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RESEARCH ARTICLE

EFFICACY OF DIFFERENT INSECTICIDES AGAINST GRAM POD BORER OF CHICKPEA UNDER FIELD CONDITION

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ABSTRACT

This study, conducted at the Agriculture Research Farm, SAGE University Indore, examined the effectiveness of various insecticides on controlling pod borers in Chickpea crops under field conditions. Testing different chemical molecules like Emamectin, Benzoate, Triazophos, Profenofos, Cypermethrin, Flubendiamide, Monocrotophos, Indoxacarb, and Fipronil, the research involved two sprays, with the first during pod formation and the second based on insect population levels. Assessing larval counts on selected plants, the findings highlighted Profenofos 50% EC at 1750ml/ha as the most effective treatment, reducing larval population by 63.05%, minimizing pod damage to 4.679%, and yielding 17.33 q/ha. Flubendiamide followed closely with a 58% reduction, 5.3396% pod damage, and a yield of 16.44 q/ha. These results emphasize the efficacy of Profenofos and Flubendiamide in managing pod borers in Chickpea cultivation.

Key words: *Biofilm production, Antimicrobial resistance, Contact killing, Cell division inhibition, Dispersal inhibition, Antimicrobial photodynamic therapy (APDT), Cold atmospheric plasma (CAP), Biofomics, Nanoparticles and Global burden.*

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INTRODUCTION

Chickpea, commonly known as "gram" or "chana," holds significant agricultural importance in the Indore region of India. This region, characterized by its diverse agro-climatic conditions, favors chickpea cultivation due to its adaptability to various soil types and climatic variations. Indore's agricultural landscape provides suitable conditions for chickpea growth, with the crop typically sown in the Rabi season (winter cropping) from October to November and harvested from February to April. Chickpea serves as a staple food and a vital source of protein in the local diet while contributing substantially to the region's agricultural economy. The cultivation of chickpea, a vital leguminous crop, faces significant threats from the gram pod borer (*Helicoverpaarmigera)* infestation, leading to substantial yield losses worldwide. Managing this pest is crucial to ensure optimal chickpea production. The present study delves into evaluating and comparing the efficacy of diverse insecticides against the gram pod borer under authentic field conditions. By examining the impact of various chemical compounds known for their distinct modes of action, this research aims to identify the most effective insecticide for controlling pod borer infestations in chickpea crops. The findings of this study hold promise in providing farmers and agricultural practitioners with valuable insights into selecting the most efficient insecticide to safeguard chickpea yields against the ravages of the gram pod borer.

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MATERIAL AND METHODS

The experiment, conducted at the Agriculture Research Farm, SAGE University Indore, during 2019-20, employed a randomized block design with nine treatments replicated three times in plots of size 2 x 1.50 m². The study focused on the chickpea variety JG 315, following recommended cultivation practices, except for plant protection measures. Two sprays were applied, the first during pod formation and the second based on insect population levels. Larval populations of the pod borer were recorded on three randomly selected plants in each plot, with pre-treatment and post-treatment observations taken at weekly intervals during the 2019-20 season.

The larval population percent reduction was calculated using the formula:

$$\text{Percent reduction in larval population} = \frac{\text{Larval population in control plot} - \text{larval population in treated plotd}}{\text{Larval population control plot}} \times 100$$

Additionally, data on healthy and damaged pods were recorded for each plot, and the percentage of infected pods was calculated before statistical analysis:

$$\text{Percent infected pods} = \frac{\text{Number of insect pods}}{\text{Total number of pods}} \times 100$$

The Benefit Cost Ratio (B:C) was calculated for each treatment by dividing the gross return per hectare by the cost of cultivation:

$$\text{Benefit Cost Ratio} = \frac{\text{Gross return}}{\text{Cost of cultivation}}$$

Statistical analysis was performed after arcsine transformation of the data to draw meaningful conclusions from the experiment's results.

RESULT AND DISCUSSION

Effects of Insecticidal Treatments on the Larval Population Reduction: During the Rabi season of 2019-20, all treatments were significantly superior to the control in controlling the larval population. Profenophos 50% EC at 1750 ml/ha emerged as the most effective treatment, reducing the larval population by 63.05%. However, it did not show a significant difference compared to Flubendamide 480 EC at 1000 ml/ha, Spinosad 45% EC at 220 ml/ha, Emmamectin Benzoate 5% SG at 220 gm/ha, Cypermethrin 10% EC at 850 ml/ha, Indoxacarb 14.5% SC at 400 ml/ha, Monocrotophos 36% SL at 1000 ml/ha, Fipronil 5% SC at 1750 ml/ha, and Triazophos 40% EC at 1500 ml/ha, which showed larval population reductions of 57.63%, 54.67%, 50.73%, 48.27%, 48.27%, 45.32%, 36.94%, and 30.04%, respectively. These findings align with previous studies by Kumar and Sarada (2015) and Singh et al. (2015), which also found these insecticides effective in reducing larval populations.

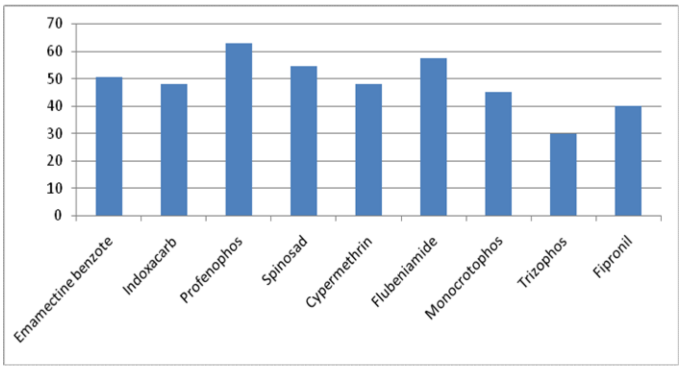

Fig.1. Effects of Insecticidal Treatments on the Larval Population Reduction

Effect of chemical treatment on pod damage: In assessing pod damage efficacy, all treatments demonstrated significant superiority over the control. The treatments with the least percentage of pod damage were observed in plots treated with Profenophos (4.679%), followed by Flubendamide (5.3396%), Spinosad 45 SC (6.67%), Emmamectin Benzoate 10EC (7.3396%), Indoxacarb 14.5 EC (8.00%), Cypermethrin 10% (8.679%), Monocrotophos 36% EC (10.6796%), Fipronil 5% SC (12.006%), and Triazphos (13.339%). These findings align with studies conducted by Sharma et al. (2016) and Patel and Chavadhari (2016), which also highlighted the effectiveness of these treatments against chickpea pod borer, showcasing their ability to significantly reduce pod damage.

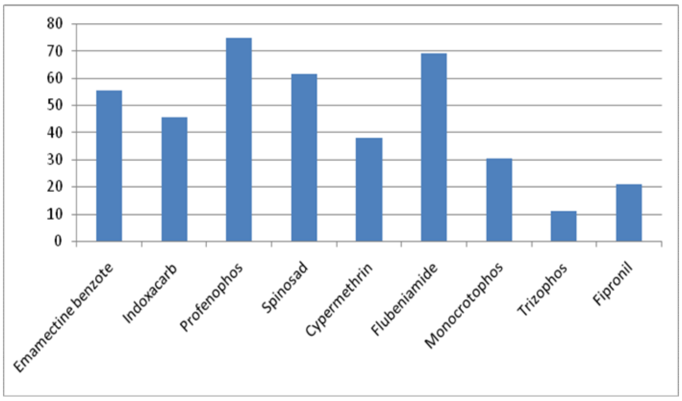

Fig. 2. Effect of chemical treatment on pod damage

Effect of chemical treatment on grain yield: In the yield assessment, Profenophos 50% EC at 1750 ml/ha resulted in the highest yield (17.33 q/ha) among treatments, outperforming Flubendamide 480 EC (16.44 q/ha), Spinosad 45% SC (15.55 q/ha), Emmamectin Benzoate 5% (14.48 q/ha), Indoxacarb 14.5 SC (13.51 q/ha), Cypermethrin 10% EC (12.53 q/ha), Monocrotophos 36% SL (11.82 q/ha), Fipronil 5% SC (10.84 q/ha), and Triazophos (10.04 q/ha). The avoidable yield loss percentages for these treatments, including Profenophos, were found to be 49.39%, 46.65%, 43.60%, 39.43%, 35.08%, 30.00%, 25.08%, 19.09%, and 12.64% respectively. These findings align with previous studies conducted by Kumar and Sarada (2015), Singh et al. (2015), Sharma et al. (2016), and Patel and Chavadhari (2016), validating the efficacy of these treatments in enhancing yield and minimizing avoidable losses in chickpea cultivation.

Cost Benefit Ratio: Among the various insecticide treatments, the plots sprayed with Indoxacarb displayed the highest cost-benefit ratio. Interestingly, even though Profenophos stood as the costliest treatment, its cost-benefit ratio was comparatively lower compared to others. The cost-benefit ratios for the insecticides were as follows: Indoxacarb: 1:7.70, Cypermethrin: 1:6.78, Flubendamide: 1:5.21, Spinosad: 1:3.05, Monocrotophos: 1:2.14, Emamectine Benzoate: 1:2.08, Triazophos: 1:1.54, Fipronil: 1:1.50, Profenophos: 1:1.10. Despite Profenophos being the costliest treatment, it had a lower cost-benefit ratio compared to Indoxacarb, which exhibited the most favorable cost-to-benefit return among the tested insecticides.

CONCLUSION

In conclusion, Profenophos 50% EC at 1750 ml/ha emerged as the most effective treatment, displaying superior larval population reduction compared to other treatments, while all treatments proved to be more effective than the control group. Notably, Profenophos-treated plots exhibited the minimum percentage of pod damage, highest grain yield, and the lowest avoidable yield loss, showcasing its overall effectiveness in protecting and enhancing chickpea production. On the contrary, Triazophos 40% EC at 1500 ml/ha exhibited less favorable outcomes, with higher percentages of pod damage, lower grain yield, and increased avoidable yield loss. The yield increase over the control was maximum with Profenophos-treated plots, while Triazophos-treated plots showed the highest percentage of yield loss. Furthermore, the economic analysis revealed that the plots treated with Indoxacarb 14.5 SC at 400 ml/ha demonstrated the highest cost-benefit ratio of 1:7.70, emphasizing its economic viability. In contrast, Profenophos 50% EC at 1750 ml/ha, despite being effective, showed a relatively lower cost-benefit ratio of 1:2, indicating a less favourable economic return compared to Indoxacarb. Overall, these findings underscore the multifaceted impact of insecticide treatments on various parameters, with Profenophos excelling in biological efficacy but exhibiting a comparatively lower economic efficiency.

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