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Original Article

# First record of *Kallima horsfieldii* (Sahyadri blue oakleaf) in a college campus in Bhiwandi, Maharashtra: Implications for urban biodiversity conservation

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***Abstract***

*This paper reports the first sighting of Kallima horsfieldii butterfly on a college campus in Bhiwandi, Maharashtra. The butterfly is endemic to the Western Ghats and belongs to the family Nymphalidae. The butterfly is protected under Schedule II of India's Wildlife (Protection) Act, 1972. The species is known to depend on specific larval host plants, which include Pseuderanthemum malabaricum, Strobilanthes callosus and Lepidagathis cuspidata. These plants belong to the Acanthaceae family and serve as essential nourishment for the caterpillars of this species. Notably, despite the scarce vegetation and the absence of host plants, the butterfly was observed utilizing microhabitats on a college campus. Such observations underscore the species' adaptability to urban settings where plant growth is severely constrained. K. horsfieldii, a sensitive bioindicator species, points to the ecological potential of fragmented urban green spaces in supporting biodiversity. This observation draws critical attention to the need for protecting microhabitats within urban settings. E.g. academic campuses can host biodiversity reserves through continuous monitoring along with community engagement. The paper also suggests the reintroduction of native vegetation in the framework of urban development to improve ecosystem resilience. Thus, by promoting the growth of native plants, urban planners can create a favourable environment to support not only K. horsfieldii but also a variety of other species.*

***Keywords:*** *Kallima horsfieldii, urban biodiversity, butterfly host plants, urban microhabitats, habitat restoration.*

## Introduction

### Taxonomy and Morphology of *Kallima horsfieldii*

*Kallima horsfieldii*, belongs to the Nymphalidae family, is commonly known as the Sahyadri Blue Oakleaf and it is a butterfly species confined to the Western Ghats of India *(Varshney & Smetacek, 2015) (Sadasivan & Sengupta, 2024)*. According to *Wang et al. (2022)* males and females have blue and brown dorsal wings respectively, while the ventral wings are leaf-shaped to provide camouflage with their surroundings. *Wang* elaborated that this feature is so advanced that the butterfly's wings appear like closed leaves, an aspect common across *Kallima* species. The dried- and wet-season varieties of the species exhibit subtle variation in band pigmentation and colour patterning on the wings, demonstrating responsive phenotypic plasticity to environmental changes *(Bingham, 1905)*.

### Butterflies as Bioindicators of Ecosystem Health

Recent studies suggest that butterflies are one of the most vulnerable and hence the most effective bioindicators because they are able to react quickly to climate change, habitat destruction, and pollution *(Parikh et al., 2021) (Ismail et al., 2020)*. Butterflies, with short life spans specific feeding habits, and behavioural thermoregulation, are efficacious indicators of ecological health *(Whitworth et al., 2018) (Ghazanfar et al., 2016)*. With urbanization comes a loss in biodiversity, particularly with the loss of host plants and nectar providers. However, *K. horsfieldii* is one of the persistent butterflies that could occupy niche positions in altered environments. Studies in Fuzhou, China, and Sierra Leone have demonstrated that butterfly community composition correlates strongly with vegetation quality and anthropogenic stress *(Chowdhury et al., 2023)*.

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**Larval Host Plant Specificity**

The larvae of *K. horsfieldii* feed solely on *Pseuderanthemum malabaricum*, *Strobilanthes callosus*, and *Lepidagathis cuspidata* that belong to the Acanthaceae family *(WynterBlyth 1957; Robinson et al. 2010; Bell 1910; Nitin et al., 2018)*. These plants are usually found in the humid and dark understory of tropical forests. *Kasambe and Giri (2020)* found *Eranthemum roseum (Acanthaceae)* as a new larval host plant. The absence of these host plants on the Bhiwandi campus raises questions about the butterfly's origin and survival strategy, suggesting either transient dispersal from nearby forest fragments or cryptic host plant utilization. This aligns with studies showing that butterflies in fragmented landscapes can disperse up to 5–10 km to exploit microhabitats for basking or transient shelter *(Rochat et al., 2017)*.

**Urban Biodiversity and Legal Protections**

Urbanization poses substantial challenges to butterfly populations, primarily through habitat fragmentation and loss of host plants. However, the recent observation, highlights the role of urban green spaces including college campuses, can serve as important refuges for butterflies, supporting local biodiversity *(Azahra et al., 2022) (Starlin & Rani, 2024)*. The presence of *K. horsfieldii* in an urban area is significant as it reveals important information regarding the adaptability of the species and the potential for urban landscapes to contribute to conservation efforts.

*K. horsfieldii*, is listed under Schedule II of the Wildlife (Protection) Act 1972 and therefore cannot be captured, traded, or harmed without permission. This strengthens and supports the conservation purposes of the species, however in this case, urban expansion still negatively impacts the habitat *(The Wild Life (Protection) Act, 1972) (Kunte et al., 2025)*.

**Materials and Methods**

**Study Site**

The study was conducted on a G. M. Momin College campus college campus in Bhiwandi (19°17'42"N 73°03'23"E), which is an urban area located in the state of Maharashtra (Fig 1). The campus features sparse vegetation, with approximately 15-20% green cover. The flora comprises a mix of native and non-native species. The hardscapes (buildings, concrete pathways) make up around 80-85% of the area, with the rest being taken up by some isolated shrubs and trees.

**Observation Protocol**

On February 15th February 2025 from 10:43 am to 1.30 pm IST, a single adult *K. horsfieldii* was observed while basking on the west staircase wall, receiving indirect sunlight. Environmental parameters were recorded, including light intensity ranging from 204 lux to 167 lux and an ambient temperature of 27°C. The butterfly's behaviour, position, and surrounding vegetation were documented.

Photographic documentation was obtained using a Samsung S24, 69mm macro lens which captured both dorsal and ventral wing patterns, confirming species identification *(Best, 1951) (Gaonkar, 1996) (Kunte, 2000) (Rout et al., 2005) (Kunte et al., 2025)*. The campus flora was inventoried, with special attention to potential host plants and nectar sources.

**Results**

**Morphological and Behavioural Observations**

With respect to the observed specimen, the butterfly is identified as *Kallima horsfieldii* (Sahyadri blue oakleaf) validated with intensely blue colour dorsal wings. The mimicry in ventral wings was leaf-like and almost perfect, suggesting the presence of a midrib, fungal spots, and serrated edges characteristic of decaying leaves (Fig. 2). The butterfly spent around 3 hours in one place and periodically adjusting its wings to optimize sun exposure. The position of the butterfly was approximately 2 meters above ground, likely to protect itself from predatory risk while also gaining solar energy. This adaptation allows the butterfly to use artificial structures as temporary refuges in urban areas.

**Microhabitat Utilization**

Despite the absence of larval host plant and the limited availability of its nectar sources, the butterfly was found utilizing microhabitats on the college campus. The west-facing staircase wall that receives indirect sunlight is particularly beneficial for species like *Kallima horsfieldii*, which prefer shaded or semi-lit conditions similar to their natural forest understory habitats *(Kamrunnahar et al., 2018) (Wang et al., 2022) (Verma & Arya, 2023)*.

**Vegetation Assessment**

The campus survey verified the absence of larval host plants although limited adult nectar plants for *K. horsfieldii*. No larval host plants were found on-site; however, nectar sources such as *Hibiscus rosa-sinensis* were noted. This implies that the campus, even with its limited green cover, is capable of sustaining at least transient populations of these species.

**Discussion**

**Ecological Significance**

The occurrence of *K. horsfieldii* within a college campus that has little vegetation contradicts the previous considerations of the species' habitat requirements. This observation implies that:

1. *K. horsfieldii* has the ability to adapt to urban areas by using microhabitats *(Rochat et al., 2017)*.
2. The presence of even limited green spaces in urban landscapes is essential to biodiversity sustenance *(Azahra et al., 2022) (Starlin & Rani, 2024)*.
3. The species may have a greater capability to disperse through urban matrices than previously thought *(Rochat et al., 2017) (Marini-Filho & Martins, 2010)*.

**Conservation Implications**

As a Schedule II protected species, the presence of *K. horsfieldii* on college campus requires conservation actions.

1. **Habitat Improvement:** Introducing larval host plants and increasing the nectar sources on campus could support a more stable population.

2. **Microhabitat Maintenance:** The maintenance of shaded walls, leaf litter, and plant diversity is crucial for providing suitable conditions for the species.
3. **Connectivity Conservation:** It is also necessary to improve green corridors connecting the campus to the nearby forest fragments, facilitating butterfly movement.

**Urban Planning and Biodiversity**

The research draws attention to the possible contribution of urban green areas, including educational campuses, to the conservation of biodiversity. It highlights the need for urban planning policies that integrate biodiversity consideration in areas characterized by scant vegetation.

**Limitations and Further Projections**

This study is limited by a single observation; hence long-term monitoring is needed to assess the population viability. Community involvement along with DNA barcoding of larval hosts, may elucidate dispersal patterns and resource utilization.

**Conclusion**

The first sighting of the Sahyadri Blue Oakleaf butterfly on a college campus in Bhiwandi highlights the species adaptability and potential of urban ecosystems to sustain such delicate species. Even within the Wildlife Act, legal protection exists, but for maintaining biodiversity in cities, habitat restoration—especially the introduction of host plants—remains essential. This study calls for the inclusion of microhabitat conservation in urban planning so that even highly disturbed green areas can be used for biodiversity goals in India. Continuous monitoring along with community engagement will be essential in turning academic campuses into biodiversity reserves.

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**Conflicts of interest**

The authors declare that there are no conflicts of interest regarding the publication of this paper.

**Authors' Contributions**

All authors have equal contributions to the manuscript.

**Ethical approval & declaration**

The Animal ethical guidelines are followed in the study for species observation, photography and identification.

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**Data and materials availability**

All data associated with this study are present in the paper.

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**Fig 1:** A satellite image from Google Earth showing the study area
**A.** Overview of Bhiwandi, **B.** Close-up view of college campus

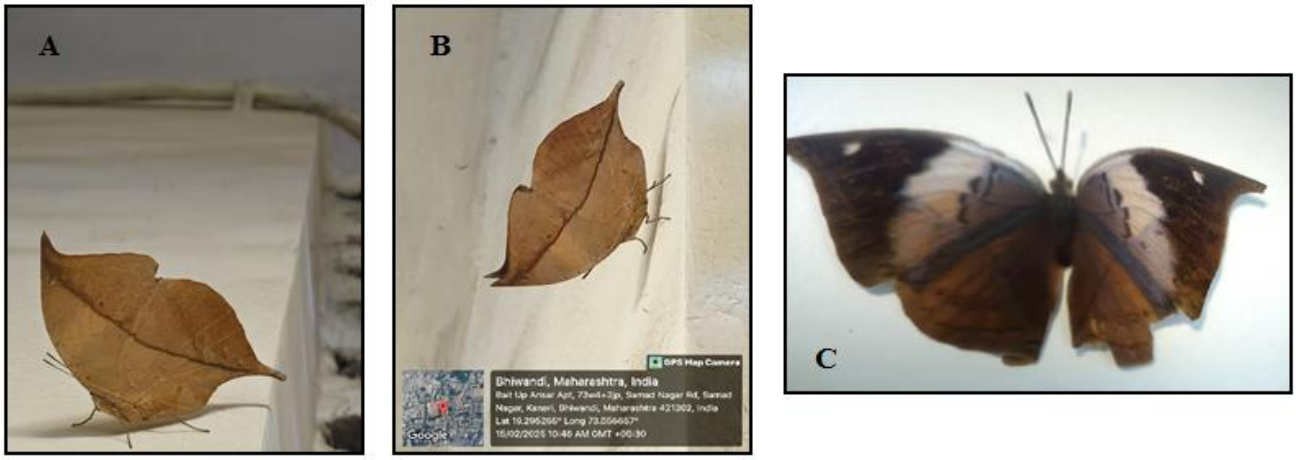


Fig. 2- Ventral (A, B) and dorsal (C) view of *Kallima horsfieldii* (Kollar, 1844) showing characteristic dead-leaf camouflage