Bio-efficacy of newer insecticides against okra shoot and fruit borer, *Earias vittella* fabricius

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**DOI:** [https://doi.org/10.22271/chemi.2021.v9.11as.11726](https://doi.org/10.22271/chemi.2021.v9.11as.11726)

**Abstract**
Different newer chemical insecticides were evaluated for their effectiveness against okra shoot and fruit borer, *Earias vittella* during Kharif 2019. The experiment was conducted at the Instructional Farm, Department of Agricultural Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri. Three foliar applications of each insecticide treatment were given at an interval of 10 days, initiating first application when pest reached to ETL. The result of the study revealed that the treatment of combination insecticide viz. flubendiamide 90 SC + deltamethrin 60 SC (36+24 g a.i./ha) was proved to be the most effective with lowest larval population (0.81 larva/plant), least fruit infestation (4.5%) and highest fruit yield (9.64 t/ha) among all the treatments.

**Keywords:** Flubendiamide, deltamethrin, bioefficacy, okra

**Introduction**
Okra (*Abelmoschus esculentus*) also referred as lady’s finger is an important vegetable crop of the family Malvaceae. The place of origin is Ethiopia and is mainly grown for its green tender nutritious fruits. India is the largest producer of okra in the world. In India, it is grown on an area of 5.14 lakh hectare with an annual production of 61.26 lakh tons and productivity of 12 MT per hectare. In Maharashtra, it is grown on area of 1.44 lakh hectare with an annual production of 14.80 lakh tons and productivity of 10.26 MT per hectare (Anonymous, 2018) [2]. West Bengal, Gujarat, Bihar, Odisha, Chhattisgarh, Jharkhand, Madhya Pradesh and Maharashtra are the major okra growing states in country. In India, more than 13 species of insect pests have been reported to infest okra crop (Mandal et al., 2007) [7], (Mani and Singh 2012) [8] reported 15 arthropod species in okra ecosystem. Among all, shoot and fruit borer (*Earias* sp.) is considered as the most important pest in okra (Aziz et al., 2011) [3] which causes both quantitative and qualitative losses of the crop (Butani and Jotwani, 1984) [4]. The larvae bore into the terminal growing shoots, floral buds, flowers and fruits of okra, resulting in cessation, withering and drying of infested shoots, tender leaves and heavy shedding of floral buds and flowers. The infested fruits become malformed and are rendered unfit for human consumption as well as for procurement of the seeds. Grown up larva damages many fruits results in 54.04% yield loss and also reduces the vitality of the plant (Sivakumar et al., 2003) [10]. The borer has been reported to cause 24.6 to 26.0 percent damage to okra shoots (Pareek et al., 1986) [9]; Zala et al., 1999) [10] and 40 to 100 per cent loss to fruits (Dhawan and Sidhu, 1984); (Kumawat, 1997) [6]; (Shah et al., 2000) [11]; (Pareek and Bhargava, 2003) [10]; Shinde et al., 2007) [15]. Many chemical insecticides are available in the market for the management of the pest. Hence the present study was carried out to evaluate the efficacy of newer molecules with novel mode of action to find out a viable option for sustainable management of shoot and fruit borer of okra crop.

**Material and Method**
Present studies were conducted during Kharif-2019 at the Instructional Farm, Department of Agril. Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri. The trial was laid out in randomized block design with seven treatments and replicated thrice with a plot size of 3 m x 3 m using the variety Phule Utkarsha.

The treatments of chemical insecticides were imposed as foliar spray against the okra shoot and fruit borer by knapsack sprayer with hollow cone nozzle. Total three sprays of each...
Results and Discussion

Larval population

The data on larval population per plant clearly indicated that all the treatments were significantly superior over untreated control in minimizing the population of Earias vitellae. The population ranged between 0.81 to 2.30 larvae/plant in untreated control and was at par with chlorantraniliprole 18.5% SC @ 25 g a.i./ha recorded lowest larval population (1.77 larvae/plant). Flubendiamide 39.35 SC @ 48 g a.i./ha which was found next effective treatment which recorded 1.08 larvae/plant and was at par with chlorantraniliprole 18.5% SC @ 25 g a.i./ha with the population of 1.14 larvae/plant. Mean larval population in the rest of treatments was 1.47 and 1.77 larvae/plant. Pyriproxyfen 5% EC + fenpropathrin 15% EC @ 750 g a.i./ha showed least efficacy against Earias vitellae with population of 2.30 larvae/plant and this treatment was at par with pyridalyl 10% EC @ 70 g a.i./ha recorded 2.16 larvae/plant. Untreated control plot recorded significantly higher (3.54 larvae/plant) mean larval population.

The data on effect of various treatments on reduction of okra shoot and fruit borer infestation indicated that treatment with flubendiamide 90 SC + deltamethrin 60 SC @ 36+24 g a.i./ha was proved to be the most effective among all the treatments followed by flubendiamide 39.35 SC @ 48 g a.i./ha which was at par with chlorantraniliprole 18.5% SC @ 25 g a.i./ha. The superior efficacy of flubendiamide 39.35 SC @ 48 g a.i./ha as effective in reducing per cent fruit infestation. The effectiveness of flubendiamide 39.35 SC @ 48 g a.i./ha was in agreement with earlier report of Potai et al. (2019) who found that flubendiamide 90 SC + deltamethrin 60 SC @ 36+24 g a.i./ha as effective in reducing per cent fruit infestation. The effectiveness of flubendiamide 39.35 SC @ 48 g a.i./ha was in agreement with earlier report of Potai et al. (2019) who found that chlorantraniliprole 18.5% SC @ 25 g a.i./ha was in agreement with earlier report of Potai et al. (2019) who found that chlorantraniliprole 18.5% SC @ 25 g a.i./ha was the most effective in reducing fruit damage caused by okra shoot and fruit borer infestation. Further, they reported that flubendiamide 39.35 SC @ 48 g a.i./ha registered the lowest fruit infestation (12.78%) with maximum marketable fruit yield (15.27 t/ha). The present findings in respect of chlorantraniliprole 18.5% SC @ 25 g a.i./ha was in agreement with earlier report of Potai et al. (2019) who reported the effectiveness of chlorantraniliprole 18.5% SC @ 25 g a.i./ha was in agreement with earlier report of Potai et al. (2019) who reported the effectiveness of chlorantraniliprole 18.5% SC @ 25 g a.i./ha was the most effective in reducing fruit damage caused by okra shoot and fruit borer, Earias vitellae. Reddy et al. (2019) reported the effectiveness of chlorantraniliprole 18.5% SC @ 25 g a.i./ha 44.89 per cent reduction in fruit damage and 70.51 q/ha yield.

Marketable fruit yield of okra

The results pertaining to the marketable fruit yield of okra are presented in Table No. 2. The effectiveness of treatments was reflected on yield. All the insecticidal treatments were found superior over untreated control in terms of the yield. The data revealed that the treatment flubendiamide 90 SC + deltamethrin 60 SC @ 36+24 g a.i./ha exhibited highest yield (9.64 t/ha) with maximum (99.58%) increase in the yield over control and found superior to all other insecticidal treatments. It was followed by flubendiamide 39.35 SC @ 48 g a.i./ha (8.91 t/ha) with 84.47 per cent increase in the yield over control. Next to the order in obtaining higher yield was chlorantraniliprole 18.5% SC @ 25 g a.i./ha (8.64 t/ha) with 78.88 per cent increase in the yield over control. Considerable yield advantage (9.64 t/ha) due to effective control of Earias vitellae in okra particularly through use of flubendiamide 90 SC + deltamethrin 60 SC @ 36+24 g a.i./ha as observed in present investigation was in agreement with Ameta and Swami (2015) who found that the flubendiamide 90 SC + deltamethrin 60 SC @ 36+24 g a.i./ha was effective in reducing per cent fruit infestation.

Table 1: Cumulative effect of selected insecticides on larval population due to Earias vitellae on okra

| Tr. No. | Treatments            | Dose (g a.i./ha) | Precount | I spray | II spray | III spray | Mean | Reduction (%) |
|--------|-----------------------|-----------------|----------|---------|----------|----------|------|---------------|
| T1     | Chlorantraniliprole 18.5% SC | 25              | 2.66     | 1.17 (1.08) | 1.14 (1.07) | 1.11 (1.05) | 1.14 (1.07) | 67.80 |
| T2     | Pyridalyl 10% EC      | 50-70           | 2.72     | 2.01 (1.42) | 2.26 (1.50) | 2.21 (1.48) | 2.16 (1.47) | 38.98 |
| Tr. No. | Treatments                                      | Dose (g a.i./ha) | Percent fruit infestation | Reduction (%) | Marketable fruit yield (T/ha) | Increase over control (%) |
|--------|------------------------------------------------|-----------------|---------------------------|---------------|-------------------------------|--------------------------|
|        |                                                 | Precount | I spray (18.34) | II spray (23.88) | III spray (21.73) | Mean (16.19) |                             |                        |
| T1     | Chlorantraniliprole 18.5% SC                   | 25       | 18.42          | 10.51 (18.34)      | 8.05 (16.05)    | 6.01 (13.87) | 8.19 (16.19) | 72.51                      | 8.64                      | 78.88                  |
| T2     | Pyridal 10% EC                                 | 50-70    | 18.49          | 18.78 (24.52)      | 17.81 (23.88)   | 14.75 (21.73) | 17.11 (23.41) | 42.56                      | 5.67                      | 17.39                  |
| T3     | Deltamethrin 2.8% EC                           | 18.57    | 16.11 (22.71)  | 14.01 (21.18)      | 11.49 (19.18)   | 13.87 (21.07) | 53.44                      |                          |                          |                        |
| T4     | Emamectin benzoate 5% SC                       | 18.53    | 12.94 (20.35)  | 10.92 (18.70)      | 8.78 (16.76)    | 10.88 (18.66) | 63.48                      |                          |                          |                        |
| T5     | Flubendiamide 39.35 SC                         | 48       | 18.69          | 9.83 (17.74)       | 7.62 (15.62)    | 5.46 (13.22) | 7.64 (15.64) | 74.35                      | 8.91                      | 84.47                  |
| T6     | Flubendiamide 90 SC + Deltamethrin 60 SC       | 36+24    | 18.57          | 6.30 (14.20)       | 4.74 (12.31)    | 2.73 (9.35)  | 4.59 (12.12) | 84.59                      | 9.64                      | 99.58                  |
| T7     | Pyriproxyfen 5% EC + Fenpropathrin 15% EC      | 500-750  | 18.53          | 19.72 (25.13)      | 18.60 (24.40)   | 15.73 (22.44) | 18.02 (24.02) | 39.51                      | 5.34                      | 10.55                  |
| T8     | Untreated control                              | --       | 18.59          | 24.14 (27.81)      | 30.76 (31.39)   | 34.47 (33.23) | 29.79 (30.89) | -                          | 4.83                      | -                      |
| S.Em+  |                                                 | 0.41     | 0.23           | 0.38             | 0.34            | 0.31           |                          | -                          |                          |                        |
| CD @ 5%|                                                 | -        | 0.69           | 1.14             | 1.02            | 0.95           |                          | -                          |                          |                        |

(Figure in the parenthesis are angular transform values)

**Table 2:** Cumulative effect of selected insecticides on fruit infestation due to *Earias vittella* on okra

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