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Management Strategies Of Brown Planthopper (BPH)

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Rice (*Oryza sativa* L.) is a staple food for more than half of the world's population, and its productivity is severely threatened by the Brown Planthopper (BPH), *Nilaparvata lugens* (Stål). This pest causes direct damage through phloem feeding and indirect losses by transmitting viral diseases such as grassy stunt and ragged stunt. Outbreaks often result in severe yield losses, with hopper burn leading to complete crop failure in extreme cases.

This review highlights the biology, occurrence, and nature of BPH damage while emphasizing sustainable management strategies. Integrated Pest Management (IPM), combining resistant varieties, balanced nutrient management, cultural practices, biological control, and judicious insecticide use, provides an effective and eco-friendly solution. The article also discusses environmental concerns, challenges in BPH management such as resistance development and climate change, and future prospects including molecular breeding, digital pest monitoring, and farmer training. Strengthening research and extension systems for IPM adoption remains critical for sustainable rice production.

Introduction

Rice (*Oryza sativa* L.) is one of the most important food crops worldwide, providing nearly 20% of the total global calorie intake. India alone accounts for more than 43 million hectares of rice cultivation, producing about 130 million tonnes annually (FAO, 2022). However, rice productivity is threatened by a range of insect pests, among which the Brown Planthopper (BPH), *Nilaparvata lugens* (Stål), is considered the most destructive.

BPH causes damage directly by feeding on plant sap and indirectly by transmitting viral diseases such as grassy stunt and ragged stunt. Historically, severe BPH outbreaks in Asia have led to crop losses of 60–100%, particularly in high-yielding, irrigated rice ecosystems. Uncontrolled infestation leads to "hopper burn," characterized by the drying of entire patches of rice fields. This article reviews the biology of BPH, the nature of its damage, and effective management strategies, with emphasis on sustainable and integrated approaches.

Biology and Occurrence

Classification

- **Order:** Hemiptera
- **Family:** Delphacidae
- **Species:** *Nilaparvata lugens* (Stål)

Life Cycle

Females insert eggs in leaf sheaths, which hatch in 7–10 days. Nymphs pass through five instars and become adults within 15–20 days under optimal conditions. Adults exist in two forms—macropterous (long-winged, migratory) and brachypterous (short-winged, sedentary). A single female may lay 200–300 eggs, enabling exponential population growth.

Favorable Conditions

High humidity (above 70%), warm temperature (25–30°C), excess nitrogen fertilization, dense planting, and continuous rice cropping favor BPH multiplication.

Distribution

BPH is endemic to South and Southeast Asia, with frequent outbreaks in India, China, Vietnam, Thailand, and the Philippines, particularly in irrigated rice ecosystems.

Symptoms and Nature of Damage

1. **Early Infestation:** Yellowing and stunted growth due to continuous sap sucking from the base of tillers.
2. **Severe Attack:** Circular patches of dried plants ("hopper burn") that can spread rapidly across the field.
3. **Yield Loss:** Reduction in tiller number, poor panicle emergence, and empty grains.
4. **Disease Vector:** BPH transmits viral diseases such as Rice Grassy Stunt Virus (RGSV) and Rice Ragged Stunt Virus (RRSV).

Unchecked infestations can reduce yields by 60–80%, and in outbreak years, entire crops may be lost (IRRI, 2021).

Management Strategies of Brown Planthopper

1. Cultural Practices

- **Resistant Varieties:** Use varieties with resistance genes (e.g., *Bph1*, *Bph3*, *Bph14*, *Bph17*) such as Pusa Basmati 1718, Swarna Sub1, and IR64.
- **Balanced Nutrient Management:** Avoid excessive nitrogen; apply adequate potassium.
- **Synchronous Planting:** Planting within a short window to break pest life cycles.
- **Crop Rotation:** Rotate rice with pulses or oilseeds to disrupt pest buildup.
- **Water Management:** Alternate wetting and drying discourages hopper multiplication.

2. Mechanical and Physical Control

- Use light traps for monitoring adult activity.
- Remove heavily infested clumps.
- Maintain wider spacing to reduce humidity and pest buildup.

3. Biological Control

- **Predators:** *Cyrtorhinus lividipennis* (mirid bug), *Lycosa* spp. (spiders), dragonflies.
- **Parasitoids:** Egg parasitoids such as *Anagrus* spp.

- **Entomopathogens:** *Beauveria bassiana* and *Metarhizium anisopliae*.
- Conserve natural enemies by avoiding broad-spectrum insecticides.

4. Chemical Control

Apply insecticides only when the **Economic** Threshold Level (ETL) is exceeded (10 hoppers per tiller at booting stage).

- Imidacloprid 17.8 SL – 40 ml/acre
- Buprofezin 25 SC – 200 ml/acre
- Thiamethoxam 25 WG – 40 g/acre

Spray at the base of the plants and avoid overuse to prevent resistance development.

5. Integrated Pest Management (IPM)

- Combine resistant varieties with balanced fertilization.
- Use light traps and field surveillance.
- Conserve natural enemies.
- Apply need-based insecticide sprays only after ETL is reached.

Community-based IPM programs in India and the Philippines have reduced insecticide use by 40–50% while maintaining yields (Jena & Kim, 2010).

Environmental Significance

Effective BPH management protects both crop yield and environmental health. Overuse of insecticides leads to soil and water contamination, secondary pest outbreaks, and loss of biodiversity. IPM adoption minimizes chemical dependence, enhances natural pest regulation, and supports sustainable rice production systems.

Challenges in BPH Management

- Development of insecticide resistance in BPH populations.
- Climate change favoring pest outbreaks.
- Overuse of nitrogen and insecticides by farmers.
- Breakdown of resistance in rice varieties due to new BPH biotypes.

Future Prospects

- Molecular breeding for durable resistance through gene pyramiding.
- Nano-formulated biopesticides and microbial consortia for enhanced biocontrol.
- Digital tools such as drones, apps, and remote sensing for real-time pest monitoring.
- Farmer training and community-based IPM adoption.
- Policy support promoting eco-friendly pest management practices.

Conclusion

The Brown Planthopper is among the most serious pests of rice. Reliance solely on chemical control is unsustainable due to resistance and ecological impacts. Integrated Pest Management, combining host resistance, ecological and cultural practices, biological control, and judicious insecticide use, offers the best long-term solution. Strengthening farmer education, research in molecular breeding, and adoption of eco-friendly technologies are vital for sustainable rice production.

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