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Research Article

New distributional record and taxonomic notes on *Phalera grotei* Moore, 1860 (Lepidoptera: Notodontidae) from Meghalaya, India

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ABSTRACT

The present study establishes the new distribution record of *Phalera grotei* Moore 1859 from Meghalaya, India based on the male specimen collected in May 2025 from the Ri-Bhoi district in the state. Though the specimen was closely resembled with its congeners morphologically, its male genitalia characters such as slender uncus, thumb-shaped apical flap of the valva with paired costal processes, strongly developed socii and a tubular aedeagus with a vesica bearing numerous cornuti. Presence of a broader apical moon-spot on the forewing and a distinctive abdominal band pattern further confirms its identification. This finding not only establishes the range extension of *Phalera grotei* but also highlights the importance of genitalia-based taxonomic identification in solving species complexes.

Key words: *Phalera grotei,* Range extension, Ri Bhoi, Meghalaya

INTRODUCTION

The diversity of Lepidoptera is marked by thousands of species that have adapted to a variety of habitats, playing crucial roles in pollination, herbivory, and serving as prey within food webs. Species assemblages exhibit significant variation across different biogeographic regions and habitat types (Dadheech and Kumawat, 2025). The state of Meghalaya, located in northeast India, is part of the Indo-Burma biodiversity hotspot showcases a high level of Lepidoptera diversity and richness, which is reflective of the state's diverse habitats and ecological complexity. Comprehensive multi-year surveys conducted statewide have identified approximately 514 butterfly species, which are categorized among the principal families of the Lepidoptera order (Papilionidae, Nymphalidae, Pieridae, Lycaenidae, Hesperiidae, and Riodinidae) (Bora *et al*., 2015). Previous surveys in the Garo Hills have recorded at least 298 butterfly species belonging to around 156 genera (Kunte *et al*., 2012). These results highlight the remarkable butterfly biodiversity present in Meghalaya. In contrast, research on moth diversity, although still in its early stages, has reported only 52 species of moths on the USTM campus (Dhar *et al*., 2023). This suggests the potential for many additional taxa to exist across various habitats in Meghalaya. The present study has attempted to describe taxa belong to family Notodontidae which was found to its first distribution record in Meghalaya, India through its genitalia and other morphological characteristics.

Members of the family Notodontidae are characterized by an elongated abdomen and triangular forewing with a prominent tuft of scales on the inner margin near the base. Most of the species are pests of economically important crops like Poplar (Mazumder *et al.,* 2023). More than 4400 species under 532 genera of family Notodontidae are known globally (Schintlmeister, 2013; Mazumder *et al.,* 2023). In India, remarkable work on the documentation and description on the family Notodontidae was done by Hampson (1892), Schintlmeister (2008), Chandra *et al*. (2018), Mazumder *et al*. (2020) and Irungbam (2022) and represented by 284 species of the family (including nominotypical subspecies) under 119 genera (Singh *et al.,* 2021; Mazumder *et al.,* 2022; Irungbam *et al*., 2022; Joshi *et al.,* 2023; Mazumder *et al.,* 2023). The Genus *Phalera,* one of the representatives under the subfamily Notodontinae, looks like a fragment of twig complete with chipped bark that perfectly resembling a broken piece of wood in order to save them from predators. They range

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from Europe and Japan southwards through Asia to Borneo and Africa which extend as far south as Australia (Smetacek, 1999). In India, 10 species of the genus *Phalera* are reported (Chandra *et al.,* 2018). In this manuscript, we report the *Phalera grotei* Moore, 1859 for the first time from the state of Meghalaya. Though this species is found in Assam, Nagaland, Arunachal Pradesh and Sikkim, but not reported from the state of Meghalaya.

spectacular array of birds is also found here such as the Brown Hornbill, Manipur Bush Quail, Rufous Necked Hornbill etc.

RESULTS

The study confirmed the first records of the *Phalera grotei* Moore 1859 from the state of Meghalaya (Ri-Bhoi district) based on the morphological and anatomical characters which are given below:



Figure 1. Location of 18th Mile in Umling Village near Nongkhyllem Wildlife Sanctuary and Reserve Forest of Meghalaya, India where this species was found

MATERIALS AND METHODS

Methodology

The adult moths were collected with the help of vertical sheet light trap with 160w mercury bulb. Collected moths were killed with the help of ethyl acetate vapours. Male genitalia are dissected by keeping the abdomen in 10 percent KOH for overnight, dissection process was followed as per the standard techniques given by Sterling in Singh, Joshi, Kendrick, Pathania & Banerjee (2024). A collected specimen is deposited in department of Zoology, University of Science & Technology, Meghalaya.

Study Area

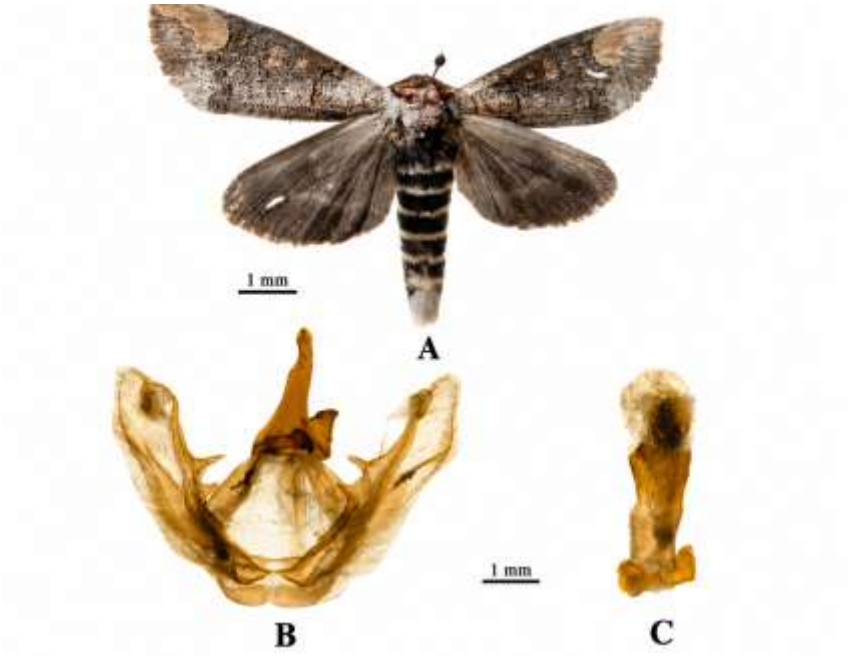
The specimen was collected from 18th Mile area in Umling Village in Ri-Bhoi district of Meghalaya, India at an elevation of 330 m. This area is located at the fringe of Nongkhyllem Wildlife Sanctuary and Reserve Forest of Meghalaya (Figure 1). The area experiences tropical monsoon climate, with hot and wet summers and cool, dry winters. The average rainfall is around 2500 mm, placing it in a relatively low rainfall zone. The dominant habitat type is Tropical moist deciduous forest with patches of Tropical semi-evergreen forest, especially along the river valleys and streams. Some of the common faunal species which dwell here enlist Indian Bison, Himalayan Black Bear, Clouded Leopard and many more. A

Systematic position

Order Lepidoptera
  Superfamily Noctuoidea
    Family Notodontidae
      Subfamily Phalerinae
        Genus *Phalera* Hübner [1819]: 147

Type species: *Phalera bucephala* Linnaeus, 1758
= *Acrosema* Meigen, 1830): 24 (TS. *Phalera bucephala* Linnaeus, 1758)

= Hammatophora Westwood, 1843: 63 (TS. *Phalera bucephala* Linnaeus, 1758)
= *Anticyra* Walker, 1855: 980, 1091 (TS. *Anticyra combusta*) nec. Curtis, 834: 216 (Trichoptera)
= *Dinara* Walker, 1856: 1699 (TS. *Dinara lineolata* Walker, 1856 [= *Anticyra combusta* Walker, 1855])
= *Horishachia* Matsumura, 1929: 39 (TS. *Horishachia infuscata* Matsumura, 1929 [= *Phalera obscura* Wileman, 1910)
= *Phaleromimus* Bryk, 1949: 9 (TS. *Phaleromimus albocalceolata* Bryk, 1949)



Palte 1. *Phalera grotei* Moore, 1859. A: Adult, B: Male genitalia, C: Aedeagus.

Diagnosis: Members of the genus are characterized by the presence of silver greyish background colour, apical moon-spot on the forewing. Male genitalia with robust socii and modified valva, shapes of the aedeagus are diagnostic.

Distribution: Uttarakhand, West Bengal, Sikkim, NE India (Arunachal Pradesh), Bhutan, Myanmar, Nepal, Pakistan (Chandra *et al.* 2018).

***Phalera (Phalera) grotei* Moore, 1860: 434**
Type locality: Kolkata [West Bengal, India]; TD: NHMUK
=*Phalera sangana birmicola* Bryk, 1949
=*Phalera cihuai* Yang & Lee, 1978; 2: 487.
=*Phalera birmicola obfuscata* Nakamura, 1978; 10: 221.

Material examined: Meghalaya, Ri Bhoi (25º58᾽4319N; 91º 49’5681E), 01.05.2025, 01 exs, Golphina Ahmed leg.

Diagnostic characters: Adults are very much similar to its sibling species and harder to distinguish externally, but can be characterized by the presence of broader apical moon-spot of the forewing, presence of two variable sizes of medial reniform spot in and abdomen with black band separated by whitish band. *P. grotei* Moore, 1860 can be best diagnosed by the external male genitalia by having slender uncus, valva with thumb shape apical flap and pair of costal process, socii strong and apically acute; aedeagus tubular, shorter and vesica with bunch of cornute (*Plate 1*).

Distribution in India: Himachal Pradesh, Uttarakhand (Kumaon, Dehradun), West Bengal, Sikkim, Arunachal Pradesh (Pakke TR), Assam, Nagaland, Chhattisgarh, Maharashtra (Sanjay Gandhi NP, Malshej Ghat), Karnataka, Kerala, Tamil Nadu, Andaman Islands (Chandra *et al.,* 2018; Sondhi *et al.,* 2025), Meghalaya (present study). ***Global Records:*** Bangladesh, Bhutan, China, Indonesia (Borneo), Korea, Malaysia, Myanmar, Nepal, Philippines, Vietnam (Chandra *et al.,* 2018).

DISCUSSION

The current study accounts *Phalera grotei* Moore, 1860 from Ri Bhoi district, Meghalaya, chronicling a significant range extension for the species within the eastern Himalayan biodiversity hotspot. This discovery of *P. grotei* in Meghalaya likewise assists in understanding the broader distribution patterns of the species. Earlier records have documented its occurrence in the Himalayan foothills and the Western Ghats, together with states such as Himachal Pradesh, Uttarakhand, West Bengal, Sikkim, Arunachal Pradesh, and the Andaman Islands (Chandra *et al.,* 2018; Sondhi *et al.,* 2025). Additionally, its discovery in tropical and subtropical forests of South and Southeast Asia, including Bhutan, Bangladesh, Nepal, Myanmar, China, Korea, and Indonesia, wires its pan-oriental distribution (Yang and Lee, 1978; Nakamura, 1978). Its presence in geographically disjunct regions advocates a wide ecological tolerance and possible dispersal capacity, assisted by forest continuity and climatic suitability across these zones. This new record packs a critical biogeographical gap and emphasizes the need for comprehensive Lepidoptera surveys in the region (*Chandra et al.*, 2018b; Sondhi *et al.,* 2025).

Known for the cryptic morphology and mimicry, species of *Phalera* often resembles broken twigs as a form of camouflage (Scoble, 1992). The adult moths display subtle external morphological differences, relinquishing field identification challenging. In the case of *P. grotei*, distinguishing features such as the broader apical moon-spot and dual reniform spots on the forewing are useful, although insufficient for definitive species identification. These features may overlap with those of sibling species, which emphasizes the importance of genitalia-based taxonomy for accurate classification (Holloway, 1982; Kononenko and Pinratana, 2005). Our investigation of the male genitalia revealed a suite of diagnostic traits, including a slender uncus, valva with thumb-shaped apical flap, strong and acute socii, and a tubular aedeagus with a cluster of cornuti in the vesica—consistent with the original description by Moore (1860) and consequent redefining by Yang and Lee (1978).

The distribution of this species in Meghalaya further indicates the existence of their favorable host plants in mid-elevation regions. Considering that numerous moths are affected by microclimatic variations, habitat fragmentation, and pollution, the presence of *P. grotei* could also act as a bioindicator of forest health (Summerville and Crist, 2003; Hailay and Getu, 2023).

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ETHICAL CONSIDERATION

The authors declare that there were no legal or ethical issues associated with the collection and dissection of moths in the present study. Moth species are not included under the Wild Life (Protection) Act, 1972 (as amended in 2022). Therefore, no specific permission was required for the collection of moths from non-protected areas or for the dissection of their genitalia.

CONFLICT OF INTEREST

Authors have no conflict of Interest.

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