Biological Forum – An International Journal **14(2): 1555-1558(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Impact of Various Modules on Ants and Coccinellids of Fall Armyworm, *Spodoptera frugiperda* (J. E Smith) in Maize Ecosystem

Kavyashree B.A., Sharanabasappa S. Deshmukh**, Kalleshwaraswamy C.M., Shivanna B.K. and Sridhar S.
Department of Entomology, Department of Agronomy, College of Agriculture,
Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga (Karnataka), India.

(Corresponding author: Sharanabasappa S. Deshmukh)*

(Received 24 April 2022, Accepted 20 June, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: It is crucial to thoroughly understand the natural enemies to develop an environmentally sound pest management approach. This has made it necessary to assess various modules against *Spodoptera frugiperda* in maize. Different modules were tested in the field against *S. frugiperda*, and their impact on its natural enemies specifically on ants and coccinellids in maize during the Rabi 2019-20 were tested. The results revealed that the Bio Intensive Pest Management (BIPM) module was ultimately the most promising, with respect to density of ants and coccinellids and effective conservation of natural enemies, despite the fact that the Farmers Practice (FP) and Integrated Pest Management (IPM) modules had lower larval populations and less damage, indicating the suitability and feasibility of BIPM in maize ecosystems by augmenting natural enemies.

Keywords: Fall armyworm, *Spodoptera frugiperda*, Ants, Coccinellids, Module, IPM, Farmers practice, Bio-intensive.

INTRODUCTION

Fall armyworm (FAW), *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae), native to the Americas and is known to attack a large number of crops. This recently invaded pest has out crossed the damage of other pests of maize, causing considerable damage (CABI, 2019). The economic losses of crop yield from FAW can reach between 15-73 per cent worldwide in maize alone (Guo *et al.*, 2018). The development of integrated pest management (IPM) solutions is necessitated by the growing challenges caused by the ongoing use of pesticides and the inability of control strategies to keep insect populations under check. IPM has received more attention as a potential strategy for lowering reliance on chemical pest management and promoting the cultivation of maize and its long-term viability (Pretty and Bharucha, 2015; Bista *et al.*, 2020). As a result, numerous IPM solutions must be developed and assessed to sustain maize yield while minimizing adverse environmental effects. As a result, the current study is being carried out to incorporate eco-friendly inputs in IPM modules against the natural enemies of *S. frugiperda* in the maize ecosystem.

MATERIAL AND METHODS

The experimental sites were located at the Agricultural and Horticultural Research Station (14.2959° N, 75.8323°E), Kathalagere, Davanagere, and the farmer's field (14.1435°N, 75.5539°E), Surahonne village of Honnali taluk of Davanagere district of Karnataka, Both the sites experience a semi-arid climate (Central dry zone, KA-4) with an average annual rainfall of 567 mm. The fields selected for the study were equipped with all the required agricultural practices except recommended plant protection measures. The maize hybrid, CP-818, was sown at 60 cm × 30 cm spacing with a plot size of 125 m^2 for each module. The experiments were laid in Randomized Block Design (RBD) in both the years, *i.e.*, *Rabi* 2020 and *Rabi* 2021. The observations on infestations by fall armyworms on maize crop were recorded weekly on 20 randomly selected maize plants from each of the five replications. The following observations were recorded in each module. The population of natural enemies from twenty randomly selected maize plants from five points in each module was counted weekly, from 15 days after sowing up to 50 days after sowing. The data were analyzed and subjected to one-way ANOVA with SPSS software for pooled data and are presented with a level of significance of 5% (p=0.05). Treatment details of various modules used in the study are provided below (Table 1).

RESULTS AND DISCUSSION

Coccinellids population was recorded based on their number. Adult coccinellids *viz.*, *Coccinella septempunctata*, *Coccinella transversalis*, *Harmonia* sp., *Scymnus* sp. were recorded in various modules.

Table 1: Treatment details.

Module 1.	
	Bio intensive module
1.	Installation of pheromone traps (10 /ha) at the time of sowing
2.	Removal of egg masses and neonates. Performed at fortnightly interval from 15 DAS upto 49 DAS.
3.	Spraying of sugar solution 10 % to the plants. Two sprays at fortnightly interval, 1st at 15 DAS and 2nd at 30 DAS.
4.	Spraying of *Metarrhizium rileyi* @ 3 g/lt. Two sprays at 21 DAS and 35 DAS.
Module 2.	
	IPM module
1.	Installation of pheromone traps (10 /ha) at the time of sowing
2.	Removal of egg masses and neonates. Performed at fortnightly interval from 15 DAS.
3.	Spraying of *Metarrhiziumrileyi* @ 3g/lt. Single spray at 15 DAS.
4.	Spraying of emamectin benzoate @ 0.5g/lt. Single spray at 21 DAS.
Module 3:	
	Chemical control module
1.	Seed treatment with cyantraniliprole 19.8 % + thiamethaxam 19.8 % (Fortenza duo) @6 ml/kg of seed
2.	Spraying of emamectin benzoate 5 SG @ 0.5g/lt. At 15 DAS.
3.	Spraying of chlorantraniliprole18.5 SC @ 0.4ml/lt. At 28 DAS.
Control	No plant protection measures were applied, served as an untreated control

There was no significant difference in the density of coccinellids in all the modules, including the untreated control at 14 DAS in both years. Bio intensive module (0.64/plant) showed higher coccinellids density, followed by the IPM module (0.40/plant). Significantly higher number of coccinellids was recorded in the bio-intensive module (0.50/plant), whereas, IPM module (0.16/plant) and chemical control module (0.18/plant) showed lower number in the coccinellids at 28 DAS. The average number of coccinellids population on different days after sowing, the bio-intensive module (0.51/plant) recorded a higher number of coccinellids, followed by the IPM module (0.36/plant). The chemical control module (0.24/plant) recorded the least coccinellids density. Untreated control (0.33/plant) also exhibited a considerable amount in coccinellids, comparable to the IPM module (0.36/plant). The chemical control module recorded the lowest number in coccinellids (0.18/plant). Whereas remaining modules, including control, showed a significantly higher number of coccinellids at 14 DAS. Bio intensive module recorded the highest number of coccinellids (2.18/plant), and the lowest number (0.10/plant) was recorded in the chemical control module. At 28 DAS, the bio-intensive module exhibited a higher number of coccinellids (1.86/plant). The bio-intensive module recorded a significantly higher number of coccinellids at 42 DAS (1.73) and 49 DAS (1.65). The chemical control module recorded the least coccinellids density (0.22/plant) (Fig. 1).

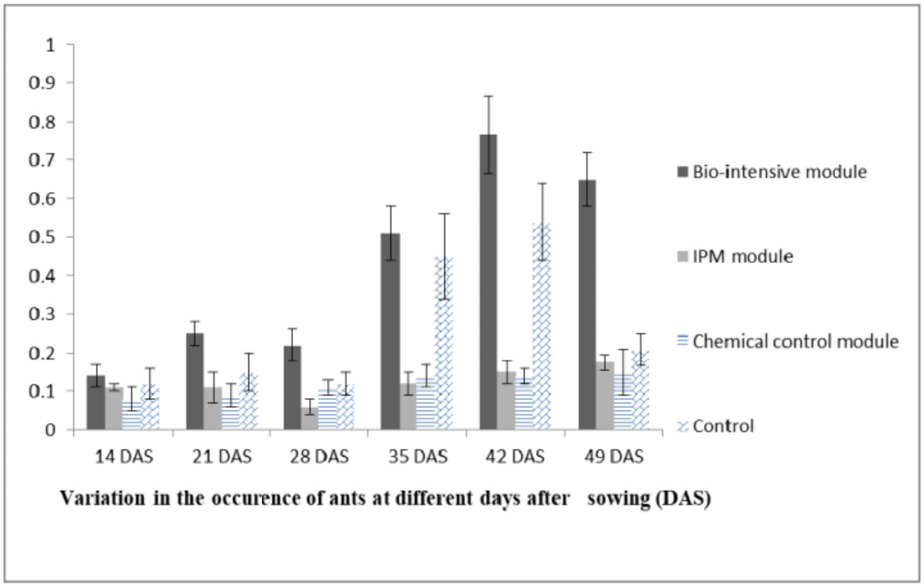

Fig. 1. Pooled data on density of coccinellids in various modules of rabi2019-20 and 2020-21.

Variation in the population of ants, *Camponotus sericeus* were recorded. There was no significant difference in all the modules tested and the density of ants was on par with each other at 14 and 21 DAS. The significant difference in ant density was observed at 28 DAS, where highest density were recorded in bio intensive module (0.22). Similarly, highest ant density was recorded at 35 (0.51/plant), 42 (0.76/plant) and 49 DAS (0.65/plant) in bio-intensive module. The chemical control module (0.12/plant) and IPM module (0.12/plant) recorded the lowest ants density during crop growth. The highest density in ants was recorded in the bio-intensive module (0.42/plant) (Fig. 2). Ompraksh *et al*. (2020) recorded variation in coccinellids from 2-3 per plant in several modules. The highest density was reported in Module II, consisting of 10 days after germination (DAG)-Azadirachtin 1500 ppm (5ml/litre), 20 DAG- Bt formulation (2 g/lire), 30 DAG-Emamectin benzoate (0.4 g/litre), 40DAG-Spinetorum (0.5 ml/litre). Two sprays of sugar solution (10%) at 15 and 30 DAS have increased ant density in the bio-intensive module. Our results are in conformity with Canas and O'Neil (1998), who reported an increase in ant population in sugar-treated maize. The application of sugar in maize fields enhanced the number of individual natural enemies, linked to lower leaf area damage and whorl infestations. By preserving the natural enemies, sugar could play a vital role in a fall armyworm pest management programme (Canas and O’Neil 1998). Ants, particularly *S. geminata*, have been identified as major predators of early instar fall armyworms, and ants have been linked to fall armyworm dynamics (Perfecto, 1991). Canas and O'Neil (1998) observed that spraying corn with white sugar at a rate of 17 kg/ha of white sugar enhanced the number of *Solenopsis geminata* (Fabricius) (Hymenoptera: Formicidae). Similarly, Bortolotto *et al*. (2014) showed the highest number of parasitized fall armyworms (11.38%) treated with white sugar and also showed higher parasitism caused by white sugar and molasses treatment reduced neither pest population nor leaf injuries, and their treatment with white sugar and molasses increased the parasitism of *S. frugiperda*, but did not reduce the fall armyworms in the field. Their treatment with the application of sugar was nowhere related to the occurrence of ants and they observed ants only in one particular season.

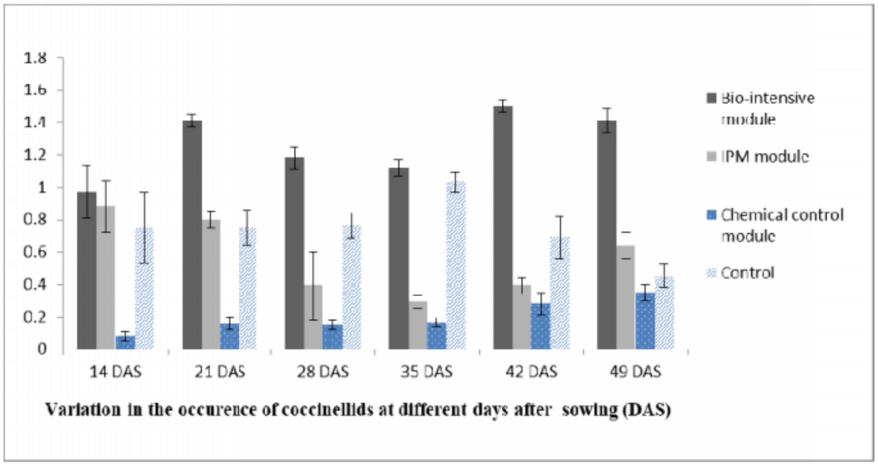

Fig. 2. Pooled data on density of ants in various modules ofrabi2019-20 and 2020-21.

CONCLUSION

The bio-intensive module was effective in maintaining the ants and coocinellids population in maize crop. Thus, contributing the higher natural enemies population in controlling the target pest.

FUTURE SCOPE

Evaluation of IPM modules with other natural enemies including egg parasitoids of *Spodoptera frugiperda* could be checked to know the efficacy on the pest.

Acknowledgement. The authors acknowledge the College of Agriculture, KSNUAHS, Shivamogga, Karnataka, India for providing all the facilities to carryout this research work.
Conflict of Interest. None.

REFERENCES

Bista, S., Thapa, M. K. and Khanal, S. (2020). Fall armyworm: Menace to Nepalese farming and the integrated management approaches. *International Journal of Agriculture Environment and Biotechnology*, *5*: 1011-1018.

Bortolotto, O. C., Menezes, A. D. O., Hoshino, A. T., Carvalho, M. G., Pomari-Fernandes, A. and Salgado-Neto, G. (2014). Sugar solution treatment to attract natural enemies and its impact on fall armyworm *Spodoptera frugiperda* in maize fields. *Interciencia*, *39*: 416.

CABI (2019). *Spodoptera frugiperda*. Retrieved from Invasive Species Compendium: https://www.cabi.org/isc/datasheet/29810

Canas, L. A. and O'neil, R. J. (1998). Applications of sugar solutions to maize, and the impact of natural enemies on fall armyworm. *International Journal of Pest Management*, *44*: 59-64.

Guo, J. F., Zhao, J. Z., He, K. L., Zhang, F. and Wang, Z. Y. (2018). Potential invasion of the crop devastating insect pest fall armyworm *Spodoptera frugiperda* to China. *Plant Protection*, *513*: 1-10.

Omprakash, S., Srinivasa Reddy, S., Lavakumar Reddy, M. and Uma Reddy, R. (2020). Evaluation of different modules for the management of fall army worm *Spodoptera frugiperda* in maize. *Journal of Pharmacognosy and Phytochemistry*, *9*: 1765-1767.

Perfecto, I. (1991). Ants (Hymenoptera: Formicidae) as natural control agents of pests in irrigated maize in Nicaragua. *Journal of Economic Entomology*, *84*: 65-70.

Pretty, J. and Bharucha, Z. P. (2015). Integrated pest management for sustainable intensification of agriculture in Asia and Africa. *Insects, 6*: 52-182.

How to cite this article: Kavyashree, B.A., Sharanabasappa, S. Deshmukh, Kalleshwaraswamy, C.M., Shivanna, B.K. and Sridhar, S. (2022). Impact of Various Modules on Ants and Coccinellids of Fall Armyworm, *Spodoptera frugiperda* (J. E Smith) in Maize Ecosystem. *Biological Forum – An International Journal*, *14*(2): 1555-1558.