The Pharma Innovation Journal 2022; SP-11(5): 309-312

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(5): 309-312
© 2022 TPI
www.thepharmajournal.com
Received: 09-03-2022
Accepted: 12-04-2022

Saurabh Jaiswal
Department of Entomology, Raj Mohini Devi College of Agriculture and Research Station, Indira Gandhi Krishi Vishwavidyalaya, Chhattisgarh, India

Shani Raj
Department of Entomology, Raj Mohini Devi College of Agriculture and Research Station, Indira Gandhi Krishi Vishwavidyalaya, Chhattisgarh, India

PK Bhagat
Department of Entomology, Raj Mohini Devi College of Agriculture and Research Station, Indira Gandhi Krishi Vishwavidyalaya, Chhattisgarh, India

GP Painkra
Department of Entomology, Raj Mohini Devi College of Agriculture and Research Station, Indira Gandhi Krishi Vishwavidyalaya, Chhattisgarh, India

Corresponding Author
Shani Raj
Department of Entomology, Raj Mohini Devi College of Agriculture and Research Station, Indira Gandhi Krishi Vishwavidyalaya, Chhattisgarh, India

Pest complex and extent of damage caused by fall army worm (*Spodoptera frugiperda*) in maize

Saurabh Jaiswal, Shani Raj, PK Bhagat and GP Painkra

Abstract
The experiment was conducted at Research-Cum-Instructional Farm of the Raj Mohini Devi College of Agriculture and Research Station; Ambikapur (C.G.) during *kharif* 2019 under field condition to determine the bio efficacy of different pesticides against the fall army worm (*Spodoptera frugiperda*) on maize. The data related to dead heart percentage were recorded on randomly ten selected plants. The maximum dead heart percentage were observed during 38th SMW *i.e.* 14th-22nd September and 39th SMW *i.e.* 30th Sept-08 Oct. (60%). After that during 42nd SMW *i.e.* 24th Oct-1st Nov. the minimum dead heart percentage were observed (10%). This was paramount importance in designing a determine the bioefficacy of different pesticide control program for fall armyworm, either through conservation of native natural enemies or augmentative release.

Keywords: FAW, incidence, maize, pest complex, *Spodoptera frugiperda*

1. Introduction
Maize is the most important staple food crop in India, where it is grown predominantly by smallholder farmers. Currently, however, the production of maize is threatened by the fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae). The pest, which is highly polyphagous, causing economic damage in various crops such as maize, sorghum, beans and cotton (Abrahams *et al.*, 2017; Day *et al.*, 2017) [6]. This invasive pest was first reported in West Africa in late 2016 (Goergen, Kumar, Sankung, Togola, & Tamo, 2016) [7]; by early 2017, the pest invaded Sub- Saharan Africa. Recent reports confirmed the occurrence of fall armyworm in 28 countries. threatening the food security of millions of people. Recent studies conducted by Centre for Agriculture and Biosciences International in 12 maize producing countries showed that, without control, fall armyworm can cause maize yield losses ranging from 8.3 m to 20.6 m tonnes per year (Day *et al.*, 2017) [6].
Soon after the occurrence of FAW infestation, a massive spraying programme of chemical insecticides was deployed by governments of African countries. However, most smallholder farmers in Africa cannot afford repeated sprays of insecticides and Bt maize is not available in Africa. Furthermore, excessive use of chemical insecticides removes potential natural enemies, negatively impacts human and livestock health, leads to resistance development in target pests and increases crop production costs
In general, the excessive usage of insecticides and associated risks has raised food safety and sustainability concerns. This highlights the need for development of integrated pest management (IPM) strategies that suit the needs of the African smallholder farmers. Furthermore, FAW being a recent invader in the continent, information on natural enemies associated with this pest is not well-documented for Africa. A wide range of natural enemies, including parasitoids, arthropod predators and entomopathogens attack FAW in its native region. For example, Molina-Ochoa *et al*. listed about 150 species of parasitoids of FAW in the Americas and Caribbean. Some species of egg and larval parasitoids have been reported in East and West Africa.
Maize is cultivated on an area of 8.69 mha with a production of 21.80 million tonnes and productivity of 2509 kg/ ha (Anonymous, 2016) [1]. Rajasthan is one of the major maize growing states in India covering an area of 0.88 mha with a production of 1.14 million tonnes and productivity of 1318 kg/ ha (Anonymous, 2016) [1]. Maize can be grown in both rabi and kharif seasons in Chhattisgarh, but it is a major kharif season crop in the maize growing districts. The area under rabi maize is increasing in Ambikapur, Bilaspur, Raipur and korba etc. districts of the state where irrigation facilities are available.

2. Materials and Methods

The experiment was undertaken at Research Cum Instructional Farm of the Raj Mohini Devi College of Agriculture and Research Station, Ambikapur (C.G.) during *kharif* 2019. In the field experiment, each treatment was demarcated during the seasons with the following technical program.

In a plot size of 5x3 m^2area, maize variety "JKMH-502" was sown. Observations of fall armyworm and other insect pests population were recorded from their appearance on plants till harvest at different intervals. Ten plants were selected randomly at per plot for the study of fall armyworm and many other insect pest by the direct visual counting method at weekly interval during morning hours, without disturbing the pest fauna. The observed populations were correlated with the meteorological data during the study period.

3. Results and Discussion

3.1 Leaf injury rating scale (1 to 9 scale by Nagarjuna and Manjunath, 2015) [8].

The data related to leaf injury rating (number of pin holes) on leaves were recorded on randomly ten selected plants. The data regarding no. of pin holes, leaf injury rating, dead heart percentage were recorded.

Table 1: Leaf injury rating scale (1 to 9 scale by Nagarjuna and Manjunath, 2015)

Rating scale	Description	Category
1	1-5 pin holes/ plant	Resistant
3	>5-10 pin holes/ plant	Moderately resistant
5	>10-20pin holes/ plant	Moderately susceptible
7	>20-30 pin holes/plant	Susceptible
9	>30 pin holes/plant	Highly susceptible

3.2 Indicating maize leaf rating scale

Table 2: Indicating maize leaf rating scale

Explanation/definition of damage	Rating
No visible leaf damage;	0
Only pin-hole damage;	1
Pin-hole and small circular hole damage to leaves.	2
Pinholes, small circular lesions and a few small elongated (rectangular shaped) lesions of up to 1.3 cm in length present on whorl and furl leaves.	3
Several small to mid-sized 1.3 to 2.5 cm in length elongated lesions present on a few whorl and furl leaves	4
Several large elongated lesions greater than 2.5 cm in length present on a few whorl and furl leaves and/or a few small to mid-sized, uni-form to irregular shaped holes (basement mem-brane consumed) eaten from the whorl and/or furl leaves.	5
Several large elongated lesions present on several whorl and furl leaves and/or several large uniforms to irregular shaped holes eaten from furl and whorl leaves.	6
Many elongated lesions of all sizes present on several whorl and furl leaves and/or several large uniform to irregular shaped holes eaten from the whorl and furl leaves.	7
Many elongated lesions of all sizes present on most whorl and furl leaves plus many mid to large sized uniform to irregular shaped holes eaten from the whorl and furl leaves.	8
Whorl and furl leaves almost totally destroyed.	9

3.3 No. of pin holes per 10 plants

The data related to number of pin holes on leaves were recorded on randomly ten selected plants. The maximum pin holes on leaves were observed during 37th SMW *i.e.* 14th-22nd September (25.00 per 10 plants) when the larvae of fall army worm is maximum. After that during 42nd SMW *i.e.* 24th Oct-1st Nov. the minimum pin holes were observed (3.10per 10 plants).

3.4 Dead heart percentage

The data related to dead heart percentage were recorded on randomly ten selected plants. The maximum dead heart percentage were observed during 38th SMW *i.e.*14th-22nd September and 39th SMW *i.e.* 30th Sept-08 Oct. (60%). After that during 42nd SMW *i.e.* 24th Oct-1st Nov. the minimum dead heart percentage were observed (10%).

More or less the present findings are in agreement with the Xinzhi *et al*., (2016) [11] who examined ear-colonizing pest resistance, 20 maize lines from the USDA- ARS Germplasm Enhancement of maize (GEM) Program were evaluated for whorl-feeding fall armyworm (FAW) *Spodoptera frugiperda* resistance using 4 maize inbred lines as the resistant and susceptible controls. Crubelati-mulati *et al.*, (2014) The goal of the study was to evaluate the damage caused by *S. frugiperda* on single-cross popcorn hybrids under field conditions with natural infestation as well as to study the effect of 11 popcorn hybrids on the *S. frugiperda* life cycle under laboratory conditions. A completely randomized block design with 4 replicates was used for the field experiment, and a completely randomized design with 10 replicates was used for the laboratory experiment.

Table 3: Extent of damage by fall army worm in maize during *kharif* 2019.

S. No.	SMW	Date	*Spodoptera furgiperda*		
			No. of pin holes per 10 plants	Scale (1-9) LIR	DH (%)
1	31	28 July to 05 Aug. 2019	1.60	1	0.0
2	32	05 Aug. to 13 Aug. 2019	3.30	1	0.0
3	33	13 Aug. to 21 Aug 2019	9.10	3	10.0
4	34	21 Aug. to 29 Aug 2019	11.10	4	10.0
5	35	29 Aug. to 06 Sep.2019	16.20	6	30.0
6	36	06 Sep. to 14 Sep.2019	20.10	7	30.0
7	37	14 Sep. to 22 Sep.2019	25.00	7	40.0
8	38	22 Sep. to 30 Sep.2019	20.20	7	60.0
9	39	30 Sep. to 08 Oct.2019	17.00	5	60.0
10	40	08 Oct. to 16 Oct.2019	10.20	5	40.0
11	41	16 Oct. to 24 Oct.2019	4.10	4	30.0
12	42	24 Oct. to 01 Nov.2019	3.10	1	10.0
Seasonal Mean			141/12 = 11.75	51/12 = 4.25	320/12 = 26.66

DH = Dead heart, LIR = Leaf injury Rating

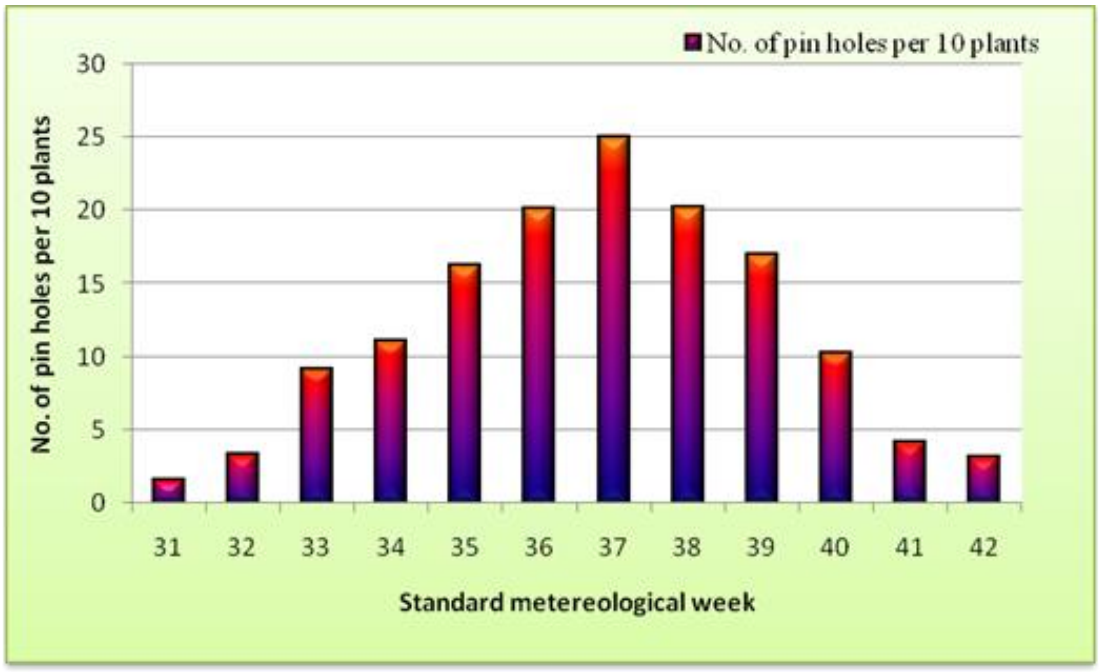

Fig 1: No. of pin holes per 10 plants during *kharif* 2019.

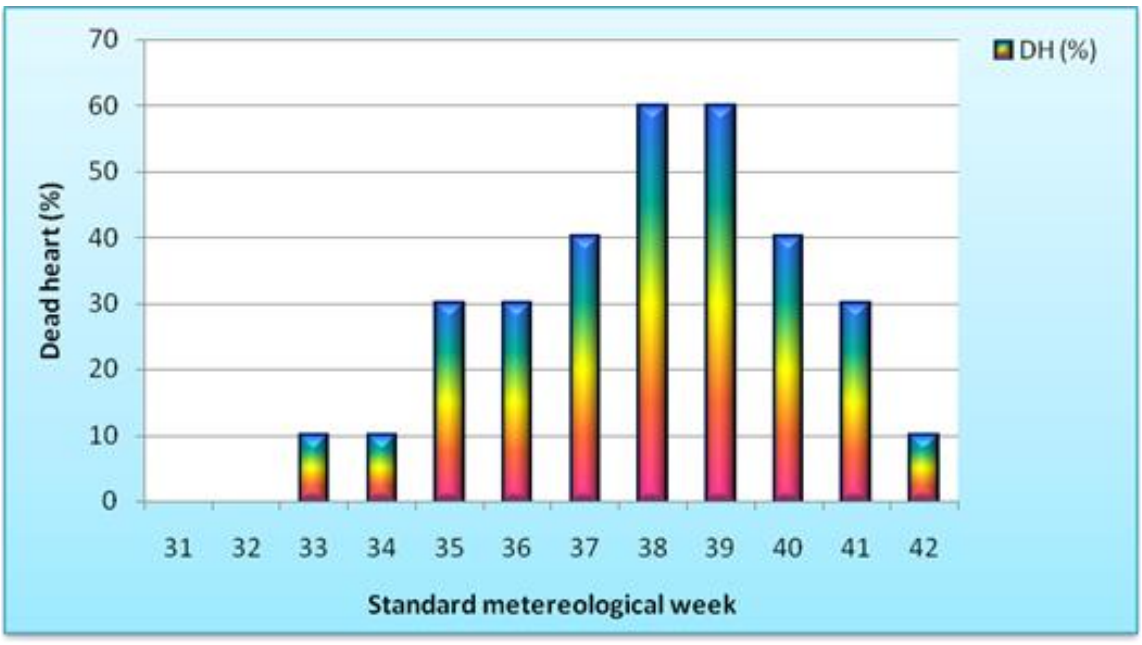

Fig 2: Dead heart percentage during *kharif* 2019.

4. Conclusion

The data related to number of pin holes on leaves were recorded on randomly ten selected plants. The maximum pin holes on leaves were observed during 37th SMW *i.e.*14th-22nd September (25.00 per 10 plants) when the larvae of fall army worm is maximum. After that during 42nd SMW *i.e.* 24th Oct-1st Nov. the minimum pin holes were observed (3.10 per 10 plants).

The data related to dead heart percentage were recorded on randomly ten selected plants. The maximum dead heart percentage were observed during 38th SMW *i.e.* 14th-22nd September and 39th SMW *i.e.* 30th Sept-08 Oct. (60%). After that during 42nd SMW *i.e.* 24th Oct-1st Nov. the minimum dead heart percentage were observed (10%).

5. References

1. Anonymous. Krishi Darshika, Director of Extension Services, IGKV, Raipur, 2016.
2. Aditya S, Singh SP. Fall army worm *Spodoptera frugiperda* (J.E. Smith) new formidable challenge pest in maize crop: A review. International Journal of Chemical Studies. 2019;7(3):2537-2539.
3. Battu SR. Screening of germplasm and management of *Spodoptera litura* (Fab.) infesting post-rainy groundnut. MSc Thesis, Acharya N.G. Ranga Agricultural University Rajendranagar, Hyderabad, 2005, 72p.
4. Brahams P, Bateman M, Beale T, Clottey V, Cock M, Colmenarez Y, *et al*., Evidence, (2), September 2017. CABI, Wallingford, UK, 2017.
5. Deole S, Paul N. First report of fall army worm, *Spodoptera frugiperda* (J.E. Smith), their nature of damage and biology on maize crop at Raipur, Chhattisgarh. Journal of Entomology and Zoology Studies. 2018;6(6):219-221.
6. Day R, Abrahams P, Bateman M, Beale T, Clottey V, Cock M, *et al*. Fall armyworm: Impacts and implications for Africa. Outlooks on Pest Management. 2017;28196-201. https://doi.org/10.1564/v28_oct_02
7. Goergen G, Kumar PL, Sankung SB, Togola A, Tamo M. First report of outbreaks of the fall armyworm *Spodoptera frugiperda* (J E Smith) (Lepidoptera, Noctuidae), a new alien invasive pest in west and central Africa. PLoS ONE. 2016;11(10):e0165632. https://doi.org/10.1371/journal.pone.0165632
8. Nagarjuna B, Manjunatha M, Latha MI. Studies on varietal screening of maize hybrids against stem borer, *Sesamia inferens* (Walker). Journal of Eco-friendly Agriculture. 2015;0(1):64-66.
9. Sharanabasappa *et al*., Biology of invasive fall army worm *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) on maize. Indian Journal of Entomology. 2018;80(3):540-543.
10. Singh G, Jaglan MS. Seasonal incidence of different insect-pests in *Kharif* maize. Journal of Pharmacognosy and Phytochemistry. 2018;7(3):3666-3669.
11. Xinzhi Ni, Wenwei Xu[2], Michael, Blanco H, Paul W. Evaluation of fall army worm resistance in maize germplasm lines using visual leaf injury rating & predator survey, insect science. 2016;21:541-555.