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Efficacy of Different Insecticides for the Management of Stem Borer (Chilo partellus Swinhoe) in Sorghum

Vivek Kumar Saini[1], Dalip Kumar[2*] and Dilbag Singh Ahlawat[3]

1. Department of Zoology, Government College, Hisar-125001
2. Department of Entomology, CCS Haryana Agricultural University, Hisar-125004
3. CCS HAU, Regional Research Station, Rohtak-124001, India

* Corresponding Author: Email-dilipshroff@rediffmail.com

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Abstract

The efficacy of various insecticides on stem borer (Chilo partellus Swinhoe) in sorghum variety HC 308 was tested in a field experiment during 2016 at a farmer's Agricultural Farm, Chandan Nagar, Hisar, Haryana. The experiment was designed in the form of a Randomized Block Design where seven treatments existed which were various doses of carbofuran 3% CG and neem seed kernel extract (NSKE). Data concerning percent plant infestation and yielding of grains were noted. The findings showed that the most effective treatment was carbofuran 3% CG @ 10 kg/ha (T3) with the lowest infestation (16.12%), and highest yield (20.52 q/ha). NSKE treatments were moderately effective with the untreated control recording the highest infestation (53.68) and lowest yield (6.76 q/ha). Infestation was considerably less than control by all treatments. The paper shows that carbofuran is the best in managing stem borers, although more environmentally friendly solutions such as NSKE can provide moderate management.

Keywords: Sorghum, Chilo partellus, carbofuran, NSKE, stem borer, insecticide efficacy, yield

1. Introduction

Sorghum (*Sorghum bicolor* L. Moench) is a significant cereal crop that is widely grown in the tropical and subtropical parts of the world that utilize it as a staple food crop, nutritious feed crop and is a source of valuable industrial raw materials like bioethanol and starch. It is extremely drought-tolerant and can adapt to marginal soils, which is why it is relevant to semi-arid areas in

particular. Sorghum is cultivated in kharif and rabi seasons in the different agro climatic areas in India and contributes significantly to food and nutritional security particularly among the farmers who are resource poor. In spite of its significance, the productivity of sorghum is significantly limited by different biotic stressors with insect pests being of significant concern. The stem borer (*Chilo partellus* Swinhoe) is considered to be one of the most devastating and common pests of sorghum that severely damages the crops at various stages of its growth (Sharma, 1993). The larvae first feed on the leaf tissues and then bore into the stem leading to development of the dead hearts which is the drying up of the central whorl. This interstitial feeding interferes with the nutrient translocation and impairs the vegetative strength and eventually causes a serious decline in the grain production and quality of fodder. Under extreme cases of infestation, the loss of yield can be between 20 and 50 percent based on the environmental factors and the stage of crop growth. The key to maintaining the production of sorghum is therefore its effective management. Different control measures have been used to control this pest such as the cultural, biological and chemical methods. These include the chemical insecticides which include carbofuran which have gained massive adoption because of their rapid effect and the great efficiency in their ability to reduce the incidence of the pests. Nonetheless, issues of environmental safety, pesticide residues, and resistance development have caused the growth of attention to alternative methods. Another promising avenue is botanical pesticides specifically neem-based preparations like neem seed kernel extract (NSKE) which possess antifeedant, repellent and growth regulating effects (Koul et al., 2008). Even though these botanicals are relatively less toxic and less harmful to the non-target organisms, they are not always effective in field conditions. It is in this respect that the current research was conducted to determine the relative effectiveness of various insecticides (including various doses of carbofuran and various concentrations of NSKE) in managing stem borer infestation in sorghum. The objective of the study is to find out beneficial and cost-effective management solutions to reduce the destruction of pests and to increase crop yield.

2. Materials and Methods

Experimental Site

The experiment was performed in the year 2016 a farmer's Agricultural Farm, Chandan Nagar, Hisar, Haryana.

Experimental Details:-

Crop Variety: HC-308

Plot Size: 3 x 5 m^2

Spacing: 25 x 10 cm

Design: Randomised Block Design (RBD)

Replications: 3

Treatments T1: Carbofuran 3% CG @ 6.6 kg/ha T2: Carbofuran 3% CG @ 8.33 kg/ha T3: Carbofuran 3% CG @ 10 kg/ha T4: NSKE 5% T5: NSKE 10% T6: NSKE 15% T7: Control

Application of Treatments Carbofuran was laid on the soil and NSKE was sprayed at 15^{th} and 30^{th} day after sowing (DAS).

Observations Recorded

The counting of number of infested plants was done in one middle row in each plot before insecticide application (DBS) and 7 days after insecticide application. Grain yield (q/ha) was recorded. Statistical Analysis ANOVA and Critical Difference (CD) at 5% level were used to analyze and compare the treatment means respectively.

3. Results

The findings of the current research greatly demonstrated that the various insecticidal treatments showed a strong impact on the stem borer infestation and grain yield of sorghum, which showed significant variation in the treatments. The degree of infestation and the productivity of crops was highly dependent on the kind of insecticide used and its amount. Carbofuran 3% CG at 10 kg/ha (T3) was the most effective of all the treatments since it had the lowest infestation of the stem borers (16.12%) after the second spray as well as the highest yield of grain (20.52 q/ha). The better performance of this treatment could be explained by the increased dose and systemic activity of carbofuran which guaranteed the crop protection by the efficacious larvae control in the stem. Carbofuran 3% CG in its form of T2 (8.33 kg/ha) was found to be already to the next best treatment and exhibited significant level of infestation reduction and relatively high yield (19.54 q/ha). It

had a slightly lower efficacy than T3 but this still indicated that carbofuran at moderate doses can be used to offer good control against stem borer. The neem-based treatments (NSKE), on the contrary, had a moderate efficacy. Of these, NSKE 5% (T4) had relatively high infestation (21.31%) and yield (16.53 q/ha) implying that lower levels of neem extract were less helpful in reducing the population of the pest. Nonetheless, an increase in the level of NSKE (T5 and T6) provided a slight performance improvement, which implies a dose-dependent effect, but the effect was still worse than a carbofuran. Treatment T7 had the most infestation (53.68) and the lowest grain yield (6.76 q/ha), which is a clear indication of the drastic effect of infestation of the stem borers on crop production when there is no control of the posing agents. The significant difference between the treatment and control plots demonstrates the significance of applying pest management interventions in a timely manner. Statistical analysis also showed that the treatment plots were much better than the control in controlling infestation by stem borers, and high yield. Nevertheless, comparison between the plots treated (and not the control) revealed that the difference in the level of infestation was mostly non-significant, especially following the application of the insecticides. This implies that even though the treatment methods were all effective in reducing the incidence of pests, they did not necessarily differ statistically in their ability to control infestation. Conversely, the statistical significance of yield differences across treatments showed that even minor differences in the pest control effectiveness succinctly translated into quantifiable differences in crop productivity. On the whole, the findings indicate that there is a significant negative correlation between stem borer infestation and yield, which proves that a successful pest management is directly related to the increase in productivity in sorghum.

Table 1: Efficacy on different insecticides against stem borer, *Chilo partellus* Swinhoe in sorghum crop (HC 308)

Treatments	Per cent infested plants per middle row per plot				Yield (q/ha)
	Ist spray (15 DAS)		2nd spray (30 DAS)		
	DBS	7 DAS	DBS	7 DAS	
T1	4.17	7.34	14.63	18.27	18.90

T2	7.34	4.17	13.48	17.11	19.54
T3	4.17	4.17	11.99	16.12	20.52
T4	7.34	8.82	18.27	21.31	16.53
T5	4.17	7.34	16.12	19.42	17.35
T6	4.17	4.17	13.15	17.28	17.65
T7	7.34	24.62	39.85	53.68	6.76
CD at 5%	NA	11.03	6.05	7.82	0.53

4. Discussion

The results of the current research evidence clearly show that carbofuran was very effective in the management of the stem borer infestation in sorghum. Of all the treatments tested, Carbofuran 3% CG 10 kg/ha was the most successful which can be explained by the fact that this is a systemic treatment and has a long-term residual toxicity in the soil. Carbofuran is a systemic insecticide, and the roots of the plant easily absorbs this pesticide and later translocate in the plant's tissues, therefore, providing internal protection against the larvae of *Chilo partellus.* Insecticides that can be used to control them are not always effective considering that the larvae bore into the stem and are hidden in plant tissues. Carbofuran on the contrary, does not impact the plant system which leads to a higher larval kill and the protection of the plant larva during a critical period in its development. The increased efficacy at 10 kg/ha dose relative to the lower dosage also indicates the presence of dose effecting the response where greater the concentration the higher the persistence, bioavailability of the active ingredient with consequent higher pest suppressing effect. This then ends up in less infestation and more production of grain as the current study has seen. The obtained results are closely correlated with the previous data provided by Jose et al. (2007), who found out that carbofuran could greatly decrease the damage of the stem borer and registered the lowest percentage of dead hearts in comparison with the ones treated with neem and untreated plots. All these studies support the reliability and consistency of carbofuran as a good management tool of controlling stem borers in sorghum. Conversely, the neem-based remedies like NSKE showed moderate levels of controlling the infestation of stem borers. In spite of the fact that NSKE treatments stopped infestation as compared to control without the treatment, they proved to be less

efficient than carbofuran. This could be as a result of the mechanism of action of the compounds of neem which are rather antifeedants, repellents and insect growth regulators as opposed to being toxicants. This leads them to have a smaller effect when they encounter already established larvae within the stem. These results are in line with those of Spurthi and Shekharappa (2007) who found that neem extracts have the ability to reduce the number of pests but are typically slower and less effective in pest control than synthetic insecticides. Although they are relatively less efficient, the neem based formulations are very important in sustainable agriculture because they are environmentally friendly, biodegradable and non-toxic to non-target organisms including natural enemies. Thus, they can be successfully included into the Integrated Pest Management (IPM) systems, especially in combination with the cultural and biological means of control to decrease the level of chemical insecticides use. The present study found that there was a strong negative correlation between stem borer infestation and the grain yield meaning that the high incidence of the pest is directly correlated with a decrease in yield. Management of the pest hence is very important in improving crop productivity. Although carbofuran has proven the most effective, its application should be effectively looked into because of the issues associated with environmental pollution, non-target organismal toxicity, and legal limitations in multiple areas.

5. Conclusion

Carbofuran 3 percent CG 10 kg/ha was discovered as the most efficient intervention in the management of stem borer in sorghum, which brought about least infestation and greatest yield. The use of NSKE treatments is moderate and can be considered as eco-friendly alternatives. A combination of both chemical and botanical management and cultural control is suggested as the way to manage stem borer sustainably.

6. References

- Al-Ghuraiz, Y., et al. (2010). Effectiveness of granular insecticides against stem borers. *Crop Protection*, 29(5): 456–460.
- Balikai, R.A., & Bhagwat, V.R. (2001). Management of sorghum stem borer using insecticides. *Karnataka Journal of Agricultural Sciences*, 14(2): 456–459.
- Dhillon, M.K., & Sharma, H.C. (2012). Integrated pest management strategies for sorghum. *Indian Journal of Entomology*, 74(1): 1–10.

- Gupta, G.P., & Rani, S. (2009). Bioefficacy of neem products against insect pests. *Indian Journal of Entomology*, 71(4): 315–320.
- Jose, S., Nair, M.R.G.K., & Mathew, T. (2007). Evaluation of neem-based formulations against stem borer in sorghum. *Journal of Tropical Agriculture*, 45(1-2): 45–48.
- Koul, O., Walia, S., & Dhaliwal, G.S. (2008). Essential oils as green pesticides: Potential and constraints. *Biopesticides International*, 4(1): 63–84.
- Kumar, R., & Singh, S. (2015). Efficacy of insecticides against stem borer in sorghum. *Journal of Applied and Natural Science*, 7(2): 850–854.
- Sharma, H.C. (1993). Host plant resistance to insects in sorghum and its role in pest management. *Crop Protection*, 12(1): 11–34.
- Spurthi, G.S., & Shekharappa (2007). Evaluation of neem-based formulations against sorghum stem borer, *Chilo partellus*. *Indian Journal of Plant Protection*, 35(2): 200–203.
- Singh, B.U., & Rana, B.S. (2008). Influence of host plant resistance on stem borer damage in sorghum. *Indian Journal of Plant Protection*, 36(2): 230–234.

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