

Harnessing the Potential of Insectivorous Birds in Managing the Rice Leaf Folder, *Cnaphalocrocis Medinalis* in Paddy Ecosystems of Kerala

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Abstract

This study evaluates the effectiveness of various treatments for managing leaf folder pests in rice crops during the maximum tillering stage, focusing on the role of insectivorous birds. The treatments included bird perches (T1), nylon nets (T2), Bt spray (T3), a combination of bird perch and Bt spray (T4), flubendiamide spray (T5), and a control group (T6). Results indicated significant differences in pest densities. T2 showed the highest mean density at 5.28 (27.50), reflecting their protective effect against bird predation. In contrast, the T6 had a density of 4.58 (20.56), while T1 reduced pest density to 3.52 (12.12). The T3 resulted in a mean density of 3.10 (9.37), and the combination treatment produced a density of 2.95 (8.50), showing no additive effect between the two methods. T5 was the most effective treatment, achieving a density of 1.74 (3.25), though it raised sustainability concerns. Overall, the findings advocate for a holistic pest management approach that integrates ecological strategies, such as promoting insectivorous birds, with chemical methods to enhance sustainability in rice cultivation. This integrated strategy can improve pest control while minimizing environmental impacts, contributing to more sustainable agricultural practices and better crop yields. By considering both ecological and chemical interventions, farmers can achieve effective pest management while protecting biodiversity.

Keywords: Granivorous birds, rice, nylon net, reflective ribbon, rope grid, bio-bird repellent

INTRODUCTION

Rice is a staple food in Kerala, deeply ingrained in the state's economy, and crucial for ensuring food security. However, rice cultivation faces persistent challenges, particularly from lepidopteran insect pests that significantly threaten crop yields. Two of the most problematic pests in Kerala's rice

fields are the yellow stem borer (*Scirpophaga incertulus*) and the rice leaf folder (*Cnaphalocrocis medinalis*) [1]. Among these, the leaf folder is notorious for its capacity to cause extensive damage by folding rice leaves and feeding on them, which severely disrupts the plant's ability to perform photosynthesis. This leads to stunted growth, poor health, and substantial yield losses, making it one of the most formidable threats to rice productivity [2]. Farmers have traditionally relied on chemical insecticides as the primary means of controlling these pests. However, while effective in reducing pest populations, chemical interventions come with significant costs, both financial and environmental. The use of pesticides can degrade soil health, contaminate water resources, and harm nontarget organisms, including beneficial insects, pollinators, and aquatic life. Furthermore, repeated and

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Received Date: October 10, 2024

Accepted Date: October 17, 2024

Published Date: October 24, 2024

Citation: Ranjith M.T., Mani Chellappan, and Vipin Chaudhary. Harnessing the Potential of Insectivorous Birds in Managing the Rice Leaf Folder, *Cnaphalocrocis Medinalis* in Paddy Ecosystems of Kerala. International Journal of Insects. 2024; 1(2): 6–9p.

indiscriminate use of chemical pesticides can lead to the development of pest resistance, rendering these treatments less effective over time and necessitating higher doses or stronger chemicals. This has prompted growing concern among farmers and environmentalists alike, who are increasingly looking for more sustainable, cost-effective alternatives [3]. One promising solution lies in the natural pest control services provided by insectivorous birds. Birds that prey on insects are a vital part of maintaining ecological balance in agricultural landscapes. Many species of insectivorous birds feed on pests like the rice leaf folder, helping to naturally regulate their populations and reduce the extent of crop damage. In Kerala, the rice fields serve as a rich and diverse habitat for a variety of avian species, owing to the state’s agroecosystem, which supports a complex web of biodiversity. This avian community, which includes species like swallows, warblers, and drongos, offers a natural solution to pest control by preying on harmful insects in rice fields [4]. The focus of this study is to investigate the potential of insectivorous birds in managing leaf folder populations in the rice ecosystem of Kerala and provide insights into how avian conservation efforts can be integrated into sustainable farming practices. This could involve measures, such as creating bird-friendly habitats in and around rice fields, ensuring the availability of nesting sites, and avoiding harmful pesticide applications during critical bird feeding periods.

MATERIALS AND METHODS

An experimental field was meticulously established at the College of Agriculture, Vellanikkara, located on the Kerala Agricultural University (KAU) main campus in Thrissur. The primary objective of this study was to assess the efficacy of various techniques aimed at reducing the population of the rice leaf folder, *Cnaphalocrocis medinalis*, a notorious pest that significantly impacts rice yields. In particular, the research focused on examining the predatory potential of insectivorous birds, which could serve as a natural biological control method. The layout of the experimental field included a range of treatments designed to evaluate their effectiveness in managing the pest population. The details of these treatments are outlined in Table 1. The field was designed using a randomized block design (RBD) to ensure that the effects of each treatment could be accurately assessed while controlling for variability within the experimental area

Table 1. Experimental details.

S.N.	Item	Remarks
1	Total area of field	28 cents
2	Design	RBD
3	No. of treatments	6
4	Replications	4
5	No of plots	24 (6 m x 4 m, each)
6	Treatment-T1	T1- Bird Perch
7	-T2	T2- Nylon net
8	-T3	T3 -Bt spray
9	-T4	T4- Bird perch + Bt spray
10	-T5	T5- Flubendiamide spray
11	-T6	T6- Control
12	Rice variety	Vaisakh

The total area of the experimental field was 28 cents, divided into 24 plots measuring 6 meters by 4 meters each. Each treatment was replicated four times to ensure the reliability of the results. The six treatments included:

- *T1 (Bird Perch)*: Establishing structures to attract insectivorous birds.
- *T2 (Nylon net)*: Utilizing nets to exclude insectivorous birds.
- *T3 (Bt spray)*: Applying *Bacillus thuringiensis* as a biological pesticide.
- *T4 (Bird perch + Bt spray)*: Combining the attraction of birds with T3 for synergistic effects.

- *T5 (Flubendiamide spray)*: Using a synthetic pesticide known for its efficacy against lepidopteran pests.
- *T6 (Control)*: A plot with no interventions, serving as a baseline for comparison.

The rice variety used for the study was Vaisakh, which is commonly cultivated in the upland cultivation.

To analyze the data collected on insect populations across the various treatments, we employed the statistical software, GRAPES [5]. This software facilitated a comprehensive analysis and comparison of the effectiveness of each treatment, enabling us to draw meaningful conclusions about the role of insectivorous birds and other pest control methods in managing the rice leaf folder population.

RESULTS AND DISCUSSION

During the maximum tillering stage, the presence of insectivorous birds such as White breasted kingfisher, Streaked Wren-Warbler, Magpie-Robin and Redrumped Swallow were observed in the experimental plots. The effectiveness of various treatments in managing leaf folder pests was assessed, revealing significant differences in pest densities across the approaches employed (Table 2). The nylon net (T2) demonstrated the highest mean pest density of 5.28 (27.50), indicating that it effectively protects the leaf folder from insectivorous birds and allowed to increase their population. In comparison, the control group (T6) showed a moderate mean pest density of 4.58 (20.56), underscoring the natural pest dynamics present without intervention. The bird perch treatment (T1) resulted in a mean pest density of 3.52 (12.12), demonstrating that attracting insectivorous birds can help mitigate leaf folder infestation in rice ecosystem. This finding supports the notion that promoting beneficial birds can enhance natural pest control, which is vital for sustainable agriculture.

The application of Bt spray (T3) yielded a mean pest density of 3.10 (9.37), reflecting a reasonable level of pest management through biological methods. However, the combined treatment of bird perch and Bt spray (T4) was the least effective, with a mean pest density of 2.95 (8.50). This unexpected outcome suggests that the interaction between these two strategies did not produce the anticipated additive effect, highlighting the complexity of pest management dynamics and the need for further research into effective combinations. However, the spraying of flubendiamide (T5) resulted in the lowest mean pest density at 1.74 (3.25). While this chemical treatment was effective, it raises concerns about long-term sustainability and environmental impacts associated with pesticide use. Overall, the results indicate that while chemical methods may provide significant control, integrating the ecological roles of bird perches could enhance pest management strategies in rice cultivation. This study advocates a holistic approach to pest management that combines effective methods while promoting environmental sustainability and biodiversity.

Table 2. Comparative leaf folder population in rice crops.

S.N.	Treatment	No. of Rice Leaf Folder Larva
1	T1 – Bird Perch	3.52 ^c (12.12)
2	T2 – Nylon net	5.28 ^a (27.50)
3	T3 – Bt spray	3.10 ^{cd} (9.37)
4	T4 – Bird perch + Bt spray	2.95 ^d (8.50)
5	T5 – Flubendiamide spray	1.74 ^e (3.25)
6	T6 – Control	4.58 ^b (20.56)
7	CD@5%	0.49
8	CV	9.48

The experiment demonstrated that flubendiamide spray was the most effective treatment in reducing leaf folder larvae populations, followed closely by the combination of bird perches and Bt spray, which performed similarly to plots sprayed with Bt formulation alone [6]. The use of bird perches also effectively reduced larval populations, indicating that beneficial birds contribute significantly to natural pest control [7, 8]. Interestingly, plots protected by nylon netting had the highest larval populations, suggesting that excluding birds also inadvertently protect insect pest larvae, allowing their numbers to increase. These findings underscore the value of utilizing beneficial birds in integrated pest management strategies, as their presence can naturally regulate insect populations, thereby reducing the reliance on chemical interventions in crop ecosystems [9, 10]. This approach could be particularly valuable for sustainable agriculture, offering an eco-friendly alternative to conventional pest control methods.

CONCLUSIONS

The study highlights that while chemical treatments like flubendiamide are highly effective in reducing leaf folder populations, integrating ecological methods, such as the use of bird perches, can significantly contribute to pest control. Though the combination of bird perches and Bt spray did not yield additive effects, promoting beneficial insectivorous birds offers a sustainable and eco-friendly alternative to conventional chemical methods. This underscores the importance of holistic, integrated pest management strategies that balance effectiveness with environmental sustainability.

Acknowledgments

We would like to extend our heartfelt gratitude to the Indian Council of Agricultural Research and KAU for their vital support in carrying out the project activities. Their expertise, guidance, and resources have been essential to the successful implementation of our work. We deeply appreciate the collaborative spirit and commitment of both institutions, which have significantly contributed to the advancement of our research objectives.

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