New distributional records of *two butterflies* from Bangladesh: Insights into potential climate-driven range shifts

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Abstract

During field surveys on butterfly taxa at Madhobkunda Eco Park, located in the northeastern region of Bangladesh, two species from the Hesperiidae family were recorded for the first time in the country. Particularly, a skipper butterfly, *Pithauria marsena, Hewitson,1866* (Banded Straw Ace), was observed in December 2023, and a flat butterfly, *Celaenorrhinus nigricans, de Nicéville,1885* (Small-banded flat), was observed in February 2025. Both species were identified based on their key morphological traits and have not been previously documented from Bangladesh. This represents the confirmation of first record of these two species in Bangladesh which fall well outside their previously known distribution ranges. These locations do not overlap with historical clusters, suggesting an actual range extension rather than random isolated sightings. We hypothesize that regional climate trends, together with the dispersal abilities of the species, are allowing them to expand into peripheral portions of their known ranges. Though single observations cannot confirm expanding populations, but a significant geographic gap between previous and current records suggests the possibility of undiscovered resident or gradually shifting range movements. Such range movements are becoming more common among tropical insects, as warming temperatures, shifting seasonal cycles, and microclimate shifts make new habitats suitable. Also new records of these butterflies highlight the ecological significance of Madhobkunda Eco Park and will help to enrich the known butterfly diversity of Bangladesh.

Keywords: Small Banded Flat, Branded straw Ace, Bangladesh, Madhobkunda Eco Park, First record.

Introduction

Bangladesh, a part of the Indo-Malayan biogeographic realm with tropical and sub-tropical forests that hold enormous biodiversity, considering as one of the richest biodiversity regions (Wikramanayake et al., 2002). Therefore, the study on butterfly diversity and distribution in biodiversity-rich regions are necessary for conservation initiatives. Butterfly research has advanced significantly over the past few decades (Chowdhury et al., 2021; Hossain, 2023; Chowdhury et al., 2021) and nearly 500-550 butterfly species are predicted to be found in Bangladesh based on habitat variation and floral composition (Larsen, 2004). But, the latest literature on butterfly diversity confirmed the presence of 421 species in Bangladesh (Hossain, 2023) which informs less habitat exploration and presence of many under documented butterfly in Bangladesh.

This study reveals two new butterfly species, *Pithauria marsena, Hewitson,1866* (Banded Straw Ace) and *Celaenorrhinus nigricans, de Nicéville,1885* (Small-banded flat) from Hesperiidae family, a diverse family of butterflies within the order Lepidoptera, characterized by their robust bodies, hooked antennae, and rapid flight (Warren et al., 2009). In South and Southeast Asia, Hesperiidae is a well-represented family with a large number of genera and species diversity (Jong & Treadaway, 1993).

Butterflies are widely recognized as sensitive indicators of environmental change because their distribution, abundance, and phenology respond quickly to ecological disturbances and climatic variability (Bonebrake et al., 2010). Agricultural expansion, habitat loss and fragmentation, and climate change are placing strong pressure on natural ecosystems across tropical and temperate regions, and these stresses like rising temperatures and altered microclimates can shift their geographic ranges toward higher elevations, more northern latitudes to cope with the changing ecosystems (Chen et al., 2011; Butchart et al., 2010; Parmesan & Yohe, 2003). Climate change is reshaping many aspects of species biology, altering the timing of key life-cycle events, pushing species into new areas, and affect migration patterns (Lenoir et al., 2010; Thomas et al., 2006; Walther et al., 2002; Pacifici et al., 2017). In this context, the discovery of *Pithauria marsena* and *Celaenorrhinus nigricans* from Madhobkunda Eco Park provides important evidence of ongoing range dynamics and underscores the ecological significance of this protected site. These

findings not only contribute to fills important gaps in regional biodiversity data but also reflect broader biogeographic patterns shaped by environmental change.

Materials and Methods

Sylhet, a part of northeast Bangladesh has floral and faunal affinity and supports a large number of natural habitats with rich biodiversity making it an important portion of Indo-Burma hotspots that have high conservation value (Mittermeier, et al., 2009). The study was conducted at Madhobkunda Eco Park (Figure. 1), located in Baralekha Upazila under Moulvibazar District in northeastern Bangladesh. Madhobkunda Eco Park (MEP) is a part of the greater Juri Forest Range with tropical mixed evergreen forest. MEP is located between 24°30'- 24°32' N latitudes and 92°37'-91°39' E longitudes and occupies 265.68 acres with an average annual rainfall of 390 cm and temperatures ranging between 12° and 32°C (Islam, et al., 2022). Gangamara River flows along the Patharia Hill, where a waterfall cascades and runs throughout the year (Rini, 2024). *Pithauria marsena* (Branded Straw Ace) was recorded in december 2023 and *Celaenorrhinus nigricans* (Small-banded flat) was recorded at February 2025 from the study area.

The geographic coordinates were taken by GPS (Garmin eTrex 10). Collection and killing of the specimens were avoided. Banded Straw Ace was photographed with Nikon D7200, 70-300mm lense and Small-banded Flat was photographed with Nikon D500, 200-500mm lense for the proper identification. The average temperature was 27.8 and humidity was 59% during the observation period. The temperature and humidity were measured using a digital thermometer (hygrometer HTC-1). The butterflies were identified following keys from (Evans, 1932) and (Kehimkar, 2016).

To study potential range expansion, we retrieved geo-referenced records for both species from GBIF and the ifoundbutterflies repository. After filtering, we retained six historical records for *Celaenorrhinus nigricans* (Small Banded Flat) and three for *Pithauria marsena* (Banded Straw Ace). Because historical sample sizes were low and insufficient for constructing range polygons (e.g., convex or concave hulls) or kernel-density envelopes, we follow recommendations from studies on small sample range estimation and report nearest-neighbor distance as a metric of

observed range extension. The nearest-neighbor distance was calculated using the Haversine method available in geosphere package in R statistical software.

Results

Following the identification features of specimens, one specimen was identified as *Pithauria marsena, Hewitson,1866* (Branded Straw Ace) and another was *Celaenorrhinus nigricans, de Nicéville,1885* (Small-banded flat) from Hesperiidae family. Both of the species have no pictorial evidence and document about presence in Bangladesh which indicates their first record. The specimens are reported below -

Systematic accounts

Pithauria marsena, (Hewitson, 1866) (Fig. 2a and Fig. 2b)

Material examined: Madhobkunda Eco Park, Moulovibazar, Bangladesh, N 24°38'17.8", E 92°13'27.0", 21 Dec 2023, leg. Uzzal Das, 1♂

During field survey on butterfly diversity along the hill stream of Madhobkunda Eco Park a single male of *Pithauria marsena* was found. The specimen was resting on a semi wet stone near the waterfall. It was found during a sunny day of winter season at 3:03:06 PM

Description: Under side of the wings are brown; small spots on under side of the hind wings. Most of the upper side is covered with hairs. (Fig. 2a)

Upper side of the forewings dark brown with two cell spots, two central spots and two apical spots. Male brand on upper side of the forewings. (Fig. 2b)

Remarks: *P. marsena* has some similarity with *Pithauria stramineipennis, Wood-Mason & de Nicéville,1887* (Light Straw Ace*)* and *Pithauria murdava Moore, 1865* (Dark Straw Ace) but can be distinguished from each other. Upperside of the forewings have prominent male black brand above veins 1b in *P. marsena* which rules out other two members of genus *Pithauria* (*P. stramineipennis* and *P. murdava*). Only *Pithauria stramineipennis, Wood-Mason & de Nicéville,1887* (Light Straw Ace*)* is found in Bangladesh (Hossain, 2023)

General distribution: India (Sikkim-Arunachal, NE), Myanmar (Kehimkar, 2016)

Range Extension: For the *Pithauria marsena* (Banded Straw Ace), the new record is situated 158.40 km from the nearest known site and all historical records are more than 150 km away from the new documented locality. This distance place new observation well outside the cluster of historical occurrences for the Banded Straw Ace

Celaenorrhinus nigricans, (Nicéville, 1885) (Fig. 3a and Fig. 3b)

Material examined: Madhobkunda Eco Park, Moulovibazar, Bangladesh, N 24°38'16.9", E 92°13'18.4", 27 Feb 2025, leg. Uzzal Das, 1♂

During field survey on butterfly diversity along the hill stream of Madhobkunda Eco Park a single male of *Celaenorrhinus nigricans* was found. The specimen was resting on a semi-dry leaf beside the main stream. It was found during a sunny day of spring season at 10:37:25 AM

Description: Upper side of the forewings lower apical spot out of the line, nearer to outer edge and detached. spot in central band in space 3 projects out on upper side of the forewings. No yellow spots on hind wings. Absence of yellow spots on hind wing and lower apical spot on upper forewings is detached. (Fig. 3a)

Remarks: There are many species from genus *Celaenorrhinus* in indian subcontinent but only three species is distributed in Bangladesh; *Celaenorrhinus leucocera Kollar, 1844 (Common Spotted Flat), Celaenorrhinus munda Moore, 1884 (Himalayan Spotted Flat) and Celaenorrhinus asmara Butler*, 1879 (White Banded Flat) (Kehimkar, 2016). Another species *Celaenorrhinus putra Moore, 1866* (Restricted spotted Flat) from genus *Celaenorrhinus* has only photographic record in Bangladesh (Abbas, 2021). Absence of yellow spots on hind wing and lower apical spot on upper forewings is detached,out of line and nearer to the outer edge in *Celaenorrhinus* nigricans rules out *Celaenorrhinus leucocera, Celaenorrhinus munda and Celaenorrhinus putra* (Kehimkar, 2016). Absence of compact white band of 3 spots and no middle spot projects out in *Celaenorrhinus* nigricans rules out *Celaenorrhinus asmara* (Kehimkar, 2016). Thus, the spcecimen shown in Fig.3 and Fig.4 is stands out as *Celaenorrhinus nigricans, de Nicéville,1885.*

General distribution: India (Sikkim-Arunachal,NE), Myanmar,Bhutan (Kehimkar, 2016).

Range Extension: For the *Celaenorrhinus nigricans* (Small Banded Flat), the new record lies 86.42 km from the nearest known site. Among the historical records, no locality falls within 80 km of the new site. This distance place new observation well outside the cluster of historical occurrences for the Small Banded Flat

Discussion

In both species, the newly observed localities lie well outside the spatial clusters formed by historical occurrences, supporting their interpretation as genuine range extensions rather than incidental outliers. Range extensions of tropical insects have increasingly been attributed to warming temperatures, altered phenology, and changes in forest microclimate, all of which can allow species to colonize formerly unsuitable areas. Continued monitoring and surveys are required to determine whether these represent undocumented populations or recent arrivals responding to environmental change. Besides, first occurrence of two species will increase country's Lepidopteran diversity. A large number of butterfly species are yet to be recorded in Bangladesh and need more exploration efforts to build a comprehensive national butterfly checklist. Finding of these species indicates the importance of citizen science efforts on field exploration in under surveyed locations.

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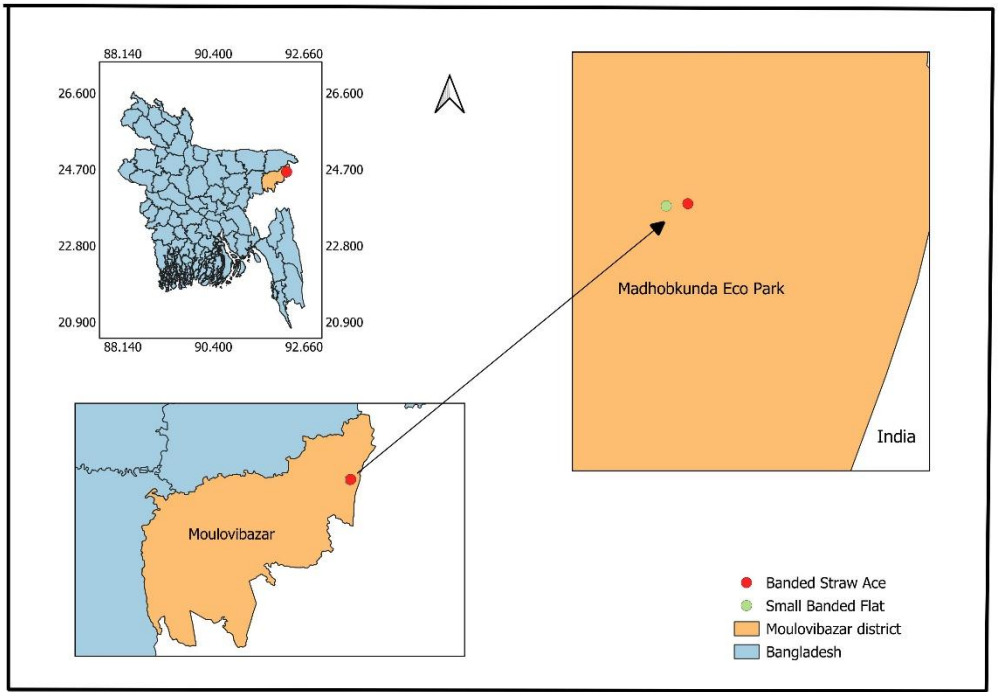
Fig 2b *Pithauria marsena, Hewitson,1866,* Upper wings view

Fig 3a *Celaenorrhinus nigricans, de Nicéville,1885,* Upper wings view

Fig 3b *Celaenorrhinus nigricans, de Nicéville,1885,* Under wings view

Fig 4 *Habitat of Pithauria marsena*

Fig 5 Habitat of *Celaenorrhinus nigricans*



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