SUSTAINABLE INTEGRATED PEST MANAGEMENT IN PADDY: INNOVATIONS, CHALLENGES AND FUTURE PROSPECTS

1st Edition

N. Murugan, N.Vairam, L. Ramazeame, R. Nisha, B. Rex, T. Thamizharasu, N. Santhoshraj

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Sustainable Integrated Pest Management in Paddy: Innovations, Challenges and Future Prospects

1st Edition

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FOREWORD

Insect pest management (IPM) is a vital strategy for achieving sustainable agriculture and supporting human livelihoods. Climate change, globalization, and increased movement of people and goods have enabled many invasive species to spread across regions, causing significant alterations in ecosystems. These factors also intensify insect pest issues by triggering secondary pest outbreaks, resurgence, and resistance to insecticides in agroecosystems. Such biological stresses result in major agricultural losses through their harmful effects on crops, forests, livestock, poultry, and humans. It has been observed that agricultural crops suffer losses of about 20–25% both in the field and during post-harvest storage.

The study of insects is as vast as their diversity, as they represent the largest group of living organisms. It includes numerous aspects that naturally occur in ecosystems and therefore involves fundamental scientific principles. The interactions between insects and humans make this field more complex, integrated, and economically significant to human life. Moreover, it is unavoidable that these interactions are closely linked with human activities across both time and space. Consequently, entomology is becoming increasingly responsible and accountable for ensuring a healthy and sustainable human existence. All these factors highlight that applying the scientific principles of entomology, particularly through IPM, has become essential and indispensable for agriculture and human well-being. The current edition of *Sustainable Integrated Pest Management in Paddy: Innovations, Challenges and Future Prospects* contributes to this objective by simplifying and clearly presenting the economic aspects of entomology for learners.

We extend our best wishes to the authors and the book for effectively spreading entomological knowledge for the advancement of agriculture and human life.

PREFACE

Sustainable Integrated Pest Management (IPM) has emerged as a vital and holistic approach to address pest problems in paddy ecosystems. This book, *Sustainable Integrated Pest Management in Paddy: Innovations, Challenges and Future Prospects*, presents a comprehensive overview of pest management strategies that combine ecological principles, modern technologies, and farmer-friendly practices. It emphasizes the integration of biological control agents, cultural practices, resistant varieties, and need-based chemical interventions to minimize environmental impact while ensuring effective pest suppression.

The book explores recent innovations such as precision pest monitoring, digital decision-support systems, climate-resilient pest management strategies, and the role of beneficial organisms in maintaining ecological balance. At the same time, it critically examines the challenges faced in the adoption of IPM practices, including lack of awareness, limited accessibility to technologies, and field-level constraints encountered by farmers. Designed as a valuable resource, this book will benefit students, researchers, extension personnel, and farmers by providing both theoretical knowledge and practical insights. For students, it serves as a foundational text that bridges academic concepts with real-world applications. For farmers and practitioners, it offers practical guidance on sustainable pest control measures that reduce input costs, improve yields, and protect the environment. Looking ahead, the future of pest management in paddy lies in the integration of advanced technologies such as artificial intelligence, remote sensing, and climate modeling with traditional ecological knowledge. This book aims to inspire further research, innovation, and adoption of sustainable practices that will contribute to resilient and productive rice ecosystems.

We express our heartfelt gratitude to Skyfox Publishing Group, Thanjavur, for their dedicated support, encouragement, and professionalism in bringing out the first edition of this book in 2026. Their commitment to academic excellence has greatly contributed to the successful publication of this work.

We look forward to criticisms and constructive suggestions for the improvement of the book.

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YELLOW STEM BORER IN RICE

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Abstract

Yellow Stem Borer (*Scirpophaga incertulas* Walker) continues to be one of the most devastating insect pests affecting rice (*Oryza sativa* L.) production across Asia and other rice-growing regions. This review synthesizes current knowledge on the biology, ecology, damage symptoms, and integrated management strategies of this pest while identifying critical gaps for future research. *S. incertulas* exhibits a univoltine to multivoltine life cycle depending on environmental conditions, with larvae boring into rice stems, causing 'dead hearts' in the vegetative stage and 'whiteheads' during the reproductive phase, resulting in significant yield loss and economic damage. We discuss the influence of climatic factors, host plant resistance, and cropping patterns on pest population dynamics. Advances in molecular tools have enhanced our understanding of host–pest interactions and insecticide resistance mechanisms, yet practical field application remains limited. Chemical control remains widely practiced; however, increasing resistance and environmental concerns underscore the urgent need for sustainable alternatives. Biological control agents, such as parasitoids (*Trichogramma* spp.) and entomopathogens (*Beauveria bassiana*, *Metarhizium anisopliae*), show promise under conservation management frameworks. Cultural practices, including synchronous planting, optimized nitrogen management, and water regime manipulation, contribute substantially to reducing pest incidence when integrated effectively. Furthermore, host plant resistance—through traditional breeding and genomic selection—has emerged as a cornerstone of durable stem borer management, though widely adopted resistant cultivars are still limited. We propose an integrated pest management (IPM) framework that combines ecological, biological, and genetic strategies tailored to local agroecologies. Finally, the review highlights priority research areas such as climate change impacts, landscape-level pest modeling, and farmer participatory trials to achieve resilient rice production systems in the face of evolving Yellow Stem Borer challenges.

Keywords: Yellow stem borer; *Scirpophaga incertulas*; Rice; Yield loss; Integrated pest management

Introduction

Rice (*Oryza sativa* L.) is one of the most important staple food crops worldwide, providing primary nutrition to more than half of the global population. Ensuring sustainable rice production is therefore critical for food security, particularly in Asia where rice is cultivated extensively. Among the biotic constraints limiting rice productivity, insect pests play a major role, causing significant yield losses each year. The Yellow Stem Borer (YSB), *Scirpophaga incertulas* (Walker) (Lepidoptera: Crambidae), is recognized as one of the most destructive and persistent pests of rice in irrigated and rainfed ecosystems.

The larval stage of *S. incertulas* causes damage by boring into the rice stem and feeding internally, making early detection and control difficult. Infestation during the vegetative stage results in the formation of "dead hearts," while attack during the reproductive stage leads to "whiteheads," both of which directly reduce grain yield. Yield losses attributed to Yellow Stem Borer may range from 10 to 30 percent, and under severe infestation, losses can exceed 50 percent, depending on crop stage, variety, and management practices.

The population dynamics of Yellow Stem Borer are influenced by several factors, including climatic conditions, nitrogen fertilization, cropping intensity, and varietal susceptibility. Continuous rice cultivation, indiscriminate use of nitrogenous fertilizers, and monocropping practices have been reported to favor pest buildup. In addition, the concealed feeding habit of larvae and the development of resistance to commonly used insecticides have made management of this pest increasingly challenging.

Management strategies for Yellow Stem Borer traditionally rely on chemical control; however, growing concerns over insecticide resistance, environmental contamination, and impacts on non-target organisms have necessitated the adoption of more sustainable approaches. Integrated Pest Management (IPM), combining cultural, biological, chemical, and host plant resistance strategies, has emerged as an effective and environmentally sound option. Recent advances in breeding for resistance, biological control agents, and ecological pest management provide new opportunities to mitigate YSB damage.

This review aims to compile and critically analyse existing literature on the biology, damage symptoms, epidemiology, and management of Yellow Stem Borer in rice. By highlighting recent research advances and identifying existing gaps, the paper seeks to support the development of sustainable and location-specific management strategies for effective control of *Scirpophaga incertulas* in rice-based agroecosystems.

Taxonomic classification

Order: Lepidoptera

Superfamily: Pyraloidea

Family: Crambidae

Subfamily: Schoenobiinae

Genus: *Scirpophaga*

Species: *Scirpophaga incertulas* (Walker)

Host Range

The Yellow Stem Borer (*Scirpophaga incertulas* Walker) is a highly host-specific insect pest, primarily associated with rice (*Oryza sativa* L.). Cultivated rice is considered the principal and most preferred host, supporting the complete development and reproduction of the insect. Both irrigated and rainfed rice ecosystems provide favorable conditions for the survival and multiplication of this pest.

Although *S. incertulas* shows strong monophagous tendencies, it has occasionally been reported on a limited number of wild and cultivated graminaceous plants. Wild rice species (*Oryza rufipogon*, *O. nivara*) and certain grasses such as *Leersia hexandra* and *Panicum* spp. may serve as alternate or off-season hosts, particularly in areas where rice is not continuously available. These hosts play an important role in maintaining pest populations between cropping seasons and act as reservoirs for reinfestation.

However, compared to other rice stem borers, the host range of Yellow Stem Borer is relatively narrow, and its economic damage is largely confined to rice. This high degree of host specificity makes *S. incertulas* an important target for rice-based pest management strategies, including host plant resistance and habitat manipulation aimed at reducing carryover populations in non-crop hosts.

Origin and Distribution

The Yellow Stem Borer (*Scirpophaga incertulas* Walker) is believed to have originated in South and Southeast Asia, coinciding with the center of origin and domestication of rice (*Oryza sativa* L.). The long co-evolutionary association between rice and *S. incertulas* has contributed to the pest's high adaptability and persistence in rice-based agroecosystems.

The pest is widely distributed across major rice-growing regions of Asia, including India, Bangladesh, Sri Lanka, Nepal, Pakistan, Myanmar, Thailand, Vietnam, Indonesia, the Philippines, China, and Japan. It is particularly prevalent in tropical and subtropical climates where warm temperatures, high humidity, and continuous rice cultivation favor its development and survival.

In India, Yellow Stem Borer occurs in almost all rice-growing states and is considered the most dominant stem borer species in irrigated and lowland rice ecosystems. Its abundance and severity

vary with agroclimatic conditions, cropping patterns, and management practices. The pest is most destructive in areas practicing intensive rice cultivation with multiple cropping cycles per year.
Outside Asia, *S. incertulas* has limited distribution and is rarely reported as a serious pest, largely due to climatic constraints and the absence of suitable host availability. Its current distribution highlights the strong relationship between rice cultivation intensity and pest prevalence. The continued expansion of rice cultivation and changes in climate patterns may further influence the geographical spread and population dynamics of Yellow Stem Borer in the future.

Morphology

Eggs are laid in masses on rice leaves and covered with buff-colored hairs from the female abdomen, a key field diagnostic feature.**Larvae** are creamy white, legless, and smooth-bodied with a brown head capsule, reaching about 20–25 mm in length. They bore into rice stems soon after hatching.**Pupae** are yellowish-brown and formed inside the stem or leaf sheath, often partially protruding before adult emergence.**Adults** are straw-yellow moths; females are larger and possess a characteristic tuft of yellow hairs at the abdominal tip, while males are smaller and darker with a central wing spot. **Diagnostic characters** include hair-covered egg masses, unmarked larvae, yellow female moths with anal hair tufts, and typical damage symptoms such as dead hearts and whiteheads.

Life Cycle

The Yellow Stem Borer (*Scirpophaga incertulas* Walker) undergoes complete metamorphosis with four distinct stages: egg, larva, pupa, and adult. The duration of the life cycle varies with temperature, humidity, and crop stage, generally ranging from 35 to 55 days.
Females lay egg masses on the upper surface of rice leaves, usually near the midrib. The eggs hatch within 5–8 days. Newly emerged larvae move to the leaf sheath and bore into the stem, where they feed internally. The larval period lasts about 20–30 days and is responsible for the major crop damage, causing dead hearts during the vegetative stage and whiteheads during the reproductive stage.
Pupation occurs inside the stem or leaf sheath and lasts for 6–10 days. Prior to adult emergence, the pupa partially protrudes from the stem. Adults are short-lived, surviving for 2–7 days, during which mating and oviposition occur.
Yellow Stem Borer populations persist year-round in areas with continuous rice cultivation. Peak activity generally coincides with the tillering and panicle initiation stages of the crop. Phenology is strongly influenced by planting time, nitrogen fertilization, and climatic factors, with warm and humid conditions favoring rapid population buildup. Synchrony between pest development and rice growth stages plays a critical role in determining the severity of infestation and yield loss.

Symptoms

Yellow Stem Borer (*Scirpophaga incertulas*) larvae bore into rice stems, causing significant yield loss. *Dead hearts*—central shoots wilt and die in vegetative stage. *Whiteheads*—empty, whitish panicles due to larval feeding in reproductive stage. Stunted growth, reduced tillers, and wilting in severe infestations.

Yield losses range from 10% to over 50%, with severity influenced by crop stage, variety, and environmental conditions. Early detection is difficult due to the larvae's concealed feeding.

Field Detection

Effective management of Yellow Stem Borer (*Scirpophaga incertulas*) requires early detection using visual and monitoring techniques. Key field indicators include:**Dead hearts:** Wilted central shoots during the vegetative stage.**Whiteheads:** Empty, whitish panicles at the reproductive stage.**Egg masses:** Buff-colored hairs on leaf surfaces, usually near the midrib.**Larval presence:** Boreholes and frass inside stems, often visible by gently splitting the stem.**Adult moths:** Straw-yellow females with anal hair tuft; males are smaller and darker.

Regular field scouting, especially during tillering and panicle initiation, helps identify infestation early. Using light traps or pheromone traps can also aid in monitoring adult populations and predicting outbreaks.

Damaging Stage

The **larval stage** of Yellow Stem Borer (*Scirpophaga incertulas*) is the most destructive. After hatching, larvae bore into rice stems and feed internally, disrupting nutrient and water flow.Larval feeding causes *dead hearts* in vegetative stage. Larval feeding results in *whiteheads* and empty panicles in reproductive stage.

Other stages—egg, pupa, and adult—do not directly damage the crop but are important for the continuation of the pest's life cycle.

Preventive Methods

Preventive measures aim to reduce Yellow Stem Borer (*Scirpophaga incertulas*) infestation before it becomes severe: **Field Sanitation:** Remove and destroy rice stubbles and alternate hosts after harvest to reduce carryover populations. **Synchronous Planting:** Coordinate planting within a locality to avoid continuous availability of susceptible rice stages. **Crop Rotation:** Alternate rice with non-host crops to break the pest's life cycle. **Water Management:** Maintain proper water levels; draining fields for a short period can reduce larval survival. **Use of Resistant Varieties:** Grow varieties with tolerance or resistance to Yellow Stem Borer. **Balanced Fertilization:** Avoid excessive nitrogen, which favors pest multiplication.

These measures help minimize infestation and support integrated pest management strategies.

Integrated Pest Management (IPM)

Integrated Pest Management (IPM) for Yellow Stem Borer (*Scirpophaga incertulas*) combines cultural, biological, and chemical approaches to minimize damage while reducing environmental impact: Synchronous planting and proper field sanitation to reduce pest carryover. Crop rotation and water management to disrupt larval survival. Balanced fertilizer use to avoid excessive nitrogen that favors pest growth. Cultivate rice varieties with resistance or tolerance to Yellow Stem Borer. Use of improved varieties developed through conventional breeding or molecular techniques. Release or conservation of natural enemies such as parasitoids (*Trichogramma* spp.) and predators. Application of entomopathogens like *Beauveria bassiana* or *Metarhizium anisopliae* under suitable conditions. Apply selective insecticides only when pest populations exceed economic thresholds. Rotate insecticides with different modes of action to prevent resistance. Regular field scouting for egg masses, larvae, dead hearts, and whiteheads. Use of light or pheromone traps to monitor adult populations.

Adopting an IPM approach ensures sustainable management of Yellow Stem Borer, reduces yield loss, and minimizes negative environmental effects.

Conclusion

The Yellow Stem Borer (*Scirpophaga incertulas*) remains one of the most destructive pests of rice, causing substantial yield losses through dead hearts and whiteheads. Its concealed larval feeding, adaptability to diverse rice ecosystems, and potential for insecticide resistance make management challenging. Effective control requires a combination of preventive measures, host plant resistance, biological agents, and judicious use of chemicals within an Integrated Pest Management (IPM) framework. Sustainable strategies, including synchronous planting, crop rotation, and monitoring, can significantly reduce pest incidence and improve rice productivity. Continued research on resistant varieties, biological control, and eco-friendly management practices is essential to ensure long-term, resilient rice production systems.

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GALL MIDGE IN RICE

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Abstract

The Asian rice gall midge, *Orseolia oryzae* (Diptera: Cecidomyiidae), is an economically important pest of lowland and irrigated rice in many parts of South and Southeast Asia. Larvae feed within the developing shoot apex and trigger the formation of a hollow tubular gall, producing the typical "onion leaf" or "silver shoot" symptom that renders the tiller sterile. Outbreaks are favored by cloudy, rainy weather, high-tillering varieties, continuous rice cultivation, and the presence of off-season hosts in wetland environments. This assignment summarizes the pest's identity, distribution, life cycle, damage, field diagnosis, economic threshold, and integrated management options with emphasis on ecologically sound IPM in rice-based farming systems.

Keywords: gall midge, onion leaf, silver shoot, rainy weather, Southeast Asia, IPM.

Introduction

Rice (*Oryza sativa* L.) is the staple food crop for a large portion of the global population, and yield stability is strongly influenced by insect pest pressure in tropical and subtropical production zones. Among the monophagous pests of rice, the gall midge has emerged as a key pest in irrigated and rainfed wetland ecosystems from nursery to tillering stage. The maggot's feeding activity not only destroys the productive tillers but also alters plant architecture, which can cause yield losses up to 30–40% in severely affected fields in some regions of India and Sri Lanka. Modern cultivation practices such as intensive input use, short-duration high-tillering varieties, and continuous rice cropping often favor the buildup and survival of *O. oryzae* populations.

Taxonomic classification

Order: Diptera

Family: Cecidomyiidae

Genus: *Orseolia*

Species: *Orseolia oryzae* (Wood-Mason)

Host range

The pest is highly specialized on rice and is primarily associated with *Oryza sativa* grown in irrigated and rainfed lowlands, though it can also survive on wild and volunteer rice plants that act as off-season reservoirs. Reports indicate that the species is widely distributed in major rice-growing belts of India, Bangladesh, Sri Lanka, China and other Asian rice ecosystems where wetland conditions prevail during tillering.

Morphology and diagnostic characters

Adult gall midges are small, delicate, mosquito-like flies with long legs and narrow wings; they are usually orange to reddish in color and show crepuscular or nocturnal activity, often attracted to light traps. Females are slightly larger than males and possess a pointed ovipositor suited for inserting eggs into young plant tissue near the leaf sheath or shoot apex.

Eggs are elongate, tubular and translucent, deposited singly or in small groups on plant parts near the growing point of the tiller. The larva is a legless, pale to orange maggot that feeds inside the meristem and does not leave the gall once established, whereas the pupa is obtect and found within the gall, with the pupal case sometimes protruding when the adult is about to emerge. The combination of onion leaf/silver shoot symptom plus the presence of maggot-like larvae and pupal skins in the gall helps distinguish gall midge injury from stem borer or nutrient disorders.

Origin and distribution

The Asian rice gall midge is considered native to rice-growing regions of Asia and has been documented as a major pest in India, Bangladesh, Sri Lanka, China and several other rice-producing countries. Within India, heavy infestations are frequently reported from wetland rice areas of eastern and southern states, particularly under irrigated and rainfed lowland conditions. Population build-up is strongly favored by cloudy or rainy weather, high relative humidity, and prolonged standing water in fields during the tillering phase. Continuous cultivation of susceptible, high-tillering varieties, presence of ratoon crops and volunteer rice, and absence of close season or crop rotation allow the pest to survive from season to season.

Life cycle

The life cycle of *O. oryzae* includes egg, larva, pupa and adult and can be completed within a few weeks under favorable temperatures. Females normally lay eggs on young rice plants at the nursery or early tillering stage; eggs hatch in a few days and neonate larvae move to the shoot tip where they begin feeding on developing tissues.

Larvae secrete substances that induce gall formation while feeding, and this stage usually accounts for most of the crop damage. After completing development, the larva pupates within the gall; adults subsequently emerge, often at dawn or dusk, leaving behind empty pupal cases on the gall surface. In many irrigated systems the pest can have multiple overlapping generations per crop season, with peak incidence commonly coinciding with mid-tillering. During dry periods or off-season, the insect may persist in the pupal stage in dried galls or in alternate hosts until suitable conditions return.

Symptoms

Rice gall midge mainly attacks the crop from nursery to end of tillering, with larvae feeding at the base of the growing shoot. The most characteristic symptom is the production of a silvery-white, tubular gall that looks like an elongated, hollow leaf sheath known as “onion leaf” or “silver shoot.”

The affected tiller becomes unproductive; the normal leaf blade and panicle fail to emerge, resulting in sterile tillers and reduced panicle number per hill. Infested plants may show stunted growth and uneven crop stands, and patches of silver shoots in the field are typical indicators of severe infestation. These symptoms can resemble nutrient disorders or drought in some cases, but the presence of the larva and the hollow gall differentiates gall midge damage from other stresses.

Field detection

Early detection is crucial, and scouting is usually recommended from nursery stage through tillering, focusing on the appearance of isolated galls or silver shoots. Farmers and scouts should examine multiple spots per field, counting the number of tillers bearing galls versus total tillers to estimate percent infestation.

Extension guidelines commonly consider an economic threshold level of about 10% silver shoots or galled tillers as a trigger for intervention in many rice IPM programs. Light traps can help monitor adult activity at night, while the presence of parasitized larvae or pupae indicates the action of natural enemies that should be conserved.

Damaging stage of pest

The larval stage is the primary damaging stage of *O. oryzae* because maggots feed directly on the meristematic tissue of the growing shoot, inducing gall formation and preventing panicle initiation. Adults live briefly, mainly for mating and oviposition, and do not cause significant direct feeding damage.Gall formation provides the larva with food and shelter, and this intimate interaction between insect saliva, plant tissues, and associated microbes appears to modify host defense responses and tissue differentiation. Because injury occurs early at the tiller base, damage to each tiller is irreversible even if the larva dies later, which explains the strong impact on yield when infestation is high during the active tillering phase.

Preventive and cultural methods

Deployment of resistant or tolerant rice varieties is the most widely recommended and environment-friendly option for managing gall midge. Several local and improved genotypes in India and other countries have been identified as resistant or highly resistant to prevalent gall midge biotypes, and these are often promoted in endemic areas. Avoiding continuous rice–rice cropping and including non-host crops or planned fallow helps break the pest life cycle and reduce carry-over in off-season. Synchronized planting within a command area minimizes prolonged availability of susceptible crop stages and discourages multiple overlapping generations. Field sanitation and destruction of alternate hosts. Plowing in or destroying ratoon rice, volunteer plants and grassy weeds that can harbor gall midge is recommended to reduce off-season survival. Removal of galled tillers at early stages, where practical, can locally reduce larval populations before they complete development. Balanced fertilizer application, particularly avoiding excessive nitrogen, is often advised because over-lush crops can favor higher pest and disease incidence. Proper water management to avoid continuous stagnant water at very high levels during vulnerable stages may contribute to reduced pest buildup in some situations.

Mechanical and physical methods

Regular roguing of galled tillers and their destruction outside the field can physically remove larvae and pupae where infestation is still localized. In small plots, manual clipping of silver shoots combined with removal of alternate hosts along bunds and irrigation channels can complement other IPM tactics.Light traps operated at night can help monitor adult emergence and may contribute to partial reduction in adult populations while guiding the timing of other interventions.

Biological control

A wide range of natural enemies is associated with rice gall midge, including egg–larval parasitoids, larval–pupal parasitoids and generalist predators. Platygasterid, eupelmid and pteromalid parasitoid wasps attack the larval and pupal stages inside galls, while phytoseiid mites feed on eggs and spiders and predatory beetles prey on adults.

Conservation of these beneficial organisms through reduced and selective pesticide use is a key component of IPM in rice ecosystems. Some local recommendations include periodic releases of *Platygaster oryzae* in heavily affected areas to augment natural parasitism of gall midge larvae.

Chemical control (need-based)

Chemical measures are generally considered a last resort and should only be used when infestation exceeds the economic threshold and other tactics are insufficient. Recommendations from rice IPM programs include: Seedling root dipping or nursery treatment with chlorpyriphos solution (around 0.2%) for several hours before transplanting to protect plants from early attack by stem borers and gall midge. Application of granular insecticides such as carbofuran or phorate in the nursery or main field to suppress early larval establishment, observing label rates and national restrictions on specific molecules.In some studies, fipronil formulations have been reported effective against gall midge when applied at recommended granular rates in the main field, again with attention to their effects on natural enemies. Sprays should be timed to coincide with peak adult activity or early larval stages and should be avoided once the crop nears panicle initiation to minimize residues and non-target impacts. Integration with resistant varieties and biological control is strongly emphasized to delay resistance development and protect beneficial fauna.

Integrated pest management (IPM) strategy

An effective IPM strategy for rice gall midge typically combines the following components in a compatible way: Planting of locally adapted, gall-midge-resistant rice varieties in endemic areas. Synchronized sowing and transplanting, along with removal of ratoons, volunteers and grassy hosts to reduce off-season survival and staggered infestation. Regular field scouting for early detection of onion leaf or silver shoot symptoms and monitoring of adult activity using light traps where feasible. Conservation and, where recommended, augmentation of parasitoids and predators, supported by judicious pesticide use only above ETL. Need-based application of compatible chemical insecticides, using proper doses and safety measures, with special focus on early crop stages and avoiding indiscriminate spraying.

Conclusion

Rice gall midge remains a serious constraint in many wetland rice ecosystems because its larval feeding destroys productive tillers and produces sterile silver shoots. Sustainable management depends on the combined use of resistant varieties, cultural manipulation, biological control and carefully targeted insecticide applications, embedded within a broader integrated pest management framework. When these tactics are implemented in a coordinated manner at community level, the pest can usually be kept below economic threshold, thereby protecting yield while reducing ecological and health risks associated with sole reliance on chemicals.

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SWARMING CATERPILLAR IN RICE

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Abstract

The swarming caterpillar, Spodoptera mauritia (Boisduval), is an important defoliating pest of rice, particularly during the vegetative stages of crop growth. Although traditionally considered a sporadic pest, frequent outbreaks have been reported in several rice-growing regions of India and other Asian countries. The larvae exhibit gregarious feeding behavior and migrate in large swarms, causing rapid and extensive defoliation of rice seedlings and tillers. Severe infestations result in a grazed appearance of fields and significant yield losses. This article presents a comprehensive review of the pest's identity, distribution, morphology, biology, damage symptoms, and management strategies with emphasis on cultural, mechanical, and biological control measures for sustainable rice production.

Keywords: Swarming caterpillar, Spodoptera mauritia, rice pest, armyworm, integrated pest management.

Introduction

Rice (Oryza sativa L.) is the staple food for more than half of the world's population and plays a vital role in food security, particularly in Asia. Insect pests are major constraints to rice production, causing considerable yield losses annually. Among these, defoliating pests such as the swarming caterpillar have gained importance due to their sudden outbreak nature and capacity to destroy crops within a short period. Spodoptera mauritia is capable of inflicting serious damage during the nursery and early vegetative stages of rice, necessitating timely identification and effective management.

Pest Identity and Taxonomy

Scientific name: Spodoptera mauritia (Boisduval)

Order: Lepidoptera

Family: Noctuidae

Genus: Spodoptera

The pest belongs to the family Noctuidae, which includes several economically important agricultural pests commonly known as armyworms and cutworms.

Common Names: Swarming caterpillar, Rice swarming caterpillar, Armyworm, Lawn armyworm

Host Range

Spodoptera mauritia is polyphagous in nature. Although rice is the principal host, the larvae also feed on several grasses and cereal crops. Common weed hosts present in and around rice fields serve as alternate hosts and aid in the survival and multiplication of the pest during off-seasons.

Origin and Distribution

The swarming caterpillar is widely distributed in the Oriental and Australasian regions. In India, it has been reported from eastern, southern, and northeastern rice-growing states. Outbreaks are generally associated with favorable climatic conditions such as high humidity, moderate temperature, and continuous cropping of rice.

Morphology

Eggs are spherical, creamy white, and laid in clusters on leaf surfaces, covered with brownish hairs. Larvae are smooth, cylindrical, and greenish-brown to dark brown in color with distinct longitudinal stripes and characteristic C-shaped black spots on the dorsal side. Pupae are dark brown and found in earthen cocoons in the soil. Adults are stout-bodied moths with grayish-brown forewings and pale markings.

Life Cycle

The life cycle of Spodoptera mauritia consists of egg, larva, pupa, and adult stages. The egg stage lasts about 6–7 days. The larval stage passes through six instars over a period of 25–30 days. Pupation occurs in the soil and lasts for 8–10 days. Adults are nocturnal and lay eggs in clusters. Multiple generations may occur in a single cropping season under favorable environmental conditions.

Symptoms

Larvae feed voraciously on rice leaves, cutting leaf tips and margins and skeletonizing foliage. In severe infestations, seedlings and young plants are completely defoliated, giving the field a grazed appearance. Damage is more severe during the nursery and early tillering stages and can lead to significant yield reduction.

Field Detection

Early detection is essential for effective management. Indicators include irregular defoliation, presence of larval masses during early morning or evening hours, and visible migration tracks. Sweep net sampling and visual inspection during dusk help in assessing larval populations.

Damaging Stage of the Pest

The larval stage is the most destructive stage of the swarming caterpillar. Adult moths do not cause direct damage to the crop but contribute to population buildup through egg laying.

Preventive Methods

Preventive measures include removal of weeds and alternate hosts, deep summer ploughing to expose pupae, proper water management, and balanced fertilizer application. Encouraging natural enemies also helps suppress pest populations.

Cultural, Mechanical and Biological Methods

Cultural methods include field sanitation, flooding of fields to expose larvae, and avoiding excessive nitrogen application. Mechanical control involves hand collection and destruction of larvae and installation of light traps. Biological control relies on natural enemies such as birds, parasitoids, predators, and entomopathogens including nucleopolyhedrovirus and entomopathogenic nematodes.

Conclusion

The swarming caterpillar, Spodoptera mauritia, poses a serious threat to rice cultivation due to its gregarious feeding behavior and outbreak potential. Effective management depends on early detection, preventive cultural practices, and integration of mechanical and biological control methods. Adoption of integrated pest management strategies will reduce crop losses while ensuring environmental safety and sustainability in rice ecosystems.

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LEAF FOLDER IN RICE

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Abstract

Rice leaf folder (*Cnaphalocrocis medinalis*) is one of the most destructive lepidopteran pests of rice, causing significant yield losses in major rice-growing regions of Asia. The larval stage damages the crop by folding rice leaves longitudinally and feeding on the green mesophyll tissue, leading to reduced photosynthetic efficiency and poor grain filling. The incidence and severity of leaf folder infestation are strongly influenced by varietal susceptibility, climatic factors, crop growth stage, and agronomic practices such as excessive nitrogen application. This review synthesises current knowledge on the biology, ecology, and damage symptoms of the rice leaf folder, along with recent advances in its management. Emphasis is placed on integrated pest management (IPM) strategies, including cultural, biological, host plant resistance, and chemical control measures. The role of natural enemies, pheromone-based monitoring, and eco-friendly approaches is also discussed. Understanding the interactions between the pest, host plant, and environment is crucial for developing sustainable and cost-effective management practices. This review aims to provide a comprehensive overview to support researchers, extension workers, and farmers in improving leaf folder management and minimising yield losses in rice cultivation.

Keywords: Rice, leaf folder, *Cnaphalocrocis medinalis*, damage, integrated pest management

Introduction

Rice (*Oryza sativa* L.) is one of the most important staple food crops, sustaining more than half of the world's population, particularly in Asia. Ensuring stable rice production is critical for global food security; however, productivity is severely constrained by a range of biotic stresses, among which insect pests play a major role. More than a hundred insect species have been reported to attack rice at different growth stages, causing significant yield losses under favorable conditions. Among these pests, the rice leaf folder, *Cnaphalocrocis medinalis* Guenée (Lepidoptera: Crambidae), has emerged as a serious threat to rice cultivation in many rice-growing regions. The pest is particularly prevalent in irrigated and high-input rice ecosystems. The larval stage causes damage by wfolding the leaves longitudinally and feeding on the green mesophyll tissue, resulting in reduced leaf area, impaired photosynthesis, and ultimately lower grain yield. Severe infestations can lead to substantial economic losses, especially during the tillering and booting stages of the crop.

The incidence and intensity of leaf folder infestation are influenced by several factors, including climatic conditions, varietal susceptibility, cropping patterns, and agronomic practices such as excessive nitrogen fertilizer application. Changes in rice cultivation practices, expansion of high-yielding varieties, and indiscriminate use of insecticides have further contributed to the increased occurrence and outbreak potential of this pest.

Effective management of the rice leaf folder remains a challenge due to its cryptic feeding behavior and the risk of insecticide resistance. Sustainable approaches emphasizing integrated pest management (IPM), including cultural practices, biological control, host plant resistance, and judicious use of chemical insecticides, are therefore essential. This review aims to compile and critically analyze existing information on the biology, ecology, damage potential, and management strategies of rice leaf folder, with the objective of supporting the development of environmentally sound and economically viable control measures.

Taxonomy of Rice Leaf Folder

Order: Lepidoptera
Family: Crambidae
Subfamily: Spilomelinae
Genus: *Cnaphalocrocis*
Species: *Cnaphalocrocis medinalis*

Host Range

The rice leaf folder (*Cnaphalocrocis medinalis*) is primarily an oligophagous pest with rice (*Oryza sativa* L.) as its main and most economically important host. In addition to cultivated rice, the insect can utilize several grasses belonging to the family Poaceae as alternative hosts, including wild rice species (*Oryza rufipogon*, *O. glaberrima*) and common grassy weeds such as *Echinochloa crus-galli*, *E. colona*, *Leersia hexandra*, *Panicum repens*, *Cynodon dactylon*, *Setaria* spp., and *Paspalum* spp. These alternative hosts serve as reservoir plants that enable the pest to survive during the off-season and contribute to carryover populations, thereby facilitating infestation in subsequent rice crops.

Origin and Distribution

The rice leaf folder (*Cnaphalocrocis medinalis* Guenée) is believed to have originated in the **tropical and subtropical regions of Asia**, where rice cultivation has been practiced for centuries. The insect is now widely distributed across major rice-growing areas of the world. It occurs throughout **South Asia**, **Southeast Asia**, **East Asia**, and parts of **Oceania**, including India, Sri Lanka, Bangladesh, Pakistan, Nepal, Myanmar, Thailand, Vietnam, Indonesia, Malaysia, the Philippines, China, Japan, and Korea. The pest has also been reported from **Australia** and some regions of the **Middle East**. Its wide distribution is attributed to favorable climatic conditions, continuous rice cultivation, availability of alternative grass hosts, and the adoption of high-yielding rice varieties. The rice leaf folder is particularly abundant in irrigated and high-input rice ecosystems, where warm temperatures and high humidity favor its development and population buildup.

Morphology

The rice leaf folder undergoes complete metamorphosis with four distinct life stages: egg, larva, pupa, and adult. **Eggs** are small, flat, oval to elliptical, and creamy white when freshly laid, gradually turning yellowish before hatching. They are usually laid singly or in small groups on the upper surface of rice leaves. **Larvae** are slender, translucent green with a pale yellowish head capsule and grow up to about 15–20 mm in length. The larval body is smooth and lacks prominent hairs; it exhibits characteristic wriggling movement when disturbed. The larva folds the leaf longitudinally and remains concealed within, feeding on the green mesophyll tissue. **Pupation** occurs within the folded leaf inside a silken cocoon, and the pupa is light brown to dark brown in color.The **adult moth** is small and delicate, with a wingspan of about 18–22 mm. The forewings are pale yellowish-brown with two distinct dark brown wavy transverse bands and a characteristic dark spot near the center, while the hind wings are paler with a single faint band. At rest, the moth holds its wings roof-like over the body. Diagnostic characters of *C. medinalis* include the typical leaf-folding damage pattern, the presence of green larvae inside folded leaves, and the distinctive wing markings of the adult moth, which help distinguish it from other rice leaf-feeding lepidopteran pests.

Life Cycle

The rice leaf folder undergoes complete metamorphosis, passing through egg, larval, pupal, and adult stages, and completes several generations in a year depending on climatic conditions. Females lay eggs singly or in small groups on the upper surface of rice leaves. The **incubation period** generally lasts 3–7 days. Upon hatching, the **larvae** pass through five to six instars over a period of about 15–25 days. During this stage, larvae fold rice leaves longitudinally using silken threads and feed on the green mesophyll tissue from within the folded leaf, causing characteristic damage. **Pupation** takes place inside the folded leaf within a silken cocoon and lasts for 6–10 days. The **adult moths** are short-lived, surviving for 4–7 days, during which mating and oviposition occur.Phenologically, leaf folder infestation is most severe during the **tillering to booting stages** of the rice crop, when lush foliage provides favorable conditions for larval development. Population buildup is influenced by warm temperatures (25–30 °C), high relative humidity, cloudy weather, and continuous availability of host plants. Excessive nitrogen fertilization and dense crop canopy further favor pest incidence. The pest persists throughout the year in tropical regions by surviving on successive rice crops and alternative grass hosts, while in subtropical regions its activity is largely seasonal, coinciding with the main rice-growing periods.

Symptoms and Damage

The primary symptom of rice leaf folder infestation is the **longitudinal folding of rice leaves**, in which the larva ties the leaf edges together with silk and feeds on the green mesophyll tissue inside. This feeding results in **transparent or whitish "windowpane" streaks** along the leaf blade, reducing the photosynthetic area. Early-stage damage may appear as narrow, pale streaks, while severe infestations cause entire leaves to turn **dry and straw-colored**. The damage is most pronounced during the **tillering to booting stages** of rice, when rapid leaf growth provides ample feeding sites. Infested plants exhibit stunted growth, reduced tillering, and poor panicle development. Severe outbreaks can lead to **significant yield losses**, often ranging from 10% to 30%, and in extreme cases, losses may exceed 50% in susceptible varieties. The hidden feeding behavior of larvae within folded leaves makes early detection difficult and contributes to rapid pest buildup. Management strategies rely on monitoring leaf folding symptoms, larval presence, and adult moth activity to implement timely control measures.

Field Detection

Field detection of rice leaf folder relies on visual observation of characteristic symptoms and direct sampling of larvae and adults. The most reliable key indicators include:Folded leaves – Young larvae fold the rice leaves longitudinally with silk threads; this is the most distinctive and early sign of infestation. Transparent or whitish streaks – Feeding inside the folded leaf produces pale streaks or "windowpane" symptoms on the leaf blade. Presence of larvae – Slender green larvae with pale yellow heads can be found inside folded leaves. They exhibit wriggling movements when disturbed. Silken webs or cocoons – Pupation occurs within the folded leaves, which may contain small silken cocoons. Adult moths – Small pale yellow-brown moths with characteristic dark transverse bands and a central spot can be observed resting on leaves, particularly in the evening or early morning. Increased stunted tillers or dead leaves – In severe infestations, entire leaves turn dry and straw-colored, and affected plants may show reduced tillering. Monitoring can be enhanced with pheromone traps to detect adult moth activity and anticipate outbreaks, enabling timely intervention. Regular field scouting during tillering to booting stages is critical, as early detection prevents large-scale damage.

Damaging Stage of the pest

The larval stage of the rice leaf folder is the primary damaging stage. After hatching from eggs laid on the upper surface of rice leaves, the larvae fold the leaves longitudinally using silken threads and feed on the green mesophyll tissue inside. This concealed feeding behavior reduces the photosynthetic area, leading to characteristic pale streaks or "windowpane" symptoms on the leaves. While the egg and pupal stages do not directly damage the crop, they are crucial for pest continuity. Adult moths are also non-damaging but are important for reproduction and dispersal. Damage is most severe during the tillering to booting stages, when the rice crop has abundant foliage, supporting higher larval survival and population buildup. Severe infestations during these stages can lead to stunted growth, reduced tillering, poor panicle development, and significant yield losses.

Preventive methods

Effective prevention of rice leaf folder infestation integrates cultural, varietal, and monitoring strategies aimed at reducing initial pest pressure and limiting outbreak potential before major damage occurs. Preventive cultural practices include maintaining field sanitation and weed management by removing grassy weeds and alternate host plants from field borders and bunds, as these hosts facilitate pest carryover, and avoiding excessive nitrogen fertilizer that promotes lush growth attractive to larvae. The use of resistant or tolerant rice varieties reduces larval establishment and feeding damage, while synchronized and timely planting across fields minimizes the vulnerability window for pest buildup. Intermittent irrigation and proper crop spacing improve air circulation and deter favorable microclimates for leaf folder development. Regular field scouting and pheromone-based monitoring of moth activity allow early detection and enable preventive action before populations reach damaging levels. Additionally, emerging techniques such as hyperspectral imaging for early infestation detection show promise for guiding precise interventions and reducing unnecessary chemical sprays. By combining these proactive measures within an integrated pest management framework, rice growers can minimize leaf folder incidence and delay reliance on chemical control, thereby enhancing sustainability and reducing environmental impact.

Integrated Pest Management (IPM)

Integrated Pest Management (IPM) is a **sustainable approach** that combines multiple control strategies to manage rice leaf folder populations effectively while minimizing environmental impact. The IPM strategy for leaf folder typically includes:**Field sanitation** by removing weeds and alternate hosts to reduce pest reservoirs.**Synchronized planting** to limit periods of vulnerability.**Balanced fertilizer use** and proper irrigation to avoid excessive vegetative growth favorable to larvae.Planting **leaf-folder resistant or tolerant rice varieties** reduces larval survival and damage.Conservation and augmentation of **natural enemies** such as parasitoids (*Trichogramma spp.*, *Telenomus spp.*) and predators (spiders, mirid bugs) help regulate pest populations naturally.**Manual removal of folded leaves** in small fields.Use of **light traps or pheromone traps** to monitor adult moth activity.Judicious use of selective insecticides, applied only when pest populations exceed economic threshold levels, to reduce resistance development and environmental hazards. Regular field scouting and **economic threshold–based interventions** ensure timely and effective control.IPM emphasises **combining preventive, cultural, biological, and chemical measures** in a cost-effective and environmentally safe manner. Studies from 2020 onward highlight that IPM practices can significantly reduce rice leaf folder damage, maintain ecological balance, and decrease dependence on chemical pesticides.

Conclusion

The rice leaf folder (*Cnaphalocrocis medinalis*) remains one of the most destructive pests of rice, causing significant yield losses in Asia and other rice-growing regions. Its cryptic larval feeding inside folded leaves, high reproductive potential, and ability to survive on alternative hosts make management challenging. Effective control relies on **early detection, preventive cultural practices, host plant resistance, and natural biological regulation**, integrated within an **IPM framework** to minimize chemical use and environmental impact. Advances in monitoring technologies, including pheromone traps and remote sensing, offer promising tools for timely intervention. Sustainable management of the rice leaf folder requires combining traditional knowledge with modern practices to reduce infestation levels, safeguard yields, and promote eco-friendly rice production systems.

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Rice Case Worm (*Parapoynx stagnalis*)

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Abstract

Rice (Oryza sativa L.) is the primary food source for a large portion of the global population. Insect infestations pose a risk to rice crops, mostly in wetlands. The rice case worm, known as Parapoynx stagnalis, is a big pest that eats leaves, hurting rice in its early stages, especially in waterlogged areas. The larvae create protective cases from cut leaf pieces and eat leaf tissue together, which causes a white leaf look. Serious cases can halt development and cut yields by 25–50% in poorly handled fields. This paper talks about what this pest is, how it spreads, its life cycle, what damage it does, how to spot it, and its economic impact on rice farms. It looks at different ways to handle the problem, like prevention, physical removal, using natural predators, and chemicals, all within a plan for overall pest control. It stresses keeping water levels right, watching fields early, and using eco-friendly ways to cut back on using man-made bug killers and grow rice in a way that lasts.

Keywords: Rice case worm, Parapoynx stagnalis, rice pest, defoliator, integrated pest management, water management.

Introduction

Rice grows in different environments in India, covering a big area each year. While better kinds of rice and farming methods have raised how much rice is grown, bugs are still a problem, mostly when the weather is just right for them, like when there's always water and thick plant cover. The rice case worm has been a known issue in rice fields that get flooded. It's at its worst in the rainy season in young rice plants where water stays for a long time. This pest is a concern for rice grown straight from seeds and in earth-friendly farms where fewer chemicals are used. While it tends to feed on rice and a few water grasses, it can grow fast when things are right, making it a regular threat in certain rice-growing areas of India. This paper collects what we know now about the life, damage, and control of rice case worm, with a focus on ways to control it that are good for the environment and help reach targets for smart and lasting rice growing.

Pest Identity and Taxonomy

Common name: Rice case worm

Scientific name: Parapoynx stagnalis

Order: Lepidoptera

Family: Crambidae

Subfamily: Nymphulinae

Origin and Distribution

The rice case worm comes from tropical Asia and lives in rice-growing places in India, Bangladesh, Myanmar, Thailand, and parts of China. In India, it's common in certain states that often have floods, lots of humidity, and closely planted crops. It often shows up after a lot of rain and bad water flow.

Morphology

Adult moths are small, light yellow with brown spots and clear parts on their front wings. They fly at night and not very well. Eggs are laid alone or in groups on the bottom of rice leaves, looking flat and clear. Larvae are light green to yellow, with a dark head. What stands out is how they cut pieces of leaves and make tubes to live in while they eat. They stick these tubes to leaves with silk. Pupation happens inside the leaf tube, stuck to a leaf or underwater. The pupa is light brown.

Life Cycle

Parapoynx stagnalis goes through its life cycle in about a month when conditions are good. Egg: a few days Larva: About two weeks Pupa: Less than a week Adult: Lives a few days; lays many eggs There are several sets of them each season, most active during certain months. Larvae need flooded areas to live; drying the field stops their life cycle.

Symptoms

Larvae eat the green stuff inside rice leaves from inside their tubes. Signs of damage include whitish spots that turn into big, empty areas. In bad cases, leaves turn white, with just the center rib left. Big infestations in young rice plants cause: Lots of leaves eaten, less growth, short plants, weak roots, and late growth. Loss of rice can be big in fields that aren't taken care of, mostly when the bugs hit at key growth times.

Field Detection

Things to look for to spot them include: Floating leaf tubes on the water, whitish leaves, larvae in leaf tubes, and weak plants in parts of the field. Check fields every week from when they're young to when they start growing new stems. If a certain amount of leaves are damaged or larvae are seen per plant, it's time to act. If many young plants have tubes on them, do something right away.

Movement and Multiplication

Adults move close by but can go a bit farther to find flooded places. They grow fast in flooded fields that are thick with plants and not much air. They can't live in dry fields, so managing water is key to control them. They live through the winter as larvae or pupae in old crops or water weeds.

Damaging Stage of Pest

The larva is the only part that hurts the plant. They eat leaves while safe inside their tubes, so they're hard to get to with bug killers. Adults don't eat and only reproduce.

Preventive Methods

Avoid planting seeds too close together. Make sure to use good seeds. Keep field edges in shape to stop water from sitting and let it drain fast. Get rid of other plants they might live on from around the field.

Cultural and Mechanical Methods

Dry fields for a couple of days if you see them. Larvae die without water, and their tubes fall apart. Plant early to miss when the moths are most active. Pull out and destroy badly infested plants in nurseries. Plow fields after harvest to kill any overwintering bugs. Clear old crops and weeds to lower bug numbers.

Biological Methods

Conservation of Natural Enemies: Keep natural predators around like water bugs, spiders, and fish in fields with water. Neem-based Sprays: Spray neem extract every week or so to stop them from eating and laying eggs. Entomopathogenic Fungi: Spray certain fungi in the evening to kill larvae well. Biological Larvicides: Use certain bacteria early on to kill small larvae.

Chemical Methods

Only use chemicals if you have to: Certain chemicals can be used at specific amounts per area. Avoid spraying when plants are flowering to protect pollinators. Use enough spray to cover the leaves well.

Integrated Pest Management (IPM)

A good IPM plan for rice case worm includes: Managing water, watching fields closely, keeping natural predators around, and using bug killers only when needed. Working together with others to manage water and weeds helps a lot.

Conclusion

The rice case worm is still a problem in rice areas, but it can be handled. Because it needs water, we can control it without chemicals by adjusting how we farm. Lasting control depends on farmers knowing what to do, draining water on time, and using eco-friendly methods in an IPM plan. With the weather changing and more rain and floods happening, it's key to push for strong, simple ways to manage case worms to keep rice growing well and help farmers make money.

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RICE SKIPPER

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Abstract

The rice skipper, *Pelopidas mathias* (Fabricius), is a common defoliator of rice occurring mainly during the vegetative stage of the crop. The larval stage is destructive, causing damage by folding the rice leaves longitudinally and feeding from inside, which results in white streaks, reduced leaf area, and lowered photosynthetic efficiency. Severe infestation leads to poor tillering, stunted growth, and yield reduction, especially under warm and humid conditions prevalent in irrigated and rainfed rice ecosystems. Adult skippers are active butterflies that lay eggs singly on rice leaves, and pupation takes place within the folded leaves. Management of rice skipper relies on integrated pest management practices including cultural methods, mechanical removal of infested leaves, conservation of natural enemies, and need-based application of recommended insecticides. Proper understanding of pest biology, damage symptoms, and population dynamics is essential for effective and sustainable management of rice skipper in rice cultivation systems.

Keywords: rice skipper, rice, white streaks, photosynthetic efficiency, rainfed.

Introduction

Rice is one of the most important staple food crops cultivated extensively in India and many Asian countries. Among the various insect pests affecting rice, the rice skipper, *Pelopidas mathias* (Fabricius), is a notable defoliator that causes damage mainly during the vegetative stage of the crop. The pest belongs to the order Lepidoptera and family Hesperiidae. Rice skipper infestation is commonly observed in both irrigated and rainfed rice ecosystems, particularly under warm and humid climatic conditions.

The larval stage of the rice skipper is responsible for economic damage. Larvae fold the rice leaves longitudinally and feed from within the folded leaf, leading to characteristic white streaks and loss of effective leaf area. This damage reduces photosynthetic activity, resulting in poor tillering, retarded plant growth, and potential yield reduction when infestation is severe. Although the pest rarely causes complete crop failure, its incidence can significantly affect crop vigor and productivity.

Understanding the biology, damage symptoms, and favorable conditions for rice skipper occurrence is essential for adopting timely and effective management practices. Hence, the study of rice skipper is important in rice pest management programs, particularly within the framework of integrated pest management.

Taxonomy

Pest: Rice Skipper
Scientific name: *Pelopidas mathias*
Order: Lepidoptera
Family: Hesperiidae
Host: Primarily rice (*Oryza sativa*)
Distribution: Asia (India, China, Japan, Korea, Southeast Asia), Oceania; increasingly reported across rice-growing belts of temperate and tropical Asia.

Origin & Distribution

Rice skippers, including *Parnara guttata* and *Pelopidas mathias*, are widely distributed throughout Asian rice-growing ecosystems. *P. guttata* is native to East and Southeast Asia, abundant in China, Japan, Korea, Taiwan, Vietnam, Thailand, and the Philippines; *P. mathias* ranges from South Asia (India, Sri Lanka, Nepal, Bangladesh) through Southeast Asia to the Pacific Islands (Zhang et al.). Their spread is aided by the adults' strong flight capacity, which supports regional movement between rice fields, and by the passive dispersal of larvae or pupae on rice seedlings, stubbles, and nursery planting material (Wang et al.). The species prefer warm, humid monsoonal climates and tend to surge in irrigated wetlands where lush rice foliage provides optimal larval habitat. Seasonal distribution maps from entomological surveys indicate peak abundance during tillering–booting stages across most rice ecologies (Heong & Teng).

Morphology

Adult skippers are small, robust hesperiids with a characteristic stout body, narrow wings, and rapid, skipping flight. Adults measure about 18–25 mm in wingspan; forewings are brown with pale semitransparent spots, and hindwings dark brown with subtle bands (Kim et al.). Antennae are hooked at the tips, a diagnostic trait of Hesperiidae.

Larvae are smooth, greenish to yellow-green caterpillars with a shiny dark head capsule, cylindrical body, and a tapered posterior end (Liu et al.). Early instars roll or fold leaves to create tubular shelters, while later instars develop a visibly thicker mid-body region. Pupae are slender, pale green to brownish, attached within folded rice leaves using silk. Eggs are hemispherical, creamy white when laid, and turn yellowish before hatching.

Morphological notes in taxonomic keys emphasize wing spot patterns (for *P. guttata*), antennal curvature, larval suranal plate shape, and pupal cremaster form (Shirota).

Life Cycle

The rice skipper is holometabolous: egg → larva (5 instars) → pupa → adult. Egg stage: 3–5 days under warm field conditions; slower under cooler temperatures (Chen et al.).Larval stage: Typically 12–20 days; early instars feed inside leaf folds, later instars feed openly. Each instar lasts ~2–4 days depending on temperature and host plant nutrition (Fang et al.). Pupal stage: 6–9 days during warm seasons, extending to 12–15 days in cooler climates.Adults: Live 6–12 days. Oviposition begins within 1–2 days after mating. Females lay 80–150 eggs over their lifespan.
Under tropical field conditions a full generation may complete in 21–35 days, allowing 4–8 overlapping generations per year (Zhang et al.). Population surges occur during monsoon months in irrigated rice fields.

Damaging Stage of the pest

The **larval stage** is the damaging stage (Heong & Teng). Skipper caterpillars roll rice leaves and feed on the inner surface, causing characteristic leaf-folding and leaf-scraping damage. Damage is most severe during:
Late vegetative (tillering) and Early and mid-reproductive stages (panicle initiation, booting)

Rice plants between 20–55 days after transplanting (DAT) are particularly vulnerable, as the lush foliage provides ideal food and shelter. Heavy infestations during the tillering stage can significantly reduce photosynthetic area and weaken plant vigor (Liu et al.).

Symptoms

During early infestation, freshly rolled or folded leaves begin to appear at scattered points throughout the field, each harboring a concealed small caterpillar. Within a few days, these folded leaves show narrow, longitudinal feeding streaks where the larva has scraped off the green tissue, leaving translucent patches (Chen et al.). As larvae grow and feed more vigorously, these patches expand into large whitish windows, and affected leaves lose turgor and fold permanently.
By the end of the first week, entire rice hills show clusters of rolled, whitish, ragged leaves, giving the field a scorched or partially blighted appearance. Later instars feed more aggressively, leaving only the mid-rib or partial lamina. Heavy feeding reduces chlorophyll content and slows plant growth, causing weak tillers and reduced panicle development (Fang et al.).

During severe outbreaks, large areas of the field exhibit pale, skeletonized foliage, with delayed heading and lighter panicles. Plants become more susceptible to secondary infections due to damaged tissues. At harvest, yield reduction is observed in the form of poor panicle exsertion, fewer filled grains, and reduced biomass.

Field identification

Field scouting should focus on:Rolled leaves: Gently unroll to detect early instar larvae hidden inside (Kim et al.).Scraped leaf windows: Transparent streaks are an early indicator.Larvae: Green caterpillars inside folded leaves; check morning hours for better detectability.Adults: Observe rapid, skipping flight among rice foliage; most active during sunshine.Sampling methods include:Sweep net sampling (10–15 sweeps per field section),Visual counts of folded leaves per hillExamination of nursery beds, as infestation often starts there,Presence of >3–5 folded leaves per hill or >10 larvae per 20 hills is often used as a practical warning level in research studies (Heong & Teng).

Movement & Multiplication

Eggs, larvae, and pupae remain mostly confined to individual plants; larvae spread locally through crawling and the movement of planting material (Chen et al.). Adults are strong fliers and disperse between fields, often following rice phenology to locate young, lush foliage. Under continuous rice cultivation (nursery → main field → ratoon), the pest completes multiple overlapping generations and builds up rapidly. Moist, humid conditions and nitrogen-rich fields accelerate reproduction and survival (Zhang et al.). Climatic studies indicate that warm night temperatures and cloudy days especially favor rapid larval development.

Integrated Management

Cultural

Synchronize planting to avoid continuous availability of succulent foliage. Remove grassy weeds (*Cynodon* , *Panicum*) around bunds that serve as alternative hosts (Wang et al.).Avoid excessive nitrogen which increases attractiveness and larval survival.Destroy stubble and rolled leaves during field preparation.

Mechanical / Physical

Hand-crush folded leaves especially in nursery and early tillering phases. Use sweep nets to trap adults in early infestation areas. Light traps may reduce adult populations, though effectiveness is variable.

Biological

Conserve natural enemies: spiders, predatory bugs, dragonflies, and parasitoids such as *Trichogramma japonicum* (egg parasitism) and *Cotesia* spp. (larval parasitism) (Liu et al.).Entomopathogenic fungi (*Beauveria bassiana*, *Metarhizium anisopliae*) show promising larval mortality in laboratory and field trials. Neem-based formulations reduce larval feeding and survival.

Chemical

Use only when larval density crosses research-recommended action thresholds. Common effective insecticides include:Lambda-cyhalothrin 5 EC @ 0.5 ml/L,Thiamethoxam 25 WG @ 0.2 g/L,Emamectin benzoate 5 SG @ 0.2 g/L,Chloran traniliprole 18.5 SC @ 0.3 ml/L Spray during early larval stages for best results; avoid repeated use of the same chemical group to prevent resistance (Fang et al.). Maintain PHI and avoid unnecessary spraying to protect beneficial fauna.

Conclusion

Rice skippers, chiefly *Parnara guttata* and *Pelopidas mathias*, are significant foliar pests of rice whose damage is often underestimated due to their concealed leaf-roll feeding behavior. Their synchronized life cycle with the rice tillering–booting stages allows rapid population build-up that results in substantial leaf loss, weakened tillers, delayed panicle development, and reduced grain filling. The pest's biology - rapid larval development, folded-leaf sheltering, and strong adult dispersal- enhances its outbreak potential in intensive rice systems (Zhang et al.), Effective management demands an integrated approach: vigilant nursery monitoring, cultural adjustments, conservation of biological control agents, and timely, threshold-based insecticide applications. When these practices are coordinated, rice skipper damage can be greatly minimized, sustaining plant vigor, reducing physiological stress, and ultimately improving grain yield and quality across rice ecosystems.

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SPINY BEETLE IN RICE

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Abstract

The spiny beetle, commonly referred to as rice hispa (*Dicladispa armigera*), is a invasive insect pest of rice. The pest attacks rice at various growth stages, but damage is most severe during the early vegetative and tillering stages, leading to considerable yield reduction if not properly managed. Both adults and larvae (grubs) are responsible for crop damage. Adult beetles possess spiny bodies and feed externally by scraping the leaves. This feeding results in characteristic white, parallel streaks on the leaves, giving them a scorched or silvery appearance. Severe adult infestation can cause complete drying of leaves and stunted plant growth. The larvae, on the other hand, mine inside the leaf tissues, creating tunnels between the epidermal layers. Egg singly laid in leaves , After hatching, larvae feed internally before pupating inside the leaf mine. Favorable conditions such as high humidity, warm temperatures, close spacing of plants, and excessive application of nitrogenous fertilizers promote rapid multiplication and outbreaks of this pest. Effective management of spiny beetle requires an integrated pest management (IPM) approach. Cultural practices such as removal of infested leaves, maintaining optimum plant spacing, balanced fertilizer application, and field sanitation help reduce pest buildup. When infestation reaches the economic threshold level, judicious application of recommended insecticides may be necessary to prevent serious crop losses. In conclusion, rice hispa is a significant pest that can adversely affect rice productivity if left unmanaged. A thorough understanding of its biology, damage symptoms, and integrated control measures is essential for sustainable and economical rice cultivation.

Keywords: Rice hispa, *Dicladispa armigera,* spiny beetle, rice pest, leaf scraping, leaf mining, yield loss, vegetative stage, tillering stage.

Introduction

Rice is the most important food crop for food security of the world, particularly in Asia. However, rice production is severely constrained by a wide range of different insects which attack rice. Among these, the spiny beetle, commonly known as rice hispa (Dicladispa armigera), is a serious and destructive pest that causes significant damage to rice crops .

Rice hispa infests the crop mainly during the early vegetative and tillering stages, when plants are highly vulnerable. The pest is harmful in both adult and larval stages. Adult beetles feed externally on rice leaves by scraping the green tissues, while larvae mine inside the leaf tissues. This dual mode of feeding results in reduced photosynthetic activity, poor plant growth, and ultimately lower grain yield. Heavy infestations can lead to drying of leaves and severe crop loss, especially under favorable environmental conditions.

The occurrence and severity of rice hispa infestation are influenced by agronomic practices such as dense planting, excessive use of nitrogen fertilizers, and prevailing climatic conditions like high humidity and warm temperatures. Due to its rapid multiplication and concealed larval feeding habit, the pest is often difficult to control once established. Therefore, understanding the biology, nature of damage, and management strategies of spiny beetle is essential for developing effective and sustainable pest control measures.

Pest identity and taxonomy

Common name : Sphiny beetle.

Scientific name : *Dicladispa armigera.*

Order : Coleoptera.

Family. : chrysomelidae.

Host range

The spiny beetle of rice, commonly known as rice hispa (*Dicladispa armigera)*, has a host range largely confined to grasses belonging to the family Poaceae. Rice (*Oryza sativa*) is its primary and most preferred host, where it causes significant damage. Besides rice, the beetle also feeds on several other cultivated cereal crops such as wheat, maize, sorghum, barley, pearl millet, and sugarcane. It can survive and multiply on various wild and grassy hosts including wild rice (*Oryza rufipogon)*, *Cynodon dactylon, Echinochloa spp., Panicum spp., and Setaria spp*., which help in its carryover during the off-season.

Morphology

The rice hispa or spiny beetle (*Dicladispa armigera*) shows very distinctive morphological features at different life stages, which help in its easy identification in the field. The adult beetle is small and compact, measuring about 4–6 mm in length, with a flattened, rectangular body and a metallic bluish-black or greenish sheen. The most striking feature of the adult is the presence of numerous long, sharp spines on the pronotum and elytra, which give the insect its common name "spiny beetle." The head is tiny and partially concealed, with slender, filiform antenna , while the legs are short and sturdy, adapted for clinging to leaf surfaces. The eggs are minute, oval, and creamy white, laid singly within slits cut by the female in the rice leaf tissue, making them difficult to detect. After hatching, the larvae are yellowish-white, soft-bodied, legless (apodous), and grublike, and they feed internally by mining between the leaf epidermal layers. This feeding results in long, narrow, whitish or translucent leaf mines, a key symptom of infestation. The pupa is pale yellow to light brown and is formed inside the leaf mine itself, providing protection during transformation. Diagnostic characters of rice hispa include the metallic, spiny adult beetles, the presence of sharp spines on both pronotum and elytra, and the characteristic leaf-mining damage caused by larvae. These features clearly distinguish rice hispa from other beetle pests and leaf-feeding insects carryover.

Life Cycle

The rice hispa or spiny beetle (Dicladispa armigera) undergoes complete metamorphosis, passing through egg, larval, pupal, and adult stages, and completes its life cycle in about 3–4 weeks under favorable conditions. Females lay eggs singly within slits made in the rice leaf tissue, with an incubation period of 4–7 days. The larvae hatch and mine inside the leaf, feeding between the epidermal layers and passing through 3–5 instars over 7–14 days. Pupation occurs within the leaf mine and lasts for 4–7 days, after which adults emerge by cutting through the leaf surface. Newly emerged adults feed by scraping the green tissue of leaves, producing characteristic white streaks. Rice hispa phenology is closely associated with the rice-growing season and prevailing climatic conditions. The pest is most active during the tillering to early vegetative stages of the crop, especially under warm and humid weather. Population levels generally increase during the kharif (monsoon) season, with several overlapping generations in regions practicing continuous rice cultivation. During the off-season, adults persist on rice stubble, volunteer plants, and grassy weeds, allowing the pest to survive and infest subseque

Symptoms

Larval mining is clearly visible on rice leaves. Adult feeding results in scraping of the upper leaf surface, leaving the lower epidermis intact as characteristic white streaks running parallel to the midrib. Larval tunneling through the leaf tissue produces irregular, translucent white patches aligned with the leaf veins. Severely damaged leaves gradually wither and dry. Under heavy infestation, the entire rice field may appear scorched or burnt.The grubs mine into the leaf blade and feed on the green tissue between the veins. Adult beetles also damage the crop by scraping the green matter from tender leaves. Damage is most severe during the early growth stages of the rice plant.

Movement and multiplication

Rice hispa adults are capable of active flight and usually migrate from grassy weeds, rice stubbles, and volunteer rice plants to newly transplanted or young rice crops. Multiplication occurs rapidly under warm, humid conditions, especially during the monsoon season. Females lay eggs singly inside leaf tissue, which protects the eggs from natural enemies and environmental stress. Because the insect completes its life cycle in about 3–4 weeks, several overlapping generations occur within a single cropping season, leading to sudden population outbreaks if conditions are favourable

Damage Stage of the Pest

Adults and larvae (grubs) are damaging stages,Adults scrape the leaf surface,Grubs mine inside the leaf tissue,White, elongated, transparent streaks on leaves (window-paning),Leaves dry up in severe infestation,Reduced tillering and yield loss,

Integrated Pest Management (IPM):

Integrated Pest Management of rice hispa involves the coordinated use of preventive, cultural, mechanical, biological, and chemical strategies to control the pest in an environmentally sustainable manner. Both the adult and larval stages are destructive; adults feed by scraping the green tissue from the upper leaf surface, while larvae mine within the leaf, forming elongated, transparent white patches commonly referred to as window-paning. Heavy infestations, particularly during the seedling and early tillering stages, lead to leaf drying, reduced tillering, and significant yield loss. Preventive practices include raising healthy and pest-free seedlings, adopting synchronized planting within a region, maintaining optimum plant spacing, and avoiding excessive nitrogen application, which favors pest buildup. Cultural and mechanical methods are essential for lowering pest incidence and include balanced fertilizer use, removal of weeds and alternate host plants, regulated irrigation with intermittent drainage, manual collection and destruction of adult beetles, clipping and disposal of infested leaves, and installation of light traps for monitoring adult populations. Biological management emphasizes the conservation of natural predators such as spiders and ladybird beetles, along with the promotion of parasitoids like Trichogramma species. Entomopathogenic fungi, including Beauveria bassiana and Metarhizium anisopliae, can be applied as biopesticides to reduce pest populations safely. Chemical control should be employed only when the pest reaches the economic threshold level, using recommended insecticides such as chlorpyriphos, quinalphos, cartap hydrochloride, or lambda-cyhalothrin at prescribed doses. An effective IPM program for rice hispa relies primarily on preventive and biological measures, reserving chemical interventions as a final option.

Conclusion:

Integrated Pest Management of spiny beetle (rice hispa) in rice is essential for reducing crop damage while maintaining environmental safety. By combining preventive, cultural, mechanical, and biological methods, the pest population can be effectively managed at low levels without relying heavily on chemicals. Chemical control should be used only when necessary and in a judicious manner to avoid pest resistance and harm to beneficial organisms. Thus, IPM provides a sustainable, economical, and eco-friendly approach for the effective management of spiny beetle in rice cultivation.

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GRASSHOPPER IN RICE

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Abstract

Rice (*Oryza sativa L.)* serves as a primary food source for a large portion of the world's population. Numerous insect pests impact it during its growth. Among these, grasshoppers (Orthoptera: Acrididae) are key pests that eat leaves in rice fields, mainly in the early stages of growth. Species like Oxya nitidula, Oxya hyla hyla, and Hieroglyphus banian are frequently seen in rice fields in South and Southeast Asia. Both young and adult grasshoppers eat rice leaves quickly, which causes notches in the leaves, loss of leaves, fewer tillers, and yield loss when there are many. Climate, the presence of other grass plants, and poor field upkeep affect how grasshopper populations grow. This paper gives an overview of how to identify the pest, where it lives, its biology, signs of damage, how to spot it in the field, and ways to manage it using integrated pest management (IPM). It focuses on control methods that are sustainable and eco-friendly.

Keywords: Grasshopper, Oxya spp., rice, defoliator, integrated pest management

Introduction

Rice (*Oryza sativa L*.) stands out as one of the most vital cereal crops farmed worldwide, securing food and supporting the lives of many farmers. Despite improvements in how crops are managed, rice output is limited by many insect pests, especially those that eat leaves when the plant is young. Grasshoppers are a big group of pests that eat leaves in rice fields. They are often missed since they don't always appear.Grasshoppers mainly attack rice when it is first growing, eating leaf blades and reducing the area for photosynthesis. A lot of them appear when the weather is dry, when there are grassy weeds, and when the bunds are not well kept. Even though they are mostly seen as minor pests, grasshoppers can greatly lower yields when conditions are right. Knowing how they live, what damage they do, and how to manage them matters for growing rice sustainably.

Pest Identity and Taxonomy

Common name: Rice grasshopper

Scientific name: *Oxya spp*. (e.g., *Oxya nitidula*, *Oxya hyla hyla*), *Hieroglyphus banian*

Order: Orthoptera

Family: Acrididae

Host Range

Grasshoppers are polyphagous insects, meaning they eat many kinds of plants, but mostly grasses. They eat rice, wheat, maize, sorghum, millets, sugarcane, and different wild grasses. In rice fields, there are more when there are other grasses growing along the bunds and edges of the field. Rice is especially at risk when it is a seedling and when it is first growing (Jan et al., 2023; Demis, 2025).

Origin and Distribution

Grasshoppers live in the tropical and subtropical parts of Asia, Africa, and some of Europe. Species that eat rice, like *Oxya spp*. and *Hieroglyphus banian*, are usually seen in the main rice-growing areas of India, Bangladesh, Sri Lanka, and Southeast Asia. Where they are found depends on the climate, what crops are planted, and the plant cover (CABI, 2022).

Morphology and Diagnostic Characters

Adult grasshoppers are medium-sized insects with long bodies, strong back legs for jumping, and mouthparts made for chewing. They can be green or brown, which helps them hide among the rice plants. Their front wings are tough, and their back wings are thin. Young grasshoppers look like adults but do not have fully grown wings. Both young and adult grasshoppers have strong jaws for eating leaves. You can tell they are damaging the plant if you see insects jumping around and the leaves have notches in them (Demis, 2025).

Life Cycle and Phenology

Grasshoppers change in stages (egg–nymph–adult). They lay eggs in the ground, in groups inside an egg pod. It takes 2–4 weeks for the eggs to hatch, depending on the temperature. The young grasshoppers go through 5–6 stages over 30–45 days before they become adults. There can be several groups in a year, mostly when it is warm and dry (CABI, 2022; Jan et al., 2023).

Symptoms and Damage

Grasshoppers hurt plants by chewing the edges and blades of leaves, leaving rough notches and partly removing the leaves. If there are many, the plant produces fewer tillers, does not grow strong, and grows slower. In nurseries, heavy feeding can completely remove the leaves and kill the seedlings. The plant produces less because it has less area for photosynthesis and is weaker (Demis, 2025).

Field Detection and Key Indicators

You can easily see grasshoppers in the early morning and late afternoon when they are moving around on the rice leaves. Signs include leaves with irregular feeding marks, young and adult grasshoppers on the plants, and insects jumping when disturbed. There are no set levels for when to take action; but, if you see more than 10–15% of the leaves are damaged when the plant is growing, you should do something (Jan et al., 2023).

Movement and Multiplication

Grasshoppers can jump far and fly a bit, so they can move around rice fields. Dry weather, many grassy weeds, and not having natural enemies help them grow in numbers. They lay eggs in the ground, which lets them live through different seasons and keep coming back (CABI, 2022).

Damaging Stage of Pest

Both young and adult grasshoppers cause damage. The young ones keep eating leaves, and the adults eat more leaf area, greatly reducing the amount of leaves. The egg and resting stages do not cause damage.

Preventive Methods

Keeping the field clean, removing grassy weeds, and practicing clean growing methods reduce places for them to lay eggs and other plants for them to eat. Managing the bunds well and removing weeds along the edges of the field are good ways to prevent them. Planting at the right time helps avoid when grasshoppers are most active.

Cultural and Mechanical Methods

Plowing deep exposes the egg pods to predators and drying out. Collecting them by hand with nets when there are only a few is good in small fields. Putting up bird perches encourages birds that eat insects to come. Keeping a natural balance helps keep the population down (Demis, 2025).

Biological Methods

Biological controls, like certain fungi (*Metarhizium anisopliae* and *Beauveria bassiana*), are helpful against young grasshoppers. Plant-based insecticides, like those made from neem, reduce feeding and population sizes. They are good for IPM programs (Jan et al., 2023).

Chemical Methods

Using chemicals is only advised when there are many grasshoppers. Spraying malathion 50 EC (2 ml L^{-1}) or chlorpyriphos 20 EC (2.5 ml L^{-1}) can lower the number of grasshoppers. Only use chemicals when needed, and avoid using them when the plant is flowering to protect natural enemies.

Integrated Pest Management (IPM)

An IPM approach that combines growing practices, physical control, biological agents, and using chemicals when needed offers good and lasting grasshopper control. Focus should be on finding them early, managing weeds, and protecting natural enemies.

Conclusion

Grasshoppers cause damage to rice by eating the leaves, mainly when the plant is young. They are often seen as minor pests, but big numbers of them can greatly lower yields. Using integrated pest management methods that focus on preventing them and using biological measures makes sure rice is grown sustainably with little harm to the environment.

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THRIPS IN RICE

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Abstract

Thrips, mainly *Stenchaetothrips biformis,* pose a severe threat to rice seedlings by rasping leaf tissues and sucking sap, causing silver-white streaks, leaf curling, tip drying, and stunted growth that can devastate nurseries under hot, dry conditions in regions like Tamil Nadu. Dark adults and pale nymphs complete a rapid 13-19 day lifecycle, peaking in dry-season or early-planted fields where water stress boosts populations to damaging levels of 60 per 12 sweeps. Management hinges on brief field flooding to drown pests, early scouting, resistant varieties, and natural predators like anthocorid bugs, minimizing chemical use while preserving yield potential in vulnerable short-duration cultivars.

Key words: Rice thrips, Paddy crop, *Stenchaetothrips biformis*, Alternate weed hosts, Integrated pest management (IPM)

Introduction

Rice (*Oryza sativa L.*) is one of the most important staple food crops of the world and plays a vital role in ensuring food security, especially in Asian countries like India. However, rice cultivation is constrained by several biotic stresses, among which insect pests are a major concern.

Thrips are small but economically important insect pests that attack rice at different growth stages, particularly during the nursery and early vegetative phases. Though often overlooked due to their minute size, thrips can cause significant damage by feeding on plant tissues, leading to reduced vigor and yield losses.

Thrips infestations are more common under dry weather conditions and in poorly managed nurseries. Their rapid reproduction and ability to remain concealed within leaf sheaths make them difficult to detect in early stages. Understanding the biology, damage symptoms, and management of thrips is therefore essential for sustainable rice production.

Pest Identity and Taxonomy

Thrips attacking rice mainly belong to the order Thysanoptera. The most commonly reported species in rice ecosystems include:

Rice thrips – *Stenchaetothrips biformis*

Taxonomic Classification

Order: Thysanoptera

Family: Thripidae

Genus: *Stenchaetothrips*

Species: *S. biformis*

Rice thrips are slender, tiny insects measuring about 1–2 mm in length. Due to their small size and cryptic nature, infestations often go unnoticed until visible symptoms appear on the crop.

Host Range

Rice is the primary host, thrips can also survive on grasses and weeds growing in and around paddy fields. These alternate hosts act as reservoirs, allowing the pest to persist even in the absence of the main crop.

Origin and Distribution

Rice thrips are widely distributed across major rice-growing regions of Asia, including India, Sri Lanka, Bangladesh, and Southeast Asian countries. In India, the pest is commonly observed in both irrigated and rainfed rice ecosystems, especially during dry spells.

Morphology

Eggs are minute, kidney-shaped, and laid singly within the leaf tissues. They are not easily visible to the naked eye. Nymphs resemble adults but are wingless. They are pale yellow to light brown in color and are actively feeding stages. Adults are slender, elongated insects with narrow fringed wings. They are yellowish-brown to dark brown in color. The presence of fringed wings is a key identifying feature of thrips. Accurate identification is important to differentiate thrips damage from nutrient deficiency or drought stress.

Life Cycle and Phenology

Thrips undergo simple metamorphosis consisting of egg, nymph, prepupa, pupa, and adult stages. The life cycle is completed within 15–25 days depending on temperature and humidity. Eggs hatch within 4–6 daysNymphal period lasts 7–10 days. Pupation occurs in soil or leaf sheaths. Adults live for about 10–15 days. Thrips reproduce rapidly under warm and dry conditions, resulting in overlapping generations during the cropping season.

Symptoms

Both nymphs and adults cause damage by scraping and sucking sap from tender leaves. Typical symptoms include: Silvery streaks or patches on leaves, Curling and rolling of leaf margins, Drying of leaf tips, Stunted growth of seedlings. In severe infestations, nursery seedlings may dry up completely, leading to poor plant establishment after transplanting.

Field Detection

Thrips infestation can be detected by close observation of young leaves, especially during early morning hours. Shaking seedlings over a white paper helps in spotting the tiny insects.

Economic damage is more serious during the nursery and early vegetative stages. Heavy infestation may delay crop growth and reduce tillering, ultimately affecting yield

Preventive Methods

Manage thrips by maintaining clean cultivation, such as removing weeds and plant debris, and practicing crop rotation. Using reflective mulches and planting resistant crop varieties can help reduce infestations. Encourage natural predators like beneficial mites and bugs, and employ yellow or blue sticky traps to monitor early thrips activity. For suppression, organic sprays such as Neem oil or spinosad can be applied, taking care to avoid spraying on flowering parts.

Cultural Methods

Maintain optimum water level in nurseries and main fields, Avoid excess nitrogen application, Timely sowing and transplanting, Removal of weeds and alternate hosts

Mechanical Methods

Flooding nursery beds to dislodge thrips, Dragging a wet cloth or rope over seedlings

Biological Control

Natural enemies such as predatory thrips, ladybird beetles, anthocorid bugs, and spiders help in reducing thrips population. Conservation of these beneficial organisms is encouraged.

Botanical and Organic Methods

Neem oil spray (3–5%), Neem seed kernel extract (5%), Use of plant-based extracts as repellents

Chemical Control

. Chemical control should be used only when infestation crosses the economic threshold level. Commonly recommended insecticides include:Imidacloprid, Fipronil, Dimethoate. Sprays should be applied judiciously to avoid resistance and harm to natural enemies.

Integrated Pest Management (IPM)

Integrated Pest Management combines cultural, biological, and chemical methods to manage thrips in an eco-friendly manner. Emphasis is placed on prevention, regular monitoring, and minimal use of chemicals. IPM not only reduces pest damage but also ensures environmental safety and long-term sustainability.

Conclusion

Thrips, though small in size, can cause considerable damage to rice crops if not managed properly. Early detection and adoption of integrated management practices are crucial to minimize losses. Sustainable approaches focusing on cultural and biological control should be prioritized over chemical methods. Proper awareness and timely intervention can effectively keep thrips under control and contribute to stable rice production.

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GREEENLEAF HOPPER IN RICE

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Abstract

The Rice Brown Planthopper (*Nilaparvata lugens* Stål) is one of the most destructive pests of rice (*Oryza sativa* L.), causing substantial yield losses across Asia through direct feeding and transmission of plant viruses. This review consolidates current knowledge on the biology, ecology, damage symptoms, and management strategies of this pest. *N. lugens* feeds on phloem sap, leading to hopperburn, stunted growth, and plant death, particularly in susceptible varieties under high nitrogen fertilization. The pest exhibits high reproductive potential, migratory behavior, and rapid development of insecticide resistance, complicating control efforts. Traditional chemical control is widely used but has environmental and resistance-related limitations. Integrated Pest Management (IPM) approaches, including host plant resistance, biological control, cultural practices, and judicious insecticide application, provide sustainable strategies for reducing pest incidence. This review emphasizes the importance of understanding the pest's life cycle, population dynamics, and interaction with agronomic practices to develop effective management strategies. Further research on resistant varieties, natural enemies, and eco-friendly control methods is crucial to ensure sustainable rice production in areas affected by Brown Planthopper infestations.

Keywords: Rice Brown Planthopper; *Nilaparvata lugens*; Rice; Hopperburn; Integrated pest management

Introduction

Rice (*Oryza sativa* L.) is a staple crop feeding more than half of the world's population, but its production is severely affected by insect pests. Among them, the Rice Brown Planthopper (*Nilaparvata lugens* Stål) is one of the most destructive pests in Asia, capable of causing significant yield losses. It damages rice plants by sucking phloem sap, which results in stunted growth, yellowing, wilting, and a condition known as *hopperburn*, leading to plant death in severe infestations. The pest also serves as a vector for viral diseases, such as rice ragged stunt virus (RRSV) and rice grassy stunt virus (RGSV), further exacerbating yield losses. Continuous rice cultivation, high nitrogen fertilization, and the use of susceptible varieties contribute to rapid population buildup. Additionally, *N. lugens* exhibits migratory behavior, high fecundity, and a tendency to develop resistance to chemical insecticides, making management challenging.

Sustainable management of Rice Brown Planthopper requires a thorough understanding of its biology, ecology, damage symptoms, and effective control measures. Integrated Pest Management (IPM), combining cultural practices, host plant resistance, biological control, and judicious insecticide use, offers the most effective strategy for minimizing losses and maintaining rice productivity. This review compiles current knowledge on *N. lugens* to support sustainable rice cultivation and pest management practices.

Taxonomic classification of Rice Brown Planthopper:

Order: Hemiptera

Suborder: Auchenorrhyncha

Superfamily: Fulgoroidea **Family:**

Delphacidae **Genus:**

Nilaparvata

Species: *Nilaparvata lugens* Stål

Host Range

The Rice Brown Planthopper (*Nilaparvata lugens* Stål) is highly specialized, with rice (*Oryza sativa* L.) as its primary host. Both nymphs and adults feed exclusively on rice phloem, causing direct damage through sap extraction and indirectly by transmitting viral pathogens such as rice ragged stunt virus (RRSV) and rice grassy stunt virus (RGSV).

Although rice is the main host, *N. lugens* can occasionally feed on wild rice species (*Oryza rufipogon*) and other closely related grasses, which can serve as alternate hosts and help maintain populations between rice-growing seasons. Understanding the host range is important for pest management, as the presence of alternate hosts near rice fields can contribute to early infestations and population buildup.

Origin and Distribution

The Rice Brown Planthopper (*Nilaparvata lugens* Stål) is believed to have originated in tropical and subtropical Asia, coinciding with the domestication and cultivation of rice. Its distribution closely follows major rice-growing regions, as the pest depends entirely on rice for feeding and reproduction. *Nilaparvata lugens* is widely reported in countries across South, Southeast, and East Asia, including India, Bangladesh, Sri Lanka, Thailand, Vietnam, the Philippines, Indonesia, China, and Japan. It is most prevalent in warm, humid climates, which favor rapid development, high fecundity, and multiple generations per year. Seasonal migration allows populations to move between rice-growing regions, further extending its distribution.

The widespread presence of *N. lugens* in rice ecosystems makes it a key target for monitoring and management to prevent significant yield losses and associated economic impacts.

Morphology and Diagnostic Characters

The Rice Brown Planthopper (*Nilaparvata lugens* Stål) exhibits distinctive morphological features at different life stages, which aid in identification and management. Eggs are Small, elongate, and whitish when freshly laid; they are inserted into leaf sheaths and turn yellowish before hatching.

Nymphs are wingless, light green to yellowish-brown, with a slender body. They pass through five instars, gradually developing wing pads in later stages. Nymphs have piercing-sucking mouthparts adapted for phloem feeding.

Adults are slender, 3–5 mm in length, usually brown in coloration, though some populations may be darker. They have long antennae, piercing-sucking mouthparts, and fully developed wings. Adults are highly mobile and capable of long-distance migration.

Diagnostic Characters:

Small, slender body with brown coloration in adults. Nymphs are green to yellowish-brown with developing wing pads.Piercing-sucking rostrum adapted for phloem feeding. Presence on leaf sheaths and lower stems during vegetative and early reproductive stages.Damage symptoms such as yellowing, wilting, and *hopperburn* in heavily infested plants. These morphological and behavioral features help distinguish *N. lugens* from other rice pests, enabling timely monitoring and management.

Life Cycle and Phenology

The Rice Brown Planthopper (*Nilaparvata lugens* Stål) undergoes **incomplete metamorphosis**, consisting of three stages: egg, nymph, and adult. The duration of its life cycle varies with temperature, humidity, and host plant conditions, typically completing in 25–30 days under favorable conditions. Eggs are laid singly or in small clusters inside rice leaf sheaths. They hatch in 5–7 days, depending on environmental conditions. Nymphs pass through five instars over 10–15 days. Nymphs are wingless, green to yellowish-brown, and feed actively on phloem sap, causing stunted growth and yellowing of plants.Adults are brown, slender, and capable of flight. They live for 10–15 days and are responsible for long-distance migration and reproduction. Females lay eggs to initiate the next generation.

Nilaparvata lugens is **multivoltine**, producing several generations per year in tropical and subtropical rice-growing regions. Peak populations often coincide with late vegetative and reproductive stages of rice when plants are most susceptible. Environmental factors, cropping patterns, and host plant availability strongly influence population dynamics and outbreak potential.

Symptoms and Damage

The Rice Brown Planthopper (*Nilaparvata lugens* Stål) causes significant damage to rice through direct feeding and virus transmission. Both nymphs and adults suck sap from the phloem, causing yellowing, stunted growth, and eventual wilting of plants. Severe infestations lead to a condition known as *hopperburn*, where entire hills of rice plants turn brown and die. *N. lugens* is a vector of viral diseases such as rice ragged stunt virus (RRSV) and rice grassy stunt virus (RGSV), which can cause additional yield loss and poor grain quality. Damage is most severe during the vegetative and early reproductive stages of rice. Continuous feeding weakens plants, reduces tillering, and decreases grain filling. Heavy infestations can result in complete crop failure in susceptible varieties, leading to substantial economic losses for farmers.

Early detection and timely management are crucial to prevent extensive damage and protect rice productivity.

Field Detection and Key Indicators

Early detection of Rice Brown Planthopper (*Nilaparvata lugens* Stål) is crucial for effective management. Key indicators include: Adults and nymphs are usually found on leaf sheaths and lower stems, feeding on phloem sap. Nymphs are green to yellowish-brown, while adults are brown and slender. Small, elongate eggs inserted into leaf sheaths, often requiring careful inspection. Yellowing of leaves, stunted growth, and wilting of rice plants. Severe infestations result in *hopperburn*, where entire hills turn brown and die. Regular field scouting, especially during the vegetative and early reproductive stages, helps detect infestations. Sweep nets and visual counts per hill or per unit area are commonly used for estimating population density.

Timely detection using these indicators allows farmers to implement appropriate control measures before severe damage occurs.

Damaging Stage

The **nymphal and adult stages** of the Rice Brown Planthopper (*Nilaparvata lugens* Stål) are the most damaging. Both stages feed by sucking phloem sap from rice plants, leading to yellowing, stunted growth, and wilting. Occurs during the vegetative and early reproductive stages, when plants are most susceptible. Severe feeding results in *hopperburn*, where entire hills of rice plants turn brown and die. Eggs do not cause direct damage but are important for maintaining pest populations and initiating subsequent infestations.

Monitoring nymphs and adults is essential for timely management to prevent significant yield losses.

Preventive Methods

Preventive measures are essential to reduce Rice Brown Planthopper (*Nilaparvata lugens* Stål) infestations and minimize crop damage: Cultivate rice varieties that are resistant or tolerant to Brown Planthopper. Coordinate planting dates within a locality to prevent continuous availability of susceptible plants. Remove and destroy rice stubbles, weeds, and alternate host plants around fields to reduce pest carryover. Avoid excessive nitrogen application, which can favor pest multiplication; maintain proper nutrient management. Maintain appropriate irrigation practices to reduce plant stress and discourage high pest populations. Alternate rice with non-host crops to disrupt the pest's life cycle. Implementing these preventive measures reduces pest pressure, minimizes economic loss, and complements integrated management strategies.

Integrated Pest Management (IPM)

Integrated Pest Management (IPM) for Rice Brown Planthopper (*Nilaparvata lugens* Stål) combines cultural, biological, and chemical strategies to control the pest sustainably while minimizing environmental impact.

1. **Cultural Control:** Synchronized planting and proper field sanitation to reduce pest carryover. Crop rotation and removal of alternate host plants to disrupt the pest's life cycle. Balanced fertilization and water management to reduce plant susceptibility.
2. **Host Plant Resistance:** Cultivation of rice varieties resistant or tolerant to Brown Planthopper. Development and use of improved varieties through conventional breeding and molecular approaches.
3. **Biological Control:**Conservation of natural enemies such as spiders, predatory bugs, and parasitoids. Use of entomopathogenic fungi and other biological agents to suppress populations.
4. **Chemical Control:** Application of selective insecticides only when pest populations exceed economic thresholds. Rotation of insecticides with different modes of action to prevent resistance development.
5. **Monitoring and Decision-Making:** Regular field scouting to detect eggs, nymphs, and adults. Use of light traps or sweep nets for adult population monitoring and outbreak prediction.

IPM ensures effective control of Rice Brown Planthopper, reduces yield losses, and minimizes adverse effects on the environment and beneficial organisms.

Conclusion

The Rice Brown Planthopper (*Nilaparvata lugens* Stål) is one of the most destructive pests of rice, causing substantial yield losses through phloem feeding and virus transmission. Nymphs and adults are the primary damaging stages, leading to yellowing, stunted growth, wilting, and *hopperburn* in severe infestations. Effective management relies on early detection, preventive measures, and the adoption of Integrated Pest Management (IPM) strategies, including resistant varieties, cultural practices, biological control, and judicious insecticide use. Sustainable approaches such as synchronized planting, balanced fertilization, and field sanitation are essential to minimize infestations and maintain rice productivity. Continued research on host plant resistance, natural enemies, and eco-friendly control methods is critical to ensure long-term, resilient rice production in areas affected by Rice Brown Planthopper.

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BROWN PLANT HOPPER IN RICE

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Abstract

Rice (Oryza sativa L.) is a vital staple crop in India, but its productivity is severely affected by insect pests, particularly the brown planthopper (BPH), Nilaparvata lugens. BPH is one of the most destructive sucking pests in irrigated rice ecosystems, causing direct damage by sap feeding and indirect damage by transmitting viral diseases such as grassy stunt and ragged stunt. Intensive cultivation practices, excessive nitrogen fertilization, and indiscriminate insecticide use have contributed to frequent pest outbreaks. Severe infestations result in "hopper burn," leading to significant yield losses. This article reviews the pest's identity, distribution, biology, nature of damage, and management strategies. Emphasis is placed on integrated pest management (IPM), combining resistant varieties, cultural practices, biological control, and need-based chemical application. Adoption of IPM approaches is essential for sustainable rice production, minimizing environmental hazards, and conserving natural enemies.

Keywords: Brown planthopper; *Nilaparvata lugens*; Rice; Hopper burn; Sucking pest; Integrated pest management (IPM); Biological control; Insecticide resistance

Introduction

Rice (Oryza sativa L.) is one of the most important staple food crops of India, supporting food security and rural livelihoods. However, rice production is constrained by several insect pests, among which the Brown Planthopper (BPH), *Nilaparvata lugens,* is considered one of the most destructive sucking pests in irrigated rice ecosystems (Pathak & Khan, 1994). The pest has gained major importance due to the adoption of high-yielding varieties, intensive fertilizer use, and indiscriminate application of insecticides (Heinrichs, 1994). Brown planthopper damages rice by sucking sap from the phloem tissues and also acts as a vector of viral diseases such as grassy stunt and ragged stunt. Severe infestations lead to complete drying of plants, a condition commonly known as "hopper burn", causing heavy yield losses (IRRI, 2013).

Pest Identity and Taxonomy

Common name: Brown planthopper

Scientific name: *Nilaparvata lugens (Stål)*

Order: Hemiptera

Family: Delphacidae

Host Range

Brown planthopper is primarily a monophagous pest, feeding mainly on rice. Under certain conditions, it may survive on wild rice species and grassy weeds, but economically significant damage occurs only on cultivated rice (Pathak & Khan, 1994). High nitrogen fertilization and continuous rice cropping favor rapid population build-up of the pest (IRRI, 2013).Origin and Distribution

Nilaparvata lugens is believed to have originated in the tropical regions of Asia and is now widely distributed throughout South and Southeast Asia, including India, Sri Lanka, China, Japan, Philippines, Vietnam, and Indonesia (Heinrichs, 1994). In India, BPH is a major pest in rice-growing states such as Tamil Nadu, Andhra Pradesh, Telangana, Kerala, West Bengal, and Punjab, especially under irrigated conditions (Reddy et al., 2018).

Morphology

Adult brown planthoppers are small, brownish insects measuring about 3–4 mm in length. They exist in two forms: Macropterous (long-winged) forms for migration, brachypterous (short-winged) forms for reproduction (Pathak & Khan, 1994), Nymphs are pale white to light brown and resemble adults but lack wings. Eggs are elongated and laid in batches inside leaf sheaths or midribs (IRRI, 2013)

Life Cycle

Brown planthopper undergoes incomplete metamorphosis, consisting of egg, nymph, and adult stages. The egg period lasts about 7–10 days, followed by five nymphal instars that complete development in 12–15 days. Adults live for 10–20 days, during which females can lay up to 300 eggs under favorable conditions (Heinrichs, 1994). Multiple overlapping generations occur in a single cropping season, leading to sudden population outbreaks (Reddy et al., 2018).

Nature of Damage

Both nymphs and adults cause damage by sucking sap from the base of rice tillers, leading to reduced vigor, yellowing, and drying of plants (IRRI, 2013). Heavy infestation results in hopper burn, where entire patches of the field dry up suddenly (Pathak & Khan, 1994).

In addition, brown planthopper acts as a vector of Grassy stunt virus, Ragged stunt virus. These diseases further reduce yield and grain quality (Heinrichs, 1994).

Symptoms

Yellowing and wilting of leaves Stunted plant growth, Brown patches in the field (hopper burn), Presence of honeydew leading to sooty mold growth, Reduced panicle formation and grain filling (Reddy et al., 2018)

Field Detection

Early detection is crucial for BPH management. The pest is commonly found at the base of tillers, near the water level. Shaking plants gently reveals jumping nymphs and adults (IRRI, 2013). 5–10 planthoppers per hill in early stages, 20–25 planthoppers per hill at later stages (Pathak & Khan, 1994). Brown planthopper is responsible for severe economic losses in rice-growing regions, particularly under intensive and irrigated cultivation systems. Yield losses due to BPH infestation may range from 10–70%, depending on the crop stage, pest density, and varietal susceptibility. In outbreak situations, complete crop failure has been reported due to hopper burn, especially in high-yielding varieties grown with excessive nitrogen fertilizer (Heinrichs, 1994; Reddy et al., 2018). The indirect losses caused by virus transmission further aggravate the impact of the pest on rice productivity and quality. Excessive application of nitrogenous fertilizers creates favorable conditions for rapid multiplication of brown planthopper by increasing plant succulence and amino acid content in rice tissues. Continuous rice cultivation without crop rotation also supports year-round survival of the pest. Dense planting and stagnant water conditions further enhance pest incidence by providing a suitable microclimate at the plant base (Pathak & Khan, 1994; IRRI, 2013).

Damaging Stage of Pest

Both nymphs and adults are damaging stages. However, nymphs are more destructive due to continuous feeding and higher population density at the plant base (Heinrichs, 1994).

Preventive and Cultural Methods

Use of resistant varieties, balanced fertilizer application, and proper water management significantly reduce BPH incidence (IRRI, 2013). Avoiding excessive nitrogen fertilizer is particularly important, as it encourages planthopper multiplication (Reddy et al., 2018).

Biological Control

Several natural enemies suppress BPH populations, including spiders, mirid bugs (Cyrtorhinus lividipennis), and parasitoids. Conservation of these natural enemies by avoiding broad-spectrum insecticides is a key IPM strategy (Heinrichs, 1994).

Chemical control

Chemical control should be adopted only when ETL is crossed. Recommended insecticides include: Imidacloprid, Buprofezin, Thiamethoxam. Rotating insecticides with different modes of action is essential to prevent resistance development (IRRI, 2013).

Integrated Pest Management (IPM)

Integrated management of brown planthopper involves a combination of resistant varieties, cultural practices, biological control, and need-based chemical application. IPM minimizes environmental pollution and delays resistance development (Pathak & Khan, 1994). Brown planthopper has developed resistance to several commonly used insecticides due to repeated and indiscriminate spraying. Misuse of broad-spectrum insecticides often destroys natural enemies, leading to pest resurgence and secondary pest outbreaks. Resistance to organophosphates, carbamates, and even some neonicotinoids has been reported in different rice-growing regions of Asia (Reddy et al., 2018). Therefore, judicious insecticide use and rotation of chemicals with different modes of action are strongly recommended. Host plant resistance is one of the most effective and economical methods for managing brown planthopper. Several rice varieties carrying resistance genes such as Bph1, Bph2, and Bph3 have shown tolerance against BPH infestation. Cultivation of resistant varieties reduces dependence on chemical control and supports sustainable pest management under IPM programs (IRRI, 2013). Excessive chemical control of brown planthopper poses serious environmental risks, including contamination of water bodies, reduction of biodiversity, and harm to beneficial arthropods. Conservation of predators such as spiders and mirid bugs plays a crucial role in naturally regulating BPH populations. Ecologically based pest management practices enhance the resilience of rice ecosystems (Heinrichs, 1994).

Conclusion

Brown planthopper is a major threat to rice production under intensive cultivation systems. Effective management requires early detection and an integrated approach rather than sole reliance on insecticides. Adoption of IPM practices ensures sustainable rice production while conserving natural enemies and protecting the environment (Heinrichs, 1994).\

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WHITE BACKED PLANT HOPPER IN RICE

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Abstract
Sogatella furcifera, a rice pest in Asia, migrates from warmer areas to northern and northeastern Asia in the spring and summer. When the growing season ends in the fall, their young head back south for the winter. Back in the 70s and 80s, a study looked at these pests and found that the spring migrants came from the Indochina Peninsula and flew into southern China. These bugs then kept going north into China on the wind. Later studies of their paths and computer simulations suggest that the East I Asian groups spend the winter in Vietnam and southern Hainan Province.
Keywords: sucking pests, susceptible to HYVs, hopper burn symptoms,ecology, Rice

Introduction

The white backed planthopper (WBPH), or Sogatella furcifera, is a major problem for rice crops in many parts of India. The reason it's such a bad pest is partly because farmers are planting high-yielding rice types that are easily infected. Also, the heavy use of fertilizers with nitrogen and strong pesticides makes the problem worse.

WBPH really takes hold when the rice is growing fastest, and you can see the plants start to look burned as they get closer to being ready to harvest. You'll see young and adult WBPH bugs on the top parts of the rice stems, mostly where the stems and leaves meet. They both suck on the plant and reproduce quickly when the weather is good for them.

When you plant the rice also matters. It depends on when it rains or how much water is available for irrigation. This affects when the bugs first show up, how many there are, and if that happens when the rice is weak and the temperature and humidity are good for the bugs . Temperature really affects how these bugs grow, stay alive, and reproduce.

You can predict when the different bug generations will appear if you enter the daily high and low temperatures for your area, starting from when you first saw the bugs in the field, and also what stage the bugs were in. You can apply this pest forecast to your location by picking the State and District.

Pest Identification:

Scientific Name - *Sogatella furcifera*

The insect's cylindrical eggs are laid in groups. When the rice plant is small, the eggs are laid low. When the rice plant is big, they are laid up high. Young nymphs are small, about 0.6 mm, and range in color from white to a mottled dark grey or black and white. The fifth-stage nymph has a narrow head and a white or creamy white body. The top of its thorax and abdomen has grey and white markings. The adult hopper is 3.5 - 4.0 mm long. Its forewings are clear with dark veins. Look for the white band between where the wings join. You'll typically see long-winged males and females, and short-winged females, out in the fields.

Taxonomy

Order: Hemiptera (True Bugs, Hoppers, Aphids)

Suborder: Auchenorrhyncha (Hoppers)

Infraorder: Fulgoromorpha (Planthoppers)

Superfamily: Delphacoidea

Family: Delphacidae (Delphacid Planthoppers)

Genus: Sogatella

Species: Sogatella furcifera (Horvath)

Host range

Primary Host: Rice: The most important host, with all life stages (nymphs and adults) feeding on sap, particularly damaging young plants during tillering and flowering. Maize: Another grass host where it can survive and develop. Grass Weeds: Various wild grasses serve as alternative hosts, allowing populations to persist outside the rice season

Origin and Distribution

All over the place in India, China, Japan, and Southeast Asia (like the Philippines, Vietnam, and Thailand). You can even find them in parts of the old Soviet Union. They live in Australia, Fiji, Papua New Guinea, and a bunch of other islands in that area. They usually don't live here, but there have been some reports of them in small areas of Africa and South America.

Life cycle

Cylindrical eggs are laid in groups when the rice plant is small but in the upper part of the rice plant when the plant is large. White to a strongly mottled dark grey or black and white in colour and 0.6 mm size when young. Fifth instar nymph with a narrow head and white or creamy white body. Dorsal surface of the thorax and abdomen marked with various amounts of grey and white markings. The adult hopper is 3.5 - 4.0 mm long. The forewings are uniformly hyaline with dark veins. There is a prominent white band between the junctures of the wings. Macropterous males and females and brachypterous females are commonly found in the field.

Symptom

They suck plant fluids, which stunts growth. They cause hopper burn, which appears as random dead patches. These hoppers are most common when rice plants are young, mostly in nurseries. Rice suffers more at the tillering stage than when it's booting or heading. They damage plants by feeding and laying eggs. The females laying eggs puncture the leaf sheaths. Both young and adult hoppers suck sap, weakening the plant, stunting it, yellowing leaves, and delaying tillering and grain formation. The rice crop doesn't fully produce grains, leading to empty glumes, and this is called red disease. When they feed and females lay eggs, they wound the plants, making them prone to disease, and their sugary waste promotes sooty mold growth.

Preventive measures.

To manage pests, use Integrated Pest Management (IPM). Focus on things like not using too much nitrogen, planting rice types that can fight off pests, keeping fields clean by getting rid of weeds and leftover plant stuff. Also, control water by sometimes draining the fields to mess with the pests' life cycle. Keep an eye on things with light traps and check fields often. If you need to treat, do it only when there are enough pests to cause problems. This way, you help protect the good bugs like spiders that eat the bad ones.

Management strategies:

Cultural Methods: Don't use too much nitrogen fertilizer. Drain fields occasionally to manage irrigation. Plant at the same time (within 3 weeks) and keep fields rice-free for a while. This may help keep Brown plant hopper numbers down. IRRI has released rice types with genes that resist White backed plant hopper, such as IR26, IR64, IR36, IR56 and IR72. Space out plants and leave gaps (30 cm) every 2.5 to 3.0 m to help reduce pest problems.

Chemical treatment: Phosphamidon 40 SL at 1000 ml per hectare , Carbofuran 3 G at 17.5 kg per hectare, Dichlorvos 76 WSC at 350 ml per hectare

Natural Treatments: 3-5% Andrographis paniculata kashaayam, Garlic, ginger, chilli extract, Neem oil 3% at 15 liters/hectare, Illupai oil 6% at 30 liters/hectare, Neem seed kernel extract 5% at 25 kg/hectare.

Biological method

Use Anagrus sp to kill the eggs, and Pachygonatopus sp. to kill grown-up white backed plant hoppers and their young. Ladybugs (Coccinella arcuata), Cyrtorrhinus lividipennis, and Tytthus parviceps are good at eating these pests too. Tiny wasps usually attack the eggs. Mirid bugs and phytoseiid mites will also eat the eggs. Mirid bugs also eat the babies. Spiders and ladybugs like to eat both the grown-ups and young ones. If any white backed plant hoppers fall into the water, water beetles and bugs, dragonflies and damselflies will eat them.

These bugs can be kept under control with natural enemies. Little wasps lay their eggs inside the plant hopper's eggs, killing them. Mites and mirid bugs eat both the eggs and young. Beetle, dragonfly and damselfly babies that live in the water, plus water bugs, will eat the young and grown-up plant hoppers. Spiders and some kinds of beetles and bugs will hunt for the white backed plant hopper babies and adults on the plant.

Trap Methods Set up light traps during night. Use yellow pan traps during day time. Installation of light traps with incandescent light at 1-2 m height @ 4/ acre to monitor the population.

Integrated pest management

To deal with White-backed Planthopper (WBPH), Integrated Pest Management (IPM) uses a few strategies: preventing infestations, keeping an eye on things, and mixing different ways to control them. This means planting types of crops that can fight off WBPH, using just the right amount of fertilizer (not too much Nitrogen), watering correctly, using light traps, and introducing bugs that eat WBPH (like mirid bugs). If we need to use bug spray, we pick ones that only kill WBPH and don't harm the good bugs, so WBPH doesn't become resistant. The trick is to watch how many WBPH there are (like 1-2 hoppers per tiller or 4 pregnant females per hill) and use methods that keep the helpful bugs safe, like not using strong bug sprays early in the season.

Conclusion

The White-backed Planthopper (WBPH) is a big problem for rice crops. It causes damage and yield loss by sucking out plant juices, spreading viruses, and making plants more likely to get sick. To manage it, we need to use a mix of approaches, like planting rice types that can resist it, using fertilizer wisely (especially nitrogen), and switching between different bug killers to prevent the bugs from getting resistant. Careless use of chemicals and climate shifts can make infestations worse, so we need to keep a close eye on things and control the bugs with sustainable techniques.

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RICE EARHEAD BUG

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Abstract

The Rice Earhead Bug (*Leptocorisa acuta* Thunberg) is a significant pest of rice (*Oryza sativa* L.), causing substantial yield and quality losses in both irrigated and rainfed systems. This review consolidates current knowledge on the biology, ecology, damage symptoms, and management strategies of this pest while identifying areas requiring further research. *L. acuta* primarily feeds on developing grains by piercing spikelets, leading to shriveled, discolored, or unfilled grains, commonly referred to as "pecky rice." The pest exhibits a multivoltine life cycle, with populations influenced by climatic conditions, cropping patterns, and the availability of alternative hosts. Traditional chemical control methods remain widely used but are limited by insecticide resistance, non-target effects, and environmental concerns. Biological control agents, including egg and nymph parasitoids, along with cultural practices such as synchronized planting, field sanitation, and habitat management, have shown potential in reducing pest incidence. Breeding for resistant or tolerant rice varieties offers a sustainable approach, though adoption remains limited. This review emphasizes the importance of integrated pest management (IPM) strategies that combine ecological, biological, and genetic tools to minimize losses. Additionally, it highlights the need for ongoing research on population dynamics, climate change impacts, and farmer-participatory approaches to achieve resilient and sustainable rice production in the presence of Rice Earhead Bug infestations.

Keywords: Rice Earhead Bug; *Leptocorisa acuta*; Rice; Grain damage; Integrated pest management

Introduction

Rice (*Oryza sativa* L.) is a staple food for more than half of the world's population, and its productivity is often threatened by insect pests. Among them, the Rice Earhead Bug (*Leptocorisa acuta* Thunberg) is a major pest in Asia, causing significant grain losses and reducing both yield and quality. The bug feeds by piercing developing grains with its rostrum and sucking out the contents, leading to shriveled, discolored, or unfilled grains, commonly known as "pecky rice." Infestations are most severe during the flowering and grain-filling stages, and the pest is favored by high humidity, warm temperatures, and dense crop stands. Continuous rice cultivation, multiple cropping systems, and nearby alternative host plants contribute to population buildup. Chemical insecticides are commonly used for control, but their overuse has led to resistance, environmental contamination, and negative impacts on beneficial organisms.

Sustainable management of Rice Earhead Bug requires understanding its biology, behavior, and ecology. Integrated Pest Management (IPM) approaches, combining cultural practices, biological control, host plant resistance, and judicious chemical use, offer the most effective strategy for minimizing losses. This review aims to compile current knowledge on the biology, damage symptoms, monitoring methods, and management strategies of *L. acuta* to support sustainable rice production.

Taxonomic classification of Rice Earhead Bug:

Order: Hemiptera

Family: Alydidae

Genus: *Leptocorisa*

Species: *Leptocorisa acuta*

Host Range

The Rice Earhead Bug (*Leptocorisa acuta* Thunberg) is primarily a pest of rice (*Oryza sativa* L.), feeding on developing grains during the flowering and grain-filling stages. While rice is the main host, the bug can also feed on other grasses and cereals, including wild rice species and certain weeds, which serve as alternate or off-season hosts. This relatively narrow host range makes *L. acuta* largely specific to rice ecosystems, but the presence of alternative hosts in or near rice fields can support population carryover between cropping seasons. Managing these alternate hosts through field sanitation and weed control is an important preventive strategy to reduce infestation levels in rice crops.

Origin and Distribution

The Rice Earhead Bug (*Leptocorisa acuta* Thunberg) is believed to have originated in Southeast and East Asia, coinciding with the domestication and widespread cultivation of rice in the region. Its distribution is closely linked to rice-growing areas, where favorable climatic conditions and continuous availability of host plants support its survival and multiplication.

L. acuta is widely reported in countries such as India, Bangladesh, Sri Lanka, Thailand, Vietnam, the Philippines, Indonesia, China, and Japan. The pest is most prevalent in tropical and subtropical climates, where warm temperatures and high humidity favor rapid population buildup. Occasional infestations have been reported in regions outside Asia where rice is grown, but these are generally less severe due to climatic constraints and limited host availability.

The widespread distribution of *L. acuta* in rice-growing regions highlights the importance of understanding its biology and ecology for effective management and minimizing crop losses.

Morphology and Diagnostic Characters

The Rice Earhead Bug (*Leptocorisa acuta* Thunberg) exhibits distinct features at different developmental stages, useful for identification and monitoring.

Eggs are Small, elongated, and pale green initially, turning yellowish before hatching. Eggs are usually laid on rice panicles or leaves. Nymphs are Immature stages are green to brown, wingless, and resemble small adults. They have a slender body and long antennae, and pass through multiple instars before adulthood. Adults are Slender, elongated bugs measuring 15–20 mm in length. Body coloration ranges from brownish to greenish. Adults have long antennae, a narrow head, and piercing-sucking mouthparts. The wings are well-developed, allowing mobility between plants.

Diagnostic Characters:

Slender, elongated body with long antennae. Brownish to green coloration in adults. Piercing-sucking rostrum adapted for feeding on rice grains. Presence on rice panicles during the flowering and grain-filling stages. These morphological features help distinguish *L. acuta* from other rice pests, enabling timely detection and management.

Life Cycle and Phenology

The Rice Earhead Bug (*Leptocorisa acuta* Thunberg) undergoes incomplete metamorphosis with three stages: egg, nymph, and adult. The duration of its life cycle varies with temperature, humidity, and crop conditions, generally lasting 25–40 days. Eggs are laid on panicles, leaves, or stems and hatch in 5–7 days. Nymphs pass through five instars over 15–20 days. They are wingless and gradually develop adult features with each molt, Adults are mobile and capable of flight, living for 10–15 days. Females lay eggs during this period, completing the reproductive cycle.

L. acuta is multivoltine, producing several generations per year in regions with continuous rice cultivation. Populations peak during the flowering and grain-filling stages of rice, when grains are most vulnerable. Environmental factors such as warm temperatures, high humidity, and nearby alternate host plants influence its population dynamics and severity of infestation.

Symptoms and Damage

The Rice Earhead Bug (*Leptocorisa acuta* Thunberg) causes damage primarily by feeding on developing rice grains, leading to both quantitative and qualitative yield losses. Piercing-sucking feeding results in shriveled, discolored, or unfilled grains, commonly called *pecky rice*. Infested panicles may show partial sterility, reduced grain weight, and overall poor grain filling. Severe infestations can lead to reduced yield, lower milling quality, and economic losses, particularly in late-sown or densely planted crops.

Damage is most severe during the flowering and grain-filling stages, when the pest is actively feeding on tender grains. Early detection and timely management are critical to prevent significant yield loss.

Field Detection and Key Indicators

Effective management of Rice Earhead Bug (*Leptocorisa acuta*) relies on early detection using visual observation and monitoring tools. Key indicators include: Adults and nymphs are usually found on rice panicles during flowering and grain-filling stages. Shriveled, discolored, or empty grains (*pecky rice*) indicate feeding activity. Small, pale green to yellowish eggs on panicles or leaves. Wingless, green to brown nymphs moving slowly on panicles. Regular field scouting, particularly in the morning or evening when adults are less mobile, helps detect infestation early. Light traps or sweep nets can also assist in monitoring adult populations and predicting outbreaks.

Damaging Stage

The **nymphal and adult stages** of the Rice Earhead Bug (*Leptocorisa acuta* Thunberg) are the most destructive phases of its life cycle. Both nymphs and adults feed on developing rice grains by piercing them with their rostrum and sucking out the contents, which leads to shriveled, discolored, or unfilled grains, commonly referred to as *pecky rice*. Damage is most severe during the flowering and grain-filling stages when the grains are tender and highly susceptible to feeding. Heavy infestations during this period can significantly reduce yield and affect grain quality, impacting both market value and seed viability.The egg stage does not cause direct damage to the crop but ensures the continuity of pest populations, contributing to subsequent nymphal and adult infestations. Understanding the damaging stages helps in timing monitoring and control measures effectively to minimize economic losses.

Preventive Methods

Preventive measures are essential to reduce Rice Earhead Bug (*Leptocorisa acuta*) infestations and minimize grain damage: Remove and destroy crop residues, weeds, and alternate host plants around fields to reduce pest carryover. Coordinate planting within a locality to limit continuous availability of susceptible panicles. Alternate rice with non-host crops to disrupt the pest life cycle. Proper irrigation and field drainage can reduce bug survival and breeding. Grow rice varieties with tolerance or resistance to Rice Earhead Bug. Avoid excessive nitrogen application, which can favor pest multiplication. Implementing these preventive practices helps reduce pest pressure and complements integrated management strategies.

Integrated Pest Management (IPM)

Integrated Pest Management (IPM) for Rice Earhead Bug (*Leptocorisa acuta* Thunberg) combines cultural, biological, and chemical approaches to control the pest effectively while minimizing environmental impact:

1. **Cultural Control:** Synchronized planting and proper field sanitation to reduce pest carryover. Crop rotation and removal of alternate host plants to disrupt the pest's life cycle. Proper water management and balanced fertilization to discourage population buildup.
2. **Host Plant Resistance:** Cultivation of rice varieties that are resistant or tolerant to Rice Earhead Bug. Adoption of improved varieties developed through conventional breeding or molecular approaches.
3. **Biological Control:** Conservation and augmentation of natural enemies such as egg and nymphal parasitoids. Use of entomopathogens under suitable conditions to suppress populations.
4. **Chemical Control:** Application of selective insecticides only when pest populations exceed economic thresholds. Rotation of insecticides with different modes of action to prevent resistance.
5. **Monitoring and Decision-Making:** Regular field scouting to detect eggs, nymphs, and adults. Use of light traps or sweep nets to monitor adult populations and predict outbreaks. Implementing IPM ensures sustainable management of Rice Earhead Bug, reduces yield losses, and minimizes negative impacts on the environment and beneficial organisms.

Conclusion

The Rice Earhead Bug (*Leptocorisa acuta* Thunberg) is a significant pest of rice, causing severe grain damage and yield losses through its feeding on developing panicles. The nymphal and adult stages are the primary damaging phases, leading to shriveled, discolored, or unfilled grains (*pecky rice*). Effective management relies on early detection, preventive measures, and the adoption of Integrated Pest Management (IPM) strategies, including cultural practices, host plant resistance, biological control, and judicious chemical use. Sustainable approaches, such as synchronized planting, field sanitation, and monitoring, are essential to minimize infestations and maintain rice productivity. Continued research on resistant varieties, biological control agents, and eco-friendly management practices will support long-term, resilient rice production in regions affected by Rice Earhead Bug.

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MEALY BUG IN RICE

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Abstract

The rice mealy bug, Brevennia rehi (Hemiptera: Pseudococcidae), attacks rice plants, mostly in nurseries and right after transplanting. Young and adult mealy bugs harm the plant by feeding on sap from the roots and lower stems. This causes yellowing, stunted growth, fewer tillers, and weak plants. If there are many mealy bugs, the plants can dry out, and it becomes easy to pull up the affected rice plants. The mealy bugs also produce honeydew, which encourages sooty mold growth, which then lowers photosynthesis. Mealy bug problems get worse in dry weather, sandy soils, when rice is grown constantly, and when water control is poor. Good control requires an approach that includes proper water management, weed control, protecting natural predators, and using insecticides only when needed. Using integrated pest management practices helps cut down on yield loss and helps ensure rice production can continue long-term. Rice mealy bugs (Brevennia rehi) are sap-sucking pests that attack rice plants. They typically infest the base of the stem and roots, causing damage. These pests secrete honeydew, which leads to the growth of sooty mold. Infested plants often exhibit stunted growth and are more susceptible to moisture stress. Integrated pest management (IPM) strategies are used to control these mealy bugs.

Keywords: mealy bug, IPM, rice, yellowing, honey dew, management.

Introduction:

Rice stands out as a key food crop in tropical and subtropical areas. Rice mealy bug, Brevennia rehi, is a bad pest that sucks fluids from rice plants. They are bad during dry times. These pests mainly target young rice plants in nurseries, attacking the roots and lower stems. The young and adult bugs suck plant fluids. The plants grow poorly. They also turn yellow and dry out. Bad infestations can totally wipe out parts of crops. Things that make rice mealy bug problems worse are bad watering practices, always growing rice, and weeds. Knowing about how these bugs live, what damage they do, and how to control them assists in creating solid pest control plans and keeping rice harvests steady.

Pest identity and taxonomy

Common name: Rice mealy bug

Scientific name: Brivennia rehi

Order: Hemiptera

Family: Pseudococcidae

Subfamily: Coccoidea

Host range

The rice mealy bug, Brevennia rehi, is a pest that feeds on a limited number of plants. It mainly infests rice but can live on other cereals and grasses. Rice (Oryza sativa) is its main and preferred host, where it finishes its life cycle and causes major economic losses, mainly in nurseries and early transplant stages. Besides rice, the rice mealy bug can infest wheat, barley, maize, sorghum, and pearl millet. These crops act as secondary hosts, mostly when it is off-season, or rice is absent. The pest also lives on grasses and weed types like Cynodon dactylon, Echinochloa, and wild grasses often found on field borders and irrigation canals. These secondary hosts help the mealy bug stay in the ecosystem and become a source of the planting of the next rice crop. Because of this, weed control and crop rotation are important in lowering the carryover and cases of rice mealy bug.

Origin and distribution

The rice mealy bug (*Brevennia rehi*) started in the Indian subcontinent. This bug lives in many rice-growing areas of Asia, like India, Sri Lanka, Bangladesh, Pakistan, Nepal, Myanmar, Thailand, and Indonesia. In India, it's in most of the big rice-producing states, mostly where it's dry or the plants don't get enough water. It's now found in: Asia: It's all over Asia, in countries like India, Bangladesh, Myanmar, Nepal, Pakistan, Thailand, Indonesia, Philippines, and Taiwan. Australia and nearby: It's been seen in parts of Australia and nearby islands, like Papua New Guinea and New Britain. It lives on grasses there. Middle East and Central Asia: It's in Middle Eastern countries such as Afghanistan, Iran, Iraq, Israel and some parts of Central Asia. North America: It's in the USA (Arizona, California, Florida, and Texas). It's on grasses in lawns and turf. South America: It's been seen in places like Puerto Rico and the U.S. Virgin Islands. Recently, it was found in Bahia, Brazil, showing it's spreading into South America.

Morphology

Adults are small and soft, with an oval or elongated form. They appear pinkish or light yellow and are coated in a white, mealy, waxy substance. The females don't have wings and are seen often, while the males have wings but are rare. The body is divided into segments and has short, waxy filaments around the edges. The antennae are short. The legs are well-developed, which allows them to crawl. Their mouthparts are designed to pierce and suck, which is fit for feeding on sap.

Life Cycle Stages: Females deposit eggs in a white, cotton-like sac at the base of plant stalks or on the roots. The eggs are small, yellowish, and oval. They hatch in 7–10 days, depending on the temperature and humidity. Rice mealy bugs have a nymph phase because they undergo incomplete metamorphosis. These nymphs are small, soft, and yellowish at first, turning pink or pale yellow as they grow. Adults are small, soft, oval-shaped, and coated in a white, powdery wax. They range in colour from pinkish to pale yellow.

Symptoms:

White, cotton-like clusters at the lower stem and root areas. Rice plants appearing yellowed and underdeveloped. In serious instances, the main shoot may wilt. Damaged roots cause affected plants to be easily pulled from the ground.A sweet liquid secretion, which results in sooty mold at the plant's base. Uneven spread, frequently beginning in areas with weeds or plant stress.

Damage

Both young and adult insects feed on sap from the lower stem and roots, which weakens the plant. This reduces the number of new shoots, plant strength, and grain production. A heavy infestation can lead to some or all seedlings or young plants dying. Sweet secretions and sooty mould decrease photosynthesis, making yield loss worse. The problem is worse in dry soils lacking moisture and in sandy fields.

Field inspection

Examine the base of the stem and roots: These pests gather at the base of plant stems and root areas. Check for white, waxy clumps, which are groups of young and grown females Note any signs of plant stress: Affected plants might have yellow leaves, limited growth, and poor stem production Look at weeds and grasses nearby: Mealy bugs often live on other plants, like grasses and weeds, which can keep the infestation going. Spot honeydew and sooty mould: As these insects feed, they leave behind a sugary substance. This can cause black sooty mould to grow near the plant’s base.

Key indicators

The problem often begins in the driest, most stressed parts of the field. Affected plants can be pulled out easily because their roots are weak. Plants that have this issue grow slower and look less healthy. Small, yellow bugs moving near the base of the plant show that the problem is active. A cotton-like, waxy substance at the base of the stem and roots clearly shows that rice mealy bugs are present.

Movement and Multiplication:

Newly hatched nymphs, known as crawlers, can move around freely. They travel short distances on stems, roots, and soil to find new plants close by. Crawlers can also spread by wind, water, or farm tools, moving them around fields. Adult females usually stay in one place, hidden near the plant's base or roots. Adult males have wings but are not common and don't live long. They can help spread the population locally. The pest can move to new fields through infested seedlings, nursery soil, weeds, and grasses.

Life cycle

Females deposit 50–200 eggs in cottony sacs near the base of rice plants. Eggs hatch in 7–10 days, with nymphs beginning to feed right away. Nymphal Development: Nymphs go through 3–5 stages, turning into adults in 15–25 days, depending on the environment. Adult Stage and Egg Laying: Adult females live for 2–3 weeks and continue to deposit eggs, leading to several generations in one growing season. Population Growth: Having many generations along with certain dry, moisture-stressed conditions and other host plants around, the population can grow quickly, leading to bad cases.

Damaging Stage of Pest:

The nymph and adult female phases cause the most harm. Nymphs actively consume sap from roots and lower stems, which weakens seedlings and cuts down on tillering. Adult females keep eating as they deposit eggs in cottony sacs, maintaining and growing infestations. Adult males are rare, live briefly, and don't eat, so they don't directly harm plants.

Preventive Measures:

Use healthy seedlings free from pests when transplanting. Check nurseries regularly for white cottony masses at the base of seedlings. Do not transplant infested seedlings, as they are a main source of field infestation. Rice mealy bugs favour dry conditions. Keep water levels at 2–5 cm in the field to discourage pest buildup and reduce nymph survival near the plant base. Remove weeds, grasses, and crop residues from fields and irrigation channels. These can act as alternate hosts, helping the pest survive when not in season. Switch rice with crops that don't host the pest helps break its life cycle. This practice reduces the number of pests that remain in the soil. Avoid using too much nitrogen, which can cause plant growth that attracts mealy bugs. Using a balanced amount of nutrients improves plant health and tolerance. Check fields often to find infestations early. Uproot and destroy heavily infested plants. Lightly rake the soil around plants to expose insects and stop them from spreading.

Cultural and Mechanical Methods:

Cultural practices aid in developing conditions that aren't good for rice mealy bug survival and growth Only move healthy seedlings without mealy bugs from well-kept nurseries. Do not use seedlings from nursery beds that have pest, Keep 2–5 cm of water in the field, mostly when the crops are young. Flooding stops mealy bugs, as they like dry soils with little moisture. Get rid of weeds, grasses, and leftover crops from fields and irrigation paths. This gets rid of other things that the pest can live on between growing seasons. Switch from rice to other crops that the pest can't live on. This stops the pest's life cycle and lowers the amount that lives on. Do not use too much nitrogen, which makes plants grow in a way that helps mealy bug infestations. Put on fertilizers based on what soil tests say.

Physical Methods:

Physical tactics include getting rid of the pest and damaged plant parts. Pull up and destroy hills of plants that have a lot of pests on them. This will stop the pests from spreading. Lightly rake or hoe near the bottom of plants. This shows young and adult pests to sunlight and animals that eat them, which lowers how many live. In small nursery beds, you can see and remove cottony groups by hand.

Biological methods:

Biological methods are important for managing rice mealy bugs in an eco-friendly way by protecting and using their natural enemies. Coccinellid beetles (ladybird beetles) like Cryptolaemus montrouzieri: Both the young and adult beetles eat mealy bugs. Green lacewings (Chrysoperla carnea): The young eat young and adult mealy bugs. Spiders and predatory bugs: These help keep mealy bug numbers down in rice fields naturally. Encyrtid parasitoids (like Anagyrus species): They lay eggs inside mealy bugs, and the growing young kill the mealy bug. Don't use strong insecticides carelessly because they kill helpful insects. Keep different weeds on bunds (without letting them host other pests) to help natural enemies survive. Entomopathogenic fungi like Beauveria bassiana and Metarhizium anisopliae can infect and kill mealy bugs if the humidity is right.

Chemical methods:

Use chemical control only for severe infestations. Mealy bugs hide at the base of plants, and general spraying can hurt helpful insects. Since rice mealy bugs eat roots and the lower stem, treating the soil works best. Mix 2.5 ml of chlorpyriphos 20 EC with each liter of water and drench the soil. Mix 0.3 ml of imidacloprid 17.8 SL with each liter of water and drench the soil. Apply around the base of plants in standing water so it soaks in better. Apply phorate 10 G at 10 kg per hectare. Apply carbofuran 3 G at 33 kg per hectare. Put granules in damp soil, then water lightly, drench nursery beds with chlorpyriphos or imidacloprid solution. Don't transplant seedlings that are infested. Only apply chemicals after you find the pests early and they reach the economic threshold. Don't keep using the same insecticide to avoid resistance. Use only the needed amount and follow safety rules. Treat only the spots that are affected instead of the whole field.

Conclusion:

The rice mealy bug (Brevennia rehi) is a key pest that sucks fluids from rice plants, mainly when conditions are dry. These pests harm rice by feeding on roots and stems at the base, which causes yellowing, stunted growth, fewer tillers, and lower yields. Because they are hard to spot, multiply quickly, and can live on other plants, it's hard to control them after they infest a field. To manage them, it is important to spot them early and take preventive steps. These steps should the use of farming and physical methods, protect helpful insects, and use chemicals only when needed. Using Integrated Pest Management is important to cut down on losses, reduce environmental damage, and keep rice production sustainable.

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RICE BLACK BUG

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Abstract

Rice is Asia's main food crop, critical for feeding millions. Though farming tech has gotten better, bugs still hit rice hard at different growing stages. One big one is the rice black bug (Scotinophara spp.). It sucks on the plants, causing major trouble, especially when the rice is young and making grains. Both young and adult bugs suck juice from the bottom of the rice plants, making them weak, dry up, and yield less. If there are many bugs, it looks like the rice is burned, and the whole crop can die. These bugs love hot and wet weather and are common where rice is planted close together all the time. This paper talks about what this bug is, what it eats, where it's found, what it looks like, how it lives, what kind of damage it does, when it's worth fighting, and how to control it in a way that's good for the environment.

Keywords: Rice black bug, Scotinophara spp., rice, sucking pest, bug burn, integrated pest management

Introduction

Rice (Oryza sativa L.) feeds over half the world. In places like India, rice grows in all kinds of weather, from wet lowlands to dry uplands. Still, bugs keep messing with the rice from when it's a seedling until it's ready to pick. The rice black bug (Scotinophara spp.) is a big problem among the bugs that suck on rice. When these bugs aren't taken care of, they hurt the crop a lot in many rice-growing areas, mainly during the early growing stages. Young and old bugs stick their mouths into the bottom of the plants and suck the juice out, which makes the plants wilt and dry out (Pathak & Khan, 1994). Rice black bug issues often happen when rice is always planted, has a lot of fertilizer, and grows super thick. These create the perfect spot for the bugs to grow fast. It's super important to know how these bugs live, what they do to the plants, and how to handle them to keep them away for good.

Pest Identity and Taxonomy

Common name: Rice black bug

Scientific name: *Scotinophara spp*. (mainly *Scotinophara lurida* Burmeister)

Order: Hemiptera

Family: Pentatomidae

Host Range

Black bugs mostly eat rice plants. They can also live on other grasses out in the fields. Rice (*Oryza sativa*).Wild grasses .Sometimes on other grains if there are tons of bugs.Rice that's always planted in the same spot gets hit harder by these bugs (Heinrichs, 1994).

Origin and Distribution

The rice black bug comes from South and Southeast Asia. You can find it in big rice countries like India, Sri Lanka, Bangladesh, the Philippines, Indonesia, Thailand, and Vietnam. In India, they're in Tamil Nadu, Andhra Pradesh, Telangana, Kerala, Karnataka, Odisha, and West Bengal.

These bugs grow fast when it's hot and wet, mostly in rice farms that get water and have thick rice plants (IRRI, 2013).

Morphology and Diagnostic Characters

Adult bugs are like dark brown or black ovals, about 8–10 mm long. They're flat and shaped like shields. They have antennas and legs that help them move, but not very fast. If you bug them, they stink. Young bugs look like the grown-ups, but they're smaller and don't have wings. They start reddish-brown and get darker as they turn into adults. You usually find them hanging out at the bottom of the rice plants.

Life Cycle

Rice black bugs change in stages: egg, young bug, and grown-up bug. They lay eggs in groups on the leaves or at the bottom of the plants; it takes 5–7 days for them to hatch. Young bugs take about 20–30 days to grow up, going through five stages. Grown-up bugs live for 1–2 months, eating and having babie. They have babies all the time during the rice season, mostly when the rice is growing its stems (Pathak & Khan, 1994).

Symptoms

Young and old bugs hurt the plants by sucking juice from the bottom.Leaves turn yellow and droop.Stems dry out, causing “dead hearts”.Plants don't grow as many stems and get weak.Fields look like they're drying up in patches, called “bug burn”.If there are too many bugs, the whole crop can fail.The worst damage is when the rice is making stems and getting ready to make grains (Heinrichs, 1994).

Management Methods

Follow crop rotation, adopt wider spacing, use the right amount of fertilizer, and clean up the stalks after harvest Synchronized planting, Dry out the fields for a bit to get rid of bugs, Pick off the bugs by hand if there aren't many, practice crop systems and rotation, Protect bugs that eat the bad bugs, like spiders, Use neem stuff (neem oil 3% or NSKE 5%, Keep the rice fields balanced. Only use bug spray if you really need to, Chlorpyriphos 20 EC @ 2.5 ml/L. Malathion 50 EC @ 2 ml/L. Lambda-cyhalothrin 2.5 EC @ 1 ml/L. Spray at the bottom of the plants in the morning or evening.

Biological Control

To keep rice bugs away, protect spiders, beetles, and ants that eat them. You can also use neem oil (3%) or neem seed extract (5%). These things lower the number of bugs and how much they eat, but don't hurt the good bugs (Heinrichs, 1994). To handle rice black bugs well, find them early, focus on growing methods and bug-eating bugs, and only use a little bit of bug spray when you have to. Doing all these things helps keep bugs down for good, costs less money to grow rice, and keeps the rice fields healthy.

Conclusion

Rice black bugs (Scotinophara spp.) can really hurt your rice crop if you don't watch out. Catching them early and using all sorts of ways to control them is key to saving your rice. Focus on farming tricks and good bugs, and only spray when needed

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