

A Comprehensive Examination of Insect Pests Affecting Rice Cultivation in Dhadgaon, Nandurbar District, Maharashtra, India

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DOI: <https://doi.org/10.51583/IJLTEMAS.2025.1408000121>

Abstract: A survey conducted in farmers' fields in Dhadgaon, Nandurbar District, Maharashtra, during the 2024 kharif season assessed the occurrence of major rice pests. Observations were made biweekly from August to November/December. The study identified seven pest species, including *Cnaphalocrocis medinalis* (leaf folder) and *Scirpophaga incertulas* (yellow stem borer), as the most abundant and dominant in the paddy fields.

Keywords: Rice, Fortnightly observation, Kharif season

I. Introduction

Rice (*Oryza sativa* L.) is a staple food for millions of people worldwide, cultivated on approximately 148 million hectares and producing around 483 million tonnes (FAO, 2012), primarily in Asia. India is the second-largest producer, accounting for approximately 20% of global rice production. The country cultivates 44.31 million hectares and produces 155.74 million metric tonnes of rice (FAO, 2012). In Maharashtra, rice is grown on about 14.66 lakh hectares, yielding approximately 34.19 lakh tonnes, with a productivity rate of 1.84 tonnes per hectare.

The key rice-growing districts in Maharashtra include Thane, Ratnagiri, Raigad, Sindhudurg, Kolhapur, Nashik, and Nandurbar. However, rice Crops are susceptible to over 100 species of insects, with 20 of these capable of causing significant economic damage (Pathak and Khan, 1994). One of the most detrimental pests affecting rice crops is the brown plant hopper (BPH), scientifically known as *Nilaparvata lugens* (Stål). This pest poses a serious threat as it directly damages plants by sucking their sap and laying eggs within the plant tissue. This can lead to wilting and a condition known as hopper burn. (Dr. Sarika Fulpagare, June 2024)

Rice is the most widely cultivated crop in India. Recently, there has been an increase in the incidence of insect pests affecting rice. Since the Green Revolution in India, the number and types of insect pests have changed and increased (Sain & Prakash, 2008). Additionally, climate change is expected to impact both the number and severity of these pests, as well as the conditions for growing rice (Ananthakrishna, 2007).

II. Materials and Methods

A survey was conducted in farmers' fields in Dhadgaon, Nandurbar District, Maharashtra, India, during the 2024 kharif season to assess the occurrence of major insect pests in rice. Observations were made biweekly from August to December, focusing on pest populations and damage during both the vegetative and reproductive stages. Insects were collected through hand-picking and nets, identified using surveillance data, and sorted with the help of taxonomic keys. Damage percentages were calculated based on the methods outlined by Rath et al. (2015), Singh and Singh (2017), and Venkateswarlu et al. (2018) (Dr. Sarika Fulpagare, June 2024)

Percent incidence of Yellow Stem Borer =

$$\frac{\text{Total no of dead hearts/white ears in 15 hills}}{\text{Total no of tillers (dead heart or white ears + healthy tillers) in 15 hills}} \times 100$$

Percent incidence of Leaf folder =

$$\frac{\text{Total no. of yellow/ brown leaves in 15 hills}}{\text{total no of leaves (yellow+healthy) in 15 hills}} \times 100$$

Percent incidence of Brown Plant hopper =

$$\frac{\text{No. of hopper burn symptoms of hills}}{\text{total no of hills in one meter square}} \times 100$$

Percent incidence of army worm =

$$\frac{\text{damaged plants in one meter square}}{\text{Total no of plants (damage+healthy) in one meter square}}$$

In this investigation, four herbivore species were identified as major rice pests: leaf folder (*C. medinalis*), stem borer (*S. incertulas*), armyworm (*M. separate*), and brown plant hopper (*N. lugens*). These pests were consistently observed from the early vegetative stage to harvest

(Table 1) Among them, the leaf folder and stem borer were dominant. Specific symptoms in the field help identify the affected areas, and damage extent was calculated using a standard formula (Rath et al., 2015; Singh and Singh, 2017; Venkateswarlu et al., 2018).

The leaf folder (*Cnaphalocrocis medinalis*) was first observed in the last week of August, causing 4.35 percent damage to leaves. Following this initial detection, the population continued to grow, reaching a peak of 10.75 percent damage from the middle of September to the first week of October, coinciding with the crop's reproductive stage. After reaching a peak, the population began to fluctuate and gradually declined by the end of December 2024. The rise in leaf folder populations is mainly due to heavy fertilizer use, which boosts their reproduction rates, coupled with increased humidity and rainfall in paddy fields. A severe infestation is marked by scorched fields and folded leaves. First instar larvae can be found on tender leaves without causing any folding, while older larvae bind the edges of the leaves with a sticky substance and feed within the folds.

Stem borer infestations were first observed 18 to 20 days after transplanting, with initial damage recorded at 0.50 percent. The population of yellow stem borers peaked from mid-September to mid-October before beginning to decline. As the crop matured, the infestation increased, reaching 12.11 percent of damaged leaves in early October 2024, during the reproductive stage. After 15 days, the infestation was at moderate levels by mid-October and then gradually decreased.

Yellow stem borers damage paddy crops from the nursery stage through the reproductive stage, showing "dead heart" symptoms during the vegetative stage and "white ear" formation during the reproductive stage. Additionally, the larvae of the stem armyworm (*Mythimna separate*) primarily feed on rice leaves at night. The first appearance of armyworms was noted on August 16, 2024, causing 0.25 percent damage. High population levels were observed from late August to early October, peaking at 10.50 percent damage during the second week of September, which coincided with the vegetative stage of the plants. Following this peak, armyworm activity declined, falling to a low of 0.75 percent damage in the second week of October (see Table 2).

The brown planthopper (*Nilaparvata lugens*) creates circular patches known as "hopper burn" by sucking sap from plants and releasing a sticky fluid that can lead to fungal infections. This pest is most active from the last week of August to mid-September and remains in the fields from August to December. Its population decreases as the harvest approaches.

Table 1: Major insect pests of Paddy Dhadgoan District of Nandurbar, Maharashtra, India.

SL No	Common Name	Scientific name	Order: Family
1.	Yellow stem borer	<i>Scirpophaga incertulas</i> (Walker, 1863)	Lepidoptera: Pyraustidae
2	Leaf folder	<i>Cnaphalocrocis medinalis</i> (Guenée, 1854)	Lepidoptera: Crambidae
3	Armyworm (Rice ear cutting caterpillar)	<i>Mythimna separate</i> (walker)	Lepidoptera: Noctuidae
4	Brown plant hopper	<i>Nilaparvata lugens</i> (Stal 1854)	Hemiptera: Delphacidae

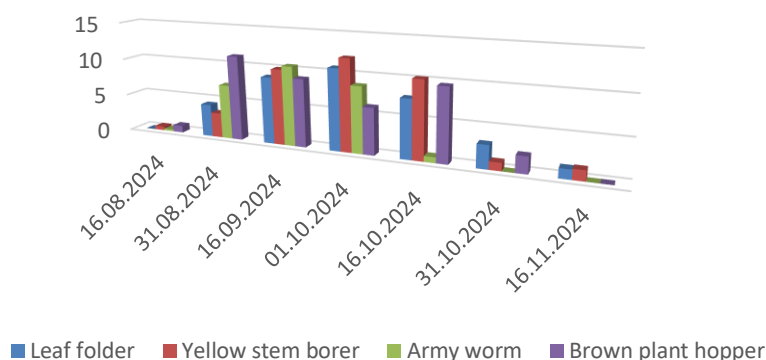
During the study period, it was observed that rice crops were infested by various insect pests, including the leaf folder (*Cnaphalocrocis medinalis*), yellow stem borer (*Scirpophaga incertulas*), army worm (*Mythimna separate*), and brown planthopper (*Nilaparvata lugens*), across different farmers' fields in Dhadgaon, Nandurbar District, Maharashtra, India, during the kharif season of 2024. Among these, the leaf folder and yellow stem borer were identified as the most abundant and dominant pest species affecting the rice cultivated in the study area, while the other species caused moderate damage to the crops.

These findings align with the research of Ghosh et al. (2016), who reported that the leaf folder (*C. medinalis*) and yellow stem borer (*S. incertulas*) were the major and most serious pests of rice plants in the Burdwan district of West Bengal. Similarly, Saini et al. (2015) documented twelve species of insect pests in basmati rice, with the yellow stem borer and leaf folder identified as the dominant pests in Meerut.

Table 2 Major insect-caused damage in paddy field (Percentage incidence) with damage extent.

Observation date (Fortnightly)	Leaf folder	Yellow stem borer	Army worm	Brown plant hopper
16.08.2024	0.00	0.50	0.25	0.92
31.08.2024	4.35	3.30	7.25	11.25
16.09.2024	8.85	10.00	10.50	9.00
01.10.2024	10.75	12.11	8.75	6.17
16.10.2024	7.75	10.25	0.75	9.65
31.10.2024	3.05	1.05	0.00	2.20
16.11.2024	1.25	1.35	0.00	0.00

Table 2 Major insect-caused damage in paddy field (Percentage incidence) with damage extent.



Previous studies conducted in different regions of India have recorded numerous insect pests in rice ecosystems. In total, more than 100 insect pests have been reported affecting rice crops, among which the stem borer, leaf folder, planthopper, rice hispa, gundhi bug, caseworm, and gall midge are considered the most significant. Additionally, a study by Rupshree Das (2020) highlighted the yellow stem borer (*S. incertulas*), leaf folder (*C. medinalis*), brown planthopper (*N. lugens*), rice bug (*Leptocorisa* spp.) as potential pests of rice in various regions of Assam. Punam et al. (2019) observed that rice hispa, leaf folder, yellow stem borer, and bugs as major pests of paddy while studying the major pests of paddy in North Tripura district. In a survey, Singh and Singh (2017) found that yellow stem borer (*S. incertulas*), green leaf hopper (*N. nigropictus*), brown plant hopper (*N. lugens*), leaf folder (*C. medinalis*), and gall midge (*O. oryzae*) as serious pests of paddy from Patna district of Bihar. Rath et al. (2020) studied the biodiversity of pests of rice in Odisha and observed that yellow stem borer (*S. incertulas*), leaf folder (*C. medinalis*), brown plant hopper (*N. lugens*), Swarming caterpillar (*Spodoptera Mauritia*), gall midge (*O. oryzae*), rice bug (*Leptocorisa* spp.). Rice hispa (*N. depunctalis*), caseworm (*D. armigera*), as potential pests of rice. While studying the major pests of rice in Madhya Pradesh, Bisen et al. (2019) found that the yellow stem borer was more prevalent in mid to late September, leaf folder increased at the time of the reproductive phase in mid-September, and the effect of brown plant hopper was more prevalent from September to November. In the present work, leaf folder population was found more at the mid of September of reproductive phase of paddy, which corroborates the findings of Prasad et al. (2005) and Singh and Singh (2017), who also observed that yellow stem borer and green leaf hopper were considerably high during the vegetative and reproductive stage of rice crop. The present findings are in agreement with the study made by Singh et al. (1977), who reported that the maximum attraction of *Nephotettix virescens* to light trap occurred from mid-August to early November. In a study, peak occurrence of green leaf hopper was observed during September and October (Gupta et al., 1989). Present findings are in line with the findings of Singh and Singh (2015). Rupashree Das (2020) reported that both the green leaf hopper and the brown plant hopper are most active during the vegetative phase of paddy growth. Their presence was only noted during this phase. The study focused on insect pests associated with the rice crop (*Oryza sativa*) in the Cachar District of Assam.

III. Conclusion

The present study offers a detailed analysis of the insect pests that significantly impact rice cultivation in the Dhadgaon region of Nandurbar district, Maharashtra. Through extensive field observations and identification, several key pest species—including stem borers, leaf folders, brown planthoppers, and gall midges were found to contribute to considerable yield losses. These pests not only reduce the quantity of rice produced but also compromise its quality, posing a major challenge to local farmers who primarily depend on rice as a staple crop and economic resource.

Climatic conditions, traditional agricultural practices, and limited awareness of integrated pest management (IPM) strategies were identified as contributing factors to the prevalence and severity of pest infestations. The findings underscore the urgent need for region-specific pest control measures that include a combination of biological, cultural, and chemical methods. Enhancing farmer education, promoting sustainable practices, and strengthening agricultural extension services will be critical in mitigating pest-related losses and ensuring food security in the region.

Ultimately, this research contributes valuable insights into the local pest dynamics affecting rice farming in Dhadgaon and lays the groundwork for future studies and interventions aimed at improving crop health, productivity, and the livelihoods of farmers in the region.

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