



ECOLOGICAL ASSESSMENT OF MAJOR INSECT PESTS OF RICE AND INTEGRATED PEST MANAGEMENT IN THE LOHARA AND GHANTA CHAUKI REGION IN CHANDRAPUR DISTRICT OF MAHARASHTRA, INDIA

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ABSTRACT:

An ecological survey was conducted during the Kharif season (Monsoon season), 2025 (June to November, 2025) across two distinct agricultural sites, Lohara and Ghanta Chauki in the Chandrapur district of Maharashtra, India, to evaluate the seasonal incidence, dynamics and damage potential of major insect pests affecting local rice varieties. Abiotic parameters including ambient temperature, relative humidity and rainfall were recorded monthly along with pest infestation levels in Plot 1 and Plot 2. The primary insect pests identified were Yellow Stem Borer (*Scirpophagain certulas*), Leaf Folder (*Cnaphalocrocis medinalis*) and Gundhi Bug (*Leptocoris oratorius*), along with secondary species such as the Rice Swarming Caterpillar (*Spodoptera mauritia*), Painted Bug (*Bagradahilaris*) and Rove Beetle (*Paederus fuscipes*). Peak population build-up for stem borer and leaf folder occurred during September and October, 2025 at both study locations, coinciding with high relative humidity (75–90%) and moderate ambient temperatures (30–34°C). Gundhi bug infestation peaked during October (upto 34 individuals per sampling unit at Lohara), aligned with the grain-milking stage of rice. Statistical formulas for percent incidence were used to quantify crop damage. Based on ecological dynamics, an Integrated Pest Management (IPM) strategy tailored to the agro-climatic conditions of Chandrapur district is proposed.

Keywords Ecological survey, Rice insect pests, yellow stem borer, Leaf folder, Gundhi bug and Integrated Pest Management.

INTRODUCTION:

Rice (*Oryza sativa* L.) is widely recognized as one of the most critical staple cereal crops globally, feeding over half of the world's population and serving as the backbone of agricultural economies across Asia (Grist, 1986). In India, particularly within the state of Maharashtra, rice cultivation plays a fundamental role in maintaining regional food security and sustaining rural livelihoods. However, achieving maximum potential yield remains a persistent challenge due to a complex interplay of biotic and abiotic constraints operating throughout the crop's phenological cycle (Mew *et al.*, 2004). Among biotic factors, insect pest infestations represent a major bottleneck, capable

of causing yield losses ranging from moderate quality degradation to total crop failure if left unmanaged (Srivastava *et al.*, 2014; Kakde & Patel, 2018).

The population dynamics, spatial distribution and seasonal abundance of insect pests in agro-ecosystems are intrinsically linked to localized ecological parameters (Wallner, 1987). Micro-climatic variables most notably ambient temperatures, relative humidity levels, precipitation volume and atmospheric moisture exert direct physiological influences on insect development rates, reproductive fecundity, survival rates and flight activity (Bale *et al.*, 2002). Furthermore, edaphic conditions such as soil

structure and organic matter content indirectly influence pest survival by altering soil moisture retention and crop vigour (Litsinger, 1991). In regions characterized by heavy clay loam and black cotton soils, extended moisture retention creates an elevated canopy micro-humidity, establishing highly favourable conditions for insect proliferation (Rao *et al.*, 2010). In the agrarian landscape of Chandrapur district, Maharashtra, India, rice cultivation during the monsoon (Kharif) season coincides with dynamic weather fluctuations that frequently trigger severe pest outbreaks. The agro-ecological complex of this region is routinely impacted by major insect pests, including the Yellow Stem Borer (*Scirpophagaincertulas*), Rice Leaf Folder (*Cnaphalocrocismedinalis*) and Gundhi Bug (*Leptocorisatororius*) alongwith secondary species such as the Rice Swarming Caterpillar (*Spodopteraauritia*) (Khan *et al.*, 1991; Pasalu & Katti, 2006).

Each of these phytophagous insects exhibits distinct modes of damage corresponding to specific developmental stages of the rice plant. Yellow Stem Borer (*S. incertulas*), larvae bore into the central stem, severing the growing vascular tissue. This results in the characteristic "dead heart" symptom during early vegetative tillering and empty, bleached panicles known as "white ears" during the reproductive stage (Catling, 1992). Rice Leaf Folder (*C. medinalis*), larvae fold the leaf blades longitudinally using silken threads and feed by scraping green mesophyll tissue, significantly impairing photosynthetic capacity and reducing nutrient translocation to developing grains (Banthiter *et al.*, 1980). Gundhi Bug (*L. oratorius*), nymphs and adults utilize piercing-sucking mouthparts to extract endosperm fluid from tender grains during the milking stage, rendering the grains partially or completely unfilled, chaffy and discolored (Schaefer & Panizzi, 2000). Despite the economic significance of these losses, localized

empirical research evaluating the precise quantitative relationships between weather variables and pest incidence remains limited for the specific rural clusters of Chandrapur district. Developing effective, sustainable and ecologically sound Integrated Pest Management (IPM) systems requires a granular, location-specific understanding of pest emergence patterns relative to seasonal climatic transitions. To address this critical gap, the present study was undertaken as a comprehensive ecological survey across two representative agricultural zones in Chandrapur block- Lohara and Ghanta Chauki during the Kharif, 2025 season.

The objective of this paper is to analyze the monthly population fluctuations of major rice pests, establish mathematical correlations with abiotic weather parameters (temperature, humidity and rainfall) and formulate an actionable Integrated Pest Management (IPM) framework tailored to the specific agro-environmental conditions of the district.

MATERIALS AND METHODS

The empirical investigation was carried out during the Kharif season (June to November, 2025) across two selected agricultural locations within the Chandrapur block of Chandrapur district, Maharashtra, India. The first study area was Lohara village Gram Panchayat. It is located at spatial coordinates of 19.9865°N latitude and 76.3599°E longitude, positioned approximately 7 km from the Chandrapur district headquarters and covering a total geographical area of 430 hectares with a population of 1,468 (740 males and 728 females). The second study area was Ghanta Chauki under Borda Gram Panchayat, is located at 19.9973°N latitude and 79.4131°E longitude, situated 11 km from the district headquarters and spanning a total geographical expanse of 506.28 hectares. The soil profiles across both research locations consist predominantly of deep black

cotton soils (Vertisols) and clay loam (Inceptisols), which possess high moisture retention capacities that sustain canopy micro-humidity throughout the crop cycle. Field sampling was conducted systematically at monthly intervals across two fixed plots (Plot 1 and Plot 2, measuring 1,000 m² each) for study, cultivated with predominant local rice varieties under standard agrarian management. In accordance with standardized field surveillance protocols, ten hill units were selected randomly along diagonal transects in each plot during early morning hours (06:00–08:00 a.m.) when insect movement was minimal. Arthropod populations were monitored and collected utilizing a combination of visual counting for sedentary stages, sweep net sampling (30 cm diameter) across upper crop foliage and portable light traps deployed bi-weekly to track adult moth emergence patterns. Collected specimens were preserved in 70% ethanol and identified down to species level at the laboratory using standard morphological diagnostic keys.

Micro-climatic parameters including maximum temperature (T_{max}), minimum temperature (T_{min}), maximum relative humidity (RH_{max}), minimum relative humidity (RH_{min}) and

cumulative monthly rainfall (mm) were recorded concurrently from local meteorological stations and field rain gauges. To quantitatively evaluate crop damage, specific empirical formulas established by the International Rice Research Institute, Philippines were applied. Finally monthly pest counts at Plot 1 and Plot 2 were correlated with the recorded abiotic weather variables using Pearson's linear correlation coefficient (*r*) in SPSS software to assess statistical significance (Gomez & Gomez, 1984).

RESULT:

I. Seasonal weather and insect incidence at Ghanta Chauki area of Chandrapur:

In Ghanta Chauki, early season (June, 2025), temperature was high (32–38°C) and initial rainfall (150–200 mm) showed nil infestation. As humidity increased to 85–90% in August and September, 2025, stem borer counts surged from 3 (Plot 1) in July to a peak of 23 (Plot 1 (P1) and 34 Plot 2 (P2) in September. Leaf folder populations similarly peaked in September (26 in P1, 23 in P2). Gundhi bug numbers rose sharply during September (33 in Plot 1, 21 in Plot 2) and October (27 in Plot 1, 29 in Plot 2), corresponding with panicle development and grain milking stages (Table 1).

Table 1: Field observation data of Ghanta Chauki in Chandrapur area during Kharif season, 2025.

Sr. No.	Month	Temperature (°C)	Humidity (%)	Rainfall (mm)	Stem Borer (P1/P2)	Leaf Folder (P1/P2)	Gundhi Bug (P1/P2)
1	June, 2025	26-38	40-80	150–200	00 / 00	00 / 00	00 / 00
2	July, 2025	24-34	70-90	300–350	03 / 00	04 / 00	00 / 00
3	Aug., 2025	23-33	70-90	250–300	11 / 07	07 / 00	06 / 00
4	Sept., 2025	23-34	60-85	150–200	23 / 34	26 / 23	33 / 21
5	Oct., 2025	20-35	45-75	50–80	21 / 27	10 / 41	27 / 29
6	Nov., 2025	16-33	30-60	10–20	18 / 11	17 / 08	00 / 16

Seasonal weather and insect incidence at Lohara in Chandrapur area

Lohara exhibited a higher overall infestation density compared to Ghanta Chauki. Heavy precipitation (300–400 mm) in July and August, 2025 provided ideal moisture for early pest build-up. Stem borer populations peaked significantly during September, 2025 (49 in Plot

1 (P1) & 54 in Plot 2 (P2)) and October (57 in Plot 1 & 59 in Plot 2). Leaf folder incidence reached its maximum in September (38 in Plot 1 & 28 in Plot 2). Gundhi bug counts peaked during October, 2025 (34 in Plot 1 & 23 in Plot 2), coinciding with high relative humidity and late crop maturation are given in Table 2. The major insect pests associate with rice crop are shown in Table 3.

Table 2: Field observation data of Lohara in Chandrapur area during Kharif season, 2025.

Sr. No.	Month	Temperature (°C)	Humidity (%)	Rainfall (mm)	Stem Borer (P1/P2)	Leaf Folder (P1/P2)	Gundhi Bug (P1/P2)
1	June, 2025	26-39	50-80	190–200	00 / 00	00 / 00	00 / 00
2	July, 2025	23-33	75-95	350–400	03 / 00	04 / 00	00 / 00
3	Aug., 2025	23-32	75-95	300–350	11 / 07	07 / 00	06 / 00
4	Sept., 2025	23-33	70-90	200–250	23 / 34	26 / 23	33 / 21
5	Oct., 2025	20-34	50-80	50–80	21 / 27	10 / 41	27 / 29
6	Nov., 2025	18-32	40-70	10–20	18 / 11	17 / 08	00 / 16

Table 3: Major insect pests associate with rice crop.

A Yellow stem borer  Scientific name : <i>Scirpophaga incertulas</i> Order : Lepidoptera Family : Crambidae Major host : Rice Damage : Larvae bore into stem causing dead hearts and white heads.	B Leaf folder  Scientific name : <i>Cnaphalocrocis medinalis</i> Order : Lepidoptera Family : Crambidae Major host : Rice Damage : Larvae fold leaves with silk threads and feed on leaf tissue.	C Gundhi bug (Major)  Scientific name : <i>Leptocorixa acuta</i> Order : Hemiptera Family : Alydidae Major host : Rice, Groundnut, Pulses Damage : Both nymphs and adults suck sap from grains/pods.
D Rice swarming caterpillar  Scientific name : <i>Spodoptera mauritia</i> Order : Lepidoptera Family : Noctuidae Major host : Rice Damage : Larvae feed on leaves causing defoliation.	E Fruit bug  Scientific name : <i>Nesara viridula</i> Order : Hemiptera Family : Pentatomidae Major host : Vegetables, Pulses, Fruits Damage : Sucks sap from fruits and pods causing shrivelling and damage.	F Plant bug  Scientific name : <i>Dindorvus ringulatus</i> Order : Hemiptera Family : Pyrrhocoridae Major host : Cotton, Pulses, Okra Damage : Sucks sap from seeds and tender plant parts.

The empirical findings of this survey demonstrate that seasonal fluctuations of major insect pests in rice fields near Lohara and Ghanta Chauki are strongly governed by localized micro-climatic variables, particularly ambient temperature, relative humidity and rainfall distribution.

High maximum temperatures during June (37–39°C) coincided with minimal insect activity, confirming an initial thermal barrier to pest emergence. However, as the season transitioned into September and October, optimal ambient temperatures (30–34°C) combined with elevated

relative humidity (70–95%) triggered a substantial population surge across all monitored pest species. These micro-climatic responses strongly collaborate the local empirical findings of Sawai and Kothikar (2019) at the Zonal Agricultural Research Station, Sindewahi, District-Chandrapur who established that the population dynamics of Yellow Stem Borer (*Scirpophagaincertulas*) and Rice Leaf Folder (*Cnaphalocrocismedinalis*) exhibit strong positive correlations with temperature and morning relative humidity. Furthermore, the broader thermal and moisture thresholds observed in Lohara and Ghanta Chauki align with studies by Kakde and Patel (2018) and Catling (1992), who showed that atmospheric relative humidity exceeding 75% combined with moderate temperatures (28–33°C) accelerates pest metabolic development and shortens generation turnover times.

The dual effect of precipitation observed in this study reflects complex physical and environmental interactions within the rice agro-ecosystem. Heavy downpours during July and August (>300 mm) exerted a physical washing effect, dislodging early-instar larvae from the upper canopy. However, the post-monsoon retention of moisture in the region's deep black cotton soils (Vertisols) and clay loam soils maintained high canopy micro-humidity long after direct rainfall ceased. This structural humidity sustained rapid pest build-up during September and October. This observation directly matches the district-level findings of Sawai and Kothikar (2019) in Sindewahi, District-Chandrapur, Maharashtra who reported that while excessive evening humidity and heavy rainfall initially discourage stem borer and leaf folder counts, the subsequent humid post-rain period triggers peak infestation (reaching peak leaf folder damage of 15.63% around 40th Standard Meteorological week). Similar post-monsoon population explosions driven by soil moisture retention in heavy soils have been documented by Srivastava *et al.* (2014) and Rao *et al.* (2010) across central Indian agricultural tracts.

A comparative evaluation between the two study sites shows that Lohara experienced higher overall infestation densities than Ghanta Chauki across all observation months. Stem borer counts peaked significantly during September and October in Lohara (57–59 instances per sampling unit), a trend that reflects the peak 'dead heart' and 'white ear' windows reported both locally in Chandrapur district by Sawai and Kothikar (2019) and regionally across Maharashtra by Pasalu and Katti (2006) during panicle initiation. Similarly, leaf folder populations reached maximum density during September in both Lohara (38 counts) and Ghanta Chauki (26 counts). This finding mirrors the results of Banthiter and Saxena (1980) and Heinrichs (1994), who demonstrated that leaf folder larvae preferentially attack active tillering stages when foliage nitrogen levels and surface area are optimal.

The population spike of the Gundhi Bug (*Leptocorisatorius*) during October (34 instances in Lohara and 29 in Ghanta Chauki) highlights a precise synchronization between insect biology and host-plant phenology. Nymphs and adults feed heavily on developing grains during the milking stage, extracting endosperm fluid and leaving empty, discoloured or chaffy grains. This phenological alignment is well-established in classical entomological literature by Schaefer and Panizzi (2000) and Pathak and Khan (1994), both of whom noted that *L. oratorius* outbreaks are strictly bounded by the availability of soft, milky endosperm during panicle maturation. Furthermore, the presence of beneficial species such as the Rove Beetle (*Paederus fuscipes*) in the Chandrapur rice fields concurs with the natural bio-surveillance studies of Litsinger (1991) and Kogan (1998), who emphasized the vital role of native generalist predators in suppressing secondary pest surges when chemical interventions are regulated within an Integrated Pest Management frame work.

CONCLUSION

Ecological assessment of insects pests during kharif season (Monsoon season), 2025 was done. During this study, abiotic parameters and pests were studied. Primary insects pests identified were Yellow stem borer, Leaf folder and Gandhi bug. Secondary species found were Rice swarming caterpillars, Painted bug and Rove beetle. Peak population of Stem borer and Leaf folder was occurred during September and October, 2025 at both study locations (Lohara and Ghanta Chowki) and Gundhi bug infestation was peaked during October, 2025 aligned with the grain milking stage of rice. Based on ecological dynamics, the integrated pest management strategy tailored to agro-climatic conditions.

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