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EVALUATION OF FOUR BIO-PESTICIDES AGAINST JASSID, *AMRASCA BIGUTTULA* (HEMIPTERA: JASSIDAE) FOR THE SAFE PRODUCTION OF YARDLONG BEAN

Annesha Sarker, Hasan Fuad El Taj, Mohammad Mosharof Hossain Bhuyain and Md. Alamgir Hossain[*]

[*]Department of Entomology, Hajee Mohammad Danesh Science and Technology University, Dinajpur 5200, Bangladesh.

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ABSTRACT

Yardlong bean (*Vigna unguiculata* subsp. *sesquipedalis*) is a highly nutritious vegetable widely cultivated in Bangladesh, serving as an important source of protein, particularly for rural populations. However, its production is often constrained by sap-sucking pests, especially jassids, which can cause considerable yield losses. To evaluate effective pest management strategies, a field experiment was conducted at the Entomology Research Field of Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur, using RCBD. The study assessed the efficacy of four bio-pesticides against jassid infestation in yardlong bean variety BGL-1205. Four treatments were tested: T_1 Azadirachtin 1% EC, T_2 *Celastrus angulatus* 1% EW, T_3 Buprofezin 40% SC, T_4 Lufenuron 5% EC, and an untreated control. The results showed that buprofezin 40% SC @ 0.4 ml L^{-1} was the most effective treatment (T_3), recording the lowest mean jassid populations of 8.77, 6.00, and 8.39 per three leaves per plant after the first, second, and third sprays, respectively. In contrast, the untreated control consistently exhibited the highest infestations. Buprofezin reduced jassid populations by 58.67%, 68.42%, and 57.92% after 1st, 2nd and 3rd sprays, respectively and produced the highest yield per pit (318.07 g), the largest yield increase (68.70%) over control and the maximum benefit-cost ratio (2.26). These findings indicate that buprofezin 40% SC @ 0.4 ml L^{-1} is an effective, economical, and bio-safe option for jassid management, enhancing plant growth and significantly increasing yardlong bean productivity.

Keywords: Evaluation, bio-pesticides, yardlong bean, jassid, safe food

*Corresponding author: *alamgirhstu@gmail.com*

INTRODUCTION

Yardlong bean (*Vigna unguiculata* subsp. *sesquipedalis* (L.) Walp) is a key legume crop extensively cultivated in Southeast Asia and southern China (Suma *et al*. 2021, Mia *et al*. 2024). The crop is rich in essential amino acids such as lysine and tryptophan, vitamins, and minerals (Pandey *et al*. 2020), earning it the nickname "meat of the poor" and has importance in rural diets (Jat *et al*. 2013, Khatun *et al*. 2020). Despite its significance, the average yield in Bangladesh remains low at 4.65 t ha^{1} (BBS 2021), far below the standards in other Asian countries (Sarada and Rao 2020). Low productivity is largely due to abiotic stresses and biotic challenges, with insect pests and diseases being major limiting factors (Khan *et al*. 2018, Khatun *et al*. 2020, and Mia *et al*. 2024). Over 55 insect pest species attack yardlong bean (Chopkar *et al*. 2020, Chowdhury *et al*. 2019, Rahman *et al*. 2022). Among them, the jassid *Amrasca biguttula* (Cicadellidae: Hemiptera) is a significant seasonal pest (Tamang *et al*. 2025). This polyphagous pest feeds on plant sap using piercing-sucking mouthparts, reducing photosynthesis, resulting stunting growth, and lowering yields (Afzal *et al*. 2025). It also produces honeydew-like exudates, which accumulate more on younger leaves, which affect plant health and productivity (Bhandari *et al*. 2022).

At present, farmers rely almost exclusively on synthetic chemical insecticides to combat various insect pests to protect the crops from the pest damage. However, extensive usage of chemical insecticides leads to pest resistance, pest resurgence and serious health hazards due to their bio-magnification and persistent nature (Sharma *et al.* 2019, and Goff & Giraudo 2019). Hence, globally, researchers are increasingly adopting alternatives to detrimental chemical pesticides, with a strong focus on new-generation bio-rational pesticides and bio-pesticides. This shift is driven by the need to reduce environmental harm, protect beneficial organisms, and address consumer concerns about food safety and ecological sustainability (Khanal *et al.* 2021). So, keeping in view the importance of yardlong bean jassid, a field trial was conducted to evaluate the effectiveness of four selected bio-pesticides viz., Azadiractin, *Celastrus angulatus*, Buprofezin, Lufenuron in controlling jassid.

MATERIALAS AND METHODS

Experimental site: The experiment was carried out in the research field of the Department of Entomology of Hajee Mohammad Danesh Science and Technology University, Dinajpur during March to July 2024. The site is categorized as medium high land within AEZ-1 of the Old Himalayan Piedmont Plain. The soil is characterized by medium to high elevation and featured sandy loam and sandy clay loam textures with a pH of 5.52, an electrical conductivity of 2.0 mS m^{-1}, and a medium organic matter content (Shil *et al*. 2016).

Plant culture: The seeds of yardlong bean (*Vigna unguiculata* subsp. *sesquipedalis*) variety BGL-1205 were obtained from the Bangladesh Agricultural Development Corporation (BADC), Sadar Upazila, Dinajpur. The experimental field was thoroughly prepared by ploughing and cross-ploughing using a power tiller to achieve a fine tilth, followed by laddering and spading. Stubbles and uprooted weeds were removed, and the field was leveled prior to sowing. Three seeds were placed in each prepared pit and lightly irrigated to maintain adequate soil moisture for germination. At 15 days after sowing, thinning was performed to retain a single healthy seedling per pit. Each plant was provided with a bamboo stake to prevent lodging. Routine intercultural operations, including irrigation, weeding, and other necessary field management practices were carried out as required. Fertilizers were applied according to the recommended doses to ensure optimum growth and yield (Mia *et al*. 2024).

Treatments and data collection: Four bio-pesticides evaluated as the treatments were T_1 = Azadiractin 1 EC @ 1 mlL^{-1} of water; T_2 = *Celastrus angulatus* 1 EW @1.5 mlL^{-1} water, T_3 = Buprofezin 40 SC @ 0.4 mlL^{-1} water, and T_4 = Lufenuron 5 EC @ 0.5 mlL^{-1} water. An untreated control was maintained by applying water only. Sprayings were done three times at 15-days intervals using a knapsack sprayer, at 4:00 pm to minimize risk to pollinators. Number of jassids were counted at 1, 5 and 10 days atter treatments on three leaves per plant. Also, number and weight of healthy pods, along with percent infestation increase and decrease over control were recorded and calculated after the 1st, 2nd, and 3rd sprays. Pods were harvested at 5-day intervals after each spray during the fruiting stage, and weighed separately.

$$\text{Infestation decrease (\%) over control} = \frac{\text{Control mean - Treatment data}}{\text{Control data}} \times 100$$

$$\text{Infestation increase (\%) over control} = \frac{\text{Treatment mean - Control mean}}{\text{Treatment mean}} \times 100$$

Yield estimation: Fruits were harvested from each picking event and were weighed using a digital scale and recorded for each pit at 5 days intervals. The total yield per pit was calculated by summing the weights from all harvested within that specific pit, providing a cumulative measure of productivity across the growing period. To standardize the results and enable comparisons with other studies, the yield per pit measured in grams and was converted to kilogram per hectare using the following formula:

$$\text{Yield (Kg/ha)} = (\text{Yield (kg) plot}^{-1} / \text{Plot size m}^2) \times 10000$$

Benefit cost ratio (BCR): To determine the Benefit Cost Ratio (BCR), current market prices of fruits were obtained from local markets. Gross income for each plot was calculated by multiplying the weight of marketable fruits by the prevailing market price. Net income was derived by subtracting the total cost of cultivation including land preparation, planting material, fertilizers, labor, irrigation, pest management, and other inputs from the gross income. The BCR was then calculated as the ratio of gross income to total cost of cultivation using the following equation:

$$\text{BCR} = \text{Gross return / Total cost of production (treatment costs + common cost)}$$

Statistical analysis: Statistical analysis of the experimental data was carried out to determine significant differences among treatments. The data were analyzed using STATISTIX-10 software, and analysis of variance (ANOVA) was performed. Mean comparisons among treatments were conducted using the Least Significant Difference (LSD) test at the 5% level of significance.

RESULTS AND DISCUSSION

Effect of four bio-pesticides against jassid after 1st spray: The tested biopesticides showed statistically promising effects against the jassid after the first (3DAS: $p< 0.01$, $F =33.04$, $df =14$; 5DAS: $p< 0.01$, $F =16.90$, $df =14$; 10DAS: $p< 0.01$, $F = 40.49$, $df =14$), spray as compared to the untreated control (Tables 1-3). Significantly

(3 DAS: $p< 0.01$, F =33.04, *df* =14; 5 DAS: $p< 0.01$, F =16.90, *df* =14; 10 DAS: $p< 0.01$, F = 40.49, *df* =14) the lowest number of jassids were found as 8, 9 and 9.33, respectively from the T_3 (buprofezin 40 SC at 0.4 mlL^{-1} water treated plant) after the 1st spray while the highest jassid recorded were 19, 21 and 23.67 at 1, 5 and 10 days, from the untreated control. Buprofezin 40 SC @ 0.4 ml L^{-1} showed the highest percentage decrease (58.67%) over untreated control. The results clearly indicate that buprofezin based treatments were found as the most effective in controlling jassid populations in yardlong bean after first spray. Ahmed *et al.* (2020) reported that buprofezin @ 0.75 mLL^{-1} water achieved the highest infestation reduction over untreated control of jassid population in flower (64.16%) and pod (70.60%) of yardlong bean. Similarly, Kavita *et al.* (2014) found that buprofezin 25% SC significantly reduced jassid population (1.10 jassids/leaf) compared to the control, demonstrating its efficacy against jassids in mungbean.

Efficacy of bio-pesticides against jassid after second spray: Similarly, significantly (3DAS: $p< 0.01$, F =25.70, *df* =14; 5DAS: $p< 0.01$, F =23.19, *df* =14; 10DAS: $p< 0.01$, F =24.88, *df* =14) the lowest number of jassids were counted as 6, 5.33 and 6.67, respectively from the T_3 (buprofezin 40 SC at 0.4 mlL^{-1} water) treated plant while the highest 17.67, 18.67 and 20.67 were recorded at 1, 5 and 10 days, from the untreated control after 2nd spray. Buprofezin 40 SC @ 0.4 ml L^{-1} also showed

Table 1. Effectiveness of four bio-pesticides against jassid on yardlong bean after first spray

Treatments	Doses (ml L^{-1})	Number of jassid after 2nd spray			Mean	Decrease (%) over control
		1 DAS	5 DAS	10 DAS		
T_1	1	12.67 c	12.67 c	12.67 c	12.67 c	40.29
T_2	1.5	16.33 b	16.33 b	16.33 b	16.11 b	24.08
T_3	0.4	8.00 d	8.00 d	8.00 d	8.77 d	58.67
T_4	0.5	15.00 bc	15.00 bc	15.00 bc	15.22 bc	28.27
Untreated control	-	19.00 a	19.00 a	19.00 a	21.22 a	-
CV (%)	-	13.72	15.83	13.90	8.53	-

Means in a column with different letters differ significantly at 0.05% (LSD test). DAS = Days after spray, T_1 = Azadirachtin, T_2= *Celastrus angulatus*, T_3 = Buprofezin, T_4 = Lufeneuron, and Untreated control the highest percentage decrease (68.42%) over untreated control. Choudhary *et al.* (2022) reported that buprofezin 25 SC (0.04%) resulted effectively against jassid count after the second spray, achieving a high population reduction of 85.52% at 3 days after treatment, indicating strong and timely suppression. Likewise, Barot and Patel (2022) observed that buprofezin + acephate 0.075% significantly effective against jassid, reducing the population to 1.27 jassids per leaf after the second spray.

Efficacy bio-pesticides against jassid after third spray: Again, significantly (3DAS: $p< 0.01$, $F =28.37$, $df =14$; 5DAS: $p< 0.01$, $F =29.43$, $df =14$; 10DAS: $p< 0.01$, $F =37.84$, $df =14$) the highest number of jassids were counted as 18, 19.67 and 22.17 after 1, 5 and 10 days, respectively from the untreated control. Conversely, the lowest number of jassids were found as 8.83, 8.33 and 8.0 after 1, 5 and 10 days, respectively from the T_3 (buprofezin 40 SC @ 0.4 mlL^{-1}) treatment. The highest reduction (57.92%) over the untreated control was observed from buprofezin 40 SC @ 0.4 ml L^{-1} followed by T_2 treatment (*Celastrus angulatus* 1% EW @ 1.5 ml L^{-1}). These findings are consistent with Kumar *et al.* (2019) who observed that buprofezin 25 SC (800 mlha^{-1}) significantly reduced jassid populations to 7.00-10.67 jassids per three leaves after sprays. Also, Chaudhary *et al.* (2018) found similar result of buprofezin which reduced jassid populations to1.97-2.04 jassids per three leaves after sprays. In short, buprofezin 40% SC @0.4 mlL^{-1} worked as the best in

Table 2. Effectiveness of four bio-pesticides against jassids on yardlong bean after the second spray

Treatments	Doses (ml L^{-1})	Number of jassid after 2nd spray			Mean	Decrease (%) over control
		1DAS	5DAS	10DAS		
T_1	1	14.00 b	11.00 b	13.33 b	12.78 b	32.74
T_2	1.5	13.67 b	10.67 b	13.33 b	12.56 b	33.98
T_3	0.4	6.00 c	5.33 c	6.67 c	6.00 d	68.42
T_4	0.5	8.00 c	9.33 b	10.33 b	9.22 c	51.47
Untreated control	-	17.67 a	18.67 a	20.67 a	19.00 a	-
CV (%)	-	13.72	15.83	13.90	8.53	-

Means in a column with different letters differ significantly at 0.05% (LSD test). DAS = Days after spray, T_1 = Azadirachtin, T_2= *Celastrus angulatus*, T_3 = Buprofezin, T_4 = Lufeneuron, and Untreated control

Table 3. Effectiveness of four bio-pesticides against jassids on yardlong bean after the third spray

Treatments	Doses (ml L^{-1})	Number of jassid after 3rd spray				Decrease (%) over control
		1 DAS	5 DAS	10 DAS	Mean	
T_1	1	15.33 b	14.67 b	15.83 b	15.28 b	23.37
T_2	1.5	12.17 c	11.17 c	13.00 c	12.11 c	39.27
T_3	0.4	8.83 d	8.33 d	8.00 d	8.39 d	57.92
T_4	0.5	14.83 b	12.50 bc	15.83 b	14.39 b	27.83
Untreated control	-	18.00 a	19.67 a	22.17 a	19.94 a	-
CV (%)	-	8.18	10.23	9.67	8.17	-

Means in a column with different letters differ significantly at 0.05% (LSD test). DAS = Days after spray, T_1 = Azadirachtin, T_2= *Celastrus angulatus*, T_3 = Buprofezin, T_4 = Lufeneuron, and Untreated control

managing jassid populations on yardlong bean compared to the other treatments.

Efficacy of tested bio-pesticides on the yields: The effectiveness of selected bio-pesticides on the yield of yard-long bean was evaluated, and significant variations were observed among treatments at each harvest (Table 4). The highest cumulative yield (318.07 g plant^{-1}) was recorded with buprofezin 40% SC @ 0.4 ml L^{-1} water, while the lowest yield (99.54 g pit^{-1}) harvested from the untreated control. Yield increase over the untreated control was the most distinct with buprofezin 40% SC @ 0.4 ml L^{-1}, showing a substantial increase of 68.70%. These findings align well with Ahmed *et al.* (2020a) reported that, buprofezin at 0.75 ml L^{-1}achieved the highest yardlong bean yield (15.14 t ha^{-1}), which was 40.34% increase over untreated control treatment. Likewise, Badariprasad *et al.* (2020) observed that buprofezin @175 g a.i./ha produced the highest yield of 65.50 qha^{-1}, which marked a 40.6% increase over untreated control.

Efficacy of bio-pesticides on Benefit Cost Ratio (BCR): Table 5 presents the economic analysis and Benefit Cost Ratio (BCR) of yard-long bean cultivation under different treatments. Among them, buprofezin 40% SC @ 0.4 ml L^{-1} proved to be the most economically viable, recording the highest BCR (2.26) and emphasizing the importance of effective pest management in improving yield and profitability. However, differences in treatment costs indicate that although several bio-pesticides

Table 4. Effectiveness of four bio-pesticides on the yield of yardlong bean at different harvesting stage

Treatments	Doses (ml L^{-1})	Cumulative yield	Yield increase (%) over control
T_1	1	178.76 b	44.32
T_2	1.5	182.66 b	45.49
$_T3$	0.4	318.07 a	68.70
T_4	0.5	159.84 c	37.72
$_T5$	-	99.54 d	-
CV (%)	-	2.10	-

Means in a column with different letters differ significantly at 0.05% (LSD test). DAS = Days after spray, T_1 = Azadirachtin, T_2= *Celastrus angulatus*, T_3 = Buprofezin, T_4 = Lufeneuron, and Untreated control

offer economic benefits, buprofezin provides the highest return on investment in this specific context.

These results align with previous studies demonstrating the economic benefits of buprofezin. Ahmed *et al*. (2020a) reported the highest BCR (1.48) with buprofezin @ 0.5 ml L^{-1} in yard-long bean. Similarly, Alam *et al*. (2022) recorded a BCR of 1:1.44 using buprofezin (Award 40 SC). Chakraborty *et al*. (2017) also observed a superior BCR (1:5.79) with a buprofezin–fipronil combination, confirming its economic viability.

Table 5. Effectiveness of four bio-pesticides on the economic analysis and benefit cost ratio (BCR) infesting yardlong bean

Treatments	Yield (Kg/ ha)	Gross return (Tk/ha)	Total cost of production (Tk/ha)			Net return (Tk/ha)	Benefit Cost ratio
			Common	Treatments	Total		
T_1	3575.2	178760	135000	3265	138265	40495	1.29
T_2	3653.2	182660	135000	4120	139120	43540	1.31
T_3	6361.4	318070	135000	5626	140626	177444	2.26
T_4	3196.8	159840	135000	3858	138858	20982	1.15
Untreated control	1990.8	99540	135000	-	135000	-35460	0.74

T_1 = Azadirachtin, T_2= *Celastrus angulatus*, T_3 = Buprofezin, T_4 = Lufeneuron and Untreated control

All the tested chemicals e.g., Azadirachtin, *Celastrus angulatus*, Buprofezin and Lufeneuron yielded significant results over untreated control. However, among the treatments, buprofezin 40% SC @ 0.4 ml L^{-1} of water was observed more effective against the jassids in yardlong bean.

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