

New addition to the Distribution of two species of *Curetis* Hübner, [1819] from southern West Bengal, India (Lepidoptera: Papilionoidea, Lycaenidae)

Aniruddha Singhamahapatra, Arnab Kumar Samanta, Pradeep Nayak, Sandip Das, Anitava Roy & Subhajit Roy

Abstract

The present study extends the distributional range of two *Curetis* Hübner, [1819] species in the southern part of West Bengal state, India. This study reports *Curetis saronis* Moore, 1877 for the first time from the coastal mangrove forests of India. *Curetis bulis* (Westwood, 1852) is reported for the first time from the Chhotanagpur plateau region of India and is the first report from West Bengal outside the Himalayan ranges. **Keywords:** Lepidoptera, Papilionoidea, Lycaenidae, *Curetis*, Sundarban, Purulia, Chhotanagpur, West Bengal, India.

Nueva adición a la distribución de dos especies de *Curetis* Hübner, [1819] del sur de Bengala Occidental, India (Lepidoptera: Papilionoidea, Lycaenidae)

Resumen

El presente estudio amplía el área de distribución de dos especies de *Curetis* Hübner, [1819] en la parte meridional del estado de Bengala Occidental, India. Este estudio informa de la presencia de *Curetis saronis* Moore, 1877 por primera vez en los manglares costeros de la India. *Curetis bulis* (Westwood, 1852) se cita por primera vez en la región de la meseta de Chhotanagpur de la India y es el primer informe de Bengala Occidental fuera de las cordilleras del Himalaya.

Palabras clave: Lepidoptera, Papilionoidea, Lycaenidae, *Curetis*, Sundarban, Purulia, Chhotanagpur, Bengala Occidental, India.

Introduction

The genus *Curetis* Hübner, [1819] is the only genus from subfamily Curetinae (Family: Lycaenidae) (Eliot, 1990), 6 of which are distributed in India (Varshney & Smetacek, 2015). Of these six, *Curetis siva* (C. & R. Felder, [1865]) is known to be endemic to the Sahyadri mountains of south-western India, and *Curetis naga* Evans, 1954 (previously considered as a subspecies of *Curetis acuta* Moore, 1877) is known to be restricted to the mountainous region of Naga Hills of Nagaland, India, adjacent Yunnan in south China (Huang, 2003) and possibly in Myanmar (Savelle, 2016). All the remaining four species are known to be distributed in the state of West Bengal (Varshney & Smetacek, 2015). However, the state of West Bengal is peculiar in the sense that it is the only state in the biogeographically megadiverse country of India which includes both parts of the Himalayan Mountain range and has a coastline with mangrove forest. It also includes a part of the Chhotanagpur plateau and the Rarh region (which is a transitional zone between the plateau and the flood plains of the Gangetic basin) in its south-western part.

Materials and Methods

AKS, out of his virgin interest in nature, found an individual of *Curetis* species, which was basking on a pumpkin leaf grown outside his rural house in a neighbourhood of Namkhana, South 24 Parganas district, on the edge of Sundarban in southern West Bengal the morning on 14-XI-2022. The observation was photographed using the Samsung Galaxy A13 mobile phone of AKS and was uploaded in iNaturalist (Samanta, 2024) with the initial misidentification of *Curetis thetis* (Drury, [1773]), which is the commoner, but soon it was rectified by peers as the yellow on the upper side of the wings clearly indicated it to be a female of *Curetis saronis* Moore, 1877. The authors, particularly SR, SD and AS, are conducting opportunistic surveys in various parts of the state for around a decade, particularly focusing to fill up the Wallacean and Eltonian shortfalls regarding the knowledge of Papilionoidea in West Bengal. As part of that, they visited the location on 26-XI-2022, and along with AKS, visited the mangroves in the outskirts of the nondescript neighbourhood, which outgrew on the banks of the Bhagirathi-Hooghly River, and found around 9 individuals of *Curetis saronis*, along with three individuals of *Curetis thetis*, which is otherwise the most common member of the genus throughout most of the country and the state. Individuals of the species were repeatedly sighted henceforth by AKS in that mangrove stretch till February 2023. Though the species was not sighted in the locality in the winter of 2023-2024 in spite of regular surveys by AKS, three individuals of the species were observed again by SR, along with SD and AKS, in a planted Casuarina Forest adjacent to the Bonbibhi temple in the heavily touristed Bakkhali sea beach, South 24 Parganas district, around 27 kilometres south of the previous location on 30-XII-2023.

As part of the state-wide Papilionoidea survey, AS and AR, along with PKN, visited Garh Panchakot hill in Purulia district in western part of southwest Bengal on 29-VII-2023, and among various other Lepidoptera, observed and photographed a *Curetis* species mud puddling on the ground in a sunny day. The individual was later identified as *Curetis bulis* (Westwood, [1851]), but later confirmed to be *Curetis acuta* Moore, 1877 with the help of available literature and consultation with various experts in social media platforms. However, an upper wing photograph of a male individual from the photo archive of AR was identified as *Curetis bulis* (Westwood, [1851]), which was photographed from the same study site (Garh Panchakot hill) on 05-IV-2023, a few months prior.

Lepidoptera nets or traps were not used and none of the individuals were collected. The individuals were photographed with Nikon D7500, Nikon D5300 with Nikon AF-P 70-300 lens, Canon R7 camera with Canon 100-400 Rf lens. Field guides and published literature were used to verify the identification and hitherto known distribution range of the species.

To study the temporal and spatial distribution of the *Curetis* spp. found across the state of West Bengal, occurrence data of the genus was extracted (GBIF, 2024) using appropriate filters. Photographic data stored in the WikiCommons (Anonymous, 2024a) as part of the Wiki Loves Butterfly Project across the North-East India, and IFoundButterflies (Kunte et al., 2024) website are also added to our data, omitting the duplicate data already considered from GBIF, through checking the dates of observation and co-ordinates, using SQL query. Considering the importance of social media platforms, particularly Facebook, to gather biodiversity data generated by citizens (Barman et al. 2022), data from Facebook groups, particularly Butterfly of West Bengal facebook group, dedicated to butterflies of the study area, was also extracted, which significantly filled in some sampling gaps of data in GBIF, at the same time generating a lot of redundant data. The redundant data resulting from observations of same individual in multiple databases were eliminated along with those where multiple photos of same individual were posted as different observational records. The data related to the museum specimens were also omitted. The existing and novel observational records were plotted using ESRI® ArcMap™ 10.8.0.12790 (ESRI, 2020) installed, as part of ESRI® ArcGIS Desktop 10.8. India Street Map, a subset of the World Street Map (ESRI, 2017) is used as the basemap to plot the records.

Study Area

The state of West Bengal (Figure 1) is eastern India, mostly the lower part of Gangetic plain, also covers parts of various other biogeographic zones including Himalaya in its north, coastal mangroves in its south and extension of Deccan plateau in the south-west (Rodgers & Panwar, 1988). The western districts of Purulia, Jhargram and western parts of Bankura, Birbhum and Paschim Bardhaman district in the state,

along with neighbouring Jharkhand state, Mayurbhanj and Sundargarh districts of Odisha state and Jashpur district of Chhattisgarh state encompass the north-eastern extension of the Deccan Plateau, which is known as Chhotanagapur Plateau. The region is interspersed with residual remnant hillocks and hill ranges and hosts dry deciduous forests (Roy et al. 2022), fragmented in parts due to industrialisation and mining activities.

Southern parts of South 24 Parganas, and the south-eastern fringe of North 24 Parganas on the eastern bank of Bhagirathi-Hooghly River cover the Sundarban, world's largest mangrove forest, most of which lies in neighbouring Bangladesh. The northern districts of Darjeeling and Kalimpong along with northern fringes of Alipurduar district in the state is located within the Himalayan mountainous region, while the remaining part of the state is very densely populated fertile alluvial flood plain centred around the Ganga River and its tributaries and distributaries.

Results

Order Lepidoptera Linnaeus, 1758
Family Lycaenidae Leach, 1815
Genus *Curetis* Hübner, [1819]

Curetis saronis Moore, 1877

Curetis saronis is larger than the more common *Curetis thetis*, having average wingspan 46 mm compared to 44 mm of the latter (Kehimkar, 2016). The female of *Curetis saronis* is readily identifiable from other sympatric species of the genus by the golden yellow discal area (Figure 2), instead of white, in the upperside of both the wings (Moore, 1884; Bingham, 1907; Evans, 1932). The male of *Curetis saronis* can be distinguished from *Curetis thetis* by as the upper side of the former has significantly larger black costal and terminal border (Bingham, 1907; Eliot, 1990), as evident from Figure 3. The underside of *Curetis saronis* is quite like *Curetis thetis*, except the fact that the faint discal band of black lunules is better defined and the subterminal series of black dots is also better marked than *C. thetis* (Bingham, 1907).

Curetis bulis (Westwood, [1851])

Males of *Curetis bulis* can be differentiated with *Curetis acuta* from the upper forewing (Figure 4) by the lack of a black tooth in the cell end and by absence of orange above the base of vein 5 in its upper forewing (van der Poel & Smetacek, 2022). The orange area in the forewing extends into the space 6, which is typical for *Curetis acuta* (Ek-Amnuay, 2012). From the underwing, *Curetis bulis* and *Curetis acuta* are quite similar, but *Curetis bulis* can be identified by the central band in the under hindwing not in line with bar at cell end, while the faint central band is in line with bar at cell-end for *Curetis acuta* (Kehimkar, 2016). However, given the obscurities and the variations in description of the underwings (Chapman, 1915; Ek-Amnuay, 2012), distinguishing these only from the underwing is tricky (Figure 5) and not recommended without close observation of their upper wings. It may be worth noting that the individual photographed at Garh Panchakot hill on 29-VII-2023 was initially misidentified as *Curetis bulis* based on under wing photographs, but later an accidental flight shot clicked by AR helped to conclude its identity as *Curetis acuta* from the presence of the black tooth in the cell end and the extension of orange in space 6, similar to the one in Figure 3a. In contrast, the individual shown in Figure 4 is identified to be *Curetis bulis* male through restricted presence of orange in the upper wings and the lack of prominent teeth in upper forewings.

Discussion

Of the four *Curetis* species distributed in the state of West Bengal, *Curetis thetis*, is the most common and distributed (Figure 6) almost throughout the state, barring the alpine regions. The apparent absence of *C. thetis* in central part of West Bengal (Figure 1) is nothing more than a result of sampling gaps and lack of observers and recorders in citizen science portals and social media, and the similarity of the landscape, human interference and other environmental parameters are a clear indicator that the species should be quite commonly present in this region too. *Curetis bulis* and *C. saronis* were known in the state only from the forests of Himalayan foothills adjacent to the state of Assam. *Curetis acuta* is also found mostly in the deciduous forests of the western plateau region along with the foothills of Himalayas in the northern part of the state.

Curetis saronis Moore, 1877

Originally described from Port Blair in the Andaman islands of India, the species is distributed throughout the south-east Asian countries of Myanmar (Bingham, 1907), Thailand (Godfrey, 1927; Pinratana, 1981; Ek-Amnuay, 2012), Malaysia (Druce, 1896; Bingham, 1907; Sulaiman et al. 2022), Indonesia (Druce, 1896), Singapore (Khew, 2015), Cambodia (Chartier & Kosterin, 2022), Laos (Motono & Negishi, 1989) and Vietnam (Inoué & Kawazoé, 1965) along with India and Bangladesh. While a significant part of its distribution is in the low elevations of montane rainforests (north-eastern India in the states of Assam, Meghalaya, Arunachal Pradesh (Kehimkar, 2016); Sylhet of Bangladesh (Moore, 1884; Larsen, 2004), Arakan state of Myanmar (Bingham, 1907), Cambodia, Tenasserim, Kinabalu, in Malaysia, a large area of its distribution is in the mangrove forests (Andaman and Nicobar islands of India (Moore, 1877; Chapman, 1915; Evans, 1932); Sundarbans of Bangladesh (Larsen, 2004); Thailand, Singapore (Tan, 2010), Labuan of Malaysia and Banjarmasin in Indonesia (Druce, 1896)). While the species is locally common in certain montane evergreen forests of south-east Asia, it is rare throughout the Indian subcontinent.

In India, apart from the Andaman and Nicobar Islands where it is quite a commoner, it is distributed only in the lower slopes of montane rainforests from the states of Assam, Arunachal Pradesh, Meghalaya and West Bengal, where it is quite uncommon (van Gasse, 2018; Anonymous, 2024b). In West Bengal, the species was reported from the foothills of the Himalayan range in Buxa Tiger Reserve of Alipurduar district (in the north-eastern part of the state) by Subhagit Mazumder in 2015 (Sinha et al., 2019; Anonymous, 2024). The observational report presented here is the first report of the species from southern part of West Bengal and is the second report overall from the state. The new sighting from Namkhana, around 575 kilometres (aerial distance) south of Alipurduar, indicates the presence of species from the Sundarbans of West Bengal. *Curetis saronis* is also reported from northern hilly regions of Sylhet (adjacent to the hilly regions of Meghalaya and Assam in India) and tentatively listed from the Sundarbans in the neighbouring country of Bangladesh (Larsen, 2004). This report is thus the first report of the species from the Indian part of Sundarbans and the first sighting of the species from mangrove forests of mainland India, extending its range in the country beyond the Andaman archipelago and the mountainous rainforests of the north-eastern part of the country.

Apart from *Pongamia pinnata* (L.) Pierre, which is the common host plant of all the four *Curetis* species (Robinson et al. 2010) distributed in West Bengal, *Derris trifoliata* Lour., a mangrove associate, deciduous climber, is documented as its host plant (Tan, 2010). The plant is distributed along the coasts of East Africa including Madagascar all along tropical and subtropical Asia to tropical Australia and is found in sandy beaches, mangroves and coastal swamps (Tomlinson, 1986). The abundance and biomass of this mangrove associate plant is known to have increased in recent years (Zhang et al., 2021). The presence of this mangrove associate plant in the mangroves of both Namkhana and Bakkhali should be a factor for the presence of *Curetis saronis* in this region. The report of the species from the Indian Sundarbans, bolsters the faunal diversity of Sundarban Biosphere Reserve.

Curetis bulis (Westwood, [1851])

Originally described from Shimla of Himachal Pradesh in India, the species is distributed through India (Varshney & Smetacek, 2015), Nepal (van Gasse, 2018; van der Poel & Smetacek, 2022), Bhutan (Wangdi & Sherub, 2015), Bangladesh (Larsen, 2004), Myanmar (Moore, 1879), Thailand (Pinratana, 1981; Ek-Amnuay, 2012), Vietnam (Metaye, 1957; Inoué & Kawazoé, 1965), China (Fruhstorfer, 1908; Chou, 1994; Zhang et al. 2013), Cambodia (Chartier & Kosterin, 2022), Laos (Motono & Negishi, 1989).

In India, the species is known to be distributed across the Himalayan range from Jammu and Kashmir (Sheikh et al. 2021), Himachal Pradesh, Uttarakhand, Arunachal Pradesh, Assam, Meghalaya, Nagaland, Sikkim and northern West Bengal (Varshney & Smetacek, 2015; Kehimkar, 2016) where it is fairly common (van Gasse, 2018) and uncommon (van Gasse, 2018) in Eastern Ghats (the states of Andhra Pradesh (Rao et al. 2004) and Odisha (Paria et al. 2018)) and Satpura hills of Madhya Pradesh (Bingham, 1907). Though fairly common in the Himalayan ranges, it is yet to be recorded from the states of Tripura and Mizoram (van Gasse, 2018). However, previous studies from the Purulia district (Mukherjee et al. 2023), and its neighbouring districts of Bankura (Mukherjee & Mondal, 2020), Jhargram (Mandal & Ray, 2023) in West Bengal and in the states of Jharkhand

(Morrison-Godfrey, 1948; Verma, 2009; Singh, 2010; Reddy et al. 2023), Mayurbhanj district of Odisha (Payra et al. 2016; Boruah et al. 2018) could not find evidence of the species from the Chhotanagpur Plateau. The Kuldiha wildlife sanctuary situated in Balasore district of Odisha is the nearest location of the species where it was previously sighted (Paria et al. 2018), which is, however, geographically part of the Eastern Ghat hills (Reddy et al. 2014) and not part of the Chhotanagpur Plateau (Singh, 2012). This is thus the first report of the species from the Chhotanagpur Plateau.

Of its known host plants (Robinson et al. 2010), *Pongamia pinnata*, the common host plant of all the *Curetis* spp. is quite common and distributed throughout West Bengal, excepting the coniferous and alpine vegetation of the Himalayan slopes. *Neustanthus phaseoloides* (Roxb.) Benth., also known to be its host plant, is quite common in the deciduous forests of Garh Panchakot and other forested regions in the Deccan plateau. *Ougeinia oojeinensis* Hochreutiner, though not common in the area, is also distributed in Purulia and its surrounding districts (Das Das et al. 1992). Thus, all the three known host plants are distributed in the Chhotanagpur plateau region, which establishes a potential of its distribution in the plateau region too.

It is interesting to note that *Curetis acuta* is quite common in the study site, and has been observed multiple times from Garh Panchakot Conservation Area by SR and AR. It is also quite common in the Ajodhya Hills of this district (Mukherjee et al. 2023) and is reported from the surrounding districts of Bankura (Mukherjee & Mondal, 2020) and Jhargram (Dwari & Mondal, 2020). However, *Curetis thetis* has not been observed in the Garh Panchakot hills and is quite rare also in the Ajodhya hills of Purulia. It may thus be quite feasible that in spite of commonness in the availability of at least one of the host plants (*Pongamia pinnata*) in the rural and urban human habitats, *Curetis acuta* and *Curetis bulis* are rare or unavailable as they do not face stiff competition from *Curetis thetis*.

Conclusion

While some Papilionoidea surveys have been conducted in the Chhotanagpur Plateau region, various new observational reports from this region including this report of *Curetis bulis* is a testimony to sampling gaps in this region. The sympatry and syntopy of *Curetis bulis* and *Curetis acuta* in the region and their localised allopatry with *Curetis thetis* may be indicative of the dominance of *Curetis thetis* in habitats suffering from anthropogenic interferences.

The presence of *Curetis saronis* in two different spots of Sundarbans confirms the presence of the species in the Indian part of Sundarbans along with previous reports from the Bangladesh part of Sundarbans. The presence of this species in the mangroves of Ganga-Brahmaputra delta indicates that it might also be distributed in the mangroves of the Mahanadi delta situated nearby in Odisha and thorough study of Bhitarkanika National Park is necessary to ascertain the south-western boundary of its range. The repeated observations of *Curetis saronis* in winter and absence of it beyond the winter in the patch indicates that it may undergo seasonal migration. Only detailed studies throughout its distributional range can provide conclusive evidence on the migratory status and patterns of this species.

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Conflict of Interest

The authors declare that there is no known financial interests or personal relationships that could have influenced the work presented in this article.

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Aniruddha Singhamahapatra
Kadma, Bankura
722151 West Bengal
INDIA / INDIA
E-mail: aniruddha9735@gmail.com
<https://orcid.org/0000-0002-8578-7177>

y / and

Lakshminagar, South Dum Dum
700074 West Bengal
INDIA / INDIA

Arnab Kumar Samanta
Namkhana
South 24 Parganas
743357 West Bengal
INDIA / INDIA
E-mail: samantakumar18@gmail.com
<https://orcid.org/0009-0003-9381-4846>

Pradeep Nayak
#2-24-66/1, Kulshekar Chowki 2nd Cross
Kulshekar, Mangalore
575005 Karnataka
INDIA / INDIA
E-mail: nayakpradeep007@gmail.com
<https://orcid.org/0009-0000-8536-7976>

Sandip Das
Lakshminagar, South Dum Dum
700074 West Bengal
INDIA / *INDIA*
E-mail: sandipdasoutsider1969@gmail.com
<https://orcid.org/0009-0001-8339-5372>

Anitava Roy
District Primary School Council
Amlatora Primary School
Amlatora, PS: Chhatna, Bankura
722203 West Bengal
INDIA / *INDIA*
E-mail: anitavaroyphotography@gmail.com
<https://orcid.org/0009-0005-6039-4712>

*Subhajit Roy
Durgapur Wildlife Information and Nature Guide Society
Durgapur, Paschim Bardhaman
713206 West Bengal
INDIA / *INDIA*
E-mail: subhajit.roy@makautwb.ac.in
<https://orcid.org/0000-0001-8768-6815>

y / and

Department of Information Technology
Maulana Abul Kalam Azad University of Technology
West Bengal, Simhat, Haringhata, Nadia
741249 West Bengal
INDIA / *INDIA*

*Autor para la correspondencia / *Corresponding author*

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Figure 1. Map of West Bengal state, India showing the observational records of *Curetis* spp. along with the novel distributional records.

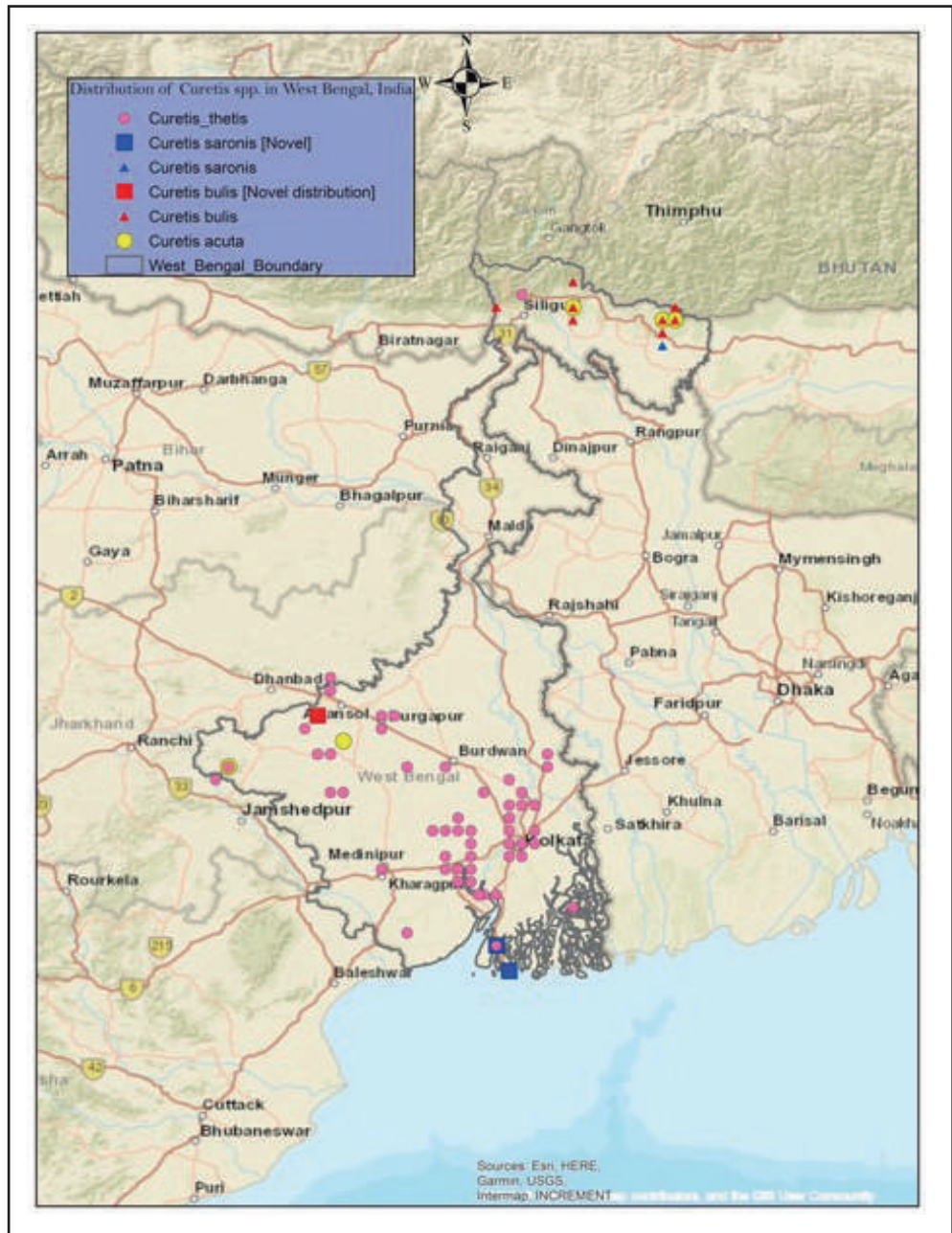


Figure 2. **2a.** Open wing of *Curetis saronis* female. **2b.** Closed wing of *Curetis saronis* female, Bakkhali (South 24 Parganas district, West Bengal), 29-XII-2023 (Photographs by Sandip Das and Subhajt Roy respectively).



Figure 3. **3a.** Open wing of *Curetis saronis* male. **3b.** Open wing of *Curetis thetis* male, Namkhana (South 24 Parganas district), 26-XI-2022 (Photographs by Sandip Das).



Figure 4. 4a. Open wing of *Curetis acuta* male. 4b. Open wing of *Curetis bulis* male, Susunia Hill (Bankura district) and Garh Panchakot Hill (Purulia district), 05-XII-2017 and 05-IV-2023 (Photographs by Aniruddha Singhamahapatra and Anitava Roy respectively).



Figure 5. 5a. Closed wing of *Curetis bulis* male. 5b. Open wing of *Curetis acuta* male, Garh Panchakot Hill (Purulia district), 29-VII-2023 (Photographs by Anitava Roy).

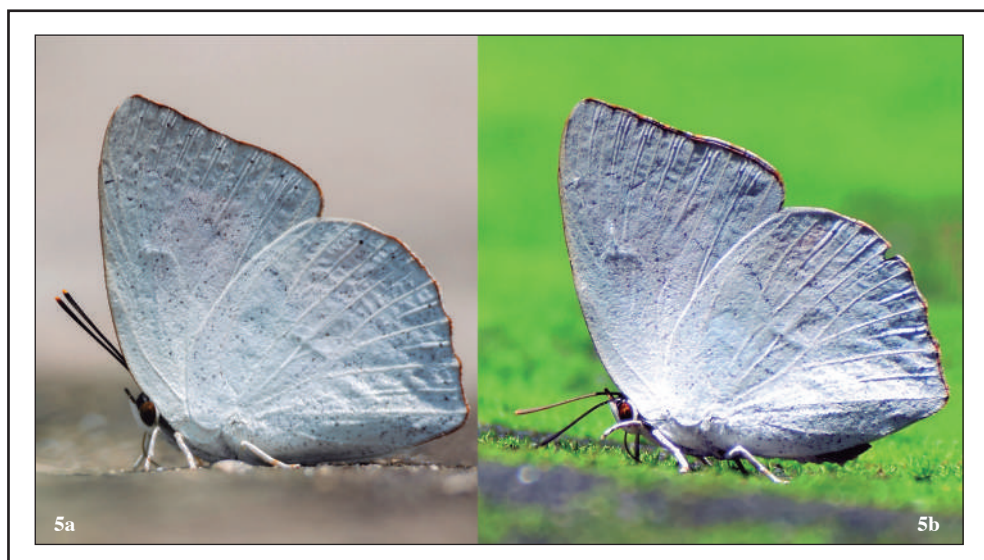


Figure 6. Temporal observational records of the *Curetis* spp. in West Bengal, India from peer-reviewed citizen science portals

