Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2020; 8(1): 932-936

Received: 10-11-2019
Accepted: 14-12-2019

Anand N Warghat
Department of Agricultural Zoology and Entomology, Raja Balwant Singh College of Agriculture, Bichpuri, Agra Dr. Bhimrao Ambedkar University, Agra Uttar Pradesh, India

Dipika Nimbalkar
Department of Agricultural Zoology and Entomology, Raja Balwant Singh College of Agriculture, Bichpuri, Agra Dr. Bhimrao Ambedkar University, Agra Uttar Pradesh, India

Anoorag R Tayde
Department of Agricultural Zoology and Entomology, Raja Balwant Singh College of Agriculture, Bichpuri, Agra Dr. Bhimrao Ambedkar University, Agra Uttar Pradesh, India

Corresponding Author:
Anand N Warghat
Department of Agricultural Zoology and Entomology, Raja Balwant Singh College of Agriculture, Bichpuri, Agra Dr. Bhimrao Ambedkar University, Agra Uttar Pradesh, India

Bio-efficiency of some insecticides against Brinjal shoot and fruit borer, *Leucinodes orbonalis* (*Guen*.)

Anand N Warghat, Dipika Nimbalkar and Anoorag R Tayde

Abstract
The studied data of shoot and fruit borer shows that, results were statistically superior over control in suppression of shoot damage caused by shoot borer. Lowest shoot infestation was recorded in treatment spinosad 0.01% (12.13%). The other effective treatments in minimizing the percentage damage of shoot borer were listed in descending order as emamectin benzoate 0.002% (15.05%) > cypermethrin 0.005% (17.19%) > imidacloprid 0.025% (21.95%) I > Metarrhizium anisopliae 1 lit/ha (23.16%) > *B. Bassiana* 1 lit/ha (24.88%) > Azadirachtin 2.5 ml ml/lit (24.88%) > mechanical shoot clipping (27.10%) respectively, these treatments were found superior over control (water spray) recording highest shoot infestation (36.60%) and for the fruit borer The next effective treatments in minimizing the percentage of fruit borer are listed in descending order as emamectin benzoate 0.002% (16.57%) > cypermethrin 0.005% (18.70%) > imidacloprid 0.025% (22.06%) > Metarrhizium anisopliae 1 lit/ha (23.91%) > *B. Bassiana* 1 lit/ha (%) (24.97%) > Azadirachtin 2.5 ml/lit (26.56%), > mechanical shoot clipping (29.48%) respectively, whereas in the treatment control (water spray) was recorded highest shoot infestation (37.15%).

Keywords: Bio efficacy, insecticides, *Leucinodes orbonalis*, brinjal

Introduction
The eggplant or aubergine or brinjal (*Solanum melongena* L.) is one of the most important solanaceous vegetables in south-east Asian countries including India, Bangladesh, Sri Lanka, China, Japan etc. It is a native of Indo-Burma region, and was known to be grown in India since ancient times. The major brinjal growing states in India are, Andhra Pradesh, Karnataka, West Bengal, Tamil Nadu, Maharashtra, Orissa, Uttar Pradesh, Bihar and Rajasthan. India produces about 13.44 M mt of brinjal from an area of 0.722 M ha with an average productivity of 18.6 mt/ha (Indian Horticulture Database 2013). Shoot and fruit borer, L. orbonalis (Lepidoptera: Pyralidae) is the key pest throughout Asia (Purohit and Khatri, 1973; Kuppuswamy and Balasubramanian, 1980; Allam *et al*., 1982) [5]. In India, this pest has a country wide distribution and has been categorized as the most destructive and most serious pest causing huge losses in brinjal (Patil, 1990). The larvae bore into tender shoots in the early stage resulting in drooping shoots, which are readily visible in the infested fields. At the later stage, caterpillars bore into flower buds and fruits, rendering the fruits unfit for consumption and marketing, resulting in direct yield losses. The pest has been reported to inflict losses to the tune of 20.7-60.0 per cent in Tamil Nadu (Raja *et al*., 1999), 70 per cent in Andhra Pradesh (Sasikala *et al*., 1999) [34], 80 per cent in Gujarat (Jhala *et al*., 2003) and 41 per cent in Himachal Pradesh (Lal *et al*., 1976) [23]. The insecticides have been used extensively for the control of this insect pest. Despite diverse ill effects of the chemicals pesticides, insecticides use still constitutes major control option to tackle this pest (Singh *et al*., 2008) [56].

Materials and Methods
The Experiments was carried out under field conditions at the ICAR Research field, Raja Balwant Singh College, Bichpuri, Dr. Bhimrao Ambedkar University, and Agra (U.P.). Bio efficacy of seven insecticidal treatments comprising Emamectin Benzoate 5 SG, Spinosad 45 SC, Deltamethrin 2.8 EC, NSKE 5 per cent, Acephate 75 SP, Indoxacarb 14.5 SC, Profenofos 50 EC was determined during 2012-13 Brinjal variety Pusa ankur was shown in Randomized Block Design. There were three replications with 2 × 3 m meter plot size. The plant spacing between row to row and plants to plant were maintained 75 cm and 75 cm, respectively.

The carried out with a view to find out the bio efficiency of some eco-friendly materials like botanicals, microbial, with newer and convectional insecticides against the pest of brinjal.

Methods adopted

Table 1: Layout plan detail (Details of experiment)

1. Year of Experiment	:	2016
2. Design of Experiment	:	RBD
3. Area allotted for experiment	:	14 m x 10 m
4. Layout plan date	:	03.12.2016
5. Plot Size	:	2.4 m x 1.8 m
6. Total No. of plot in each replication	:	4
7. Total Replication	:	4
8. Total no. of plot	:	16
9. Variety	:	PPL
10. Area in bunding	:	50 cm
11. Irrigation channel (size)	:	1 m
12. Total No. of plant/per Row	:	15
13. Total Row per plot	:	4
14. Total No. of plant/plot	:	60 plant/plot
15. Spacing	:	Row× Row 60cm
		Plot× Plot 60 cm
16. Date of Planting	:	05.12.2016
17. Total Number of treatment	:	9

Cultural operation

1. Preparatory tillage

During summer, the soil thoroughly prepared by ploughing followed by two harrowing. The field was cleaned by picking stubbles of previous crop. Before sowing of seeds on raised beds, one harrowing was given and the experimental plots were laid out as per the statistical design (Fig. 1)

2. Sowing of seed on raised beds

The seed of brinjal chandur (local) variety was sown on 17.11.2016 to raise the seedlings in nursery. Regular watering and weeding were undertaken up to transplanting seeding to the main field.

3. Transplanting

The seedlings were transplanted after 5-6 weeks of sowing in the main field in 5th Dec 2016 as per layout shown in Fig. 1.

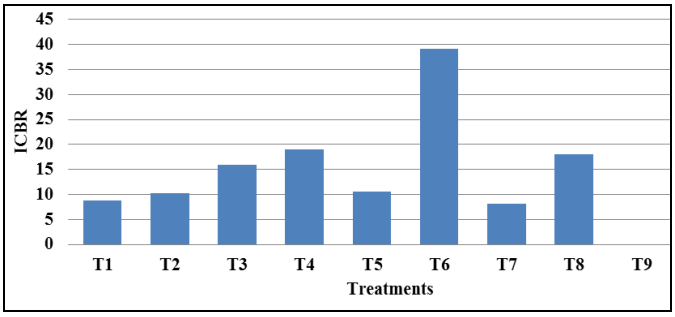

Fig 1: Incremental cost benefit ratio in different treatments

4. Gap filling

Gap filling was done on main field to maintain the plant population, keeping behind one plant per hill.

5. Application of fertilizers

Application of fertilizers was done at the rate of 60:50:50 (N.P.K.) kg/ha. Half dose of nitrogen and full dose of phosphorus and potash were given at the time of transplanting. Fertilizers were applied by ring method in the form of urea, single super phosphate and muriate of potash.

6. Hoeing and weeding

Timely hoeing and weeding operation were carried out to conserve soil moisture and to remove weeds as and when needed.

7. Irrigation

The protective irrigation was given in field experimental plots as and when essential.

8. Preparation of spray solution

The required concentrations of spray solution were prepared by using following formula.

$$Amount\ of\ insecticide\ require = \frac{Concentration\ required\ x\ Amount\ of\ water\ required}{Formulation}$$

1.2 Application of spray solution

The required quantity of insecticides was being thoroughly mixed with water as per the concentration of spray at times of spraying and then the solution was used for spraying.

From that the total quantity of water required to cover 1 ha area was determined and then the actual quantity of insecticide to be mixed on gram active ingredient basis was calculated. The spraying was done during morning hours with the help of knapsack sprayer. The suspension was thoroughly mixed before spraying and stirred frequently during the time of spray due care was taken for even distribution of spray solution, thoroughly coverage of entire plant and avoiding drifting of spray solution. Spraying and containers were washed thoroughly with fresh water after each application to avoid contamination.

Number of spray application with dates

First Spray	December 14, 2016
Second Spray	February 24, 2016
Third Spray	April 3, 2017

1.3 Method of observations

A. Vegetative Phase: Percent shoot infestation per plot was worked out.

B. Reproductive Phase: Also percent fruit infestation by following observation from the selecting five plants.

Observations were recorded on 3rd, 7th and 15th day after spraying (DAS).

Form randomly five plants, following observations were recorded.

1. Total number of infested fruits.
2. Total number of healthy fruits.
3. Total weight of infested fruits.
4. Total weight of healthy fruits.

1.4 Per cent fruit infestation

The per cent of infested fruit due to fruit borer on number as well as weight basis was be worked out by using the following formulae.

$$\text{per cent fruit damage(number basis)} = \frac{\text{Number of damage fruits}}{\text{Total number of fruits plucked}} \text{ x } 100$$

$$\text{per cent fruit damage(weight basis)} = \frac{\text{Number of damage fruits}}{\text{Total number of fruits plucked}} \text{ x } 100$$

1.5 Natural enemies
Average populations of natural enemies were recorded on 5 randomly selected plants from each ploy 3rd, 7th 12th days after application of treatment.

Results and Discussion
Effects of different newer insecticides on brinjal shoot damage: The mean per cent shoot infestation before spray per 5 plants recorded one day before application of insecticides revealed that the infestation of *L. orbonalis* varied from 6.55 to 7.70 per cent in different test plots (Table 2). After first spray the post treatment data indicated that all the treatments were effective and significantly superior to untreated control in bringing down the shoot infestation by *L. orbonalis*. Among the treatments, Profenofos 50 EC and Indoxacarb 14.5 SC was the best and most effective and significantly superior to all other treatments by recording the minimum infestation of shoots 3.98 per cent and 4.07 per cent respectively and Deltamethrin 2.8 EC and NSKE 5% found least effective with 5.18 per cent, 5.08 per cent shoot infestation respectively. After second spray the post treatment data indicated that Indoxacarb 14.5 SC and Profenofos 50 EC found superior to all other treatments by recording the minimum infestation of shoots 2.95 per cent and 3.00 per cent respectively. The maximum infestation of shoot was recorded on NSKE 5% and Deltamethrin 2.8 EC with 4.47 per cent, 4.20 per cent respectively after second spraying. The mean per cent shoot infestation after both sprays data indicated that Profenofos 50 EC and Indoxacarb 14.5 SC was significantly reducing the shoot infestation with 3.49 per cent and 3.51 per cent respectively. Both sprays data indicated that on NSKE 5% and Deltamethrin 2.8 EC found least effective with 4.77 per cent, 4.69 per cent shoot infestation respectively. Present findings are in conformity with finding of Patra *et al*. (2009) that mean shoot as well as fruit infestation of *L. orbonalis* was recorded in brinjal plots treated by Indoxacarb 14.5 SC 50 g a.i. ha-1 (8.89 and 13.13%), followed by Emamectin Benzoate 5 SG 15 g a.i. ha-1 (10.95 and 16.66%). Sinha *et al*., (2010) [57] also reported that the efficacy of Indoxacarb against *Leucinodes orbonalis*. Three foliar sprays of Indoxacarb at 70 and 140 g/ha were performed at fortnightly intervals starting at flowering/fruiting stage of the crop. Indoxacarb was effective in controlling the shoot and fruit borer of brinjal. Effects of different newer insecticides on brinjal fruit damage: The mean per cent fruit infestation before spray per 5 plants recorded one day before application of insecticides revealed that the infestation of *L. orbonalis* varied from 8.10 to 9.45 per cent in different test plots. After first spray the post treatment data indicated that all the treatments were effective and significantly superior to untreated control in bringing down the fruits infestation by *L. orbonalis*). Among the treatments, Indoxacarb 14.5 SC and Profenofos 50 EC was the best and most effective and significantly superior to all other treatments by recording the minimum infestation of fruits 3.50 per cent and 3.68 per cent respectively and NSKE 5% and Deltamethrin 2.8 EC found least effective with 5.20 per cent, 5.00 per cent fruit infestation respectively. After second spray the post treatment data indicated that Indoxacarb 14.5 SC and Profenofos 50 EC found superior to all other treatments by recording the minimum infestation of fruits 2.72 per cent and 2.87 per cent respectively. The maximum infestation of fruits was recorded on NSKE 5% and Deltamethrin 2.8 EC with 4.78 per cent, 4.38 per cent respectively after second spraying. The mean per cent fruit infestation after both sprays data indicated that Indoxacarb 14.5 SC and Profenofos 50 EC were significantly reducing the fruits infestation with 3.11 per cent and 3.27 per cent respectively. Both sprays data indicated that on NSKE 5% and Deltamethrin 2.8 EC found least effective with 4.99 per cent, 4.69 per cent fruits infestation respectively. Effect of different insecticides on shoot infestation by shoot and fruit borer in brinjal after spray. Before spraying as shoot and fruit borer is concerned, treatments with deltamethrin @ 15 g/fipronil @ 50 g a.i. /ha or indoxacarb @ 70 g a.i./ha gave minimum damages of brinjal fruits. Present findings are also in conformity with finding of Patra *et al*. (2009) that mean shoot as well as fruit infestation of *L. orbonalis* was recorded in brinjal plots treated with insecticides. Effects of different newer insecticides on brinjal yield shown respectively. As mentioned in below Table No.02

Table 2: Show the treatments of doses

Treatments	Doses
T_1 Emamectin Benzoate 5 SG	0.002 per cent
T_2 Spinosad 45 SC	0.01 per cent
T_3 Beauveria Bassiana 1×10^8	1 lit/ha.
T_4 Metarrhizium anisopliae 1×10^8	1 lit/ha
T_5 Azadirachtin spraying 1500ppm	2.5 ml/lit
T_6 Cypermethrin 25 EC	0.005 per cent
T_7 Imidacloprid 17.8 SL	0.025 per cent
T_8 Mechanical clipping of damaged shoot	
T_9 Control (Water supply)	

Observations
Per cent fruit infestation
The per cent of infested fruit due to fruit borer on number as well as weight basis was be worked out by using the following formulae.

$$\text{per cent fruit damage(number basis)} = \frac{\text{Number of damage fruits}}{\text{Total number of fruits plucked}} \times 100$$

$$\text{per cent fruit damage(weight basis)} = \frac{\text{Number of damage fruits}}{\text{Total number of fruits plucked}} \times 100$$

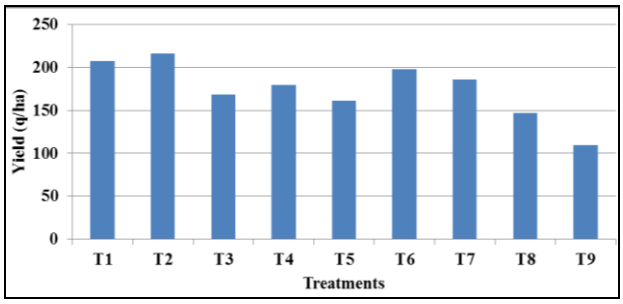

Fig 2: Effect of various treatments on yield

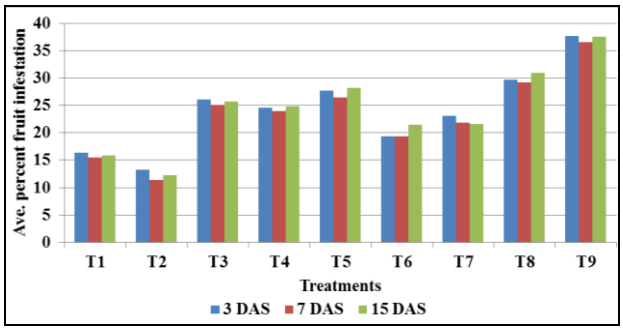

Fig 3: Cumulative mean per cent infestation of brinjal fruit borer (weight basis)

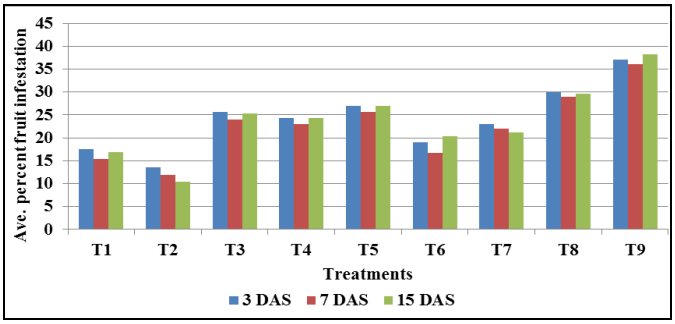

Fig 4: Cumulative mean per cent infestation of brinjal fruit borer (number basis)

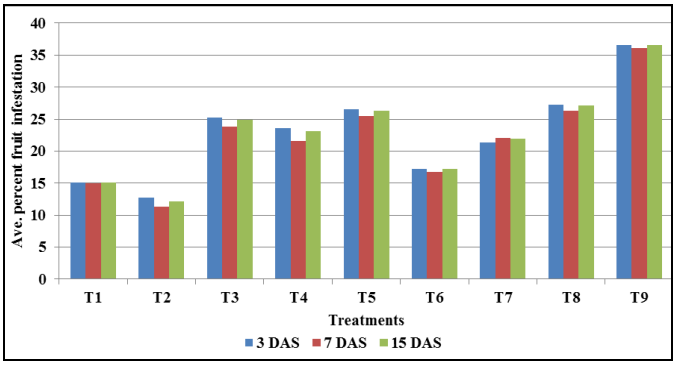

Fig 5: Cumulative mean per cent infestation of brinjal shoot borer

Conclusion

For the management of brinjal shoot and fruit borer, the treatment with Spinosad 45 SC @ 0.01% was found to be the most effective and superior followed by Emamectin benzoate 5 SG @ 0.002%, which was equally effective. The treatment with Spinosad 0.01% was found most effective followed by Emamectin benzoate 0.002%, Cypermethrin 0.005%, imidacloprid 0.025%, Metarhizium anisopliae 1 lit/ha respectively, in managing the fruit borer infestation of brinjal. The highest yield of brinjal fruit was obtained from the treatment spinosad 0.01% being superior to next effective treatments Emamectin benzoate 0.002%, Cypermethrin 0.005%, imidacloprid 0.025%. On the basis of ICBR among the effective treatments, Cypermethrin was appeared to be the most economically viable treatment followed by Metarrhizium anisopliae 1 lit/ha, mechanical shoot clipping, *Beauveria Bassiana* 1 lit/ha, Azadirachtin 2.5 ml/lit. Thus, it can be concluded that, Spinosad 0.01% was proved to be the best treatment in managing the brinjal shoot and fruit borer producing higher marketable fruit yield followed by next best treatment was Emamectin benzoate 0.002%, However the application of botanicals and mechanicals shoot clipping was relatively lesser utility in managing the brinjal shoot and fruit borer.

References

1. Aliam MA, Rao PK, BHK. Chemical control of brinjal shoot and fruit borer, *Leucinodes orbonalis* (Guenee) with newer insecticides. Entomon. Anonymous, 2006. Annual Report, ICAR Pub, New Delhi. 1992; 7(2):133-135.
2. Anil PC, Sharma. Bioefficiency of insecticides against *Leucinodes orbonalis* on brinjal Journal of Environmental Biology, 2010, 399-402.
3. Anonymous, Annual Report, ICAR Pub, New Delhi, 2006, 95.
4. Anonymous, Area and production of brinjal in Maharashtra, 2008. http.www.nhb.gov.in
5. Awate BG, Gandhale DN, Patil AS, Naik LM, Effectiveness of synthetic pyrethroids against shoot and fruit borer on brinjal. Pestology. 1982; 8(4):5-7.
6. Aycord WR. The nutritive value of Indian food and planning of satisfactory diets, ICMR Special Report, 1983, 42.
7. Butani DK, Verma S. Pest of vegetable and their control (Brinjal). Pesticides. 1976; 10(2):32-35.
8. Chakraborti S. A bio rational approach for management of brinjal shoot and fruit borer (*Leucinodes orbonalis* G.) J Ent. Res. 2001; 25(1):73-76.
9. Chakraborti S, Sarkar PK, Management of *Leucinodes orbonalis* Guenee on egg plants during the rainy season in India Journal of Plant Protection Research. 2011; 51(4):325-328.
10. Duara d SC, Deka AALH, Baruah, Barman N. Bioefficacy of synthetic parathyroid against brinjal shoot and fruit borer *Leucinodes orbonalis* (Guenee). Pestology. 2003; 28(2):28-30.
11. Fernandez HC, Londona ZME. *Plutella xylostella* susceptibility to different native isolate of Beauveria Bassiana and additional effect to other cauliflower Lepidoptrea. Revista-Colombianade. Entomology. 2003; 29(2):211-229.
12. Frengpong E, Buohing GKA. Studies on the pests of eggplant (*Solanum melongena* L.) Ghana. Bulletin-de-institute. Fundamental d' Afrique no criteria-A. 1978; 39(3):629-641.
13. Ganguli RN, Roy DR, Roy Choudhary AK. Control of brinjal shoot and fruit borer *Leucinodes orbonalis* Guenee. In Tripura Plant roc. Bull. Indian Publ. 1971-1974; 23(3):25-28.
14. Ghananand T, Prasad CS, Lok Nath. Integrated management of brinjal shoot and fruit borer, (*Leucinodes orbonalis* Guenee) in western Uttar Pradesh. Annals of Horticulture. 2009; 2(1):54-61.
15. Ghongale PR, Satpute NS, Tikare SN, Naitam NR. Field evaluation of ready mix insecticides against BSFB of brinjal. L. orbonalis Guen. Pestology. 2002; 26(3):26-28.
16. Gomez KH, Gomez AA. Statistical procedure for agricultural Research, Textbooks, 1984.
17. Jat KL, Prateek. Field evaluation of eco-friendly insecticides against brinjal shoot and fruit borer *Leucinodes orbonalis* (Guenee). Indian J Pl. Prot. 2001; 29(1&2):53-56.
18. Junsheng R. Advances in Integrated pest management in egg plants by seasonal Innoculative release of bioagents. Advances in integrated pest management for Hort. Crop, 1997-2000, 11(4).
19. Jyoti DP, Basavana Goud K. Safety of organic amendments and microbial pesticides to Natural enemies in Brinjal Ecosystem. Annl. Pl. Prot. Sci. 2008; 16(1):111-114.
20. Kalloo. Solanaceous crops in: vegetables breeding CRC. Press. INC Boca Ratan, Florida, 1988, (2).
21. Kaur SS, Singh BG, Sidhu AS, Dhillon TS. Management of brinjal shoot and fruit borer (*L. orbonalis* Geun). Through net house cultivation. Acta-Horticulture. 2004; 659(1):345-350.
22. Kavita VS, Revathi, Kingsleys. Bio efficacy neem derivatives against 4th instar larvae of *Lecunidoes orbonalis* (Guen.), J Appl. Zool. Res, 2008; 19(2):183-185.

23. Krishna TM, Lal OP, Srivastava YN, Srivastava SK, Handa. Field Efficacy of different insecticides, *Bacillus thuringienesis* var. Kurstake, Neem and difubenzuron for the control of brinjal shoot and fruit borer (*Leucinodes orbonalis* G.) on the egg plants J Ent. Res. 2002; 26(1):43-49.
24. Latif MA. Efficacy of nine insecticides against shoot and fruit borer, *Leucinodes orbonalis* Guenee (Lepidoptera: Pyralidae) in eggplant, J Pest Sci, 2010, 83(4).
25. Mandal D, Baral K, Talekar NS, Integrated pest management of brinjal shoot and fruit borer, *Leucinodes orbonalis* Guen. J. Appl. Zool. Res. 2008; 19(1):42-45.
26. Maniana NK, Okello RO, Oluch RO, Odero TA. Potential of entomopathogenic hyphomycetes (Dueteromycotina) fungi for the control of stem borer *Chillo partellus* (Lepidoptera: Pyralidae). J African Zoology. 1994; 108(6):529-536.
27. Mishra NC, Dash D. Evaluation of synthetic and neem based pesticides schedules against shoot and fruit borer (*Leucinodes orbonalis* Guen) on brinjal. J of Plant Prot. and Environment. 2007; 4(2):93-96.
28. Mote UN. Control of brinjal pests. Indian J Ento. 1981; 43(2):229-232.
29. Murugesan N, Murugesh T. Bioefficacy of some plant products against brinjal fruit borer, *Leucinodes orbonalis* (Guen.) (Lepidoptera: Pyrallidae). J Biopesticides, 2009; 2(1):60-63.
30. Muthukumar M, Kalyansundaram M. Studies on the efficacy of certain insecticides against brinjal shoot and fruit borer *L. orbonalis* Guen. Pestology. 2003; 27(5):13-16
31. Naik V, Chinna Babu P, Rao Arjuna, Krishnayya PV, Srinivasa. Seasonal incidence and mangemnet of *L. orbonalis* Guen. On Brinjal. Anni. Pl. Prot. Sci. 2008; 16(2):329-332.
32. Natekar MG, Raj S, Agnihotri NP. Bioefficacy of synthetic pyrethroids and their residues on brinjal fruits. Pestology. 1998; 22(11):28-32.
33. Patil BV, Bheemanna M, Hosamani AC, Tulsiram SG, Hanchinal. Fenpropathrin (Meothrin) 30 EC; an Ideal insecticide in brinjal, Pestology. 2004; 28(12):53-57.
34. Sasikala K, Rao PA, Krishnayyar V. Comparative efficacy of eco-friendly methods involving egg parasitoid. *Trichogramma japonicum*, mechanical control and safe chemical against *Leucinodes orbonalis* Guen. Infestating brinjal. J Ent. Res. 1999; 23(4):369-372.
35. Savendra NT. Eggplant shoot and fruit borer, *Leucinodes orbonalis* Guen. N. C. P. C. Newsletter. 1987; 2(1):3-4.
36. Sharma D, Masarra H, Qamar Muntaha. Comparative Potential of different botanicals and synthetic insecticides and their economics against *Leucinodes orbonalis* in egg plant. J plant Prot. Res. 2011; 52(1):132-139.
37. Sharma RK, Sinha SR. Management of shoot and fruit borer, *Leucinodes orbonalis* Guenee. Through border cropping and insecticides in Brinjal India J Ent. 2009; 71(2):130-132.
38. Shelton, Romas M. Efficacy and persistence of *Beauveria bassiana* and other fungi for control of DBM in Cabbage seeding. RAE. 1998; (65):110-112.
39. Shivalingaswamy TM, Akhilesh Kumar, Satpathy S, Rai AB. Efficacy of emamectin benzoate in the management of vegetable pests progressive Hort. 2008; 40(2):193-197.
40. Singh HS, Sridhar V, Nai G. Evaluation of some alternatives measures against brinjal shoot and fruit borer, *Leucinodes orbonalis* Guen. Under Bhubaneswar climatic condition. J Appl. Zool. Res, 16(2), 123-125.
41. Singh HS, Sridhar V, Naik G. Evaluation of some alternative measures against brinjal shoot and fruit borer, *Leucinodes orbonalis* Guen. Under Bhubaneswar climatic condition. J Appl. Zool. Res. 2005; 16(2):123-125
42. Singh JP, Vishwa Nath. Field evaluation of insecticide and neem formulations for management of brinjal shoot and fruit borer, *Leucinodes orbonalis*. In brinjal. Ind. J Ent. 2007; 69(4):341-344.
43. Singh PK. Effect of neem products on incidence of brinjal shoot and fruit borer *L. orbonalis* Guen. J Appl. Zool. Res. 2000; 11(1):23-24.
44. Singh PK. Control of brinjal shoot and fruit borer, *L. orbonalis* Guen. With combination of insecticides and plant extract. Indian J Ent. 2003; 65(2):155-159.
45. Singh R, Sinha SR, Paul AVN. Bio-efficacy of insecticides against two major insects' pests of brinjal. Ann. Pl. Protec. Sci. 2009; 17(1):225-274.
46. Singh SS. Comparative efficacy of certain bio-rational insecticide and *Bacillus thuringinesis* based bio-insecticides against *Leucinodes orbonalis* Guenee. In brinjal, Indian J Hort. 2010; 67(3):353-356.
47. Sivaramkrishna M, Kulat SS, Sunetra Tirathkar, Jesmi Vijayam. Performance of microbial for the management of *H. armigera* (Hubner) on Chickpea (*Cicer arientinum* L.) J Microb World. 2005; 7(2):317-320.
48. Som MG, Maity TK. Brinjal vegetable crops in India Ed. By T.K. Bose and M.G. Som, Department of Horticulture, Bidhan Chandra Krishi Vishwavidyalaya, Kalyani Pub. India, 1986, 293.
49. Srinivasan T, Kumaran N, kumar BV, Kuttalam S. Bio efficacy of emamectin benzoate 1.9 EC against bollworm complex on cotton. Indian J Ent. 2007; 70(3):264-268.
50. Suradkar Asmita, Naitam NR, Gotarkar SB, Aherkar SK. Management of brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee. Using different IPM Modulaes. J Ent. Res. 2008; 32(2):125-126.
51. Tambe VJ, Udar PV, Wagh SM, Patil PS. Pathogenicity of *Beauveria bassiana* against H. armigera (Hubner) Hardwick. J Microbial world. 2003; 5(1):111-115.
52. Tewari GC, Moorty PNK. Effectiveness of synthetic pyrethroids against the pest complex of brinjal. Entomon. 1983; 8(4):365-358.
53. Vevai EJ. Know your crop its pest problems and control brinjal pest. Pesticides. 1970; 4(4):26-35.
54. Wankhede SM, Kale VD. Effect of Insecticides on Brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee Ann. P1. Prote, Sci. 2010; 18(2):336-339.
55. Yadhav P, Maghadia AB, Vyas RV. Efficacy of microbial bio agent against *Helicoverpa armigera* on chickpea. International chickpea and pigeon pea newsletter. 2004; 11:41-43.
56. Ann. of Pl. Protect. Sci., 19: 318-20.
57. Sinha SR, Gupta RK, Gajbhiye VT, Vishwa Nath. Bio efficacy and persistence of indoxacarb on Solanum melongena. Ann. of Pl. Protect. Sci. 2010; 18:278-80.
58. Singh DK, Yadava LP, Pati R, Gupta VK. Effect of insecticides in management of brinjal shoot and fruit borer *Leucinodes orbonalis* Guene. Asian J of Bio Sci. 2008; 3:99-101.