalis* on brinjal crop at second spray

At 3 Days after second spray application

Table 3 revealed that all the treatments were significantly superior over untreated control. The minimum percentage of shoot damage due to *Leucinodes orbonalis* recorded in the treatment (T10) Azadirachtin 10000 ppm @ 2 ml/L + Triazophos 40 EC @ 1 ml/L (10.83%shoot damage/plot) and it was statistically at par with the treatments (T11) Azadirachtin 10000 ppm @ 2 ml/L + Fenpropathrin 30 EC @ 0.75 ml/L (11.40% shoot damage/plot), (T5) Triazophos 40 EC @ 2 ml/L (11.90% shoot damage/plot), (T6) Fenpropathrin 30 EC @ 1.5 ml/L (12.33% shoot damage/plot), (T8) Azadirachtin 10000 ppm @ 2 ml/L + Imidacloprid 17.8 SL @ 0.12 ml/L (12.77% shoot damage/plot), (T9) Azadirachtin 10000 ppm @ 2 ml/L + Thiamethoxam 25 WG @ 0.2 g/L (12.99% shoot damage/plot), (T7) Azadirachtin 10000 ppm @ 2 ml/L + *Verticillium lecanii* 1 x 10^8 cfu/g @ 4 g/L (13.30% shoot damage/plot), (T1) Azadirachtin 10000 ppm @ 2 ml/L (13.49% shoot damage/plot), (T2) *Verticillium lecanii* 1 x 10^8 cfu/g @ 4 g/L (13.38% shoot damage/plot), (T3) Imidacloprid 17.8 SL @ 0.25 ml/L (13.53% shoot damage/plot) and (T4) Thiamethoxam 25 WG @ 0.4 g/L (14.37% shoot damage/plot). Maximum percentage of shoot damage was recorded in (T12) untreated control (23.07% shoot damage/plot).

At 7 Days after second spray application

All the treatments were significantly superior over control (Table 3, Figure 2). The minimum percentage of shoot damage due to *Leucinodes orbonalis* recorded in the treatment (T10) Azadirachtin 10000 ppm @ 2 ml/L + Triazophos 40 EC @ 1 ml/L (11.13% shoot damage/plot), (T11) Azadirachtin 10000 ppm @ 2 ml/L + Fenpropathrin 30 EC @ 0.75 ml/L (11.40% shoot damage/plot), (T5) Triazophos 40 EC @2 ml/L (12.20% shoot damage/plot), (T6) Fenpropathrin 30 EC @1.5 ml/L (12.33% shoot damage/plot), (T8) Azadirachtin 10000 ppm @ 2 ml/L + Imidacloprid 17.8 SL @ 0.12 ml/L (12.77% shoot damage/plot), (T9) Azadirachtin 10000ppm@ 2ml/L+ Thiamethoxam 25 WG @ 0.2 g/L(13.29% shoot damage/plot), (T7) Azadirachtin 10000 ppm @ 2 ml/L + *Verticillium lecanii* 1 x 10^8 cfu/g @ 4 g/L (13.57% shoot damage/plot), (T1) Azadirachtin 10000 ppm @ 2 ml/L (13.89% shoot damage/plot) and

Table 3: Effect of various treatments on per cent shoot infestation on brinjal crop at second spray

Tr. No.	Treatment details	Formulation	Conc. (%),/ ml/L/ g/L	percent shoot infestation		
				3 DAT*	7 DAT*	14 DAT*
T1	Azadirachtin	10000 ppm	2 ml/L	13.49 (3.66)*	13.89 (3.72)	14.41 (3.79)
T2	*Verticillium lecanii*	1.15% WP	4 g/L	13.38 (3.66)	13.91 (3.73)	14.73 (3.83)
T3	Imidacloprid	17.8 SL	0.0045	13.53 (3.68)	14.18 (3.76)	15.14 (3.89)
T4	Thiamethoxam	25 WG	0.01	14.37 (3.78)	14.88 (3.85)	15.43 (3.93)
T5	Triazophos	40 EC	0.08	11.90 (3.43)	12.20 (3.48)	13.03 (3.59)
T6	Fenpropathrin	30 EC	0.045	12.33 (3.51)	12.33 (3.51)	13.29 (3.63)
T7	Azadirachtin + *Verticillium lecanii*	10000 ppm + 1.15% WP	2 ml/L + 2 g/L	13.30 (3.64)	13.57 (3.68)	14.37 (3.78)
T8	Azadirachtin + Imidacloprid	10000 ppm + 17.8 SL	2 ml/L + 0.0023	12.77 (3.57)	12.77 (3.57)	13.51 (3.67)
T9	Azadirachtin + Thiamethoxam	10000 ppm + 25 WG	2 ml/L + 0.005	12.99 (3.60)	13.29 (3.64)	13.86 (3.71)
T10	Azadirachtin + Triazophos	10000 ppm + 40 EC	2 ml/L + 0.04	10.83 (3.29)	11.13 (3.33)	11.93 (3.44)
T11	Azadirachtin + Fenpropathrin	10000 ppm + 30 EC	2 ml/L + 0.023	11.40 (3.37)	11.40 (3.37)	12.83 (3.56)
T12	Untreated control		-	23.07 (4.76)	24.00 (4.85)	25.67 (5.05)
	F test			Sig.	Sig.	Sig.
	SE (M) ±			0.19	0.18	0.21
	CD at 5 %			0.57	0.55	0.62

* Figures in parenthesis are square root transformations. DAT – Days after treatment

(T2) *Verticillium lecanii* 1 x 10^8 cfu/g @ 4 g/L (13.91% shoot damage/plot), (T3) Imidacloprid 17.8 SL @ 0.25 ml/L (14.18% shoot damage/plot) and (T4) Thiamethoxam 25 WG @ 0.4 g/L (14.88% shoot damage/plot). Maximum percentage of shoot damage was recorded in (T12) untreated control (24.00% shoot damage/plot).

At 14 Days after second spray application

The entire treated plots revealed significant differences over control at 14 DAT (Table 3). The lowest percent of *Leucinodes orbonalis* (11.93% shoot damage/plot) was observed in treatment (T10) Azadirachtin 10000 ppm @ 2 ml/L + Triazophos 40 EC @ 1 ml/L and was at par with rest of the treatments except treatment (T4) Thiamethoxam 25 WG @0.4 g/L (15.43% shoot damage/plot). Maximum percentage of shoot damage was recorded in (T12) untreated control (25.67% shoot damage/plot).

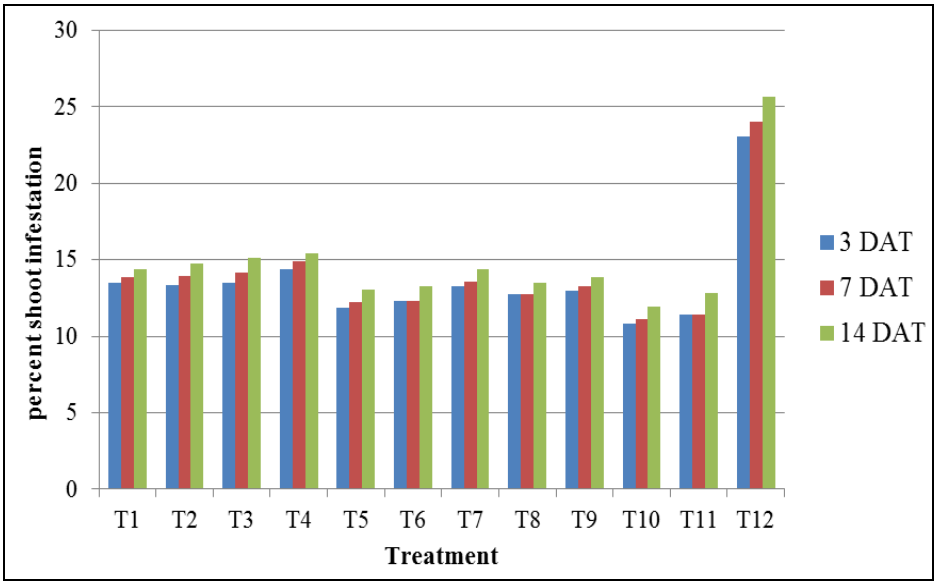

Fig 2: Percent shoot infestation due to *Leucinodes orbonalis* on brinjal crop at second spray.

Discussion

Very few researchers have done their work with alternate sprayings of these biopesticide and chemical insecticide like Niranjan Das (2014) [5] who reported that soil application of neem cake @ 2.5 q/ha, removal and destruction of infected shoots and fruits and alternate spraying of triazophos 40 EC @ 1250 ml/ha and neem oil @ 2.5 lit/ha at 10 days interval was found to be the most effective for management of shoot and fruit borer of brinjal.

Regarding the efficacy of Triazophos 40 EC @ 2 ml/L present finding are in confirmation with Prasad Kumar (2010)[6] who found that application of Triazophos 40 EC @ 2500ml/ha recorded minimum dead hearts due to L. *orbonails* on brinjal. Also Singh *et al.*, (2009) [8] reported efficacy of azadirachtin 0.2% + thiamethoxam 0.0025%, thiamethoxam 0.005% and azadirachtin 0.4% against the shoot infestation of brinjal. Smilarly Chinna Babu *et al.*, (2008) [3] also reported efficacy of azadirachtin 0.15% + thiamethoxam 0.0025%, thiamethoxam 0.005% and azadirachtin 0.3% against the shoot infestation of brinjal.

Regarding the efficacy of *Verticillium lecanii* 1 x 10^8 cfu/g @ 4 g/L Anjali *et al.*, (2012) [1] who reported that *V. lecanii* (5 g/L) recorded minimum shoot damage by *L. orbonails* which provides maximum protection against control. Regarding the efficacy of Imidacloprid 17.8 SL @ 0.25 ml/L present finding are in confirmation with Tiwari *et al.*, (2011) [9] who reported the Imidacloprid 17.8 SL @ 0.015% provides maximum protection and minimum shoot damage in brinjal.

Conclusion

Over all it is seen from above investigation that the treatment Azadirachtin 10000 ppm @ 2 ml/L + Thiamethoxam 25 WG @ 0.2 g/L was significantly superior over untreated control but at par with rest of the treatments. More or less similar trend was found on 7 DAT and 14 DAT. For the best combination treatment Azadirachtin 10000 ppm @ 2 ml/L + Triazophos 40 EC @ 1 ml/L followed by Azadirachtin 10000 ppm @ 2 ml/L + Fenpropathrin 30 EC @ 0.75 ml/L, Triazophos 40 EC @ 2 ml/L, Fenpropathrin 30 EC @ 1.5 ml/L were found significantly effective in recording lower percentage of shoot damage due to shoot and fruit borer.

References

1. Anjali M, Singh NP, Meena M, Singh S. Seasonal incidence and effect of abiotic factors on population dynamics of major insect pests on brinjal crop. Journal of Environmental Research and Development. 2012; 7(1A):431-435.
2. Anonymous. Statistical data base –Agriculture at http://www.fao.org, 2014.
3. Chinna Babu NV, Arjuna Rao P, Krishnayya PV, Srinivasa RV. Seasonal incidence and management of *Leucinodes orbonalis* Guenee on brinjal. Annals of Plant Protection Sciences. 2008; 11:54-56
4. Eswara Reddy SG, Srinivasa. Management of shoot and fruit borer (*Leucinodes orbonalis*) in brinjal using botanicals. Pestology. 2004; 28:50-52.
5. Niranjan Das. Impact assessmemt of IPM module for management of shoot and fruit borer in Brinjal. Annals of Plant Protection Sciences. 2014; 23(1):46-48.
6. Prasad Kumar. Efficacy of triazophos 40EC against pest complex of brinjal Pest Management in Horticulture Ecosystem. 2010; 16(1):87-89.
7. Ragupathy A, Palaniswami S, Chandramohan N, Gupta K. Guide on Crop Pests. Sooriya Desk Top, Coimbatore, 1997.
8. Singh DK, Singh R, Datta SD, Singh SK. Seasonal incidence and insecticidal management of shoot and fruit borer (*Leucinodes orbonalis* Guenee) in brinjal. Annals of Horticulture. 2009; 2(2):187-190.
9. Tiwari G, Prasad CG, Lok nath, Singh R. Efficacy of bio-pesticide and insecticides on brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee. Annals of Plant Protection Sciences. 2011; 19(2):345-349.