**Seasonal Activity of Major Insect Fauna of Paddy (*Oryza sativa* L.) and Collected through Light Trap at Raisen District of Madhya Pradesh, India**

**Abstract**

 The present study investigates the seasonal occurrence of major insect pest species of paddy collected using a light trap during the Kharif seasons of 2022 and 2023. The relationship between insect population dynamics and weather parameters was analyzed. Data collection was conducted weekly, and correlation analysis was performed to determine the influence of temperature, relative humidity, rainfall, and sunshine on insect abundance. The results indicated significant seasonal variations in insect incidence, with peak populations observed during certain weeks. Maximum temperature and sunshine hours had a positive correlation with most insect species, while relative humidity and rainfall negatively impacted their occurrence. These findings provide crucial insights for integrated pest management strategies in paddy cultivation.

Keywords: Paddy, Insect Pests, Seasonal Incidence, Weather Correlation, Integrated Pest Management

**Introduction**

 Paddy (*Oryza sativa L*.) is a staple food crop for a significant portion of the global population, especially in Asian countries (Sharma et al., 2019; Prakash et al., 2020). However, the crop is susceptible to various insect pests, leading to substantial yield losses (Kumar et al., 2021; Ghosh & Sen, 2020). Among the major insect pests affecting paddy, species from Hemiptera, Lepidoptera, and Orthoptera orders are commonly reported (Singh et al., 2020; Roy et al., 2018; Patil et al., 2021). The population dynamics of insect pests are influenced by various abiotic factors, including temperature, humidity, and rainfall (Gupta et al., 2018; Reddy & Ali, 2020; Srivastava et al., 2019). Climate change and unpredictable weather patterns have further complicated pest management strategies, increasing the need for scientific interventions (Mahmood et al., 2021; Joshi et al., 2022). Understanding the relationship between insect occurrence and weather parameters can aid in predicting pest outbreaks and implementing effective control measures (Verma & Yadav, 2022; Bose et al., 2017; Sharma & Kaur, 2021).

This study aims to evaluate the seasonal incidence of major insect pests in paddy during Kharif 2022 and 2023 and to analyze the correlation between pest population dynamics and weather parameters. Furthermore, it seeks to compare variations in insect populations across different environmental conditions and provide insights for integrated pest management strategies to minimize pest-related yield losses and improve paddy cultivation sustainability.

**Materials and Methods**

 The study was conducted in a paddy-growing region during Kharif seasons of 2022 and 2023 in Raisen district of Madhya Pradesh. Insect pests were collected weekly using a light trap, and their abundance was recorded. The insect species were identified based on morphological characteristics using standard identification keys (Ali et al., 2017). Weather data, including temperature, relative humidity, rainfall, and sunshine hours, were obtained from a nearby meteorological station.

The collected data were analyzed using statistical methods. The correlation coefficient (r) was calculated to determine the relationship between weather factors and insect pest incidence (Gomez & Gomez, 1984). Significance levels were tested at a 0.05 probability level.

**Results and Discussion**

 The study documented the seasonal occurrence of major insect pests in paddy fields, identifying key species such as *Leptocorisa acuta* (Rice gundhi bug), *Nephotettix virescens* (Green leafhopper), *Mythimna separata* (Army worm), *Cnaphalocrocis medinalis* (Rice leaf folder), *Melanitis leda ismene* (Rice butterfly), *Tetrix subulata* (Short horn grasshopper), *Euscyrtus concinnus* (Field cricket), and *Gryllotalpa orientalis* (Mole cricket) (Rathore et al., 2019; Patel et al., 2020) (Table 1). Among these, *Leptocorisa acuta* and *Nephotettix virescens* were found to be the most abundant, peaking between weeks 37-42 in both years of observation (Das et al., 2021) (Table 1).

 A comparative seasonal incidence analysis between 2022 and 2023 revealed notable variations in pest populations. *Leptocorisa acuta* recorded a higher population in 2023 than in 2022, reaching a peak in week 42, though a slight decline was noted (1602.4 in 2022 vs. 1502.4 in 2023) (Singh et al., 2022) (Table 2). Similarly, *Nephotettix virescens* followed a similar trend, with a high incidence observed between weeks 38 -42 (Sharma et al., 2022) (Table 2). *Mythimna separata* remained nearly absent in both years but showed a slight increase towards the season's end (Kumari et al., 2023) (Table 2). On the other hand, *Cnaphalocrocis medinalis* showed a noticeable rise in 2023 compared to 2022, suggesting a possible influence of changing climatic conditions & (Verma et al., 2023) (Table 2). (Jasmine et al., 2023) Our finding supported with her experiment on eco-friendly pest management of sesame crop through botanicals.

 A correlation analysis between insect pest populations and weather parameters indicated significant influences of climatic factors on pest dynamics. Maximum temperature exhibited a strong positive correlation with *Leptocorisa acuta* (r=0.50, p<0.05) and *Nephotettix virescens* (r=0.61, p<0.05) (Chakraborty & Saha, 2021; Yadav et al., 2023) (Table 3). Additionally, *Cnaphalocrocis medinalis* was negatively correlated with morning relative humidity (r=-0.99, p<0.05) but positively influenced by sunshine hours (r=0.97, p<0.05) (Bose et al., 2018; Nair et al., 2023) (Table 3). Conversely, rainfall negatively impacted *Euscyrtus concinnus* (r=-0.43, p<0.05) (Verma et al., 2022; Das et al., 2023) (Table 3). These findings confirm that pest population fluctuations are closely linked to climatic variations, with warmer and drier conditions favoring pest outbreaks, whereas high humidity and rainfall suppress their occurrence.

**Conclusion**

 The study concludes that weather conditions play a crucial role in determining the seasonal incidence of major insect pests in paddy cultivation. The high populations of *Leptocorisa acuta* and *Nephotettix virescens* during warm and dry periods highlight the need for targeted pest management strategies during these conditions. Meanwhile, excessive rainfall and high humidity serve as natural deterrents for certain pest species. These insights are critical for developing effective pest forecasting and integrated pest management strategies, thereby improving sustainable paddy product.

Table 1. Seasonal Occurrence of Major Insect Pest Species of Paddy Collected in Light Trap During Kharif 2022 and 2023 in Relation to Weather Parameters

|  |  |  |  |
| --- | --- | --- | --- |
|  S.No. | Common Name | Scientific Name |  Family |
|  | ORDER-HEMIPTERA |
| 1 | Rice gundhi bug | *Leptocorisa acuta* (Thunberg) |  Coreidae |
| 2 | Green leaf hopper | *Nephotettix virescens* (Distant) |  Cicadelliae |
|  | ORDER-LEPIDOPTERA |
| 3 | Army worm |  *Mythimna separata* (Walker) | Noctuidae |
| 4 | Rice leaf folder | *Cnaphalocrocis medinalis* (Guene) | Pyralidae |
| 5 | Rice butterfly | *Melanitis leda ismene* Cramer | Nymphalidae |
|  |  ORDER-ORTHOPTERA |
| 6 | Short horn grass hopper |  *Tetrix subulata* Linnaeus | Tetrigidae |
| 7 | Field cricket |  *Euscyrtus concinnus* (de Haan) | Gryllidae |
| 8 | Mole cricket |  *Gryllotalpa orientalis* Burmeister | Gryllotalpide |

Table 2. Seasonal incidence of insect pest species of paddy during kharif (June to December) 2022 and 2023 (Weekly average)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Emergences after week | *Leptocorisa acuta* | *Nephotettix virescens* | *Mythimna separata* | *Cnaphalocrocis medinalis* | *Melanitis leda ismene* | *Tetrix subulata* | *Euscyrtus concinnus* | *Gryllotalpa orientalis* |
| 2022 | 2023 | 2022 | 2023 | 2022 | 2023 | 2022 | 2023 | 2022 | 2023 | 2022 | 2023 | 2022 | 2023 | 2022 | 2023 |
| 26 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.9 | 6.3 | 233.7 | 208.7 | 2.9 | 4.6 |
| 27 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.9 | 8.3 | 169.9 | 181.9 | 5.4 | 5.8 |
| 28 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 11.3 | 10.5 | 284.4 | 284.4 | 7.9 | 7.3 |
| 29 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.3 | 9.2 | 130.7 | 130.7 | 6.3 | 6.5 |
| 30 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.9 | 7.9 | 113.1 | 113.1 | 3.6 | 3.1 |
| 31 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.3 | 4.3 | 73.7 | 73.7 | 1.6 | 2.3 |
| 32 | 3.3 | 5.2 | 26.9 | 38.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7.3 | 7.3 | 46.9 | 46.9 | 2.3 | 2.9 |
| 33 | 2.1 | 4.3 | 61.1 | 61.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 10.7 | 10.7 | 128.4 | 128.9 | 3.4 | 3.4 |
| 34 | 2.9 | 4.6 | 73.6 | 69.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.3 | 5.3 | 78.4 | 68.4 | 5.3 | 5.3 |
| 35 | 5.1 | 5.1 | 76.7 | 76.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.8 | 4.8 | 31.7 | 41.7 | 6.3 | 6.3 |
| 36 | 11.7 | 13.7 | 208.3 | 198.3 | 0.0 | 0.0 | 0.0 | 0.0 | 2.3 | 3.7 | 5.1 | 5.1 | 93.6 | 83.6 | 9.6 | 10.6 |
| 37 | 23.3 | 23.3 | 797.3 | 747.3 | 0.0 | 0.0 | 0.0 | 0.0 | 5.9 | 4.4 | 22.4 | 19.4 | 177.9 | 137.9 | 24.0 | 22.0 |
| 38 | 21.3 | 24.5 | 812.6 | 832.6 | 0.0 | 0.0 | 1.7 | 2.9 | 12.1 | 5.3 | 24.9 | 31.9 | 76.6 | 76.6 | 14.6 | 14.6 |
| 39 | 60.4 | 50.4 | 872.4 | 902.4 | 6.6 | 5.8 | 3.7 | 3.7 | 11.4 | 11.9 | 45.4 | 43.4 | 48.6 | 48.6 | 12.4 | 12.4 |
| 40 | 28.3 | 29.3 | 923.5 | 923.5 | 7.1 | 6.5 | 4.2 | 4.3 | 9.6 | 1.2 | 24.3 | 26.3 | 32.3 | 32.3 | 10.9 | 14.5 |
| 41 | 43.9 | 43.8 | 1256.4 | 1156.4 | 14.3 | 13.3 | 5.4 | 5.4 | 6.4 | 7.3 | 21.6 | 19.5 | 22.7 | 22.7 | 10.9 | 10.9 |
| 42 | 90.1 | 85.5 | 1602.4 | 1502.4 | 15.6 | 15.6 | 0.0 | 0.0 | 15.6 | 13.9 | 18.6 | 18.6 | 64.4 | 54.4 | 23.7 | 23.7 |
| 43 | 60.9 | 65.9 | 601.6 | 601.6 | 11.4 | 13.4 | 0.0 | 0.0 | 10.6 | 16.6 | 18.9 | 18.4 | 20.6 | 35.6 | 10.4 | 10.4 |
| 44 | 32.6 | 32.6 | 576.7 | 576.7 | 7.6 | 6.3 | 0.0 | 0.0 | 21.8 | 17.5 | 19.7 | 19.7 | 18.3 | 16.3 | 8.6 | 8.6 |
| 45 | 20.3 | 21.3 | 570.1 | 470.1 | 3.9 | 4.7 | 0.0 | 0.0 | 16.6 | 14.3 | 15.6 | 15.5 | 15.9 | 14.4 | 6.7 | 6.7 |
| 46 | 4.7 | 5.7 | 155.1 | 115.1 | 0.0 | 0.0 | 0.0 | 0.0 | 5.9 | 4.9 | 5.6 | 5.5 | 5.6 | 4.4 | 4.3 | 4.3 |
| 47 | 4.4 | 4.6 | 46.1 | 47.1 | 0.0 | 0.0 | 0.0 | 0.0 | 3.1 | 2.1 | 0.0 | 0.0 | 0.0 | 0.0 | 1.6 | 3.4 |
| 48 | 3.1 | 3.6 | 36.4 | 36.4 | 0.0 | 0.0 | 0.0 | 0.0 | 2.4 | 1.5 | 0.0 | 0.0 | 0.0 | 0.0 | 1.9 | 2.9 |
| 49 | 1.9 | 2.9 | 1.4 | 5.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 1.3 |
| 50 | 1.3 | 1.3 | 1.1 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 1.3 |
| 51 | 0.9 | 0.4 | 0.7 | 1.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.6 |
| 52 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.4 |

Table 3. Correlation coefficient (r) of weather factors of seasonal incidence of insect pest species of paddy during kharif

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Weather Parameter** | ***Leptocorisa acuta*** | ***Nephotettix virescens*** | ***Mythimna separata*** | ***Cnaphalocrocis medinalis*** | ***Melanitis leda ismene*** | ***Tetrix subulata*** | ***Euscyrtus concinnus*** | ***Gryllotalpa orientalis*** |
| **2022** | **2023** | **2022** | **2023** | **2022** | **2023** | **2022** | **2023** | **2022** | **2023** | **2022** | **2023** | **2022** | **2023** | **2022** | **2023** |
| Maximumtemp. (oC) | 0.50\* | 0.49\* | 0.61\* | 0.59\* | -0.46 | 0.13 | 0.74 | 0.90 | 0.47 | 0.29 | 0.01 | 0.22 | 0.48\* | 0.06 | 0.33 | 0.49 |
| Minimumtemp. (oC) | 0.14 | 0.11 | 0.30 | 0.25 | 0.10 | -0.008 | -0.84 | -0.84 | -0.03 | -0.26 | -0.19 | -0.16 | 0.57\* | 0.61\* | 0.29 | 0.30 |
| MorningRH. (%) | 0.12 | -0.49\* | 0.29 | -0.36 | -0.05 | -0.13 | -0.99\* | -0.87 | -0.02 | -0.68\* | -0.04 | -0.12 | 0.26 | 0.45\* | 0.33 | -0.20 |
| EveningRH. (%) | 0.01 | -0.27 | 0.20 | -0.16 | 0.07 | -0.21 | -0.90 | -0.95\* | -0.13 | -0.53 | -0.10 | -0.27 | 0.55\* | 0.62\* | 0.31 | 0.03 |
| Rainfall(mm) | -0.26 | -0.25 | -0.13 | -0.24 | 0.37 | -0.45 | 0.29 | -0.78 | -0.33 | -0.37 | -0.39 | -0.43\* | 0.43 | 0.45\* | 0.07 | -0.14 |
| Number ofrainy days | -0.21 | -0.34 | 0.02 | -0.25 | 0.35 | 0.59 | -0.73 | -0.74 | -0.10 | -0.50 | -0.26 | -0.47\* | 0.46\* | 0.57\* | 0.15 | -0.01 |
| Sunshine(hrs) | 0.41 | 0.51\* | 0.23 | 0.42 | 0.38 | 0.69 | 0.97\* | 0.97\* | 0.39 | 0.70\* | 0.38 | 0.42 | -0.37 | -0.54\* | 0.09 | 0.17 |

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