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Research paper

Diversity of Insect Pests in Rice Crop Fields of Saran, Bihar

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ABSTRACT

In this study, various crop fields from randomly selected blocks in the Saran district of Bihar have examined to assess the prevalence of insect pests affecting paddy crops. Rice serves as a staple food for populations in India and the subcontinent, and it is typically grown in water-rich areas. Bihar ranks among India's leading rice-producing states. A portion of the cultivated rice or paddy crop is lost during pre-harvesting, harvesting, and post-harvesting stages. Various insect pests significantly contribute to the reduction in paddy crop productivity during the pre-harvesting phase. The population dynamics of these insect pests in paddy fields are influenced by the frequency of different pest species. While some pests are commonly found across northern India, others appear sporadically. Overall, their population parameters can fluctuate due to seasonal changes and the extensive use of pesticides and fertilizers, which alter the typical population dynamics of insect species in paddy fields.

1. Introduction

Bihar covers a total geographical area of approximately 94,163 km^2, which includes a net cultivated land area of 56.03 lakh hectares and a gross cultivated area of 79.46 lakh hectares (Harish et al., 2013). The primary crops cultivated in the region are rice, wheat, maize, and legumes (ICAR-IGFRI, (2022). Recently, Bihar has expanded its production of flowers on a large scale for both domestic and international markets. The state received the Krishi Karman Award for rice production in 2013 and maize production in 2016. However, challenges such as high rural population density and fluctuating annual rainfall have resulted in instability in agricultural growth and impeded agricultural diversification.

The main crops include paddy, wheat, jute, maize, and oilseeds. The state also cultivates a variety of vegetables, including cauliflower, cabbage, tomatoes, radishes, carrots, and beets. Non-cereal crops such as sugarcane, potatoes, and barley are also grown. Agricultural activities are divided into two distinct crop seasons, Kharif and Rabi. The Kharif season commences in the third week of May and continues until the end of October, after which the Rabi season begins.

Insect pests inflict considerable damage on agricultural products intended for human and animal consumption. In addition to the direct harm to plant systems, fruits, and seeds, insects also cause indirect losses by contaminating food with their body parts, exoskeletons, eggs, and unpleasant odors. Despite the existence of approximately six million insect species, only small fractions are significant agricultural pests. These pests, which affect agricultural and

horticultural crops, include a diverse array of insects, mites, nematodes, and gastropod mollusks (Alford et al., 2014; Tiwary, 2026). The damage they cause results from both direct harm to plants and the indirect effects of transmitting fungal, bacterial, or viral diseases (Macfadyen and Kriticos, 2012). Although plants have inherent defenses against such attacks, these defenses can be overwhelmed, particularly in stressed environments or when pests are introduced without natural predators (Dhaliwal *et al*., 2010). Most tree pests are insects, many of which have been inadvertently introduced and lack natural enemies, while others have spread new fungal diseases with severe consequences (Srivastava, 1993).

Paddy is a staple in the diet of a substantial portion of the population, often consumed alongside other cereals (Burlando and Cornara, 2014; Sen *et al*., 2020). Paddy cultivation is conducted in 37 districts of Bihar, with 25 of these districts categorized as low productivity areas, accounting for 63% of the total 36.57 lakh hectares of land used for paddy farming in the state. Only the Rohtas district is classified as a high productivity zone for paddy cultivation, with yields exceeding 2500 kg/Ha. According to Pathak and Khan (1994), various insect pests damage paddy through different mechanisms, affecting plants either directly or indirectly. Common insect pests of paddy include the Yellow Stem borer (*Scirpophaga incertulas*), Green Leaf hopper (*Nephotettix virescence*), Brown Plant hopper (*Nilaparvata lugens*), Leaf folder (*Cnaphalocrosis medinalis*), and Gall midge (*Orseolia oryzae*). In this study, different crop field of random blocks of Chapra districts were surveyed for the prevalence of insect pests of paddy crop.

2. Materials and Methods

The survey was conducted to estimate insect pest population in 4 blocks (Garkha, Jalalpur, Manjhi, and Nagra) of the Chapra district in Bihar with sampling site from nursing to harvesting stage of paddy crop. The presence of insect pests in each area was documented through counting. The quadratic method was employed for sampling.

To collect various insect pests, net trapping and hand-picking techniques were employed during the early morning and evening hours. The Aberdeen method[10] was utilized to assess the distribution of insect pest species and to examine the population dynamics associated with paddy fields. The distribution patterns of various insect pests were analyzed to estimate their distribution among their respective groups.

3. Results and Observations

The study revealed various insects within rice fields from nursery to maturing crop stages. Table 1 illustrates the presence of insect pests across various collection sites, with a greater number of + signs indicating higher frequencies of occurrence. Every species was gathered at each site, exhibiting both high and low frequencies.

Table 1 Distribution of different insect pests in Paddy crop field area (100m^2)

Scientific Name	Site-I	Site-II	Site-III
Stenchaetothrips biformis	++	+++	+++
Nephotettix virescens	++	+++	++++
Nephotettix nigropictus	++	+++	++++
Nephotettix cincticeps	+++	+++	+++
Nilaparvata lugens	+++	++	+++
Sogatella furcifera	+++	+++	++++
Leptocorisa acuta	++	+++	+++
Brevennia rehi	++++	+++	++++
Scotinophora lurida	+++	++++	+++
Scotinophora coarctata	++++	+++	+++

During specimen collection at each location, the quadratic sampling method was employed. The total number of specimens collected (No.) and the coverage (C) in quadratic sampling (Q) were documented for each site (Table 2). From Site-I, 3541 specimens were gathered, covering an area of 247.4 in 51 quadrate samplings. Similarly, Sites II, III, and IV accounted for total specimen collections of 3318, 2897, and 2339, respectively, with coverage areas of 231.5, 215.2, and 203.7 for the 51 quadrate studies at each site.

Table 2 Quardate-wise distribution of insect pests in different sampling zones

Scientific Name	Site-I			Site-II			Site-III		
	No.	C	Q	No.	C	Q	No.	C	Q
Stenchaetothrips biformis	1102	57.2	08	982	51.8	08	724	49.7	08
Nephotettix virescens	654	24.6	06	532	27.6	06	461	24.4	06
Nephotettix nigropictus	534	21.4	06	407	24.1	06	387	19.5	06
Nephotettixcincticeps	381	31.1	06	354	29.9	06	387	28.7	06
Nilaparvata lugens	282	22.7	05	387	22.2	05	328	20.1	05
Sogatella furcifera	205	20.3	05	286	18.6	05	161	15.4	05
Leptocorisa acuta	106	18.5	04	119	19.4	04	243	21.5	04
Brevennia rehi	83	16.2	04	137	21.1	04	84	16.1	04
Scotinophora lurida	111	17.8	03	68	8.2	03	107	17.2	03
Scotinophora coarctata	83	17.6	04	46	8.6	04	15	2.6	04
Total	3541	247.4	51	3318	231.5	51	2897	215.2	51

Table 3 and Fig. 1 present the distribution parameters of various insect pests at different survey sites of Chapra district.

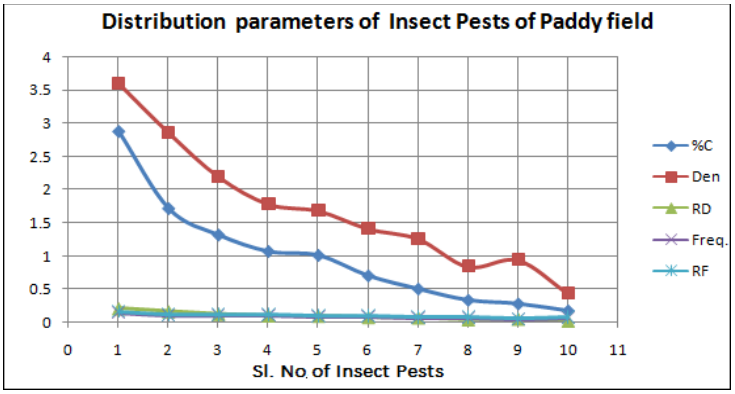


Fig. 1 Distribution parameters of different insect pests of the paddy fields of Chapra district

Table 3 Different distribution parameters of Insect pests of paddy crop field sites of Chapra district
(Ai=No. of Insect, %C=Percentage Coverage, Rc=Relative coverage, RD=Relative Density, Feq=Frequency and RF = Relative Frequency)

Scientific Name	Mean of all four sites (I,II.III & IV) Total Area=1000m2(10mX10mX10m)						
	Ai	%C	Den	RD	Freq.	RF	Quadrate
Stenchaetothrips biformis	874	28.73	3.59	0.211	0.15	0.163	8
Nephotettix virescens	522	17.15	2.85	0.167	0.11	0.119	6
Nephotettix nigropictus	401	13.18	2.19	0.128	0.11	0.119	6
Nephotettix cincticeps	326	10.71	1.78	0.104	0.11	0.119	6
Nilaparvata lugens	308	10.12	1.68	0.098	0.09	0.097	5
Sogatella furcifera	214	7.05	1.41	0.083	0.09	0.097	5
Leptocorisa acuta	154	5.07	1.26	0.074	0.07	0.076	4
Brevennia rehi	103	3.38	0.84	0.049	0.07	0.076	4
Scotinophora lurida	86	2.83	0.94	0.055	0.05	0.054	3
Scotinophora coarctata	54	1.78	0.44	0.025	0.07	0.076	4
Total	3042	100.0	16.98	0.994	0.92	0.996	51

The highest average percentage coverage (28.73) was recorded for *Stenchaetothrips biformis* across all four sites. In contrast, *Scotinophora coarctata* exhibited the lowest average percentage coverage (1.78), followed by *Brevennia rehi* and *Leptocorisa acuta*. The density (Den), relative density (RD), frequency (Freq), and relative frequency (RF) were found to be highest for the *Stenchaetothrips biformis* species and lowest for *Scotinophora coarctata*.

4. Discussion

According to Dhaliwal *et al*. (2010) insect pests were responsible for approximately 5.1% of global yield losses before the green revolution, but this figure increased to 9.3% during the post-green revolution period of the 1990s. The surveyed paddy cultivation areas revealed a notable presence of various insect pest groups. *Stenchaetothrips biformis* (Thrips) was particularly prevalent, significantly influencing the dynamics of other pests. In total, ten insect pests were identified across all surveyed locations. Among these sites, the species with the lowest average frequency included *Scotinophora lurida* (Rice Black Bug), *Scotinophora coarctata* (Rice Black Bug), *Brevennia rehi* (Mealy Bug), and *Leptocorisa acuta* (Rice Earhead Bug). The distribution patterns of these pests can vary depending on the dominant insect pest (Aslam *et al*., 2005). The ecology and niche specialization among different interacting species also limit their populations, which are significantly affected by the biotic and abiotic factors present during a specific crop season (Alford *et al*., 2014; Akhtar, 1971).

Numerous researchers have carried out surveys and observations concerning insects, but data on the relationship between insect population growth rates and rice development under varying climatic conditions is lacking. This finding highlights the slow increase of insect infestations at various stages and how their populations change with weather variations (Singh and Singh, 2017). As the crop enters the vegetative phase, the insect numbers increase further. Population changes are noted in conjunction with alterations in meteorological conditions.

The plant affected by disease takes on a slightly curved shape, often referred to as the parrot-beak form. This condition reduces the plant's ability to perform photosynthesis, which in turn affects its fertility rate, as noted by Noeli (2014) and Buffon *et al.* (2015). Typically, during the vegetative phase, crops can recover from damage. However, if leaf folders attack during the reproductive stage, the economic consequences can be substantial (Panithavalli *et al*., 2011; Sulagitti *et al*., 2018).

Given the growth stages of paddy field crops, thrips are identified as more invasive and potentially more resilient compared to other insect pests, as indicated by distribution parameters (Tiwary, 2026). It is essential to conduct surveys at specific intervals to assess the current distribution patterns of insect pests in paddy crop fields.

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