International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2017; 5(5): 1232-1236

Received: 19-07-2017
Accepted: 21-08-2017

**Deepak S**
Department of Entomology, Agriculture College, Hyderabad, TelanIndia

**Narasa Reddy G**
Department of Agricultural Entomology, UAS, GKVK, Bengaluru, Karnataka, India

**Narendra Reddy**
Department of Entomology, Agriculture College, Hyderabad, Telangana, India

**Shashi Bhushan V**
Department of Entomology, Agriculture College, Hyderabad, Telangana, India

**Correspondence**
**Narasa Reddy G**
Department of Agricultural Entomology, UAS, GKVK, Bengaluru, India

# Bio-efficacy and dissipation of newer molecules against leafhopper (*Amrasca biguttula* biguttula) of okra

**Deepak S, Narasa Reddy G, Narendra Reddy and Shashi Bhushan V**

**Abstract**
The bio-efficacy of different insecticides *viz*., bifenthrin 10 EC at 80 g a. i. $ha^{-1}$, fipronil 5 SC at 500 g a.i. $ha^{-1}$, flubendiamide 480 SC at 60 g a. i. $ha^{-1}$, quinalphos 25 EC at 350 g a.i $ha^{-1}$, profenophos 50 EC at 400 g a. i. $ha^{-1}$ and β-cyfluthrin 25 SC at 18.75 g a.i. $ha^{-1}$ against leafhopper (*Amrasca biguttula biguttula* Ishida) of okra was studied in the field conditions at Student's Farm of Agricultural College, Hyderabad during 2012. All the insecticidal treatments were superior over control after second spray where, profenophos (400 g a. i. $ha^{-1}$) recorded highest population reduction of 68.72 per cent followed by β-cyfluthrin (50.72 %) and bifenthrin (44.19 %). Further, dissipation pattern of profenophos at 400 g a. i. $ha^{-1}$ was studied by collecting 500 g of okra fruits from the field on zero (1 hr), one, three, five, seven and ten and fifteen days after second spray and analysed at laboratory of AINP on pesticide residues, Hyderabad. An initial deposit of profenophos was recorded to be 1.52 mg $kg^{-1}$ dissipated to below detectable level on $10^{th}$ day. The half-life was 2.16 days with waiting period for safe harvest of okra fruit was 5.10 days.

**Keywords:** okra, leafhopper, profenophos, bio-efficacy, dissipation and half-life.

## Introduction
Okra, *Abelomoschus esculentus* L. is an important vegetable crop, which alone accounts for 21 per cent of total exchange earnings from vegetables export. It is grown on an area of 4.51 lakh ha with an annual production of 47.96 lakh tons and productivity of 10.62 ton per ha (Anon., 2011). Okra crop is attacked by several insect pests right from germination to till harvest. Among them, the leafhopper (*Amrasca biguttula biguttula* Ishida) is a serious as a heavy infestation of the pest results in curling and crinkling of leaves, stunted growth and ultimate death of plants (David and Ramamurthy, 2016) [5]. The loss in okra due to leafhopper infestation ranges from 32.06 to 40.84 per cent (Brar *et al*., 1994) [3]. In order to reduce the loss caused due to leafhopper, farmers are going for many sprays of chemical pesticide (Kumari *et al*. 2005). Such discriminate use of pesticides lead to problem of development of resistance, resurgence, environmental pollution and health hazards. Pesticide residue in fresh fruits and vegetables has affected exports in recent years and should be strictly monitored owing to the high concern about the toxic properties of residues. Profenophos is cholinesterase inhibitor which possesses ability to inhibit acetylcholine esterase (Leader *et al*. 1982) [12], and effective for controlling the okra pests including jassids, white fly and spotted boll worm (Akbar *et al*., 2009 and Das *et al*., 2000) [1, 4]. Hence, the current investigation was formulated to evaluate the efficacy of profenophos and to establish the dissipation pattern to fit in the pest management strategy.

## Materials and methods
To evaluate the efficacy of different insecticides, a field experiment was laid out with three replications having seven treatments. Okra crop of the variety 'Arka Anamika' was raised with spacing of 45x15 cm by following all the agronomic practices as recommended by the university. Insecticidal treatments (Table-1) were sprayed at 50 per cent flowering in okra plants and second spray was given on 15 days after the first spray.
For the efficacy studies, the population of leaf hopper was recorded on five randomly selected okra plants per plot leaving the border rows. The population counts were taken from top,

middle and bottom leaves in each of the five selected plants in every plot and mean number of leafhopper per five plants were calculated. The percentage reduction of leafhopper in all treatments over the control was calculated using modified Abbot's formula (Fleming and Ratnakaran, 1985) [7].

$$\text{Population Reduction Percentage} = 1 - \left\{ \frac{\text{Post treatment population in treatment}}{\text{Pre treatment population in treatment}} \times \frac{\text{pre treatment population in check}}{\text{post treatment population in check}} \right\} \times 100$$

The percentage reduction at one, three, five, seven and ten days after each spraying were pooled and transformed into arc sine values, which were further subjected to Randomized Block Design Analysis. The overall effect of the treatment was obtained by combining these five days observations and that data was analysed by ANOVA (Gomez and Gomez, 1984) [8].

**Table 1:** Details of treatments for field application

| S. No | Common Name | Dosage (g a.i ha$^{-1}$) | Trade Name & Formulation | Source of Supply |
|---|---|---|---|---|
| 1. | Bifenithrin | 80 | Player 10 EC | GSP Crop Science Pvt. Ltd., Ahmedabad |
| 2 | Fipronil | 500 | Regent 5 SC | Bayer Crop Science Ltd., Mumbai |
| 3. | Flubendamide | 60 | Fame 480 SC | Bayer Crop Science Ltd., Mumbai |
| 4. | Quinalphos | 350 | Milux 25 EC | Insecticides (India) Ltd., Rajasthan. |
| 5. | Profenophos | 400 | Profex 50 EC | Nagarjuna Agrichem Ltd., Hyderabad. |
| 6. | B-cyfluthrin | 18.75 | Bulldock 25 SC | Bayer Crop Science Ltd., Mumbai |

**Dissipation**

The insecticidal treatment, which found most effective (profenophos at 400 g a.i ha$^{-1)}$ in reducing the leafhopper in the previous experiment, was subjected to dissipation studies at the laboratory of AINP on pesticide residues, Hyderabad.

**Sampling**

The okra fruit samples of 250 g were collected randomly from profenophos treated plots in three replications at zero, one, three, five, seven, ten and fifteenth day after last spray in polythene bags and brought to the laboratory immediately for processing. Further, the procedures of extraction, clean up and analysis of fruit sample was followed according to Dikshit and Pachauri (2000) [6] with slight modification.

**Extraction and clean-up**

Representative fruit sample of 25 g was homogenized with 50 ml acetontrile and was filtered. The filtrate was evaporated to near dryness using a vacuum rotary evaporator and the contents were re-dissolved in 25 ml of hexane. Further, the filtrate was partitioned after adding 100 ml of acetonirile and 125 ml of 5 per cent sodium chloride solution. The extract was cleaned up with florosil column eluting with dichloromethane. Elute was concentrated again and dissolved in n-hexane and later subjected to alumina column clean up. The final elution was done with hexane: acetone (9:1) and evaporated to dryness and analyzed on Gas Chromatograph (GC).

**Estimation**

The residue of profenophos was estimated using GC-ECD by comparing the peak area of standard with that of the peak area in the sample under identical conditions. From the technical grade of profenophos, one ppm standard solution was prepared by diluting with n-hexane and used for carrying out the recovery and comparative studies of pesticide residues in the fruit samples collected at different intervals. The recovery study of profenophos was carried out at the level of 0.01 and 0.10 ppm, which recorded the recovery of 88 and 87 per cent, respectively. The sample was analyzed on (Shimadzu) GC-2010A equipped with fused silica capillary column factor four (30 mt x 0.25 mm id) coated with one per cent phenyl-methylpolysiloxane (0.25 µm film thickness) using 63Ni Electron Capture Detector (ECD). General operating conditions were as follows: For Profenophos, the column temperature program was initially 80$^{o}$C for 2 min hold, increased 5$^{o}$C min$^{-1}$ for 10 min to 150$^{o}$C for 2 min, 2$^{o}$C for 180 min hold. Total programme was 90 min, injection volume: 1 µl, nitrogen flow rate @ 1 ml min$^{-1}$ and makeup 25 ml min$^{-1}$ with split ratio 1:10 using carrier gas ($N_2$) 99.5 per cent, injector port temperature 260$^{o}$C, detector temperature 300$^{o}$C. Retention time of profenophos was 48.9 min.

**Kinetic Study**

In order to calculate the rate of degradation, waiting period and half-life of profenophos on okra fruits, Hoskin's (1961) [10] linear regression equation was followed.

The period to be allowed to expect the residues to reach below the tolerance limit after treatment for safe use of the treated okra fruits was calculated by using the formula (Gunther and Blinn, 1955) [9].

$$Y = a + b X$$

where,

Y - Log of tolerance limit

a - Log of initial deposit

b - Slope of the regression line

Waiting period is the minimum number of days to lapse before the insecticide reaches the tolerance limit. The waiting periods were calculated by the following formula.

$$T_{tol} = \frac{[a - \text{Log tol}]}{B}$$

where,

$T_{tol}$ - Minimum time required for the pesticide residue to reach below the tolerance limit.

tol - Tolerance limit of the insecticide

a - Apparent initial deposits obtained in the regression equation

b - Slope of the regression line

Half-life ($RL_{50}$) is the time in days required to reduce the pesticide residues to half of its initial deposits.

$$RL_{50} = \frac{\text{Log } 2}{K_1} = \frac{0.301}{K_1}$$

Where,

$K_1$ = Slope of regression line (Hoskins, 1961) [10]

## Results and Discussion

### Bio-efficacy

The observations on over all efficacies of all the insecticides (Table 2) evaluated against leafhopper revealed that all the insecticidal treatments were significantly superior over control during first and second spray. At first spray, profenophos at 400 g a.i. ha$^{-1}$ and β- cyfluthrin at 18.75 g a.i. ha$^{-1}$ were found to be most effective with a population reduction of 51.94 and 50.36 per cent, respectively and were significantly superior over rest of the treatments. The next promising treatment was bifenthrin at 80 g a. i. ha$^{-1}$ (44.43 %) and was on par with fipronil at 500 g a. i. ha$^{-1}$ (41.71 %) and quinalphos at 350 g a.i. ha$^{-1}$ (40.66 %). Flubendiamide at 60 g a.i. ha$^{-1}$ was least effective among all the insecticides tested against leafhopper registering of 38.88 per cent reduction.

The cumulative efficacy of insecticides after second spray revealed that profenophos at 400 g a. i$^{-1}$ was the significantly superior treatment with 68.72 per cent population reduction. Next best treatment was β-cyfluthrin at 18.75 g a.i. ha$^{-1}$ which recorded 50.72 per cent leafhopper reduction. Efficacy in the descending order, bifenthrin at 80 g a.i$^{-1}$ followed by fipronil at 500 g a.i$^{-1}$ and flubendiamide at 60 g a. i ha$^{-1}$ recorded 44.19, 41.43 and 40.52 per cent of leafhopper reduction. The lowest population reduction as recorded in quinalphos at 350 g a.i. ha$^{-1}$ (36.31 %).

Overall scenario of the current investigation revealed that, all the insecticidal treatments were significantly superior over untreated control against leafhopper on okra. However, profenophos at 400 g a. i. ha$^{-1}$ was found to be the most effective among the all insecticides tested. These findings are in conformity with Sandeep Kaur (2002), who reported foliar application of Profenophos at 800 g a. i. ha$^{-1}$ was effective in reducing the population of leafhopper (*A. biguttulla biguttulla*). Sharma *et al.* (2002) also obtained the reduced leafhopper population by 82.65 per cent following application of profenophos (500 g a. i. ha$^{-1}$). Similarly, Suroshe *et al.* (2004), reported reduced leafhopper population in brinjal by application of profenophos at 250 g a. i. ha$^{-1}$.

**Table 2:** Efficacy of insecticides against leafhopper (*Amrasca biguttula biguttula*)

| Treatments | Dosage (g a.i. ha$^{-1}$) | Mean per cent of reduction over untreated check | |
|---|---|---|---|
| | | Over all efficacy after first spray | Over all efficacy after second spray |
| $T_1$ - Bifenthrin | 80 | 44.43$^{b}$ (41.78) | 44.19$^{c}$ (41.78) |
| $T_2$ - Fipronil | 500 | 41.71$^{bc}$ (40.21) | 41.43$^{c}$ (40.00) |
| $T_3$ - Flubendiamide | 60 | 38.88$^{c}$ (38.60) | 40.52$^{c}$ (39.50) |
| $T_4$ - Quinalphos | 350 | 40.66$^{bc}$ (39.60) | 36.31$^{d}$ (37.00) |
| $T_5$ - Profenophos | 400 | 51.94$^{a}$ (46.10) | 68.72$^{a}$ (56.00) |
| $T_6$ - B-cyfluthrin | 18.75 | 50.36$^{a}$ (45.20) | 50.72$^{b}$ (45.40) |
| $T_7$ - Control | -- | 0.00 (0.00) | 0.00 (0.00) |
| S.Em± | -- | 0.74 | 0.81 |
| C.D at 5% | -- | 2.37 | 2.58 |
| C.V. (%) | -- | 3.57 | 3.76 |

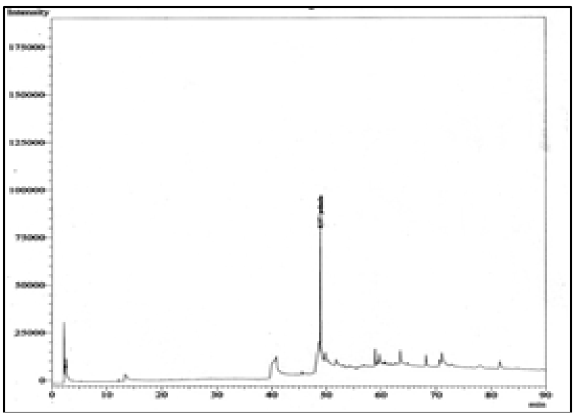
DAS - Days after spray

*Figures in the parentheses are arc sine transformed values.

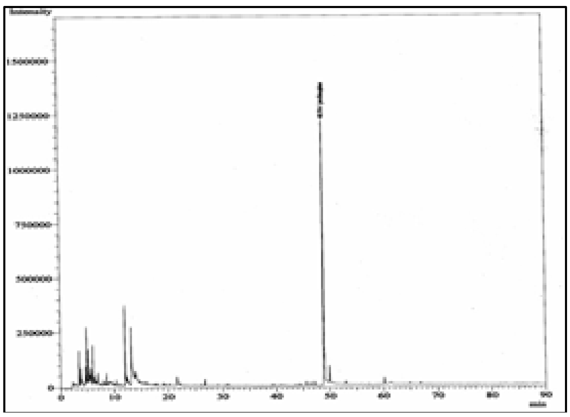
### Dissipation

Initial deposits and subsequent residues profenophos (400 g a. i ha$^{-1}$) in okra fruits at an interval of zero, one, three, five, seven, ten and fifteen days after the last spray were presented in the table -3 and figure 1. An average initial deposit of 1.52 mg kg$^{-1}$ on the day of spray gradually dissipated to 0.09 mg kg$^{-1}$ by 7$^{th}$ day after last spray. The residues of 1.14, 0.75, 0.62 and 0.09 mg kg$^{-1}$ were recorded after 1, 3, 5 and 7 days after last spray, respectively. The residues of profenophos reached below tolerance limit of 0.5 mg kg$^{-1}$ in 5.10 days while corresponding half-life was 2.16 days.

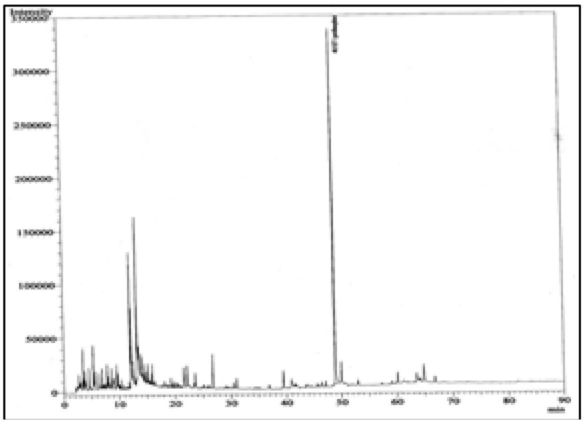
The results are in agreement with the findings of Sahoo *et al.* (2004) [15] who reported that an initial deposit of 1.37 mg kg$^{-1}$ following application of profenophos at 500 g a.i. ha$^{-1}$ on tomato and was reduced to below detectable level (BDL) after 15 days of application. Radwan *et al.* (2004) [13] also observed a waiting period of 10 days on green pepper and 14 days on eggplant when profenophos was applied at 400 g a. i. ha$^{-1}$. Similarly, Reddy *et al.* (2007) also reported a same trend of profenophos on chilli. The variation in the rate of dissipation in different crop may be due to changes in the crop matrix.



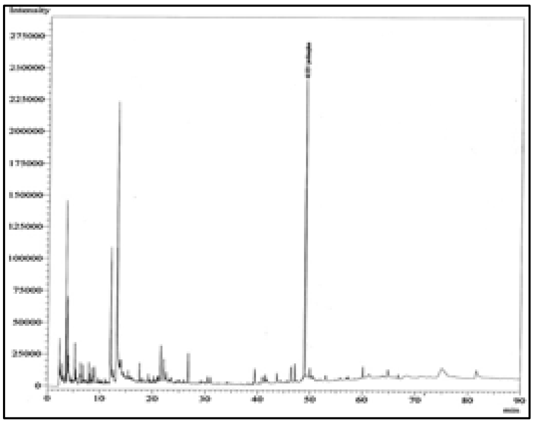
Profenofos Standard (1ppm)



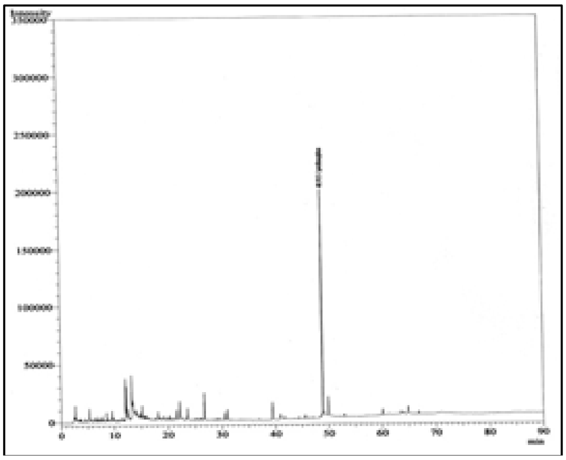
Profenofos (0 DAS)



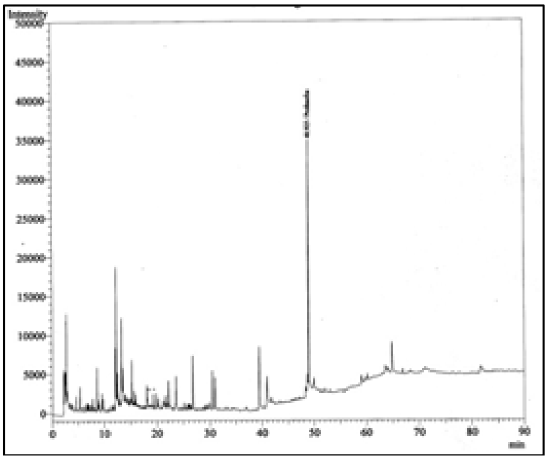
Profenofos (1 DAS)



Profenofos (3 DAS)



Profenofos (5 DAS)



Profenofos (7 DAS)

**Fig 1:** Profenofos (400 g a.i. $ha^{-1}$) chromatograms

**Table 3:** Dissipation of Profenophos (400 g a.i. $ha^{-1}$) in okra

| Days | R1 | R2 | R3 | Average | Dissipation % |
|---|---|---|---|---|---|
| 0 | 1.51 | 1.59 | 1.48 | 1.52 | -- |
| 1 | 1.13 | 1.11 | 1.20 | 1.14 | 24.92 |
| 3 | 0.75 | 0.74 | 0.78 | 0.75 | 50.44 |
| 5 | 0.64 | 0.63 | 0.61 | 0.62 | 58.96 |
| 7 | 0.09 | 0.09 | 0.1 | 0.09 | 93.88 |
| 10 | BDL | BDL | BDL | BDL | 100 |
| 15 | BDL | BDL | BDL | BDL | 100 |

BDL – Below Detectable Level

## Conclusion

Present studies concluded that all the insecticides used were found effective against leafhopper feeding on okra. But the best results were obtained for profenophos with highest population reduction of 68.72 per cent. Profenophos has shown faster rate of dissipation, where their residue reached below detectable level within five days (MRL in India on okra is 0.2 mg $kg^{-1}$). This input could be utilized in formulating the spray schedule for managing okra pests and thereby reducing the ill effects of insecticide on environment and human health.

## References


1. Akbar MF, Yasmin N, Latif TA, Naz F. Effectiveness of different spray schedules against population of whitefly, *Bemisia tabaci* Genn. on okra crop. Pakistan Journal of Entomology. 2009; 24:45-8.
2. Annonymous. Centre for Monitoring Indian Economy (CMIE) Pvt. Ltd. Mumbai, 2011.
3. Brar KS, Arora S, Ghai TR. Losses in fruit yield of okra due to *Earias spp.* as influenced by dates of sowing and varieties. Journal of Insect Science. 1994; 7(2):133-135.
4. Das S, Ray S, Chattarjee ML. Efficacy of some new insecticides against *Earias vittella* F. infestation on okra and cost benefit analysis, Pest Management and Economic Zoology. 2000; 8:99-101.
5. David BV, Ramamurthy VV. Elements of Economic Entomology, eighth edition, Brillion Publishing, New Delhi. 2016, 141.
6. Dikshit AK, Pachauri DC. Persistence and bio-efficacy of β-cyfluthrin and imidacloprid on tomato fruits. Plant Protection Bulletin. 2000; 52(3/4):1-3.
7. Fleming R, Ratnakaran A. Evaluating single treatment data using Abbot's formula with reference to insecticides. Journal of Economic Entomology. 1985; 78:177-181.
8. Gomez KA, Gomez AA. Statistical procedures for Agricultural Research, Second edition. John willey and Sons. New York. 1984, 582.
9. Gunther FA, Blinn RC. *Analysis of Insecticides and Acaricides*, Interscience Publishers, New York. 1955, 696.
10. Hoskins WM. Mathematical treatments of loss of pesticide residues. *Plant Protection* Bulletin. FAO. 1961; 9:163-168.
11. Kumari M, Singh SP, Kumari K. Bioefficacy of β-cyfluthrin, lambda-cyhalothrin and imidacloprid against jassid *Amrasca biguttula biguttula* Ishida. in okra. Plant Protection Bulletin. 2005; 57(3/4):37-40.
12. Leader H, Casida JE. Resolution and biological activity of the chiral isomers of O-(4-bromo-2-chlorophenyl) O-ethyl S-propyl phosphorothioate (Profenofos insecticide), J Agric Food Chem. 1982; 30:546.
13. Radwan MA, Shiboob MH, Abu-Elamayem MM, Abdel-Aal A. Residues of pirimiphos-methyl and profenophos

on green pepper and eggplant fruit and their effects on some quality properties. Emirates Journal of Agriculture Sciences. 2004; 16(1):32-42.

14. Reddy KD, Narasimha Reddy K, Mahalingappa PB. Dissipation of fipronil and profenophos residues in chillies *Capsicum annuum* L. Pesticide Research Journal. 2007; 19(1):106-107.
15. Sahoo SK, Sharma RK, Battu RS, Balwinder Singh. Dissipation kinetics of flubendiamide on chilli and soil. Bulletin of Environmental Contamination and Toxicology. 2009; 83(3):384-387.
16. Sandeep Kaur. Management of cotton jassid (*Amrasca biguttulla biguttulla* Ishida) and spotted bollworm (*Earias spp.)* in okra. Vegetable Science. 2002; 29(2):172-175.
17. Sharma DR, Lal OP. Bio-efficacy of thiamethoxam in comparison to recommended insecticides against leaf hopper and white fly of brinjal (*Solanum melongena).* Journal of Entomological Research. 2002; 26(3):257-262.
18. Suroshe SS, Reddy KD, Reddy, KN. Bio-efficacy of certain insecticides against major insect pests of brinjal. Journal of Research ANGRAU. 2004; 32(4):18-24.