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Non-chemical Tea Pest Management Practices Adopted by Small Tea Growers of Dibrugarh & Tinsukia District of Assam, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The main objective of the present study was to meticulously document the non-chemical approaches to tea pest management employed by small tea growers in the Dibrugarh and Tinsukia districts of Assam. In response to the constraints imposed by the COVID-19 pandemic, the research team resorted to telephonic interviews, utilizing a well-structured questionnaire to gather information from these tea growers. Through this method, the study successfully captured and documented the specific practices, materials, techniques, and methods utilized by these growers in

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their ongoing battle against tea pests. The study brought to light a diverse array of non-chemical methods that have been embraced by tea growers in this region. These practices, deeply rooted in traditional knowledge, demonstrated their remarkable effectiveness in pest management. What makes these findings particularly significant is the potential they hold for future scientific investigations. These traditional techniques, when subjected to rigorous validation and refinement, could find broader application in large-scale tea pest management initiatives, offering a more sustainable and eco-friendlier alternative to conventional chemical methods. A noteworthy aspect of these non-chemical practices is the sourcing of ingredients. These materials were found to be locally available and abundant, derived from both plant and animal origins. This accessibility not only ensures the practicality of these methods but also highlights their compatibility with the local ecosystem. Importantly, these traditional practices were identified as crucial tools in combating infestations by various pests, including the red spider mite (*Oligonychus coffeae*), tea mosquito bug (*Helopeltis theivora*), and looper caterpillar (*Buzura suppresseria*). In conclusion, this study focused on the valuable task of gathering insights into the non-chemical pest management methods practiced by small tea growers in the Dibrugarh and Tinsukia districts of Assam. Despite the adversities posed by the pandemic, the telephonic interviews proved to be a robust means of collecting invaluable information about these practices. The study not only underscored the efficacy of these traditional methods but also emphasized their potential for further scientific exploration and subsequent integration into broader tea pest management strategies. This presents a promising and environmentally friendly path forward for the tea industry in this region and beyond.

Keywords: Non-chemical; tea; pests; traditional knowledge.

1. INTRODUCTION

The cultivation of tea, one of the world's most consumed beverages, plays a pivotal role in the global economy and agricultural landscape. However, the tea industry faces a persistent challenge in the form of pests that can jeopardize the quality and yield of tea plantations. Traditional approaches to pest management have often relied heavily on chemical pesticides, which have proven effective but also brought about a range of unintended consequences. The overreliance on chemical pesticides has sparked concerns about their adverse effects on both the environment and human health. The indiscriminate use of these chemicals can lead to pesticide residues on tea leaves, thereby impacting the health-conscious consumer's preference for pesticide-free products. Moreover, the emergence of pesticide-resistant pest strains poses a significant threat to the sustainability of pest management strategies based solely on chemical interventions. Recognizing the need for a more balanced and sustainable approach, researchers and tea growers are turning their attention to non-chemical methods of pest management. These methods encompass a diverse range of practices, each with its unique set of advantages. By harnessing natural processes, such as biological control, plant resistance mechanisms, and cultural practices, non-chemical strategies offer an environmentally friendly and effective alternative to traditional chemical approaches. This study delves into the world of non-chemical methods for tea pest management, aiming to shed light on their efficacy, practicality, and potential for widespread adoption. By investigating these approaches, we gain insights into their ability to mitigate the negative impacts of chemical pesticide usage while maintaining or even enhancing tea plantation productivity. This research contributes to the broader dialogue surrounding sustainable agriculture, exploring methods that strike a balance between pest control and environmental preservation. As the world grapples with the imperative to reduce the environmental footprint of agricultural practices, the exploration of non-chemical pest management strategies takes on greater significance. Through a deeper understanding of these methods, we aim to pave the way for a more resilient and ecologically sound tea industry that meets the demands of both consumers and the environment.

“Recently in Assam, these traditional plant protection practices have been adopted by many small tea growers in different pockets of the state” [1]. Given the scarcity of accessible information concerning such practices, the current study addresses a notable gap. Considering the aforementioned circumstances, the present research endeavors to examine "Non-chemical tea pest management practices adopted by small tea growers of Dibrugarh and Tinsukia districts of Assam." The

primary aim of this investigation is to gather insights into the non-chemical techniques employed by small tea growers in the Assam region.

2. MATERIALS AND METHODS

The study was conducted during 2019-2021 in Dibrugarh and Tinsukia district of Assam. A selection of tea growers from each district was chosen to participate in the data collection process concerning non-chemical practices employed for tea pest management. The methods encompassing materials, techniques, and procedures were meticulously recorded by the interview schedule. The findings from these observations have been comprehensively outlined in Table 1.

3. RESULTS AND DISCUSSION

A total of 20 tea growers were specifically chosen for participation in interviews aimed at gathering information about their utilization of traditional or non-chemical methods for insect and pest management, as detailed in Table 1. The intricacies of these practices, encompassing materials, techniques, and methods, were meticulously recorded following the provided interview framework. These growers were actively employing these time-honoured practices to effectively mitigate the presence of tea pests such as the red spider mite (*Oligonychus coffeae*), tea mosquito bug (*Helopeltis theivora*), and looper caterpillar (*Buzura suppresseria*). Abundant local resources were utilized as ingredients in these practices. Some potential plants useful for the pest management were Ghora neem (*Melia azedarach),* Karanj *(Pongamia glabra),* Pothorua bihlongoni (*Polygonum hydropiper),* bhoot jolokia (*Capsicum chinense*), Agora (*Xanthium strumarium),* Water hyacinth *(Eichhornia crassipes),* Dhopat tita *(Clerodendrum infortunatum),* Citronella *(Cymbopogon nardus [2])* as shown in Table 2. It was found that 45% of the small tea growers used cow urine with *Melia azedarach, Pongamia glabra* and *Polygonum hydropiper* combinations for management of red spider mite. Other materials were used in small quantities. Overall control of tea pest prepared from the indigenous products was 60-80% Similar studies were conducted by many workers [1,2].

Table 1. Non-chemical methods used by small tea growers

Target pest	Materials used	Practice/preparation/method of application	Farmer's Observation	Location
1. Red spider mite (*Oligonychus coffee*), Looper caterpillar (*Buzura suppresseria*)	a) Bhoot jolokia- 0.5 kg and Cow urine-20L b) Neem-15kg Pothorua bihlongoni- 10kg , Baam bihlongoni-10kg and Water-50L	a) Bhoot jolokias are crushed, mixed with cow urine and kept for 7 days. The solution is then filtered and sprayed on infested bushes at 5L in 100L of water at 30days interval. b) Neem, Pothorua bihlongoni and Baam bihlongini are crushed and mixed with water and kept for 10days. The solution is then filtered and sprayed on infested bushes at 10L in 100L of water at an interval of 10 days.	Satisfactory control	Dibrugarh
2. Red spider mite (*Oligonychus coffee)*	Sour Curd- 4kg Wheat flour- 8kg Soapy Water-50L	10L of lassi made form sour curd, 10L of wheat flour and water solution then mixed with soapy water and kept for 6 hours. The solution was sprayed on infested bushes at 20L in 100L of water through 200L power machine at 3 months of interval.	Satisfactory control	Dibrugarh
3. Red spider mite (*Oligonychus coffee)*	Cowdung-20kg 20L- Cow urine 2kg-Oil cake Gur-1kg Karanj-10kg Weed- 5kg Water- 20L	Karanj leaves are crushed and mixed with cow dung, cow urine, oil cake, gur, weed, water and kept for 20 days. The solution is then filterd and sprayed on infested bushes at 10L in 200L of water at 1 month interval	Satisfactory control	Dibrugarh
4. Red spider mite	Bhoot Jolokia- 0.5kg	Bhoot jolikia and dhapaat tita leaves are crushed and mixed with gur and	About 80%	Dibrugarh

Target pest	Materials used	Practice/preparation/method of application	Farmer's Observation	Location
(*Oligonychus coffee)*	Gur- 5kg Dhapaat tita- 20kg Water- 50L	water,kept them for 10days. The solution is then filtered and sprayed on infested bushes at 20L in 100L of water when required.		
5. Red spider mite *(Oligonychus coffee)*	Cow urine-10 L Cow dung- 10kg Neem- 10kg Dhopaat tita- 5kg Water-50L	Neem, Dhopaat tita are crushed and boiled in water. The solution is then filtered and sprayed on infested bushes at 10L in 100L water at 21days interval.	Satisfactory control	Dibrugarh
6. Tea Mosquito Bug *(Helopeltis theivora)* 7. Red spider mite *(Oligonychus coffee)*	Neem- 10kg Karanj- 10kg Aatlaas leaves- 5kg Dhopaat tita- 5kg Water-50L	Neem, Karanj, Aatlas leaves, Dhopaat tita are crushed and mixed with water, kept for 10 days. The solution is then filtered and sprayed on infested bushes at 10L in 100L water at 21days interval.	Satisfactory control	Dibrugarh
8. Tea Mosquito Bug *(Helopeltis theivora)*	Bhoot jolokia- 0.5kg Piyaz- 3kg Water- 90ml	Bhoot jolokia and onions are crushed and mixed with water are kept for 1 day. The solution is then filtered and sprayed on infested bushes at 10L in 100L water at 7days interval.	About 70% control	Dibrugarh
9. Tea Mosquito Bug *(Helopeltis theivora)* 10.	Neem - 10kg Pothorua bihlongoni- 10kg Water hyacinth- 5kg Water- 50L	Neem, Pothorua bihlongoni and water hyacinth are crushed and soaked in water for 15 days. After that filtered and sprayed in the field at 20L in 100L of water. It was sprayed when required.	Satisfactory control	Dibrugarh
11. Red spider mite (*Oligonychus coffee)*	Sebu guti- 1kg Cowdung- 10kg Water- 50L	Sebu gutis are crushed and soaked in water for 1 day, cow dung dip in water for 1 day after that mixed the both mixture and filtered and sprayed on infested bushes at 10L in 100L of water at 20 days of interval.	About 50% control	Dibrugarh
12. Looper caterpillar (*Buzura suppresseria*)	Dhopaat tita- 5kg Bahek tita- 5kg Water- 100L	Dhopat tita and bahek tita leaves ae crushed and dip in 100L water for 24 hours and filteres and sprayed in the field.It was sprayed when required.	About 70% control	Dibrugarh
13. Looper caterpillar (*Buzura suppresseria*)	Neem - 10kg Pothorua bihlongoni- 5kg Water hyacinth- 5kg Water- 50L	Neem, Pothorua bihlongoni and water hyacinth are crushed and soaked in water for 7 days. After that filtered and sprayed in the field at 10L in 100L of water. It was sprayed when required.	70% control	Tinsukia
14. Looper caterpillar (*Buzura suppresseria*)	Ghora neem-5kg Karanj- 5kg Garlic-1kg Onion-2kg Cow urine-15L Water-50L	Ghora neem, karanj, garlic, onion are crushed and mixed with cow urine, water and kept in a cool place for 10 days. The solution is then filtered and sprayed on infested bushes at 20L in 100L of water when required.	Satisfactory control	Tinsukia
15. Red spider mite (*Oligonychus coffee)*	Karanj- 10kg Cow dung- 5kg Cow Urine-20L Water-100L	Karanj leaves are crushed,soaked in water for 1 day then mixed with cow dung, cow urine, water are kept for 5-7 days then the solution is filtered and sprayed on infested bushes at 20L in 100L water at 21 days intervals.	About 60% control	Tinsukia
16. Red spider mite (*Oligonychus coffee)*	Bhoot jolokia-0.5kg Gur-3kg Cow urine-20L	Bhoot jolokias are crushed, mixed with gur, and cow urine and kept for 10 days. The solution is then filtered and sprayed on infested bushes at 5L in 100L of water at 30days intervals	About 80% control	Tinsukia

Target pest	Materials used	Practice/preparation/method of application	Farmer's Observation	Location
17. All pests	Ghora neem-5kg Karanj- 5kg Garlic-1kg Cintronella Grass-2kg Cow urine-15L Water-50L	Ghora neem, karanj, garlic, cintronella are crushed and mixed with cow urine, water and kept in cool place for 7-10 days. The solution is then filtered and sprayed on infested bushes at 20L in 100L of water at 30 days interval	About 80% control	Tinsukia
18. All pests	Ghora neem-5kg Fish waste- 2kg Cow dung-3kg Water-15L	Leaves of ghora neem are crushed and boiled, mixed with cow dung and fish waste overnight. Next day the mixture is sprayed to the affected area @250ml/15L water. Sprayed at 15days interval.	About 50% control	Tinsukia
19. All pests	Neem - 10kg Pothorua bihlongoni- 5kg Water hyacinth-5kg Water- 50L	Neem, Pothorua bihlongoni and water hyacinth are crushed and soaked in water for 7 days. After that filtered and sprayed in the field at 10L in 100L of water. It was sprayed when required.	About 80% control	Tinsukia
20. All pests	Ghora neem-5kg Karanj- 5kg Garlic-1kg Onion-2kg Cow urine-15L Water-50L	Ghora neem, karanj, garlic, onion are crushed and mixed with cow urine, water and kept in cool place for 10 days. The solution is then filtered and sprayed on infested bushes at 20L in 100L of water when required.	Satisfactory control	Tinsukia

Table 2. Some potential plants useful for tea pest management

Scientific Name	Common name	Local name	Parts used
Pongamia pinnata	Pongum	Karanj	Leaves
Melia azadirac	Neem	Ghora neem	Leaves
Polygonum hydropiper	Knot weed	Pothorua bihlongani	Aerial parts
Adhatoda vasica	Basaka	Teeta bahek	Leaves and succulent stems
Azadirachta indica	Neem	Mahaneem	Leaves and seeds
Allium sativum	Garlic	Nohoru	Whole plant
Capsicum annum	Chilli pepper	Jolokia	Fruits
Eichhornia crassipes	Water hyacinth	Meteka	Whole plant
Clerodendrum viscosum	Clerodendrun	Dhopat teeta	Leaves and succulent leaves
Capsicum chinensis	Ghost pepper	Bhut jolokia	Fruits
Nicotinna tabacum	Tabacco	Dhopat	Dried Leaves
Phyllanthus emblica	Amla	Amlokhi	Leaves and fruits
Musa acuminata	Banana	Kol	Pseudostem
Ocimum tenuiflorum	Tulsi	Tulasi	Leaves

Assam is renowned for its tea production, and the region's small tea growers play a pivotal role in the industry. This study serves as a valuable contribution to the broader field of agriculture and pest management by shedding light on alternative, eco-friendly methods to control pests in tea plantations [3,4]. It not only addresses the immediate concerns of small tea growers but also aligns with global efforts to reduce the ecological footprint of agriculture, making it highly pertinent in the context of agroecological research [5,6].

Furthermore, the comparison of these non-chemical pest management practices with agroecological studies in other tropical territories adds another layer of significance to the research [7,8]. By assessing the efficacy of these practices in the unique environmental and geographical conditions of Assam and contrasting them with similar studies in other tropical regions [9,10] this research can provide insights into the adaptability and generalizability of these methods [11,12]. This comparative aspect of the study can inform policymakers [13,14], researchers [15,16], and farmers alike about the potential for knowledge transfer and the development of sustainable [17,18], context-specific pest management strategies in diverse tropical ecosystems [19,20]. In summary, the scientific relevance of this study lies in its potential to promote sustainable agricultural practices

[21,22], protect biodiversity [23-27], and contribute to the global discourse on agroecological approaches to pest management in tropical regions [28-31].

4. CONCLUSION

Based on the current investigation, it is evident that the preparation methods employed in traditional practices vary across different regions and necessitate validation and standardization. Given the relatively small-scale nature of these plantations, growers have been able to effectively address pest management by embracing these techniques. Once these practices are standardized, they have the potential to significantly benefit the small tea grower segment of the tea industry, facilitating the production of organic tea and thereby contributing positively to the future of the tea industry.

5. FUTURE PROSPECT

The investigation outlined in the research appear promising and hold significant potential for the tea industry. The recognition of variations in traditional tea preparation methods across different regions highlights the need for validation and standardization. Once these methods are thoroughly studied and standardized, they can pave the way for improved quality and consistency in tea production. Moreover, the emphasis on pest management techniques within small-scale plantations is a positive indicator of sustainable and environmentally-friendly practices. As these methods become more widely adopted and integrated into the industry, there is potential for the emergence of a thriving segment of small tea growers specializing in organic tea production. This could not only lead to increased market demand for organic tea but also contribute positively to the long-term sustainability and growth of the tea industry as a whole.

CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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