The Pharma Innovation Journal 2023; 12(6): 2937-2940

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(6): 2937-2940

www.thepharmajournal.com
Received: 15-04-2023
Accepted: 20-05-2023

Shashank Gopal Naik
Student M.Sc. (Agri.)
Entomology, Department of Entomology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Ashwani Kumar
Associate Professor and Head, Department of Entomology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Corresponding Author:
Shashank Gopal Naik
Student M.Sc. (Agri.)
Entomology, Department of Entomology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Field efficacy and economics of certain chemicals and biopesticides against brinjal shoot and fruit borer [*Leucinodes orbonalis* (Guenee)]

Shashank Gopal Naik and Ashwani Kumar

Abstract
A field study was conducted at Naini, Prayagraj during the *rabi* season 2022-23 at Central Research Farm, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P). Different chemicals and biopesticides such as Thiodicarb 75 WP, Flubendiamide 480 SC, Emamectin benzoate 5 SG, Spinosad 45 SC, *Metarhizium anisopliae* $1x10^8$ CFU/gm, *Beauveria bassiana* 1% WP and Neem oil 5% were tested against brinjal shoot and fruit borer. During the investigation, it was revealed that lowest shoot infestation was observed in the treatment T_4 Spinosad 45 SC (10.03%) followed by T_2 Flubendiamide 480 SC (12.71%), T_3 Emamectin benzoate 5 SG (14.34%), T_1 Thiodicarb 75 WP (15.05%), T_6 *Beauveria bassiana* 1%WP (16.24%), T_5 *Metarhizium anisopliae* $1x10^8$ CFU/gm (17.07%) and T_7 Neem oil 5% (18.08%). Also, in fruit infestation T_4 Spinosad 45 SC (12.03%) shows lowest infestation followed by T_2 Flubendiamide 480 SC (13.54%) and highest yield over control was observed in the treatment spraying of T_4 Spinosad 45 SC (221.95 q/ha) followed by the treatment spraying of T_2 Flubendiamide 480 SC (198.15 q/ha). Among biopesticides *Beauveria bassiana* 1% WP and *Metarhizium anisopliae* $1x10^8$ CFU/gm shown promise in managing brinjal shoot and fruit borer. Among all the treatments Spinosad 45 SC was the most economical treatment and recorded highest cost benefit ratio (1:6.33) followed by Flubendiamide 480 SC (1:5.56), Emamectin benzoate 5 SG (1:5.23), Thiodicarb 75 WP (1:4.75), *Beauveria bassiana* 1% WP (1:4.31), *Metarhizium anisopliae* $1x10^8$ CFU/gm (1:3.82), and Neem oil 5% (1:2.39) as compared to untreated control plot (1:1.74).

Keywords: Bio-pesticides, brinjal, chemicals, economics, efficacy, *Leucinodes orbonalis*

Introduction
Brinjal or eggplant (*Solanum melongena* Linn.) is worldwide known as aubergine or guinea squash which is most popular and principle vegetable crop hence regarded as "King of vegetables belonging to the family 'Solanaceae' is one of the common and popular vegetables grown throughout the world. Brinjal is a versatile and economically important vegetable among small-scale farmers and low-income consumers of the entire universe. It is the leading vegetable in the country and ranks first among summer and winter vegetables in terms of total acreage. Asia has the largest brinjal production which comprises about 90% of the total production area and 87% of the world production (Mannan *et al.*, 2015) [8].

Brinjal is one of the widely used vegetable crops by most of the people and is popular in many countries *viz*., Central, South and Southeast Asia, some parts of Africa and Central America. It is native of India and is grown throughout the country. It is an important vegetable grown in all the seasons. Due to its nutritive value, consisting of minerals like iron, phosphorus, calcium and vitamins like A, B and C, unripe fruits are used primarily as vegetables in the country. It is also used as a raw material in pickle making and as an excellent remedy for those suffering from liver complaints. It has been reported as Ayurvedic medicine for curing diabetes. In addition, it is used as a good appetizer, good aphrodisiac, cardiotonic, laxative and reliever of inflammation (Kalawate and Dethe. 2012) [4].

Annual production of eggplants in China is ranked No.1, the country accounts for 64.41% of total world eggplant production, cultivated over 781,695 hectares, producing 454,852 hg/ha. Followed by India which accounts for 22.97% of total world eggplant production cultivated over 727,000 hectares with a yield of 174,415 hg/ha and Egpyt which accounts for 2.14% of total world eggplant production, cultivated over 43,818 hectares with a yield of 269,350 hg/ha. (FAO, 2019).

Brinjal is subjected to attack by a number of insect pest right from nursery stage till harvesting. Among the insect pests infesting brinjal, the major ones are shoot and fruit borer, *Leucinodes*

orbonalis (Guen.), whitefly *Bemicia tabaci* (Genn.), leafhopper *Amrasca biguttula biguttula* (Ishida), and non-insect pest red spider mite *Tetranychus macfurlanei*, out of these, *L. orbonalis* is considered the main constraint as it damages the crop throughout the year. The yield loss due to the pest is to the extent of 70-92 percent. The infested fruits become unfit for consumption due to loss of quality and hence lose their market value. (Kalawate and Dethe. 2012) [4].

Materials and Methods

The experiment was conducted during *rabi* season 2022-23 at a Central Research Farm of Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, India in a Randomized Block Design (RBD) with seven treatment and three replication three times using variety Purple long seeds in plot size of 2m X 1m at a spacing of 60 cm x 45 cm with a recommended package of practices excluding plant protection. The soil of the experimental site was well drained and medium high. The treatments were Thiodicarb 75 WP, Flubendiamide 480 SC, Emamectin benzoate 5 SG, Spinosad 45 SC, *Metarhizium anisopliae* $1x10^8$ CFU/gm, *Beauveria bassiana* 1% WP and Neem oil 5% and one control plot (water spray) were used in this study.

The insecticides were sprayed twice, first just after the appearance of pest on shoot and the second spray was given after 20 days of first spray. For evaluating the effectiveness of insecticides against shoot and fruit borer, damaged shoots were counted in each plot after 7 and 14 days after each spray and the percent shoot infestation was computed on the basis of number of infested shoots out of total number of shoots per plot in each observation. Percent fruit infestation was worked out on the basis of number of infested fruits out of total number of fruits. Gross returns were calculated by multiplying total yield with the market price of the produce. Cost of cultivation and cost of treatments were deducted from the gross returns, to find out returns and cost benefit of ratio.

$$\% \text{ Shoot infestation} = \frac{\text{No. of shoot infested}}{\text{Total no. of shoots}} \times 100$$

(Kolhe *et al.*, 2017) [6]

$$\% \text{ Fruit infestation} = \frac{\text{No. of fruit infested}}{\text{Total no. of fruits}} \times 100$$

(Kolhe *et al.*, 2017) [6]

$$\text{BCR} = \frac{\text{Gross returns}}{\text{Total cost of cultivation}}$$

(Sankar and Kumar 2022) [12]

Results and Discussion

The data on the percent infestation of shoot borer on brinjal 7th and 14th day after first spray revealed that all the chemical treatments were significantly superior over control. Among all the treatments lowest percent shoot infestation was recorded in T_4 Spinosad 45 SC (10.03) followed by T_2 Flubendiamide 480 SC(12.71), T_3 Emamectin benzoate 5 SG (13.71) T_1 Thiodicarb 75 WP (14.27), T_6 *Beauveria bassiana* 1% WP (15.06), T_5 *Metarhizium anisopliae* $1x10^8$ CFU/gm (15.78), and T_7 Neem oil 5% (18.27) The treatments T_7 Neem oil 5% (18.27) was least effective among all the treatments Control plot T_0 (26.40) infestation.

The data on the percent infestation of fruit borer on brinjal 7th and 14th day after second spray revealed that all the chemical treatments were significantly superior over control Among all the treatments lowest percent fruit infestation was recorded in T_4 Spinosad 45 SC (12.03), followed by T_2 Flubendiamide 480 SC (13.54), T_3 Emamectin benzoate (14.62), T_1 Thiodicarb 75 WP (15.25), T_6 *Beauveria bassiana* 1% WP (16.34), T_5 *Metarhizium anisopliae* $1x10^8$ CFU/gm (17.77) and T_7 Neem Oil 5% (19.89). The treatments T_7 Neem oil 5% (19.89) was least effective among all the treatments. Control plot T_0 (28.97) infestation.

The yields among the treatment were significant. The highest yield was recorded in T_4 Spinosad 45 SC (221.95 q/ha), followed by T_2 Flubendiamide 480 SC (198.15 q/ha), T_3 Emamectin benzoate (174.87 q/ha). T_1 Thiodicarb 75 WP (167.43 q/ha), T_6 *Beauveria bassiana* 1% WP (140.69 q/ha), T_5 *Metarhizium anisopliae* $1x10^8$ CFU/gm (125.55 q/ha) and T_7 Neem Oil 5% (85.13 q/ha). The treatments T_7 Neem Oil 5% (85.13 q/ha) was least effective among all the treatments. Control plot T (55.14 q/ha) yield.

When cost benefit ratio worked out, interesting result was achieved, among the treatment studied, the best and most economical treatment T_4 Spinosad 45 SC (1:6.33), by T_2 Flubendiamide 480 SC (1:5.56), T_3 Emamectin benzoate (1:5.23), T_1 Thiodicarb 75 WP (1:4.75), T_6 *Beauveria bassiana* 1% WP (1:4.31), T_5 *Metarhizium anisopliae* $1x10^8$ CFU/gm (1:3.82) and T_7 Neem Oil 5% (1:2.39). The treatments T_7 Neem Oil 5% (1:2.39) was least effective among all the treatments. Control plot T_0 (1:1.74) ratio.

In the present research work lowest percent shoot infestation was recorded in Spinosad treated plot (10.03%) similar findings were also reported by Sankar and Kumar (2022) [12] reported that Spinosad treated plot shown lowest percent shoot infestation of *Leucinodes orbonalis* (10.75%) while the infestation in control plot was (27.53%) also Chandar *et al*., (2020) [1] reported (10.98%) infestation in spinosad treated plots while the infestation in control plot was (18.33%). Flubendiamide 480 SC treated plot showed (12.71%) percent shoot infestation of *Leucinodes orbonalis* similar findings were also reported by Patra *et al*., (2016) [9] noticed (10.99%) infestation of *Leucinodes orbonalis* in Flubendiamide 480 SC treated plot while the infestation in control plot was (24.37%). Emamectin benzoate 5 SG treated plot showed (13.71%) percent shoot infestation of *Leucinodes orbonalis* similar findings were also reported by Yadav and Singh (2015) [15] noticed (12.30%) infestation of *Leucinodes orbonalis* in Emamectin benzoate 5 SG treated plot while the infestation in control plot was (16.44%). Mean percent shoot infestation of *Beauveria bassiana* 1% WP treated plot was (15.06%) which is reported by Devi *et al*. (2015) [2] reported that shoot infestation was (11.27%) while the infestation in control plot was (24.20%) Similarly, Dongarjal and Kumar (2017) [3] reported (11.37%) infestation in *Beauveria bassiana* 1% WP treated plot while the infestation in control plot is (19.52%).

In the present research work lowest percent fruit infestation was recorded in Spinosad treated plot (12.03%) similar findings were also reported by Palika and Tayde (2019) [11]

reported that spinosad treated plot shown lowest percent fruit infestation of *Leucinodes orbonalis* (09.22%) while the infestation in control plot was (23.43%). Mean percent fruit infestation of Flubendiamide 480 SC treated plot is (13.54%) which is reported by Tripura *et al*., (2017) [14] reported (14.09%) that the infestations in control plot was (28.03%). Emamectin benzoate 5 SG treated plot showed (14.62%) percent fruit infestation of *Leucinodes orbonalis* similar findings were also reported by Reddy and Kumar (2022) [10] noticed (11.90%) infestation of *Leucinodes orbonalis* in Emamectin benzoate 5 SG treated plot while the infestation in control plot was (29.06%). Mean percent fruit infestation of *Beauveria bassiana* 1% WP treated plot is (16.34%) which is similar to Karmakar *et al*., (2015) [5] reported (16.25%) infestation while the infestation in control plot was (33.66%). Highest yield was recorded in Spinosad (221.95 q/ha), similar findings were in conformity with Palika and Tayde (2019) [11] reported that higher crop yield Followed by Flubendiamide 480 SC (198.15 q/ha) similarly Patra *et al*., (2016) [9] reported yield of (161.22 q/ha) Emamectin benzoate 5 SG, which recorded a yield of (174.87 q/ha), similarly Patra *et al*., (2016) [9] reported yield of (143.55 q/ha). The yield recorded in *Beauveria bassiana* 1% WP treated plot is (140.69 q/ha) similar finding reported by Dongarjal and Kumar (2017) [3] In the Control plot (55.14 q/ha) yield is recorded.

Table 1: Efficacy and economics of certain chemicals and biopesticides against *L. orbonalis* (Guenee)] on brinjal

S. no.	Treatment	Dosage	1 DBS	Percent shoot and fruit infestation of Leucinodes orbonalis							Yield (q/ha)	B:C Ratio
				7 DAS	14 DAS	1st spray mean	1 DBS	7 DAS	14 DAS	2nd Spray mean		
T_1	Thiodicarb 75 WP	2 kg/ha	22.13	13.49	15.05	14.27	19.75	14.38	16.13	15.25	167.43	1:4.75
T_2	Flubendiamide 480 SC	300 ml/ha	20.87	11.96	13.47	12.71	21.58	12.38	14.70	13.54	198.15	1:5.56
T_3	Emamectin benzoate 5 SG	400 gm/ha	21.49	13.08	14.34	13.71	20.75	13.70	15.54	14.62	174.87	1:5.23
T_4	Spinosad 45 SC	500 ml/ha	19.98	9.40	10.67	10.03	22.81	10.87	13.19	12.03	221.95	1:6.33
T_5	Metarhizium anisopliae $1x10^8$ CFU/gm	4 Kg/ha	19.79	14.50	17.07	15.78	21.10	16.89	18.66	17.77	125.55	1:3.82
T_6	Beauveria bassiana 1% WP	2.5 kg/ha	21.06	13.88	16.24	15.06	21.59	15.35	17.33	16.34	140.69	1:4.31
T_7	Neem oil 5%	5 lit/ha	22.83	18.46	18.08	18.27	23.07	19.30	20.49	19.89	85.13	1:2.39
T_8	control	_	21.96	25.00	27.81	26.40	24.06	27.76	30.19	28.97	55.14	1:1.74
	Overall mean	---	21.26	14.97	16.59	15.77	21.83	16.32	18.27	17.30	---	---
	F test	---	NS	S	S	S	NS	S	S	S	---	---
	S. Ed.(±)	---	0.93	0.92	0.74	0.86	0.85	0.97	0.93	0.91	---	---
	C.D. at 0.05%	---	---	2.528	2.298	1.688	---	2.939	2.827	0.683	---	---

DBS= Day before spraying, DAS= Day after spraying, NS= Non-significant, S= Significant

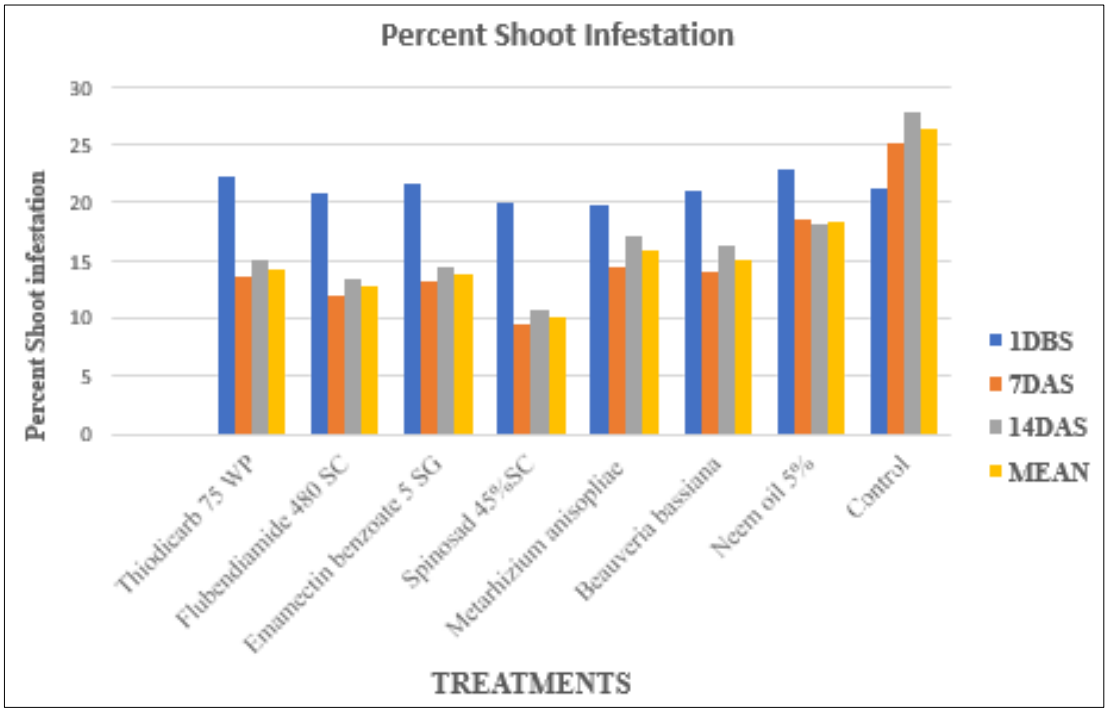

Fig 1: Field efficacy of certain chemicals and biopesticides against brinjal shoot and fruit borer [*L. orbonalis* (Guenee)] (First spray): (% Shoot Infestation)

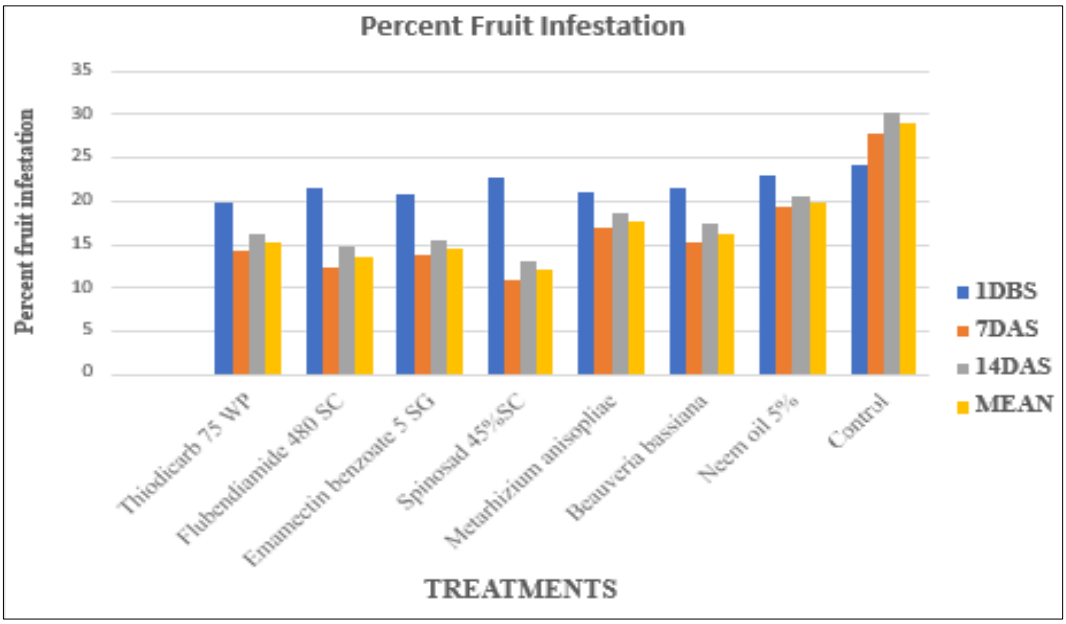

Fig 2: Field efficacy of certain chemicals and biopesticides against brinjal shoot and fruit borer [*L. orbonalis* (Guenee)] (Second spray): (% fruit Infestation)

Conclusion

From the analysis it concluded that spinosad 45 SC found most effective insecticide treatment against brinjal shoot and fruit borer (*Leucinodes orbonalis*) as it recorded lowest percent of shoot infestation (10.03%) and fruit infestation (12.03%) and highest marketable fruit yield (221.95 q/ha) with B:C ratio (1:6.33) which was followed by Flubendiamide 480 SC and Emamectin benzoate 5 SG. While Neem oil 5% found to be least effective in controlling the Shoot and fruit borer infestation.

References

1. Chandar AS, Kumar A, Singh U, Kakade AA, Nawale JS, Narode MK, *et al*. Efficacy of certain chemicals and biopesticides against brinjal shoot and fruit borer *Leucinodes orbonalis* (Guenee). Journal of Entomology and Zoology Studies. 2020;8(5):220-223.
2. Devi LL, Ghule TM, Chatterjee ML, Senapati AK. Effectiveness of biorational insecticides for the management of brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee and on yield Ecology, Environment and Conservation. 2015;21(2):783-788.
3. Dongarjal SB, Kumar A. Field efficacy of Cypermethrin and certain biopesticides against brinjal shoot and fruit borer, (*L. orbonalis* (Guenee)) on Brinjal (*Solanum melongena* L.). Journal of Pharmacognosy and Phytochemistry. 2017;6(4):1930-1933.
4. Kalawate A, Dethe MD. Bioefficacy study of biorational insecticide on brinjal. Journal of Biopesticides. 2012;5(1):75.
5. Karmakar SK, Samanta S, Sen K, Manger A, Padhi GK, Das U, *et al*. Bio-pesticidal management of brinjal shoot and fruit borer, *Leucinodes orbonalis* (Guen.). Journal of Entomology and Zoology Studies. 2018;6(4):1142-1145.
6. Kolhe PS, Kumar A, Tayde AR. Field Efficacy of Certain Chemicals and Neem Products against Shoot and Fruit Borer (*Leucinodes orbonalis* Guenee) on Brinjal (*Solanum melongena* L.) in Trans Yamuna Region of Allahabad. International Journal of Current Microbiology and Applied Sciences. 2017;6(9):1320-1327.
7. Muthukrishnan N, Visnupriya M, Babyrani W, Muthiah C. Persistence toxicity and field evaluation of spinetoram 12 SC against shoot and fruit borer, *Leucinodes orbonalis* (Guenee) in brinjal. Madras Agricultural Journal. 2013;100(4-6):605-608.
8. Mannan MA, Islam KS, Jahan M. Brinjal shoot and fruit borer infestation in relation to plant age and season. Bangladesh Journal of Agricultural Research. 2015;40(3):399-407.
9. Patra S, Thakur NS, Firake DM. Evaluation of bio-pesticides and insecticides against brinjal shoot and fruit borer (*Leucinodes orbonalis* Guenee) in Meghalaya of north-Eastern India. International Journal of Bio-resource and Stress Management. 2016;7(5):1032-1036.
10. Reddy CS, Kumar A. Efficacy of selected insecticides against brinjal shoot and fruit borer, *Leucinodes orbonalis* (Guenee). The Pharma Innovation Journal. 2022;11(4):1327-1330.
11. Sanjana PSV, Tayde AR. Field Efficacy of Some Insecticides, Neem oil and Spinosad against Shoot and Fruit Borer, *Leucinodes orbonalis* (Guenee) on brinjal. J Entomol Zool Stud. 2019;7(5):563-6.
12. Sankar AS, Kumar A. Evaluation of certain insecticides to control shoot and fruit borer, *Leucinodes orbonalis* Guenee on brinjal (*Solanum melongena* L). The Pharma Innovation Journal. 2022;11(9):2183-2186.
13. Sharma JH, Tayde AR. Evaluation of bio-rational pesticides, against brinjal fruit and shoot borer, *Leucinodes orbonalis* Guen. on brinjal at Allahabad Agroclimatic region. International Journal of Current Microbiology and Applied Sciences. 2017;6(6):2049-2054.
14. Tripura A, Chatterjee ML, Pande R, Patra S. Biorational management of brinjal shoot and fruit borer (*Leucinodes orbonalis* guenee) in mid hills of Meghalaya. Journal of Entomology Zoology Studies. 2017;5(4):41-45.
15. Yadav, Sunita, Singh SP. Bio-intensive integrated management strategy for mustard aphid Lipaphis erysimi Kalt. (Homoptera: Aphididae). Journal of Applied and Natural Science. 2015; 7(1):192-196.