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# Bio-Efficacy of Bio-Rational Insecticides against Pod Borer on Black Gram

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**ABSTRACT: An experiment on the bio-efficacy of bio-rational insecticides against insect pests infesting black gram was conducted at Agronomy farm, Rajasthan College of Agriculture, Udaipur during *Kharif*, 2018. The experiment was laid out in a randomized block design with three replications in uniformly sized plots measuring 5×4.5 m with three replications. The Variety PU-31 of black gram was sown during last week of June with row to row and plant to plant spacing of 45×15 cm$^2$, respectively. Among different treatments, indoxacarb 14.5 SC a.i./ha caused significant maximum reduction in the population of pod borer.**

**Keywords:** *Helicoverpa armigera*, bio-rational insecticides, incidence, management, black gram.

## INTRODUCTION

Pulses occupy a unique position in the agriculture economy of our nation, being the major source of plant proteins. The major pulses crop under cultivation includes black gram, chickpea, cowpea, green gram, pigeon pea, lentil, moth bean, and pea. Black gram (*Vigna mungo* L.) is the fourth most important short-duration pulse crop grown in India due to its nutritional and industrial values. Seeds of a black gram are very rich in protein (24 per cent) and phosphoric acid (385 mg 100 g-1) among pulses. Black gram is used in different food items all over the world. Its green fodder is very nutritive and specially fed to milch cattle (Jeswani and Baldev 1990).

The black gram is one of the important pulse crops grown throughout the country. The major districts of Rajasthan producing black gram are Bhilwara, Chittorgarh, Udaipur, Rajsamand, Banswara, Dungarpur, Bundi, Baran and Tonk. Though the crop is being cultivated over a large area, the production and productivity of the black gram are very low due to losses caused by various abiotic and biotic factors. Among biotic factor; insect pests are a major factor responsible for causing heavy losses in the yield of black gram and thus limit its production in the region. As many as 200 insect pests have been reported to infest black gram from sowing to the harvest (Talekar, 1990). The major insect pests causing economic losses to the crop are whitefly (*Bemisia tabaci*), leaf hopper (*Empoasca kerri*), gram pod borer (*Helicoverpa armigera*), aphid (*Aphis craccivora*) and blister beetle (*Mylabris pustulata*). The gram pod borer is the most prominent insect species that cause major economic damage to this crop. It was recorded that the yield loss in chickpea due to pod borer was 10-60 per cent in normal weather conditions while it was 50-100 per cent in favorable weather conditions (Kachhawa *et al*., 2017).

There are many insecticides of biological origin that are not only effective in managing the pest population but also safer to human beings, animal and environment health. Among bio-rational insecticides, several compounds have been proved to be very effective in reducing the pest infestations and losses caused by them in various crop ecosystems. Some biorational insecticides originated from microbes *viz.*, Emamectin benzoate, Spinosad, and insect growth regulator Novaluron are also reported to be effective against lepidopteran and coleopteran insect pests in pulse crops (Shinde, 2016). In the present investigation bio-rational management of gram pod borer infesting black gram was studied.

## MATERIALS AND METHODS

The experimental field was prepared during 1$^{st}$ week of July by ploughing using the disc plough followed by cross harrowing and planking. A well pulverized field was used for sowing the seeds of black gram. The seeds of black gram variety PU 31 were sown in well prepared field on 26$^{th}$ June 2018 with the seed rate of 15 kg/ha. The row-to-row distance and plant to plants spacing were maintained at 15 and 45 cm$^2$, respectively. Irrigation, hoeing, weeding and other cultural practices were followed as per the recommendations. Recommended

doses of fertilizers (20-25 kg N/ha and 40-50 kg $P_2O_5$/ha) were applied as basal application. The bio-efficacy of bio-rational insecticides against gram pod borer infesting black gram was conducted under natural infestation condition at Agronomy farm, Rajasthan College of Agriculture, Udaipur during *Kharif*, 2018. The Variety PU-31 of black gram was sown during last week of June with row to row and plant to plant spacing of 45×15 $cm^2$, respectively. In experiment was laid out in a randomized block design with three replications in uniformly sized plots measuring 5×4.5 m with three replications (Table 1). The seven treatments comprising of different bio-rational insecticides were applied in each replication when the pest population reaches economic threshold level (ETL). The insecticide application was repeated at 15 days interval. Two applications were done during the crop growth period.

**Table 1: Treatment details.**

| Sr. No. | Treatment | Dose (a.i./ha) |
|---|---|---|
| $T_1$ | Emamectin benzoate 5 SG | 12 g |
| $T_2$ | Spinosad 45 SC | 50 g |
| $T_3$ | Novaluron 10 EC | 75 g |
| $T_4$ | NSKE | 5% |
| $T_5$ | Indoxacarb 14.5 SC | 75 g |
| $T_6$ | Neem oil | 2% |
| $T_7$ | Control | - |

The observations on the population of pod borer were recorded from five randomly selected and tagged plants in each replication. The observations recorded before spraying and 3, 7 and 10 days after each spray. The population data thus recorded was converted into per cent reduction by using the correction factor given by Henderson and Tilton (1955) as under:

$$\text{Percent reduction in population} = 100 \left[ 1 - \frac{T_a \text{ X } C_b}{T_b \text{X } C_a} \right]$$

Where,

$T_a$= Number of insects after treatment in treated plot

$T_b$ = Number of insects before treatment in treated plot

$C_a$=Number of insects in untreated check after treatment

$C_b$= Number of insects in untreated check before treatment

The pod borer infestation was expressed as a mean percentage infestation.

$$\text{Mean infestation (\%)} = \frac{\text{No. of infested pods}}{\text{No. of total pods}} \text{x } 100$$

The increase in pod yield was calculated as yield in treated plots compared to untreated plots as follows:

$$\text{Per cent increase in yield} = \frac{\text{Yield in treated plot} - \text{Yield in untreated plot}}{\text{Yield in untreated plot}} \text{ x } 100$$

## RESULTS AND DISCUSSION

The experiment to evaluate the relative bio-efficacy of different bio-rational insecticides *viz.,* emamectin benzoate 5 SG @ 12 g a.i./ha, spinosad 45 SC @ 50 g a.i/ha (%), indoxacarb 14.5 SC a.i./ha, novaluron 10 EC @ 75g a.i./ha, NSKE 5% and neem oil 2% against pod borer infesting black gram was conducted during *Kharif* 2018 and the bio-efficacy of each treatment was studied in terms of mean reduction in the population of pod borer and pod damage over control. The data recorded on mean reduction have been presented in Table 2. The observations recorded on the mean larvae population at 3, 7, and 10 days after second sprays in black gram during *Kharif* 2018 are tabulated in Table 2 the insect. All the treatments were significantly superior over control in terms of reduction in the population of pod borer larva at three, seven and ten days after spraying. The application of indoxacarb 14.5 SC a.i./ha, was found most effective against pod borer with 65.78 per cent mean reduction in population of larva of pod borer at 3 days after spray during *Kharif* 2018. It was followed by spinosad 45 SC @ 50 g a.i/ha, emamectin benzoate 5 SG @ 12g a.i./ha and neem oil 2% which recorded 61.75, 53.42 and 48.47 per cent mean reduction in larval population, respectively. The above treatments were statistically at par to each other in reduction the pod borer population. The spray of NSKE 5% and novaluron 10 EC @ 75 g a.i./ha recorded 43.68 and 26.17 per cent mean reduction was found least effective among all the treatments in reducing pod borer in black gram during *Kharif* 2018.

At seven days after spraying, application of indoxacarb 14.5 SC a.i./ha was found most effective against pod borer with 85.78 per cent mean reduction in population of larva of pod borer during *Kharif* 2018. It was followed by spinosad 45 SC @ 50 g a.i/ha, emamectin benzoate 5 SG @ 12g a.i./ha and neem oil 2% which recorded 81.46, 77.71 and 53.70 per cent mean reduction in larval population, respectively. The above treatments were statistically at par to each other.

The spray of NSKE 5% and novaluron 10 EC @ 75 g a.i./ha recorded 50.29 and 75.80 per cent mean reduction and were found least effective among all the treatments in reducing pod borer in black gram during *Kharif* 2018. Similarly, at ten days after spraying application of indoxacarb 14.5 SC a.i./ha was found most effective against pod borer with 65.02 per cent mean reduction in population of larva of pod borer at 10 days after spray during *Kharif* 2018. It was followed by spinosad 45 SC @ 50 g a.i/ha, emamectin benzoate 5 SG @ 12g a.i./ha and novaluron 10 EC @ 75 g a.i./ha which recorded 64.05, 62.75 and 63.27 per cent mean reduction in larval population, respectively.

The above treatments were statistically at par to each other. The spray of neem oil @ 2 % and NSKE recorded 50.27 and 45.98 per cent mean reduction was found least effective among all the treatments in reducing pod borer in black gram during *Kharif* 2018.

**Table 2: Bio-efficacy of bio-rational insecticides against pod borer on black gram during *Kharif*, 2018.**

| Sr. No. | Treatment | Dose (a.i./ha) | Reduction (%) in Pod borer population (days after sprays) | | | | |
|---|---|---|---|---|---|---|---|
| | | | II Spray | | | | Mean pod damage % |
| | | | PTP | 3 DAS | 7 DAS | 10 DAS | |
| 1 | NSKE 5% | 5% | 15.67 (4.01) | 41.37 (43.68) | 45.17 (50.29) | 42.70 (45.98) | 22.58 (14.74) |
| 2 | Neem oil 2% | 2% | 12.3 (3.57) | 44.12 (48.47) | 47.12 (53.70) | 45.15 (50.27) | 21.82 (13.81) |
| 3 | Indoxacarb 14.5SC | 75g | 13.33 (3.70) | 54.20 (65.78) | 67.84 (85.78) | 53.74 (65.02) | 14.66 (6.41) |
| 4 | Spinosad 45SC | 50g | 13.00 (3.67) | 51.80 (61.75) | 64.50 (81.46) | 53.16 (64.05) | 16.29 (7.87) |
| 5 | Novaluron 10EC | 75g | 14.33 (3.85) | 30.77 (26.17) | 60.53 (75.80) | 52.72 (63.27) | 19.79 (11.46) |
| 6 | Emamectin benzoate 5SG | 12g | 13.67 (3.75) | 46.96 (53.42) | 61.83 (77.71) | 52.39 (62.75) | 16.66 (8.22) |
| 7 | control | | 13.67 (3.76 | | | | 29.06 (23.59) |
| | S.Em.± | | 0.14 | 2.58 | 1.80 | 2.51 | 1.12 |
| | C.D at 5% | | 0.45 | 8.12 | 5.66 | 7.92 | 3.46 |

* PTP- Pre treatment population, *DAS- Days after spray, * Figures in the parenthesis are retransformed per cent values

The observation on the pod damage by pod borer in black gram were recorded at 3, 7, 10 days after second spray during *Kharif* 2018 and have been tabulated in Table 2. The result revealed that the lowest mean pod damage per cent was recorded in indoxacarb 14.5 SC a.i./ha with 6.41 per cent mean damage and was significantly superior over all other treatments in reducing the per cent mean pod damage by pod borer complex in black gram during *Kharif* 2018. The treatment spinosad 45 SC @ 50 g a.i/ha, emamectin benzoate 5 SG @ 12 g /ha and novaluron 10 EC @ 75 g a.i./ha. recorded 7.87, 8.22 and 11.46 per cent mean pod damage, respectively and were statistically at par with each other. The spray of neem oil 2% and NSKE 5% which recorded 13.81 and 14.74 per cent mean damage was found least effective in reducing per cent mean pod damage among all the treatments during *Kharif* 2018.

The result of the experiment on bioefficacy against pod borer infesting blackgram and revealed that among different treatments tested**,** single spray of Indoxacarb 14.5 SC @ 75 g a.i./ha recorded maximum reduction of 65.78, 85.78 and 65.02 per cent in mean population at 3, 7 and 10 days after spray, respectively and minimum pod damage of 6.41 per cent was recorded, which was significantly superior over other treatments during *kharif* 2018 and was followed by spray of Spinosad 45 SC @ 50 g a.i/ha recorded reduction of 61.75, 81.46 and 64.05 per cent in mean population at 3, 7 and 10 days after spray, respectively. Spinosad 45 SC was found at par with emamectin benzoate 5 SG @ 12 g a.i./ha with reduction of 53.42, 77.71 and 62.75 per cent in mean population at 3, 7 and 10 days after spray, respectively. These findings are in agreement with that of Deshmukh *et al*. (2010) who studied the efficacy of indoxacarb, spinosad and emamectin benzoate against pod borers infesting chickpea and reported that these chemicals reduced the larval population of *H. armigera* by 71.58, 71.21 and 68.85 per cent in chickpea. Similarly, Babar *et al*. (2012) found that higher per cent reduction in larval population of *H. armigera* in chickpea with emamectin benzoate (91.47%), indoxacarb (91.47%), spinosad (90.64%) and novluron (86.66%). Similarly, Srinivasan and Durairaj (2007) found that spinosad 45SC @ 73 g a.i./ ha was the most effective against *H. armigera* followed by indoxacarb 14.8SC in pigeon pea. Babariya *et al.* (2010) observed that indoxacarb 0.0075% reported maximum mortality of *H. armigera* in pigeon pea. Thus, indoxacarb 14.5 SC a.i./ha can be recommended against pod borer, *H. armigera*.

## CONCLUSION

It can be concluded that among different treatments, effective treatments were emamectin benzoate 5 SG @ 12g a.i./ha and indoxacarb 14.5 SC a.i./ha. The

indoxacarb 14.5 SC a.i./ha caused significant maximum reduction in the population of pod borer.

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