Pakistan Entomologist

Journal homepage: www.pakentomol.com

INTEGRATED PEST MANAGEMENT OF OKRA FRUIT BORER (*EARIAS* SPP. NOCTUIDAE, LEPIDOPTERA)

Muhammad Asrar*, Syed Makhdoom Hussain, Muhammad Azeem, Awais Ali Chatha and Muhammad Zubair ul Hassan Arsalan

Department of Zoology, Government College University, Faisalabad, Pakistan

ARTICLE INFORMATION

Received: July 07, 2016

Received in revised form: November 28, 2016

Accepted: December 03, 2016

***Corresponding Author**:

Muhammad Asrar

E-mail: asraragri@gmail.com

ABSTRACT

This study was conducted to develop IPM package for controlling okra fruit borer (*Earias vittella* and *Earias insulana*) in okra crop. This experiment comprised of seven treatment (T_1: Flubendiamide @ 40ml/Acre, T_2: Sanitation (hoeing and weeding), T_3: *Trichogramma* @ 25000 wasps/Acre @ week interval, T_4: Neem seed oil @ 5%, T_5: Flubendiamide and Sanitation, T_6: Flubendiamide and *Trichogramma*, T_7: Flubendiamide and neem seed oil) with control and was laid out in Randomized Complete Block Design (RCBD) with three replications. The results reveal that integrated application of Flubendiamide and neem seed oil demonstrated least fruit infestation (5.51%) and maximum reduction in fruit infestation (67.05%). Integrated application of Flubendiamide and Sanitation resulted in 6.83% fruit infestation and 61.33% reduction in fruit infestation. The highest fruit infestation (20.69%) and lowest reduction in fruit infestation (13.22%) was recorded in where sanitation was applied. While other treatments such as *Trichogramma* releases, neem seed oil and flubendiamide application showed 16.43%, 13.71% and 7.63% fruit infestation; and 13.27%, 21.17% and 56.1% reduction in fruit infestation, respectively. In conclusion, integrated application of Flubendiamide and neem seed oil as well as of Flubendiamide and Sanitation can be used for the management of okra fruit borers *E. vittella* and *E. insulana*.

Keywords: *E. vittella* and *E. insulana*, , IPM, Okra

INTRODUCTION

Okra or lady's finger, *Abelmoschus esculentus L.*, is an important summer crop in Pakistan with production of 303.16 tons from 232.05 hectares of land per year (Kashif *et al.*, 2008). Okra provides an important source of carbohydrate, protein, fat, vitamins, calcium, potassium and other mineral matters which are often lacking in the diet of developing countries (Anonymous, 2000; Benchasri, 2012). The fruits also have some medicinal value. A mucilaginous preparation from the pod can be used for plasma replacement or blood volume expansion. The okra fruit is considered valuable for control of goiter, because of its high iodine contents (Savello *et al.*, 1980).

Okra production is affected by many factors, among them insect pest attack is the major one that causes 69% reduction in okra yield (Schmutterer, 1990; Mani *et al.*, 2005). Nineteen insect pests and four mites species have been reported on okra (Anonnymous, 2000). The fruit borers include *Earias vittella* and *Earias insulana* which alone cause damage ranging from 52.33 to 70.75 percent (Pareek and Bhargava, 2003;Kanwar and Ameta, 2007).

The farmer of Pakistan solely depends on insecticide to control the insect pests and apply 10-12 sprays in a season on vegetables Due to indiscriminate use of pesticides, the pest has developed resistance besides, that pesticides are hazardous to human health and reduce the density of beneficial insect and soil microorganisms. Therefore, it is need to develop alternate methods of pest management other than the use of insecticides (Devi *et al.,* 2015).

Mixtures of various plant parts such as leaf, bark, seed and vegetable are traditionally being practiced in Asia and Africa for the management of this insect pest. Botanicals possess insecticidal activity and have low mammalian toxicity, no reported development of resistance, less hazardous effects to non-target organisms, no pest resurgence problem, no adverse effect on plant growth, negligible application risks, low cost and easy availability (Prakash *et al.*, 1990).

Biological control is a component of an integrated pest management strategy. *Bracon hebetor, B. greeni* and

Cite this article as: Asrar, M., S.M. Hussain, M. Azeem, A.A. Chatha and M.Z.H. Arsalan, 2016. Integrated pest management of okra fruit borer (*Earias* spp. Noctuidae, Lepidoptera). Pak. Entomol., 38(2):147-151.

Trichogramma spp. vave been extensively exploited for successful management of Lepidopteran pests including *Earias* spp. in okra fields (Mani *et al.,* 2005). Integrated pest management strategies such as use of pest resistant plant species, biological, chemical and other cultural control methods can be an effective and economic tool of pest management program (Sajid *et al.,* 2012; Akhter *et al.*, 2014). The present study was conducted to evaluate Flubendiamide @ 40ml/Acre, Sanitation (hoeing and weeding), *Trichogramma* @ 25000 wasps/Acre @ week interval and Neem seed oil @ 5%, alone and integrated application of Flubendiamide and Sanitation, Flubendiamide and *Trichogramma* and Flubendiamide and neem seed oil for developing IPM package for fruit borer (*Earias vittella* and *Earias insulana*) in okra crop.

MATERIALS AND METHODS

The field studied was carried out at experimental area of Entomological Research Institute Ayub Agricultural Research Institute (AARI), Faisalabad during 2015. The study area was 186.54m above the Sea level (Amjad *et al.*, 2000) having hot summer with mean highest temperature of 36.11°C, mean lowest temperature 24.24°C and cold winter. During hottest month daily maximum temperature can reach up to 49 °C and daily minimum temperature can be as low as 21.11°C. Moreover experiment site experiences less than 500 mm average annual rainfall and frequently dust storms (April to May).

Design of the experiment and layout

The experiment was laid out in a Randomized Complete Block Design (RCBD) with seven treatments [(T_1: Flubendiamide @ 40ml/Acre, T_2: Sanitation (hoeing and weeding), T_3: *Trichogramma* @ 25000 wasps/Acre @ week interval, T_4: Neem seed oil @ 5%, T_5: Flubendiamide and Sanitation, T_6: Flubendiamide and *Trichogramma*, T_7: Flubendiamide and neem seed oil] with control. The entire experimental field was further divided into three blocks. Each block was divided into eight plots. Each experimental plot comprised of 5m x 7m area. Each treatment was allocated randomly within the block and replicated three times.

Collection and sowing of seeds

Seeds of Sabz Pari were collected from the Vegetable Research Institute, Ayub Agricultural Research Institute (AARI), Faisalabad. Seeds were sown on 1st April, 2015. The row to row and plant to plant spacing was maintained at 60 cm and 50 cm, respectively.

Preparation of the treatments

Neem oil

For proper management of okra fruit borer 4 ml neem oil was poured in 1 Litre of water and then 1ml trix was mixed to obtain fine droplet to spray 3m x 2m area.

Trichogramma chilonis

The freshly laid and cleaned *Sitotroga cerealella* eggs were taken and glued on a strip of card sheet (12 inch x 8 inch) in single layer using gum and these cards were exposed to *Trichogramma chilonis* for 8 to 10 hours to maintain the culture. After 24 hours, the parasitized cards were withdrawn and placed in convenient glass containers. The open end of the container was closed using muslin cloth fastened by rubber band.

Application of the treatments

Spray was applied in the evening to avoid moisture on leaves. First application was done after 55 days of germination. Treatments were applied at 7 days interval. Spraying was done by knapsack sprayer having a pressure of 4.5 kg/cm^2. To get complete coverage of plant, spraying was done uniformly on the entire plant with special care.

Method of recording fruit infestation

The data on the number of healthy and infested fruits were recorded from 5 tagged plants, in each treatment. The percent infestation of fruit was calculated with the following formula:

$$\% \text{ infestation of fruit} = \frac{\text{Number of infested fruits}}{\text{Total number of fruits}} \times 100$$

Statistical analysis

The data on fruit infestation and yield was subjected to ANOVA technique and means were compared by Tuckey HSD test at 5% level of significant.

RESULTS

This Study was conducted to integrate various methods viz., Sanitation (weeding/ hoeing), spray of neem seed oil (5%), release of *Trichogramma chilonis* @ 25000 wasps per acre and a spray of Flubendiamide 40 ml per acre individually and in their all possible combinations. The treatments were applied 6 time during 2015 for control *Earias* spp. on resistance genotype of okra Sabz pari. The objective of this study was find out the most effective and economical treatment for the recommendation to the farmers. In 1st week of observation plot showed least fruit infestation (5.11%) where Flubendiamide and neem seed oil were collectively applied. Application of Flubendiamide and sanitation resulted in 8.21% fruit infestation. The highest fruit infestation (18.19%) recorded in plots where sanitation was applied. While other treatments such as Flubendiamide, *Trichogramma* releases and neem seed oil application showed 9.00%, 11.78% and 11.81% fruit infestation, respectively (Table 1).

In 2nd week of observation collectively application of Flubendiamide and neem seed oil showed least infestation (6.14%) and in other plot where collectively application of Flubendiamide with *Trichogramma* and spray of Flubendiamide were practiced showed almost similar result with 6.41% and 6.39% fruit infestation respectively. Highest fruit infestation (22.75%) was recorded in second plot where sanitation was performed (Table 1). Similarly in 3rd week of observation, plot showed least infestation (5.51%) where Flubendiamide and neem seed oil were applied and maximum fruit infestation (23.11%) was noticed in plot where sanitation was performed. While other treatment such as *Trichogramma* releases and spray of Flubendiamide showed 17.24% and 7.28% fruit infestation, respectivily (Table 1).

In fourth and fifth week of observations similar results were noticed in plot which was treated with collectively Flubendiamide and neem seed oil that demonstrated the least fruit infestation (4.95% and 4.86%). Flubendiamide application showed significant result with 8.03% and 7.29% fruit infestation and release of Trichogramma demonstrated 18.83% and 17.15% fruit infestation; while senitation explained the maximum fruit infestation of 22.43% and 19.50% during forth and fifth observation respectivily (Table 1).

In 6th week of observation collectively application of Flubendiamide and sanitation was gave least fruit infestation (5.31%) and surprisingly releases of *Trichogramma* recorded the highest fruit infestation (19.06%). Application of neem seed oil, sanitation and Flubendiamide respectively demonstrated 14.33%, 18.19% and 7.81% fruit infestation (Table 1).

The maximum reduction in fruit infestation (67.05%) was recorded in those plots which were integratively treated with flubendiamide and neem seed oil followed by plot integratively treated with flubendiamide and sanitation (61.33%) and plot treated with flubendiamide alone (56.1%).Integrated application of flubendiamide and *T.chilonis* resulted in 43.75% reduction in fruit infestation. Application of sanitation measures, *T.chilonis* and neem seed oil alone demonstrated 13.2%, 13.27% and 21.7% reduction in fruit infestation respectively (Fig.1).

It is concluded that combine application of Flubendiamide and neem seed oil is most suitable and ecofriendly method to reduce the fruit infestation of okra.

RESULTS AND DISCUSSION

Integrated application of Flubendiamide and neem seed oil proved the most effective resulting in a minimum fruit infestation (5.51%) and was found at close with those plots where Flubendiamide was sprayed along with sanitation (T-5) had (6.83% fruit infestation). Application of Flubendiamide alone showed 7.63 percent fruit infestation where as in combination with the release of *T. chilonis* (T-6), it show almost same result (7.66% fruit infestation). The present findings can partially be compared with those of Raja *et al.* (1998) who reported 49.73, 32.36 and 67.13% reduction in fruit infestation in okra by *Aerias* spp. treated with *T. chilonis*, endosulfan and neem seed oil respectively. The present findings can be compared with those of Aziz *et al.* (2012) who reported 7 % fruit infestation in a chemical treatment.

In the present study, the neem seed oil alone showed 13.71% fruit infestation in okra due to *Earias* spp. These findings can be compared with those of Rahman *et al.* (2013), who

Table 1

Fruit infestation (Means±SE) recorded during different observations in various treatments.

Treatments	Predetermine Treatment Mean ±SE	1st observation Mean ±SE	2nd observation Mean ±SE	3rd observation Mean ±SE	4th Observation Mean ±SE	5th observation Mean ±SE	6th observation Mean ±SE
Control	17.77±0.75ab	19.61±1.55a	21.82±0.94a	24.58±0.60a	23.81±0.90a	24.89±0.87a	25.85±0.75a
Flubendiamide @40ml/Acre	17.13±0.86ab	9.00±0.60bc	6.39±0.30c	7.28±0.96d	8.03±0.62d	7.29±0.36d	7.81±0.40d
Sanitation at 15 days interval	18.19±0.76a	18.19±0.64a	22.75±0.94a	23.11±0.52a	22.43±1.25a	19.50±0.83b	18.19±1.19b
Trichogramma spp. @25000 wasps/Acre at week interval	16.64±0.91ab	11.78±1.84b	14.55±0.57b	17.24±0.49b	18.83±0.83b	17.15±0.83c	19.06±1.26b
Neem seed oil @ 5% at 15 days interval	17.40±1.28ab	11.81±0.98b	15.79±0.60b	12.53±0.72c	14.67±0.63c	13.16±0.97c	14.33±0.97c
Flubendiamide and Sanitation	17.67±0.86ab	8.21±1.22cd	6.74±1.16c	6.46±0.56d	5.58±0.79e	8.69±0.84e	5.31±0.35e
Flubendiamide and *Trichogramma* spp.	15.71±0.71b	8.51±0.86bc	6.41±0.29c	7.28±0.87d	7.93±0.19d	7.83±0.31e	7.99±0.50d
Flubendiamide and Neem seed oil	16.74±1.17ab	5.11±0.44d	6.14±0.16c	5.51±0.42d	4.95.±0.60e	4.86±0.15f	6.52±0.31de
LSD at 0.05%	2.79	3.30	2.21	1.94	2.32	2.13	2.40
P- value	0.4509	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
F- value	1.03	20.9	93.4	143	98.5	97.6	85.5
df	$7^a/16^b$	$7^a/16^b$	$7^a/16^b$	$7^a/16^b$	$7^a/16^b$	$7^a/16^b$	$7^a/16^b$

[a] = Degree of freedom of Treatment; [b] = Degree of freedom of Error; Means with similar letter do not different significantly at probability level of 0.05

reported that neem seed oil showed 10.05-14.98% fruit infestation.

In the present study, the combination of neem seed oil, and spray of Flubendiamide resulted in a higher percentage reduction of the fruit infestation. These findings can be compared with those of Sarode and Gabhane (1994) who also reported that the application of neem seed kernel extract and chemicals application alone and in combination showed a significant control of *Earias spp.* than the untreated control. The present findings can partially be compared with those of Shukla *et al.* (1997) who applied different botanicals and endosulfan for the control of fruit borer and had a lowest damage with endosulfan followed by the other botanicals.

Similarly, Gowri *et al.* (2002) observed that amongst various botanicals, Nimbecidine were found to be the most effective in controlling the fruit borer as compared with the endosulfan. In the present study all the treatments alone are in a combination resulted in a lower fruit infestation (6.89-21.64%) than of the control (27.00%) in okra caused by *Earia*s spp. Present findings are inconformity with those of Bagade *et al.* (2005) who reported that the test treatments resulted in a lower fruit infestation (8.05-14.38%) than the control treatment (25.03%) while using various botanicals concentrations along with the neem seed kernel extract and various conventional insecticides.

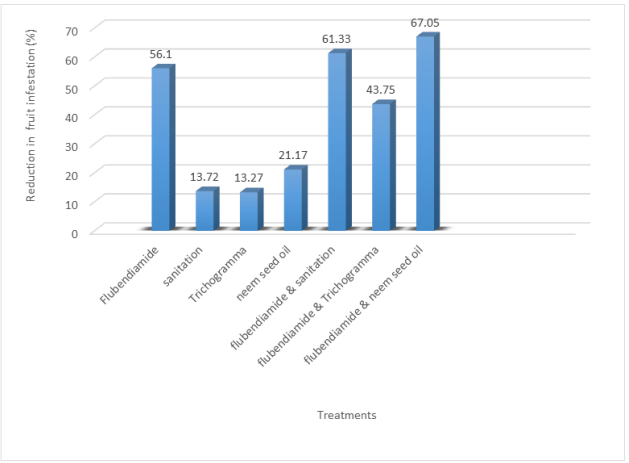

Fig. 1

Reduction in fruit infestation (%) in okra plots implemented with different treatment:

The results revealed that all the treatments showed significantly minimum fruit infestation as against the control. Maximum control was observed in those plots where neem seed oil and spray of Flubendiamide were used in combination, followed by the sanitation and spray of Flubendiamide were applied together which resulted in 5.51% and 6.83% reduction in the fruit infestation, respectively. The present findings can partially be compared with those of Samuthiavelu and David (1991) as well as of Sarode and Gabhane (1994), who applied different botanical treatments along with different conventional insecticides for the control of *E. vittella* on okra and got variable results. Similarly Shukla *et al.* (1996) reported that fenvalerate proved to be the best with a highest yield amongst various treatments. Furthermore they reported that treatment with neem oil produced the lowest pest damage in the highest fruit yield whereas in the present study the fruit damage was recorded to be 13.71% in neem seed oil treatments which are categorized as intermediate. Similarly according to Singh *et al.* (2005), Fenvalerate was found to be the most effective in reducing the pest incidence followed by the neem seed oil.

REFERENCES

Akhter, M., F. Jabeen, S. Sultana, T. Sultana, D. Hussain, and A. Ali, 2014. Selection of different okra genotypes against *Earias* spp. (Lepidoptera: Noctuidae). J. Entomol. Zool. Stud., 2: 138-141.

Amjad, M., M. Sultan, M.A. Anjum and C.M. Ayyub, 2002. Response of okra *(Abelmoschus esculentus* L. Moench) to various doses of N & P and different plant spacings. J. Res. Sci., 13(1): 19-29.

Anonymous, 2000. Yearbook of Agricultural Statistics of Bangladesh, Bangladesh Bureau of Statistics (BBS). Ministry of planning, Govt. of the People's Republic of Bangladesh. p. 96.

Aziz, M.A., M.U. Hasan, A. Ali, and J. Iqbal, 2012. Comparative efficacy of different strategies for management of spotted bollworms, *Earias* spp. on okra, *Abelmoschus esculentus* (L). Moench. Pak. J. Zool., 44(5): 1203-1208.

Bagade, A.S., J.S. Ambekar, V.Y. Bhagavati and B.A. Bade, 2005. Field efficacy of neem formulations in alternation with synthetic insecticides against okra fruit borer (*Earias vittella* Fab.). J. Maharashtra Agric. Univ.

Benchasri, S., 2012. Okra (*Abelmoschus esculentus* (L.) Moench) as a valuable vegetable of the world. Ratarstvo I Povrtarstvo, 49(1): 105-112.

Devi, L.L., T.M. Ghule, M.L. Chatterjee and A.K. Senapati, 2015. Biorational management of shoot and fruit borer of okra (*Earias vittella* Fab) and their effect on insect predators. Envir. Ecol., 33(3): 1052-1054.

Gowri, S., G. Ramachandrarao, and B. Nagalingam, 2002. Impact of neem formulations on coccinellid predators of okra pest complex. Pestic. Res. J., 14(2), 242-243.

Hossain, S. (2010). Eco-Friendly management of Okra shoot and okra fruit borer using Bio-control agents.

Kanwar, N. and O.P. Ameta, 2007. Assessment of loss caused by insect pests of okra, *Abelmoschus esculentus* (L.) Moench. Pestol., 31(5): 45-47.

Kashif, S., M. Yaseen, Arshad and M. Ayub, 2008. Response of okra (*Hibiscus esculentus* L.) to soil given encapsulated calcium carbide. Pak. J. Bot., 40(1): 175-181.

Mani, M., A. Krishnamoorthy and C. Gopalakrishnan, 2005. Biological control of lepidopterous pests of horticultural crops in India-A review. Agric. Rev., 26(1): 39.

Pareek, P.L. and M.C. Bhargava, 2003. Estimation of avoidable losses in vegetables caused by borers under semi arid condition of Rajasthan. Ins. Environ., 9: 59-60.

Prakash, A., J. Rao and V. Nandagopal, 2008. Future of botanical pesticides in rice, wheat, pulses and vegetables pest management. J. Biopestic., 1(2): 154-169.

Rahman, M.M., M.M. Uddin and M. Shahjahan, 2013. Management of okra shoot and fruit borer, *Earias Vittella* (Fabricius) using chemical and botanical insecticides for different okra varieties. Int. Res. J. Appl. Life Sci., 2(1): 55-69.

Raja, J., B. Rajendran, C.M. Pappiah and A. Verghese, 1997. Management of eggplant shoot and fruit borer, *Leucinodes orbonalis* Guen. *In*: Advances in IPM for Horticultural Crops. Proceedings of the First National Symposium on Pest Management in Horticultural Crops: Environmental Implications and Thrusts. pp. 15-17.

Sajid, M., M.A. Khan, A. Rab, S.N.M. Shah, M. Arif, I. Jan, and M. Mukhtiar, 2012. Impact of nitrogen and phosphorus on seed yield and yield components of okra cultivars. The J. Animal Plant Sci., 22(3), 704-707.

Samuthiravelu, P., and B.V. David, 1991. Bioefficacy of neem oil and endosulfan against the fruit borer, *Earias vittella* (Fab.) (Noctuidae: Lepidoptera) on okra. Madras Agric., J., 78(1-4): 77-78.

Sarode, S.V. and A.T. Gabhane, 1994. Performance of neem seed kernel extract with reduced insecticidal dosage on the infestation of okra fruit borer, *Earias vittella* Fab. J. Entomol. Res., 18(4): 327-330.

Savello, P.A., F.W. Martin and J.M. Hill, 1980. Nutritional composition of okra seed meal. J. Agric. Food Chem., 28(6):1163-1166.

Schmutterer, H., 1990. Properties and potential of natural pesticides from the neem tree, *Azadirachta indica*. Ann. Rev. Ent., 35(1), 271-297.

Shukla, A., S.C. Pathak and R.K. Agarwal 1998. Field evaluation of okra varieties for resistance to shoot and fruit borer, *Earias vittella* (Fab.). J. Insect Sci., 11(1): 60-61.

Singh, H.S., V. Sridhar and G. Naik, 2005. Evaluation of some alternative measures against brinjal shoot and fruit borer, *Leucinodes orbonalis* G. under Bhubaneswar climatic conditions. J. Appl. Zool. Res., 16(2): 123-125.