

SCREENING OF A NEW CHEMISTRY INSECTICIDE AGAINST *AMRASCA BIGUTTULA BIGUTTULA* ON COTTON

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Abstract

In the pursuit of effective management strategies against *Amrasca biguttula biguttula*, a notorious pest infesting cotton crops, this study investigated the efficacy of novel insecticides during the Kharif season 2023 at the Plant Protection Research Institute, Tandojam. Employing a Randomized Complete Block Design (RCBD) with three replications, four treatments including Simodis, Inspire SC 17.5%, Latitude Star 53% WDG, and an untreated control were evaluated for their impact on pest infestation levels. Data analysis revealed significant reductions in pest population following insecticide application, with Simodis demonstrating the highest efficacy, consistently outperforming other treatments. Initially, the pest population ranged between 6.46 ± 1.31 to 9.07 ± 1.2 per plant. Simodis showed the best control, bringing the population down to 3.07 ± 0.59 after 24 hours, followed by Inspire (5.2 ± 0.48) and Latitude Star (5.87 ± 0.83). This downward trend continued for 96 hours. However, one week after the spray, all treatments showed an increase in pest numbers, with Latitude Star having the highest (6.87 ± 0.98) followed by Inspire (4.6 ± 0.78) and Simodis (3.5 ± 0.52). The pest population then slowly increased throughout the second week, with Simodis again maintaining the lowest population (5.73 ± 0.41) compared to Inspire (6.8 ± 1.15) and Latitude Star (6.96 ± 1.17). The second spray of insecticides also showed Simodis as the most effective treatment. The initial pest population ranged from 6.26 ± 0.38 to 7.27 ± 0.67 per plant. After 24 hours, Simodis again had the lowest number (2.53 ± 0.37) followed by Inspire (3.6 ± 0.31) and Latitude Star (3.66 ± 0.38). The pest population decreased to 96 hours but then increased after a week. Like the first application,

Latitude Star had the highest pest count (3.52 ± 0.38) at this point, followed by Inspire (3.46 ± 0.45) and Simodis (1.91 ± 0.19). The pest numbers slightly fluctuated throughout the second week, with Simodis maintaining the lowest population (3.87 ± 0.68) compared to Inspire (4.52 ± 0.41) and Latitude Star (5.8 ± 0.47). Overall, the study contributes valuable insights into the efficacy of novel insecticides in controlling *A. biguttula biguttula* infestations. By elucidating the interplay between chemical treatments, environmental conditions, and pest dynamics, this research offers a holistic understanding essential for optimizing pest control strategies in cotton cultivation.

INTRODUCTION

Cotton is the important crop and globally known as white gold as the country primary cash crop and the source of cattle feed, fiber and oil cotton is the considered as the backbone of Pakistan economy, contributing 0.8% of the national Gross Domestic Product (GDP) and 4.1% of the agricultural value added amount south-Panjab, Pakistan has remained a significant cotton belt of the country (Shahzadi et al., 2024). The combination of these physical and chemical changes will substantially reduce the crop growth, development, and yield (Wang et al., 2025). Pakistan has experienced agricultural disaster since May 2022 because of rainfall-related flooding and water logging. The rainfall rate experienced in Pakistan was disastrous and led to considerable damage to crop production in the country. Being an agricultural country, approximately 40% of the labor force relies on agriculture for employment and the sector represents about 20% of the country's economy (Sohail et al., 2023). Pakistan's annual cotton production fell by 17.5% (with an annual yield of 9.861 million bales), 7.2% (with an annual yield of 9.148 million bales), and 22.8% (with an annual yield of 7.064 million bales), respectively (Government of Pakistan, 2019, Government of

Pakistan, 2020, Government of Pakistan, 2021). After three consecutive years of low cotton yield, the last season (i.e., 2021–2022) yields 8.329 million bales and represents a 17.9% increase over the previous year's yield (Hussain et al., 2025). Pakistan is the 5th largest cotton producer in the world and its annual production accounts for 5% of the global output. The country has recently struggled with the heat waves, crisis followed by floods, which, as a result damage. The cotton production led to a shrinking in the world's cotton supply, prompting the agricultural sector into turmoil. Around 45% of the country's crop land has already been deluged, completely wiping out vegetables and cotton crops (Devi, 2022; Sohail et al., 2023). However, these are not the sole effects. Flooding also creates complex abiotic stress in crops, including oxygen depletion, altered soil chemical characteristics and reduced light availability (Qamar et al., 2026; Sohail et al., 2023). Although a recent surge in production (18.6% increase) was achieved through the cultivation of Bt cotton varieties with a higher average yield (815 kg/ha) (Government of Pakistan, 2022), Pakistan still lags behind giants like China, USA, Uzbekistan, and India (Khadi et al., 2010). Globally, the annual cotton production stands at

around 26.247 million metric tons, with China, USA, Uzbekistan, India, and Pakistan leading the charge, followed by Australia, Turkey, Brazil, Greece, and Egypt (Ahmed, 2026). One of the most critical factors hindering Pakistan's potential to maximize cotton yield is the insect pests. Cotton crops are particularly vulnerable to a diverse of insects, including pests, parasites, predators, and parasitoids. A staggering 145 species of insects and mites have been identified as detrimental to cotton production in Pakistan alone (Hussain et al., 2025). These pests are estimated to cause yield losses ranging from 35% to 40% (Junaid & Gokce, 2024). Broadly categorized into chewing and sucking types, these insect pests inflict significant damage. Chewing insects, primarily targeting squares, flowers, and bolls, can cause yield reductions of 30-40% (Gurjar et al., 2023). Meanwhile, sucking pests, as Chavan et al. (2010) suggest, can contribute to yield losses of up to 28%. Among the most notorious sucking pests causing destruction on Pakistan's cotton fields is the jassid, particularly the species *Amrasca biguttula biguttula*. This widespread pest not only targets cotton but also damages other crops like okra and watermelon (Shah et al., 2025). *A. biguttula biguttula* infestation leaves a trail of destruction in its wake, characterized by pale white eggs, nymphs changing color as they develop, and a telltale signature on the plant itself: yellowing leaves, loss of firmness, and a downward curl – a phenomenon known as hopper burn. The severity of yield losses caused by *A. biguttula biguttula* varies depending on the crop and the extent of

infestation, with studies indicating potential losses ranging from 19% to a staggering 45% (Bhandari et al., 2022; Brar & Bhullar, 2023). This damage arises from the *A. biguttula biguttula* sap-sucking behavior, which reduces the plant's photosynthetic area. Additionally, both nymphs and adult *A. biguttula biguttula* inflict further harm by injecting toxic saliva into the plant tissues (Akter, 2024; Tariq et al., 2017). The primary goal of increased cotton production was undeniably achieved, to a large extent, through the liberal use of pesticides. Notably, a staggering 83% of these pesticides were specifically targeted at controlling the sucking pests that plague cotton fields. In response to these devastating insect attacks, pesticides have become an indispensable tool for Pakistani farmers seeking large-scale pest control and rapid population reduction (Shuli et al., 2018). The large-scale adoption of pesticides began in the 1950s to combat widespread insect invasions. By 1954, Pakistan had become a significant importer of pesticide mixtures, with imports reaching a staggering 254 tons. This reliance on pesticides continued to escalate, with an estimated 90% of all pesticides used in Pakistan by 1980 being directed towards protecting the cotton crop (Bhandari et al., 2022). In view of above facts, this study was proposed to screen new chemistry insecticides against *Amrasca biguttula biguttula*. The further experiments were conducted to find out the mortality percentage of different insecticides on *A. biguttula biguttula* and Impact of weather parameters on performance of various insecticide against cotton *A. biguttula biguttula* particularly in

the context of cotton production in Pakistan. The study focused on understanding how different insecticides control the pest population from cotton crop. The outcomes of this research will help farmers to understand the role of pesticides so that they can choose the appropriate insecticide to get optimum results from the pesticides against target pests with minimum time and dosage. We study to determine mortality percentage of different insecticides on cotton jassid and impact of weather parameters on performance of various insecticide against cotton jassid

Material and Methods

Experimental area

The present study was carried out for Screening of new chemistry insecticides against *Amrasca biguttula biguttula*. The experiments were conducted in Kharif season of 2023 at the field of Plant Protection Research Institute Tandojam.

Experimental Design: RCBD with Three Replications

Plot size: 30 × 40 sq ft

Experimental Layout Treatments:

T₁: Simodis (Isocycloscrem) 240ml/acre

T₂: Inspire 17.5% SC 100 ml/acre
(Chlorantraniliprol + Thiamethoxame)

T₃: Latitude Star 53% WDG (Spionsad + Flonicamid)

T₄: control (untreated)

Observations:

The monitoring of crop was started soon after seed germination on regular basis. The appearance of insect pests was noticed and recorded to monitor the development of pest population. The insecticides were applied as soon as the pest population reached at economic threshold level. Five plants from each treated plot were randomly selected to record the pest population and from each selected plant five leaves were observed. The first data that reach the ETL was considered as pre-treatment data of 1st spray is 6.64 and 2nd spray 8.00 and then observation was noted after 24, 48, 72, 96 hours one week and two weeks of spray.

Data Analysis

All the recorded data were enumerated in excel sheet from field data collection register. Statistical software STATIX 8.1 was used to perform ANOVA to determine the difference between the different data set obtained from different experimental plots. Furthermore, the LSD (Least Significant Difference) was calculated to find out the least significant difference between different treatments used in the study. Moreover, the correlation coefficient was calculated to find out the effect of abiotic factors (temperature, humidity and wind velocity) on the performance of different insecticides under field conditions. The check the relation between two variable dependent and independent variables the range of correlations of the coefficient is plus minus 1.

LSD: The least significant difference (LSD) test is used in the context of the analysis of variance,

when the F-ratio suggests rejection of the null hypothesis H_0 , that is, when the difference between the population means is significant. This test helps to identify the populations whose means are statistically different.

Pearson's Correlation Coefficient

Correlation is statistical calculation that indicates the extent to which or more variables change jointly. A positive correlation indicates the extent to which those variables increase or decrease similarly, a negative correlation indicates the extent to which one variable increases as the other decreases.

Analysis of Variance (ANOVA)

The analysis of variance (ANOVA), developed by statistician and evolutionary biologist Ronald Fisher, is a method that partitions the total variance, a term separated from the variance and measured by sum of square of deviation from means into its parts each of which is associated with a different source of variance such as variance among and b/w groups. These component parts of variance are analyzed in such manner that certain hypothesis can be tested. Investigation of variance (ANOVA) comprises of estimation that gives data about level of variability inside of a model and shapes a premise for test of importance. The ANOVA calculation for multiple regression is nearly identical to the calculation for simple linear regression, except that the degrees of freedom are adjusted to reflect the number of explanatory

variables included in the model.

Results

The experiments for the management of *Amrasca biguttula biguttula* in cotton field using novel insecticides were carried out during Kharif season of 2023 at the field of Plant Protection Research Institute, Agriculture Research Sindh, Tandojam. Further experiment wise, detailed results are given below:

Mean population of *Amrasca biguttula biguttula* after 1st spray of various insecticides

The pre-population (Pre-T) of *A. biguttula biguttula* in various insecticide treatments ranges between 6.46 ± 1.31 to 9.07 ± 1.2 *A. biguttula biguttula* per plant. After application of Simodis, a prominent reduction was recorded in *A. biguttula biguttula* population showing a significant difference among various treatments ($P < 0.05$). Simodis was found to be more effective among all treatments. After 24-hours of spray lowest population 3.07 ± 0.59 *A. biguttula biguttula* was recorded in treatments of Simodis followed by Inspire and Latitude Star 5.2 ± 0.48 and 5.87 ± 0.83 , respectively. A similar population decreasing trend was observed till 96 hours of spray. After one week of insecticide application an increasing flow was found in the population of *A. biguttula biguttula* in every treatment. The maximum number of the pest was 6.87 ± 0.98 in treatments of Latitude followed by Inspire 4.6 ± 0.78 and Simodis 3.5 ± 0.52 , respectively. Afterwards, a slow increasing fluctuation was recorded in population

of *A. biguttula biguttula* in various treatments till the 2nd week, the lowest and highest population 5.73±0.41, 6.8±1.15 and 6.96±1.17A. *biguttula*

biguttula/ plant was recorded in Simodis, Inspire and Latitude Star respectively (Table 1 and Fig 1).

Table 1. 1st spray of various insecticides against *Amrasca biguttula biguttula* on cotton

Treatment Doses Pretreatment			Post treatment					
			24hrs	48hrs	72hrs	96hrs	1week	2weeks
Simodis	50 ml	9.07±1.2 ^a	3.07±0.59 ^c	2.77±0.71 ^c	2.13±0.57 ^c	1.93±0.45 ^c	3.5±0.52 ^b	5.73±0.41 ^b
Inspire	25 ml	10.2±1.67 ^a	5.2±0.48 ^b	4.9±0.48 ^{bc}	3.93±0.7 ^{bc}	2.6±0.76 ^{bc}	4.6±0.78 ^b	6.8±1.15 ^{ab}
Latitude Star	25 ml	8.86±1.52 ^a	5.87±0.83 ^b	5.67±0.82 ^b	5±0.69 ^b	4.73±0.55 ^b	6.87±0.98 ^a	6.96±1.17 ^{ab}
Control	—	6.46±1.31 ^a	6.00±1.27 ^a	7.00±0.98 ^a	5.6±0.9 ^a	6.56±1.32 ^a	7.66±0.76 ^a	8.46±1.92 ^a

Means followed by the same letters are not significantly different (LSD, $P < 0.05$), as mentioned in the appendix.

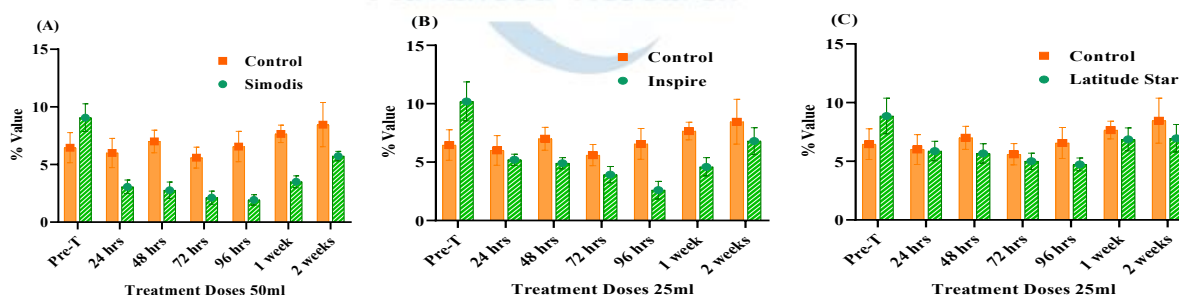


Figure 1. The reduction percentage after first spray of different insecticides against *A. biguttula biguttula*. (A) Simodis, (B) Inspire, and (C) Latitude Star, each compared with the untreated control at different post-treatment intervals.

The reduction is measured at six different time intervals from 24, 48, 72, 96 hours, 1, and 2 weeks. After 24 hours of the first spray, Simodis showed a reduction of 66.15% in the *A. biguttula buguttula* population. This is the highest reduction observed for Simodis at any time point. The reduction in population remained above 65% for the first 48 &

72 hours after the spray. Similarly, after 96 hours of spray, Simodis showed the highest reduction (77.55%) among all treatments. The reduction then declined to 56.62% at 1 week and 38.45% at 2 weeks after the first spray. Inspire showed a lower reduction in *A. biguttula buguttula* population compared to Simodis at all time points except for

96 hours. After 24 hours of spray, Inspire showed a reduction of 42.66% in the *A. biguttula biguttula* population. The reduction fluctuated between 39.72% and 48.76% for the first 48 & 72 hours after the spray. Similarly, 96 hours of first spray, Inspire showed the second highest reduction (69.00%). The reduction then declined to 42.99% at 1 week and 26.96% at 2 weeks after the first spray. Latitude Star showed the lowest reduction in *A. biguttula biguttula* population compared to the other treatments. After 24 hours of first spray, Latitude Star showed a reduction of 35.28% in the *A. biguttula biguttula* population. The reduction remained below 45% at all time interval measured. The reduction then declined to 14.86% at 1 week and 25.24% at 2 weeks after the first spray.

Mean population of *Amrasca biguttula biguttula* after 2nd spray of various insecticides

The results of *Amrasca biguttula biguttula* population was observed in Table 2) after 2nd spray of various insecticides. The population ranged between 6.26±0.38 to 7.27±0.67 *A. biguttula biguttula* per plant before various insecticide

applications. After application of Simodis, a prominent decrease in pest population was recorded which showed a significant difference among various treatments ($P < 0.05$). Simodis was found to be more effective among all treatments. After 24-hours of spray lowest population 2.53±0.37 *A. biguttula biguttula* was recorded in treatments of Simodis followed by Inspire and Latitude Star 3.6±0.31 and 3.66±0.38, respectively. A similar trend for decreasing population was observed till 96 hours of spray in all treatments. After one week of insecticide application an increasing flow was found in the population of *A. biguttula biguttula* in every treatment. The maximum number of the pest was 3.52±0.38 in treatments of Latitude followed by Inspire 3.46±0.45 and Simodis 1.91±0.19, respectively. Afterwards, the population of *A. biguttula biguttula* continued to fluctuate slightly over the next week. the lowest and highest population 3.87±0.68, 4.52±0.41 and 5.8±0.47 *A. biguttula biguttula*/ plant was recorded in Simodis, Inspire and Latitude Star respectively (Fig 2).

Table 2. 2nd spray of various insecticides against *Amrasca biguttula biguttula* on cotton

Treatment	Doses	Pre-Treatment	Post Treatment					
			24hrs	48hrs	72hrs	96hrs	1week	2weeks
Simodis	50 ml	7.27±0.67 ^a	2.53±0.37 ^c	1.87±0.13 ^c	0.93±0.13 ^c	0.29±0.13 ^c	1.91±0.13 ^c	3.87±0.68 ^c
Inspire	25 ml	6.26±0.38 ^a	3.60±0.31 ^{bc}	2.78±0.13 ^{bc}	1.72±0.13 ^{bc}	1.47±0.13 ^b	3.46±0.41 ^b	4.52±0.41 ^{bc}
Latitude Star	25 ml	6.42±0.41 ^a	3.66±0.31 ^b	3.23±0.13 ^b	2.86±0.61 ^b	1.58±0.13 ^b	3.52±0.31 ^b	5.8±0.47 ^b
Control	~~~~	8.39±0.56 ^a	9.06±0.41 ^a	10.55±0.89 ^a	10.60±0.61 ^a	10.70±0.71 ^a	11.00±0.57 ^a	11.20±0.56 ^a

Means followed by the same letters are not significantly different (LSD, $P < 0.05$), mentioned in the appendix

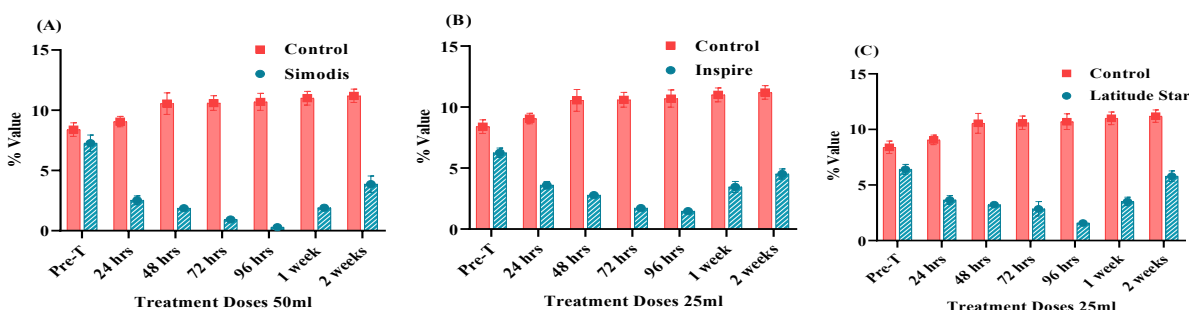


Figure 2. Correlation coefficients of weather parameters with different insecticides used against *Amrasca biguttula biguttula*. (A) Simodis, (B) Inspire, and (C) Latitude Star, each compared with the untreated control at different post-treatment intervals.

The reduction percentage after second spray of different insecticides against *A. biguttula biguttula*

The reduction in the insect population is measured at six times: 24, 48, 72, and 96 hours, and 1 and 2 weeks after the spray. Throughout the experiment, Simodis offered the strongest reduction. At 24 hours, it reduced the insect population by 57.83%, and this effect remained above 83% for the first 72 hours. It achieved the highest reduction (95.83%) at 96 hours, but the effectiveness then declined to 75.06% at 1 week and 54.3% at 2 weeks. Compared to Simodis, Inspire showed lower effectiveness at all time points except for 96 hours. It reduced the population by 40% at 24 hours, with a fluctuation between 60 % and 69 % during the next 72 hours. At 96 hours, it achieved a reduction of 77.62%, but this dropped to 54.83% at 1 week and 46.63% at 2 weeks. This treatment showed the least

effectiveness against the insect population. At 24 hours, it reduced the population by 39%, and this effect remained below 76% throughout the experiment. The reduction further declined to 54.04% at 1 week and 31.52% at 2 weeks.

Correlation coefficient of weather parameters with different insecticides used against *Amrasca biguttula*

The correlation between weather parameters and synthetic insecticide against population fluctuation of *Amrasca biguttula biguttula* on cotton during 1st and 2nd spray in Table 3 and Fig 2. The results showed that, was a highly significant relationship of temperature with population of *A. Biguttula biguttula* was observed in 1st spray with all treatments ($P < 0.05$). Relative humidity and wind velocity also showed a positive and significant relation with population of *A. biguttula biguttula*. Similar trend was found in 2nd spray, showed a positive and significant impact in maximum and

minimum temperature, relative humidity and wind velocity with population fluctuation of *A. biguttula biguttula* in various treatments ($P < 0.05$).

Table 3. Correlation coefficient of weather parameters with different insecticides used against *Amrasca biguttula biguttula*

Weather Parameters	FIRST SPRAY				SECOND SPRAY			
	Simodis	Inspire	Latitude Star	Control	Simodis	Inspire	Latitude Star	Control
Maximum Temperature	0.84*	0.93*	0.93*	0.98*	0.92*	0.95*	0.98*	0.99*
Minimum Temperature	0.85*	0.93*	0.93*	0.98*	0.86*	0.95*	0.98*	0.99*
Relative Humidity	0.85*	0.93*	0.94*	0.98*	0.95*	0.98*	0.99*	0.99*
Wind velocity	0.92*	0.95*	0.97*	0.97*	0.93*	0.96*	0.97*	0.98*

The values donated with * show significant impact of abiotic factors on performance of insecticides.

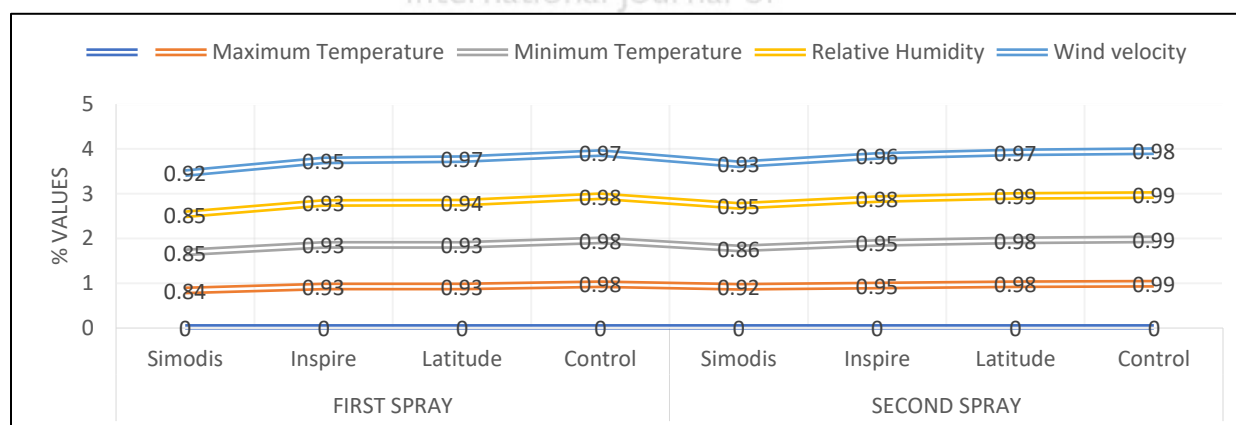


Figure 3. Correlation coefficients between weather parameters and the efficacy of different insecticides against *Amrasca biguttula biguttula*.

Correlation is a statistical calculation that indicates the extent to which two or more variables change jointly. A positive correlation indicates the extent to which variables increase or decrease together; a negative correlation indicates the

extent to which one variable increases as the other decreases. Level of Correlation Coefficient: Weak: 0.1, 0.2, 0.3, Moderate: 0.4, 0.5, 0.6, and Strong: 0.7, 0.8, 0.9.

Discussion

Our growing population places immense pressure on food and fiber production. This challenge is compounded by climate change, crop pests, and water scarcity (Hussain et al., 2025; Mollah et al., 2022). Cotton, the primary raw material for the textile industry, serves as a major source of fiber (Cai et al., 2025). Cotton production faces a significant challenge in the form of pests. Among these, sucking insects are the most destructive, causing yield losses of 50-60% (Akter, 2024). Common culprits wreaking havoc on Pakistani cotton crops include *Amrasca devastans*, *Thrips tabaci*, *Aphis gossypii*, *Bemisia tabaci*, and *Phenacoccus solenopsis* (Bhandari et al., 2022; Khan et al., 2013). Farmers typically rely on synthetic insecticides to control these pests due to their perceived effectiveness and rapid results (Susanti et al., 2022; Thakur et al., 2021). Globally, millions of tons of pesticides are applied annually to control pest populations, with Pakistan alone using over 206,730 metric tons in 2017 (Abbas, 2025; Barroso et al., 2025). The findings of this study revealed significant variations in pest infestation reduction among different insecticide treatments applied to cotton crops. Our results demonstrated that Lambda, a synthetic insecticide, exhibited the highest reduction percentage of 75.34% after 24 hours of 2nd spray application, followed by *A. Indica* (35.59%) and *N. tabacum* (33.51%) (Malinga & Laing, 2024). Conversely, *Datura stramonium*, *Citrullus colocynthis*, and *Calotropis procera* showed lower reduction percentages ranging from 9.99% to 28.82% (Islam et al.,

2023). The observed increase in reduction of pest infestation after 48 hours across various treatments underscores the effectiveness of these insecticides over time (Hnamte & Tayde, 2022). Our study also assessed the long-term efficacy of these insecticides, with Simodis consistently demonstrating the highest reduction percentages over 72 hours, 96 hours, and even after one week of application (Reddy et al., 2026). Among botanical treatments, *Azadirachta Indica* exhibited significant reduction percentages, aligning with previous findings by (Anbalagan et al., 2024). regarding the efficacy of *Azadirachta Indica* in pest control. Additionally, our results align with previous studies indicating the effectiveness of *A. Indica* in reducing pest populations (Rasheed et al., 2024; Roy et al., 2024). Comparison with previous research corroborates our findings. For instance, Sivakumar (2004) reported the effectiveness of *Meranoplus bicolor* in controlling insect feeding on cotton flowers, supporting our observation of Lambda-cyhalothrin efficacy. Additionally, our results align with previous studies indicating the effectiveness of *Azadirachta Indica* in reducing pest populations (Hanchinal et al., 2024). Synthetic insecticides demonstrated immediate reduction in infestation levels, but concerns regarding insecticide resistance pose challenges for cotton farmers (Peshin et al., 2022; Shah et al., 2025). In contrast, biopesticides like *Azadirachta Indica* offer a promising alternative, as they are derived from natural substances and are less likely to induce resistance in pests (Al-Salihi, 2022; Perveen, 2024). Furthermore, our correlation analysis

between weather parameters and insecticide efficacy revealed significant relationships, particularly with temperature, relative humidity, and wind velocity (Rizwana et al., 2024; You et al., 2026).

Conclusions

Based on various observations of this study it can be concluded that cotton crop is still infested by *A. biguttula biguttula* throughout its growth and development. The field scouting demonstrated that the population *A. biguttula biguttula* the threshold level and need to be managed for better yield. It is also concluded that the study contributes valuable insights into the efficacy of novel insecticides in controlling *A. biguttula biguttula* infestations, this research offers a holistic understanding essential for optimizing pest control strategies in cotton cultivation. The insecticides Simodis, Inspire and Latitude Star produced better results against *A. biguttula biguttula* in the field. Additionally, there was a significant correlation between the insecticidal effects and weather parameters. So, there is need of proper monitoring of day-to-day weather conditions before application of insecticides.

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