International Journal of Agriculture and Food Science 2025; 7(4): 314-317

International Journal of Agriculture and Food Science

ISSN Print: 2664-844X
ISSN Online: 2664-8458
NAAS Rating: 4.97
IJAFS 2025; 7(4): 314-317
www.agriculturaljournals.com
Received: 15-03-2025
Accepted: 17-04-2025

Seasonal activity of major pest fauna of paddy (*Oryza Sativa* l.) At Raisen District of Madhya Pradesh

Sanjay Kumar Singh, Rishikesh Mandloi, Mukesh Kumar Dhaked, Manoher Saryam and AK Verma

Sanjay Kumar Singh
Ph.D. Scholar (Entomology)
Faculty of Agriculture,
Rabindranath Tagore
University, Raisen

Rishikesh Mandloi
Assistant Professor, Faculty of Agriculture, Rabindranath Tagore University, Raisen, Madhya Pradesh, India

Mukesh Kumar Dhaked
Assistant Professor, Faculty of Agriculture, Rabindranath Tagore University, Raisen, Madhya Pradesh, India

Manoher Saryam
Assistant Professor, Faculty of Agriculture, Rabindranath Tagore University, Raisen, Madhya Pradesh, India

AK Verma
Associate Professor, Faculty of Agriculture, Rabindranath Tagore University, Raisen, Madhya Pradesh, India

Corresponding Author:
Rishikesh Mandloi
Assistant Professor, Faculty of Agriculture, Rabindranath Tagore University, Raisen, Madhya Pradesh, India

DOI: https://www.doi.org/10.33545/2664844X.2025.v7.i4e.367

Abstract
Rice (*Oryza sativa* L.), a primary staple for over 60% of the global population, is significantly impacted by biotic stresses, particularly insect pests, which account for up to 21% of yield losses annually. This study was conducted at the Agriculture Research Farm of Rabindranath Tagore University, Raisen (Madhya Pradesh), during the kharif seasons of 2022 and 2023, to monitor the seasonal dynamics of major insect pests and their natural enemies in paddy fields. Weekly observations were made on ten randomly selected plants, with no chemical pest control applied, enabling the assessment of pest populations under natural conditions. A total of ten insect pests and three natural enemy species were documented. The most prevalent pests included the stem borer (*Scirpophaga incertulas*), case worm (*Nymphula depunctalis*), Gundhi bug (*Leptocorisa acuta*), brown planthopper (*Nilaparvata lugens*), and paddy horned caterpillar (*Melanitis leda ismene*), among others. Pest population trends were analyzed in correlation with key abiotic factors such as temperature, humidity, rainfall, and number of rainy days using correlation and regression analysis based on Snedecor and Cochran's methods. The results revealed significant associations between pest incidence and weather parameters, with most pests showing positive correlations with maximum temperature and negative correlations with rainfall and humidity. Natural enemies like the predatory beetle (*Micraspis coracea*) and spiders (*Pardosa pseudoannulata*, *Argiope catenulata*) were consistently observed across crop stages, peaking alongside pest populations. These findings underscore the importance of ecological pest monitoring and the potential for integrated pest management (IPM) strategies tailored to climatic conditions. The study contributes valuable data for sustainable rice pest management and supports the adoption of climate-resilient agricultural practices.

Keywords: Population dynamics, aphid, jassid, BPH, GLH stem borer and natural enemies

Introduction

The Poaceae or Gramineae families include the paddy plant (*Oryza sativa* L.). It is the most widely farmed crop in the world, providing the main source of nutrition for more than 60% of the world's population. The anticipated total paddy production for 2022-2023 is 1308.37 lakh tons, which is a record. Compared to last year, it is 13.65 lakh tonnes more. Sustenance for almost 60% of the global populace. Numerous biotic and abiotic elements affect rice crops. Insect fauna is a major contributor to the decline in productivity among the biotic components. An estimated 52% of the world's rice crop is lost each year as a result of biotic causes, with insect pest fauna attacks accounting for 21% of this loss. [10]. Major insect pest fauna of rice cover the yellow stem borer (*Scirpophaga incertulas* Wlk), brown planthopper (*Nilaparvata lugens* Stal.), white backed planthopper (Sogatella furcifera Horvath), green leafhopper (*Nephotettix virescens* Distant), gundhi bug (*Leptocorisa acuta* Thumb), rice hispa (Dicladispa armigera Oliv), gall midge (Orseolia oryzae Wood Mason), leaf folder, (Cnaphalocrocis medinalis Gueni), rice horned caterpillar (*Melanitis leda ismena* Cramer), armyworm (*Mythimna seprata*), paddy skipper (*Pelopidas mathias* Fabricius) & case worm Nymphula depunctalis (Guenee) causing frequent or sporadic damage to the crop [Anonymous 1996]. Among all insect pest fauna, the hopper complex is one of the most consumptive pest complexes of rice causing enormous yield losses every year throughout the rice grown areas of Asia (Park D.S. 2008). In Madhya Pradesh and Chhattisgarh area the brown planthopper (*N. lugens*) assumed greater importance due to it's sever outbreak in 1975 and consequent yield losses reported to the extent of 34.3% (Gangrade G.A. 1978).

The hopper complex causes direct harm as sucking pest and functions as vector for various viral illnesses, causing considerable production losses to sensitive types every year. In the rice ecosystem, a high population of hopper complex is also favoured by many suggested agronomical techniques, such as close plant spacing and excessive fertilizer application. Numerous issues, including pest resurgence, insecticide resistance, loss of natural enemies, emergence of novel biotypes, pesticide residues in grains, etc., have arisen as a result of attempts to control this pest chemically. To find resistant or tolerant rice genotypes and varieties as a tool for IPM programs, field screening was done.

Material and Methods

Weekly Monitoring of Insect Pests in Paddy (*Oryza sativa* L.) at Rabindranath Tagore University Farm**.** A detailed study was undertaken to monitor the population dynamics of major insect pests affecting paddy crops at the Agriculture Research Farm, Rabindranath Tagore University, Raisen (Madhya Pradesh). The research was conducted over two consecutive cropping seasons from July to November during the years 2022 and 2023. The objective of the study was to assess the seasonal incidence, abundance, and population fluctuations of key insect pests and their natural enemies in relation to environmental conditions. Weekly observations were carried out meticulously, providing a comprehensive record of insect activity over time. The sampling unit for data collection was an individual plant, and ten sample plants were selected at random from the experimental plots during each observation. This ensured a fair representation of pest pressure throughout the field. Importantly, no insecticidal or pesticidal treatments were applied during the experimental period, allowing for the unaltered monitoring of pest populations under natural field conditions.

In addition to monitoring pest populations, the study also examined the influence of various abiotic factors, such as temperature, relative humidity, and rainfall, on the occurrence and activity of insect pests. Data collected weekly were correlated with corresponding meteorological data to determine the effects of environmental conditions on pest outbreaks. To analyze these relationships, correlation and regression analyses were conducted using the statistical framework proposed by Snedecor and Cochran (1967). This approach enabled researchers to better understand the ecological interactions between pests, their natural enemies, and prevailing weather patterns. Such knowledge is essential for predicting pest outbreaks and developing effective integrated pest management (IPM) strategies. By identifying the specific climatic conditions that favor or suppress pest activity, farmers and researchers can anticipate pest pressure and plan timely interventions to reduce crop damage while minimizing pesticide use.

The experiment was conducted using the paddy variety TN-1, grown in plots measuring 2.10 x 3.90 meters. Each plot contained 24 rows, each with a length of 2.10 meters and 12 plants per row, resulting in a total of 288 plants per plot. Uniform plant spacing was maintained at 15 cm between rows and between individual plants, ensuring consistency in growth and pest exposure across the field. This experimental design allowed for accurate and repeatable sampling, supporting reliable data analysis. The study not only contributes important baseline data on pest populations under the specific agro-climatic conditions of central India but also serves as a model for ecologically sound pest monitoring practices. The outcomes are expected to assist in future research on pest dynamics and offer practical guidance for rice growers seeking sustainable and environmentally friendly pest management alternatives.

Statistical analysis

Correlation and regression of the abiotic factors on major insect pests and natural enemies were worked out by using the formula as suggested by Snedecor and Cocharan (1967).

$$Correlation'r' = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sqrt{\left(\sum x^2 - \frac{(\sum x)^2}{n}\right)\left(\sum y^2 - \frac{(\sum y)^2}{n}\right)}}$$

Result and Discussion

The study conducted at the Agriculture Research Farm of Rabindranath Tagore University, Raisen (Madhya Pradesh), during the kharif seasons of 2022 and 2023, focused on understanding the population dynamics of insect pests and their natural enemies in paddy (Oryza sativa) cultivation. The research aimed to observe weekly fluctuations in insect pest populations and their correlation with prevailing weather conditions. Ten individual paddy plants were randomly selected from experimental plots each week as the sampling unit for monitoring, ensuring uniformity and minimizing sampling bias. These systematic field observations extended from July to November, encompassing the most critical stages of paddy growth, including tillering, panicle initiation, flowering, grain filling, and crop maturity. Over the two years, ten economically significant insect pests were recorded, along with three species of natural enemies that naturally contribute to biological pest suppression. The study also integrated meteorological data—including temperature, humidity, rainfall, and the number of rainy days—to assess how abiotic factors influence pest emergence and density. This dual approach, combining entomological monitoring with weather analysis, provided a holistic understanding of the agroecosystem's pest dynamics, supporting the development of eco-friendly and timely pest management strategies.

Among the prominent insect pests observed, the stem borer (*Scirpophaga incertulas*) was notable for its gradual population build-up. Although its initial incidence in Standard Meteorological Week (SMW) 35 was minimal (0.08 larvae/plant), the pest population surged to 0.66 larvae/plant by SMW 41, corresponding to a peak during the late vegetative to early reproductive stages. Strong negative correlations were observed between stem borer population and abiotic factors such as minimum temperature, evening relative humidity, rainfall, and the number of rainy days in 2022. Conversely, in 2023, the population was positively correlated with maximum temperature, indicating that drier and warmer conditions favored its development. Similar population trajectories were documented for the case worm (Nymphula depunctalis), whose activity was confined to SMW 36 to 42, peaking in SMW 40 across both years. Rainfall and the number of rainy days negatively influenced its density, while positive correlations with morning humidity were observed in 2023, suggesting a partial dependence on relative humidity for its proliferation. The Gundhi bug (*Leptocorisa acuta*) displayed a clear increase in activity from SMW 34 onwards, with highest infestation levels occurring around grain filling and maturity stages. Its density peaked at 1.56 bugs/plant in 2022 and 1.33

bugs/plant in 2023. The population showed significant negative relationships with minimum temperature and relative humidity, while a strong positive correlation with maximum temperature was evident. This suggests that the Gundhi bug, like several other pests, is more likely to thrive in hot and dry environments. Madhuri (2017) [1] also found that the temperature and relative humidity favoured the development of leaf folder, stem borer, whorl maggot, green leaf hopper, brown plant hopper and white backed plant hopper. However, Nigam *et al*. (2009) [2] observed negative correlation between per cent leaf damage and temperature which are contradictory to the present findings. Kraker (1999) [3]. Observed larval peak of leaf folder population around booting stage.

Another pest, the paddy horned caterpillar (*Melanitis leda ismene*), emerged at the flowering stage (SMW 36-38) and increased toward the dough stage, peaking at 1.84 and 1.70 individuals per plant in 2022 and 2023, respectively. Its population was negatively associated with evening humidity and rainfall, but positively with maximum temperature, supporting the trend observed across other chewing pests. The paddy skipper (*Pelopidas mathias*) exhibited similar behavior, with peak activity during the dough stage. It was negatively affected by rainfall and rainy days but positively influenced by higher temperatures, underlining its preference for relatively dry conditions. Hopper pests such as the brown planthopper (*Nilaparvata lugens*) and white-backed planthopper (*Sogatella furcifera*) appeared early, around SMW 35, and reached their population peaks during the milking stage (SMW 39). The brown planthopper showed no correlation with weather in 2022 but had a positive association with maximum temperature in 2023. Meanwhile, the white-backed planthopper exhibited a notable negative correlation with rainfall and rainy days, and a positive correlation with temperature. Both pests declined in population as the crop approached maturity, which is consistent with their preference for actively growing, succulent plants. Several workers like Anuj and Saxena (1999), Rai *et al*. (2002a), Khan *et al*. (2003), Samui *et al*. (2004), Prasad and Prasad (2006), Shamim *et al*. (2009), Anonymous (2010b), Sabale *et al*. (2010). Mandloi *et al* (2018), Sharma *et al* (2017) and Sharma *et al* (2019) [4, 5, 6, 11, 8, 9, 10, 11, 22, 19].

Lesser prevalent pests like the green leafhopper (*Nephotettix virescens*) and paddy hispa (*Dicladispa armigera*) were also observed, albeit at low population levels throughout the season, ranging between 0.10 to 1.30 individuals per plant. These pests did not exhibit any significant correlation with weather parameters in either year, indicating a relatively neutral response to climatic variations or potentially a more host-plant-specific feeding behavior. The army worm (*Mythimna separata*) emerged in SMW 37 and persisted until crop maturity, with a peak population of 1.16 and 1.13 individuals per plant in 2022 and 2023, respectively. Its population showed strong negative correlations with rainfall, humidity, and minimum temperature, but positive correlation with maximum temperature, confirming its susceptibility to cool and wet conditions. These findings reinforce the broader pattern observed throughout the study: insect pests tend to flourish under warm and dry climatic conditions, and their population dynamics are highly sensitive to variations in temperature and rainfall. Such trends emphasize the importance of continuous pest surveillance combined with weather data analysis to anticipate outbreaks and implement targeted control measures. Spiders have been reported as important predator by Ghahari *et al*. (2008) and Mandloi *et al* (2018) [13, 22].

The research also highlighted the presence and seasonal trends of three important natural enemies, namely the predatory beetle (*Micraspis coracea*), *lycosid spider* (Pardosa pseudoannulata), and the grass cross spider (*Argiope catenulata*), all of which play crucial roles in suppressing pest populations naturally. *Micraspis coracea* was active from SMW 31 to 43, covering the tillering to maturity stages, with peak density recorded in SMW 40. The beetle's population ranged from 0.24 to 1.78 individuals per plant across the two seasons. The lycosid spider followed a similar trend, with populations ranging from 0.12 to 0.88 individuals per plant, peaking in SMW 40-41. Meanwhile, the grass cross spider appeared later, around the panicle initiation stage (SMW 34), and remained active until the dough stage (SMW 42), reaching its highest density at 0.74 individuals per plant. These predators play a significant role in integrated pest management (IPM) by keeping pest populations below economic thresholds. The study's observations demonstrate that natural enemies are synchronized with pest emergence and often peak shortly after pest population surges, helping to naturally regulate the agroecosystem. Their presence supports reduced reliance on chemical pesticides and encourages the promotion of biodiversity in rice fields. Collectively, these insights contribute to our understanding of pest-predator interactions in paddy ecosystems and offer valuable guidance for climate-adaptive, ecologically balanced crop protection strategies. Spiders have been reported as important predator by, Ghahari *et al*. (2008), Kumar *et al*. (2008), Madhukar (2011) and Rajna and Chandra (2012) [13, 14, 15].

Table 1: Seasonal occurrence of insect pests/plant* on paddy in different standard meteorological weeks during *kharif* 2022

SMW	Month	*S. incertulas*	*N. depunctalis*	*L. acuta*	*M. leda ismene*	*P. mathias*	*N. lugens*	*S. furcifera*	*N. virescens*	*D. armigera*	*M. separata*
31	July-Aug.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
32	Aug	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00
33	Aug	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.04	0.00
34	Aug	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.83	0.51	0.00
35	Aug-Sep	0.08	0.00	0.16	0.00	0.00	0.10	0.12	0.54	0.58	0.00
36	Sept	0.18	0.50	0.12	0.00	0.00	1.40	0.94	0.48	0.61	0.00
37	Sept	0.30	0.46	0.36	0.00	0.37	2.69	5.16	1.48	1.21	0.24
38	Sept	0.47	0.64	0.64	0.34	0.55	4.37	6.00	1.78	1.12	0.52
39	Sept	0.52	0.73	0.70	0.84	0.68	7.43	6.42	2.47	1.11	0.36
40	Oct.	0.63	0.94	1.16	1.84	1.42	5.42	6.46	1.64	0.54	1.12
41	Oct.	0.66	0.42	1.34	1.68	1.32	4.32	4.66	1.54	0.26	0.92
42	Oct.	0.64	0.54	1.56	1.48	0.96	1.87	4.46	1.24	0.34	1.08

43	Oct.	0.59	0.00	1.20	1.16	0.37	1.36	3.12	0.34	0.00	1.16

* All values are mean of 25 plants observed randomly at 4 locations on farmer fields

Table 2: Seasonal occurrence of insect pests/plant* on paddy in different standard meteorological weeks during *kharif* 2023

SMW	Month	*S. incertulas*	*N. depunctalis*	*L. acuta*	*M. leda ismene*	*P. mathias*	*N. lugens*	*S. furcifera*	*N. virescens*	*D. armigera*	*M. separata*
31	July-Aug.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
32	Aug	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00
33	Aug	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.08	0.00
34	Aug	0.06	0.00	0.03	0.00	0.00	0.00	0.00	0.83	0.50	0.00
35	Aug-Sep	0.00	0.00	0.12	0.00	0.00	0.10	0.16	0.46	0.58	0.00
36	Sept	0.16	0.56	0.10	0.00	0.30	1.40	0.89	0.43	0.61	0.00
37	Sept	0.28	0.43	0.33	0.20	0.32	2.69	4.11	0.97	1.22	0.11
38	Sept	0.47	0.69	0.60	0.61	0.54	4.37	6.13	1.03	0.99	0.40
39	Sept	0.51	0.71	0.68	0.83	0.68	6.47	6.88	1.30	1.28	0.39
40	Oct.	0.62	1.00	1.08	1.44	1.02	5.41	5.46	0.86	0.67	0.96
41	Oct.	0.61	0.74	1.22	1.70	1.34	4.32	4.92	0.61	0.49	0.92
42	Oct.	0.65	0.73	1.33	1.54	0.96	1.88	4.40	0.30	0.05	1.11
43	Oct.	0.62	0.00	1.20	1.26	0.37	1.36	3.00	0.12	0.00	1.13

* All values are mean of 25 plants observed randomly at 4 locations on farmer fields

Acknowledgement
Special thanks are due to Dr. H.D. Verma (Dean) Dr. Ashok Kumar Verma (Asso. Dean), Faculty of Agriculture and Dr. Digvijay Dubey (HoD, Agronomy), Department of Agronomy RNTU for their valuable advice and for providing paddy varieties & germplasm for screening trial.

References
1. Madhuri G, Dash PC, Rout KK. Effect of weather parameters on population dynamics of paddy pests. *Int J Curr Microbiol Appl Sci*. 2017;6(10):2049-2053.
2. Nigam VD, Sharma RC, Singh RB. Effect of abiotic factors on the population fluctuation of rice leaf folder, *Cnaphalocrocis medinalis* (Guenee) in Eastern Uttar Pradesh. *Agric Biol Res*. 2009;25(2):128-134.
3. Kraker JD, Huis AV, Heong KL, Lenteren JC, Rabbinge R. Population dynamics of rice leaf folders (Lepidoptera: Pyralidae) and their natural enemies in irrigated rice in the Philippines. *Bull Entomol Res*. 1999;89:411-442.
4. Anuj B, Saxena RR. Environmental correlation of population build-up of rice insect pests through light trap catches. *Oryza*. 1999;36(3):241-245.
5. Rai AK, Khan MA. Light trap catch of insect-pest, *Nephotettix virescens* (Distant) and its relation with climatic factors. *Ann Plant Prot Sci*. 2002;10(1):17-22.
6. Khan AA, Misra DS. Abundance of spider in relation to biotic and abiotic factors in upland rice ecosystem of eastern Uttar Pradesh. *Plant Prot Bull Faridabad*. 2003;55(3-4):23-29.
7. Saxena RC, Demayo CG, Barrion A. Allozyme variation among biotypes of *Nilaparvata lugens* (Stål) in Philippines. *Biochem Genet*. 1991;29:115-123.
8. Prasad R, Prasad D. Account of insect pests problem in rice ecosystem in Ranchi. *Indian J Entomol*. 2006;68(3):240-246.
9. Shamim M, Shekh AM, Patel VJ, Dodia JF, Korat DM, Mehta AM. Effect of weather parameters on population dynamics of green leaf hopper and white backed plant hopper in paddy grown in middle Gujarat region. *J Agrometeorol*. 2009;11(2):172-174.
10. Anonymous. BPH outbreak in Thailand. *Rice Today*. 2010;9:7.
11. Sabale JP, Das C, Samui RP. Influence of weather factors on light trap catches of green leaf hopper at Pattambi, Kerala. *J Agrometeorol*. 2010;12(1):108-110.
12. Khan ZH, Ramamurthy VV. Influence of weather factors on the activity of rice leaf folder. *Ann Plant Prot Sci*. 2004;12:267-270.
13. Ghahari H, Hayat R, Tabari M, Ostovan H, Imani S. A contribution to the predator and parasitoid fauna of rice pests in Iran, and a discussion on the biodiversity and IPM in rice fields. *Linzer Biol Beitr*. 2008;40(1):735-764.
14. Madhukar FJ. A preliminary study of the predatory natural enemy complex of rice ecosystem in Vidarbha region of Maharashtra, India. *Int Ref Res J*. 2011;2(22):25-27.
15. Rajna S, Chander S. Spatial distribution of rice planthoppers and leaf folder, and their predators. *Indian J Entomol*. 2012;74(3):220-228.
16. Mandloi R, Pachori R, Prajapati S, Patel S. Seasonal incidence of insect complex on tomato (*Solanum lycopersicon* L.). *J Ent Res*. 2015;39(4):347-352.
17. Mandloi R, Pachori R, Prajapati S, Patel S. Assessment of bio-efficacy of phyto-extract against the major insect pests of tomato (*Solanum lycopersicon* L.). *Res Environ Life Sci*. 2016;9(3):377-381.
18. Sharma AK, Mandloi RK, Bisen UK. Effect of abiotic factors on seasonal fluctuation of major phototactic insect pests of rice. *J Entomol Zool Stud*. 2017;5(6):160-165.
19. Sharma AK, Mandloi R, Bhowmick AK, Thakur AS. Study on biodiversity of phototactic hexapod fauna by light trap in soybean (*Glycine max* L.) ecosystem. *J Entomol Zool Stud*. 2019;7(2):641-646.
20. Sharma AK, Mandloi R, Saxena AK, Thakur AS, Sharma R, Ramakrishnan RS. Biodiversity of phototactic insect pests of chickpea ecosystem and records on population dynamics of *Helicoverpa armigera* (Hübner) and *Agrotis ipsilon* (Hufnagel). *J Pharmacogn Phytochem*. 2020;9(1):824-849.
21. Mandloi R, Sharma AK. Effect of abiotic factors on seasonal fluctuation of major phototactic insect pests of rice. *J Entomol Zool Stud*. 2017;5(6):160-165.
22. Mandloi R, Shukla A, Venkatesan T, Bhowmick AK, Singh SK. Field screening of rice (*Oryza sativa* L.) varieties and genotypes against hopper complex. *J Entomol Zool Stud*. 2018;6(3):487-490.