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Cover photo: Red Giant Snail (*Indrella ampulla*) in poster colors. ©Rajib Saha.

Interpretation for sustainable ecotourism

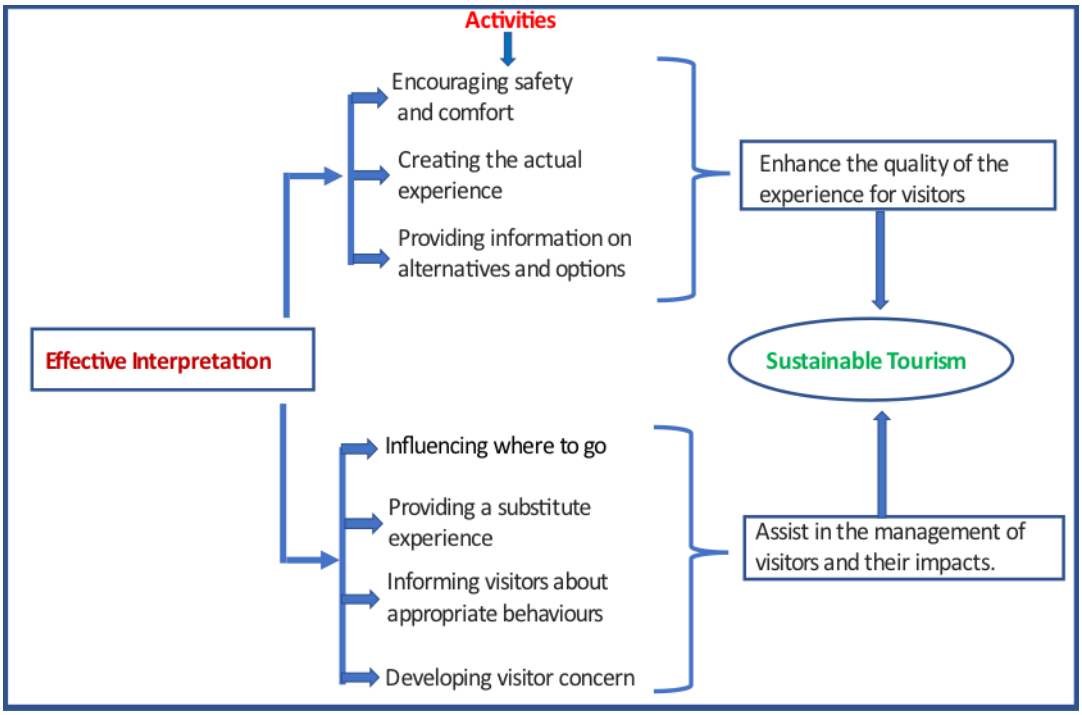
Tourism has become a major industry providing huge income and employment opportunity all over the world. The World Travel and Tourism Council calculated that tourism generated ₹13.2 lakh crore (US$170 billion) or 5.8% of India's GDP and supported 32.1 million jobs in 2021. Tamil Nadu was one of the most visited tourist destination by both Indian and International tourists in 2021 with over 14 crore domestic visitors. Among various types of tourist places, forests and wildlife areas have become more popular and attractive. As a result, more and more pressures are built on the environment and forests which in turn lead to many negative impacts. Managers of such tourism sites face difficulties in managing the visitors against the increasing environmental damage and resort to taking harsh measures including closure of the site for the visitors partially or fully and temporarily or permanently.

Ecotourism is where both the visitors and the environment are supposedly benefitted making the programme a 'sustainable' one. The International Ecotourism Society (2015), defines Ecotourism as, "responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education". As per this definition, interpretation has become the integral part of any ecotourism programme. Tilden (1977) defines interpretation as, "An educational activity which aims to reveal meanings and relationships through the use of original objects, by first-hand experience, and by illustrative media, rather than simple communication of factual information".

Interpretation has been recognised as an important solution to reduce negative impacts whilst also educating the visitors to achieve the goals of sustainable tourism development (Ballantyne et al. 2007). Forestell (1990) considers interpretation as a 'win-win' situation for environmental managers and tourists. According to Tubb (2003), the three key goals of interpretation are "knowledge gain and awareness increase, attitude change and behaviour modification". So, wherever the ecotourism programme is going on, there must be interpretation component to ensure its sustainability. Accordingly, the objectives of the interpretation programme are proposed by the proponents as follows:

Knudson et al. (1995) listed six objectives of interpretation indicating the wide scope of activity inherent in the concept.

1. to increase the visitor's understanding, awareness, and appreciation of nature, of heritage & of site resource.
2. to communicate messages relating to nature & culture, including natural & historical processes, ecological relationships, and human roles in the environment.
3. to involve people in nature and history through first hand (personal) experience with the natural and cultural environment.
4. to affect the behaviour and attitudes of the public concerning the wise use of natural resources, the preservation of cultural & natural heritage, and the respect & concern for the natural & cultural environment.
5. to provide an enjoyable and meaningful experience, and



Role of Interpretation in providing a sustainable tourism (adapted from Moscardo 1998).

6. to increase the public understanding & support for an agency's role, its management objectives, and its policies.

According to Moscordo (1998), an effective interpretation can contribute to sustainable tourism in two main ways: it can enhance the quality of the experience for visitors and assist in the management of visitors and their impacts. According to him, there are three ways that interpretation can contribute to the quality of visitors' experience, by providing information on alternatives and options; encouraging safety and comfort, and creating the actual experience. Similarly, there are four important ways communication can contribute to visitor management: influencing where visitors go; providing a substitute experience; informing visitors about appropriate behaviours; and developing visitor concern.

Powell et al. (2010) after reviewing 70 research articles on interpretation in tourism, categorized the outcomes under the following categories: Satisfaction, Awareness, Knowledge, Attitudes, Behavioural Intensions, and Behaviour. They also categorised different activities / best practices that were followed to achieve the above outcomes based on their review.

Interpretive techniques for reaching the objectives

Motivation and Arousing Interest:

Interpretation cannot force people to change their behaviour, rather it seeks to persuade voluntary behaviour change. In order to prompt behaviour change, tourists must be convinced of the reasons why they should change. Providing examples of human activities that are harming the environment is an important mechanism for creating behaviour change motivation (Orams 1996). Arousing interest among the visitors on the object or the scene to be interpreted is prerequisite for detailed interpretation. This will make the visitors to pay more attention on the interpreter's talk or on the subject. This can be done by presenting thought-provoking questions to the visitors.

For example, one can present a question near crocodile enclosure in a zoo, 'why do these crocodiles keep their mouth open most of the times? Like to know more such interesting behaviours of the crocodiles?' Such questions certainly make the visitors to pay more attention on the subject. Paulraj (1992b) has explained various such techniques which arouse interest on the subject of interpretation.

Interpretation for neglected objects:

Many occasions the visitors pay more attentions on the subjects of their interest and pay no or little attention to many things which are of less attractive to them in a forest or in a zoo. But such neglected subjects may be of more ecological / environmental value. For example, most of the visitor neglect visiting or knowing about wild boars as it is common and not attractive. But if the visitors come to know about their important role in the ecosystem as 'ecosystem engineers' through proper interpretation, their negative thinking on these animals will certainly vanish. Interpretation on even small ants or a common tree could be made interesting by a good interpreter (Paulraj 2010, 2011). More such techniques are explained by Paulraj (1992a).

Media of Interpretation:

Selection and use of appropriate media for interpretation is of great importance. A good interpreter could select appropriate media for an effective interpretation. Recent technological advancements provide vast scopes for developing interactive methods of learning that are very effective in interpreting facts or information. Use of humour elements in interpretation seems to be effective and are enjoyed by visitors (Paulraj 2018).

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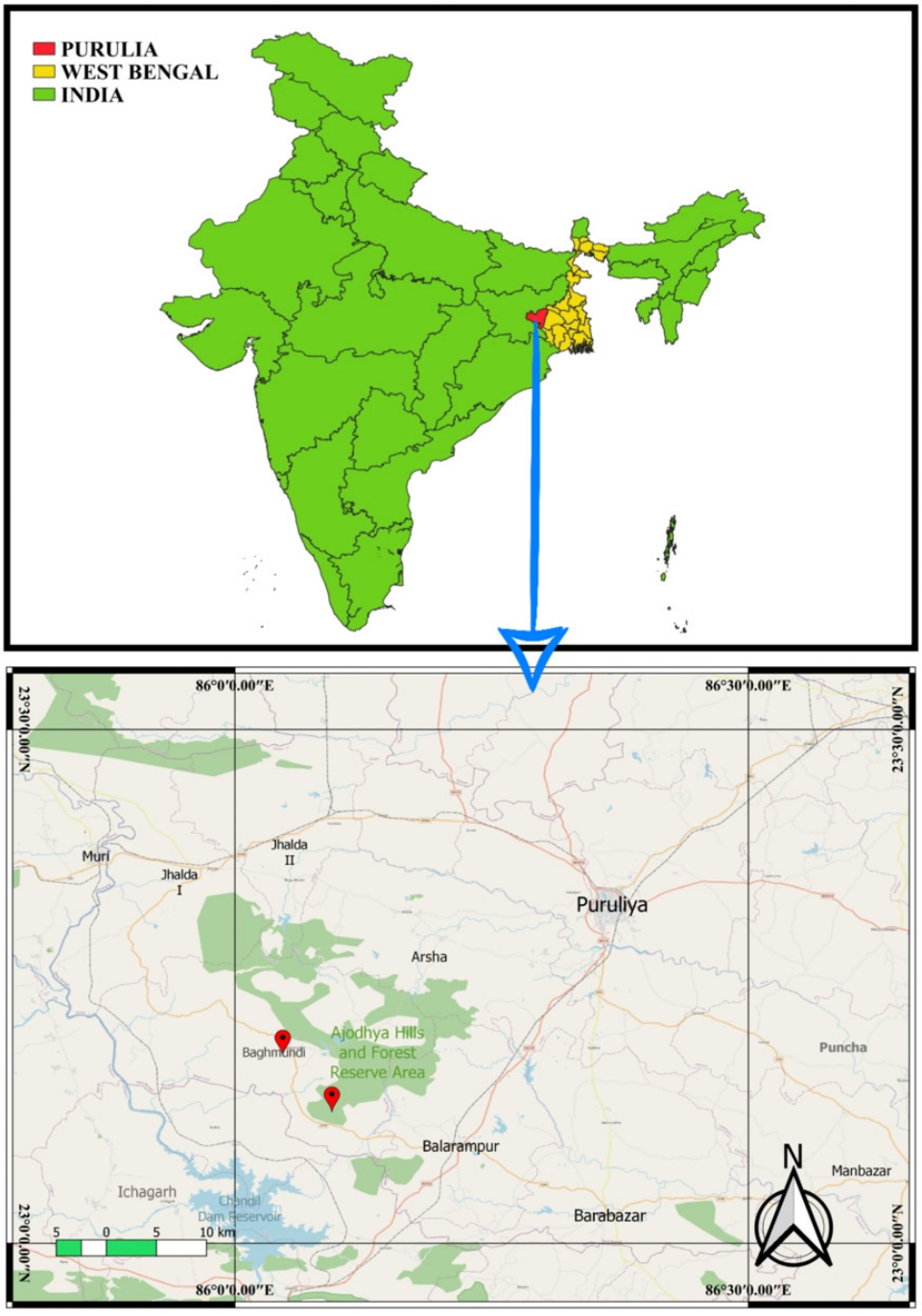
Observation of Pierre's Wart Frog from Purulia, West Bengal, India

Pierre's Wart Frog *Minervarya pierrei* was observed in the Baghmundi Village & Ajodhya Hills of Purulia District, West Bengal, India. This is a regional documentation of the *M. pierrei* and this note would contribute to knowing the species' regional level distribution.

The genus *Minervarya* consists of 31 species at present including our observed species *M. pierrei* (Frost 2021). The species mostly prefers aquatics, woods along

Pierre's Wart Frog *M. pierrei* sighted in Baghmundi, West Bengal, India.

Dorsal view of Pierre's Wart Frog *M. pierrei.*



Location of the sightings of Pierre's Wart Frog *M. pierrei* from Purulia.

rivers, and grassland habitats (Mathew & Sen 2010). It has been evaluated as Least Concern by the IUCN Red List (Shrestha & Ohler 2016).

This frog is reported from Assam, Manipur, Nagaland, Meghalaya, Mizoram, Arunachal Pradesh, West Bengal, Bihar, Uttar Pradesh, Uttarakhand (Saikia & Lyngdoh 2014) and Madhya Pradesh (Prasad et al. 2020).

The species was identified on the basis of the key provided by Mathew & Sen (2010) such as pointed head, snout tip jutting out above the lower jaw, laterally placed nostril which is closer to snout tip, presence of a narrow supra tympanic fold, the tympanum is not very distinct due to spotted colouration, moderate forelimbs, 3/4 th webbed short

hind limbs, a cream coloured mid dorsal snout-vent stripe with reddish spots interrupt inter orbital band and the presence of tiny pale warts in the loreal region, loreal region of *M. pierrei* is slightly concave.

The species was observed during our herpetological survey and photographed from Baghmundi Village (23.11°N, 86.02°E, 264 m) on 8 March 2021, at around 1932 h using a Nikon D5600 camera and a Nikon 70–300 mm lens with a macro filter. Also, it was previously observed on 19 February 2021, around 1220 h in the Ajodhya Hills (23.08°N, 86.05°E, 285 m).

During our survey, the specimens were not harmed nor collected at both times of the observation. In Baghmundi Village the species was observed near human habitation (rural as well as densely populated city area) whereas in Ajodhya Hills the species was observed in a dry and deciduous forest area with a small water passage surrounded by rocks and dry leaves.

As no proper documentation on the amphibian diversity is present from the region, this study will be helpful to understand the regional level distribution of *M. pierrei*. Also, this study can be used for conservation purpose and for future documentation on amphibian diversity from this region.

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Observation of interspecific amplexus between Indian Skipper Frog and Indian Bull Frog in Uttarakhand, India

***Euphlyctis cyanophlyctis* and *Hoplobatrachus tigerinus* in axillary amplexus. © Shyamal Saikia.**

Interspecific amplexus is reported from various anuran species and can occur due to sympatry, overlap of the breeding season, and explosive breeding pattern (Groffen et al. 2019; Jithin et al. 2021). Despite having a high diversity of anurans, relatively fewer cases of interspecific amplexus are reported from India compared to the countries of the Nearctic and Neotropical regions (Serrano et al. 2022). *Euphlyctis cyanophlyctis* and *Hoplobatrachus tigerinus* both belong to the Dicroglossidae family and are widely distributed in the Indian subcontinent (Frost 2021). *Euphlyctis cyanophlyctis* is aquatic while *Hoplobatrachus tigerinus* is a semi-aquatic species and both frogs breed in stagnant water pools during monsoon (Daniels 2005). In this note, we report our observation of the interspecific amplexus between *E. cyanophlyctis*

and *H. tigerinus* from Dehradun, Uttarakhand, India.

At 1740 h on 30 April 2022, we observed a male *E. cyanophlyctis* engaged in axillary amplexus with *H. tigerinus* of unknown sex on the edge of a small cement water tank near a natural lake in the nature trail of Wildlife Institute of India in Dehradun (30.2863°N, 77.9745°E). Three more *E. cyanophlyctis* were present inside the water. We observed the pair for around 5–7 min, thereafter, the *H. tigerinus* jumped inside the water and the pair separated. Amplexus of *E. cyanophlyctis* usually occur inside the water (Daniels 2005). However, this pair was observed outside of the water. Interspecific amplexus between *E. cyanophlyctis* and *H. tigerinus* has been reported previously by Sharma & Koli (2016) and interspecific amplexus between *E. cyanophlyctis* and *Duttaphrynus melanostictus* has been reported previously by Patel et al. (2022).

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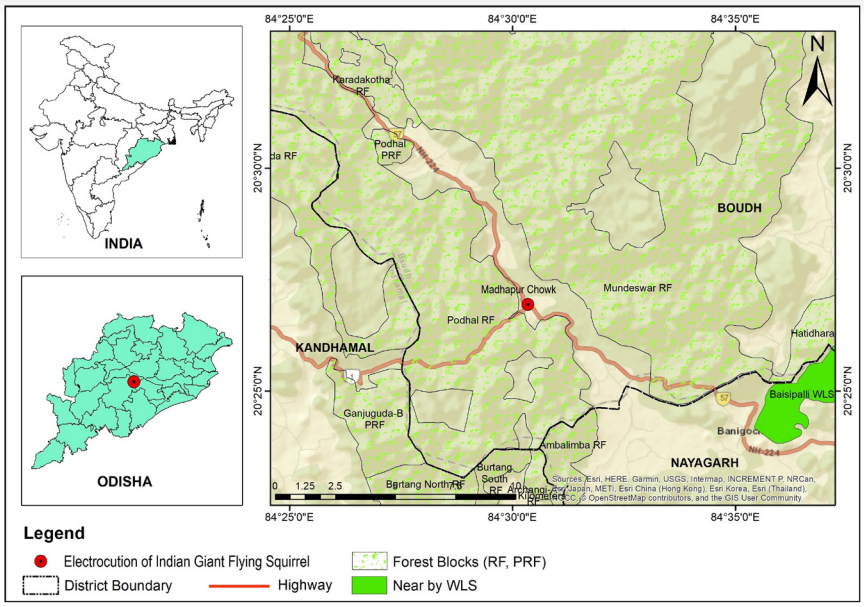
Electrocution of an Indian Giant Flying Squirrel in Odisha, India

The Indian Giant Flying Squirrel or the Large Brown Flying Squirrel *Petaurista philippensis* of the rodent family Sciuridae glide horizontally through the tree canopies for their mobility. It generally takes shelter in the mid-canopy and uses tall trees for feeding and gliding across (Koli 2006). Preferring cryptic habitats, this species remains active from dusk hours and retires before dawn, ideally resting to narrow tree cavities (Koli 2006). *P. philippensis* is frugivorous & folivorous and prefers tree species such as *Madhuca longifolia*, *Terminalia bellirica*, *Diospyros melanoxylon*, and *Ficus religiosa* for nesting and foraging (Koli et al. 2013).

Dead Indian Giant Flying Squirrel tied to an advertisement board by villagers after electrocution at Madhapur Chowk, NH 57, Boudh District, Odisha.

The species with a wide distribution range is regarded globally as 'Least Concern' in the IUCN Red List (Walston et al. 2016) and listed in Schedule I of the 2022 amendment of the Indian Wildlife Protection Act, 1972. However, many recent studies are indicative of its declining status, with increasing anthropogenic pressures such as habitat encroachment and fragmentation, agricultural expansion, logging, poaching, induced forest fire, hunting for domestic consumption, and ethnomedicinal uses (Koli 2016).

We encountered a fresh carcass of a flying squirrel on a road junction of NH 57 in the early morning hours of 25 November 2021 at Madhapur Chowk, Boudh District, Odisha (20.4489 N & 84.5058 E). The carcass was tied with ropes on an advertisement board out of curiosity and concern by the gathered crowd. The incident was then informed to the forest department by the locals. Upon casual interrogation, the eyewitnesses revealed that the animal fell unconscious after colliding with an adjacent live electric transmission wire, parallel to the highway, along the forest edge, over a height of 8 m from the ground. The length of the carcass approximately measured ~48 cm and tail ~58 cm as it was roughly measured by a piece of rope and marked with a pen, because of unavailability of a proper measuring tape at the site. Later on, the approximate measurements of the specimen were compared with a field guide (Menon 2014) for confirming the



Electrocution site of Indian Giant Flying Squirrel in Eastern Ghats of Odisha, India. RF - Reserve Forest, PRF - Protected Forest, WLS - Wildlife Sanctuary.

identification. The squirrel had long bushy tail, longer than the slender body, and a claret grey colour washed with white hair in the ventral part, overall grey fur and patagium between forelimbs and hind limbs was confirmly identified to be a Giant Indian Flying Squirrel *P. philippensis* (Menon 2014; Koli 2016). The ventral body of the carcass showed marked injuries from the electrocution and a few burnt furs on careful observation. The area in which the incident took place, is a critical wildlife habitat passing through Podhal and Mundeswar reserve forests of Boudh District, Odisha in the Eastern Ghats. The hilly mountainous region is composed of mixed deciduous forests (Mohapatra et al. 2019). The site is about 10–12 km far radially from the Baisipali Wildlife Sanctuary and Satkosia Tiger Reserve where the species has been recorded previously.

To the best of our knowledge, such incidents of electrocution have not been recorded in the region, in the case of the Giant Indian Flying Squirrel *P. philippensis* previously and this report hence presents one such first case. A roadkill case of the species was previously reported from the Nilgiris (Samson et al. 2016), and two observations being caught dead in the barbed wire fence, were reported from Agumbe in the Western Ghats (Conservation India 2013, 2014).

Increasing linear infrastructures such as roads, railways, and high-tension electric lines in important wildlife areas, without effective mitigation measures, pose a severe threat to wildlife. Especially in the case of small-bodied, arboreal mammals, such incidents become even more serious in areas of heterogeneous forest habitats in peri-urban landscapes. Many such incidents in cases of arboreal primates have been widely recorded previously and electrocution is one major concern among them (Chaves et al. 2022). Such structures, fragment the forests, restrict animal mobility, and increases the chances of accidents by acting as physical and psychological barriers (WII 2016). However major mitigation measures considered in developmental projects are in prior to the movement of large-bodied animals, and birds, but are often silenced in cases of other animals (WII 2016; Chaves et al. 2022).

Several reports have discussed measures for ease of movement across such structures for birds (WII 2016) and arboreal macaques but

since these squirrels have specified gliding capability, broadly restricted to particular heights distances and need good canopy closure and connectivity for moving across, structures and areas passing through their habitats must be amended accordingly for better permeability of the species across its habitat fragments. Moreover, such species are understudied across their distribution ranges and often remain unnoticed in many places by locals, despite their good presence in marginal forest patches, adjacent to human habitations (Mahapatra et al. 2019). The species needs a better understanding of its ecology, biology, distribution, and underlying conservation aspects for its long-term persistence (Koli 2016). This case report hence drops light again on the often-undermined consequences of development, faced by lesser attended mammals such as the Giant Indian Flying Squirrel *P. philippensis* and urges our attention towards understanding more on the conservation significance of such species and include them while planning green infrastructures.

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A preliminary survey of butterflies in Pachamalai Hills, Tamil Nadu, India

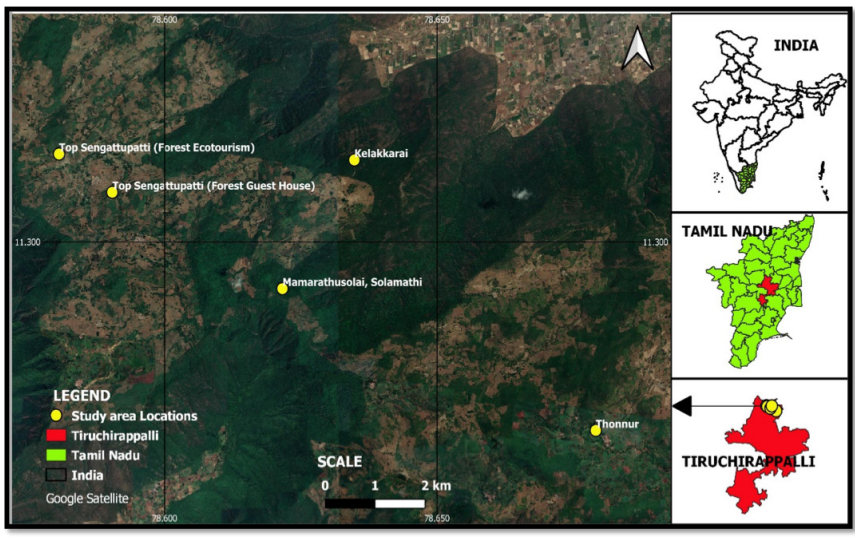
A preliminary butterfly study was carried out in Pachamalai Hills of Tiruchirappalli District on 18 & 19 September 2021. Pachamalai Hills in the Eastern Ghats stretch across Salem and Tiruchirappalli districts of Tamil Nadu, India. The mountains are mostly covered with dry evergreen, semi-evergreen, and southern tropical dry mixed deciduous forests. Pachamalai Hill comprises of 59.5 percent forest area and 40.5 percent cultivation land with human settlement. Tapioca, rice, and other minor millets form the staple food of the people who inhabit this mountain. The Pachamalai is rich in the biodiversity of plants, birds, butterflies, and other insects. The present study was done at five sampling sites: Top Sengatupatti (Forest ecotourism), Top Sengatupatti (Forest guest house), Kelakarai, Mamarathusolai, and Solamathi.

Butterflies were observed opportunistically and counted throughout the day. During the study time, the temperature varied between 25–29°C. All sighted species were photographed in the wild with Nikon B600 and Nikon D3400. The species of butterflies were identified with the help of the field guide by Kehimkar (2016). No specimen was collected during the study.

We recorded 1,345 individuals representing 103 species (Table 1) of butterflies belonging to six families.

Nymphalidae family dominated others with 32 species and 608 individuals followed by Lycaenidae with 26 species and 235 individuals, Pieridae with 20 species and 251 individuals, Hesperiidae with 15 species and 94 individuals, Papilionidae with nine species and 228 individuals and Riodinidae was represented by one species and 29 individuals.

The biodiversity indices were computed as described by Magurran (2004) and Kyerematen et al. (2014) (Table 2).



Location of the study area of Pachamalai Hills from Tiruchirappalli District.

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Orange Awlet. © R. Santhosini.

Common Small Flat.

Indian Skipper.

Tailed Jay.

Crimson Rose.

Southern Birdwing.

Lime Butterfly.

Mottled Emigrant.

Crimson Tip.

Plain Orange Tip.

Common Jezebel.

Double-banded Judy.

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Bugs ALL

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Common Silverline.

Yamfly.

Monkey Puzzle.

Plain Tiger.

Black Rajah.

Gladeye Bushbrown.

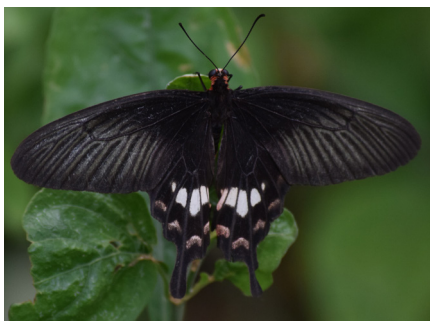
Blue Pansy.

Angled Castor.

Lemon Pansy.

Striped Tiger.

Common Leopard.



Common Rose.

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Table 1. List of Butterflies in Pachamalai Hills in Tiruchirappalli District.

	Family	Common Name	Scientific Name	Day 1	Day 2
1	Hesperiidae (Skippers)	Orange Awlet	*Burara jaina*	1	0
2		Common Banded Awl	*Hasora chromus*	2	1
3		Common Snow Flat	*Tagiades japetus*	4	2
4		Fulvous Pied Flat	*Pseudocoladenia dan*	2	0
5		Common Small Flat	*Sarangesa dasahara*	8	4
6		Malabar Spotted Flat	*Celaenorrhinus ambareesa*	0	1
7		Common Spotted Flat	*Celanorrhinus leucocera*	17	14
8		Indian Skipper	*Spialia galpa*	3	2
9		Bush Hopper	*Ampittia dioscorides*	4	1
10		Chestnut Bob	*Lambrix salsala*	3	2
11		Straight Swift	*Parnara guttata*	3	1
12		Rice Swift	*Borbo cinnara*	4	1
13		Small Branded Swift	*Pelopidas mathias*	7	4
14		Dark Palm Dart	*Telicota aneilla bambusae*	2	0
15		Kanara Swift	*Caltoris canaraica*	0	1
16	Papilionidae (Swallowtails)	Common Jay	*Graphium doson*	11	7
17		Tailed Jay	*Graphium agamemnon*	3	4
18		Common Rose	*Pachliopta aristolochiae*	27	22
19		Crimson Rose	*Pachliopta hector*	13	9
20		Southern Birdwing	*Troides minos*	19	21
21		Common Mormon	*Papilio polytes*	16	18
22		Blue Mormon	*Papilio polymnestor*	13	16
23		Lime Butterfly	*Papilio demoleus*	7	3
24		Common Banded Peacock	*Papilio crino*	12	7
25	Pieridae (Whites & Yellows)	Three-spot Grass Yellow	*Eurema blanda*	7	9
26		Small Grass Yellow	*Eurema brigitta*	5	7
27		Common Grass Yellow	*Eurema hecabe*	8	11
28		Common Emigrant	*Catopsilia pomona*	18	21
29		Mottled Emigrant	*Catopsilia pyranthe*	12	14
30		Crimson Tip	*Colotis danae*	7	3
31		Small Orange Tip	*Colotis etrida*	2	1
32		Plain Orange Tip	*Colotis aurora*	11	6
33		Small Salmon Arab	*Colotis amata*	5	2
34		Large Salmon Arab	*Colotis fausta*	2	0
35		White Orange Tip	*Ixias marianne*	1	2
36		Great Orange Tip	*Hebomoia glaucippe*	7	9

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	Family	Common Name	Scientific Name	Day 1	Day 2
37	Pieridae (Whites & Yellows)	Dark Wanderer	*Pareronia ceylanica*	5	7
38		Common Wanderer	*Pareronia hippia*	8	5
39		Common Albatross	*Appias albina*	2	3
40		Striped Albatross	*Appias libythea*	0	1
41		Common Gull	*Cepora nerissa*	3	4
42		Pioneer	*Belenois aurota*	2	1
43		Psyche	*Leptosia nina*	5	4
44		Common Jezebel	*Delias eucharis*	14	17
45	Riodinidae (Judies & Punches)	Double-banded Judy	*Abisara bifasciata*	13	16
46	Lycaenidae (Blues)	Common Silverline	*Spindasis vulcanus*	2	0
47		Common Lineblue	*Prosotas nora*	24	26
48		Tailless Lineblue	*Prosotas dubiosa indica*	27	22
49		Angled Pierrot	*Caleta decidia*	4	2
50		Banded Blue Pierrot	*Discolampa ethion*	6	4
51		Common Pierrot	*Castalius rosimon*	4	2
52		Black-spotted Pierrot	*Tarucus balkanicus nigra*	2	1
53		Dark Cerulean	*Jamides bochus*	1	0
54		Common Cerulean	*Jamides celeno*	4	3
55		Metallic Cerulean	*Jamides alecto*	0	1
56		Forget-me-not	*Catochrysops strabo*	2	4
57		Zebra Blue	*Leptotes plinius*	4	3
58		Dark Grass Blue	*Zizeeria karsandra*	3	1
59		Pale Grass Blue	*Pseudozizeeria maha*	6	4
60		Lesser Grass Blue	*Zizina otis*	4	0
61		Tiny Grass Blue	*Zizula hylax*	7	4
62		Gram Blue	*Euchrysops cnejus*	3	5
63		Grass Jewel	*Freyeria trochylus*	7	2
64		Small Cupid	*Chilades parrhassius*	2	0
65		Indian Cupid	*Everes lacturnus*	0	1
66		Plains Cupid	*Chilades pandava*	8	5
67		Lime Blue	*Chilades lajus*	4	7
68		Large Oakblue	*Arhopala amantes*	0	1
69		Small Grass Jewel	*Freyeria putli*	3	5
70		Yamfly	*Loxura atymnus*	2	2
71		Monkey Puzzle	*Rathinda amor*	0	1
72	Nymphalidae (Brush-footed)	Blue Tiger	*Tirumala limniace*	42	47
73		Dark Blue Tiger	*Tirumala septentrionis*	37	43
74		Glassy Tiger	*Parantica aglea*	11	9

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	Family	Common Name	Scientific Name	Day 1	Day 2
75	Nymphalidae (Brush-footed)	Striped Tiger	*Danaus genutia*	29	32
76		Plain Tiger	*Danaus chrysippus*	31	26
77		Double-branded Crow	*Euploea sylvester coreta*	9	7
78		Common Crow	*Euploea core*	18	16
79		Common Nawab	*Polyura athamas*	1	0
80		Anomalous Nawab	*Polyura agraria*	2	0
81		Black Rajah	*Charaxes solon*	1	0
82		Common Evening Brown	*Melanitis leda*	4	2
83		Gladeye Bushbrown	*Mycalesis patnia*	7	11
84		Common Bushbrown	*Mycalesis perseus*	1	3
85		Common Five-ring	*Ypthima baldus*	7	3
86		White Four-ring	*Ypthima ceylonica*	16	18
87		Common Four-ring	*Ypthima huebneri*	27	22
88		Tawny Coster	*Acraea violae*	17	13
89		Small Leopard	*Phalanta alcippe*	0	1
90		Common Leopard	*Phalanta phalantha*	3	1
91		Rustic	*Cupha erymanthis*	6	4
92		Common Sailer	*Neptis hylas*	5	6
93		Chestnut-streaked Sailer	*Neptis jumbah*	3	5
94		Common Lascar	*Pantoporia hordonia*	0	1
95		Angled Castor	*Ariadne ariadne*	3	4
96		Common Castor	*Ariadne merione*	5	6
97		Blue Pansy	*Junonia orithiya*	0	1
98		Chocolate Pansy	*Junonia iphita*	4	7
99		Grey Pansy	*Junonia atlites*	0	2
100		Lemon Pansy	*Junonia lemonias*	5	7
101		Great Eggfly	*Hypolimnas anomala*	2	1
102		Danaid Eggfly	*Hypolimnas misippus*	2	4
103		Lobed beak	*Libythea laius*	3	5

A total of 103 butterfly species belonging to six families were recorded. Among these, one species *Burara jainaare* is a rare sighting in the Eastern Ghats from this area (Siva et al. 2021). In Tiruchirappalli District, studies on the butterfly diversity are very less and the scientific information and publications area very few. Siva & Neelanarayanan (2019) reported 72 species of butterflies observed from the Nehru Memorial College campus. This study is the primary attempt to document the butterfly fauna from the region. Therefore, it is very difficult to say whether the diversity of butterflies in the area is increasing or decreasing. Hence, it is suggested that the area under the study should be continuously

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Table 2. Family-wise diversity indices.

	Family	No. of species	Shannon-Weiner index(H')	Effective no. of species(H')	Simpson diversity index (D)	Margalef richness index	Pielou's evenness index
1	Hesperiidae	15	2.233	9.3	0.85	20.6	0.62
2	Papilionidae	9	2.059	7.8	0.86	41.9	0.87*
3	Pieridae	20	2.700	14.8	0.91	45.4	0.74
4	Riodinidae	1	0.000	0.00	0.00	8.6	0.00
5	Lycaenidae	26	2.678	14.5	0.90	43.0	0.55
6	Nymphalidae	32	2.856*	17.4*	0.92*	94.8*	0.54

Note: *higher values

monitored to observe any change in the occurrence of butterflies because the changes in the diversity can only be observed through continuous monitoring and comparing the data of every year.

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This article has been retracted by Zoo's Print due to the faulty reporting of the discovery of a North American species in India

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First record of Double-branded Crow from Purulia, India

The butterfly *Euploea sylvester* is very similar to the Common Crow, commonly called Double-branded Crow belonging to family Nymphalidae of superfamily Papilinoidea (Kehimkar 2016). It was reported for the first time by Fabricius in 1793. During a field survey in Garh Panchkot Hill, Purulia on 7 August 2020 a single specimen of *E. sylvester* was recorded. The photograph of the butterfly was taken using Nikon Coolpix P600; the specimen was not captured. The study site coordinates (86.752E, 23.615N) are plotted in raster plot by using R Studio 3.6.3 (R Studio Team 2020) from where the butterfly was observed puddling.

Double-branded Crow butterfly photographed from Garh Panchkot Hills, Purulia, West Bengal.

Identification of the adult butterfly specimen were done following the keys of Evans (1932), Wynter-Blyth (1957) and Kehimkar (2016).
In India, the Double-branded Crow has a distribution with records from southern parts of Maharashtra, Sikkim, Arunachal Pradesh, and northeastern parts of India (Kehimkar 2016). Aside from India this butterfly species is also found in other countries—Nepal, Bhutan, Bangladesh, Myanmar, and Sri Lanka (Kehimkar 2016). This butterfly prefers well-wooded areas and patches of forests, depends on flowers for collection of food, and migrates with other Milkweed butterflies (Kehimkar 2016). In West Bengal the butterfly was found only in two districts Alipurduar and Bankura (Sengupta 2021). This is the first record of *Euploea sylvester* from Purulia district situated in Chota Nagpur Plateau (Samanta et al. 2017; Das 2018), that can help in selection of conservation strategy for this particular species in this ecological region.

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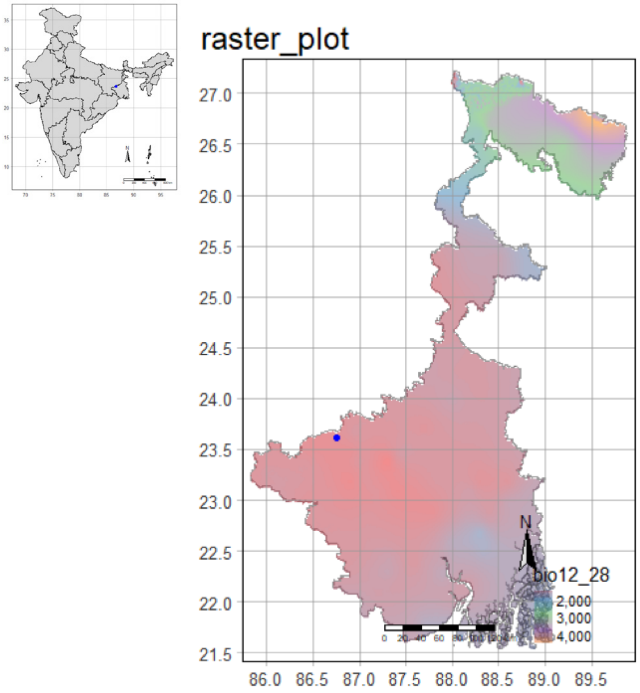

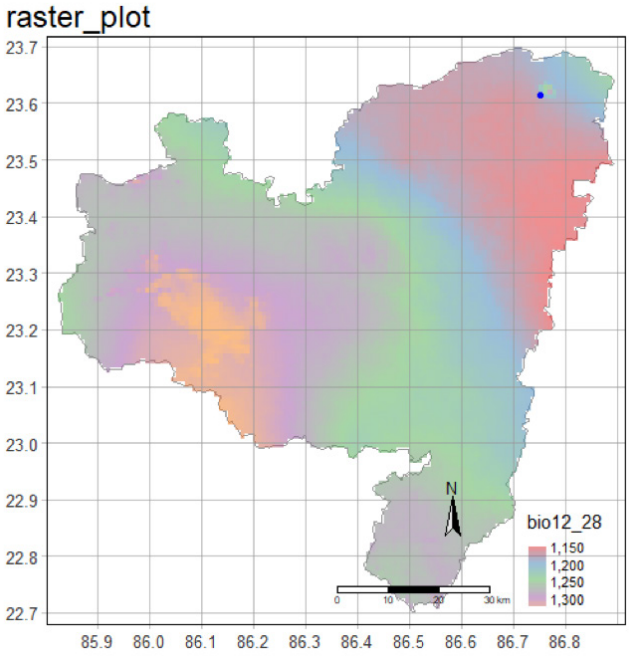

Coordinates of the site from where butterfly Double branded crow was photographed: 1a–plotted in India map | 1b–West Bengal map | 1c–Purulia.

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Unique survival strategy of termites during flood

Termites making cluster for their survival during flood.

Termites are considered social insects that come under the Infraorder Isoptera and the order Blattodea (along with cockroaches). They are considered one of the most successful insect groups on the planet as they are found on all continents except Antarctica and from a few hundred individuals to massive societies with millions of individuals they can colonize their groups. Among all the insect groups, the termite queen has the longest lifespan of any insect.

The life cycle of termites is a little bit different than ants. They go through an incomplete metamorphosis which includes egg, nymph, and adult stages, whereas other ants go through complete metamorphosis. They are considered superorganisms as they have the self-regulating entity in the colony itself. Like other social insects, termite colonies also have workers, queens, etc. In the termite colony, the majority of the labour work performed by worker termites includes the collection of food and its storage, offspring, and maintenance of nest.

Furthermore, the soldier termites play the role of defence in their colony. They have enlarged heads with extremely modified jaws (Bignell et al. 2010).

The queen is the fertile female they are known for the production of eggs in the colony. The

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king termite copulates with the queen for the life (Horwood & Eldridge 2005; Keller 1998).

During the flood in June 2022 in Athgharia village, Nalbari, Assam, it was observed that a colony of termites was floating over the water. When water enters into the termite nest, they come out with their young and eggs. They form a cluster and keep the eggs on top of the colonies for safety. After floating for a while, they form finger-like projections and help the colony to stick to bamboos and walls. They start placing their young ones and start building their nests as soon as the flood goes downs.

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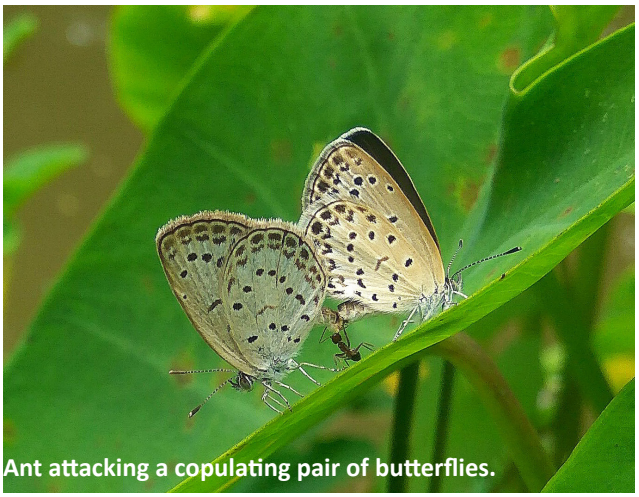
Observation of Pale Grass Blue butterfly mating and predatory behaviour of ant

The Pale Grass Blue butterfly is a tiny butterfly found in southern Asia that belongs to the lycaenid (blue) family. Vincenz Kollar described the species for the first time in 1844 (Varshney & Smetacek 2015).

Pale Grass Blue butterfly lays eggs on certain host plants which includes Leguminosae and Acanthaceae plants and *Oxalis corniculata* which belongs to family Oxalidaceae (Robinson et al. 2010). In nature, ants are omnivores, scavengers, and indirect herbivores (Wilson & Hölldobler 2005). Most ants are predators, and some feed on and prey on other social insects such as other ants (Carroll & Janzen 1973).

On 28 August 2021, at 1301 h, a pair of Pale Grass Blue butterflies was observed copulating over a leaf of a *Colocasia* plant in Athgharia Village, Nalbari District, Assam, India. While they were copulating, an ant attempted to bite the lowermost part of the butterfly's abdomen. The butterfly couple fled to the nearest *Colocasia* leaf for safety when they were startled by the ant's presence.



Ant attacking a copulating pair of butterflies.

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First record of Khasi Common Birdwing from Bankura, West Bengal, India

West Bengal, in the eastern zone of India, harbors a heterogeneous landscape comprising parts of four biogeographic zones: Himalaya, Gangetic plains, Indian/Deccan peninsula-Chotta Nagpur plateau, and Coastal zone. Butterflies from different biogeographic zones therefore contribute to the huge diversity of West Bengal with several species sharing multiple zones. Bankura District, situated in the south-west part of West Bengal, links the Gangetic plains on the east and the Chhota Nagpur Plateau on the west (Nandy & Pal 2014). Due to this unique geography, Bankura District houses a rich butterfly diversity. A few significant studies and surveys across villages, hills and forests of Bankura District as well as in Bankura town have cumulatively generated a checklist of more than 120 species of butterflies including species like *Papilio helenus* and *Vagrans egista* which had previous records only from

Photographic documentation of the *Troides helena cerberus* sighted at Biharinath, Bankura district © Arka Pal. Inset: The spotted individual is nectaring from *Lantana camara* flowers. © Souparno Roy.

Photographic documentation of the *Troides helena cerberus* sighted at Susunia, Bankura District. © Souparno Roy.

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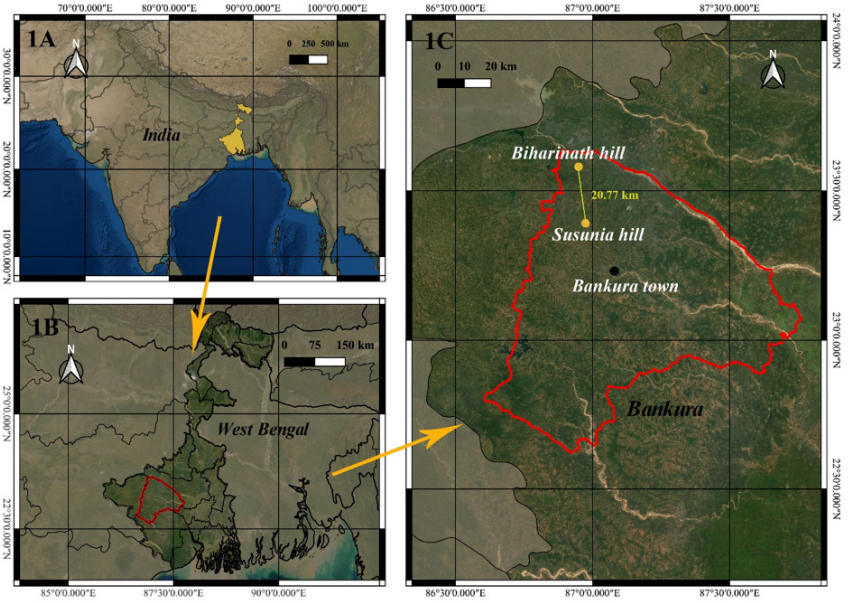

GIS map of the study site prepared using QGIS software (1A–Position of West Bengal in India | 1B–Position of Bankura District in West Bengal | 1C–Positions of Susunia Hill and Biharinath Hill in Bankura).

northern West Bengal (Mukherjee & Mondal 2020; Nayak 2020; Roy et al. 2021). Similarly, in our recent butterfly survey in Susunia and Biharinath (two hills nestled in the north-west of Bankura town), we recorded the first sighting of *Troides helena cerberus* (C. & R. Felder, 1865), Khasi Common Birdwing (Lepidoptera: Papilionidae) which is a new addition to the butterfly diversity of Bankura.

Observation

During a field trip to Bankura in September 2022, *Troides helena cerberus* was first sighted in Susunia on 17 September 2022 at 1000 h. The spotted individual was a female, flying away through the canopy adjacent to Susunia forest rest house (23.39156° N, 86.97452° E, 142m). The hindwings of the individual were torn enough which indicated that it was not freshly emerged. At the time of the sighting, the weather was partly sunny (Temp: 29˚C, RH: 69%). The duration of this sighting was so short that only one record shot could be taken before the individual disappeared. On the next day (18 September 2022), a second individual was spotted and photographed at 1122 h in Biharinath, within the campus of Biharinath Eco-tourism Centre (23.58028° N, 86.9489° E, 147m). It was also a female individual which was nectaring from the wild lantana flowers *Lantana camara*. The second individual was a bit fresher than the first one (as observed from the wing condition). At the time of the second sighting, the weather condition was cloudy (Temp: 29˚C, RH: 85%). In both observations, species identification was confirmed using taxonomic keys from the literature. The aerial distance between the two observation sites was around 21 km.

Till date, within West Bengal, *T. h. cerberus* has only been reported from the northern region, mostly along Dooars (foothills of eastern Himalaya). This species is well abundant in Buxa Tiger Reserve, Alipurduar District (Sinha et al. 2019), Chilapata Wildlife Sanctuary (pers. obs.) and Gorumara National Park, Jalpaiguri District (Ghatak & Roy 2013). It is also frequently observed in lower elevations of Mahananda Wildlife Sanctuary, Darjeeling and Neora Valley National Park, Kalimpong

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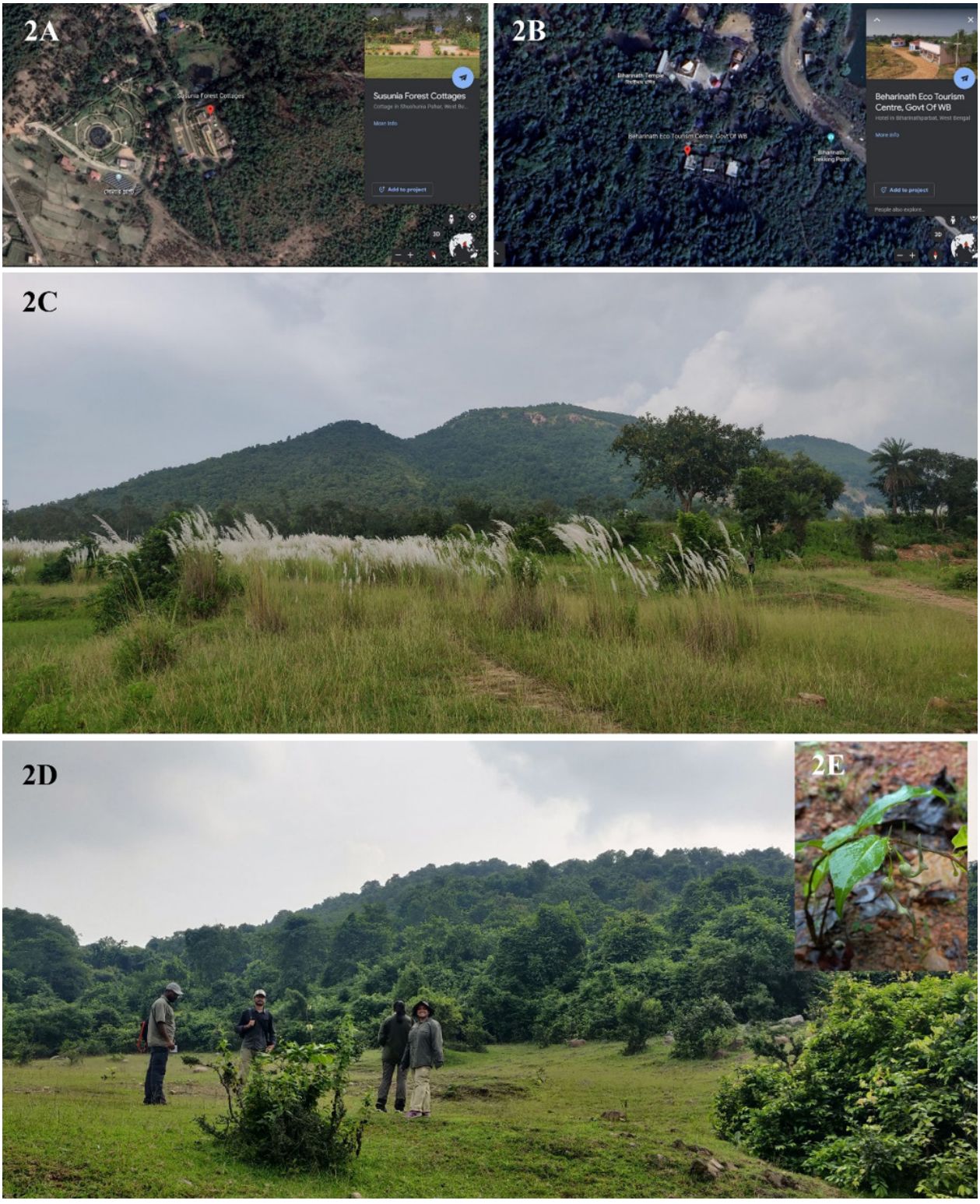

Satellite images of the study sites (2A–Susunia | 2B–Biharinath) obtained from Google Earth. Habitat of the study sites (2C–Susunia © Sarika Baidya | 2D–Biharinath © Arka Pal | 2E (Inset)–*Aristolochia indica* spotted in Biharinath © Swapna Biswas.

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District (pers. obs.). But there is no previous sighting record of this species from the districts of south Bengal. Thus, it is the first record of *T. h. cerberus* from southern Bengal, precisely from the plateau of Bankura District. However, this kind of extension of distribution is highly influenced by the distribution and abundance of host plants (Knops et al. 2002). *Aristolochia indica*, larval host plant of *T. helena*, is well abundant in Biharinath (image 2E) and Susunia region (Mukherjee & Mondal 2020). But, it is not confirmed whether *T. h. cerberus* already has an established population in the studied area or not. In order to validate that a thorough year-long survey is suggested.

Updated distribution of *T. h. cerberus* in India: Odisha, Andhra Pradesh (Vishakhapatnam District), northern Bihar (Champaran District), Sikkim, West Bengal (Northern West Bengal and Bankura), Arunachal Pradesh, Tripura and the rest of northeastern India (covering Himalaya up to 1,400 m) (Gasse 2018; Anonymous 2022).

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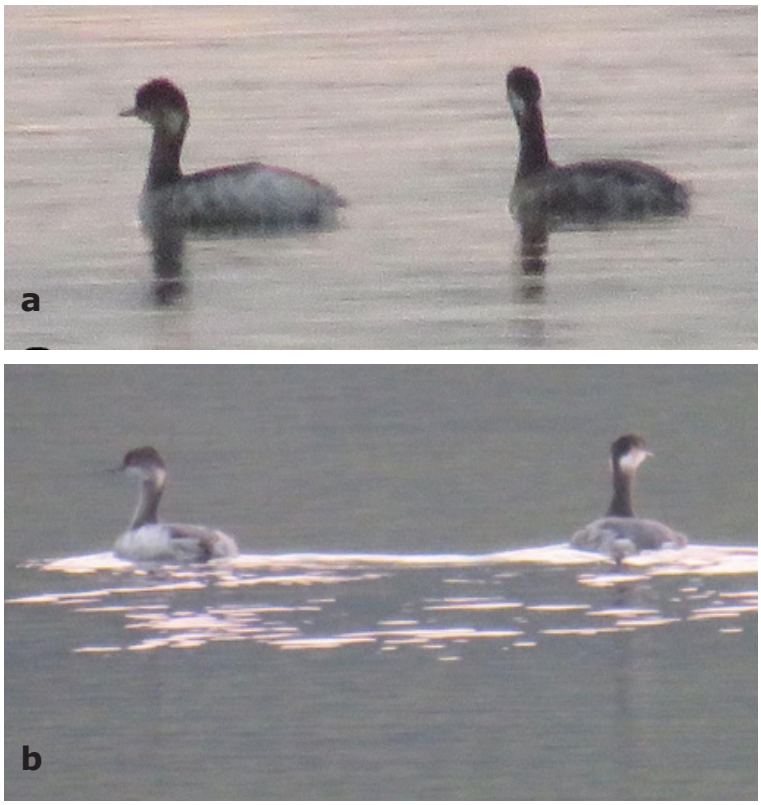
Sighting record of Eared Grebes from Soonchali, Assam, India

On 16 January 2022, while bird watching at the Brahmaputra sandbars near Soonchali, Guwahati (26.21575° N, 91.81931° E), two grebe-like birds were spotted in the water body. Initially, they were misidentified as Great Crested Grebes, which are usually found in large numbers in this area. Both birds were seen resting with their necks on their backs for an extended period of time. Once the birds began to move in the late evening, they were examined with binoculars and photographed. It then became



Pair of Eared Grebes (a and b) swimming in the river.

Table 1. Details of the sighting records of Eared Grebes in Assam during 1990–2022.

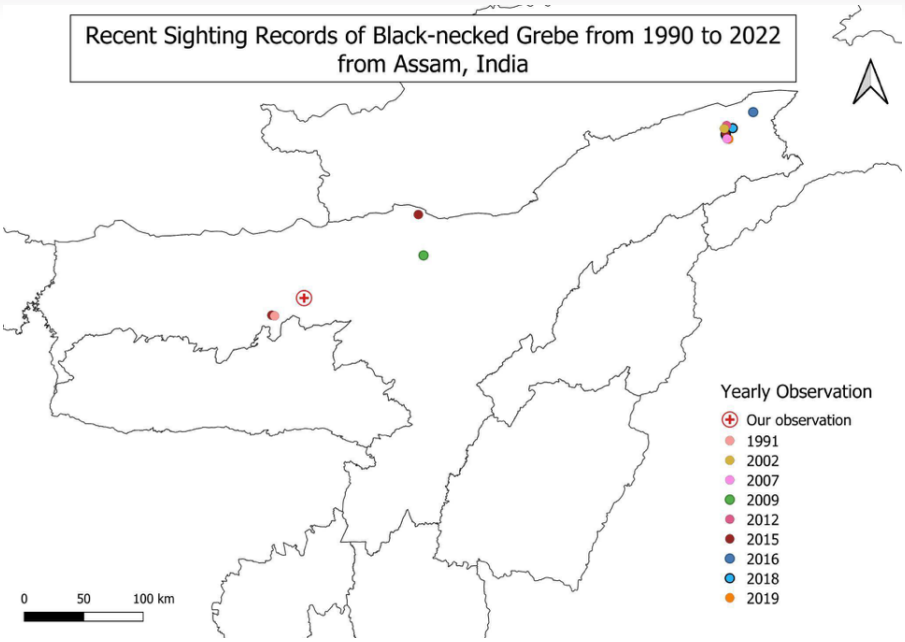
	Date	Location	Sighted By	No. of Individuals
1	06.i.1991	Deepor Beel, Kamrup	Anwaruddin Choudhury	2
2	21.xii.2002	Dibru Saikhowa National Park	Graeme Spinks	2
3	05.xi.2009	Silghat, Tezpur	Anders Osterby	2
4	09.xii.2012	Dibru Saikhowa National Park	Garima Bhatia	*Not mentioned*
5	14.i.2014	Dibru Saikhowa National Park	Imon Abedin	8
6	14.i.2014	Dibru Saikhowa National Park	Rahul Kumar	2
7	18.i.2015	Nameri National Park	Bikash Kalita	*Not mentioned*
8	24.i.2015	Dibru Saikhowa National Park	Jayanta Manna	1
9	17.xi.2015	Maguri Beel	Rishikesh Gogoi	*Not mentioned*
10	18.xi.2015	Maguri Beel	Porag Phukan	*Not mentioned*
11	30.xi.2015	Deepor Beel, Kamrup	Pritam Baruah	1
12	27.xii.2016	Sadiya River Crossing, Tinsukia	André Weiss	1
13	07.xii.2019	Maguri Beel	Amarjyoti Saikia	*Not mentioned*

evident that it was a pair of Eared Grebes *Podiceps nigricollis* (also called as Black-necked Grebes) in non-breeding plumage. The pair was spotted again on 17 January 2022 at the same spot. The birds did not exhibit fishing activity and were either seen at rest or moving slowly in the water on both days.

Grebes are aquatic species of duck-like birds found predominantly in freshwater ecosystems (Winkler et al. 2020). Despite their phenetic resemblance to loons and coots, they are cladistically related to flamingos. Eared Grebes are one of the nine species from the *Podiceps* genus of grebes. In breeding plumage, adults have a black head and upperparts, with golden ear tufts and a black erectile crest (Grimmett et al. 2016). Wintering birds have dark upperparts and a whitish-grey neck to belly (Cullen et al. 2020).

This species is a rare winter visitor to western India, the lower Himalayan ranges, Nepal, and certain parts of northeastern India (Grimmett et al. 2016). It breeds in the high altitude lakes of Ladakh (Tak et al. 2009).

In Assam, this species has no records from well-documented places such as Kaziranga National Park (Barua & Sharma 1999) or Manas



Sighting records of Eared Grebe in Assam from 1990 to 2022.

National Park (Choudhury 2006). The majority of recent records for this species are from Dibru Saikhowa National Park (Table 1). According to Choudhury (2007), this species is an infrequent visitor to the park. The majority of the sightings were of single individuals or pairs. However, one observer observed eight birds from Dibru Saikhowa National Park (Abedin 2018). This species may not be as uncommon as it is thought to be in Assam during the winters. It might have been misidentified due to its resemblance to other grebes in non-breeding plumage.

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