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The impact of climate change on population of *Leptocoris augur*

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Abstract

Leptocoris augur known as the red eye bug, is an economically significant pest that causes damage to the soapberry (rittha) plant, *Sapindus saponaria,* as well as various vegetables and fruit plants often found near host plants.This insect's diet primarily consists of seeds from diverse plant species, with dietary changes occurring as it progresses from nymph to adult stages. Future research should prioritize investigating the impacts of climate change on agricultural insect pests. This research aimed to examine how climate change affects the *Leptocoris augur* population. The study was conducted in Amravati from May to September. Global temperature increases due to climate change have posed threats to plant growth, production and distribution, while also leading to an increase in the *Leptocoris* population. Findings from this study indicated that *L. augur* populations increased with higher temperatures and decreased with lower temperatures.

Keywords:
Leptocoris augur, population, climate, temperature, Rainfall

Introduction

Insects, being poikilothermic creatures, are significantly influenced by various environmental conditions. *Leptocoris augur*, a species within the Class Insecta, Order Hemiptera, and Family Rhopalidae, was initially identified by Fabricius in 1781. This species is prevalent in Southeast Asia, including Indonesia, Malaysia, Myanmar, and Sri Lanka, and is found throughout India year-round. *Leptocoris augur* is a terrestrial insect measuring 11–16 mm in length, characterized by a red or reddish-orange dorsal surface and a black membrane. Its ventral side shares the red or reddish-orange hue, while its appendages are black. Hemiptera possess specialized mouthparts adapted for piercing and sucking.A distinctive trait of *Leptocoris* is its parental care, with at least one adult remaining with the nymph cluster. Commonly referred to as the red eye bug due to its striking red eyes, it is also known as the soapberry bug, as its typical host plant is the soapberry, *Sapindus saponaria* L.(1,3,10).Among climatic factors, temperature likely has the most significant impact on insect development (6). Consequently, temperature greatly influences insects' colonization, distribution, abundance, behavior, life history, and fitness (8).Therefore, understanding the thermal needs of invasive insect pests is crucial for control strategies, as temperature dictates the population growth and size of invasive pests and their variability under different conditions (9).Both nymphs and adults, equipped with piercing and sucking mouthparts, damage common vegetable and fruit plants like ladyfinger and cucumber.

Temperature affects many biological traits of insects, including sex ratio (13), adult life span, survival, fecundity, and fertility (12,4) according to earlier research.Climate factors, including higher temperatures,elevated atmospheric CO2 concentrations, and shifting precipitation patterns, greatly influence agricultural output and insect pests affecting agriculture. Climate

changes can impact insect pests in multiple ways. These changes may lead to a broader geographic range, better survival rates during winter, more generations, disrupted timing between plants and pests, altered interactions between species, a higher risk of invasion by migratory pests, more frequent insect-borne plant diseases, and decreased effectiveness of biological control, particularly natural predators. Consequently, there is a significant threat of economic losses in crops and a challenge to food security. As a key factor in pest population dynamics, climate change necessitates adaptive management strategies to address the evolving status of pests (7).

According to Joshi and Viraktamath (2004) , India is witnessing a decline in agricultural productivity due to variable temperatures, frequent droughts and floods, problematic soils, and a rise in insect-pest and disease outbreaks. These issues are expected to worsen with climate change, posing a significant challenge to achieving food security. As nighttime temperatures rise, the growth rates of caterpillars like the imported cabbageworm, *Pieris rapae*, also increase (11). Insects are crucial to ecosystems as they recycle nutrients and provide nourishment to organisms higher up the food chain, including humans. Furthermore, a large portion of the global food supply relies on pollinators such as bees and butterflies, and healthy ecosystems help control pest and disease-carrying insect populations. A study involving various taxa, including insects and other organisms from central Europe, found that temperature was a more significant predictor than habitat association for understanding trends in terrestrial organisms (1).An increase in temperature of 3°C (5.4°F) will nearly double the growth rate of the German cockroach, Blattella germanica. Similarly, a temperature rise of 5°C (9°F) has the same effect on the Indian meal moth, *Plodia interpunctella* (2). Thus, this study aims to examine the impact of temperature on the population of *Leptocoris augur*.

Material and Methods

The study was carried out in Amravati from May to September. During the studied period, the location's annual average rainfall, number of wet days, and maximum and lowest temperatures were 40 ° C and 31° C, respectively.

Result

The current study observed that the population of *L.augur* rose with an increase in temperature, while it declined as the temperature dropped. Additionally, higher rainfall led to a reduction in the population of *L. augur*.

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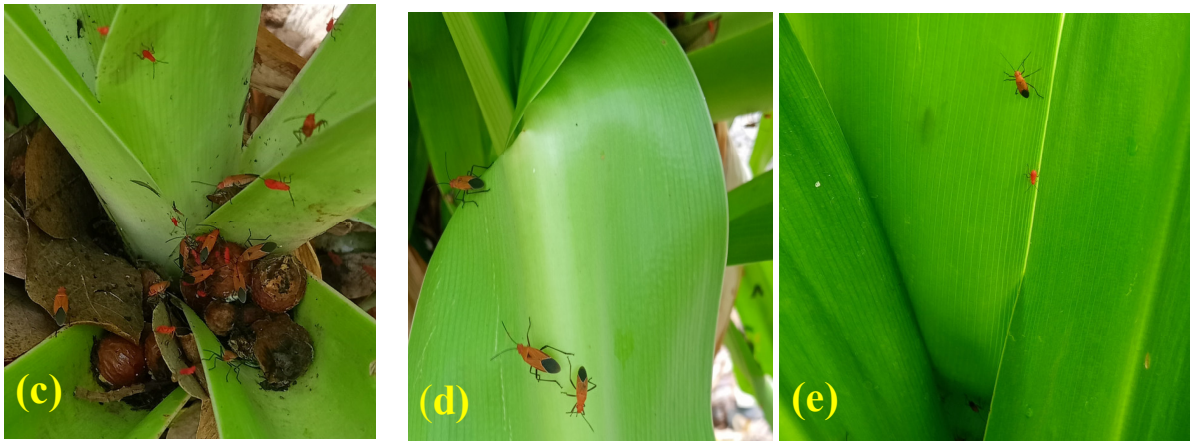

Fig .1: Effect of temperature on population of *Leptocoris augur*
Fig (a,b,c and d) showing maximum number of *L.augur* with increase temperature (40 ° C) and Fig. (e) showing minimum number of *L.augur* with decrease temperature (30 ° C).

Conclusion

It is well acknowledged that climate change, particularly temperature variations, significantly impacts the growth of agricultural crops and the insect pests that affect them. As temperatures rise, there is an average increase in pest outbreaks, involving a wider variety of insect pests. These insects are likely to expand their geographic range. Invasive pest species are expected to establish themselves more easily in new regions, leading to an increase in insect-borne plant diseases. Climate change creates favorable conditions for pest infestations and crop damage, posing a high risk of substantial economic losses and a threat to human food security. The current study found that the population of *L. augur* rose with higher temperatures and declined with lower temperatures.

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