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# Monitoring of *Earias vittella* and *Helicoverpa armigera* through Pheromone Traps in Okra under Tarai Region of Eastern Uttar Pradesh Conditions

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**ABSTRACT: The present investigation entitled "Monitoring of *Earias vittella* and *Helicoverpa armigera* through Pheromone Traps in Okra under Tarai Region of Eastern Uttar Pradesh Conditions" was carried out during the *Kharif* (Winter) *season* 2021-23 at the nearby farmer's field of B.R.D.P.G. College, Deoria (U.P.) affiliated to D.D.U. Gorakhpur University, Gorakhpur, India. The farmers's field was kept free from pesticide use. The study was designed to monitoring the population dynamics of *Earias vittella* F. and *Helicoverpa armigera* H. infesting okra, on the variety 'Arka Anamika' under Large Plot Technique, grown on a plot size of 150 $m^2$ (15 m × 10 m) with a spacing of 60 cm × 30 cm rows and plants with weekly observations. Okra (*Abelmoschus esculentus* L.), is also commonly known as Lady's finger, which an important vegetable crop belonging to the family Malvaceae, cultivating under tropical and subtropical regions. It is a favourite vegetable in India, and grown in almost all the states in the country. It is an important Zaid (Summer) and Kharif (Winter) vegetable crop grown throughout the world. Okra fruit is nutritionally very rich with vitamins, minerals, and dietary fiber. *Earias vittella* F. (Okra shoot & fruit borer) and *Helicoverpa armigera* H. (Okra fruit borer) are considered the most destructive pests of okra. The monitoring of *Earias vittella* in okra during the *Kharif* seasons of 2021-22 and 2022-23 through pheromone traps was emphasized the necessity of continuous pheromone-based monitoring, particularly between Standard Meteorological Week (SMW) of 32 and 36, Whereas the monitoring of *Helicoverpa armigera* in okra during the *Kharif* seasons of 2021-22 and 2022-23 through pheromone traps highlights clear differences in pest population dynamics between the two years. Its pest pressure was moderate and concentrated mainly between SMW 32 and 35. These SMWs are coinciding with the flowering and fruiting stages of okra, when the crop was most vulnerable for both these borer insect pests. The population of *Earias vittella* was steadily increased to 5.53 moths/trap in 30$^{th}$ SMW to 8.30 moths/trap in 32$^{nd}$ SMW, showing a rapid build-up as the crop entered its reproductive phase, while the population of *Helicoverpa armigera* was also steadily increased to 7.81 moths/trap in 31$^{st}$ SMW to 13.19 moths/trap in 33$^{th}$ SMW. This result represents the most critical window of infestation, where pest management measures are essential to minimize crop losses.**

**Keywords:** Okra (*Abelmoschus esculentus* L.), *Earias vittella*. *Helicoverpa armigera*, Monitoring, Pheromone Trap, Tarai Region, Uttar Pradesh, India.

## INTRODUCTION

Okra (*Abelmoschus esculentus* L.), is an important vegetable crop belonging to the family Malvaceae, cultivating under tropical and subtropical regions. It is also commonly known as Lady's finger. It is a famous vegetable in India, and grown in almost all the states in the country. It is an important Zaid (Summer) and Kharif (Winter) season vegetable crop grown throughout the world. Okra fruit is nutritionally very rich with vitamins, minerals, and dietary fiber. All over India, its immature tender fruits are used as vegetable (Pawar *et al*., 2023). In the 2024-25 fiscal year, India's total vegetable crop area is estimated at 12,024 million hectares and production is estimated at 214.56 million tons, a 3.6% increase compared to 2023-24. In Uttar Pradesh, a significant portion of land is dedicated to vegetable production. The area under vegetable cultivation was estimated at 1.4 million hectares according to financial year 2023. This accounts for a substantial 17% of India's total vegetable production and Uttar Pradesh was the largest vegetable-producing state in India during that year (Anonymous, 2025). West Bengal (15 %) is the second-largest vegetable producer. In India, the crop losses to the approximately 30–40% have been reported in vegetable crops (Sharma *et al*., 2017). One of the major problems in agriculture

is the control of insect pests that cause about 34% of loss crops, Okra plants are highly vulnerable to insect pests throughout their growth stages, from seedling to harvest. Both the vegetative and fruiting phases face considerable damage from a wide variety of pests (Pareek *et al*., 1986; Boopathi *et al*., 2011; Venkanna & Balikai, 2016; Singh *et al.,* 2021). Over 72 insect species have been documented infesting okra during different growth stages (Ewete, 1978). According to Nair *et al*. (2017), 28 insect pest species belonging to six orders and 20 families were identified as major threats to okra. Okra is highly vulnerable to insect pests throughout its growing period, with several species causing significant yield loss (Anjana *et al.,* 2022; Lakshmikantha *et al*., 2023; Pawar *et al*., 2023). Among them, *Earias vittella* F. (Okra shoot & fruit borer) and *Helicoverpa armigera* H. (Okra fruit borer) are considered the most destructive pests of okra. Okra shoot & fruit borer (*Earias vittella*) is the most damaging with fruit infestation rates ranging from 30% to 60%, depending on environmental conditions and crop stage. (Rakshith & Kumar 2017; Reddy *et al*., 2019). Therefore, the present study was conducted to monitor the population dynamics of *Earias vittella* and *Helicoverpa armigera* using Pheromone Traps under Tarai Region of Eastern Uttar Pradesh. It was designed to bridge the knowledge gap regarding incidence and management of insect pests of okra, especially in the Tarai region where climatic conditions favour pest proliferation. The information on incidence of major insect pest of okra, particularly under Tarai region, is meager and hence in view of the importance of okra fruits as favourite vegetables and seriousness of these pests it becomes absolutely necessary to have a comprehensive information on these aspects. During the field experiment, quantitative observations for population monitoring of *Earias vittella* and *Helicoverpa armigera* affecting okra were recorded from sowing to harvest, across various stages of crop growth.

## MATERIALS AND METHODS

The present investigation on monitoring of *Earias vittella* and *Helicoverpa armigera* through pheromone traps in okra was carried out during the *Kharif season* 2021-23 at the nearby farmer's field of B.R.D.P.G. College, Deoria (U.P.), India. The farmers's field was kept free from pesticide use. It is located in the fertile Gangetic plain near the Indo-Nepal border, making the region agriculturally productive due to its rich alluvial soil. The Deoria district climatic condition is a subtropical climate with hot summers, a monsoon period from June to September, and mild winters. Average annual rainfall ranges from 1000 to 1200 mm, with humidity between 73% and 86%. These climatic conditions particularly during the Kharif (winter) season, support the cultivation of several crops including okra and vegetables, making the region suitable for crop production and research. The study was designed to monitoring the population dynamics of *Earias vittella* F. and *Helicoverpa armigera* H.infesting okra, on the variety 'Arka Anamika' under Large Plot Technique, grown on a plot size of 150 $m^2$ (15 m × 10 m) with a spacing of 60 cm × 30 cm rows and plants with weekly observations. The okra crop was grown with all recommended package of practices in kharif season for two consecutive years *i.e*., 2021-22 and 2022-23.

Pheromone traps were procured from the market under the brand name *Agri Phero Solutions*. Two traps for each species were installed in okra field of 150 $m^2$ to monitor moth catches and assess pest populations. The traps utilize synthetic sex pheromones that mimic the natural scent emitted by female moths to attract males, aiding in the detection and monitoring of lepidopteran pests. *Earias vittella* synthetic pheromone used is (Z, E)-10,12-Hexadecadienyl acetate, while for *Helicoverpa armigera*, (Z)-11-Hexadecenal is used. These pheromone compounds were loaded into lures placed within funnel traps. The traps were installed at a height of one feet above crop canopy, aligned with the crop canopy for optimal effectiveness. There are 12 traps per hectare used for monitoring. Traps were installed around 15–20 days after planting, coinciding with the crop's early vegetative phase when pest activity starts to increase. The lures were replaced at 15-18 days interval. Observations on adult male moths of *Earias vittella* and *Helicoverpa armigera* were recorded weekly as Standard Meteorological Week (SMW). Trapped moths were killed before they were counted and recorded as moth catches/crop/week.

## RESULTS AND DISCUSSION

*A. Monitoring of Earias vittella in okra through pheromone trap in 2021-22 and 2022-23*

The comparative monitoring of *Earias vittella* in okra during the *Kharif* seasons of 2021–22 and 2022–23 through sex pheromone traps demonstrated variations in pest population dynamics, intensity, and timing of peak incidence. In 2021–22, the pest activity began at a lower level with 3.34 moths per trap in 27$^{th}$ SMW (Standard Meteorological Week), gradually increasing and reaching its maximum at 19.84 moths per trap in 34$^{th}$ SMW. The build-up was progressive, with peak infestation coinciding with the flowering and fruiting stages of okra, when the crop was most vulnerable. After this peak, the pest population showed a steady decline, yet remained above the economic threshold until later stages, indicating consistent pressure throughout the season due to continuous flowering and fruiting. In contrast, the 2022–23 season recorded higher initial catches, starting with 5.39 moths per trap in SMW 27, and exhibited more fluctuations during its progression. The pest reached its highest peak earlier and at a higher level, with 21.09 moths per trap in SMW 35, suggesting a stronger infestation compared to the previous year. Though the population later declined, a considerable number of moths were still recorded until SMW 38, showing extended pest activity. Overall, the data highlight that SMW 32 to 36 is the most critical infestation window in both years (Table 1 & Fig. 1).

Similar observations were also reported by Jyothi *et al.* (2014) reported highest 10.01 moth per pheromone lure tap in week during *Kharif* season. Almost similar

comparable findings have also been documented by several researchers, including Yadav & Singh (2022); Sehto *et al*. (2020); Kaur *et al.* (2016); Patel *et al.* (2014); Shivanna *et al.* (2012); Prasannakumar *et al.* (2009); Balakrishnan *et al.* (2003); Al-Elimi *et al*. (2002); Girish (2001).

**Table 1: Monitoring of *Earias vittella* in okra through pheromone trap during 2021-22 & 2022-23.**

| Sr. No. | Date | SMW | *Earias vittella* catch per trap (2021-22) | *Earias vittella* catch per trap (2022-23) |
|---|---|---|---|---|
| 1. | 1–7 July | 27 | 1.34 | 0 |
| 2. | 8–14 July | 28 | 3.56 | 1.39 |
| 3. | 15–21 July | 29 | 4.11 | 2.68 |
| 4. | 22–28 July | 30 | 7.11 | 5.53 |
| 5. | 29 Jul–4 Aug | 31 | 7.80 | 7.15 |
| 6. | 5–11 August | 32 | 6.15 | 8.30 |
| 7. | 12–18 August | 33 | 8.55 | 6.49 |
| 8. | 19–25 August | 34 | 10.2 | 9.09 |
| 9. | 26 Aug–1 Sept | 35 | 7.72 | 11.43 |
| 10. | 2–8 September | 36 | 5.93 | 7.64 |
| 11. | 9–15 September | 47 | 6.99 | 4.91 |
| 12. | 16–22 September | 48 | 4.76 | 4.11 |
| 13. | 23–29 September | 49 | 4.14 | 3.73 |

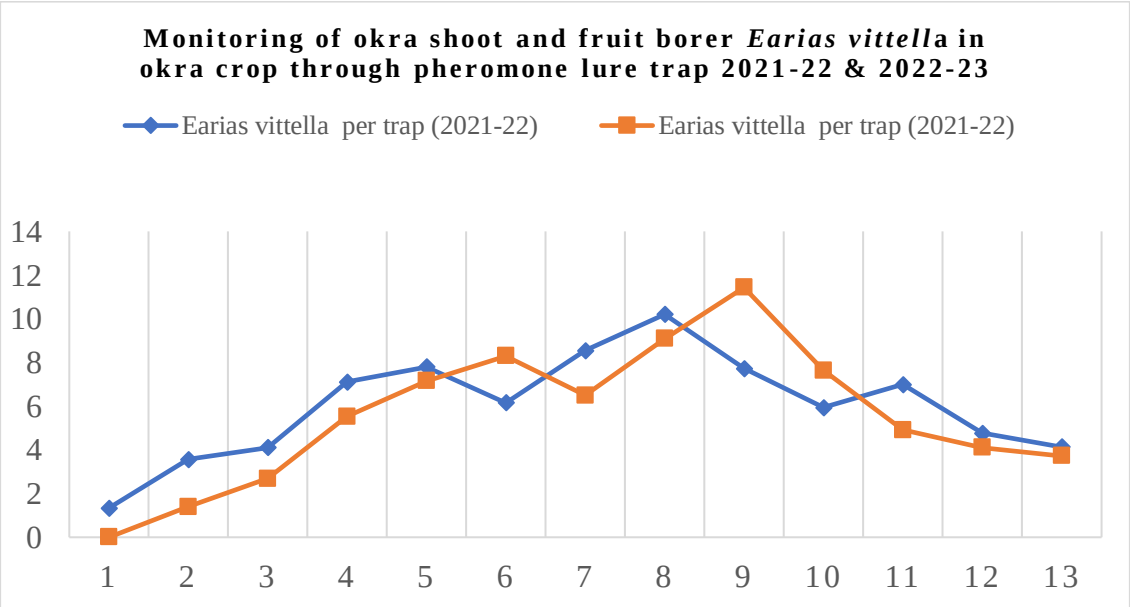



**Fig. 1.** Monitoring of *Earias vittella* in okra through pheromone trap during 2021-22 & 2022-23.

*B. Monitoring of Helicoverpa armigera in okra through pheromone trap in 2021-22 and 2022-23*

The monitoring of *Helicoverpa armigera* in okra during the *Kharif* seasons of 2021-22 and 2022-23 through sex pheromone traps highlights clear differences in pest population dynamics between the two years. In 2021-22, moth catches began later, with no activity in 30$^{th}$ SMW (Standard Meteorological Week) and only a small population from 31$^{th}$ SMW onwards. The numbers gradually increased and reached a peak of 16.39 moths per trap in SMW 35, before declining steadily in subsequent weeks. This indicates that the pest pressure was moderate and concentrated mainly between SMW 33 and 35, aligning with the flowering and fruiting stages of okra. In contrast, the 2022-23 season recorded higher catches throughout the observation period, with pest activity starting earlier at 3.58 moths per trap in SMW 30 and rising rapidly in the following weeks. The peak incidence occurred sooner, in SMW 34, with 18.58 moths per trap, which was not only higher than the previous year but also coincided with a highly vulnerable crop stage. Although the population declined thereafter, a secondary rise was noted in SMW 37, indicating more prolonged pest pressure. These findings suggest that 2022-23 experienced greater pest intensity and earlier infestation compared to 2021-22, likely due to more favourable environmental conditions. Overall, the results emphasize the necessity of continuous pheromone-based monitoring, particularly between SMWs 32 and 35. (Table 2 & Fig. 2).

Similar observations were also reported by Yadav *et al.* (2020) reported highest moth recorded 16.8 and 19.5 moths per pheromone trap standard week during *Kharif* season. Almost similar comparable findings have also been documented by several researchers, including Sheikh *et al.* (2024); Mohapatra (2023); Ballari *et al.* (2021); Ujjan *et al*. (2019); Rawat *et al.* (2017); Kumar (2014); Raghuwanshi & Garg (2013); Sonkar *et al*. (2012); Sharma *et al*. (2012); Gupta and Desh Raj (2002).

**Table 2: Monitoring of *Helicoverpa armigera*in okra through pheromone trap during 2021-2022 & 2022-23.**

| Sr. No. | Date | SMW | *Helicoverpa armigera* catch per trap (2021-22) | *Helicoverpa armigera* catch per trap (2022-23) |
|---|---|---|---|---|
| 1. | 22–28 July | 30 | 0 | 03.58 |
| 2. | 29 Jul–4 Aug | 31 | 01.58 | 07.81 |
| 3. | 5–11 August | 32 | 03.74 | 10.75 |
| 4. | 12–18 August | 33 | 08.74 | 13.19 |
| 5. | 19–25 August | 34 | 12.61 | 18.58 |
| 6. | 26 Aug–1 Sept | 35 | 16.39 | 12.32 |
| 7. | 2–8 September | 36 | 10.52 | 08.93 |
| 8. | 9–15 September | 37 | 07.94 | 10.78 |
| 9. | 16–22 September | 38 | 05.85 | 06.10 |
| 10. | 23–29 September | 39 | 04.71 | 05.48 |

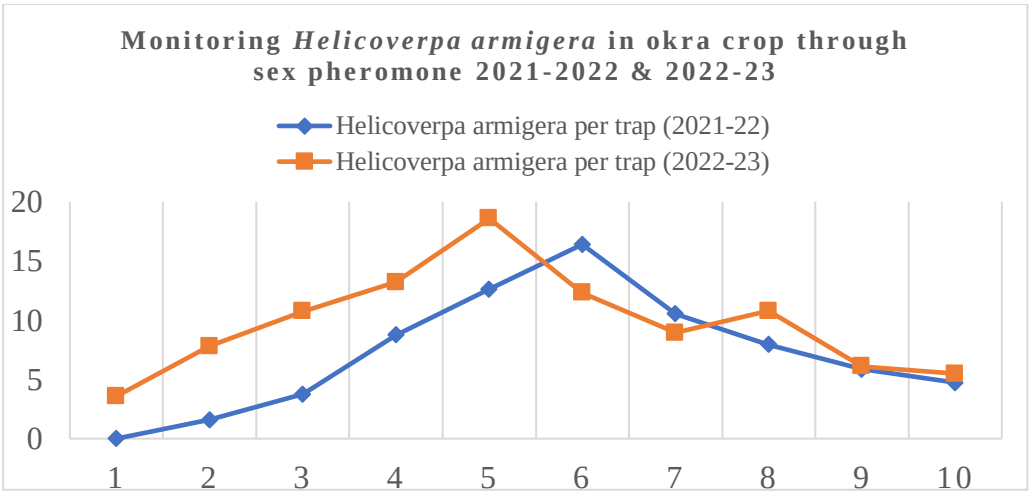



**Fig. 2.** Monitoring of *Helicoverpa armigera* in okra through pheromone trap during 2021-2022 & 2022-23.

## CONCLUSION

*Earias vittella* F. (Okra shoot & fruit borer) and *Helicoverpa armigera* H. (Okra fruit borer) are considered the most destructive pests of okra. The monitoring of *Earias vittella* in okra during the *Kharif* seasons of 2021-22 and 2022-23 through pheromone traps was emphasized the necessity of continuous pheromone-based monitoring, particularly between Standard Meteorological Week (SMW) of 32 and 36, Whereas the monitoring of *Helicoverpa armigera* in okra during the *Kharif* seasons of 2021-22 and 2022-23 through pheromone traps highlights clear differences in pest population dynamics between the two years. Its pest pressure was moderate and concentrated mainly between SMW 32 and 35. These SMWs are coinciding with the flowering and fruiting stages of okra, when the crop was most vulnerable for both these borer insect pests. The population of *Earias vittella* was steadily increased to 5.53 moths/trap in 30th SMW to 8.30 moths/trap in 32$^{nd}$ SMW, showing a rapid build-up as the crop entered its reproductive phase, while the population of *Helicoverpa armigera* was also steadily increased to 7.81 moths/trap in 31$^{st}$ SMW to 13.19 moths/trap in 33$^{th}$ SMW. This result represents the most critical window of infestation, where pest management measures are essential to minimize crop losses.

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