Case Report

Bed Bugs Infestation and Control at a Tea Stall in Lahore City: A Case Study

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Abstract | Various researches on bed bugs (Family: *Cimicidae*) have been performed in the recent past due to their re-activation in the world. These bed bugs primarily infest enclosed and inadequately ventilated spaces. They are more prevalent in densely populated areas where there is minimal movement of household furniture and bedding, particularly during the hot and humid seasons in Pakistan. Bed bugs pose direct effects by bite-associated allergies and blood-sucking; indirectly by affecting mental health. Although many bed bug control strategies are available, in this case heat treatment through boiling water was used as a control strategy. Boiling water causes thermal injury and death of bugs by desiccation. This strategy is an effective and cheap control strategy because no specific instrumentation and chemical are required.

Keywords | Bed bug, Heat treatment, Thermal injury, Bite allergy, Mental health

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INTRODUCTION

Bed bug (Order: Hemiptera; Family: *Cimicidae*) infestation remained a challenge for the human population since ancient times. During the past few years bed bug infestation has re-emerged and gained importance, especially in the big cities of developing countries like Pakistan. The most commonly found species include *C. lectularis* and *C. hemipterus*. *C. lectularis* is more prevalent than *C. hemipterus* in field conditions. Highly infested areas include closed buildings with poor sanitation and hygiene. Bed bugs directly affect the human population by blood feeding and bite allergy. Indirectly, they impact mental health by disrupting daily routines, particularly during night time sleep, owing to their nocturnal feeding habits (Akhoundi et al., 2020; Reinhardt, 2019).

Bed bugs are not detected while biting because they do not annoy by injecting an anesthetic material into the host through their saliva before blood feeding. Generally, people ignore bed bug infestation due to a lack of awareness about their harmful effects. In most cases, household insecticides are used as a control measure. Irrational use of insecticides can cause resistance in bugs leading to management failure. Accidental exposure of insecticide to humans affects mental and reproductive health. The development of resistance against pyrethroids and organophosphates rendered these insecticides no more effective against these hemipterans. The development of instant, cheap, and effective control methods and spreading awareness about them are current-

ly topics of interest in the scientific community (Gaire et al., 2020).

The suitable climatic conditions for bed bug spread are prevalent during the spring and summer seasons in Pakistan. Bed bugs have an Incomplete (hemimetabolous) life cycle in which egg-hatched nymphs almost like adults gradually change to adults in five instars. Bed bugs are prevalent around the year but in unfavourable seasons they become dormant in their hideouts due to adverse environmental conditions. Their safe hideouts include cracks or crevices in furniture and walls. Due to the high reproduction rate a resurgence is observed on the arrival of their favourable season (Štefka et al., 2022).

The susceptibility of bed bugs to elevated temperatures has made steam and hot water effective control strategies against them. Additionally, all the life stages are prone to heat treatment. Heat treatment kills the bugs that are exposed to it and also those that are present in their hideouts. Studies show that both temperature treatment and a mixture of heat, and insecticide are effective against bed bugs. Additionally, the data confirms that heat treatment is more effective and faster than insecticide treatment. In integrated pest management against bed bugs, heat treatment, both in the form of steam and hot water has been successful in the field conditions. However, heat treatment yields only transient effects. Due to the lack of long-term effects bed bugs can escape the heat treatment by moving towards their safe hideouts before their exposure to lethal temperatures. Repeated treatment with high temperatures is necessary for the complete elimination of bed bugs (Kong et al., 2023; Rukke et al., 2021).

Although effective commercial products for bed bug control are available in different areas the purpose of this study was to evaluate the efficacy of easily accessible repeated heat treatment methods for control of bed bugs in overcrowded areas of less developed communities.

MATERIAL AND METHODS

People visiting the tea stall reported several focal areas of bite-associated allergy. Efforts were made to identify the origin of the allergy. After keen observation, several tiny creatures were observed coming out of services on wooden benches in the sitting area Figure 3. A sample was taken to the Entomology Laboratory, Department of Parasitology, University of Veterinary and Animal Sciences, Lahore, Pakistan. Stereo-microscopic identification by morphological features revealed these tiny creatures as bed bugs Figure 2. The manager showed strict action at the complaint of its customers. Boiling water was applied to the sitting area including benches and sitting benches were also exposed to sunlight. The treatment was repeated twice with boiling water application on the sitting area and its benches. The second treatment was repeated with an interval of three days and there was two days interval between the second and third treatments Figure 1.

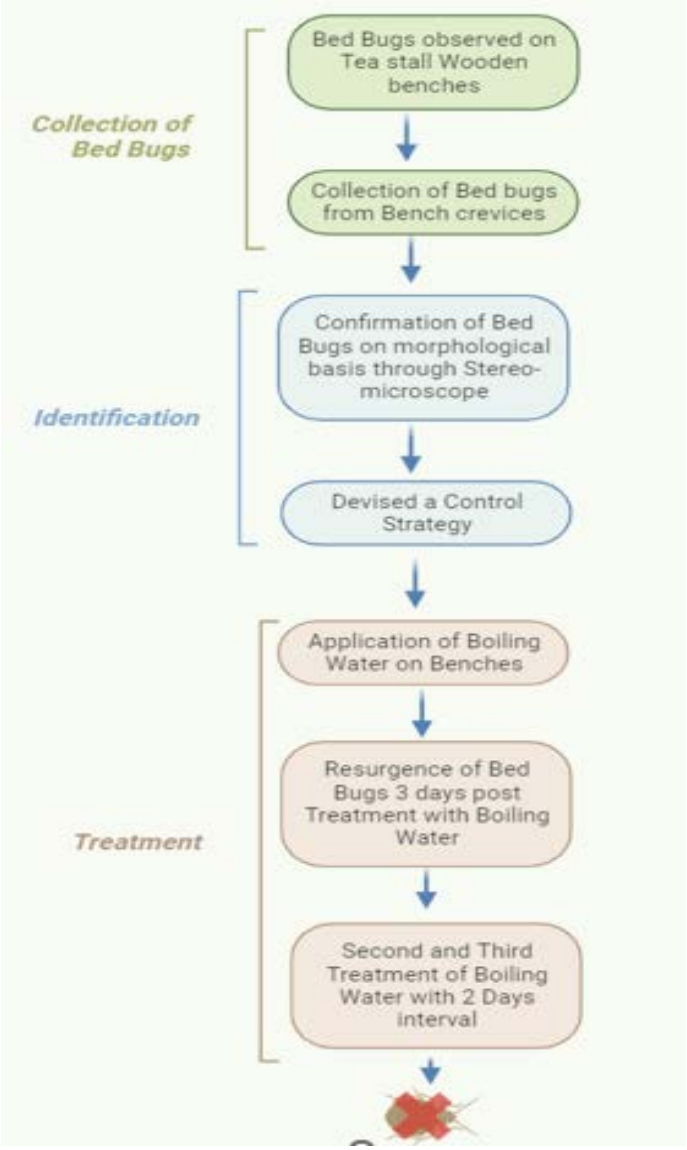

Figure 1: Materials and Method

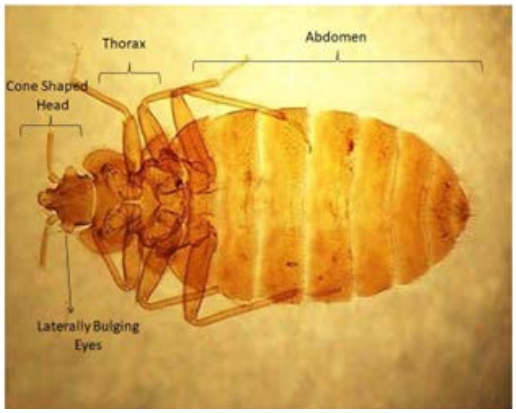

Figure 2: Bed Bug Labelled Under Sterio-Microscope

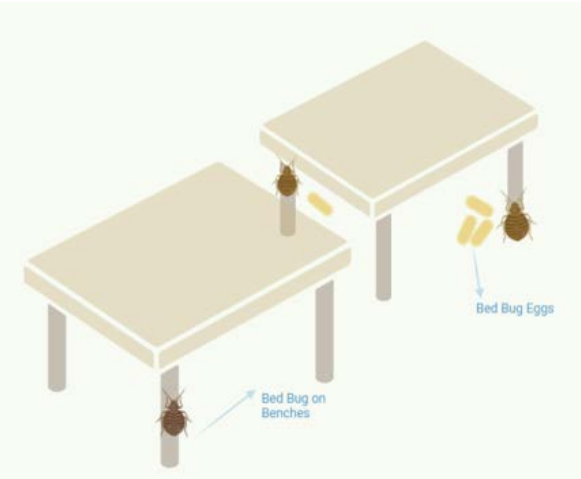

Figure 3: Bench Illustration with Bed Bugs

RESULTS

A noticeable impact on the bed bug population was observed following the initial treatment with boiling water, with a temporary disappearance immediately afterward. However, within three days, the bed bugs reappeared, although in smaller numbers than the untreated population. The initial post-treatment resurgence suggested a partial efficacy of the boiling water treatment.

Encouragingly, subsequent treatments with boiling water proved more successful. After the second and third applications, a significant reduction in the bed bug population was noted, eventually leading to complete elimination. This demonstrated the effectiveness of the boiling water method in achieving a lasting solution to the bed bug infestation.

In addition to addressing the infestation, the bedbug bite allergy was managed through a topical application of a 1 percent solution of hydrocortisone. This approach aimed at alleviating the discomfort and inflammation associated with bed bug bites. The use of hydrocortisone, a corticosteroid, is known for its anti-inflammatory properties, providing relief from the allergic reactions caused by bed bug bites.

This multi-step approach involving boiling water treatments effectively curtailed the bed bug population, leading to their complete elimination after the second and third applications. Simultaneously, the topical application of a hydrocortisone solution played a crucial role in managing the allergic reactions associated with bed bug bites, ensuring a comprehensive and successful resolution to the bed bug infestation and its aftermath.

DISCUSSION

It was very difficult to relate the allergy to bed bugs because the clinical manifestation was non-specific in nature. Secondly, it was also a challenge to find the origin of the allergy. Allergy was associated with only those peoples which regularly visited the tea stall. To investigate the environment of the tea stall we deeply observed the sitting area including the benches. On observation of bench crevices over-crowded population of adult and nymphal instars of bed bugs were observed. For their identification and treatment, laboratory procedures were necessary. Bed bugs are ectotherms and have a thermal death point of 45°C. Heat treatment in any form can induce physical injury and lead to desiccation, resulting in death. The desiccation injury not only affects nymphs and adults but also eliminates the egg stage (Alizadeh et al., 2020; Mathison and Pritt, 2021). Hot steam when applied only moves in the upward direction and also cannot be applied in an open space. Due to these factors, it does not penetrate the cracks and crevices in walls and furniture. More time is required for effective distribution of heat into cracks and crevices. Similarly to generate a threshold level of steam for the control of bed bugs relatively a high cost is required.

The boiling water, when applied effectively reaches the cracks and crevices. It does not provide any escape possibility for the bugs. Physical contact of bugs with boiling water causes thermal injury which instantly causes death of bed bugs. It is an easy, effective method that does not require any specific instrumentation for its application (Lee et al., 2023; Wang et al., 2018).

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CONFLICT OF INTEREST

There are no conflicts of interest.

NOVELTY STATEMENT

This research has highlighted a new strategy for the control of bed bugs infestation.

AUTHORS CONTRIBUTION

Kashif Nazir collected information and prepared the manuscript. Asmat Nawaz and Seraj Ud Din helped in bug's identification process. Inam Ul Haq and Moazam Ali Saim formulated figures. Shahzad Hur, Kashif Nazir and Mashal Mehreen supervised the whole process.

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