



T K M COLLEGE OF ARTS AND SCIENCE  
KOLLAM

*Diversity of Arthropod Pests Infesting Native Vegetation in  
the Kollam District:  
A Comprehensive Survey*

*Submitted by:*

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PROJECT REPORT

B.Sc Zoology (2021-24)

MARCH 2024



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## CERTIFICATE

This is to certify that the project titled "Diversity of Arthropod Pests Infesting Native Vegetation in the Kollam District: A Comprehensive Survey" was conducted by a team of eight students mentioned below under my supervision and guidance. No part of this project has been submitted elsewhere for any academic or professional program.

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*Department Seal*

## DECLARATION

I, ..... (.....), solemnly declare that the project titled "Diversity of Arthropod Pests Infesting Native Vegetation in the Kollam District: A Comprehensive Survey," conducted by us, represents original work undertaken under the supervision and guidance of Dr. Jasin Rahman V. K.

I affirm that all aspects of this project, including the research, data collection, analysis, and conclusions drawn, are genuine and authentic to the best of our knowledge. This project has not been submitted elsewhere for any academic or professional program.

.....

## ACKNOWLEDGEMENT

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*I extend my heartfelt thanks to everyone who has contributed in various capacities, making this endeavor a success.*

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## INTRODUCTION

This study documents the diversity of arthropod pests in the native vegetation across different regions within the Kollam District. Arthropods, constituting a diverse and complex group of invertebrates, play pivotal roles in ecosystems, often acting as both beneficial organisms and pests within native vegetation. Understanding the diversity and prevalence of arthropod pests within any native vegetative landscapes is crucial for effective pest management strategies. Furthermore, such surveys contribute significantly to our knowledge of local biodiversity and ecosystem health.

Studying pest diversity within native vegetation is crucial for several reasons. Firstly, it provides awareness about the complex ecological relationships between pests and their natural habitats. Understanding the diverse array of pests that exist within native vegetation helps elucidate their roles within ecosystems, such as their interactions with other organisms and their impact on plant health. This knowledge aids in predicting and managing potential pest outbreaks, allowing for more targeted and sustainable pest control measures. Additionally, studying pest diversity in native vegetation contributes to the development of integrated pest management strategies that prioritize natural and ecological approaches over reliance on chemical pesticides. By recognizing and harnessing the natural balances present within native ecosystems, researchers and farmers can work towards preserving biodiversity while effectively managing pest populations. Ultimately, studying pest diversity in native vegetation supports efforts to promote sustainable agriculture by fostering a deeper understanding of the delicate ecological harmony between pests, plants, and their environment.

Arthropod pests pose significant challenges in agroecosystems, impacting crop health and productivity. Here are some details on arthropod pests:

**Types of Arthropod Pests:** These pests belong to various classes, including insects (such as beetles, caterpillars, aphids, and thrips), arachnids (like mites and spiders), and crustaceans (for instance, some types of amphipods).

**Damage and Impact:** Arthropod pests cause damage by feeding on plants, disrupting growth, and reducing yield quality and quantity. They can transmit diseases, reduce photosynthesis, and weaken plants' immune systems, making them vulnerable to other stressors.

**Management Strategies:** Farmers use diverse strategies to manage arthropod pests. These include biological controls (using natural predators or parasites), cultural practices (crop rotation, intercropping), chemical controls (insecticides, pesticides), and genetic approaches (developing pest-resistant crop varieties).

**Challenges and Concerns:** Pesticide resistance is a significant concern with arthropod pests, as they can develop resistance to commonly used chemicals, rendering them ineffective. Additionally, the ecological impact of pesticides on non-target species and the environment is a growing concern, driving the need for sustainable pest management practices in agroecosystems.

**Integrated Pest Management (IPM):** IPM approaches focus on a combination of strategies to minimize pest damage while being environmentally and economically sustainable. This involves monitoring, using thresholds for intervention, and employing a range of pest management techniques in a holistic manner.

This comprehensive survey aims to delve into the intricate web of arthropod pests inhabiting the diverse native vegetation of the Kollam district. By employing rigorous sampling methodologies and taxonomic identification techniques, this study endeavors to provide a comprehensive understanding of the arthropod pest populations and their potential impact on the native flora. Through the examination of arthropod pest species richness, abundance, and their interactions with the indigenous flora, this research seeks to contribute valuable insights into the ecological dynamics and conservation implications within this region. The findings will not only aid in formulating targeted pest management strategies but also in fostering a deeper appreciation of the intricate relationships between arthropods and native vegetation in the Kollam district.

## REVIEW OF LITERATURE

The focus on native plant-based habitat manipulation, crop diversification, and agroforestry in addressing pest control and biodiversity loss represents a significant shift toward more sustainable agricultural practices. These approaches highlight a departure from conventional reliance on chemical pesticides and monoculture farming. The emphasis on understanding mechanisms and conducting comprehensive cost-benefit analyses underscores a commitment to evidence-based decision-making for implementing these alternative methods. However, the challenges lie in overcoming barriers to widespread adoption, which may involve policy support, education, and incentivizing farmers to embrace these practices. Overall, these strategies signal a positive direction in agriculture, promoting ecological balance, reduced environmental impact, and potentially more resilient farming systems.

The adoption of native plant-based habitat manipulation for conservation biological control in diverse cropping systems is impeded by a lack of comprehensive understanding regarding the underlying mechanisms, the impact on pest populations, and the cost-benefit analyses ([Zaviezo and Muñoz 2023](#)). However, promising alternatives exist within agricultural landscapes. [Jaworski et al. \(2023\)](#) advocate for implementing crop diversification strategies that not only combat biodiversity loss but also reduce the dependence on chemical pesticides. This approach fosters biological pest control while maintaining the same cropped areas. [Stamps and Linit \(1998\)](#) highlighted the potential of agroforestry, a system integrating trees and crops, as a more effective means to enhance insect diversity and mitigate pest issues compared to traditional polyculture methods involving only annual crops. Such practices offer greater niche diversity and complexity, contributing to improved pest management strategies.

The intricate dance of biodiversity within ecosystems is a tapestry woven by complex interactions. Studies by [Ebeling et al. \(2018\)](#) emphasize how a richer variety of plant species serves as a catalyst for diverse arthropod communities, particularly those intertwined with vegetation. This challenges established theories by shedding light on the dynamic interplay of trophic levels and functional traits, redefining our understanding of biodiversity-ecosystem relationships. [Boutin et al. \(2009\)](#) further accentuated this complexity by unraveling the differences in arthropod abundance between organic and conventional farming. Their findings underscored the pivotal role of both local factors like management practices and vegetation, alongside regional influences such as landscape

features, in shaping biodiversity patterns. [Philpott et al. \(2023\)](#) introduced a complex perspective on the impact of native plants in urban gardens. While their presence had minimal effects on the diversity and abundance of certain beneficial arthropods like bees and ladybeetles, it unexpectedly exhibited a negative influence on non-native spiders. This revelation implies that while native plants might hold limited sway, other elements within gardens can be manipulated to foster the presence of beneficial arthropods, illuminating new avenues for enhancing biodiversity within urban landscapes.

Utilizing native plants within agricultural landscapes could prove instrumental in bolstering essential resources like pollen and nectar, crucial for supporting beneficial arthropods such as bees and predatory species. This approach holds promise for augmenting insect conservation efforts, particularly in moderately complex landscapes ([Isaacs et al., 2009](#)). In contrast, intensified agricultural practices have led to landscape simplification, marked by expanded agricultural zones, larger field sizes, and diminished non-crop habitats. This shift has significantly contributed to biodiversity decline, especially along field edges ([Bianchi et al., 2006](#)). Highlighted in a comprehensive review by [Fiedler et al. \(2008\)](#), habitat management for conservation biological control underscores the urgency of expanding plant species testing. The review advocates for a holistic approach, urging the integration of conservation, restoration, and cultural values to amplify ecosystem services. Notably, the review showcases case studies geared towards reducing agriculture's reliance on chemical inputs while emphasizing the imperative role of habitat preservation in sustaining biodiversity and beneficial arthropod populations.

The use of native plant-based habitat manipulation in agricultural settings presents a promising avenue for pest control and biodiversity enhancement. However, challenges persist due to gaps in understanding the mechanisms, cost-benefit analyses, and impacts on pest populations. Strategies advocating for crop diversification and agroforestry offer alternatives to chemical pesticides, fostering biological pest control while maintaining crop areas. Studies emphasize the intricate relationship between plant diversity and arthropod communities, shedding light on the dynamic interplay shaping biodiversity patterns. Utilizing native plants within agricultural landscapes could strengthen resources crucial for supporting beneficial arthropods, countering the decline caused by intensified agricultural practices. Overall, while obstacles remain, the adoption of these strategies signifies a positive shift towards more sustainable agricultural practices and ecological balance.

## **OBJECTIVES OF THE STUDY**

- Identify and document the various species of arthropod pests in the native vegetation across different regions within the Kollam District.
- To gain awareness about the nature of damage caused by these pests and their economic importance within the agroecosystems.

## **AREA OF THE STUDY**

Kollam, situated in the southern part of Kerala, is a district known for its unique geographical and climatic characteristics that significantly shape its landscape, vegetation, and livelihoods of its inhabitants.

### **Geographical Peculiarities:**

Kollam district, positioned between 8°56' and 9°14' North latitude and 76°17' and 77°9' East longitude, boasts a diverse topography. It encompasses a vast coastal area along the Arabian Sea, extending inland to include plains, hills, and the Western Ghats. Its coastal location influences its weather patterns, livelihoods, and biodiversity. The district is adorned with numerous rivers, including the Ashtamudi Lake, the second-largest estuarine system in Kerala.

### **Monsoon and Climate:**

Kollam experiences a tropical climate with distinct monsoons. The southwest monsoon from June to September brings heavy rainfall, vital for agriculture in the region. The northeast monsoon occurs from October to November. The district enjoys a warm and humid climate throughout the year, with temperatures ranging from 22°C to 32°C. The ample precipitation contributes to the lush greenery and agricultural productivity.

### **Vegetation Features:**

The district's varied topography and climatic conditions foster diverse vegetation. The coastal regions host mangroves and coconut palms, while the plains are adorned with paddy fields, spices like pepper and cardamom, and cash crops like rubber. As you move inland towards the Western Ghats, the landscape transforms into dense tropical forests with teak, rosewood, and bamboo, fostering rich biodiversity with endemic flora and fauna.

Kollam's geographical diversity, from its coastal stretches to the lush hills of the Western Ghats, contributes to its ecological richness and sustains livelihoods through agriculture, fishing, and forestry. The district's climatic conditions, accentuated by the monsoons, shape its cultural practices, agricultural cycles, and natural landscapes, making it an integral part of Kerala's diverse geography.

## **MATERIALS AND METHODS**

### **Study Site:**

The study was conducted in vegetation areas and agricultural regions of Kollam District.

### **Sampling Equipment:**

Sweep nets (standard 30 cm diameter) for capturing flying arthropods.

Pitfall traps (plastic cups buried at ground level) filled with soapy water for ground-dwelling arthropods.

Hand picking

Hand-held magnifying lenses and taxonomic keys for species identification.

### **Identification Resources:**

A comprehensive field guide on arthropod pests in agricultural ecosystems was used for on-site identification. Samples were later verified in the laboratory using published taxonomic keys and expert assistance.

### **Sampling Strategy and Techniques:**

Sampling was conducted continuously for six months during the study period. At each visit, random sweeps were performed in each field, and pitfall traps were distributed evenly across each field. Sweep netting involved sweeping the net through the crop canopy in a figure-eight motion for 30 seconds per sweep. Pitfall traps were checked and emptied fortnightly. Some insects were collected and observed with just hands. Arthropods collected were sorted, counted, and identified to the lowest taxonomic level possible.

### **Documentation:**

Sampling was carried out by the project team only to ensure consistency. Taxonomic identifications were cross-validated by an experienced entomologist. Data on the diversity of arthropod species encountered were recorded and documented.

## **RESULTS AND DISCUSSION**

This study aimed to document the diversity of arthropod pests in native vegetation across various regions within the Kollam District. Arthropods, encompassing a diverse and intricate group of invertebrates, serve critical roles in ecosystems, often functioning as both beneficial organisms and pests within native vegetation. Our survey identified several arthropod pests, as summarized in Table 1.

The findings reveal a diverse spectrum of pest families, with significant representation from several orders (Figure 1 & 2). Among these, Lepidoptera stands out with the highest observation count, comprising 6 families. This is followed by Hemiptera and Coleoptera with 5 and 4 families respectively, demonstrating notable diversity within these orders. Additionally, Diptera contributes with 3 families and Acarina (Class Arachnida), Thysanoptera and Trombidiformes orders each present 1 family. These findings underscore the importance of understanding the distribution of pest families across taxonomic orders, providing valuable insights for pest management strategies and agricultural practices.

The survey revealed low pest infestation overall, with most plants showing only one or two pests. Notable findings include brinjal, ladies finger, mango, and pepper, which displayed a slightly higher presence of pests, with counts ranging from three to four. The majority of plants, including banana, betel leaf, breadfruit, cashew, castor, chilli, cinnamon, cowpea, hibiscus, jackfruit, mango ginger, papaya, pumpkin, spinach, tapioca, teak, and tomato, exhibited minimal pest activity. Guava, coconut, jasmine, pineapple, tamarind, and turmeric showed a moderate level of infestation. This data highlights the need for targeted pest management strategies, particularly for crops with higher pest occurrences, to ensure optimal plant health and yield.

The presence of numerous arthropod pests in agroecosystems, weeds, and other shrubs across rural, suburban, and forest areas underscores the importance of understanding their diversity and prevalence for effective pest management strategies. Among the predominant pests observed were mealybugs, aphids, and caterpillars. These findings align with previous research highlighting the prevalence of these pests in similar ecosystems. Mealybugs are globally significant insect pests due to their wide distribution, rapid spread, polyphagous nature, and challenging control, while also serving as vectors for various virus diseases and offering potential for biological control and semiochemical-based management strategies (Subramanian et al., 2021). The efficient use of

*Aphidoletes aphidimyza* as a predator in augmentative biological control offers promising potential for managing aphids, key pests of various crops, through targeted interventions addressing both biotic and abiotic factors (François-Xavier et al., 2018).

Our research suggests that certain areas of economic significance require Agroecological-oriented Pest Management. Brewer and Elliotte (2023) have emphasized the applicability of Agroecological-oriented areawide pest management (AWPM) to cropping systems. Studies focusing on agroecological pest management are crucial for identifying suitable candidates for AWPM implementation.

Table 1. List of pests identified from native vegetation in the Kollam district						
Sl. No	Scientific name	Common name	Order: Family	Infesting stage	Host plants	Parts damaged
1.	<i>Acherontia styx</i>	Pepper Leaf Caterpillar	Lepidoptera: Sphingidae	Caterpillars	Pepper	Leaves
2.	<i>Aleurothrixus floccosus</i>	Woolly whitefly	Hemiptera: Aleyrodidae	Nymphs and adults	Guava	Leaves
3.	<i>Amrasca biguttula</i>	Leaf hopper	Hemiptera: Cicadellidae	Nymphs and adults	Brinjal, Ladies finger	Stem, Leaves, Fruits
4.	<i>Amritodus atkinsoni</i>	Turmeric Leafhopper	Hemiptera: Cicadellidae	Nymphs and adults	Turmeric	Leaves
5.	<i>Aphis gossypii</i>	Aphids	Hemiptera: Aphididae	Nymphs and adults	Brinjal, Ladies finger	Stem, Leaves, Fruits
6.	<i>Aspidiella hartii</i>	Turmeric Rhizome Scale	Hemiptera: Diaspididae	Nymphs and adults	Turmeric	Rhizomes
7.	<i>Aulacaspis tubercularis</i>	Armoured scale	Hemiptera: Diaspididae	Nymphs and adults	Mango	Fruits
8.	<i>Aulacaspis yasumatsui</i>	Cycad scale	Hemiptera: Diaspididae	Nymphs and adults	Mango ginger	Stem, Leaves
9.	<i>Bactrocera correcta</i>	Guava Fruit Fly	Diptera: Tephritidae	Larvae and adults	Guava, Mango	Fruits
10.	<i>Batocera rufomaculata</i>	Jackfruit Borer	Coleoptera: Cerambycidae	Larvae	Jackfruit, Mango	Stem
11.	<i>Bemisia tabaci</i>	Whitefly	Hemiptera: Aleyrodidae	Nymphs and adults	Ladies finger	Stem, Leaves, Fruits
12.	<i>Caryedon serratus</i>	Groundnut borer	Coleoptera: Chrysomelidae	Nymphs and adults	Tamarind	Fruits
13.	<i>Conogethes punctiferalis</i>	Ginger Shoot Borer	Lepidoptera: Crambidae	Larvae	Ginger, Brinjal, Castor	Shoots
14.	<i>Dasineura tetensi</i>	Teak Leaf Roller	Diptera: Cecidomyiidae	Larvae	Teak	Leaves
15.	<i>Dysmicoccus brevipes</i>	Pineapple Mealybug	Hemiptera: Pseudococcidae	Nymphs and adults	Pineapple	Stem, Leaves
16.	<i>Epilachna dodecastigma</i>	Epilachna beetle	Coleoptera: Coccinellidae.	Grubs and adults	Brinjal, Tomato, Pumpkin	Leaves
17.	<i>Erionota thrax</i>	Banana Skipper	Lepidoptera: Hesperidae	Caterpillars	Coconut	Leaves
18.	<i>Erionota torus</i>	Tapioca Shoot Borer	Lepidoptera: Hesperidae	Caterpillars	Tapioca	Stem
19.	<i>Hendecasis duplifascialis</i>	Jasmine Budworm	Lepidoptera: Pyraustidae	Caterpillars	Jasmine	Buds
20.	<i>Idioscopus clypealis</i>	Mango Leafhopper	Hemiptera: Cicadellidae	Nymphs and adults	Mango	Inflorescence, Leaves
21.	<i>Maruca vitrata</i>	Bean Pod Borer	Lepidoptera: Crambidae	Caterpillars	Cowpea, Betel Leaf	Leaves
22.	<i>Paracoccus marginatus</i>	Papaya Mealybug	Hemiptera: Pseudococcidae	Nymphs and adults	Hibiscus, Papaya, Pepper	Stem, Leaves

23.	<i>Pegomya hyoscyami</i>	Spinach leafminers	Diptera: Anthomyiidae	Larve	Spinach	Leaves
24.	<i>Phenacoccus solenopsis</i>	Solenopsis mealy bug	Hemiptera: Pseudococcidae	Nymphs and adults	Ladies finger	Stem, Leaves, Fruits
25.	<i>Phyllocnistis citrella</i>	Citrus leafminer	Lepidoptera: Gracillariidae	Caterpillars	Cinnamon	Leaves
26.	<i>Plocaederus ferrugineus</i>	Cashew Stem and Root Borer	Coleoptera: Cerambycidae	Larvae	Cashew	Stem, Root
27.	<i>Raoiella indica</i>	Red Palm Mite	Trombidiformes: Tenuipalpidae	Larvae and adults	Pepper, Banana, Ginger	Stem, Leaves
28.	<i>Rhynchophorus ferrugineus</i>	Red Palm Weevil	Coleoptera: Curculionidae	Larvae and adults	Coconut	Trunk
29.	<i>Scirtothrips dorsalis</i>	Chilli thrips	Thysanoptera: Thripidae	Nymphs and adults	Breadfruit, Chilli	Leaves
30.	<i>Sitophilus linearis</i>	Tamarind weevil	Coleoptera: Curculionidae	Larvae and adults	Tamarind	Fruit
31.	<i>Strymon megarus</i>	Pineapple Fruit Borer	Lepidoptera: Lycaenidae	Caterpillars	Pineapple	Fruits
32.	<i>Tetranychus cinnabarinus</i>	Red spider mite	Acarina: Tetranychidae	Nymphs and adults	Jasmine	Leaves

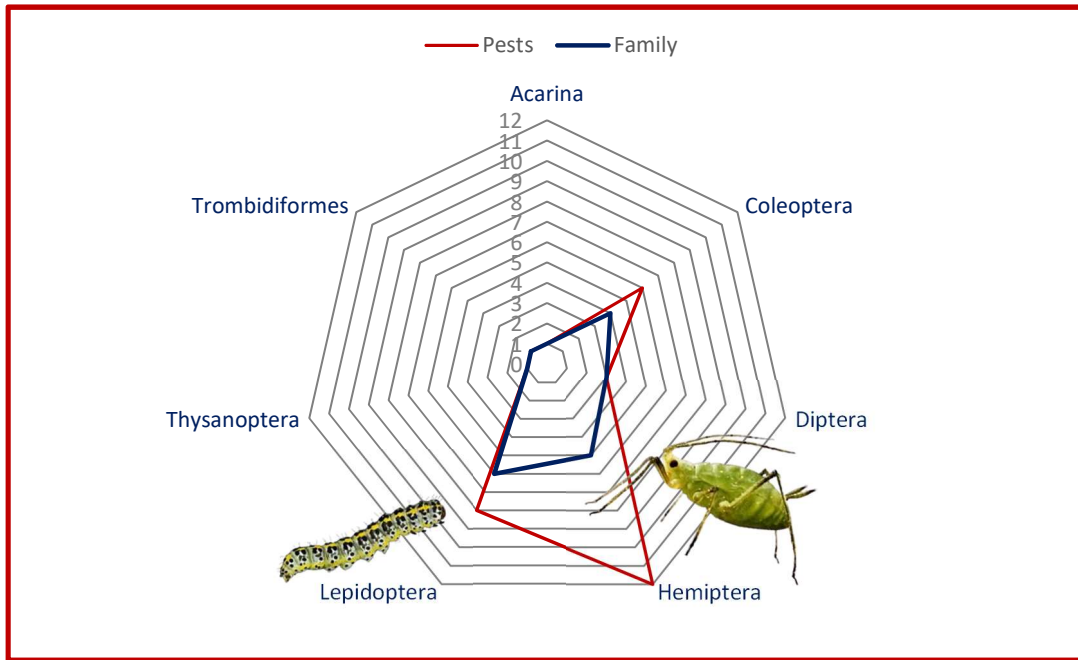


Fig. 1. Relative abundance of pests under various orders

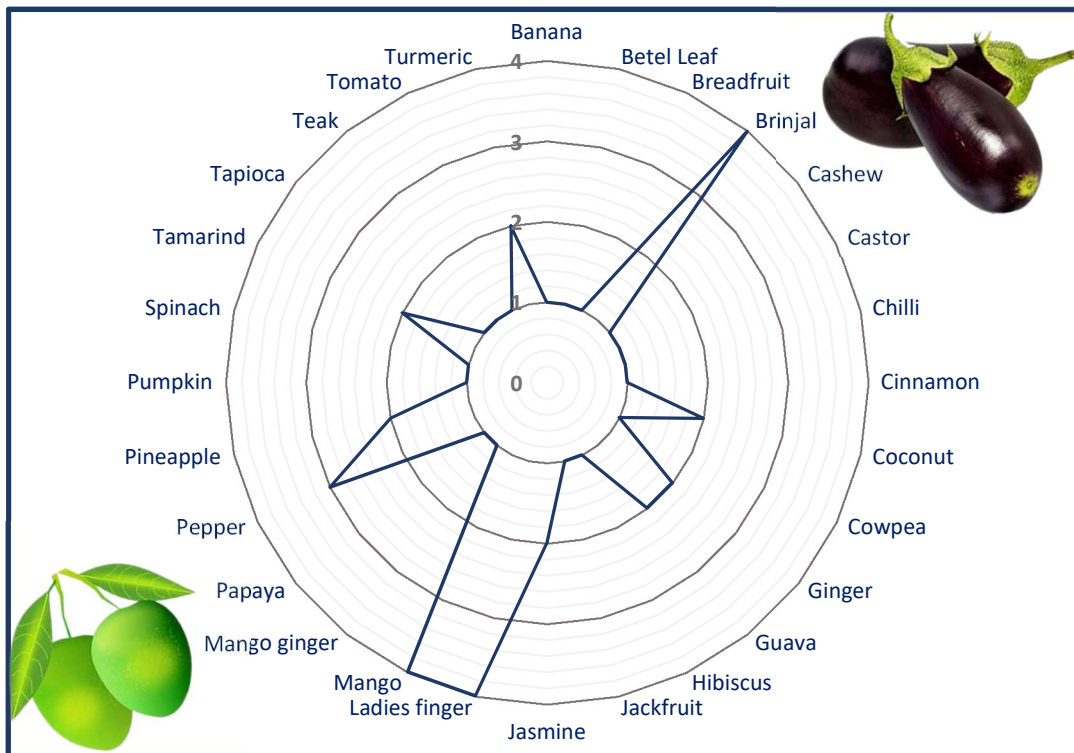


Fig. 2. Relative abundance of pests on observed plants

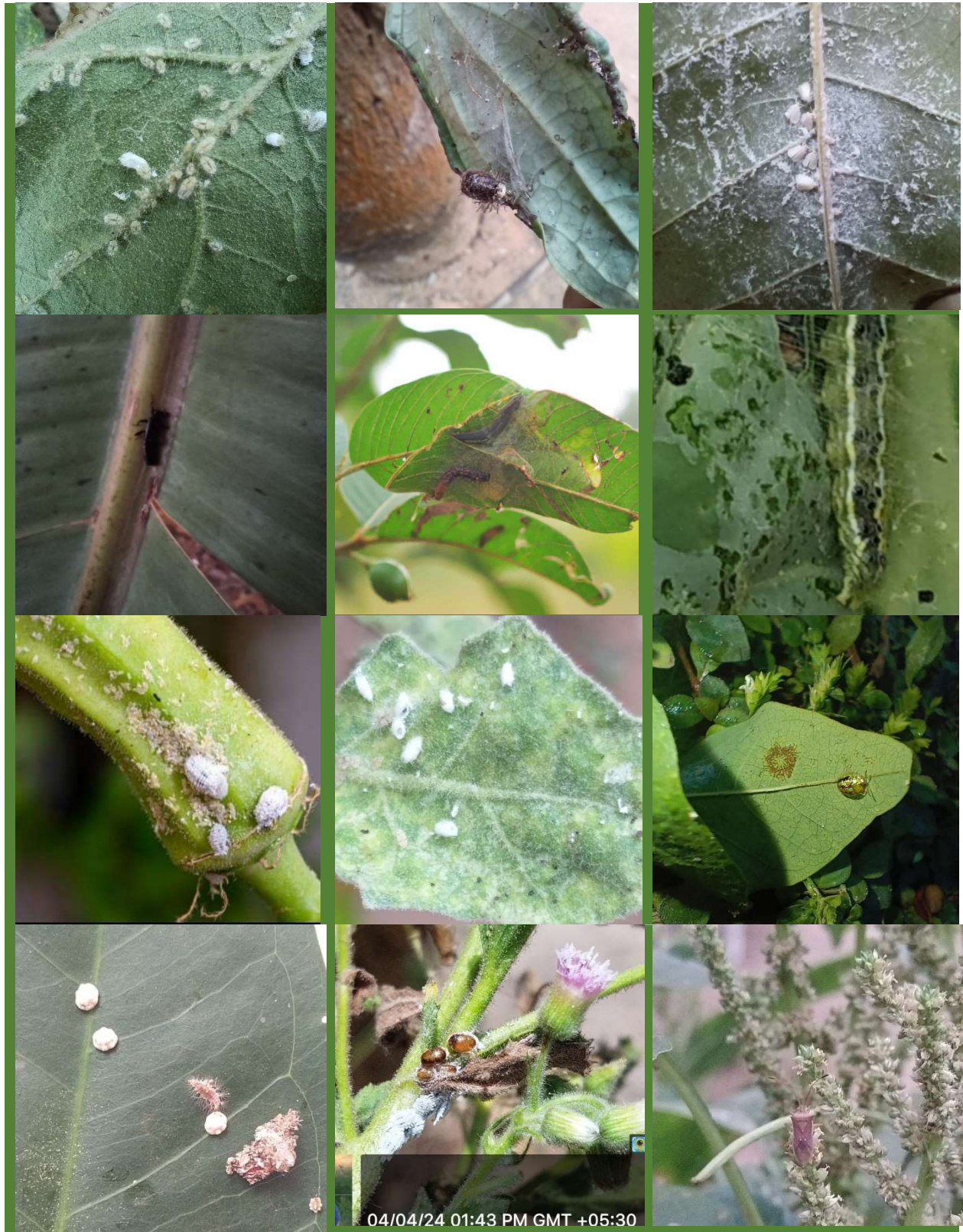
## Pests observed from various plants



## Pests observed from various plants



## Pests observed from various plants



## Pests observed from various plants



## Observation and identification



## **SUMMARY AND CONCLUSION**

Our study contributes valuable insights into the diversity and prevalence of arthropod pests in native vegetation within the Kollam District. The prevalence of diverse pests across various native vegetation poses significant challenges to agricultural and horticultural practices in the region. Factors such as changing climatic conditions, inadequate pest management practices and the absence of natural predators contribute to the proliferation of these pests. Lepidoptera, Hemiptera, and Coleoptera are the most represented orders, with significant diversity observed. Low pest infestation is noted overall, with some plants such as brinjal, ladies finger, mango, and pepper showing slightly higher pest counts. Certain insects emerged as predominant (mealybugs, aphids, and caterpillars), indicating potential focal points for targeted pest management strategies. The need for targeted pest management strategies is highlighted, especially for crops with higher pest occurrences. The infestation of pests not only leads to reduced crop yields but also affects the quality and market value of agricultural produce. Furthermore, the influence of environmental factors on pest populations became evident, highlighting the complex interplay between ecological elements and pest diversity.

Understanding this diversity is vital in devising effective pest management approaches. Further research in agroecological pest management is warranted to effectively address pest challenges in diverse agricultural landscapes. Integrating this knowledge into agricultural practices can aid in developing more sustainable and eco-friendly pest control measures. By implementing strategies that harness natural pest control mechanisms and reduce reliance on chemical interventions, farmers can potentially mitigate pest damage while preserving the ecosystem. Integrated pest management (IPM) approaches that combine cultural, biological, and chemical control methods are essential. These strategies aim to minimize the use of pesticides while effectively managing pest populations. Additionally, promoting biodiversity in agricultural landscapes and enhancing soil health can help build resilience against pest infestations.

While this study has shed light on various aspects of arthropod pest diversity, it is not without limitations. Factors such as the scale of the study and the dynamic nature of ecosystems pose challenges. Future research endeavors could focus on long-term monitoring, encompassing wider geographical areas and taking into account additional variables such as climate change impacts. Collaborative efforts involving farmers, researchers, and policymakers are crucial for

implementing sustainable pest management practices and ensuring food security in the region. By addressing the root causes of pest outbreaks and adopting holistic approaches to pest control, stakeholders can mitigate the adverse effects of pests on native vegetation and promote long-term agricultural sustainability.

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