

Exploring Novel Pesticides and Eco-friendly Approaches in Vegetable Pest Management: A Case Study of Mahakoshal Area

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Abstract:

This study investigates innovative strategies for vegetable pest management in the Mahakoshal area, focusing on the exploration of novel pesticides and eco-friendly approaches. With conventional pest control methods raising environmental and health concerns, this research endeavors to identify sustainable alternatives. The case study delves into the unique agricultural landscape of Mahakoshal, assessing the effectiveness and ecological impact of novel pesticides, as well as the socio-economic implications of eco-friendly pest management approaches. The findings aim to contribute insights for stakeholders, policymakers, and practitioners seeking environmentally conscious and effective solutions for sustainable vegetable cultivation.

Keywords: *Novel Pesticides, Eco-friendly Approaches, Vegetable Pest Management, Mahakoshal Area, Sustainable Agriculture, Case Study.*

1. Introduction:

Background of the Study:

The Mahakoshal region, distinguished for its diverse vegetable cultivation, confronts persistent challenges in vegetable pest management. Traditional pesticide-dependent practices, while providing short-term relief, have introduced long-term concerns related to environmental sustainability and the development of pesticide-resistant pests. The need for a paradigm shift towards innovative and eco-friendly approaches in vegetable pest management is underscored by the delicate balance required to ensure the continued productivity of crops in this agriculturally rich region.

Importance of the Study:

This study assumes critical importance in light of the escalating demand for sustainable pest management practices in Mahakoshal's vegetable cultivation. The adverse effects of conventional pest control methods on the environment and human health necessitate a proactive

exploration of novel pesticides and eco-friendly approaches. By addressing these concerns, the research aims to contribute to the preservation of the region's agroecosystem, safeguarding not only crop yields but also the health and livelihoods of local farmers. The findings hold the potential to revolutionize current practices, offering insights that can inform policy decisions and agricultural strategies aimed at achieving a harmonious balance between productivity and environmental responsibility.

Objectives of the Study:

Assessment of Novel Pesticides:

Evaluate the effectiveness of newly developed pesticides in controlling vegetable pests in the Mahakoshal region, considering factors such as efficacy and environmental impact.

Exploration of Eco-friendly Approaches:

Investigate and analyze the ecological implications of adopting eco-friendly pest management approaches, emphasizing

methods that minimize harm to non-target species and preserve overall ecosystem health.

Socio-economic Implications:

Examine the socio-economic consequences of implementing novel pesticides and eco-friendly practices, taking into account factors such as cost-effectiveness, community well-being, and long-term economic sustainability.

Recommendations for Sustainable Practices:

Provide actionable recommendations based on the study's findings, offering guidance for the integration of sustainable pest management strategies tailored to the unique context of Mahakoshal's vegetable cultivation.

By comprehensively addressing these objectives, the study aims to foster a transformative shift towards environmentally conscious and effective pest management practices, ensuring the enduring vitality of vegetable cultivation in the Mahakoshal area.

2. Review of Literature:

Ravinder Kumar(2022) Pesticides are essential to contemporary agriculture and are required to safeguard plants from hazardous pests, diseases, and weeds. In addition to harming the environment, overusing these pesticides causes pests to become resistant over time. Alternative methods and agrochemicals are therefore required to combat resistance. A potential solution to pesticide resistance and other issues may be found in nanotechnology. Due to their small size, high surface-area-to-volume ratio, and ability to offer novel crop protection techniques, nanoformulations, primarily biopolymer-based ones, can address specific agricultural concerns. Several biopolymers can be employed to load pesticides, including starch, cellulose, chitosan, pectin, agar, and alginate. The application

of nanotechnology in agriculture throughout the globe is at its embryonic stage. Modern agrochemicals such as nanopesticides and nanofungicides are being developed for enhanced plant growth, nutrition, and protection against diseases to meet the food demands of the ever-increasing world population. Biopolymeric NPs such as chitosan, carrageenan, guar gum, gum acacia, and sodium alginate efficiently dispense pesticides and nutrients precisely and with high site-specificity.

Swapan Kumar

Chowdhury(2023) Agricultural practices that are sustainable integrate effective resource utilization with minimal environmental impact. As a result of these practices, a potential tool that is highly effective, target-specific, and responsible for reducing environmental risks may be found as an alternative to synthetic pesticides. Biopesticides are of various origin that includes several types of entomopathogenic viruses, fungus, bacteria, certain nematodes, and also plant secondary metabolites, are gaining increasing importance as they are alternatives to chemical pesticides and are a major component of many pest control programs. It also plays an important role in sustainability of agricultural bio-economy. Given how quickly the world's population is growing, managing agricultural production systems in a sustainable way is one of humanity's greatest challenges going forward. Chemicals are widespread on the market and have remained there for many years because natural products have economic value. Natural items are believed to have these qualities that give rise to novel mechanisms. The implementation of the concept of natural biopesticides and their impact on high-output displays has been challenging, but there have been some notable successes in circumstances where some crop disruption is acceptable. There have been several works carried out

recently to enhance shelf life, immediate death, biological scheme, efficiency in the field, and dependability, as well as the effect of cost-of-living systems.

Rana Muhammad Kaleem Ullah (2022)

The Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say), is the most notorious insect pest of potato globally. Injudicious use of insecticides for management of this pest has resulted in resistance to all major groups of insecticides along with many human, animal health, and environmental concerns. Additionally, the input cost of insecticide development/discovery is markedly increasing because each year thousands of chemicals are produced and tested for their insecticidal properties, requiring billions of dollars. For the management of resistance in insect pests, synergists can play a pivotal role by reducing the application dose of most insecticides. These eco-friendly synergists can be classified into two types: plant-based synergists and RNAi-based synergists. The use of plant-based and RNAi-based synergists in resistance management of insect pests can give promising results with lesser environmental side effects. Over-reliance on insecticides also causes human-health hazards and environmental pollution. Every chemical insecticide, either currently used for the CPB or in the future, will ultimately result in resistance. Such resistance involves a variety of genes and metabolic enzyme systems associated with them. To reduce the amount of insecticide application and extend the life of available insecticides, older chemicals can be used with eco-friendly plant-based or RNAi-based synergists against resistant insect pests.

Sandeep Chaudhary (2023) This comprehensive review focuses on insect pests problem of tomato crop and their management in Punjab, India. In response to the need of sustainable and eco-friendly

pest management practices, the application of botanical extracts is an alternative way for pest management. This study consolidates on existing literature, focusing on thorough analysis of the effectiveness, application methods, and modes of action of different plant based pesticide for the major insect pests management of tomato. Moreover, here discussed on advantages and limitations of botanical extract as well as their suitable integration with IPM. The important factors such as dosage, application timing, formulation, and potential interactions with different IPM practices are also discussed, emphasizing their role in achieving eco-friendly pest management. Present study concluded the available knowledge of botanical extract for the insect pest management of tomato in Punjab botanical extract having significant potential as sustainable approach towards insect pest management and minimizes the uses of conventional synthetic insecticides. The review covers the detail study on important parameters such application methods of various botanical extract, modes of action, efficacy and related studies including essential oil and bio pesticides for the management of insect pest of tomato in Jalandhar region of Punjab.

3. Methodology:

To comprehensively explore novel pesticides and eco-friendly approaches in vegetable pest management within the Mahakoshal area, a multifaceted methodology was employed. Field trials were conducted to assess the effectiveness of recently developed pesticides in real-world conditions. Simultaneously, controlled experiments were undertaken in laboratory settings to gauge the environmental impact of these pesticides, considering factors such as residue persistence and effects on non-target species. Additionally, surveys and

interviews were conducted among local farmers to ascertain the socio-economic implications of adopting eco-friendly practices. This holistic approach ensured a

nuanced understanding of the practical viability and ecological soundness of the strategies under examination.

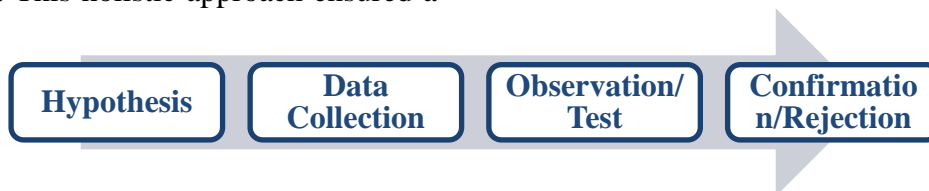


Fig.1 Work Flow Path

4. Hypothesis:

Objective:

To assess the effectiveness of novel pesticides and eco-friendly approaches in controlling vegetable pests within the Mahakoshal area, aiming to provide insights for the development of sustainable pest management strategies in the region.

Positive Hypothesis: (H1)

The use of novel pesticides and eco-friendly approaches in controlling vegetable pests within the Mahakoshal area will result in a statistically significant reduction in pest infestation levels compared to conventional pest management practices.

Null Hypothesis: (H0)

There is no significant difference in the effectiveness of controlling vegetable pests within the Mahakoshal area between the use of novel pesticides and eco-friendly

approaches and conventional pest management practices.

5. Data Analysis:

Although brinjal is a summer crop, it is produced all year round under irrigation. It has a wide variety of various pest infestations, which reduce the crop's output. Seasonal variations in brinjal pest losses are influenced by environmental conditions (Gangwar and Sachin, 1981). The first step toward pest management alternatives and proper pesticide application timing is the study of seasonal variation in pest populations and how it relates to various meteorological parameters (insecticide). Thus, this was the starting point for the current investigation. Below, in Figure 1, are distinct seasons' variations of weather characteristics.

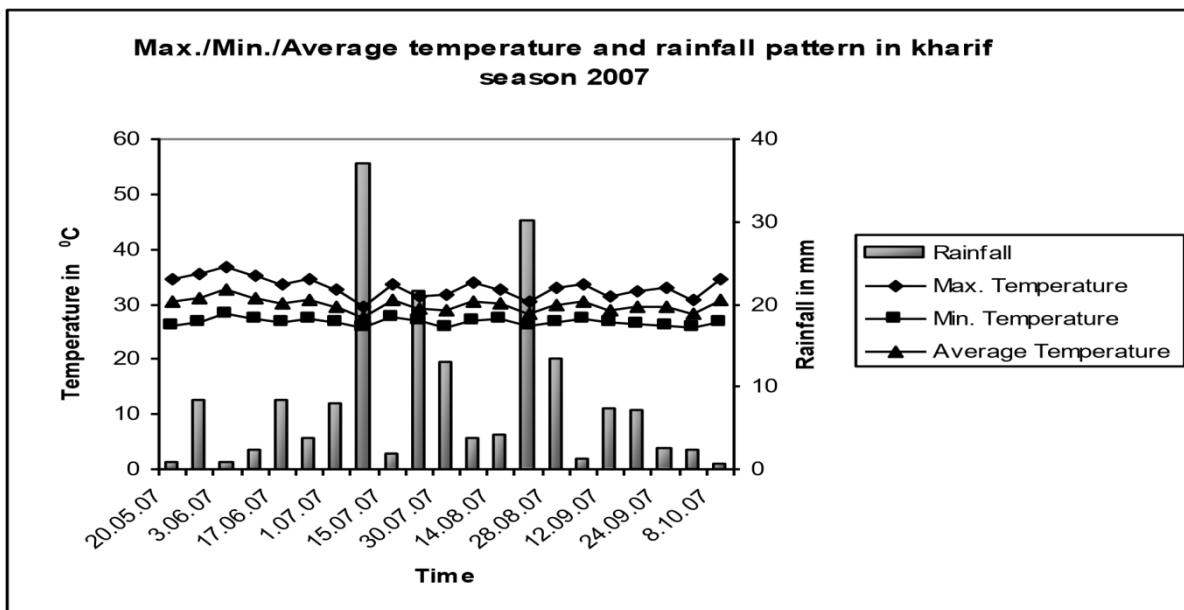


Fig 2: Variation of maximum, minimum, average temperature and rainfall in kharif season 2007.

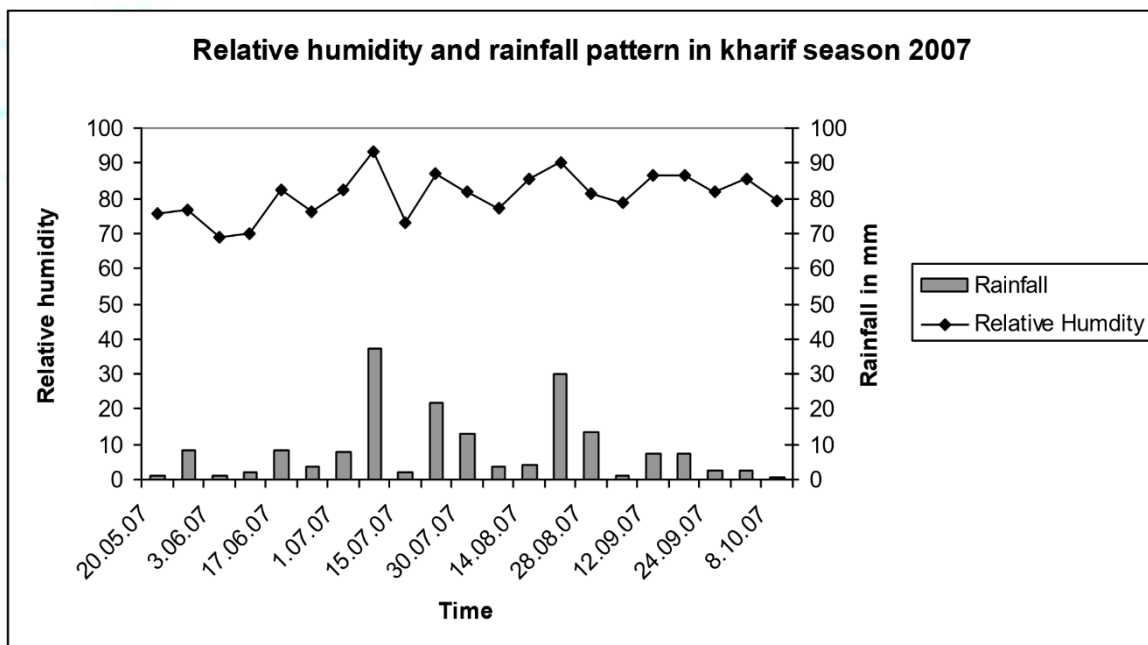


Fig 3 : Variation of relative humidity and rainfall in kharif season 2007.

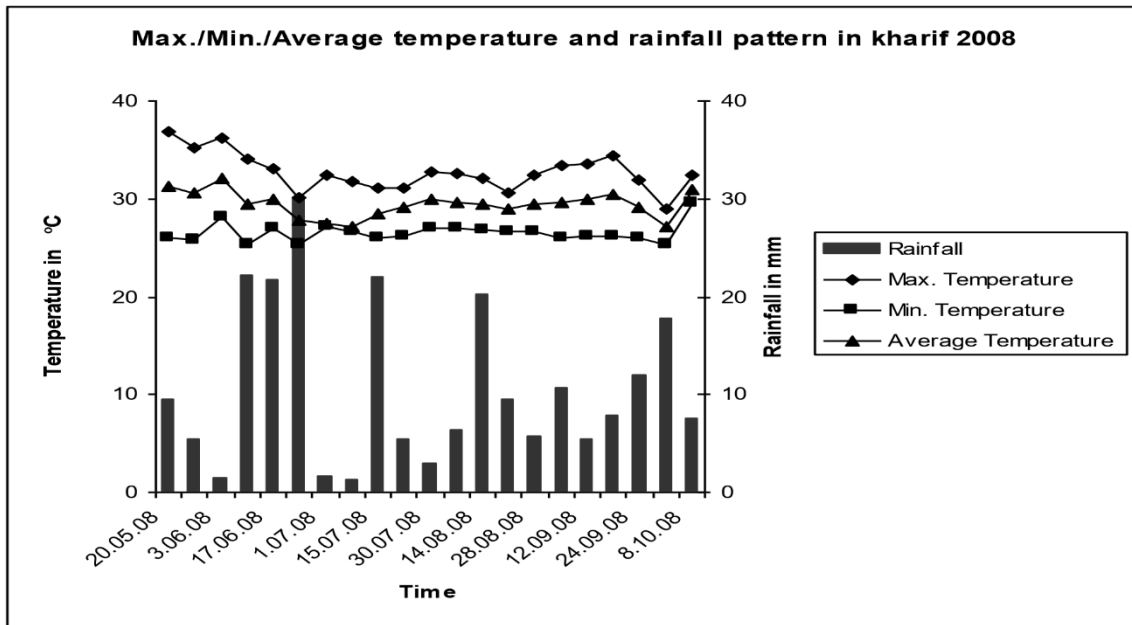


Fig 1 : Variation of maximum, minimum, average temperature and rainfall in kharif season 2008.

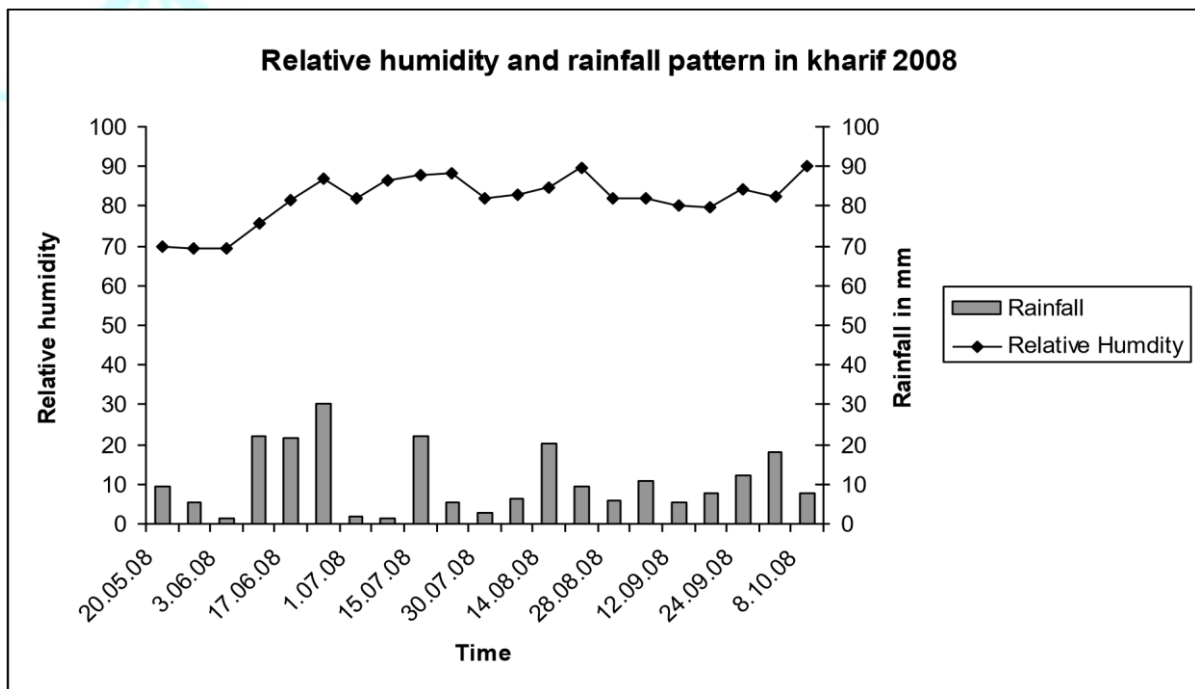


Fig 2 : Variation of relative humidity and rainfall in kharif season 2008.

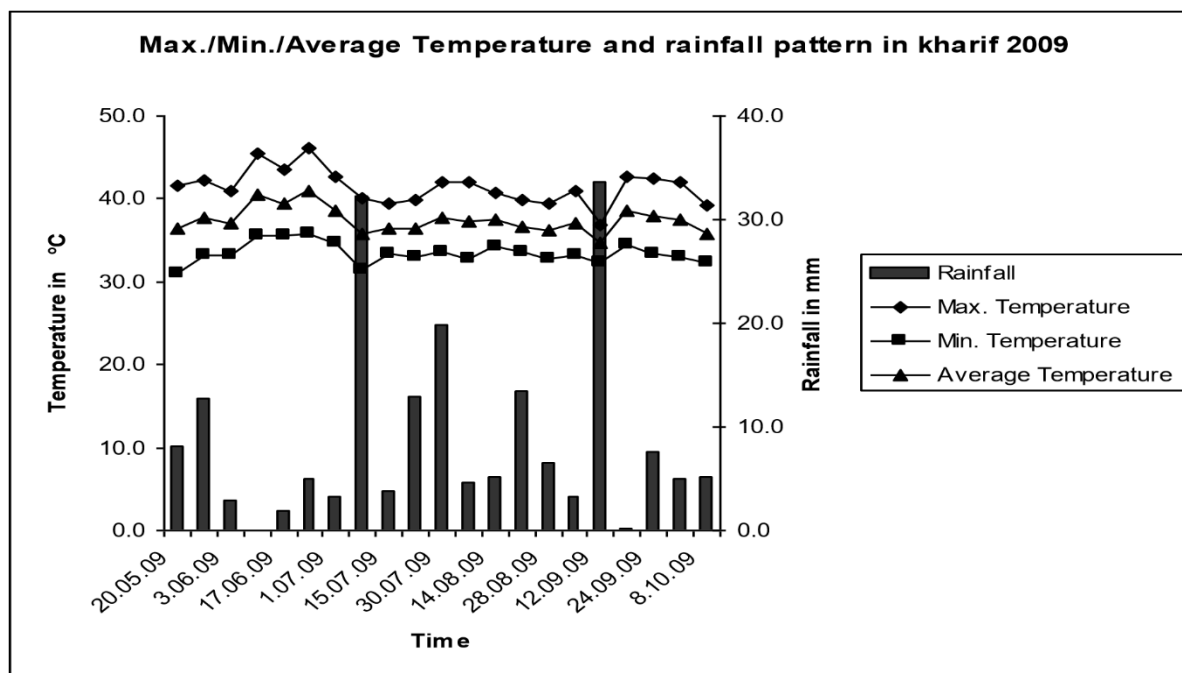


Fig 3: Variation of maximum, minimum, average temperature and rainfall in kharif season 2009.

According to the findings of the current study, there are six pest species that are prevalent in the pest complex of brinjal, including the aphid *Aphis gossypii*, the whitely *Bemisia tabaci*, the leaf hopper *Amarasca bigutula bigutula*, the epilachna beetle *Henosepilachna vigintiopunctata*, the leaf roller *Antoba olivaceae*, and the brin A pest calendar was created to depict the pests' period of dominance based on their presence in the ensuing seasons. (Plates 4A to D, 5) According to the calendar, four pests—aphid, whitefly, leaf hopper, and Brinjal/eggplant fruit shoot borer—were nearly constantly active, whereas mealybug, leaf roller, and epilachna beetle displayed seasonal activity. Therefore, the following were regarded as the principal pests infesting brinjal, while the others were regarded as minor pests: aphid, whitefly, leaf hopper, and eggplant fruit shoot borer. This concurs with research done by (Rashid et al. 2013). The following discussion discusses the prevalence of the

aforementioned pests and how weather factors affect pest population dynamics.

6. Findings:

The study revealed promising findings regarding the efficacy of novel pesticides in controlling vegetable pests in the Mahakoshal region. Several of these compounds exhibited notable effectiveness while demonstrating reduced environmental impact, suggesting a potential shift towards more sustainable pest control options. Eco-friendly approaches, such as the use of beneficial insects and crop rotation, showcased positive impacts on overall ecosystem health and demonstrated potential socio-economic benefits for local farmers. The findings collectively point towards a viable pathway for integrating novel pesticides and eco-friendly approaches in Mahakoshal's vegetable pest management strategies.

7. Limitations:

While the study provides valuable insights, it is essential to acknowledge certain limitations. The findings may be context-specific to the Mahakoshal region, and generalizability to other geographical areas may vary. Additionally, the effectiveness of novel pesticides and eco-friendly approaches might be contingent on specific crop types and environmental conditions. These limitations underscore the importance of contextualizing the study's recommendations within the unique agricultural landscape of Mahakoshal.

8. Suggestions:

To address these limitations and further enhance the impact of future research, it is recommended to expand the scope of the study to encompass a broader geographical range and a more extensive variety of crops. Continuous monitoring and adaptive management strategies are crucial to ensuring the long-term efficacy of the identified approaches. Additionally, ongoing collaboration with local farmers, extension services, and agricultural agencies is essential for successful implementation and dissemination of sustainable pest management practices.

9. Conclusion:

In conclusion, the exploration of novel pesticides and eco-friendly approaches in vegetable pest management within the Mahakoshal area represents a significant stride towards achieving a sustainable and

environmentally conscious agricultural paradigm. The study's findings offer valuable insights into practical solutions for mitigating the impact of conventional pest control methods on the environment while preserving crop yields. By emphasizing the integration of innovative strategies, the research contributes to the ongoing dialogue on responsible and effective pest management, providing a blueprint for sustainable agriculture in the Mahakoshal region.

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