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# Population Suppression of *Amrasca Biguttula* and *Bemisia Tabaci* in Okra via Insect Growth Regulators.

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**Abstract:** Okra, *Abelmoschus esculentus* (L.), is one of the essential vegetables significantly consumed and grown worldwide. However, production is highly deprived due to the infestation of the sucking complex, such as jassid and whitefly. Excessive pesticide residues on sold vegetables are harmful to people's health and the environment, which attracts the attention of researchers to focus on IPM approaches against okra pests. Hence, the present study aimed to identify and determine the most effective insect growth regulators as an alternate for hazardous pesticides to suppress jassid and whitefly populations efficiently. Data on population reduction of jassid and whitefly were recorded before and after application of IGRs (Insect Growth Regulators) on okra at the Entomology section, Plant Protection Research Institute, Agriculture Research Sindh, Pakistan, in 2023. The spray-wise efficacy of the tested IGRs showed higher mortality of *Amrasca biguttula* and *Bemisia tabaci* after the third spray, as compared to the first and second. Average pooled reduction% at different time intervals of all three sprays showed maximum significant reduction percentage (56.89%) against *A. biguttula* with Buprofezin 25% treatment, followed by Pyriproxyfen 10% (49.76%) and Diflubenzuron 25% (46.58%), respectively. However, the maximum significant reduction percentage against *B. tabaci* (58.35%) was observed after spraying Pyriproxyfen 10% treatment followed by Diflubenzuron 25% (50.69%) and Buprofezin 25 % (47.89%), respectively. Based on the results obtained, it is concluded that all IGRs could be effectively used as part of the Integrated Pest Management (IPM) strategy against okra pests.

**Keywords:** Okra, jassid, Whitefly, Population, Insect growth regulators, Biological Control

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## Introduction

With increasing population and changes in dietary habits related to urbanization, increased food demands, Pakistan has become the world's largest producer and consumer of vegetables [1]. Among them, Okra, *Abelmoschus esculentus* (L.), is also known as lady finger and one of the most popular, and commercially grown in India, Pakistan, Bangladesh, Malaysia, Thailand, Ethiopia, and Turkey [2, 3]. Besides commercial purposes, okra also contains carbohydrates, proteins, fats, vitamins A, C, and B6, folic acid, calcium, iron, zinc, magnesium, potassium, P, beta-carotene, fiber, and riboflavin, as well as other nutrients and dietary food [4].

An important barrier to effective okra production is insect infestations [5]. Among them, Jassid, *Amrasca biguttula* (Ishida) (Hemiptera: Cicadellidae), and whitefly, *Bemisia tabaci* (Hemiptera: Aleyrodidae) are the main insect pests that feed on the cell sap of okra leaves and inflict significant financial losses [6]. Different tactics have been developed to control these sucking pests by combining integrated pest management (IPM) approaches. Farmers mainly rely on synthetic pesticides to manage okra pests because of their immediate knockdown effect, but these pesticides impair ecology, natural enemies, and create health and environmental hazards [7].

Insect growth regulators are known as the best replacement of synthetic pesticides due to their benefits, because these substances don't last long due to their rapid biodegradation and show less toxicity for species other than the targeted [8]. Buprofezin is an IGR that inhibits chitin synthesis in several homopteran pests, including whiteflies. Keeping in view the damage caused by whitefly and Jassid on okra crops, the present research was conducted to observe the field evaluation of different insect growth regulators against Jassid and whitefly on okra.

## Method

### Study area

Present research work was performed at Plant Protection Research Institute, Agriculture Research Centre, Tandojam, to determine the impact of different insect growth regulators on jassid and whitefly in okra under field conditions during 2023.

### Experimental layout & design

The Sabz Pari okra variety by (Evyol Group Kanzo Ag) was planted. The experiment followed a randomized complete block design (RCBD) with plots measuring 100 ft × 50 ft (length × width). Each block measured 12 ft × 12 ft and consisted of three replications. All the agronomical practices, such as land preparation, timely sowing, proper weeding, and irrigation and fertilizer application, were carried out according to the crop's needs. Further plant sequence practices were made, such as a space row to row of 75 cm and plant to plant 25 cm.

### Details of Insect Growth Regulators

Different insect growth regulators were applied to okra crops to determine the most effective insect growth regulators in reducing the population of *A. biguttula* and *B. tabaci*. The details of insect growth regulators are as follows:

T1= Buprofezin 25% SC (0.05%),
T2= Pyriproxyfen 10% EC (0.05%),
T3= Diflubenzuron 25% WP (0.5%)
T4= Control

### Application of IGRs and Data observation

Above-mentioned IGRs were applied to evaluate the competency of each compound against sucking insects *A. biguttula* and *B. tabaci*. A total of three sprays were applied after the emergency or when the appearance of insects. For each spray, five data observations were recorded, i.e., pre-treatment (one day before spray) and 3 days after spray (DAS), 7 DAS, 10 DAS, and 15 days after spray. For each treatment, observations were recorded for 5 whole plants per replication, with a total of 20 plants examined to record *A. biguttula* and *B. tabaci* populations. Reduction rates were calculated using [9].

$$\text{Reduction\%} = 1 - \frac{\textit{No. in control before treatment x No. in treatment after treatment}}{\textit{No. in control after treatment x No. in treatment before treatment}} \times 100$$

## Data Analysis

Average data of the reduction and pooled data of IGRs efficacy were statistically analyzed by ANOVA, and means were compared by (LSD) by using Statistix-8.1 Statistical software.

## Results

A field trial was conducted at Plant Protection, Agriculture Research Institute Tandojam research area, to determine the efficacy of different insect growth regulators (IGRs) against *A. biguttula* and *B. tabaci* in 2023.

### First spray against *A. biguttula* & *B. tabaci*

Table 1 shows that the *A. biguttula* population ranged between 3.35 and 4.25 one day before applying AGRs. Highest *A. biguttula* population reduction percentages (51.06%, 61.52%, 67.16%, 71.67%) were recorded with spraying Buprofezin 25%, followed by Pyriproxyfen 10% (48.12%, 55.95%, 62.17%, and 68.83%), and Diflubenzuron 25% (42.48%, 50.74%, 60.47%, and 67.01%) at 5, 7, 10, 15 days after spray, respectively. Whereas the *B. tabaci* population ranged between 3.12 and 4.67 one day before applying AGRs. Highest *B. tabaci* population reduction percentages (38.62%, 59.69%, 74.34%, and 75.88%) were recorded with spraying Pyriproxyfen 10%, followed by Diflubenzuron 25% (37.43%, 53.80%, 71.09%, and 69.56%), and Buprofezin 25% (27.32%, 48.21%, 62.11%, and 64.45%) at 5, 7, 10, 15 days after spray, respectively (Table 1).

**Table 1. Mean and percentage reduction of *A. biguttula* and *B. tabaci* populations on okra after applications of the first spray of IGRs.**

*Means followed by same letters are not significantly different @ P < 0.05 LSD value.

| Treatments | Mean and reduction % of *A. biguttula* | | | | |
|---|---|---|---|---|---|
| | Pre count | 3-DAS | 7-DAS | 10-DAS | 15-DAS |
| Buprofezin 25% SC | 4.25 | 2.19 (51.06) f | 1.84 (61.52) d | 1.52 (67.16) bc | 1.43 (71.67) a |
| Pyriproxyfen 10% EC | 3.35 | 1.83 (48.12) g | 1.66 (55.95) e | 1.38 (62.17) d | 1.24 (68.83) b |
| Diflubenzuron 25% WP | 3.88 | 2.35 (42.48) h | 2.15 (50.74) f | 1.67 (60.47) d | 1.52 (67.01) c |
| Control | 4.16 | 4.38 | 4.68 | 4.53 | 4.94 |
| **Mean and reduction % of *B. tabaci*** | | | | | |
| Buprofezin 25% SC | 3.12 | 2.46 (27.32) g | 1.94 (48.21) f | 1.55 (62.11) cd | 1.42 (64.45) c |
| Pyriproxyfen 10% EC | 4.34 | 2.89 (38.62) g | 2.10 (59.69) d | 1.46 (74.34) a | 1.34 (75.88) a |
| Diflubenzuron 25% WP | 4.67 | 3.17 (37.43) g | 2.59 (53.80) e | 1.77 (71.09) b | 1.82 (69.56) b |
| Control | 3.89 | 4.22 | 4.67 | 5.11 | 4.98 |

** DBS: Day before Spray; DAS: Day after Spray.

### Second spray against *A. biguttula* & *B. tabaci*

Table 2 shows that the *A. biguttula* population ranged between 3.09 to 5.24 one day before applying AGRs. Highest *A. biguttula* population reduction percentages (45.02%, 58.04%, 66.31% and 70.08%) were recorded with spraying Buprofezin 25%, followed by Pyriproxyfen 10% (37.49%, 46.69%, 55.92% and 59.53%), and Diflubenzuron 25% (35.71%, 44.36%, 51.92% and

55.85%) at 5, 7, 10, 15 days after spray, respectively. Whereas *B. tabaci* population ranged between 3.88 to 5.23 one day before applying AGRs. Highest *B. tabaci* population reduction percentages (45.33%, 57.35%, 71.73%, and 75.26%) were recorded with spraying Pyriproxyfen 10%, followed by Diflubenzuron (43.86%, 49.51%, 58.24% and 63.37%), and Buprofezin 25% (35.72%, 41.05%, 55.58%, and 59.37%) at 5, 7, 10, 15 days after spray, respectively (Table 2).

**Table 2. Mean and percentage reduction of *A. biguttula* and *B. tabaci* populations on okra after applications of the second spray of IGRs.**

| Treatments | Mean and reduction % of *A. biguttula* | | | | |
|---|---|---|---|---|---|
| | Pre count | 3-DAS | 7-DAS | 10-DAS | 15-DAS |
| Buprofezin 25% SC | 3.67 | 2.06 (45.02) fg | 1.64 (58.04) c | 1.39 (66.31) b | 1.29 (70.08) a |
| Pyriproxyfen 10% EC | 3.09 | 2.69 (37.49) i | 1.76 (46.69) f | 1.55 (55.92) d | 1.47 (59.53) c |
| Diflubenzuron 25% WP | 3.46 | 2.83 (35.71) g | 2.05 (44.36) g | 1.87 (51.92) e | 1.79 (55.85) d |
| Control | 5.24 | 5.35 | 5.58 | 5.89 | 6.14 |
| **Mean and reduction % of *B. tabaci*** | | | | | |
| Buprofezin 25% SC | 4.15 | 2.78 (35.72) i | 2.61 (41.05) h | 2.15 (55.58) e | 1.98 (59.37) c |
| Pyriproxyfen 10% EC | 3.67 | 2.09 (45.35) g | 1.67 (57.35) d | 1.21 (71.73) b | 1.04 (75.26) a |
| Diflubenzuron 25% WP | 3.88 | 2.27 (43.86) g | 2.09 (49.51) f | 1.89 (58.24) d | 1.68 (63.37) d |
| Control | 5.23 | 5.45 | 5.58 | 6.10 | 5.99 |

*Means followed by the same letters are not significantly different @ $P < 0.05$ LSD value.
** DBS: Day before Spray; DAS: Day after Spray.

### Third spray against *A. biguttula* & *B. tabaci*

Table 3 shows that the *A. biguttula* population ranged between 2.89 to 5.14 one day before applying AGRs. Highest *A. biguttula* population reduction percentages (35.02%, 41.33%, 53.22% and 62.40%) were recorded with spraying Buprofezin 25%, followed by Pyriproxyfen 10% (33.96, 38.41%, 48.94% and 51.53%), and Diflubenzuron 25% (26.60%, 31.47%, 42.87% and 46.58%) at 5, 7, 10, 15 days after spray, respectively. Whereas *B. tabaci* population ranged between 4.77 to 6.13 one day before applying AGRs. Highest *B. tabaci* population reduction percentages (33.42%, 46.89%, 56.57% and 65.13%) were recorded with spraying Pyriproxyfen 10%, followed by Diflubenzuron (30.67%, 43.73, 45.51%, and 58.99%), and Buprofezin 25% (28.74%, 40.8%, 45.8% and 52.6%) at 5, 7, 10, 15 days after spray, respectively (Table 3).

**Table 3. Mean and percentage reduction of *A. biguttula* and *B. tabaci* populations on okra after applications of the third spray of IGRs.**

| Treatments | Mean and reduction % of *A. biguttula* | | | | |
|---|---|---|---|---|---|
| | DBS | 3-DAS | 5-DAS | 7-DAS | 10-DAS |
| Buprofezin 25% SC | 3.07 | 1.96 (35.02) g | 1.71 (41.33) e | 1.45 (53.22) b | 1.17 (62.40) a |
| Pyriproxyfen 10% EC | 2.89 | 2.19 (33.96) f | 1.69 (38.41) f | 1.49 (48.94) c | 1.42 (51.53) b |

| | | | | | |
|---|---|---|---|---|---|
| Diflubenzuron 25% WP | 3.12 | 2.25 (26.60) i | 2.03 (31.47) h | 1.83 (42.87) e | 1.69 (46.58) d |
| Control | 5.14 | 5.05 | 4.88 | 5.19 | 5.21 |
| **Mean and reduction % of *B. tabaci*** | | | | | |
| Buprofezin 25% SC | 5.08 | 3.75 (28.74) k | 3.27 (40.48) h | 2.93 (45.18) fg | 2.65 (52.06) d |
| Pyriproxyfen 10% EC | 4.77 | 3.29 (33.42) i | 2.74 (46.89) e | 2.18 (56.57) c | 1.81 (65.13) a |
| Diflubenzuron 25% WP | 5.11 | 3.67 (30.67) j | 3.11 (43.73) g | 2.93 (45.51) ef | 2.28 (58.99) b |
| Control | 6.13 | 6.35 | 6.63 | 6.45 | 6.67 |

*Means followed by the same letters are not significantly different @ P < 0.05 LSD value.
** DBS: Day before Spray; DAS: Day after Spray.

**Overall average pooled *A. biguttula & B. tabaci* reduction %**

Figure 1 shows that Buprofezin 25% was recorded with the highest percent reduction for *A. biguttula* (56.68%), followed by Pyriproxyfen 10% (49.576%), and Diflubenzuron 25% (46.58%), respectively. However, the highest reduction percent for *B. tabaci* (58.35%) was recorded with spraying Pyriproxyfen 10%, followed by Diflubenzuron 25% (50.69%), and Buprofezin 25% (47.89%), respectively.

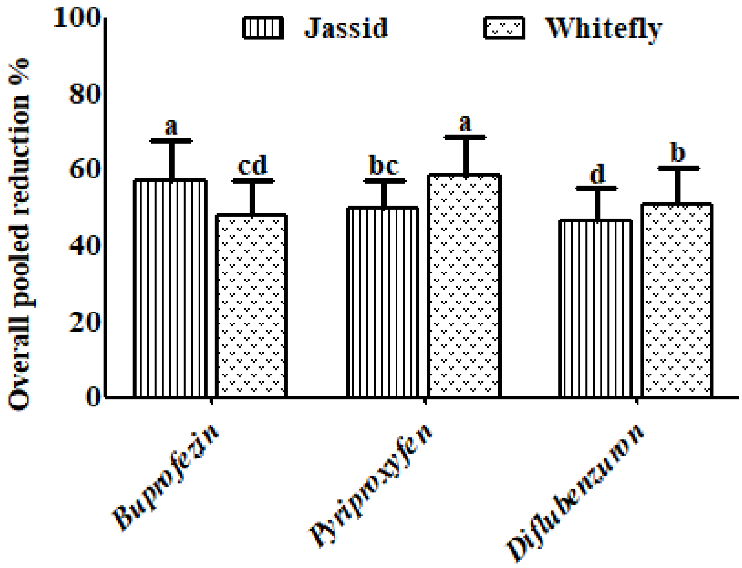


**Figure 1 Average overall pooled reduction% at different time intervals of all three sprays of different IGRs against *A. biguttula* and *B. tabaci* populations on okra crop.**
*Means followed by the same letters are not significantly different @ P < 0.05 LSD value.

**Discussion**

Okra, *Abelmoschus esculentus, is* usually famous and known as lady's finger associated with the family Malvaceae and is attacked by nearly one hundred species of insect pests right from sowing to harvest [10]. Among them, *A. biguttula* and *B. tabaci* are considered the most economically important pests of the okra crop and cause considerable losses every year [11, 12]. Therefore, the present study was conducted to observe the field evaluation of different insect growth regulators against *A. biguttula* and *B. tabaci.*

Results revealed that the maximum *A. biguttula* reduction % was observed after application of Buprofezin 25%, followed by Pyriproxyfen 10% and Diflubenzuron 25%, respectively. These findings agree with [13], who reported effective control of cotton leafhopper, *A. biguttula* (Ishida) with Buprofezin 10% WP, [14] who found Buprofezin as the most effective against *A. biguttula*, and [15] reported from Guntur, Andhra Pradesh, that Buprofezin 25% SC caused a significant reduction of cotton leafhopper *A. biguttula*. Further, results also revealed that Buprofezin 25% was most active with higher mortality till 15 days after spray, followed by Pyriproxyfen 10% and Diflubenzuron 25%, respectively, and these results are consistent with those [16] who reported Buprofezin 70% DF as highly effective against sucking insects on okra. Moreover, the present findings revealed that the maximum *B. tabaci* reduction % was observed after spraying Pyriproxyfen 10%, followed by Diflubenzuron 25%, and Buprofezin 25 %. Similarly, [17] found that insect growth regulators (IGRs), or Neonicotinoid and Nitenpyram, are very efficient in reducing whiteflies below the economic threshold level. Further, the current investigation recorded that post-treatment observations of IGRs remained effective for fifteen days against *A. biguttula* and *B. tabaci*. The spray-wise efficacy of the tested IGRs showed higher *A. biguttula* and *B. tabaci* mortality after the third spray as compared to first and second sprays. These findings align with [18, 19], who reported that Nitenpyram and Pyriproxyfen reduced the whitefly and other sucking pests' population in okra and other vegetables below ETL up to two weeks after spray.

## Conclusion

To replace the excessive and indiscriminate use of chemical pesticides, three different IGRS viz. Buprofezin 25% SC, Pyriproxyfen 10% EC, and Diflubenzuron 25% WP were tested for their efficacy in *A. biguttula and B. tabaci* populations in okra fields.

The findings concluded that an increasing trend of *A. biguttula and B. tabaci* population reduction was observed after spraying with all IGRs for fifteen days after spraying. The spray-wise efficacy of the tested IGRs showed higher *A. biguttula* and *B. tabaci* mortality after the third spray as compared to first and second sprays. Further, it was also concluded that Buprofezin 25% was found effective against *A. biguttula*, followed by Pyriproxyfen 10% and Diflubenzuron 25%, respectively, while Pyriproxyfen 10% was effective against *B. tabaci* followed by Diflubenzuron 25%, and Buprofezin 25 %. Based on the results, it is suggested that Buprofezin 25% SC should be sprayed against *A. biguttula* and Pyriproxyfen 10% EC against *B. tabaci* on the okra, as well as other crops and vegetables.

## Ethics Approval and Consent to Participate

Not Applicable.

## Human and Animal Rights

No animals or human samples were used in this study.

## Consent for Publication

Not applicable.

## Availability of Data and Materials

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

## Funding

None

## Conflict of Interest

The authors declare no conflict of interest, financial or otherwise.

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None

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