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Conquering okra pests: A comprehensive guide to sustainable management

Okra is a valuable crop that is highly susceptible to various insect pests, making effective management strategies essential. Integrated Pest Management (IPM) plays a crucial role in maintaining pest populations below economic thresholds by integrating cultural, biological, and chemical control methods. Major pests such as shoot and fruit borers, leafhoppers, whiteflies, aphids, and mites can be effectively managed through a combination of approaches including cultural practices, mechanical control, biological agents, and judicious use of chemical insecticides as a last resort. Effective pest management relies on regular monitoring, early detection, and community participation. Continued research and collaborative efforts are vital for developing sustainable and long-term pest management solutions in okra cultivation.

Keywords: Biological control, *Earias vittella,* Eco-friendly management, Sucking pests, Pheromone traps,

OKRA, *Abelmoschus esculentus* (L.) Moench, is an economically significant vegetable crop grown in tropical and subtropical regions worldwide. In India, it is predominantly cultivated on a moderate scale for local markets as well as commercial enterprises, covering a total area of 0.53 million h and yielding approximately 6.46 million tonnes annually (FAOSTAT, 2021). Okra is nutritionally rich, containing 6.40% carbohydrates, 1.90% protein, 0.20% fat, 0.70% minerals, and 89.60% moisture.

However, due to their tender and succulent nature, vegetables are highly prone to insect pest infestations, and okra is no exception. From germination to harvest, okra is susceptible to attack by nearly 72 insect pest species. To mitigate damage and ensure high-quality yields, timely and appropriate pest management strategies are essential. Although chemical control has been widely adopted for many years, its overall effectiveness in providing long-term crop protection remains limited.

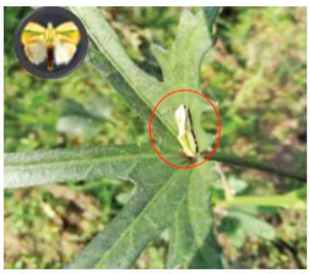
Leafhopper

Whitefly

Aphid

Two-spotted spider mite

Shoot and fruit borer larvae



Shoot and fruit borer adults

Insect pest menace in okra ecosystem

Table 1. Details of major insect pests in okra

Insect	Mark of identification	Life cycle	Nature of damage	Method of observation	ETL
Leafhopper	Adults are small, wedge-shaped, about 3 mm long, greenish-yellow in colour, each forewing bearing a black spot and an additional black spot on the vertex.	Females oviposit on the underside of leaves, inserting eggs into veins. Eggs hatch in 4–11 days, producing active wedge-shaped nymphs. Adults live 5–7 weeks and feed continuously on plant sap.	Both nymphs and adults occur throughout the crop period, sucking cell sap mainly from the ventral leaf surface. Toxic saliva causes yellowing, bronzing, and stunted growth. Yield loss ranges between 32.06–40.84%.	Leaf undersides are examined using a 10X hand lens for the presence of nymphs and adults. Samples should include three leaves each from top, middle, and lower canopy.	2.5 nymphs/leaf
Whitefly	Adults measure 1.0–1.5 mm in length, yellow-bodied, dusted with white wax, and possess two pairs of pure white wings.	Females lay 80–110 stalked eggs singly on leaf undersides. Eggs hatch in 3–5 days (summer) or 5–33 days (winter). Nymphs pass through three instars before forming pupae in 9–14 days (summer) or 17–81 days (winter). Adult emergence occurs in 2–8 days. Total life cycle spans 14–100 days, depending on climate.	Both nymphs and adults suck sap, causing curling and drying of leaves. They also transmit Okra Yellow Vein Mosaic Virus (OYVMV), leading to yield losses up to 90%. Direct damage occurs through feeding; indirect damage results from virus transmission.	As above	4 adults/leaf
Aphid	Small, soft-bodied, greenish-brown insects, occurring in colonies on tender shoots and leaf undersides; adults exist in winged and wingless forms.	Reproduce parthenogenetically and viviparously. A female produces 8–20 nymphs/day. Nymphs moult four times to become adults in 7–10 days.	A major pest of okra, polyphagous on hosts from 46 families. Nymphs and adults suck sap, causing yellowing, curling, deformation, and drying of leaves, leading to severe yield reduction.	As above	NA
Red Spider Mite (Two-spotted mite)	Very minute; colour varies from green, yellowish-green, brown to orange-red, with two dark dorsal spots.	Eggs are round, white to cream. Larval → protonymph → deutonymph → adult. Life cycle completes in 1–2 weeks, with several overlapping generations annually. Adults survive 3–4 weeks.	Causes yield losses up to 17.46%. Large colonies feed on leaf undersides causing whitish patches, bronzing, drying, and webbing over foliage. Severe attack can lead to 7–48% fruit yield loss (Kumaran et al., 2007).	Mite count taken using a 1 cm^2 leaf-window on 3 leaves per plant (top, middle, bottom canopy) at three observation points each.	2 mites/leaf
Shoot and Fruit Borer (Earias vittella)	Moths measure ~2.5cm across wings with a narrow light longitudinal green band on forewings. Larvae are dull-green, ~2 cm long, bearing fine bristles and black longitudinal spots.	Females lay 200–400 eggs singly on flower buds and tender leaves. Eggs are sky-blue; hatch in 3–4 days. Larvae pass through 6 instars in 10–16 days, pupating on plant/fruit or fallen debris. Adult emergence occurs in 8–14 days. Total cycle: 17–29 days.	Larvae bore into terminal shoots and developing fruits, causing shedding, drying, and deformation. Yield loss ranges from 24.6–26% in shoots and 40–100% in fruits (Shinde et al., 2007). Marketable yield reduction may reach 90%.	Shoot damage recorded as % infested shoots. Fruit damage assessed at weekly picking; healthy vs. infested fruits weighed to compute % fruit damage.	1 infested plant/meter row

The concept of Integrated Pest Management (IPM), though not new, has gained global recognition and practical importance. In recent years, IPM has aimed to promote sustainable agriculture by significantly reducing the use of synthetic pesticides, thereby addressing multiple socio-economic, environmental, and public health concerns. IPM emphasizes maintaining pest populations below economic threshold levels rather than achieving complete eradication. This approach integrates various control measures–including cultural, physical, biological, and mechanical practices–with judicious use of insecticides when necessary, to achieve effective, economical, and sustainable pest suppression.

Major okra pests

The primary insect pests affecting okra cultivation include the shoot and fruit borer (*Earias insulana* and *Earias vittella*); leafhopper (*Amrasca biguttula biguttula*); leaf roller (*Sylepta derogata*); whitefly (*Bemisia tabaci*); aphid (*Aphis gossypii*); and mite (*Tetranychus cinnabarinus*). These pests are major biotic factors that can severely restrict the successful cultivation of okra.

Pest management strategies

Integrated pest management (IPM) plays a key role in minimizing insect-induced losses in okra, while promoting environmental safety and human health. The following strategies are commonly adopted:

Cultural control

Cultural practices involve modifying the crop environment to reduce pest establishment and build

Table 2. Pests of okra in different seasons

Common Name	Scientific Name	Pest Status	Season
Leafhopper	*Amrasca biguttula biguttula*	Major	*Kharif*, Summer
Whitefly	*Bemisia tabaci*	Major	*Kharif*, Summer
Aphids	*Aphis gossypii*	Major	*Kharif*, Summer
Red cotton bug	*Dysdercus cingulatus (Syn. D. koenigii)*	Major	Summer
Dusky cotton bug	*Oxycarenus hyalipennis*	Minor	*Kharif*, Summer
Okra shoot and fruit borer	*Earias vittella*	Major	*Kharif*, Summer
Leaf roller	*Sylepta derogata*	Minor	*Kharif*, Summer
Tobacco caterpillar	*Spodoptera litura*	Minor	*Kharif*, Summer
Blister beetle	*Mylabris* spp.	Minor	*Kharif*, Summer
Red spider mite	*Tetranychus* spp.	Major	Summer

Source: Bhatt, *et* al., 2018

long-term field resilience. Major cultural practices in okra include:

- Growing cotton as a trap crop to attract shoot and fruit borer.
- Deep summer ploughing to expose pupae of shoot and fruit borer.
- Crop rotation with non-host crops such as brinjal, chilli and legumes to break pest cycles.
- Use of tolerant or resistant varieties:
  Purna Rakshak – Resistance to aphids, mites and shoot and fruit borer
  MHOK-14 – Tolerance to leafhopper, whitefly and shoot and fruit borer
  NOH-15 – resistance to mites, *E. vittella* and *Helicoverpa*
  VRO-5 – Tolerance to leafhopper, whitefly and shoot and fruit borer
  Arka *Anamika* – Resistant to aphids

Mechanical control

Mechanical control includes direct physical methods to reduce pest populations. In okra, the most common practices are:

- Hand-picking of larvae of shoot and fruit borer from infested plant parts.
- Removal and destruction of damaged shoots to prevent further spread.

These techniques are labour-intensive but effective when implemented early and combined with other IPM practices.

Biological control

Biological control relies on natural enemies to suppress pest populations in the field. In okra, predators play an important role, including:

- Ladybird beetles (*Coccinellids*) such as *Coccinella transversalis*, *Cheilomenes sexmaculata*, *Micraspis discolor* and *Brumoides suturalis*, which feed on aphids, mites and whiteflies.
- Predatory spiders, which help reduce populations of soft-bodied pests and small larvae.

Growing flowering plants around the field supports the activity of natural enemies. During early infestations, augmentation with lab-reared predators can be used for faster suppression.

Chemical control

Chemical insecticides can have numerous negative impacts on the environment and human health. They can lead to the development of insecticide resistance in target pests, reducing the effectiveness of control measures. Additionally, these chemicals can harm non-target organisms, including beneficial insects, birds, and aquatic life, thereby disrupting ecosystems. Human exposure to insecticides has been linked to various health issues, such as neurological disorders, respiratory problems, and cancer, highlighting the importance of their proper use and management.

As an alternative to chemical insecticides, botanical insecticides offer a broad spectrum of pest management options and are generally safer to apply. They are unique in their mode of action and can be easily processed and used. Neem products, for example, have insecticidal, repellent, antifeedant, sterilizing, and growth-inhibiting effects against several insect species. Studies have shown that the application of neem oil alone or in combination with chemical insecticides can significantly reduce damage caused by the okra shoot and fruit borer.

Field overview of the experimental plot

Name of the insecticides/ Trap	Dose	Time of application
Installation of pheromone trap (Ervit lure)	5 nos/ha	30 days after sowing
Foliar spraying of azadirachtin 0.03%	5 ml/l	30 days after sowing
Foliar spraying of flonicamid 50WG	0.4 g/l	40 days after sowing
Foliar spraying of spinetoram 11.7% SC	0.5 ml/l	50 days after sowing

It is essential to use chemical pesticides strictly according to the recommendations of the Central Insecticides Board & Registration Committee (CIB&RC) and only as a last resort (www.cibrc.gov.in).

Prevention and monitoring

Early detection: Early detection is a key component of pest prevention. Regular field inspections help identify pest presence during the initial stages of infestation. Close and consistent monitoring enables farmers to observe early symptoms, allowing for timely intervention to prevent pest spread and minimize crop damage. Detecting pests early also supports the use of eco-friendly and cost-effective management approaches, thereby reducing reliance on chemical insecticides and contributing to sustainable okra production.

***Monitoring techniques*:** Using yellow sticky traps at a rate of 20 traps per ha during the vegetative stage helps in the early detection of major sucking pests such as aphids and whiteflies. Similarly, installing pheromone traps for shoot and fruit borers–using lures such as Ervit lure, *insulana* lure, and Heli lure–at a rate of 20 traps per ha is effective for monitoring and mass trapping adult moths. These traps play a vital role in integrated pest management, enabling timely monitoring of pest populations and helping farmers initiate control measures when required.

Monitoring with yellow sticky and pheromone traps in okra can prevent yield losses by 25–30% through early pest detection and timely application of control interventions (TNAU, 2021). This practice also reduces pesticide expenses by ₹6,000–₹8,000 per ha and saves 20–25% in labour costs, offering both practical and economic benefits to farmers (ICAR-IIVR, 2020).

CASE STUDY

Study conducted at East and South Coastal Plains, Odisha

A study conducted in the East and South Coastal Plains of Odisha demonstrated the effectiveness of integrated pest management strategies in okra cultivation. Seed treatment with imidacloprid 600 FS at a rate of 9 ml/kg seed, combined with yellow sticky traps at 20 traps per h at 25 days after sowing, and pheromone traps (using Ervit lure at 5 traps per h) at 30 days after sowing, effectively controlled leafhopper, whitefly, aphid, shoot and fruit borer, and red spider mite.

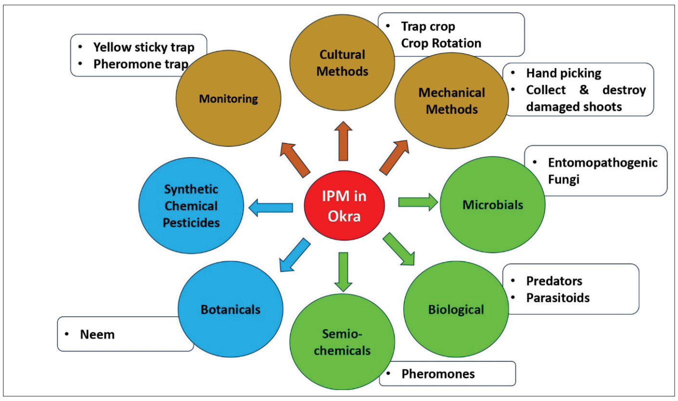


Fig 3. Schematic view of IPM practices in okra crop

Multiple components are utilized harmoniously i.e monitoring, cultural, mechanical, microbials, biological, semiochemicals, botanicals synthetic chemical pesticides for optimum output in okra crop that ensures ecologically viable, socially acceptable and economically affordable IPM technology

Additionally, foliar applications of azadirachtin at 0.03% (5 ml/l) at specified days after sowing, flonicamid 50 WG at 0.4 g/l at 10 days after the first spraying, and spinetoram 11.7% SC at 0.5 ml/l at 10 days after the second spraying were also effective. These treatments had minimal impact on natural enemies and resulted in the highest yield and economic benefits compared to untreated control plots, with a maximum net return of ₹44,245 and an incremental cost–benefit ratio of 3.31.

The successful implementation of integrated pest management relies on the active participation of farmers within a locality. Mass involvement ensures that IPM practices are consistently and effectively applied over a larger area, which is essential for managing pest populations and reducing reliance on chemical pesticides. Collaboration allows farmers to share knowledge, resources, and experiences, ultimately leading to more sustainable and environmentally friendly pest management practices.

CONCLUSION

Sustainable management of okra pests requires a holistic approach that integrates cultural, biological, and chemical control methods. Regular field inspections, combined with the strategic placement of traps, are essential for early pest detection. Pheromone traps can effectively monitor and mass trap adult moths, reducing the need for chemical interventions. The success of integrated pest management (IPM) depends on the active participation of farmers. Mass involvement ensures that IPM practices are consistently and effectively applied across a larger area, which is vital for managing pest populations and reducing reliance on chemical pesticides. By working together, farmers can share knowledge, resources, and experiences, ultimately leading to more sustainable and environmentally friendly pest management practices.

Way Forward

Continued research and innovation are key to enhancing sustainable pest management in okra cultivation. Developing new, environmentally friendly pesticides and refining existing IPM strategies can further reduce dependence on harmful chemicals. Expanding farmer education and training programs will promote the adoption of best practices. Collaborative efforts among researchers, farmers, and policymakers can facilitate the sharing of knowledge and resources, fostering more sustainable approaches to pest control. By embracing these advancements and working together, the long-term health and productivity of okra crops can be ensured while minimizing negative impacts on the environment.

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