



Monsoon Season Insect Pests and Their Management: Challenges and Sustainable Solutions for Crop Protection

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INTRODUCTION

Monsoon rainfall is a vital component of Indian agriculture, supporting the cultivation of major crops such as rice, maize, cotton, pulses, vegetables, and oilseeds. However, the same environmental conditions that promote crop growth also favor the development and spread of several insect pests. High relative humidity, moderate temperatures, frequent rainfall, and availability of young plant tissues provide ideal conditions for insect multiplication. During the monsoon period, pest populations may increase rapidly and cause damage through leaf feeding, sap sucking, stem boring, and fruit infestation. Climate variability has further increased the complexity of pest management. Changes in rainfall patterns and temperature fluctuations influence insect distribution, seasonal abundance, and outbreak frequency. Therefore, timely identification and adoption of integrated pest management strategies are essential for minimizing crop losses.

Major Monsoon Season Insect Pests and Their Management

1. Rice Insect Pests

Rice is one of the most important monsoon crops and is attacked by several insect pests.

Yellow Stem Borer (*Scirpophaga incertulas*)

Damage symptoms:

- Larvae bore into the stem.
- Drying of central shoots results in "dead heart" symptoms.
- Infested plants may produce empty panicles known as "white ear".

Management:

- Use resistant rice varieties.
- Maintain balanced nitrogen application.
- Remove and destroy damaged plants.
- Install pheromone traps for monitoring adult moth activity.
- Conserve parasitoids such as *Trichogramma japonicum*.
- Apply insecticides only when pest population exceeds economic threshold levels.

Brown Planthopper (*Nilaparvata lugens*)

Brown planthopper is a serious sucking pest of rice.

Damage symptoms:

- Nymphs and adults suck plant sap.
- Plants turn yellow and dry completely, a condition called "hopper burn".
- It can transmit viral diseases.

Management:

- Avoid excessive nitrogen fertilizer application.
- Maintain proper plant spacing.
- Encourage natural enemies such as spiders and mirid bugs.
- Use selective insecticides when required.

2. Maize Insect Pests

Fall Armyworm (*Spodoptera frugiperda*)

Fall armyworm has become a major threat to maize production in many regions.

Damage symptoms:

- Larvae feed on young leaves.
- Characteristic window-like feeding damage appears.
- Severe infestation affects plant growth and yield.

Management:

- Regular field monitoring during early crop stages.
- Use pheromone traps for early detection.
- Promote biological control agents such as *Trichogramma* spp.

- Apply neem-based formulations and microbial pesticides.
- Use recommended insecticides only under severe infestation.

3. Cotton Insect Pests

Whitefly (*Bemisia tabaci*)

Whitefly populations increase rapidly under warm and humid conditions.

Damage symptoms:

- Sap sucking causes leaf yellowing.
- Honeydew secretion promotes sooty mold development.
- It may transmit viral diseases.

Management:

- Maintain weed-free fields.
- Use yellow sticky traps for monitoring.
- Conserve predators such as ladybird beetles and lacewings.
- Avoid unnecessary insecticide sprays.
- Rotate insecticides with different modes of action to delay resistance.

Pink Bollworm (*Pectinophora gossypiella*)

Damage symptoms:

- Larvae damage cotton bolls.
- Reduce lint quality and seed development.

Management:

- Timely sowing.
- Removal of crop residues.
- Use pheromone traps.
- Follow refuge strategies in Bt cotton cultivation.

4. Vegetable Crop Insect Pests

Fruit Borer (*Helicoverpa armigera*)

This polyphagous pest attacks tomato, chilli, okra, pigeon pea, and other crops.

Damage symptoms:

- Larvae bore into fruits.
- Internal feeding causes rotting and yield reduction.

Management:

- Install pheromone traps.
- Use bird perches to encourage natural predators.

- Apply *Helicoverpa* NPV.
- Use neem-based products.
- Follow integrated pest management practices.

Diamondback Moth (*Plutella xylostella*)

A major pest of cabbage and cauliflower.

Damage symptoms:

- Larvae create holes in leaves.
- Severe infestation reduces photosynthetic activity.

Management:

- Crop rotation.
- Use biological control agents.
- Avoid repeated use of the same insecticide group.
- Use microbial pesticides such as *Bacillus thuringiensis*.

5. Sucking Pest Complex During Monsoon

Several sucking pests become active during humid conditions:

- Aphids
- Thrips
- Jassids
- Mealybugs
- Whiteflies

They damage crops by removing plant sap and transmitting plant viruses.

General Management

- Regular scouting of fields.
- Use sticky traps.
- Maintain biodiversity around farms.
- Encourage predators and parasitoids.
- Apply botanical pesticides such as neem formulations.
- Use chemical control only when economically justified.

Integrated Pest Management During Monsoon

Effective monsoon pest management requires a combination of preventive and curative approaches.

1. Pest Monitoring

Regular field inspection helps detect pest outbreaks at an early stage.

Important tools include:

- Pheromone traps
- Light traps
- Yellow sticky traps
- Digital pest monitoring systems

2. Cultural Practices

Cultural methods reduce pest establishment and multiplication.

Important practices include:

- Crop rotation
- Timely sowing
- Removal of crop residues
- Balanced fertilizer application
- Proper irrigation management
- Maintaining field sanitation

3. Biological Control

Natural enemies play a key role in suppressing pest populations.

Important biological agents include:

- *Trichogramma* spp.
- *Chrysoperla carnea*
- Ladybird beetles
- *Beauveria bassiana*
- *Metarhizium anisopliae*

4. Use of Biopesticides

Biopesticides provide environmentally safe pest management options.

Examples:

- Neem-based products
- Bt formulations
- NPV formulations
- Entomopathogenic fungi

They are compatible with sustainable agriculture and organic farming systems.

Role of Modern Technologies

Advanced technologies are improving monsoon pest management.

Important innovations include:

- AI-based pest identification
- Drone-based crop monitoring
- Remote sensing
- Smart pheromone traps
- Mobile-based pest advisory systems

These technologies enable early warning and precision pest management.

CONCLUSION

Monsoon-season insect pests represent a major challenge for sustainable crop production due to favorable environmental conditions that support rapid insect multiplication. Effective management requires early detection, ecological understanding, and integration of multiple control approaches. Dependence solely on chemical pesticides is neither economically nor environmentally sustainable.

Integrated Pest Management, supported by biological control, biopesticides, monitoring technologies, and farmer awareness, provides a practical solution for managing monsoon pests while protecting agricultural ecosystems. Future advancements in digital agriculture and precision pest monitoring will further strengthen sustainable crop protection strategies.