

DAVIS EXPEDITION FUND

REPORT ON EXPEDITION/PROJECT

Expedition/project title: Phylogenetic, biogeographic and ecological inquiry into deciduousness

Travel dates: July 2nd - August 25th, 2025

Location: Bangladesh, Singapore and Thailand

Group Members Ishrath Jahan, Mark Hughes, Manop Poopath, Thamarat Phutthai, Abdur Rahman, Mustafizur Rahman

Aims: **Tracing the number and geographic context of evolutionary transitions into deciduousness**, through examining the distribution patterns of deciduous species in relation to different environmental variables and multivariate comparative measure of species niches using Phylogenetic Generalized Linear Mixed Models.

Photography consent form attached: (please refer to your award letter) Yes No

Summary

I conducted my expedition to Thailand and Bangladesh during July and August 2025. Around 133 dipterocarp samples have been collected from ten different sites in Thailand and five different sites in Bangladesh. In Thailand, samples were collected from the dry deciduous forests of the Southwestern part, the savannas and limestone forests of the South-eastern part, and the evergreen forests of the peninsular region (detailed list attached). In addition, eight voucher specimens and five soil samples have been collected, which are in the process of transport and analysis under the supervision of Bangkok Forest Herbarium and Kasetsart University. The silica samples cover 66 species of Dipterocarpaceae including 14 deciduous species which is nearly 70% of all deciduous species of the family. In Bangladesh, field trips were conducted across the coastal dipterocarp belt of Cox's Bazar District and Chittagong, covering five different national parks and protected areas. Around 12 samples of 7 different species have been collected from Bangladesh, including four deciduous species. The collected materials will be used for DNA library preparation and Illumina whole-genome sequencing, from genome skimming to enable the assembly of the whole chloroplast genome for generating a robust phylogeny. This will be combined with the already generated phylogeny to facilitate comparative analysis. In addition, approximately 3,385 specimens of Dipterocarpaceae available in the Bangkok Forest Herbarium (BKF) were examined and photographed, and around 900 specimens were examined at the Singapore National Herbarium (SING). They will be utilized for extracting geo-references and habitat specific information. The collected samples will provide a good opportunity to fill the data gap in dipterocarps of Asia, increase phylogenetic resolution, and understand the diversity and habitat-specific relationship among different species that co-occur.

REPORT

**BOTANICAL EXPEDITION TO BANGLADESH AND
THAILAND**

ISHRATH JAHAN
(October 2025)



DAVIS EXPEDITION FUND

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INTRODUCTION

Dipterocarpaceae is a dominant canopy tree family that is distributed in Asia, Africa, and South America with 630 species under 17 genera (WFO, 2024). Dipterocarpoideae subfamily is distributed widely across continental Asia, Indo-China to Southeast Asia, with Brunei as the centre of diversity. The biogeographic history shaped the distribution pattern and adaptive ability of the family with much radiation and diversification events in early Eocene (Cvetković et al., 2022), given the fact that high temperature has been a driver of the distribution pattern from long ago. The disjunction of India from Africa has shaped the assemblage of the lineages across South-east Asia (Bansal et al., 2022). Current distribution pattern also proves the resilience of the family, influencing major biome assembly in the tropical Asian forests. They demonstrate an ideal system for analysing trait adaptation with a wide range of contrasting traits e.g. leaf phenology, which are the major focus of my PhD research.

Thailand is situated in the Indo-Malayan realm, spanning the Indochinese–Malayan transition from lowland plains to montane zones exceeding 2,500 m. There are extensive mixed deciduous (e.g., *Tectona grandis*) and deciduous dipterocarp forests (*Dipterocarpus*, *Shorea*) in the north and northeast part. Large, continuous gradients in rainfall, soils (alluvial, lateritic, karst), and fire frequency creates natural experiments for leaf phenology, drought tolerance, and wood–water strategies. Thailand lies near the core of the Indo-Burma biodiversity hotspot, combining high species richness with strong beta diversity and accessible dry-forest formations.

Bangladesh is situated at the junction of Indian and Southeast Asian floras within the Indo-Burma hotspot. It is dominated by the Ganges–Brahmaputra–Meghna delta, with hilly, wetter south-eastern uplands (Chittagong Hill Tracts) and seasonally dry North-western interiors. It contains lowland alluvial floodplains and riverine corridors, and lateritic terraces (e.g., Madhupur), which support native moist deciduous sal forests (*Shorea robusta*). The coastlines in the south and south-east add strong salinity and disturbance gradients in nearby habitats. The country represents monsoon-deciduous systems under intense disturbance (flooding, logging, fragmentation), yielding range-edge and secondary-forest populations ideal for studying adaptation, gene flow, and trait variation in seasonally dry lowlands-complementary to Thailand’s upland dry forests.

Thailand and Bangladesh support the continental monsoon gradient from upland Indochina to deltaic South Asia, encompassing key biogeographic boundaries. Sampling across both countries captures wide environmental, edaphic, and disturbance contrasts, enabling robust tests of drivers of deciduousness and providing conservation-relevant baselines for increasingly fragmented dry forests and climate effected areas.

Deciduousness-related traits are phylogenetically linked (Gorel et al., 2025), and the interdependence among traits, environment, and phylogeny must be considered when addressing broad ecological questions related to adaptation. Different species with phenological variation seem to coexist in similar habitats, which creates challenges in forming a clear hypothesis regarding deciduousness. During the expedition to Thailand and Bangladesh, samples were collected from diverse habitats, which will enhance our understanding of dipterocarps in Asia. The collected samples will contribute novel data on the diversity of dipterocarps in Thailand and across Asia and will facilitate analysis of the relationship between the two main phenological groups (deciduous and evergreen) while accounting for phylogenetic relationships. Additionally, climatic adaptation will be explored by analyzing species niches across time and space.

METHODS

I started my expedition on July 2nd by traveling from Edinburgh to Bangladesh. We had to rearrange our initial travel schedule to align with the goal of the herbarium visit in Singapore and sample collection in Bangladesh. After arranging accommodation and necessary equipment, I departed from Dhaka to Singapore on July 14th.

I worked at the Singapore National Herbarium from 15th to 18th July and met with my supervisor, Dr. Mark Hughes. In SING, I have examined around 900 specimens of Dipterocarpaceae collected from continental and Southeast Asia, and peninsular Malaysia. In addition, we held discussions with the dipterocarp expert and researchers from the Singapore Botanic Garden, Mr. S.K. Ganesan, and Dr. Daniel Thomas, regarding potential collaboration.

We departed for Thailand on 19th July and met our collaborators, Mr. Manop Poopath (Bangkok Forest Herbarium) and Dr. Thamarat Phutthai (University of Mahidol), for planning and logistic support. Mark returned after a few days, confirming the settlement and necessary preparation, and I carried out my field trip and herbarium examination from 21st July to 5th August with the help of Dr. Thamarat and Mr. Manop and persons assigned by them.



Figure 1: Herbarium specimen examination at Singapore National Herbarium (SING) and Bangkok Forest Herbarium (BKF).

I had selected three separate locations of Thailand in my initial plan, by targeting the savanna, evergreen forest and dry dipterocarp forest. During my field trip, I was able to cover all the targeted areas and expanded the sampling sites based on the availability and suggestions of my collaborators.

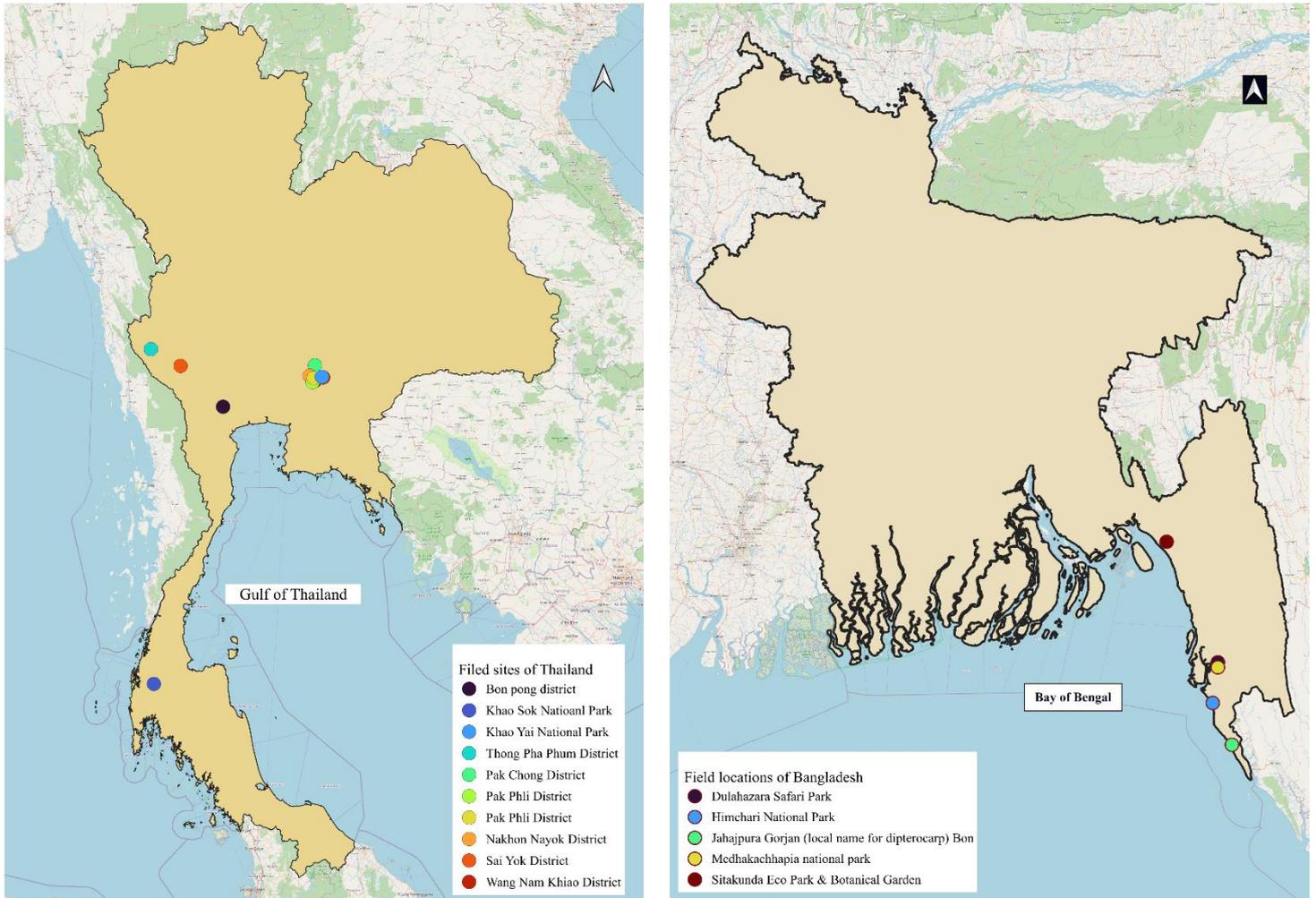


Figure 2: Map of collection localities of Thailand and Bangladesh.

Mr. Manop has conducted some independent field trips in peninsular Thailand covering Trat province, Krabi province, Phetchaburi province, Songkla province, Huai Yang National Park, Khao Chong Botanical Garden in Trang province, Thale Ban National Park in Satun province, and Nakhon Nayok Province during May-July. He collected around 93 silica samples of around 55 species. It saved my travel and expenses, making it possible to invest them in the Southwestern region of mixed deciduous and dry dipterocarp forests.

I booked accommodation at RECOFTC (an international dormitory of Kasetsart University) in Bangkok for the entire duration. It is within walking distance of the BKF, which was very convenient for processing my samples and herbarium visit. In total, I have collected from ten different sites in eight districts of Thailand. Due to excellent communication with Bangkok, I have conducted day tours for Sakaerat Environmental Research Station (savanna and mixed dipterocarp forest) and Khao Yai National Park (evergreen forest) with hired van. Later, I conducted a three-day tour in Kanchanaburi in the Southwestern region and stayed at the accommodation of the University of Mahidol. I spent a total of 20 days in Singapore and Thailand for the herbarium visit and field trip, and returned to Bangladesh on August 5th.



Figure 3: Savanna inside Sakaerat Environmental Research Station with limestone rich soil. The tree species are *Dipterocarpus obtusifolius*, *Pentacme siamensis* and *Anthoshorea roxburghii*, all are deciduous in nature.



Figure 4: In front of BKF with Dr. Mark and Dr. Thamarat. There are 5 species of dipterocarps inside this glass shade.



Figure 5: Lunch with Dr. Thamarat and Loret near the Sakaerat Environmental Research station. The benches are built with dipterocarp woods.

After returning from Thailand, I conducted a field trip in Bangladesh from 7th August, targeting the coastal dipterocarp belt in the South-Eastern part including Cox's Bazar and Chittagong district. All necessary permits were arranged beforehand in collaboration with the Forest Department of Bangladesh. Due to FCDO travel restrictions, I had to avoid travelling to Chittagong Hill Tracts and choose the sites based on accessibility and logistic support from the Forest Department. I stayed in the official guest house of the Chittagong Veterinary and Animal Sciences University in Cox's Bazar and travelled with hired van.



Figure 6: a) Colleagues of Bangladesh Forest Department; b) Soil sample collection in Jahajpura Gorjan Bon; c) *Dipterocarpus turbinatus* tree with a height of about 30m. They are co-occurring with *Hopea odorata* and *D. costatus* with a ratio of 2:1:1; d) and e) Medhakocopia National Park with extensive population of *D. costatus* creating a natural habitat for Asian elephants.

This trip covered around 120 km across the coastline of South-eastern part, and I sampled at Jahajpura Gorjan Bon, Himchhari National Park, Medhakachhapia National Park, and Dulahazara Safari Park. They are dipterocarp dominated seasonal forests with less variation in the composition. I have collected 12 samples of 7 different dipterocarp species including 4 deciduous species. Soil samples were collected wherever possible, and four samples have been collected so far. I completed my field trip on 19th August and returned to Edinburgh on 25th August.

RESULT

There are about 83 species of Dipterocarpaceae in Thailand under 8 genera ([Flora of Thailand](#)). The revised classification of *Shorea* Roxb. ex C.F.Gaertn. tribe by Ashton & Heckenhauer (2022) has reorganized the number of genera thus changing the total number for Thailand. During the expedition, about 66 species from 12 genera have been collected from Thailand which is 79% of the total species. In addition, they include 14 deciduous species, which are about 70% of all deciduous species listed so far, that have been defined as per the ability of shedding leaves to some extent. A total of 133 silica samples and 8 voucher specimens have been collected from Thailand and Bangladesh, including samples collected during the expedition, and prior to it by collaborators. The excessive height of the trees, inaccessibility and their growth habit made it difficult to collect additional voucher specimens. Furthermore, it was the peak of the monsoon season and the end of the flowering period for dipterocarps, making identification challenging. Most of the fresh samples were collected from seedlings, and the soil samples were collected targeting associated deciduous species and sent for analysis at Kasetsart University, Thailand, under the supervision of Dr. Thamarat. The voucher specimens were deposited in the Bangkok Forest Herbarium for authorization and transportation under the supervision of Mr. Manop and the herbarium staff, as per the procedure. They have already been processed for shipment to RBGE.

Table 1: Sites of collection with the total number of species from each location.

Country	Province	Location	Number of samples
Thailand	Trat	Bo Rai District	3
Thailand	Chanthaburi	Mueang Chanthaburi District	1
Thailand	Krabi	Muang District	4
Thailand	Phetchaburi	Krang Krachan National park, Kaeng Krachan District	2
Thailand	Prachuao KhiriKhan	Huai Yang National Park, Thap Sakae District	3
Thailand	Songkhla	Nathavi, Mueang Songkhla District	8
Thailand	Trang	Khao Chong botanical garden, Na Yong District	2
Thailand	Satun	Thale Ban National Park, Khuan Don District	1
Thailand	Nakhon Nayok	The CRMA Botanical Garden	71
Thailand	Nakhon Ratchasima	Mu si, Pak Chong District	2

Country	Province	Location	Number of samples
Thailand	Nakhon Ratchasima	Wang Nam Khiao District	3
Thailand	Nakhon Ratchasima	Mueang Nakhon Nayok District	2
Thailand	Nakhon Nayok	Pak Phil District	4
Thailand	Nakhon Nayok	Pak Phil District	8
Thailand	Kanchanaburi	Thong Pha Phum District	4
Thailand	Kanchanaburi	Sai Yok District	2
Thailand	Kanchanaburi	Sahakhorn Nikhom, Thong Phaphum	1
Thailand	Kanchanaburi	Yang Tone, Sai Yok	1
Bangladesh	Cox's Bazar	Himchari National Park	1
Bangladesh	Cox's Bazar	Jahajpura Gorjan Bon	4
Bangladesh	Cox's Bazar	Medhakachhapia National Park	4
Bangladesh	Cox's Bazar	Dulahazara Safari Park	2
Bangladesh	Chittagong	Sitakunda Eco Park and Botanic Garden	1
Total sample			133

A total of 66 dipterocarp species have been collected, including 8 unidentified species. Among them, 30 species, including 5 deciduous species, lack whole chloroplast sequence, which will be included in the initial lab work. The rest of the species will be analysed, given the availability of funding and time.

Table 2: Number of silica samples and voucher specimens per species. Deciduous species are color-coded red.

No.	Species	Number of collections	Voucher specimen
1.	<i>Anisoptera costata</i>	5	✓
2.	<i>Anisoptera laevis</i>	1	
3.	<i>Anisoptera scaphula</i>	3	
4.	<i>Anthohorea gratissima</i>	1	
5.	<i>Anthoshorea assamica</i> ssp. <i>globifera</i>	2	
6.	<i>Anthoshorea farinosa</i>	1	
7.	<i>Anthoshorea henryana</i>	4	✓
8.	<i>Anthoshorea roxburghii</i>	2	✓
9.	<i>Cotylelobium lanceolatum</i>	2	
10.	<i>Dipterocarpus alatus</i>	6	✓
11.	<i>Dipterocarpus baudii</i>	1	
12.	<i>Dipterocarpus chartaceus</i>	3	
13.	<i>Dipterocarpus costatus</i>	5	
14.	<i>Dipterocarpus dyeri</i>	3	
15.	<i>Dipterocarpus grandiflorus</i>	2	
16.	<i>Dipterocarpus gracilis</i>	2	

No.	Species	Number of collections	Voucher specimen
17.	<i>Dipterocarpus hasseltii</i>	1	
18.	<i>Dipterocarpus intricatus</i>	2	
19.	<i>Dipterocarpus kerrii</i>	2	
20.	<i>Dipterocarpus oblongifolius</i>	2	
21.	<i>Dipterocarpus obtusifolius</i>	4	✓
22.	<i>Dipterocarpus tuberculatus</i>	3	
23.	<i>Dipterocarpus turbinatus</i>	5	
24.	<i>Dipterocarpus sp.</i>	1	
25.	<i>Dipterocarpus sp.</i>	1	
26.	<i>Dipterocarpus sp.</i>	1	
27.	<i>Dipterocarpus sp.</i>	1	
28.	<i>Dipterocarpus sp.</i>	1	
29.	<i>Dipterocarpus sp.</i>	1	
30.	<i>Dipterocarpus sp.</i>	1	
31.	<i>Hopea beccariana</i>	1	
32.	<i>Hopea bracteata</i>	2	
33.	<i>Hopea ferrea</i>	3	✓
34.	<i>Hopea helferi</i>	1	
35.	<i>Hopea latifolia</i>	2	
36.	<i>Hopea macrocarpa</i>	2	
37.	<i>Hopea oblongifolia</i>	1	
38.	<i>Hopea odorata</i>	4	
39.	<i>Hopea pierrei</i>	1	
40.	<i>Hopea recopei</i>	1	
41.	<i>Hopea sangal</i>	2	
42.	<i>Hopea thorelii</i>	2	
43.	<i>Neobalanocarpus heimii</i>	2	
44.	<i>Parashorea densiflora</i>	1	
45.	<i>Parashorea stellata</i>	4	
46.	<i>Pentacme siamensis</i>	4	✓
47.	<i>Pentacme sp.</i>	1	✓
48.	<i>Richetia faguetiana</i>	1	
49.	<i>Rubroshorea leprosula</i>	2	
50.	<i>Shorea assamica ssp. globifera</i>	1	
51.	<i>Shorea bracteolata</i>	1	
52.	<i>Shorea glauca</i>	2	
53.	<i>Shorea guiso</i>	3	
54.	<i>Shorea hypochra</i>	1	
55.	<i>Shorea laevis</i>	1	
56.	<i>Shorea obtusa</i>	4	
57.	<i>Shorea ochrophloia</i>	1	
58.	<i>Shorea pavifolia</i>	1	
59.	<i>Shorea robusta</i>	2	
60.	<i>Shorea thorelii</i>	3	
61.	<i>Vatica diospyroides</i>	1	
62.	<i>Vatica harmandiana</i>	1	
63.	<i>Vatica mangachapoi ssp. obtusifolia</i>	1	
64.	<i>Vatica odorata</i>	2	
65.	<i>Vatica pauciflora</i>	1	
66.	<i>Vatica philastreana</i>	1	
Total		133	8

CONCLUSION

The expedition has been very successful in terms of collecting targeted deciduous dipterocarp samples from diverse habitats. Despite the peak monsoon climate and high temperature, the expedition went very smoothly as planned. It will contribute in filling the data gap and will be utilized to create a densely sampled phylogeny of the deciduous species along with other available whole chloroplast sequences and ancestral state analysis among the phenological groups. Further, the herbarium images will be added to the Dipterocarpaceae Padme database of RBGE, and geo-references will be added to the existing occurrence list and GBIF for further analysis of species environment association.

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PHOTO GALLERY

Some of the dipterocarps collected during the expedition



Figure 7: *Dipetrocarpus costatus*.



Figure 8: *Anthoshorea henryana*



Figure 9: *Dipterocarpus obtusifolius*

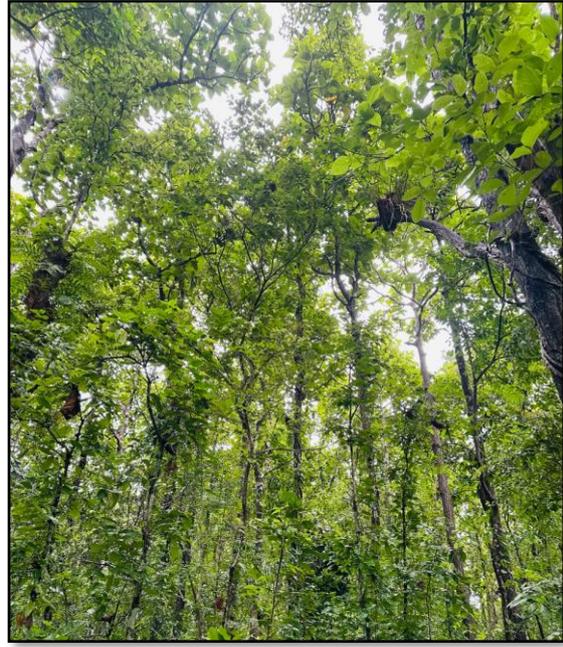
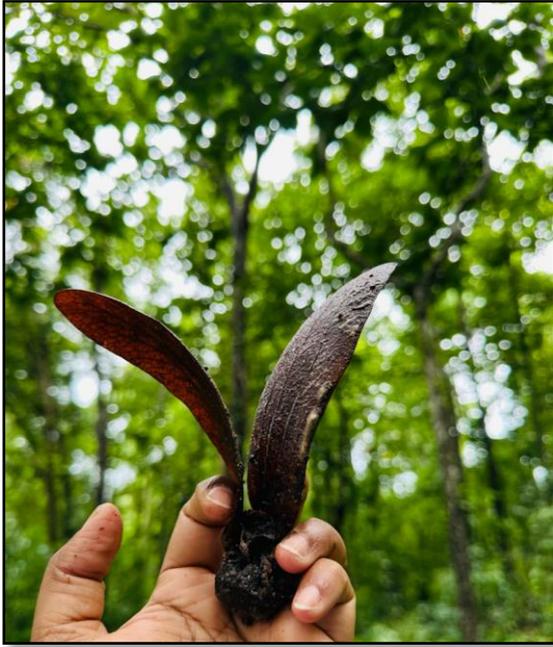


Figure 10: *Dipterocarpus tuberculatus*



Figure 11: *Shorea obtusa*



Figure 12: *Pentacme siamensis*



Figure 13: *Dipterocarpus alatus*

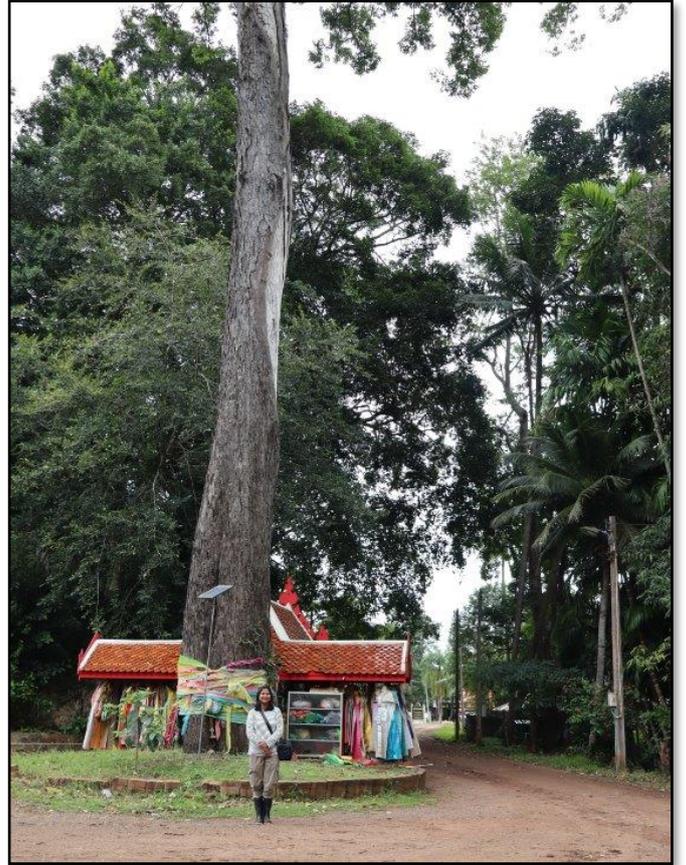


Figure 14: *Hopea odorata*



Figure 15: *Hopea ferrea*

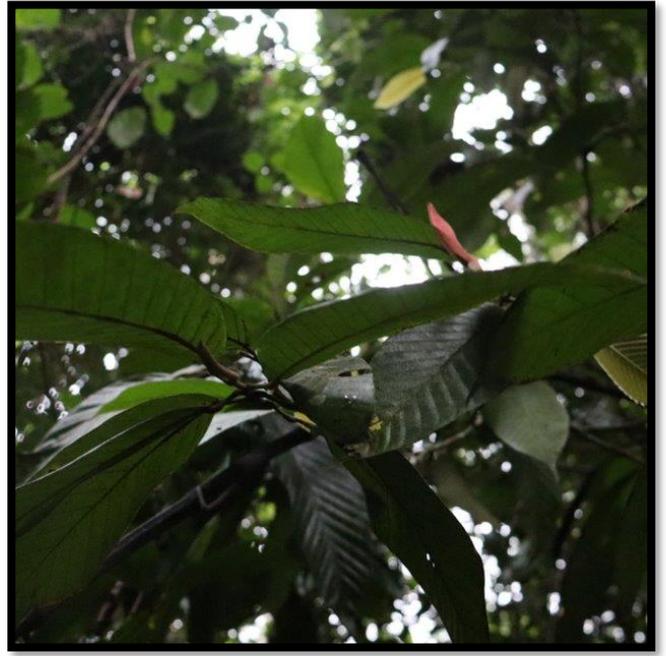


Figure 16: *Dipterocarpus intricatus*

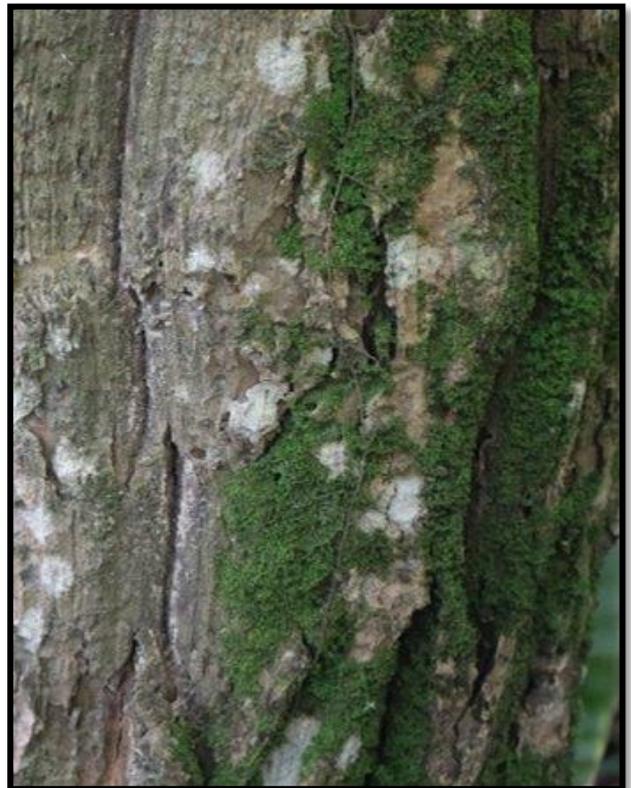


Figure 17: *Shorea robusta*



Figure 18: *Pentacme* sp.



Figure 19: *Dipterocarpus gracilis*

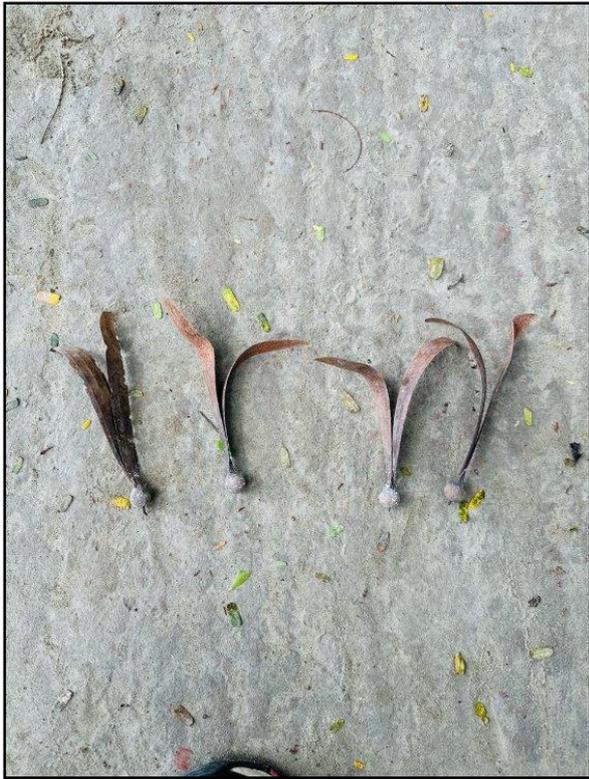


Figure 20: *Anisoptera scaphula*

Annexure I

Expenditure

Item	Cost (GBP)
Airfare (Bangladesh, Singapore and Thailand)	2409
Transport (within the country)	421
Consumables (food, petrol/gas, soil test)	563
Accommodation (Thailand and Singapore)	1011
Travel vaccine	269
Visa	30
Gross total	4703
Covered by PhD research budget	1203
Final cost	3500