Efficacy of some insecticides against the major insect pests of pigeonpea [*Cajanus cajan* (L.) Millsp.]

ABSTRACT

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| --- |
| An experiment was conducted at the School of Agricultural Sciences, Medziphema, Nagaland, over a period of six months to evaluate the efficacy of selected insecticides against the major insect pests of pigeonpea. The study was laid out in a Randomized Block Design (RBD) comprising nine treatments, including one untreated control. Observations on pest incidence were recorded before spraying and subsequently at 3, 7, and 10 days after spraying (DAS). Two rounds of insecticide applications were performed at 15-day intervals.  Results indicated that among the eight insecticidal treatments, Indoxacarb was highly effective against the pod boring weevil (*Apion clavipes*), Chlorantraniliprole effectively managed the spotted pod borer (*Maruca vitrata*), and Deltamethrin provided significant control of the blister beetle (*Mylabris pustulata*). Overall, Indoxacarb, Chlorantraniliprole, and Deltamethrin were identified as the most effective insecticides for managing the major pests of pigeonpea under the conditions of the study. |

*Keywords:* *Pigeonpea, Indoxacarb, Chlorantraniliprole and Deltamethrin*

1. INTRODUCTION

Pigeonpea scientifically termed as *Cajanus cajan* (L.) Millsp., is a member of the legume belongs to the family Fabaceae. Following chickpea, it stands as the second most cultivated pulse crop both in area and production [1]. World production of Pigeonpea is estimated at 4.49 million tons. India is account for 72% of area grown to Pigeonpea or 3.9 million hectares (FAO,2018). Uttar Pradesh is the highest producer of Pigeonpea in India [2,3] Pigeonpea is grown on 3,210 hectares in Nagaland and yields 2,950 metric tons [4] Pigeonpea is cultivated during kharif season in North eastern region. Being as a tropical crop it requires hot and humid climate and ability to tolerate high temperature. In Nagaland, pigeonpea is locally known as ‘arhar’. Pod boring weevil (*Apion clavipes*) is a serious pest of North eastern hilly areas [5]. This weevil is abundantly found in North eastern states and also observed in the states of west Bengal and Bihar[6]. A large number of insect pests (more than 300 species) are noticed to attack pigeon pea [7] Major contributors to yield loss is by pod borer complex which contributes a range of 60% [8]. Approximately 300 species of insect pests have been identified attacking pigeonpea, belongs to eight orders and 61 families from seedling stage to harvesting and continuing even in storage condition [9]. Pest management by chemical insecticides should be the last resort when the insect population reaches above economic threshold level. The newer insecticides with different modes of action are paving a potential way of reducing the different insect pests of pigeonpea. To test the effectiveness of some newer pesticides against the major insect pests of pigeonpea the following experiment was conducted.

1. material and methods

The present study on efficacy of some insecticides against the major insect pests of pigeonpea was carried out at the entomology research farm, school of agricultural sciences, Nagaland university, Medziphema campus, during kharif season of 2023 using the variety PA-291 raised in a planting geometry of 45 cm × 30 cm between rows and plants following all recommended agronomic practices. The experiment was laid out in randomized block design with nine treatments including one untreated control viz., *Bacillus thuringiensis var kurstaki* 0.5 % WP @ 2.5g/l, chlorantraniliprole 18.5 SC @ 0.3 ml/l, Flubendiamide 480 SC @ 0.2ml/l, Deltamethrin 2.8 EC @ 1ml/l, lufenuron 5.4% EC @ 1.2 ml/l, NSKE 5% @ 50g/l, Indoxacarb 14.5 SC @ 0.8ml/l, lambda cyhalothrin 5% EC @ 1 ml/l and untreated control in three replications[10,11].The first spray was done at 50% flowering and second at pod formation stage with hand operated knapsack sprayer using a spray volume of 500 l/ha. pod borers such as *Maruca vitrata* (spotted pod borer) was observed by selecting five (5) random plants in each plot and the incidence was recorded in terms of mean pod damage by counting the total number of pods and the number of damaged pods at each picking, later the mean damage was calculated. Pod boring weevil *Apion clavipes* was observed by no. Of grubs in 100 randomly selected pods per replication by destructive sampling method. Population of blister beetle was recorded by no. Of beetles/ plant, from five (5) tagged plants in each plot before spraying, 3 DAS, 7 DAS and 10 DAS [12,13]. The data generated on mean pod borer population in pigeonpea were transformed to angular root transformation for normalization and then these values were subjected to statistical analysis using OPSTAT software to test the significance

1. results and discussion

3.1 pod boring weevil (*Apion clavipes*)

The cumulative mean pertaining to relative incidence of *Apion clavipes* in different insecticidal treated plots before spraying ranged from 3.47 to 5.33 per plant. Non-significant difference was observed among all the treatments indicating more or less uniform distribution of the pest in the experimental field during the period. However, post treatment results showed significant differences in mean grub population Among various treatment after three, seven and ten days after both the sprayings. The cumulative data of efficacy of insecticides against *Apion clavipes* revealed that highest percent reduction (75.89%) over control was recorded in Indoxacarb 14.5 SC @ 0.8ml/l treated plot after two sprays followed by lambda cyhalothrin 5 EC (71.24%), Deltamethrin 2.8 EC @ 1 ml/l (67.79%). However, the present finding are in contrast with [14,15] who concluded that the Cypermethrin 25 EC was comparatively effective in reducing the *Apion clavipes* on Pigeonpea.

Table 1.

3.2 Spotted pod borer (*Maruca vitrata*)

Before spraying, the cumulative mean of *maruca vitrata* incidence in the insecticide-treated plots ranged between 2.76 and 2.43 larvae per plant. The absence of significant differences among the treatments suggested a fairly uniform pest distribution across the experimental field. In contrast, after the treatments were applied, notable differences in mean larval populations were observed across treatments at three, seven, and ten days following both sprayings. Based on cumulative efficacy data, the most effective insecticide was chlorantraniliprole 18.5 SC at 0.3 ml/l, achieving a 78.18% reduction in larval population compared to the control after two sprays. This was followed by flubendiamide 480 SC at 0.2 ml/l (73.65% reduction) and indoxacarb 14.5 SC at 0.8 ml/l (73.46% reduction). This finding is also in confirmation with the findings of [16,17,18] who studied on Efficacy of different newer insecticides against Pigeonpea pod borer and reported that Chlorantraniliprole 18.5 EC was comparatively effective in reducing Spotted pod borer [19]. Table 2.

3.3. Blister beetle (*Mylabris pustulata*)

Prior to spraying, the cumulative mean incidence of *Mylabris pustulata* across the insecticide-treated plots ranged from 1.28 to 1.60 grubs per plant. The lack of significant variation among the treatments suggested a relatively even distribution of the pest throughout the experimental area. In contrast, after spraying, significant differences in mean grub populations were observed among the treatments at three, seven, and ten days following each application. Based on cumulative efficacy results, the highest reduction in grub population compared to the control (74.50%) was achieved with Deltamethrin 2.8 EC at 1 ml/l after two sprays. This was closely followed by Lambda-cyhalothrin 5 EC at 1 ml/l, which resulted in a 71.02% reduction, and Indoxacarb 14.5 SC at 0.8 ml/l, which showed a 67.84% reduction. The results of the present investigation is fully supported by the finding of [20,21] who studied on efficacy of different insecticides against blister beetle *mylabris pustulata* thunberg in pigeonpea and mungbean Table 3.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatment** | **First Spray** | | | | **Second Spray** | | | | |
| **Pre-treatment Count** | **Percentage reduction** | | | **Pre-treatment Count** | **Percentage reduction** | | | **Mean Reduction (%)** |
| **3 DAS** | **7 DAS** | **10 DAS** | **3 DAS** | **7 DAS** | **10 DAS** |
| **T1: Bacillus thuringiensis var. kurstaki 0.5% WP @ 2.5 g/L** | 4.40 | 69.69  (54.51) | 63.80 (54.08) | 58.08 (52.79) | 1.33 | 58.43 (49.85) | 54.32 (47.47) | 51.85 (46.06) | 59.36 |
| **T2: Chlorantraniliprole 18.5 SC @ 0.3 ml/L** | 2.60 | 71.36 (57.64) | 66.66 (54.73) | 63.53 (52.85) | 1.23 | 62.22 (52.07) | 57.40 (49.25) | 61.85 (51.85) | 63.83 |
| **T3: Flubendiamide 480 SC @ 0.2 ml/L** | 4.73 | 65.00 (53.72) | 62.77 (52.40) | 53.70 (47.12) | 1.13 | 54.78 (47.74) | 52.87 (46.64) | 50.57 (45.32) | 56.61 |
| **T4: Deltamethrin 2.8 EC @ 1 ml/L** | 2.56 | 73.05 (58.73) | 69.10 (56.23) | 67.42 (55.19) | 1.46 | 66.66 (54.73) | 68.05 (55.58) | 62.50 (52.23) | 67.79 |
| **T5: Lufenuron 5.4 EC @ 1.2 ml/L** | 4.00 | 62.62 (52.31) | 59.59 (50.53) | 50.30 (45.17) | 1.40 | 53.84 (47.20) | 50.42 (45.24) | 49.57 (44.75) | 54.39 |
| **T6: NSKE 5% @ 50 g/L** | 2.43 | 62.60 (52.30) | 57.26 (49.35) | 44.65 (41.93) | 1.33 | 52.46 (46.41) | 48.45 (44.11) | 46.29 (42.87) | 52.41 |
| **T7: Indoxacarb 14.5 SC @ 0.8 ml/L** | 4.86 | 77.63 (61.77) | 73.47 (58.99) | 70.97 (57.39) | 1.40 | 73.33 (58.91) | 76.66 (61.11) | 83.33 (65.90) | **75.89** |
| **T8: Lambda cyhalothrin 5 EC @ 1 ml/L** | 2.43 | 75.87 (60.58) | 71.19 (57.54) | 68.12 (55.62) | 1.26 | 70.57 (57.14) | 68.16 (55.65) | 73.57 (59.06) | 71.24 |
| **T0: Untreated Control** | 3.67 | 0.00 (0.05) | 0.00 (0.05) | 0.00 (0.05) | 1.47 | 0.00 (0.05) | 0.00 (0.05) | 0.00 (0.05) | 0.00 |
| **SEm±** | 0.11 | 0.79 | 0.92 | 0.93 | 0.15 | 1.05 | 0.68 | 0.67 | – |
| **CD (P=0.05)** | NS | 2.37 | 2.75 | 2.77 | NS | 3.15 | 2.04 | 2.02 | – |

**Table 1: Efficacy of different insecticides against Pod boring weevil, *Apion clavipes*, on Pigeonpea during July 2023 to December2023**

**Table:1: Efficacy of different insecticides against Pod boring weevil, *Apion clavipes* on pigeonpea during July 2023 to December 2023**

***Note:***  Figures in the table are mean values and those in parenthesis are angular transformed values.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatment** | **First Spray** | | | | **Second Spray** | | | | |
| **Pre-treatment Count** | **Percentage reduction** | | | **Pre-treatment Count** | **Percentage reduction** | | | **Mean Reduction (%)** |
| **3 DAS** | **7 DAS** | **10 DAS** | **3 DAS** | **7 DAS** | **10 DAS** |
| **T1: Bacillus thuringiensis var. kurstaki 0.5% WP @ 2.5 g/L** | 2.57 | 66.30  (54.51) | 65.59 (54.08) | 63.44 (52.79) | 1.33 | 65.00  (53.72) | 63.33 (52.73) | 61.66 (51.74) | 64.22 |
| **T2: Chlorantraniliprole 18.5 SC @ 0.3 ml/L** | 2.60 | 78.12  (61.23) | 72.54 (58.40) | 77.77 (61.87) | 1.23 | 79.08  (62.78) | 80.62 (63.88) | 82.62 (65.36) | **78.18** |
| **T3: Flubendiamide 480 SC @ 0.2 ml/L** | 2.53 | 77.46  (61.65) | 75.55 (60.36) | 75.23 (60.15) | 1.13 | 74.50  (59.67) | 72.54 (58.40) | 66.66 (54.73) | 73.65 |
| **T4: Deltamethrin 2.8 EC @ 1 ml/L** | 2.56 | 73.47  (59.00) | 70.96 (57.39) | 69.89 (56.72) | 1.46 | 69.19  (56.28) | 67.17 (55.04) | 65.15 (53.81) | 69.30 |
| **T5: Lufenuron 5.4 EC @ 1.2 ml/L** | 2.50 | 69.25  (56.32) | 67.03 (54.96) | 65.18 (53.84) | 1.40 | 67.19  (55.05) | 65.60 (54.05) | 61.90 (51.88) | 66.02 |
| **T6: NSKE 5% @ 50 g/L** | 2.43 | 65.62  (54.10) | 66.66 (54.73) | 62.50 (52.23) | 1.33 | 63.33  (52.73) | 62.77 (52.40) | 58.33 (49.79) | 63.20 |
| **T7: Indoxacarb 14.5 SC @ 0.8 ml/L** | 2.60 | 77.77  (61.87) | 74.74 (59.83) | 71.38 (57.65) | 1.40 | 74.60  (59.73) | 72.48 (58.36) | 69.84 (56.69) | 73.46 |
| **T8: Lambda cyhalothrin 5 EC @ 1 ml/L** | 2.43 | 74.81  (59.87) | 73.70 (59.14) | 68.88 (56.09) | 1.26 | 71.92  (58.00) | 70.17 (56.89) | 67.25 (55.09) | 71.12 |
| **T0: Untreated Control** | 2.76 | 0.00  (0.05) | 0.00 (0.05) | 0.00 (0.05) | 1.47 | 0.00  (0.05) | 0.00 (0.05) | 0.00 (0.05) | 0.00 |
| **SEm±** | 0.11 | 0.73 | 0.77 | 0.68 | 0.10 | 0.64 | 0.60 | 0.56 | – |
| **CD (P=0.05)** | NS | 2.18 | 2.31 | 2.03 | NS | 1.91 | 1.79 | 1.68 | – |

**Table 2: Efficacy of different insecticides against spotted pod borer, *Maruca vitrata* on Pigeonpea during July 2023 to December2023**

***Note:***  Figures in the table are mean values and those in parenthesis are angular transformed values.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatment** | **First Spray** | | | | **Second Spray** | | | | |
| **Pre-treatment Count** | **Percentage reduction** | | | **Pre-treatment Count** | **Percentage reduction** | | | **Mean Reduction (%)** |
| **3 DAS** | **7 DAS** | **10 DAS** | **3 DAS** | **7 DAS** | **10 DAS** |
| **T1: Bacillus thuringiensis var. kurstaki 0.5% WP @ 2.5 g/L** | 1.60 | 63.88 (53.06) | 59.25 (50.33) | 56.94 (48.99) | 1.00 | 58.97 (50.17) | 56.41 (48.68) | 54.70 (47.69) | 1.60 |
| **T2: Chlorantraniliprole 18.5 SC @ 0.3 ml/L** | 1.30 | 69.75 (56.63) | 66.66 (54.73) | 70.37 (57.02) | 1.06 | 67.36 (55.15) | 68.75 (56.01) | 63.19 (52.65) | 1.30 |
| **T3: Flubendiamide 480 SC @ 0.2 ml/L** | 1.46 | 67.17 (55.04) | 65.15 (53.82) | 62.12 (52.01) | 1.00 | 65.18 (53.84) | 64.44 (53.39) | 60.74 (51.20) | 1.46 |
| **T4: Deltamethrin 2.8 EC @ 1 ml/L** | 1.33 | 76.11 (60.74) | 73.33 (58.09) | 78.33 (62.25) | 1.00 | 72.59 (58.43) | 70.37 (57.02) | 76.29 (60.86) | 1.33 |
| **T5: Lufenuron 5.4 EC @ 1.2 ml/L** | 1.53 | 65.21 (53.86) | 64.73 (53.56) | 63.76 (52.99) | 1.33 | 63.33 (52.73) | 62.77 (52.40) | 60.00 (50.76) | 1.53 |
| **T6: NSKE 5% @ 50 g/L** | 1.46 | 62.12 (52.01) | 65.65 (51.71) | 60.10 (50.82) | 1.20 | 61.11 (51.42) | 59.87 (50.69) | 58.02 (49.61) | 1.46 |
| **T7: Indoxacarb 14.5 SC @ 0.8 ml/L** | 1.28 | 71.92 (58.00) | 68.42 (55.80) | 64.91 (53.67) | 1.20 | 68.51 (55.86) | 69.13 (56.25) | 64.19 (53.24) | 1.28 |
| **T8: Lambda cyhalothrin 5 EC @ 1 ml/L** | 1.40 | 74.60 (59.73) | 71.42 (57.68) | 73.01 (58.70) | 1.10 | 69.04 (56.19) | 66.66 (54.73) | 71.42 (57.68) | 1.40 |
| **T0: Untreated Control** | 1.60 | 0.00 (0.05) | 0.00 (0.05) | 0.00 (0.05) | 1.40 | 0.00 (0.05) | 0.00 (0.05) | 0.00 (0.05) | 1.60 |
| **SEm±** | 0.09 | 0.60 | 0.86 | 1.03 | 0.15 | 0.75 | 0.67 | 0.90 | – |
| **CD (P=0.05)** | NS | 1.80 | 2.56 | 3.10 | NS | 2.25 | 2.02 | 2.71 | – |

**Table 3: Efficacy of different insecticides against Blister beetle, *Mylabris pustulata* on Pigeonpea during July 2023 to December 2023**

***Note:***  Figures in the table are mean values and those in parenthesis are angular transformed values.

1. **CONCLUSION**

Out of 8 treatments, Indoxacarb 14.5 SC, Chlorantraniliprole 18.5 SC, Deltamethrin 2.8 EC were proved to be more effective against major pests of Pigeonpea. Indoxacarb 14.5 SC is more effective against *Apion clavipes*. Chlorantraniliprole 18.5 SC is more effective against *Maruca vitrata.* Deltamethrin 2.8 EC is most effective against *Mylabris pustulata.*

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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